ICT Policy Support Programme

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inCASA

Integrated Network for Completely Assisted Senior citizen's Autonomy

<u>D7.1 Market Analysis</u>

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Executive summary

Telemedicine indicates a group of services to continuous monitoring of patients and people who are in need of regular assistance. Telemedicine therefore has a broad meaning, it includes data transfer/retrieval from local data bases for medical reasons to direct assistance for patience at their home through Remote Patient Monitoring technologies

Remote patient monitoring market in Europe registered an amount of $325 million in 2009 (nearly 227 million euro[1]) and is expected to double its annual revenues by 2015 reaching $ 640 (nearly 450 million euro). The market is expected to witness a CARG (Compound Annual Growth Rate) of 12,2% during the forecast period between 2010 and 2015. United Kingdom, Germany and Denmark are the leading countries in Europe in implementing and using telemedicine applications.

The aging population in Europe is the most important market driver that is propelling the need for continuous telemedicine services. Increasing demand for remote patient monitoring is also due to the increasing numbers of patients suffering from chronic illnesses. The 2008-based national population projections convergence scenario shows the population of the EU27 rising gradually from 495.4 million in 2008, reaching 520.7 million in 2035 and thereafter gradually declining to reach 505.7 million on 1st January 2060. The EU27 population is projected to become older with the median age projected to rise from 40.4 years in 2008 to 47.9 years in 2060. Chronic conditions and diseases are the leading cause of mortality in Europe and research suggests that complex conditions, such as diabetes and depression, will impose an even larger health burden on societies across Europe in the future.

Public authorities play the most important role for the introduction of teleHealth services by sponsoring and supporting high profile projects, trials / specialist applications and for developing private-public partnership schemes models to offer these services in the future. The analysis of the National Healthcare Systems in the five target countries (France, United Kingdom, Italy, Spain and Greece) confirms that aging population an increasing demand for assistance due to chronic illness will be the most important drivers for the deployment of eHealth solutions. In addition, existing local project in the fields of telematics, telehealth, and telemedicine, for testing technologies and level of services, have been paving the way for an incremental adoption of inCASA-like services. However, these local experiences, in the target countries, show that a major effort still need to be put on technology interoperability issues and a more effective promotion among people and practitioners about telemedicine's and telecare's real benefits. Furthermore, an updated healthcare legislation framework, considering eHealth services fully integrated in the NHS, with a clear reimbursement policy, will boost a wider introduction of telecare and telemonitoring solutions.

80 eHealth applications and systems have been selected and evaluated. The majority of eHealth applications analysed fall under the Information/ Communication category accounting for 45% of applications analysed. The monitoring category follows with the 40% of applications. The surveillance and diagnostic category covers a minor part of the analysis with 6% and 2% of the analysed applications.

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[1] Using and Exchange rate of 1$ = 0,77 €, an averagecollected during the year 2009.

With respect to the applications investigated inCASA offers functions which cover almost all the application categories. The inCASA's strong advantage relies on a high level of system flexibility and scalability, representing a clear strength for market deployment in the private and public health sector. Therefore remote monitoring services provided by inCASA to patients in his home, using wireless and mobile technologies, may contribute to reduce hospital overheads and public spending on healthcare services, keeping up healthcare quality services with a reasonable investment. The inCASA solution will take advantages of market drivers and market opportunities providing telehealth and telemonitoring services to suit individual needs, in a more affordable way, using standard technologies and easy-to-use man-machine interfaces.

1 Introduction

1.1 Purpose and content of this deliverable

The objective of the present deliverable, D7.1 Market Analysis, is to provide an overview of the inCASA solutions target market. The deliverable has been developed following the guidelines reported in the Description of Work (DoW) document (included in the General Agreement N. 250505) and it basically takes into consideration the following main key issues indicated in the DoW:

- Analyze the current trends in the field, identify the market segmentation and investigate about market barrier;

- Survey the existing technology, potential competitors and their distinctive features

- Perform a SWOT analysis, and highlight distinguishing features that can be provided with inCASA technology to achieve a competitive advantage.

    successful.

1.2 Outline of this deliverable

The following document sets out to explain the market analysis suggested contents. An accurate study of the Current and Future Market size provides an important starting point. Examining current and future sales can in some way begin to predict, not only the levels of demand, but potential revenue to be generated by the inCASA project.

In order to intuitively assess the Market Growth Rate, data from demographic chronic disease studies and complimentary products will be collected to forecast market behaviour.

Current Industry Trends begin the process of breaking down the market for detail in other areas than size. Market Segmentation and Existing Technology, will provide good industry overviews. To complete this task comprehensively will involve strategic collaboration with selected other project partners.

In order to determine the industry drivers and constrains affecting inCASA success the typical Porter's Five Forces model has been adopted. This method looks directly at key influencing factors on the attractiveness of a chosen market.

The target country analysis will prepare the inCASA product for a pan European launch.

Awareness of existing activities within the business cluster helps to prepare the business plan.

To have a comprehensive awareness of Market Trends, a SWOT analysis will be completed. The strengths, weaknesses, opportunities and threats of the market will be important information when highlighting areas of individuality; necessary to achieve a competitive advantage.

2   The eHealth market overview

For twenty years, since '90, the European Commission has funded research **healthcare Systems** and tools, including telemedicine. The EU has contributed more than €500 millions of research funding to the development of **electronic-health** (eHealth) tools and systems since the early 1990s. EU-supported projects have helped place Europe in a world-leading position in the use of regional health networks, electronic health records in primary care and deployment of health (smart) cards, in particular. Since the adoption of the eHealth Action Plan in 2004[2], the Commission's role has broadened to include policy support to the deployment of eHealth, supporting better quality, safer and more efficient health systems that empower patients throughout the EU.

According to some analysts[3], the European eHealth market was estimated at EUR14.269 million in 2008 and is projected to reach EUR15.619 million by 2012, with a compounded annual growth rate of 2.9%. The figure below, shows individual country performances. The graph also clearly shows the key European e-Health markets are France, Germany, Italy, Spain, and the United Kingdom.
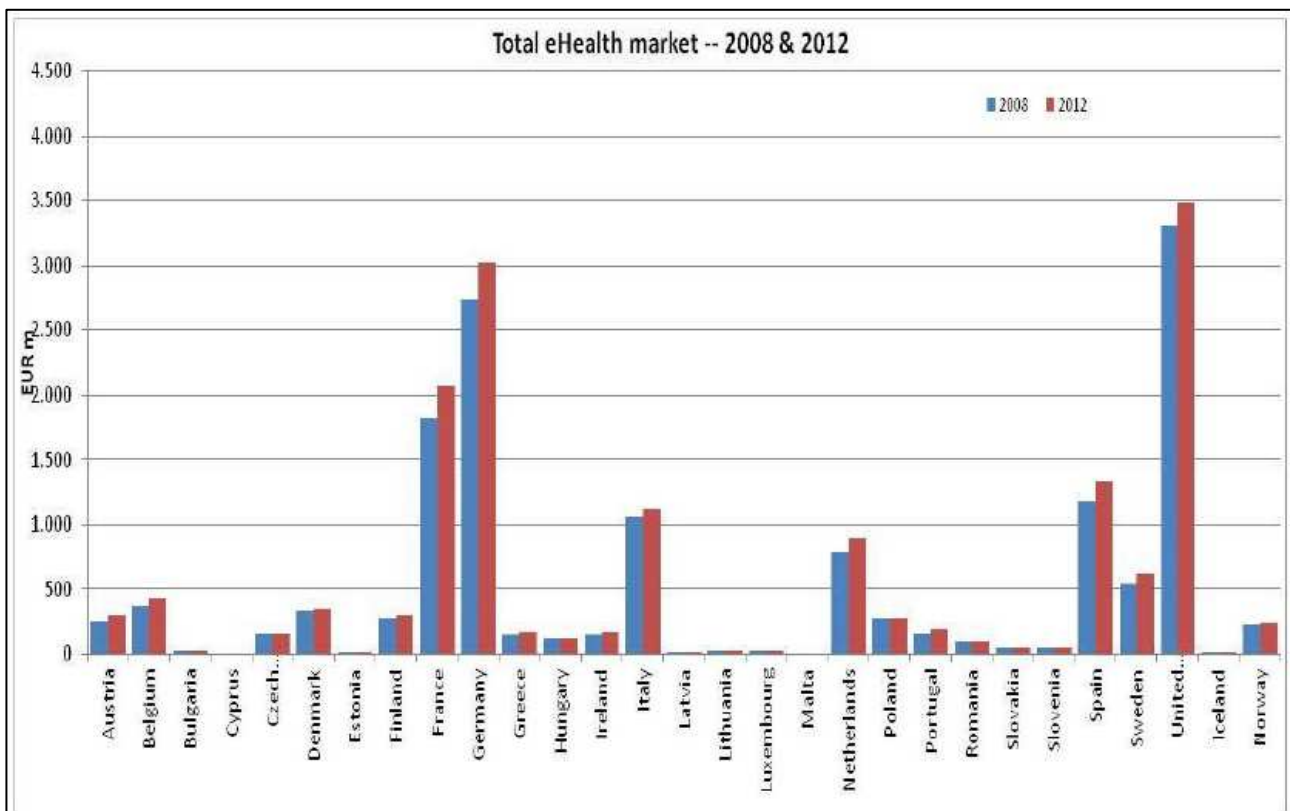
Figure 1 – Total eHealth market 2008 & 2012[4]

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[2] http://ec.europa.eu/information_society/activities/health/whatis_ehealth/index_en.htm, 2010
[3] Valeri et al., Business Models for eHealth, 2010.
[4] Cfr note 2.

Such growth in the market can be attributed to the fact that EU countries are facing similar challenges for the future as an ever ageing population, growth in chronic diseases and unhealthy lifestyles. Furthermore, populations now have better access to information; with greater knowledge of certain health issues comes increased demand for E-Health related technologies.

According to some experts[5], the e-Health market comprises four main categories of technologies and services, shortly depicted in table below.

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

Table 1 – eHealth market segments

Among the four market segments, secondary Usage Non-clinical Systems (SUNCS) accounted for 71.6% of the total eHealth market in Europe. Clinical Information Systems (CIS) represented about

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[5] Valeri et al., Business Models for eHealth, 2010

13.5% of the total European eHealth market, whilst Integrated Health Clinical Information Networks (IHCIN) are at about 5%.

EHealth market segment	Composition in 2008 (%)
CIS	22,5%
SUNCS	71,6%
IHCIN	5,0%
Telemedicine	0,9%

Table 2 - eHealth market segments size

Telemedicine accounted for a mere 0.9%, however the market for telemedicine systems and applications is expected to grow more rapidly with respect to the other segments suggesting that true adoption of this technology by providers, professional and medical staff as well as patients will provide strong business opportunities.

Telemedicine comprises ICT (Information and Communication Technology) which enables health care services, provided to patients in situations where one or more health care professionals and the patient are not in the same location. It involves several technologies such as secure transmission of medical data and information, through text, sound, images or other forms needed for the prevention, diagnosis, treatment and follow-up of patients.

In an ageing Europe, where more and more citizens live with chronic diseases, telemedicine is an important solution to ensure cares to affected people and a great opportunities for ICT solution developers. Through telemedicine important critical health parameters may be monitored, such as blood sugar levels or blood pressure at the patient's home, avoiding troublesome and, particularly in the case of older people and those with severe health problems, trips to near hospital for receiving assistance by doctors.

Telemedicine can improve the availability of specialised cares in remote areas where access to healthcare is difficult.

As a consequence of the above considerations, telemedicine is a term referring to many technologies and services one of which represents a single market of a segment. Therefore, the present market analysis needs to start by providing a definition of the telemedicine contest.

2.1 Telemedicine definition

Telemedicine indicates a group of services to continuous monitoring of patients and people who are in need of regular assistance*.* According to Reid (1996)[6]: *"Telemedicine – the use of advanced telecommunications technologies to exchange health information and provide healthcare services across geographic, time, social and cultural barriers"*. The technology and equipment used to provide the service include: videoconferencing, cameras, Internet, satellites, and wireless communications.

Telemedicine provides clinical care services through two main technologies: pre-captured (archived and then sent over the communication network) and real time. The pre-captured technology is used in non-emergency situations. Applications of this technology include Teleradiology and Telepathology. The real time technology, on the other hand, requires the use of interactive screens to facilitate face to face consultation. It also assists the provision of services such as Telecardiology, Telepsychiatry, and Telepediatrics. Videoconferencing is commonly used to provide real time healthcare services.

Telemedicine therefore has a broad meaning, it includes data transfer/retrieval from local data bases for medical reasons to direct assistance for patience at their home through Remote Patient Monitoring technologies**,** whose services may be divided in two groups[7]:

1. ***Telecare*** *provides real-time monitoring of non-medical data such as general behaviour patterns, falls, emergencies and the provisioning of social care directly to the user, in their homes with support from information and communication technology (ICT). Telecare is provided through an integration of wide range of equipment and services tailored to the needs of customers.*

2. ***Telehealth*** *provides remote monitoring of a patient's vital signs through the use of devices customised by healthcare services providers, Vital signs data such as blood pressure, glucose levels and etc. are transmitted to a response center or the clinical's computers where it will be monitored and interpreted according to the individual's health requirements.*

The aging population in Europe is the most important market driver that is propelling the need for continuous telemedicine services. Increasing demand for remote patient monitoring is also due to the increasing numbers of patients suffering from chronic illnesses. Similarly, a shortage of specialists at hospitals and increased hospital expenses are driving end-users to opt for remote monitoring solutions, as this is an affordable alternative.

Due to the two above factors, European governments are supporting huge costs to assist the two categories of patients, by injecting funds into this healthcare stream in order to ensure standard social structure for the aged population.

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[6] Reid, J.A. (1996): Telemedicine Primer: Understanding the issues. Billings, Mt./USA: Innovative Medical Communications, p 14.

[7] Frost and Sullivan, *Remote Patient Monitoring Market in Europe*, July 1st, 2010.

This also is an increasing market opportunity for companies offering remote patient monitoring technologies and services. The advent of new and innovative healthcare devices, is continuously shrinking the related high costs, overcoming incompatibilities with old systems. Remote patient monitoring services have been shifting from high priced services, mainly due to the cost involved in customization of devices to suit individual needs, to more affordable ones based on those using standard technologies and easy-to-use man-machine interfaces. However such a phenomenon of products and technology development is still in early stage and price is considered a limiting factor despite a falling price trend when the markets become more and more mature.

2.2   The telemedicine market size and trends

In the recent report *Remote Patient Monitoring Market in Europe* (2010)[8]*,* assessments are made regarding the commercial environment in Europe for the telemedicine market. This report estimated revenues of Remote patient monitoring market in Europe registered an amount of $325 million in 2009 (nearly 227 million euro[9]) and is expected to double its annual revenues by 2015 reaching $ 640 (nearly 450 million euro).
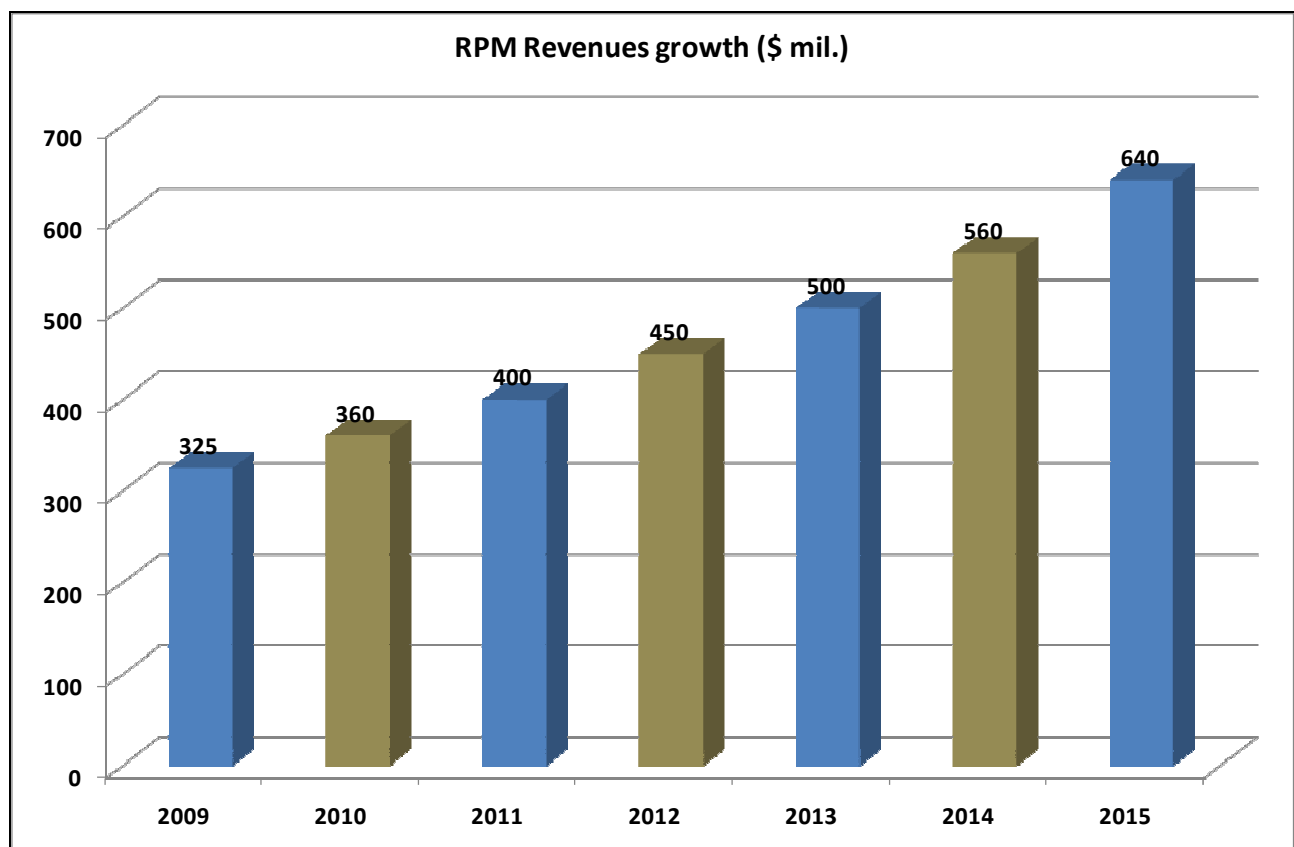
Figure 2 - Remote Patient Monitoring Market in Europe[10]

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[8] See note 2.
[9] Using and Exchange rate of 1$ = 0,77 €, an averagecollected during the year 2009.
[10] Frost and Sullivan, 2010.

The market is expected to witness a CARG (Compound Annual Growth Rate) of 12,2% during the forecast period between 2010 and 2015, as shown in figure of next page.

The major factors that expected to drive the market are growing awareness, customisation of products and services to suit the end user's needs as well as the government initiatives looking for to reduce health care costs by using ICTs. There is an increasing need for governments to address issues such as the aging population, increasing healthcare costs and the technology divide. Governments are spending a large amount of their GDP on healthcare expenditure, and use of such effective technology is expected to help them reduce the direct healthcare costs in the future.
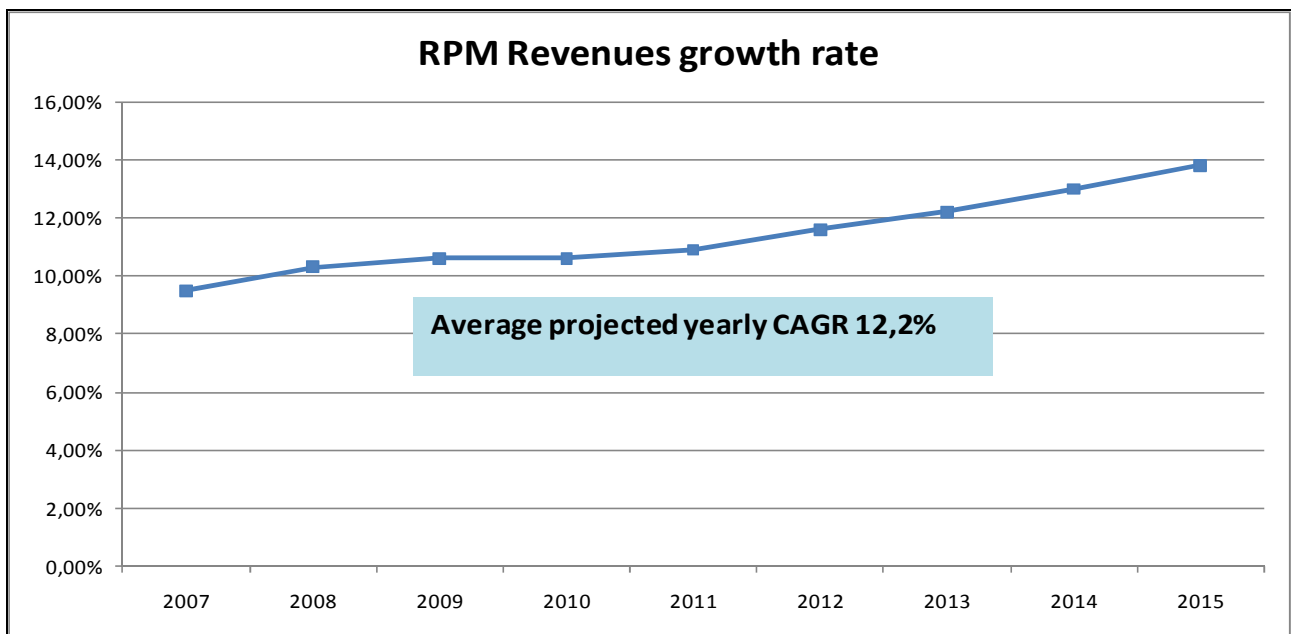
Figure 3 - Remote Patient Monitoring Market Growth in Europe[11]

Remote patient monitoring market in 2009 in Europe was leaded by UK with 35% of the total market followed by Germany with 21%, as shown in figure below. UK dominated the remote patient monitoring market in Europe due to the relatively high adoption rates for telehealth and telecare solutions.

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[11] Source Frost and Sullivan, 2010.
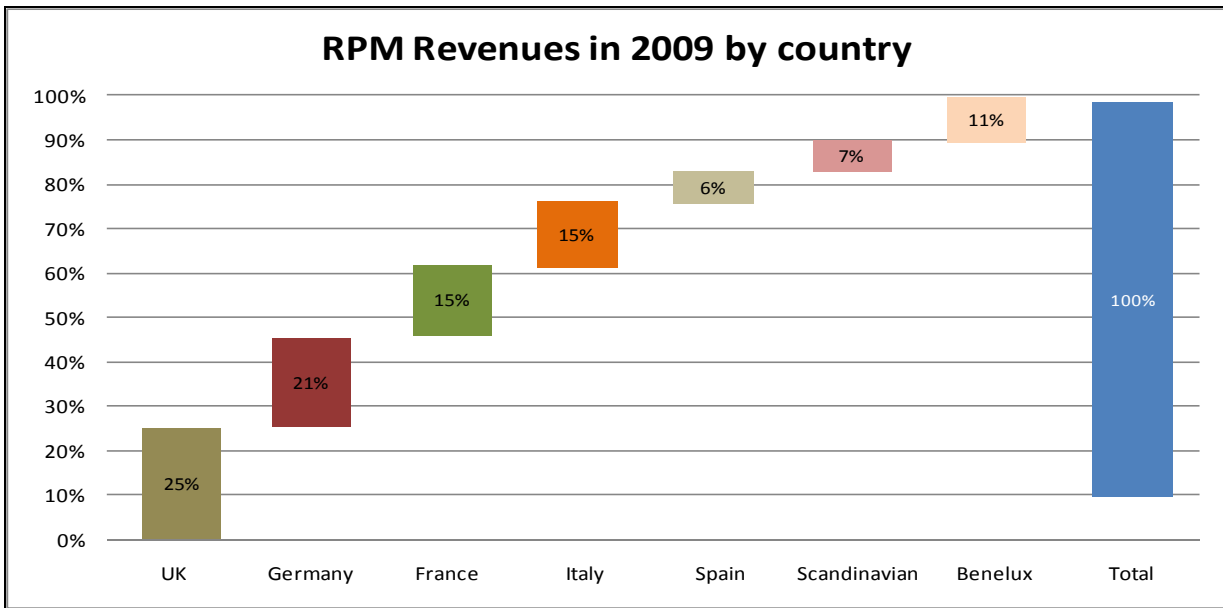
Figure 4 – RPM Revenues by country in 2009[12]

Other prominent markets include France, Italy and Benelux due to the relatively large presence of aging population that demand such services. The scenario is expected to remain the same for the next years with no major change in each country market share in the region.

In terms of presence of remote monitoring players and potential adoption of RPM, UK and Germany, can be considered the most attractive markets in Europe. The offer clear market opportunities in the short-term in terms high demand due to their mass of ageing population and technology penetration. Scandinavia also showed healthy signs of technology adoption, but was relatively less active compared to the other two big markets. However, Scandinavia is a lucrative prospect for the future market.
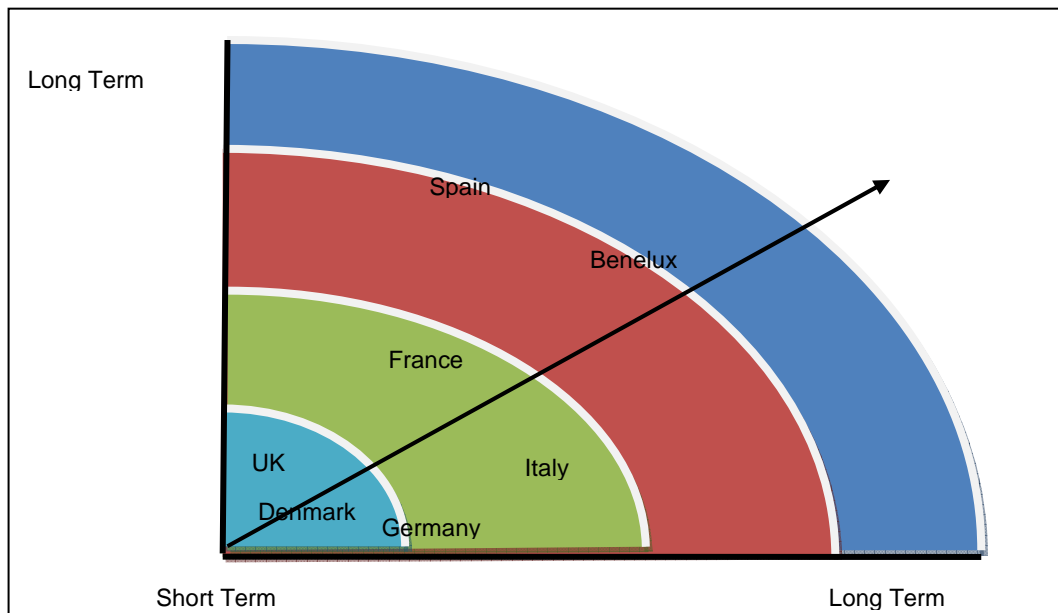
Figure 5 - Market prospects in Europe in long term and short term[13]

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[12] Source Frost and Sullivan, 2010.

Denmark is one of the most advanced country for telecare and telehealth applications. Danish information system is considered[14] the most efficient in the world, saving doctors an average of 50 minutes a day in administrative work. And a 2008 report from the Healthcare Information and Management Systems Society estimated that electronic record keeping saved Denmark's health system as much as $120 million a year. Due to the Danish eHealth system results, policy makers in the United States are studying Denmark's system to see whether its successes can be replicated as part of the overhaul of the health system making its way through Congress.

Similarly, France and Italy have shown positive signs of growth and technology adoption. They are big markets in terms of aging population and therefore telehealth and care services demand. These two countries are expected to grow a lot due to the presence of internal factors which will make them more attractive, such as the government spending and the public willingness and receptivity towards technological innovation. Italy for instance has a huge public spending for health care system and a large diffusion of mobile technologies (mobile and smart phones are highly adopted by Italian population registering one of the highest penetration rates in Europe, which permits to overcome the locally limited use of computers and fixed broadband shortage of the telecommunication system)

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[13] Adaptation of Frost and Sullivan 2010
[14] See this article in the New York Times on a Danish virtual hospital:
http://www.nytimes.com/2010/01/12/health/12denmark.html?_r=1&scp=1&sq=Frederiksberg&st=cse

3   Major factors affecting the telemedicine market trends

The inCASA services full market deployment strongly depends on some social dynamics concerning the ageing population and the evolution of chronic disease. Furthermore, present and future National Healthcare Systems (NHS) policies will be an enabling key factor to introduce telecare and telemonitoring systems. The next paragraphs will try to provide a description of the potential market scenarios in terms of population trends, chronic disease trends and NHS policies.

3.1   Ageing population trends in Europe

An ageing population has considerable implications and impacts on a wide variety of socio-economic factors and processes, such as economic growth, capital markets, pension systems, but also on technical progress and innovations, education and human capital, family and household structures - and last, but not least, on the **health** and **social care system**.

The 2008-based national population projections convergence scenario shows the population of the EU27 rising gradually from 495.4 million in 2008, reaching 520.7 million in 2035 and thereafter gradually declining to reach 505.7 million on 1st January 2060. The EU27 population is projected to become older with the median age projected to rise from 40.4 years in 2008 to 47.9 years in 2060.

According to Eurostat[15] data, the share of people aged 65 years or over in the total population is projected to increase from 17.1% to 30.0% and the number is projected to rise from 84.6 million in 2008 to 151.5 million in 2060. Similarly, the number of people aged 80 years or over is projected to almost triple from 21.8 million in 2008 to 61.4 million in 2060.
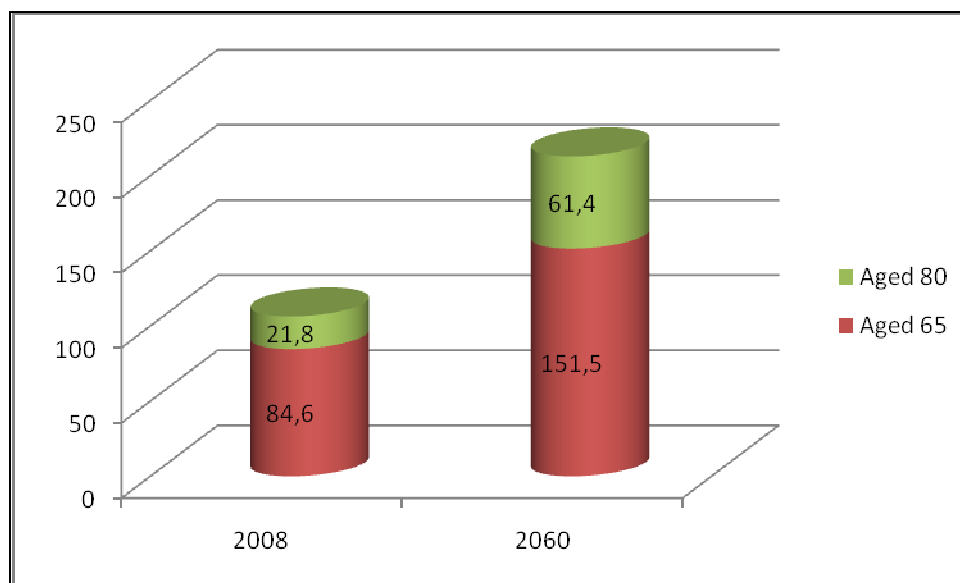
Figure 6 – EU population projection for aged people

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[15] http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes

The ageing of the population implies that the prevalence of chronic diseases will dramatically grow in the coming years and the number of disabled persons will surely rise, creating a need for customised and costly medical assistance. Evidence of age-related rationing of health interventions has been proved by data in many countries in the European Region[16], therefore, a close correlation with the aging population phenomenon and the increasing adoption of ICT solutions to provide health services can be hypnotised for the next years, fuelled by continuous technical electronic equipment evolution and its expected costs reduction. This foreseen scenario will result in a great opportunity for inCASA services, whose technologies and services will meet the future needs of a wide range of potential customers.

3.1.1 Ageing population trends in the target countries

Due to the above preliminary statements, an analysis of population dynamics is necessary to get early indications of inCASA potential market. The following demographic analysis has been targeted to the European countries[17], where inCASA project pilots will be carried out. In fact, the aim is that inCASA services will be implemented in these market first.

As for the general European population, according to recent OECD studies[18], the number of elderly people will heavily increase in the target countries during the next years and decades. This trend is expected to continue in future decades given the ageing of the baby-boom generation born after World War II further gains in life expectancy at 65 and older ages, and declining fertility rates (see figure Figure 7).

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[16] European Observatory, *Tackling chronic disease in Europe*, 2010
[17] France, UK, Greece, Italy and Spain.
[18] Trends in Severe Disability Among Elderly People: Assessing the Evidence in 12 OECD Countries and the Future Implications, OECD, 2007
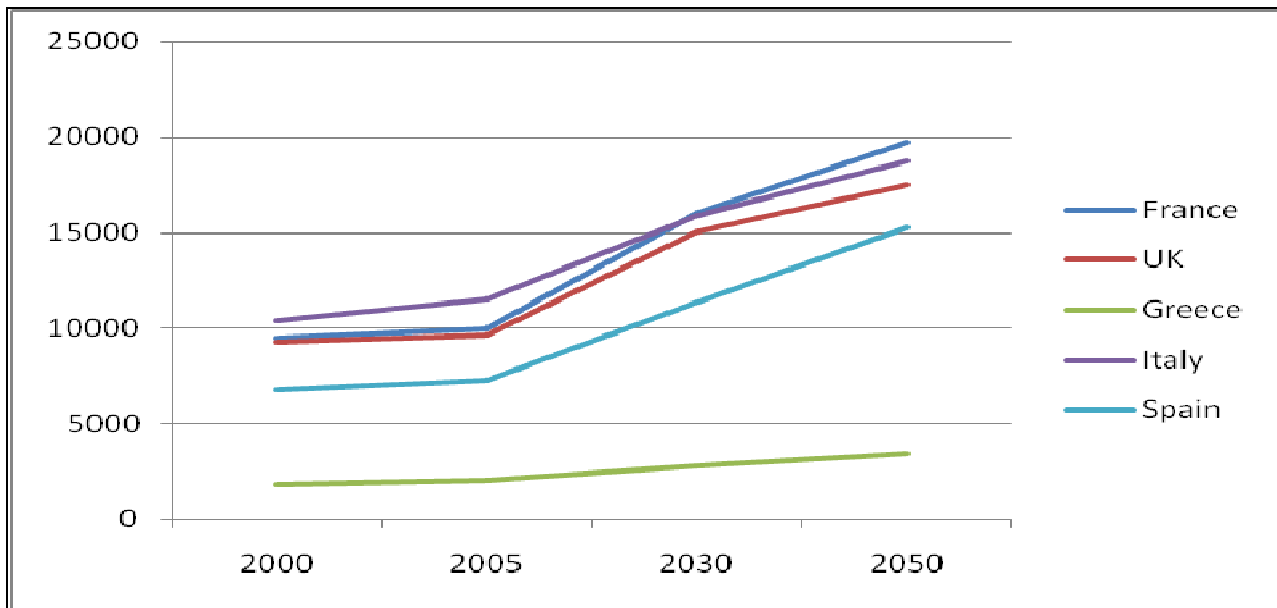
Figure 7 - Evolution of elderly population in the target countries[19]

The number of elderly people in France, Italy and UK is expected to increase significantly, almost doubling the population aged 65 years and more in 2050 compared to 2005. The same trend is expected to be registered in Spain whose elderly population in 2050 will be close to 15 million people the double of the value in 2005. Also in Greece the population will have a similar trend though the elderly population will account for less people relatively to most EU countries. Such an increase in the ageing population will imply a parallel growth of proportion of elderly people above the population, as Figure 8 illustrates.

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[19] Source: Trends in Severe Disability Among Elderly People: Assessing the Evidence in 12 OECD Countries and the Future Implications, OECD, 2007.In thousands of people
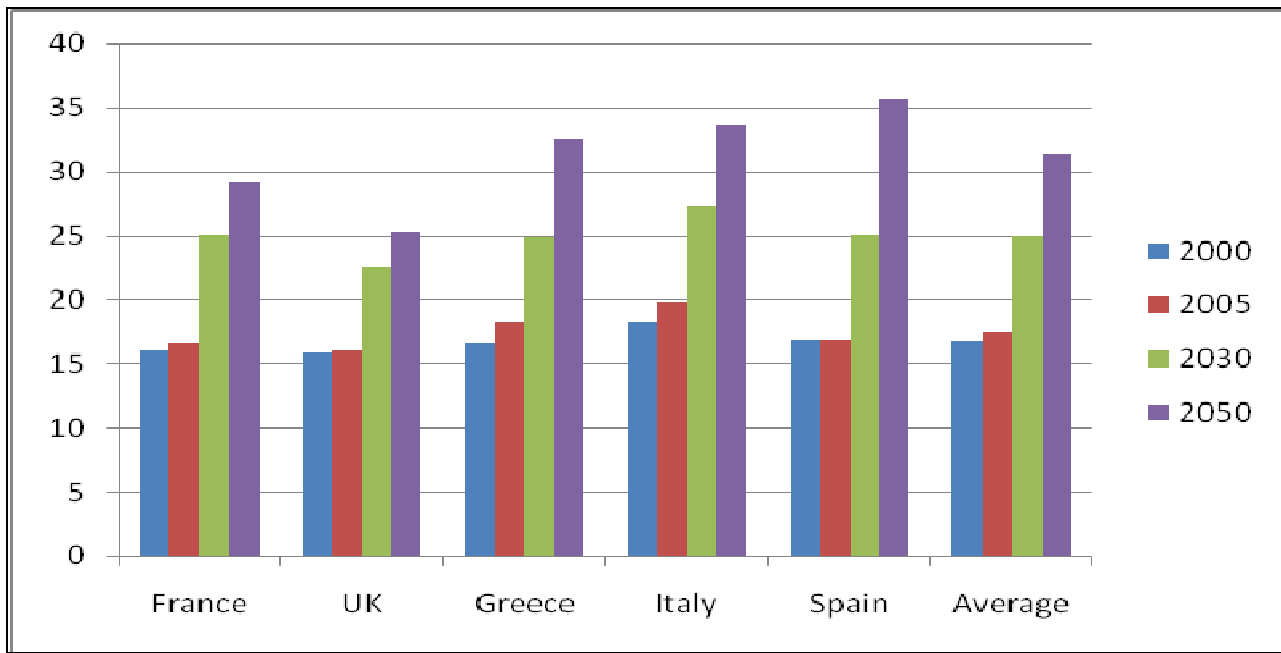
Figure 8 – Evolution of elderly people incidence in the target countries[20]

Among the considered target countries, Spain will be affected by the fasted growth of elderly people incidence in the next 20 years, where elderly population incidence is expected to pass from 15% in 2005 to over 35% in 2050. Italy will follow from 20% in 2005 to 38% in 2050 the same as Greece with similar values. Elderly people incidence will evolve with the same trends in France and UK, however old people are expected to relatively account less in these country with respect to the overall population and respectively 29% in France and 25% in UK.

In these countries, the population over 85 years will tend to increase quickly. This population group is characterised for having a great need of external assistance to ensure its daily tasks. Usually, this group has the most severe disabilities and greatest long-term care needs. Presently, about 1% of the population are over 85 years in Europe, however this proportion is expected to rise to 3% within 2030 and more than 5% within 2050.

Such an evolution will have two main implications for European national health care systems:

- Although life conditions of people have been improving in the last decades and will continue to meliorate in the future, health care services demand will certainly increase in term of size and number of services requested;

- The rising assistance demand will fuel national security and health systems costs consuming more and more major shares of national government expenditures. In fact, with the increase of elderly people (especially whose needing assistance) and the decrease of contributing people.

According to "*Ageing report of the European Commission*", (2009) [21] the projection of dependant people number, in the target countries is expected to grow. Dependand People is a term that indicates elderly people, over 65 years old, needing any kind of assistance to carry out some **daily**

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[20] Our elaboration from OECD data, see note 19.
[21] Source : The ageing report, The European Commission, 2009.

tasks. Therefore many of these people will fall in the category of being disables when "*A disability is any restriction or lack of ability (resulting from impairment) to perform an activity in the manner or within the range considered normal for a human being*"[22].

The table below provides an overview of the total number of dependant people estimated in 2010 and its projection for the next decades.

	2010	**2020**	**2030**	**2040**	**2050**
France	2.400.000	2.800.000	3.350.000	4.000.000	4.200.000
UK	3.200.000	3.650.000	4.350.000	4.950.000	5.400.000
Greece	370.000	450.000	500.000	570.000	650.000
Italy	2.650.000	3.000.000	3.350.000	3.850.000	4.400.000
Spain	1.800.000	2.100.000	2.500.000	3.150.000	3.800.000

Table 3 - Number of dependant people in the target countries until 2050[23]

The number of dependant people and its trend are useful information for an overall and approximate indication of the inCASA potential market. In fact, with a little share of such a big market, inCASA can count on huge potential sales, accounting thousand customers in the selected countries.

3.2 Chronic disease trends

Chronic conditions and diseases are the leading cause of mortality in Europe and research suggests that complex conditions, such as diabetes and depression, will impose an even larger health burden on societies across Europe in the future. The World Health Organization 'Global Burden of Disease' study estimated that, in 2002, chronic conditions accounted for 87% of deaths developed countries. The worldwide proportion of deaths due to chronic diseases is projected to rise from 59% in 2002 to 69% in 2030[24].

Chronic diseases definition embraces not only the 'classical' conditions such as cardiovascular disease, diabetes and asthma, but also many types of cancer and HIV/AIDS, mental disorders (for example, depression, schizophrenia and dementia) as well as certain disabilities (for example, visual disability).

According to the World Health Organization, in the long-term period the worldwide population situation could be depicted as follows[25]:

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[22] International Classification of Impairments, Disabilities, and Handicaps (ICIDH, 1980):

[23] Constant disability scenario, in thousand populations)

[24] Reinhard Busse, Miriam Blümel,David Scheller-Kreinsen, Annette Zentner, Tackling Chronic Disease In Europe, WHO 2010.

[25] http://www.who.int/research/en/

- 180 million people have diabetes, and the figure is expected to be more than 360 million in 2030. Currently, 210 million people have chronic respiratory diseases – estimated to 273 million in 2015 – and 300 million have asthma.

- 17.5 million people died of cardiovascular diseases in 2005, a figure that is estimated to rise to 20 million in 2015. A further 8.8 million survivors of hearth attacks in 2005 require long-term care.

The numbers of people affected by chronic diseases are expected to rise, due to:

- Obesity, which affects 400 million people, a figure expected to exceed 700 million in 2015

- Aging and dependent elderly people, globally, 650 million people are over 60, a figure estimated to reach 2 billion in 2050.

The total addressable market for chronic-illness monitoring is therefore just under 40 million, with expected near-exponential growth in the next five years, owing to current growth patterns and the impact of obesity and aging.

The link between disease and age is also crucial from an economic and public policy standpoint. The proportion of those in European countries aged 65 years and older is projected to grow from 15% in 2000 to 23.5% by 2030. The proportion of those aged 80 years and over is expected to more than double from 3% in 2000 to 6.4% in 2030. This trend is clearly one of the reasons for the growing burden of chronic conditions and diseases.

The continuous innovation in ICT may lead to more effective introduction in the NHS of care for chronic disease patients, with an improvement in the quality of life. In that respect, the European Union (EU) has proposed and supported various information technology initiatives – for example, within the framework of the eEurope action plan (i2010) – and many governments have been motivated to intensify their efforts. For the health sector, the EU presented the eHealth action plan, which encourages Member States to develop their eHealth strategies. It also seeks to set up agreed international standards for exchanging health data. The following examples show how ICT technologies can support eHealh systems.

- **Clinical decision support systems**

Clinical decision-making electronic systems main goals are to increase the quality of care by standardizing the delivery of care in accordance with quality of services while at the same time containing costs. With a clinical care processes standardization electronic systems contribute to reduce variation in health care and thereby increase quality of outcomes and reduce medical error. These electronic systems range from presenting information (treatment requirements for specific conditions or diagnosis) to perform complex functions, as is the case with expert systems and machine learning systems.

- **E-health platforms and electronic health records**

Many governments support information and communications systems such as eHealth platforms and electronic health records or cards. The aim is to improve data exchange between key people

such as doctors, patients, hospital workers, pharmacists, care workers, health insurers and public administrators. E-health platforms are intended to improve access, increase patient participation, improve efficiency of delivery and improve coordination.

Often the platforms incorporate guidelines for professionals, information and education programmes for patients, and eligibility criteria detailing benefits. Examples of such platforms include the MedCom in Denmark, NHS Connecting for Health in Britain and an Internet portal in France for chronic conditions. Cross-sectoral electronic health records are used for the long-term collection and documentation of relevant patients. They contain personal data and a wealth of medical information, such as the medical history of the patient, laboratory results, physicians' letters, records of operations and digital data from.

3.3   Overview of the Nation Security Systems in the target countries

With an ageing population, chronic diseases are destined to increase in Europe. According to experts[26] a total of 50% of the hospital bed occupancy is by patients suffering from chronic illnesses such as diabetes, placing a huge strain on the healthcare infrastructure and costs. Such a share will is expected to rise very much in the future. In addition, people are becoming more conscious about healthcare and there is a growing demand for better quality of care.

The overall healthcare costs are exploding and, as a consequence of this, the heath services growing demand will produce a shortage of medical professionals and of suitable medical infrastructures.

Therefore healthcare must focus first to prevention providing the possibility of monitoring chronically ill patients and in case enable treatments without having to accommodate them in the hospital. However some significant changes are already in progress:

- The site of care is expanding its boundaries going outside the hospital and the clinical setting and moving towards the patient's home;

- Care is enlarging its scope beyond the patient domains and is including also the support to people with special needs such as elderly and disabled for an independent living

- Informal caregivers (relatives, friends, volunteers) are playing an important role by complementing the tasks of the medical professionals (formal caregivers)

New technologies and mainly ICT certainly will play an important role for expanding e-Health services and will be determinant for the transition from the traditional healthcare model "clinical-centered" towards a new model based on telecare based on a "patient-centric" approach. This transition of healthcare from a "clinical -centric" to a "patient-centric" approach is attracting the attention of the industry that expects an evolution over the next decade towards continuous and pervasive care at home.

However this transition in European countries is strongly linked to the countries' National Health services future strategies and policies as well as strongly depending on the future shares of government budgets and spending devoted to reimbursement of such teleHealth services.

In order to support ICTs based services for care, public institutions need a better proof of the benefits of telemedicine in terms of a return on investment and above all cost savings for the public budget, maintaining or even improving the quality of services.

Public authorities play the most important role for the introduction of teleHealth services by sponsoring and supporting high profile projects, trials / specialist applications and for developing private-public partnership schemes models to offer these services in the future.

The development of a global eHealth policy will need an investment in time and efforts to introduce directives, regulations, laws and juridical interpretations that are necessary to manage the lifecycle

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[26] S. Bonfiglio, Changes in Healthcare: towards a "patient-centric" approach, from www.oasis-project.eu/.

of eHealth, including reimbursement policies and the integration of telehealth into the conventional healthcare system.

In Europe the telemedicine services are reimbursed only in few cases; physicians are not rewarded for remote device data analysis and physical presence of the clinician is needed in order to ensure reimbursement of his / her performances (face-to-face medical service delivery).

Another restraint is the cost of the new solutions; in general there is little empirical evidence of the relative benefit and this hinders the adoption of clear reimbursement policies by the National Health Service and/or by Health Insurance companies.

An eHealth strategy can today be found in all EU Member States, either as a dedicated approach or as part of larger initiatives, e.g. targeting the health system as a whole or the eGovernment domain. From an analysis in the EU, it emerges that[27]:

- strategy maturity ranges from one year to more than ten years. While some countries turned to a dedicated eHealth strategy only recently — sometimes developed from earlier and wider Information Society or health system action plans — in others second or third generation strategies can be found;

- in some Member States the particular focus is still very much on the development of suitable eHealth infrastructures, while others are deeply involved in setting up advanced eHealth activities enabling telemedicine services, in some cases building on precursor projects of limited scope.

In order to explore the real potential of inCASA telehealth and telecare services in the short (next 2/3 years) and long term period (more then 3 years), this section provides, for each of the target countries, the main features of the National Health Systems, highlighting drivers and restrains to the adoption of such technologies. The chapters will provide a short presentation of the target countries NHS and the related ICT strategy for eHealth.

3.3.1 France

The structure of the public healthcare system competencies in France are divided between two level of public governments:

- National level, centralised in the hands of the government

- Regional level, managed by local departments through the regional hospital agencies

A third level of health care system management exists handled by the Health Insurance Funds.

The national government regulates the quality of health service organisation, monitors safety, regulates the volume of health services supply and oversees social protection and regulates healthcare system. The state also sets the ceiling for health insurance spending, approves a report on health and social security trends and amends benefits and regulation. The Government decides the methods of financing and sets tariffs.

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[27] European Commission, Benchmarking ICT use among general practitioners in Europe – Final Report, April 2008

France's health system is based on a national social insurance system complemented by elements of tax-based financing (especially the General Social Tax) and complementary voluntary health insurance. The Ministry of Finance and Ministry of Social Affairs and Employment holds authority over finances, including the financial administration of the French healthcare system.

The National Health Insurance System (NHIS) guarantees universal access to healthcare for the whole population resident in France. The CNAMTS (Caisse National d'Assurance Maladie des Travailleurs Salaries) accounts for 80% of the NHIS. It covers mainly employees in the commercial and industrial sectors, as well as their families. The remaining 20% of the NHIS consists of funds for agricultural workers, independent professions, civil servants, doctors and students.

The regional hospital agencies (ARH) are responsible for hospital management (for both public and private hospitals), financial allocation to public hospitals and reimbursement of private hospitals (in the framework of national agreements). They basically manage, at the regional level, the national health services, implementing the general directive of national government and health insurance funds.

In France, three main health insurance schemes exist:

1) The general scheme (Régime general) which covers employees in commerce and industry and their families (about 84% of the population) and CMU beneficiaries (about 1.6% of the population);

2) the agricultural scheme (MSA) which covers farmers and agricultural employees and their families (about 7.2% of the population);

3) the scheme for non-agricultural self-employed people (CANAM) which covers craftsmen and self-employed people, including self-employed professionals such as lawyers (about 5% of the population).

Hospital treatments in France are generally covered up to 80%. In many cases, hospital admittance is free. Inpatients must pay a flat rate of 18€ per day in addition to the 20% co-payment hospital charge. Private health insurance generally covers a part or the total of these charges.

3.3.1.1 Elderly and chronic disease social services in France

The Elderly Dependency Act of 20 July 2001 introduced the "allocation personalisée d'autonomie" (individual attendance allowance) known as APA. This allowance, paid to dependent people over the age of 60, is intended to cover the costs of any assistance they need due to the loss of their ability to care for themselves. According to article L113-1 of the "Code de l'Action Sociale et des Familles", any person over 65 without sufficient resources may benefit either from home help or a place in a private home or establishment. This home help may take the form of a payment or actual assistance with household tasks (art. L 231-1 of the above-mentioned code).

Home help is partly financed by retirement schemes (depending on the income of the person receiving the service) and partly by social welfare benefits provided by the "département" (French division of territory, smaller than a region). Certain services, such as meals-on-wheels and house

alarm systems are often financed by regional governments and recipients may have to contribute towards costs. Home nursing care services and other paramedical services, on the other hand, are fully financed by the healthcare system.

The APA can take the form of services or cash and is paid irrespective of whether the person lives at home or in an institution. The allowance is for human and technical assistance, not the provision of care which would be covered by health insurances. As of 1 January 2006, people with a monthly income of less than EUR 658.4 are not obliged to contribute towards the costs of the APA. People with an income higher than EUR 2,622.34 have to make a contribution of 90% of the costs. Those with incomes between these two amounts have to contribute progressively towards costs.

In 2004, a new plan for Alzheimer's disease for the period 2004 – 2007 was announced. A major feature of the new plan is the recognition of Alzheimer's disease as a disease in its own right which means that medication will henceforth be 100% refunded.

Home nursing care services provide people with the necessary assistance to carry out essential activities of daily life. Here below a list of home care services offered to older people in France is provided:

- Accompanying the person for a walk, for medical visits and shopping etc.
- Adaptation of flat/house
- Administrative help
- Day or night care at home
- Delivery of medication (especially in rural areas)
- Taking the person to eat in a centre
- Granny sitting
- Hospitalisation at home (HAD)
- Home alarm service
- Household help (cleaning, cooking, shopping, washing, ironing, cleaning windows etc.)
- Keeping the person company (talking, reading etc.)
- Meals-on-wheels
- Mobile library
- Night and day care at home or in an institution
- Paramedical service (nursing, personal hygiene, physiotherapy etc.)
- Repair service for small repairs (i.e. where a craftsperson would be too expensive)
- Respite care
- Social nocturnal emergency services (e.g. buying medication or food)
- Technical assistance (hospital beds, crutches etc.)
- Transportation (special mini-buses from the local authority, informal transportation

3.3.1.2 E-health strategy in France

France is among the average eHealth performers in the EU27. As regards storage of patient data and the use of computers in consultation, the country is close to the EU27 average. Decision Support Systems are used to a lesser extent than in other countries of the EU. The situation is very much the same in relation to electronic patient data transfer. Here too, French usage rates are either at or slightly below average.

France has a long history of health-related legislation affecting eHealth deployment. This includes laws on data protection, telemedicine, eHealth service provision, health IT product liability and — more recently — Electronic Health Records. Among those, the law organising a secure electronic health infrastructure was enacted in 1996. Since the 2004 there has been a workgroup (GIP DMP) dealing with the planning and implementation of Electronic Health Records and — since 2007 — with an ePrescribing scheme. One aim of the EHR scheme is to bring together the various local and regional projects dealing with electronic patient data under one national framework.

A number of eHealth-related activities exist under the wider national health system reform strategy. Current activities include smart cards, both for identification of health professionals and insurance status verification of patients, a national health portal and several application development projects.

eHealth has been implemented at both local and regional levels. Relevant well-known practical eHealth implementations include:

- the CPS (Carte de Professionnel de Santé - Health Professional Card) is a microprocessor card managed by the GIP CPS, a dedicated structure created in 1993, and reinforced on the basis of the Juppé's 1996 law.The CPS functionalities include identification, authentication and electronic signature of health professionals;

- The SESAM-Vitale system uses a microprocessor card (carte Vitale) which contains health insurance data for the insured and their beneficiaries. It replaces paper forms by electronic reimbursement claims (Feuilles de Soins Électroniques, FSE) controlled by the simultaneous usage of the health professional and insured person's cards. In the near future, the Vitale card will be replaced by a new one, the Vitale 2;

- EU NETC@RDS Project, coordinated by SESAMVitale Economic Interest Grouping, aims at improving the access of mobile citizens to trans-European health services through a cross-insurance fund (contractual financial) verification of the personal social insurance rights and acceptance of the costs incurred for the healthcare provided;

- The official Health Web Portal in France has been developed under the auspices of the Health General Directorate of the Ministry and aims at promoting information from public agencies working on public health topics. Other important health portals were launched, such as the Plan Cancer, which is the public information website of the national health priority on cancer prevention, as well as dedicated information and recommendations about the quality of the health web sites and services;

- The Mandatory Insurance Organisations are continuing to develop dedicated applications for healthcare professionals, for example an application which allows medical doctors to

securely access information about the previously reimbursed actions or prescribed drugs concerning their patients.

- Several outstanding regional applications and platforms in the fields of telematics, telehealth, and telemedicine are already in use in different regions, as well as specialised dossiers like the DCC (Dossier Communiquant Cancer). The DMP project (Dossier Médical Personnel - personal medical record), one of the most important aspects of the 2004 law, is now presenting a real opportunity to organise the liaison and the articulation at the national level between the local and regional projects and the national projects, by building on accepted "reference practices" for security and interoperability based on international standards, for the benefit of the patient.

The following Table 4 gives a summary of the major drivers and constrains influencing the potential implementation of telecare and telehealth services in France. The attributed scores vary from 1 (less important) to 5 (highly important) indicating the importance degree of each driver and restrain. The scores have been attributed by the author on the basis of information and data collected for the related country.

	Ageing Population	Existing Projects	Financial Supports	Increasing Demand	Shortage Specialists	Hospital Expenses
Market drivers	5	4	4	5	1	3
	Unclear Value	**Interoperability Issues**	**Legislation Framework**	**High Costs**		
Market restrains	n.a.	4	4	n.a.		

Table 4 - Drivers and constrains for eHealth services deployment in France

> **Explanation of abbreviations in table above:**
>
> **Ageing Population** needing for continuous care
>
> **Existing** of valuable pilot **Projects** paving the way to the adoption of Telemonitoring and teleHealth services in a larger scale;
>
> A favourable Government/Local **Financial Support** system for telemedicine
>
> Expectations of an **Increasing Demand** due to the increase of chronic illness
>
> **Shortage** of **Specialists**
>
> Reduction of **Hospital Expenses** through telecare and telehealth
>
> **Market restrains**
>
> **Unclear** perception about the **Value** of remote monitoring services
>
> **Interoperability Issues** due to poor quality of existing ICT infrastructure
>
> Uncertain **Legislation Framework**, specifically for eHealth services reimbursement
>
> **High Costs** for the service deployment

The aging population and an increasing demand for assistance due to chronic illness will be the most important drivers for the deployment of eHealth solutions. Existing regional applications and platforms in the fields of telematics, telehealth, and telemedicine for testing technologies and level of services joint with a favourable framework of incentives have been paving the way for an incremental adoption of inCASA-like services in France. However, in France the preliminary experiences in eHealth indicate that additional efforts should be made to ensure interoperability of different technologies/devices and to innovate the healthcare legislation framework to consider a full integration of eHealth services in the NHS and therefore reimbursable.

3.3.2   United Kingdom

The United Kingdom Department of Health is responsible for the National Health Service (NHS). Furthermore, each of the four constituent countries has its own separately administered healthcare service through their own Health Service. At local level the NHS is split into Strategic Health Authorities (SHAs) whose purpose is to develop plans for improving health services in their local area and to make sure their local NHS organisations were performing well. In England for instance there are 10 strategic health authorities.

The diagram below shows how the NHS organisation in UK.
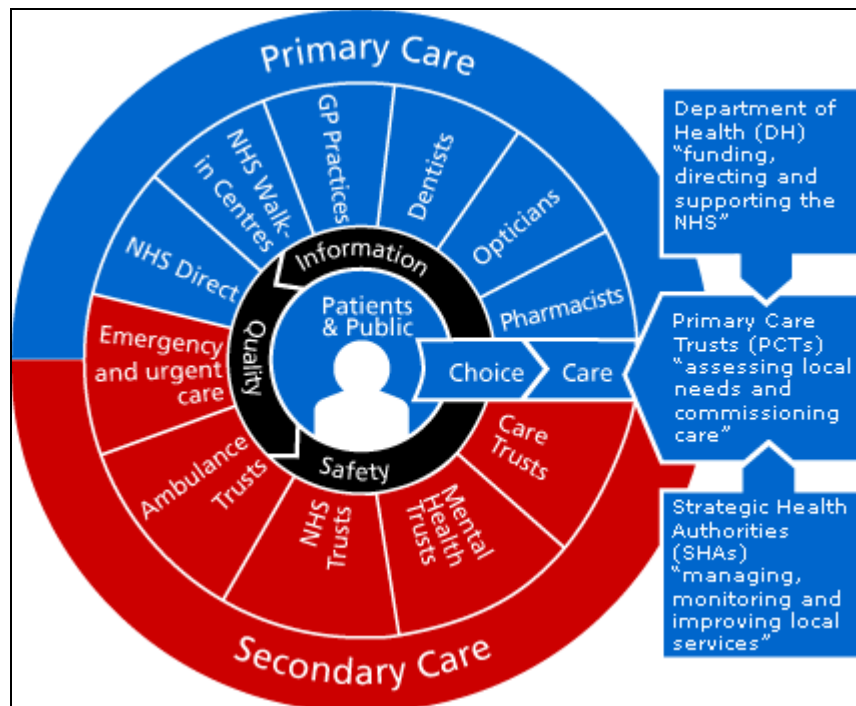
Figure 9 - NHS structure in UK

The Primary Care Trusts (PCTs) are both providers and commissioners for different healthcare services. The PCTs provide primary healthcare services such as district nurses, specialist treatment, health visitors and community nurses. These primary care health teams (including GPs) are responsible for providing home-care as well. In general, the district nurse, who works closely with a GP but who is provided (i.e. salaried) by the PCT, assists the GP with providing relevant home-care for patients. As a commissioning body, the PCTs commission healthcare services from the public, private and voluntary sector in order to meet national delivery and service requirements.

The NHS is mainly funded through general taxation: direct taxes, value-added tax and employee income contributions. Local taxation provides further funding for social services. Private funding can be broken down into out-of-pocket payments for prescription drugs, ophthalmic and dental services and private medical insurance premiums. PCTs are now at the centre of the NHS and control 80% of the NHS budget.

Hospitals are managed by secondary care trusts, which make sure that hospitals provide high-quality healthcare, and that they spend their money efficiently. They also decide on a strategy for how the hospital will develop, so that services improve.

Secondary care trusts employ a large part of the NHS workforce, including nurses, doctors, pharmacists, midwives and health visitors, as well as people doing jobs related to medicine – physiotherapists, radiographers, podiatrists, speech and language therapists, counsellors, occupational therapists and psychologists. There are many other non-medical staff employed by acute trusts, including receptionists, porters, cleaners, specialists in information technology, managers, engineers, caterers and domestic and security staff.

Some secondary care trusts are regional or national centres for more specialised care. Others are attached to universities and help to train health professionals. Acute trusts can also provide services in the community, for example through health centres, clinics or in people's homes.

In England, budgets for healthcare are set every three years through negotiations between the Chancellor of the Exchequer and Department of Health.

3.3.2.1 Elderly and chronic disease social services in UK

In November 1989, the Government published the White Paper "Caring for People", which laid out a framework for community care changes. Community care was defined in the White Paper as "providing the right level of intervention and support to enable people to achieve maximum independence and control over their own lives" (Focus on Disability, 2005)

The actual objectives of the White Paper were:

- To promote the development of domiciliary, day and respite services to enable people to live in their own homes wherever feasible and sensible.

- To ensure that service providers make practical support for carers a high priority.

- To make proper assessment of need and good case management the cornerstone of high quality care.

- To promote the development of a flourishing independent sector, along with high quality public services. (Social services would now be 'enabling' agencies - it would now be their responsibility to make maximum use of the private and voluntary sectors.)

- To clarify the responsibility of agencies and to make it easier to hold them to account for their performance.

- To ensure better value for taxpayers' money by introducing a new funding structure for social care.

The National Health Service and Community Care Act 1990, which came into force in 1993, made the necessary legal changes to implement the objectives set out in "Caring for People". This act, as modified by the Health and Social Care Act of 2001, provides the framework for assessment of social care needs (Nolan et al., 2004). If, whilst being assessed, it becomes clear that a person is disabled, the local authority is obliged under the Community Care Act to assess that person under

the Disabled Person's Act 1986. Under the latter act, a person may be entitled to practical assistance in the home amongst other services.

Healthcare is free at the point of delivery and funded by taxes not insurance. However, most social care is provided by local authorities who demand a modest means-tested contribution from patients.

The NHS and Community Care Act 1990 gave local governments the opportunity to concentrate their efforts on community needs rather than on medicalised homes. Responsibility for care fees was transferred from the Department of Social Security to local authorities. They could decide which part of their budget should be allocated to community services and which part should be dedicated to residential care.

The aim of the act is to enable people to stay in their homes for as long as possible. It gives local authorities the responsibility to assess people's needs. Local authorities differ in the kind of services they offer and the way that they are delivered. There is no obligation to actually provide services, just an obligation to assess needs.

The Community Care Act has resulted in a growing number of different services designed to support people in their own homes. However, the range and level of services vary a great deal from area to area. Financial constraints sometimes mean that it is not possible for someone to be supported at home. Local authorities are not legally obliged to provide community care for individuals if this would cost more than moving them to a residential or nursing home.

Carers may, if they wish, receive direct payments to purchase the services they need, rather than receiving services. People with dementia may be entitled to vouchers to purchase additional support when the carer needs a break. These vouchers are issued on behalf of the person with dementia but the recipient can ask to have them issued in the name of the carer so that the carer can redeem the vouchers.

Below a list of home care services offered to older people in France is provided:

- Domiciliary services e.g. home help, home care etc.
- Daytime services outside of the home e.g. day centres, lunch clubs or day hospitals
- Meals on wheels
- Respite care which allows carers and people with dementia to have a short break from each other
- Night sitting services
- Nursing home care

3.3.2.2 eHealth strategy in UK

The United Kingdom can be regarded as one of the European most advanced country for eHealth solutions usage. ICT usage rates are among the highest found in the EU27. The infrastructure availability is very high in the United Kingdom, as both computer and Internet connections are nearly universal in British GP practices. This applies to local storage of medical and administrative patient data as well.

The National Programme for IT in the NHS, a ten year programme, encourages the use of Information Technology (IT) to improve the quality of the health services. Since April 2005 the National Programme for IT in the NHS is delivered through the "NHS Connecting for Health" which is an agency of the Department of Health.

A key aim of the National Programme is to give healthcare professionals access to patient information safely, securely and easily, whenever and wherever it is needed. The National Programme is an essential element in delivering patient care by enabling clinicians and other NHS staff to increase their efficiency and effectiveness, doing this by:

- NHS Care Records Service (NHS CRS) – with an individual electronic NHS Care Record for every patient in England, securely accessible by the patient and those caring for them;

- Choose and Book- the electronic booking service, offering patients greater choice of hospital or clinic and more convenience in the date and time of their appointment;

- Electronic Prescription Service (EPS) - to make prescribing and dispensing safer, easier and more convenient for patients.

- National Network (N3) - providing IT infrastructure and broadband connectivity for the NHS so patient information can be shared between organisations.

- Picture Archiving and Communications Systems (PACS) - to capture, store, display and distribute static and moving digital medical images, providing clearer x-rays and scans and faster, more accurate diagnosis.

- IT supporting GPs including the Quality Management and Analysis System (QMAS) and a system for GP to GP record transfer- including the Quality Management and Analysis System support for the Quality and Outcomes Framework and system for GP to GP record transfer.

- The Contact email and directory service– a central email and directory service for the NHS, to enable staff to transfer patient information, swiftly, securely and efficiently.

The delivery of the programme has been divided into different phases in order to ensure that new IT strategy will be implemented successfully. The Phase 0, which was preparatory, started in April 2002 and finished in March 2003. Phase 1 concentrated on some key tools and pieces of infrastructure (April 2003-December 2005). The following diagram summarises the main expected deliverables for the Phases 2 and 3.

Phase 2: January 2006 – December 2007
Infrastructure • Broadband access implemented at recommended access speeds across local and wide area networks in the NHS; • Secure access mechanisms (e.g. Smartcards) for all NHS staff
Application Services

- Full national health record service, with core data and reference links to local EPR systems for full record access.

- National Booking Service, all patient appointments, implemented.

- National Prescriptions Service, with full clinical and patient functionality, 100% implemented

- EPR systems implemented in all Primary Care Trusts (PCTs), all hospitals

- Picture archiving and communications systems for all Secondary Trusts

- **Telecare established in all GP synergies for diabetes, heart disease, skin disease**

- Patient/Citizen Portal available via Internet, Digital TV, wireless devices

- Ambulance radio replacement

- **Home Telecare available in 20% of homes requiring it**

- Common clinical terms implemented for hospital and primary care

- National Knowledge Service fully established

Phase 3: January 2008 – December 2010

- Ambulance Telemonitoring implemented in 100% of all emergency response vehicles

- **Home Telecare available in 100% of homes requiring it**

- Unified Health Record (with all appropriate Social care information)

The National Programme for IT is the major initiative, in the four countries of the UK, including the Preventative Technologies Grant and the Whole System Demonstrators, and represents the most important concerted effort by government to stimulate innovation in this field by supporting telecare services. Since 1998, even before the existence of the National Programme, UK has funded several telecare projects. Around £175 million of finance have been spending to support additional telecare initiatives over the period 2006–2011 by involving an increasing number of people. These preliminary telecare experiments will provide information and data for a larger uptake of such services, before the final integration in the NHS. Thanks to the UK pilots projects in telecare much information and data have been collected useful to improve further experiments like these in other EU Countries. Basically, form the UK tests the following some useful lessons have been learnt shortly summarised following:

1. For some specific applications, for example, telecare really aimed at patients with diabetes or heart disease, there is evidence of benefits in terms of individual patient outcomes the most important of which is the quality of life improvements;

2. Telecare requires different levels of integration between health and social care service providers depending on the type of services being offered. The introduction of telecare services must recognise this complexity with the development of flexible service structures

that can collaborate with different public agencies. Achieving this has been demonstrated not to be easy;

3. The most important parts of a new telecare service are: i) the methodologies for client needs assessment; ii) systems installation and service provision for monitoring and response need for developing suitable supply chain involving equipment manufacturers, specialised ICT for eHealth companies, housing services, and local authority. Identifying all these stakeholders takes time and effort;

4. Another challenge found in the UK pilot tests (and in many other countries) is the way health and social care services are currently funded. In the UK most health care services are free to the users, whilst many social care services have to be paid by users (except for those with a low income). This makes it hard for commercial suppliers of telecare equipment and services to develop suitable business models.

The following table gives a summary of the major drivers and constrains, influencing the potential implementation of telecare and teleHealth services in UK.

	Ageing Population	Existing Projects	Financial Supports	Increasing Demand	Shortage Specialists	Hospital Expenses
Market drivers	5	5	5	5	1	3
	Unclear Value	**Interoperability Issues**	**Legislation Framework**	**High Costs**		
Market restrains	4	4	3	n.a.		

Table 5 - Drivers and constrains for eHealth services deployment in UK

UK has locally started several projects on telemedicine and telemonitoring. These experiences show that the major drivers leading to their widespread adoption are: i) the aging population and the parallel increasing demand for assistance due to chronic illness will; and ii) The presence of many telehealth pilots since '90 that have provided a favourable social and legislation framework for telemedicine services. A major effort still need to be put on technology interoperability issues and a more effective promotion among people and practitioners about telemedicine's and telecare's real benefits.

3.3.3 Spain

Healthcare provisioning in Spain is decentralised into 17 different regions. The decentralisation process started in 1980s, when Catalonia received healthcare responsibilities. In 1985, it was Andalusia; in the 1990s five new regions took on healthcare responsibilities and from 2002 the whole system became fully decentralised.

The Spanish National Health Service (NHS), therefore, may now be characterised as a network of health services, rather than a unique national health service. However it is in the responsibility of the national government the organisation and coordination of overall health services by:

- Indicating basic conditions and minimum requirements of public health service;

- Promoting methods for information sharing and technical standardisation in specific areas

- Surveillance and control to prevent health risks due to international trade

In 2006, Social security budget reached 97,8 b€, 8,4% more than 2005. Reserve Funds, destined to unexpected expenditures are estimated to 35 M€ (2006). Economical payments, such as pensions, family allocations, reached 85 b€, which represents 87% of the total health budget.

In 2005, private health expenditure represents about 30% of the total expenditure, equal to 13,4 b€, 17% of Spanish people have a private medical coverage.

3.3.3.1 Elderly and chronic disease social services in Spain

Home care services are free for people who are on the minimum pension, whilst people with an income twice as high as the minimum pension must pay for the services. People owning an intermediary income must pay a certain amount which is calculated on the basis of their income.

Home social services are financed jointly by the Ministry of Social Affairs, the regional ministries of Social Welfare and the municipalities. Home visits by general practitioners and primary care nurses are funded through the Public Health Service. In addition to government provided services, voluntary associations and not-for-profit associations such as the Red Cross also provide social home care services.

Home care services include primary care social services, social work, assistance with household tasks, meals-on-wheels and tele-alarm services. However, these services are not available in all the autonomous communities.

In practice, home care services are more or less limited to household tasks (which also includes laundry and shopping). This seems to be based on the choice of the elderly people many of whom think that personal care should be carried out by the family. This opinion seems to be shared by carers who often prefer to receive formal assistance with household tasks rather than personal care.

Meals-on-wheels is a services that is only available in the cities of Malaga and Cordoba Andalusia) and in the city of Lerida (in Catalonia). Teleassistance and telealarm services are offered in at least 10 of the autonomous communities. In Andalusia, Castilla-Leon, Valencia, a service exists which consists of helping to adapt the home to the needs of the dependent person.

3.3.3.2   eHealth strategy in Spain

In terms of ICT infrastructure (computer, Internet, broadband), Spanish GP practices are slightly less well equipped than their European peers on average. While the storage of medical patient data and the use of computers in consultations are quite common in Spain, the electronic transfer of patient data is only at the beginning of its development. Around two-thirds of Spanish general practices store electronic patient data and use a computer for consultation purposes as well.

There are currently two major initiatives supporting the eHealth in Spain: i) the Plan for Quality in the National Health System — decided on in 2006 — and, ii) Local pilot initiatives aiming to improve ICT use in the health sector.

As part of the wider Information Society strategy "Plan Avanza", the Spanish eGovernment formulated a strategic plan called "Health online" that aims to increase the use of ICT by adapting the human resources policy to the changing service needs in the 2006-2010 timeframe. Investment under Plan Avanza in digital health has a total budget of 448 million euros (54.29% financed by the Spanish Government and 45.71% by the Autonomous Regions) for the 2006-2012 period aimed at strengthening the basic infrastructure needed to digitalise healthcare.

Because of the strongly decentralized Spanish health care system, the regional health authorities run numerous initiatives for improving their eHealth services. This has led to the existence of numerous different systems of ePrescribing, telemedicine or electronic health records in almost all Spanish regions, each with a varying range of services as well as of actual use rates.

Telefonica is the main actor for telemedicine services in Spain. Telefonica R&D launched in 2007 its first Living Lab, which is dedicated to health- and well-being-related services and is backed by the Andalusian government. In February 2009, the Spanish operator signed an agreement to deploy all voice and data services in the 42 health centres in Spain run by healthcare organization USP Hospitals. Telefonica established two working groups, one focused on telecommunications and the other on direct health services. The Spanish incumbent has invested to develop advanced eHealth applications, such as remote monitoring.

Some success in relation to General Practitioners' ICT use is visible, as Spain is among the solid average performers in the field, with moderate to above-average usage rates in the areas of patient data storage, computer use in consultation and also the transfer of lab results. Use of more advanced electronic patient data transfer schemes is however still relatively low.

The following table gives a summary of the major drivers and constrains, influencing the potential implementation of telecare and teleHealth services in Spain.

	Ageing Population	Existing Projects	Financial Supports	Increasing Demand	Shortage Specialists	Hospital Expenses
Market drivers	5	3	3	5	1	3
	Unclear Value	**Interoperability Issues**	**Legislation Framework**	**High Costs**		
Market restrains	n.a.	3	4	n.a.		

Table 6 - Drivers and constrains for eHealth services deployment in Spain

Also in Spain aging population and an increasing demand for assistance due to chronic illness will be the most important drivers for eHealth solutions deployment. Valuable pilot projects for testing technologies and level of services have been launched locally even though a clear national strategy should be fully implemented. Also for Spain additional efforts should be made to ensure technological interoperability and to innovate the healthcare legislation framework to consider eHealth services to be fully integrated in the NHS and therefore reimbursable.

3.3.4   Italy

The Italian National Health Service (NHS) provides universal health care coverage. Following the 2001 reform of the Italian constitution, the NHS has been decentralized to the 20 regions, sharing health care responsibility with the State.

The Ministry of Health is responsible for health care planning and financing, framework regulation, monitoring, and general governance of the National Institutes for Scientific Research. Regional governments are responsible for meeting the national objectives set by the National Health Plan at the regional level. Regions are also responsible for legislative and administrative functions, for planning health care activities, for organising health care services provision in relation to local population needs. They are also in charge of monitoring the quality, appropriateness and efficiency of the services provided.

At regional level, health care services are provided through Local Health Units (called ASL – Aziende Sanitarie Locali) which are public health enterprises funded by the Regions, They are responsible for delivering healthcare services at the local level. Local health units are organised into health districts responsible for ensuring the accessibility, continuity and timeliness of care.

The Italian healthcare system is partially financed by a tax collected at regional level. This tax is supplemented by a national grant financed with revenues from the value-added tax to ensure adequate resources for each region. A contribution to cover health service is also requested to people (co-payments) when they ask for basic and specific services, for instance for diagnostic procedures, pharmaceuticals and specialist consultations.

The Ministry of Health is responsible for proposing the amount of public resources to be dedicated to health care and how these resources should be allocated among the regions and levels of care. The Ministry manages the National Health Fund and allocates resources to the regions from the global national budget. The allocation aims to ensure uniform availability of resources in the regions. The Regions have to finance the remaining health care expenditure from their own sources.

3.3.4.1 Elderly and chronic disease social services in Italy

In Italy, citizens must purchase a ticket in order to have access to services within the National Health Service. People who are over 65 years old and those suffering from an officially recognised chronic and disabling disease do not have to pay.

The regions have legislative powers over health and welfare but home care services are financed entirely by Local Councils. Such services are generally rendered to people on low incomes. Elderly people may have to contribute towards costs using their pensions, vouchers and care payments. Those with extremely limited financial resources may be exempt from making these partial payments.

National surveys have revealed that 15% of families caring for an elderly relative employ informal carers on a private basis for more than 20 hours per week. These carers are often immigrants and the amount paid per month ranges from approximately EUR 500 in the South to EUR 800 in the North. In some cases, families use the vouchers that they are given for services to contribute towards the cost of private care.

A care system was set up in the framework of the National Plan for Elderly people which includes:

- **Home Care (community care):** with social importance (home help, meals and personal care); with health importance (medical, rehabilitative and/or nursing care); integrated.

- **Integrated Home Care Services:** is a combination of integrated and coordinated health and social activities which seek to keep an elderly person at home as longer as possible. Health services are medical care (Geriatric, Psychiatry), nursing, rehabilitation, medicines and prosthesis supply. Social services are: personal care, meals, house work, laundry, administrative services.

- **Day Centres:** semi-residential structure, within the District, which hosts disabled elderly people for a short-term period (they are open during the day, 5 days a week, 7 hours a day, and admit 20 elderly persons). They provide healthcare services (prevention, therapy, and rehabilitation), and social care services (personal care and promotion of personal autonomy, entertainment, job therapy, and social activities).

- **Nursing homes:** residential structure organised into small groups ("nuclei"), which provides healthcare, social care, and functional rehabilitation for people with disabilities. Patient care can be extensive or intensive. The first area comprises temporary accommodation for long-term care and rehabilitation (while hospitalisation is limited only to the acute stage). The

second area comprises intensive rehabilitation, with high medical importance, plus a hospice for terminally ill patients which provides palliative care (reduction of pain; social protection for patients and their family; family support). Doctors, nurses, social workers and psychologists are available at the nursing homes.

3.3.4.2 eHealth strategy in Italy

The Italian eHealth Strategy aims to improve the efficiency and effectiveness of the healthcare system as a whole, to assure the fundamental levels of healthcare services throughout the country, and to speed up the technological innovation in patient-centred social and health care services.

The availability of ICT infrastructure in Italian General Practitioner (GP) practices (computer, Internet, broadband) corresponds to the average readiness in the EU 27. While the storage of patient data is quite common in Italy, the use of electronic patient data transfer is only at the beginning of its development. Both the use of a computer for consultation purposes and the use of Decision Support Systems are quite well established in Italian GP practices and therefore also slightly more common in Italy than in the EU27 in general.

In 2001, the New National Healthcare Information System (NSIS) was initiated to oversee and monitor all healthcare service levels. The main goal of this framework was to create a homogenous individual healthcare information record. The second step on the way towards this goal was the development of the so-called "National Healthcare Service's Bricks" in 2004, i.e. a toolkit to ensure the interoperability of health information systems developed by local healthcare administrations. The "bricks" programme aims to share methodologies for measuring quality, efficiency and appropriateness of the Regional Healthcare Services and to ensure a common language to classify and codify concepts in a uniform manner.

Due to the strongly decentralized Italian health care system, a permanent eHealth board (TSE - Tavolo permanente per la Sanità Elettronica-) was introduced in 2004 for the coordination of national and regional eHealth policies. The TSE published in 2004 the paper "Shared Policy for eHealth" and in 2006 the "Architectural strategy for eHealth" guidelines in compliance with the European Union eHealth Action Plan.

Three main levels will compose the structure of the Italian eHealth system:

1) a new information system accessible by all actors of National Health system. to share information and data;

2) Indication of a minimum standard level of information to be collected and a set of methods and definitions to be used to collect them;

3) Development of anew infrastructures to allow end users and local institutions to access the system.

The whole architecture is developed around the Electronic Health File (FSE, Fascicolo Sanitario Elettronico) that contains information regarding a patient medical history. These data can be accessed by citizens through the National Service Card (CNS), which is a smart card that can be

used as an Health Card or as an Identity Card[28]. A network of regional systems in which medical histories of individuals –Electronic Health Records – will be stored will compose the system. This network will be accessible anywhere in Italy by medics and administrative bodies.

Regional authorities following the guidelines given by central bodies manage the health system in Italy, therefore, the development of e-Health system has to be analyzed at a regional level:

- In Lombardy, the e-Health sector is quite developed. It was the first Italian region to introduce Regional Service Cards – in 2006 there were 9 millions digital health cards, of which 52% are already active. Electronic Health Records are stored and diffused among local actors through a network called SISS (Informative Social and Medical System). In 2007 this system will also be extended to private medical structures.

- In Emilia-Romagna in 2006, the SOLE Project (Health on line) was further developed. Now it can be used for prescriptions, booking of medical services and to store and diffuse Electronic Health Records.

- In Piemonte in 2007, a system to store and diffuse Electronic Health Records was developed, which were based on new ad hoc software.

  A pilot project for telemonitoring has started in the region to provide people at risk with tele assistance. They are typically elderly people who lives alone or having a clinical situation that require attention, to ensure rapid and effective intervention in emergency situations. The telemonitoring system provides readings of skin temperature, micro and macro movement (fingers, pulse rate), temperature and ambient lighting and heart rate. The tele-monitoring system also provides a video call feature to support frail people and care workers in case of need.

- In Veneto in 2007, a digital signature for medical prescriptions was introduced. The project IESS (Integration for the Distribution of Health services) started as a pilot project in two municipalities.

- In Friuli Venezia Giulia, the SISRCR project (Regional integrated health services for the continuity in the medical treatment) was developed. The aim of the project is to supply citizens with a complete services system, which is focused first of all on the delocalisation of access and information points in order to avoid useless accesses for the gathering of medical reports and information. The project has already activated seven portals, one for each territorial medical authority and one operating as a single access point to the Regional Health system.

- The remaining regions have been working in similar projects that are still on going.

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[28] Since January 2005, the National Service Card have been introduced, following the guidelines issued by the National Centre for ICTs in the Public Sector (issued on 4th of January 2005, www.cnipa.gov.it/site/it-IT).

The following Table 7 gives a summary of the major drivers and constrains, influencing the potential implementation of telecare and teleHealth services in Italy.

	Ageing Population	Existing Projects	Financial Supports	Increasing Demand	Shortage Specialists	Hospital Expenses
Market drivers	5	2	3	5	1	3
	Unclear Value	Interoperability Issues	Legislation Framework	High Costs		
Market restrains	4	5	5	n.a.		

Table 7 - Drivers and constrains for eHealth services deployment in Italy

The aging population and an increasing demand for assistance due to chronic illness will be the most important drivers for eHealth solutions deployment in Italy. Existing experience of telemedicine through pilot projects are very limited and they seem an isolate initiative of some regions. Technology interoperability, limited user acceptance, the presence of an heterogeneous legal framework, as well as the lack of a clear reimbursement policy seem to be the key limiting factors for a wider introduction of telecare and telemonitoring solutions.

3.3.5 Greece

The Greek healthcare system is a mixture of "the public contract and public integrated models" (according to the 1992 OECD taxonomy proposed by Hurst) where the financing is provided by a combination of social insurance and general taxation and services are offered by both public and private providers.

Public and private health expenditure as a share of the GDP is 9,4% (OECD data of 2004). A substantial part of total expenditure (47,4%) is covered by private health expenditure, making the Greek health care system one of the most privatized among EU countries.

The Ministry of Health and Social Solidarity is the main decision making body on matters concerning the overall health policy and the national strategy for health. It defines priorities on the national level, determines the extent of funding for proposed activities and allocates resources. Since 2001, 17 Regional Health Authorities have been established, originally named PE.S.Y.P. (Regional Systems of Health and Welfare) and currently referred to as D.Y.PE (Administration of Health Services Region). These authorities have extensive responsibilities for the implementation of national priorities at regional level, coordination of regional activities and organisation and management of health care and welfare services in their respective geographical areas.

Primary health care in the public sector is delivered through primary health care centres (particularly in the rural areas), as well as through the outpatient services of NHS hospitals and the primary care units belonging to the largest social fund, IKA. Health care centres also provide

emergency services, short-stay hospitalization and follow-up treatment for recovering patients, dental treatment, family planning services, preventive health, vaccinations and health education. The National Health System is responsible for the provision of hospital, emergency pre-hospital and primary healthcare services on a universal basis.

3.3.5.1 Elderly and chronic disease social services in Greece

There is no long-term care insurance in Greece. Financial assistance is mainly in the form of discretionary tax rebates to family carers. Some family carers use supplementary pensions for incapacity or dependency to help towards the costs of caring.

Open care community centres for old people were set up as a pilot scheme by voluntary organisations funded by the State. In 1982, local authorities assumed responsibility for the KAPIs and the State continued to be the main financial contributor. A "Help at Home" programme for older people was started in 1992 under the auspices of the Ministry of Health and Welfare involving a number of KAPIs and local authorities.

Where community care services exist, they are free at the point of use. They are currently funded through central government. Some services are partly funded by EU special programmes e.g. some of the KAPI home care services.

KAPI centres aim to provide the necessary support to enable people to live independently in their own homes for as long as possible. Most offer the following services:

- Preventive medical services
- Physiotherapy programmes
- Ergotherapy programmes
- Health education
- Recreational activities

Many KAPI centres collaborate with the Help at Home project which offers a range of services to elderly people who are unable to manage on their own, i.e.:

- Social services (counselling and psychosocial support, information on rights and health issues)
- Health care services
- Family assistance (assistance with housework, personal care and eating, as well as befriending)

A few community centres are run by voluntary bodies or directly by local authorities (e.g. the centres for love and friendship in Athens). They are fairly similar to the KAPI centres but do not offer health care services. A number of day care centres have been set up since the establishment of the National Social Care System in 1998. These are closely linked to the KAPIs.

In some areas, local authorities and many parishes of the Orthodox Church provide free meals at home to people in need. In many areas, neighbours, friends and volunteers offer sitting services but the main source of respite care is still through acute admissions to hospitals. In Thessalonika and Athens, there is a 24-hour tele-alarm system linked to family, neighbours, the police or the ambulance service.

The private sector offers hospital level services (primarily through general and maternity hospitals making up for almost 26% of total hospital bed capacity in the country) and primary care services through private practices, laboratories and diagnostic centres. These services are remunerated on a fee-for-service basis either through contracts with social insurance funds or directly by patients themselves.

3.3.5.2   eHealth strategy in Greece

The main actor in defining eHealth policy in Greece is the Ministry of Health and Social Solidarity (YYKA), General Secretariat for Public Health.

The National eHealth Strategy, entitled "Quality and Safety of Healthcare Services in an e-Government Environment: Common Goals and Action Framework 2006 - 2015" was made public in June 2006.

The strategy's main goal is to set up a National Health Information System implementing — among other things — Electronic Health Records. The adoption of this plan may partly explain low current eHealth usage rates in particular in relation to patient data transfer. This situation is also due to the lack of the necessary networking infrastructure — including standards, a national health portal, health insurance smart cards, various electronic information systems etc. — and will only become available on a wider scale in the coming years.

However some projects have been launched recently to introduce and test eHealth services. A project has been run by the eHealth Unit of Sotiria Hospital, Athens for the provision of eHealth home-based rehabilitation, follow up and home hospitalisation services in patients with advanced stages of chronic diseases. This specific project concerned chronic patients suffering mainly of advanced stage COPD (Chronic Obstructive Pulmonary Disease), with a past history of multiple hospital admissions. Services were offered in two stages: first, as an outpatient rehabilitation program and then as home-based rehabilitation and follow-up, combined with home hospitalization when needed. An electronic health record was created for each patient, based on a specially designed multimedia software system. The purpose of the first phase was to create the patients' EHR (Electronic Health Record), to train both patients and their relatives for the optimal, holistic rehabilitative treatment of their disease and to prepare them for the innovative services of the program. The home care phase was accomplished through nurse home visits on a scheduled or on emergency basis. The nurses used a laptop equipped with the project system supporting the patient's EHR, peripheral medical devices for patient examination at home and a digital video-camera. During scheduled home visits, the following tasks were performed:

- Checking of vital signs and physical condition

- Control of pharmaceutical therapy

- Consultation for the correct use of medical devices

- Checking of exercise training program and nutrition

- Reinforcement of patient's and relatives training

- Detection of primary signs of disease exacerbation

- Treatment of other health related special problems of each patient.

On the other hand, the tasks of an emergency home visit were:

- Monitoring of patient's vital signs

- Live communication with the Telemedicine Unit

- Patients' home treatment (in cases of mild exacerbations) or instruction for patients' admission to the hospital.

The project achieved a significant decrease in patient hospitalisation in terms of numbers of hospitalizations per year, hospitalization days and number of emergency and scheduled visits per year. These findings were sustained also two years after the intervention and led to substantial cost savings. Also, considerable progress was noted in patients' knowledge of their condition and their ability for disease self-management.

Another example comes from the field of psychiatry, where collaboration with mobile units and home care (assistance services) led to a reduction by 35% of outpatient emergency visits. The service has been utilized further in the area of Ioannina, Thesprotia through a private organisation. Finally, some municipalities offer tele-consultation services on a small scale (4-5 projects), but these are primarily local initiatives.

These projects have demonstrated that telemedicine is a significant priority, due to the need to provide healthcare services to inhabitants of islands and remote areas. They also proved that home care is one of the most important application area, with the aim of improving the quality of life particularly of chronic patients, as well as achieving substantial cost savings through avoidance of repeated hospitalizations.

However, major obstacles have been found like the absence of a general organisational and legal framework which is needed to clarify tasks, to assign responsibilities, but also to identify reimbursement principles for these services.

The following table gives a summary of the major drivers and constrains, influencing the potential implementation of telecare and teleHealth services in Italy.

	Ageing Population	Existing Projects	Financial Supports	Increasing Demand	Shortage Specialists	Hospital Expenses
Market drivers	5	3	3	5	1	3
	Unclear Value	**Interoperability Issues**	**Legislation Framework**	**High Costs**		
Market restrains	n.a.	5	5	n.a.		

Table 8 - Drivers and constrains for eHealth services deployment in Greece

Greece has been affected by same tendencies found in the other targeted countries, therefore an aging population and an increasing demand for assistance due to chronic illness will be the most important drivers for the deployment of eHealth solutions in the next years. As in the other countries, in Greece the preliminary experiences in eHealth indicate that additional efforts should be made to ensure full technological interoperability and an innovation of the healthcare legislation framework.

4   Industry analysis

The healthcare industry has specific features when compared to other markets. Differently from the automotive industry, for instance, whose value chain organisation is relatively straightforward organised and well structured, in subsequent activities and key enterprises, the healthcare value chain is divided on many different types of organisations working together and is better described as a value network. The funding structure, indeed, influences the way healthcare providers organise their business model(s) to reach potential customers and, therefore their investments in the sector. Real implementations show e.g. that the healthcare system in the USA, strongly relaying on private funding, has set up healthcare industry organisations totally different from the EU ones where the public funding is predominant in almost all the EU Countries.

The organisation of the healthcare system will influence on the way eHealth services may be organised and offered to the user both patient and healthcare professional. Reimbursement policies and available technologies and services will drive the future telecare services deployment. Advanced technological innovation is stimulating the eHealth market. Innovative biochips can identify and transmit information such as excitement, emotion, stress or disease to a monitoring centre via mobile networks by analyzing biological and chemical data contained in fluids, such as sweat and blood. Affordable multi-standard chipsets, enabling short-, medium- and long-range communication, will enable remote-monitoring products to become commercially viable. The EU Commission through its FP7 is driving technological innovation of e-health systems, supporting several R&D projects, developing home-based, wearable or implanted sensors that transmit data to mobile devices via wireless technology for communication to clinicians for monitoring.

Figure 10 shows innovation trends in telecare according to Frost and Sullivan, that says market products and services are presently limited to the first generation of telecare systems just providing "social alarms" functionalities, whilst second generation and third generation systems are used widely in pilot programmes and research activities.
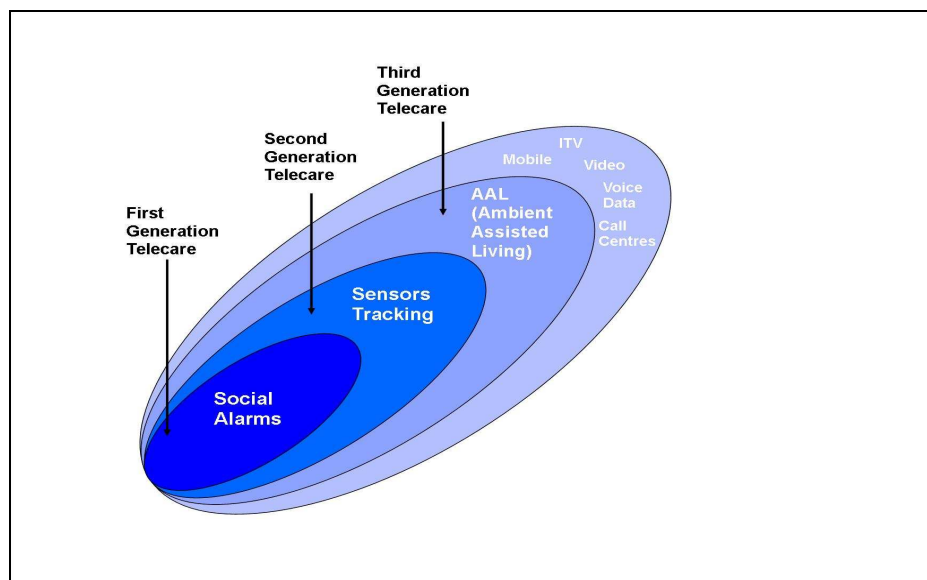

Figure 10 –Trends in telecare (from Frost & Sullivan 2010)

4.1   eHealth technological categories

The e-Health market segmentation is complex and layered for the eHealth sector, and existing solutions and services can fall into a number of different categories and/or sub categories. The current eHealth market can be broken down into four main categories[29] as shown below.

Application Category	Services/Technologies	End-user
Information / Communication	Appointment reminder	Healthcare staff/patients
	Treatment remainder	Healthcare staff/patients
	Test results	Healthcare staff/patients
	Patient data management	Healthcare staff/professionals
	Access to medical research	Healthcare professional
	Health service information	Healthcare staff/professional/patient(s)
Monitoring	Patient condition	Healthcare staff/professional/Third part data aggregator
	Patient location	Healthcare staff/professional
	Drug compliance	Healthcare staff/caregiver
	Medical supplies, equipment	Healthcare staff
Surveillance	Disease incidence	Health administration body
	Disaster relief	Health administration body
	Health worker location	Healthcare staff
Diagnostic	Diagnostic support	Healthcare professional
	Telemedicine	Healthcare professional

Healthcare staff: administrative workers
Healthcare professional = medically qualified workers, such as general practiioners nurses
Health administration body: healthcare organisation, government body or NGO
Caregiver: social worker of family member
Third part data aggregator: data center or call center that aggregates patient data and sends alerts or provides support, part of a monitoring service company

4.1.1 Information / Communication applications

This is a wide category that can be split into two sub-categories: mobile data management (also including mobile access to medical resources) and mobile messaging.

   1. *Mobile Data Management and mobile access to medical resources*

Mobile data management encompasses all clinical work that would traditionally be done on paper. It allows access to clinical data on a mobile device, such as schedules, patient records and billing information, to enable documentation at point of care without the need for later paperwork. These applications are for healthcare workers, for example, in hospitals or in the field, and require an Internet-enabled handset or a personal digital assistant (PDA), synchronized with a back-end health information management system (HIMS). Applications which offer mobile access to medical resources allow medical workers fast access to specific information, usually from trusted resources. An example of such applications are:

- iAnywhere, by Sybase, which allows secure access to clinical data systems on a mobile device;

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[29] Informa, Mobile Healthcare: Markets and Trends for M-health Applications, 2009.

- Clinical Rotation Companion, by Pepid LLC, delivers information to medical students on their clinical rotation.

2. Mobile messaging

Mobile messaging eHealth applications include appointment reminders, medication reminders and information about health issues and health services delivered to patients and targeted population groups. Examples of eHealth messaging applications are:

- HIV Confidant, by Dimagi, which distributes HIV results confidentially to African communities.
- Patient Care Messaging, by iPlato, a web-based system hosted within NHSnet which generates appointment reminders and targeted promotional messages for groups.

4.1.2   Monitoring applications

This segment is the second most common type of eHealth applications. It can be split into two sub-categories: health status monitoring and location/resource monitoring applications.

1. health status monitoring

One of the most common examples of the implementation of this type of application is a diet diary, which requires manual entry of a patient's vital signs, such as weight and blood pressure onto a software application, usually by the patient themselves, and the collected data is sent to a carer or clinician. More advanced implementations exist, such as the monitoring of a patient suffering from chronic illness. This kind of applications requires wearable or home based sensors, which are able to collect and transmit biometric data to a mobile device via a wireless technology.

The growing number of chronically ill patients is one of the major factor for using this type of application. This is not only due to the increase of the number of elderly people but also to lifestyle trends. These patients place a greater burden on the healthcare system in general. Monitoring these patients to detect a decline in their condition early allows costly clinical events to be avoided. This category represents the strongest growth area for eHealth applications**.**

Examples of health status monitoring applications include:

- Ericsson Mobile Monitoring for Healthcare, by Ericsson, which transmits medical data wirelessly to a clinician.
- ACT II, by CardGuard, which monitors heart data using sensors and transmits it to handheld devices connected to a designated call centre

2. Location and resource monitoring applications

These applications include patient and staff tracking using GPS, and asset identification – medical equipment, supplies and resources such as blood – using GPS or RFID tags.

Examples of location and resource monitoring applications include:

- Columba Bracelet, by Orange, which alerts staff if an Alzheimer's patients leave a designated area.

- Asset Management and Tracking, by Motorola, which enables quick location of medical equipment and supplies.

4.1.3   Surveillance applications

Surveillance applications are usually deployed to track health trends among large populations, in order to identify trends and patterns and allocate resources efficiently. They allow for the collection of data and are mostly used by humanitarian and research groups like NGOs wishing to track diseases in order to avoid epidemics. Examples of surveillance eHealth applications are:

- Nokia Data Gathering, which collects data quickly and accurately on disease outbreak and disaster relief via mobile devices.
- Gather, by AED Satellite with Dimagi, which collects and reports disease statistics on a weekly basis.

4.1.4   Diagnostic applications

Most diagnostic e-health applications aim to equip healthcare workers with diagnostic tools at the point of care, often for work taking place in the field or where there might be a shortage of healthcare professionals in rural developing communities. They comprise enhanced, tailored access to medical information resources for specific scenarios, guiding the health worker through the diagnostic process.

Among diagnostic applications, telemedicine involves connecting the remotely-located health worker with an expert, not simply using traditional SMS and voice services but also, by using high-speed data connections for videoconferencing for remote visual diagnosis and treatment to take place.

This trend is a response to declining expert resources in communities of growing populations, or rural communities. Implementation requires Internet-enabled handsets or specialist devices; mobile broadband and HSPA are key enablers for high-bandwidth telemedicine applications. Examples of diagnostic eHealth applications include:

- E-IMCI, by Dimagi, which guides workers through the e-IMCI (Integrated Management of Childhood Illness) algorithm on a PDA.
- Ericsson Telemedicine, by Ericsson, which delivers instant medical advice over broadband-enabled mobile networks.

4.2   Existing market solutions and inCASA positioning

An in depth analysis of existing eHealth market solution has been carried out by Reply Santer[30] (a partner in the inCASA project) that investigated more than 80 applications and systems. This analysis is extremely important to assess the real position of the inCASA solution and its differentiating factors which make it an added-value solution for the final customers.

The 80 eHealth applications and systems have been evaluated taking into account the following functionalities, which also is present in some of the inCASA pilots:

- Appointment reminder;
- Treatment reminder
- Patient data management
- Health service information
- Health information
- Patient condition
- Patient location
- Disease incidence
- Diagnostic support
- Telemedicine

Every functionality has been assessed attributing a qualitative score varying from 1 (very good) to 5 (very bad) which is useful to release an overall ranking of the selected solutions.

The majority of eHealth applications analysed fall under the Information/ Communication category accounting for 45% of applications analysed. The monitoring category follows with the 40% of applications. The surveillance and diagnostic category covers a minor part of the analysis with 6% and 2% of the analysed applications.

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[30] Reply Santer, e-Health Market Analysis, 2010

From the 80 applications and system analysed, a group of 29 has been selected taking into account their higher scores with respect to the total number of applications. The 29 applications selected have been attributed to the different technological categories and the result obtained is shown in Figure 11, below:
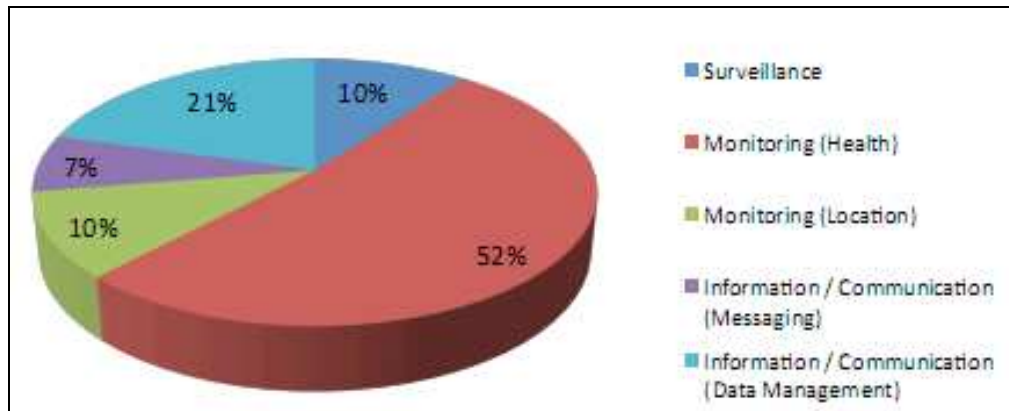

Figure 11 – Categories of the 29 selected applications[31]

The majority of the analysed applications fall in the monitoring category (both health and location monitoring), accounting for respectively 52% and 10%. The rest is distributed between the Information/ Communication and surveillance categories, with a share of 21% for Information-Data Management, 7% for ICT-Messaging and 10% for surveillance applications.

The majority of the selected applications have been implemented thanks to initiatives sponsored by the private sector (77%), whilst public support has financed only a minor part of this implementation (23%), as depicted in Figure 12 below.
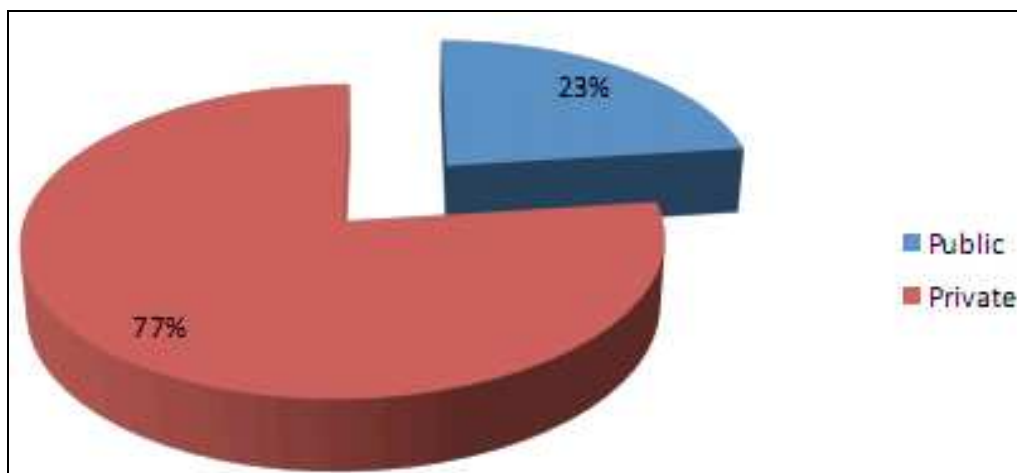

Figure 12 – Analysis by sector

When considering the macro-regions where these applications have been developed, both USA and Europe are the leading regions in terms of technology development and pilot implementation.

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[31] Surveillance: observation and reporting of findings without intervention; Health Monitoring: is the observation of some human health related variables after there has been an intervention of some sort; Location Monitoring: is the observation of some location related variables after there has been an intervention of some sort; ICT Messaging: reminder of data or information; ICT Data-Management: pure communication of data or information.

(see Figure 13). In fact, Europe accounts for the 38% of the 29 applications investigated whereas USA accounts for 34%.
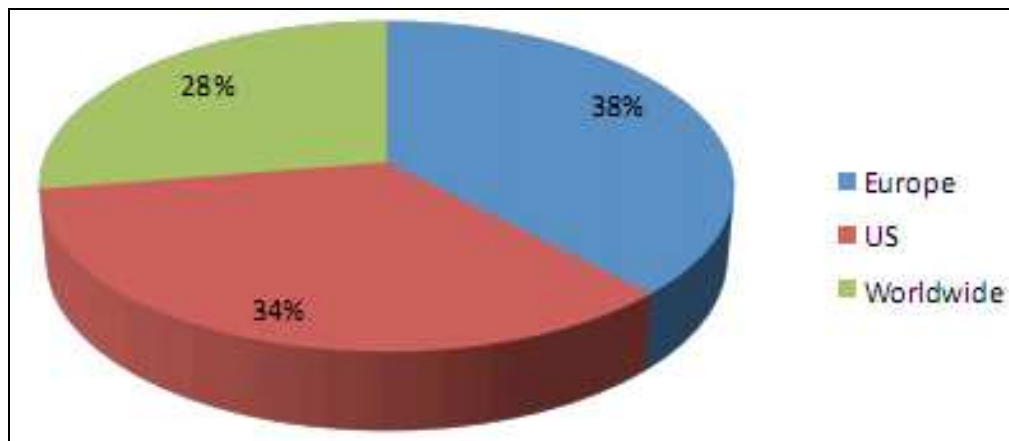

Figure 13 – Analysis by Regions

The 29 applications and systems have been further investigated using additional criteria in order to find out specific similarities and differences with the inCASA solution and therefore a positioning analysis between the present industry solutions and the inCASA one has been performed. The additional criteria used for the analysis are:

- Solution objective
- Additional device integration
- Services delivering
- Services related Cost
- Addressed user(s)
- Project objective vs Performance Indicators
- Monitored Environment Variables
- Monitored Human Variables
- Deployment under public support
- Deployment und private support
- Reference customer(s) (who pay for)
- Commercial Channel
- Partnerships (both already existing and potential ones)

By using these criteria a further assessment has been done and a new rank of the applications and systems has been developed by attributing a general score from 1 (very good) to 5 (very bad). On the basis of the obtained general score, a detailed analysis has been performed for only the application ranking the first position by highlighting its pros and cons. This analysis is reported in the next pages in which the selected applications have been grouped under the related application category.

4.2.1   Health Monitoring

The figure below shows the applications and systems belonging to the Monitoring Health category and their scores.
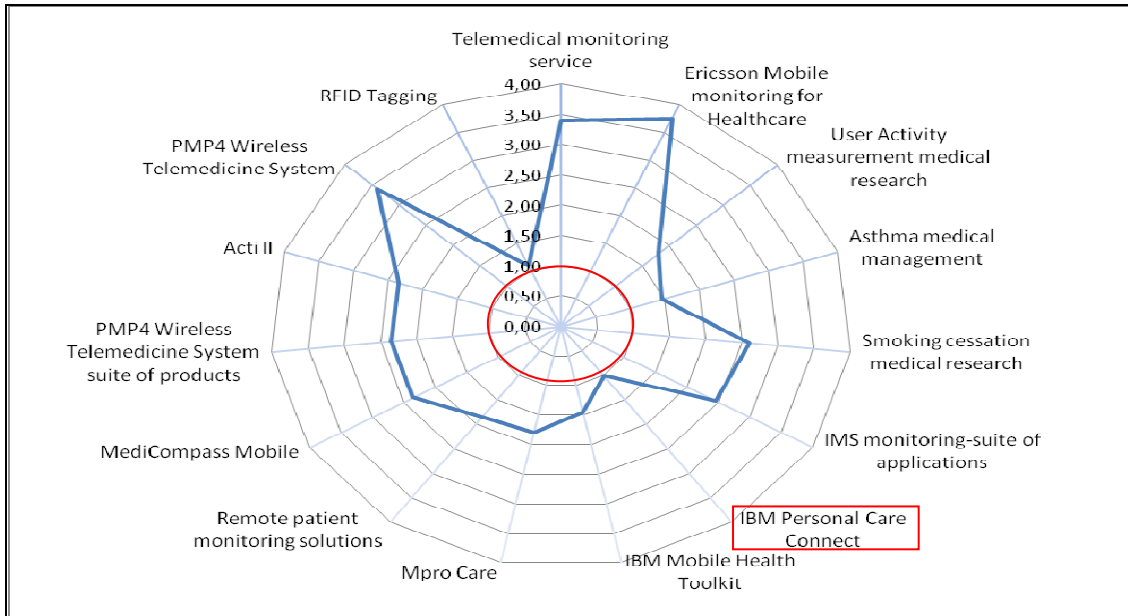

Figure 14 – health monitoring applications and related scores

The "**IBM Personal Care Connect –PCC -**" obtained the highest score among the 15 applications investigated under the Health Monitoring category. Such an attributed score indicates the IBM PCC platform provides services very similar to the ones offered by inCASA.

	IBM Personal Care Connect		
Overview	**App. Category**	**Pros**	**Cons**
It is a platform for remote monitoring. It collects data at the point of generation (typically, in the patient's home) which are normalised and stores in a central server. Through an application programming interface data may be managed and displayed	H. Monitoring	Integration of various biomedical devices is possible, to enable/expand such application	Applications and devices have to comply with the platform requirements
	L. Monitoring	An easy implementation of L. Monitoring systems is possible	Not Available
	Information/ Communication	Empowered cell phones can be used through Bluetooth connections	No information about mobile phones complying with the platform
	Surveillance	Surveillance functions can be activated integrating additional applications on the platform	At present such application has not been implemented

The IBM Personal Care Connect (PCC) facilitates the remote monitoring of patients. By providing caregivers with timely access to a patient's health status, they can provide patients with appropriate preventive interventions, helping to avoid hospitalization and to improve the patient's quality of care and quality of life. PCC is an open platform that can integrate devices from device vendors and applications from independent software vendors. A shot overview of the PCC is provided in the following scheme, by comparing its functionalities against the application categories that are described above.

4.2.2 (Location) Monitoring

The figure below shows the applications and systems grouped in the Monitoring Health category and their related scores.
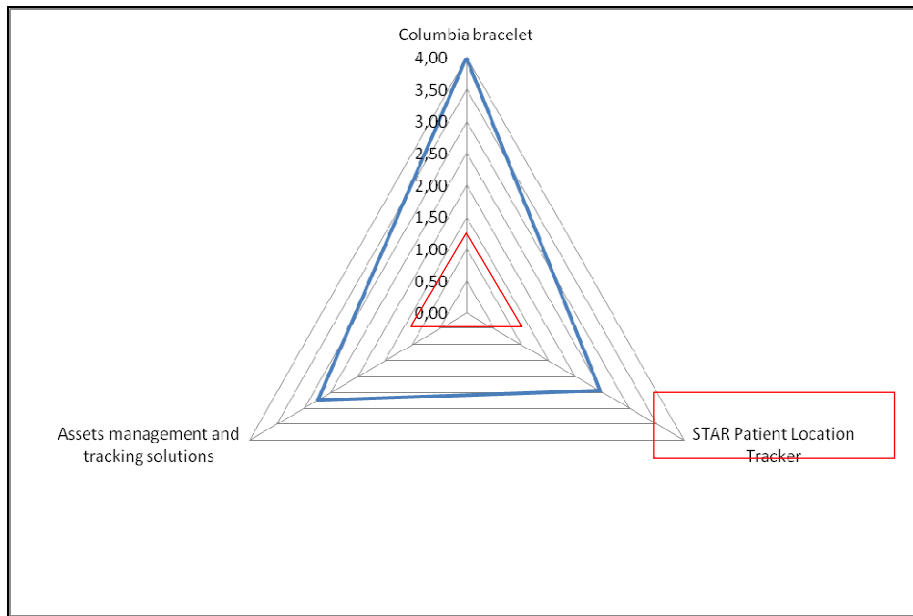

Figure 15 - health monitoring applications and related scores

Among the three applications selected in the Location Monitoring sub-category, the "**STAR Patient Location Tracker**" got the highest scores taking into account its technology and functionalities.

STAR Patient Location Tracker		
App. Category	**Pros**	**Cons**
H. Monitoring	PDA enables easy use with other sensors	n.a.
L. Monitoring	Good in patient location and tracking	Focused on tracking function for hospitals
Information/ Communication	It can be interfaced with mobile phones	System related PDAs do not have generally internet connection
Surveillance	Easy implementation of sensors	Needs for additional software Implementation

Overview

It is PDA supported application that provides patient tracking and improves access management. It enhances patient and caregiver satisfaction by reducing wait times for admission and transfers and improving your caregiver's ability to schedule and track patients.

The STAR Patient Location Tracker allows for hospital bed management. It is designed to predict bed availability, track bed utilization, track patients and transporters, and provide utilization and productivity statistics.

4.2.3   Information/ Communication

The figure below shows the applications and systems grouped in the Information/ Communication category and their related scores.
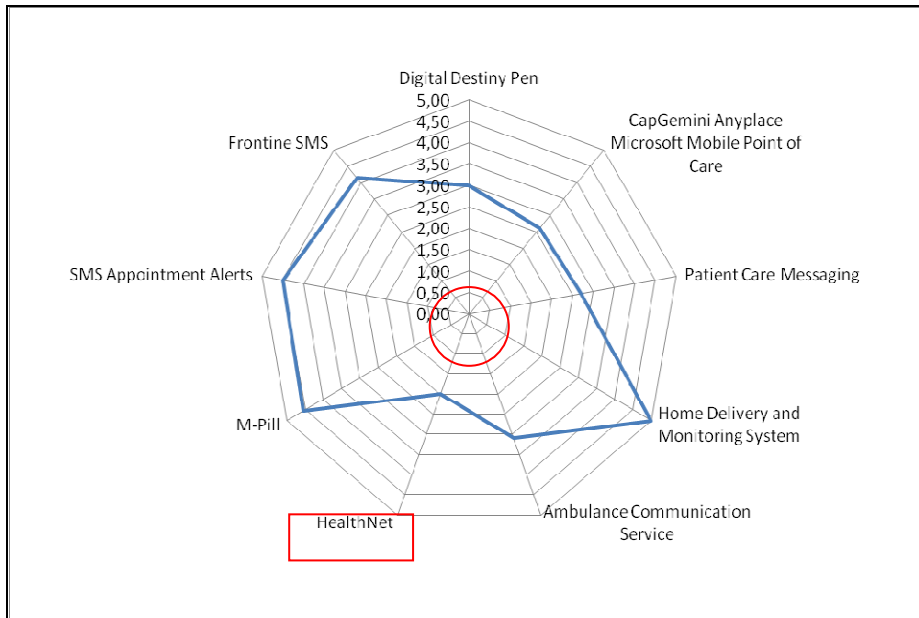

Figure 16 – Information/ Communication applications and related scores

Among the 9 applications selected in the Information/ Communication application category "**HealthNet**" got the best score in terms of the offered functionalities.

HealthNet			
Overview	**App. Category**	**Pros**	**Cons**
HealthNet is a scalable, flexible and secure Health Management Information System (HMIS) designed to support real-time collection, analysis, and exchange health data for management, reporting, monitoring and evaluation	H. Monitoring	Using various biomedical devices and applications patients can be constantly monitored	High costs for additional devices integration
	L. Monitoring	Biomedical devices and applications permit to monitor elderly people or long term patients staying at home	High costs for additional devices integration
	Information/ Communication	The information system allow to set up personal and updated plans for patients	n.a.
	Surveillance	It can be an optional service by implementing additional application	n.a.

HealthNet collects health data in real-time from anywhere via the web, mobile or fixed-line phones. Data are immediately transmitted to a secure central data base where they can be reviewed, approved and analyzed. Authorized users can access data, view, print and export standard reports and view dashboards. Web-based interfaces display key information, including indicators, graphs, alerts, and an interactive geographic information system (GIS) map. The system supports both manual and automated messaging. Notifications are automatically sent based on reported data.

4.2.4 Surveillance

The figure below shows the applications and systems grouped in the Surveillance category and their related scores.
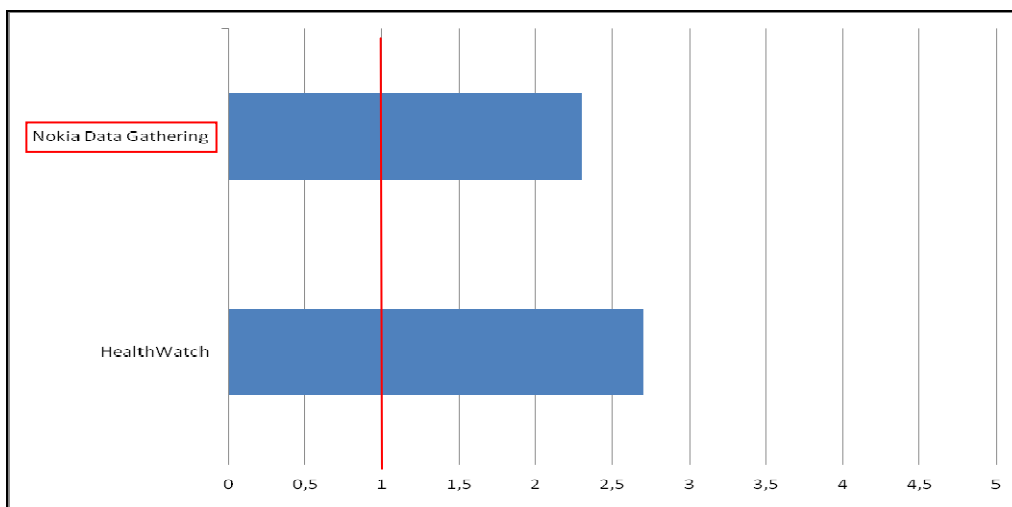

Figure 17 - Surveillance applications and related scores

Of the 2 applications selected in the category the "Nokia data gathering" got the highest score.

Overview	Nokia Data Gathering		
	App. Category	Pros	Cons
Nokia Data Gathering helps user organizations to collect data using Mobile phones. It allows to replace paper forms or laptops. Through mobile phones, data can be immediately transmitted for real time analysis.	H. Monitoring	Application developed to work on smart phones	Not integrated yet with sensors
	L. Monitoring	Smart phone allow tracking functionalities	Not integrated yet with sensors
	Information/ Communication	Very good for information collection and communication	n.a.
	Surveillance	Always available	Patience life data can not be gathered missing sensors

The analysis on teleHealth devices permits a better understanding of the inCASA solution in terms of innovation technologies integrated in the system and its market potential.

The inCASA project is devoted to improve quality of life and social care for the ageing population and to prolong the time elderly people can live independently at home.

inCASA is a telemedicine and telecare solution offering the following main services:

- Provide elderly people with means to profile their "in-home" habits by using unobtrusive motion/contact sensors and a Smart Personal Platform with an embedded Habits Analysis Application able to manage alerts;

- Provide elderly people with means to monitor their health conditions at home, by using state-of-the-art personal health systems and integrated telemedicine services;

- Provide practitioners and health professionals with more comprehensive monitoring data for understanding remote user's social/physical conditions and diagnostics;

- Enable continuity of care through a wider interaction between elderly people and caretakers, especially including not just health specialists but also relatives or people having close social relations with the user;

- Integrating home automation in a system permitting remote control of electronic devices in the immediate surroundings, to cover the specific necessities of elderly people.

With respect to the four applications investigated above since inCASA offer functions which cover almost all the application categories; this is summarised in the figure below dedicated to the inCASA platform positioning versus the other platforms.
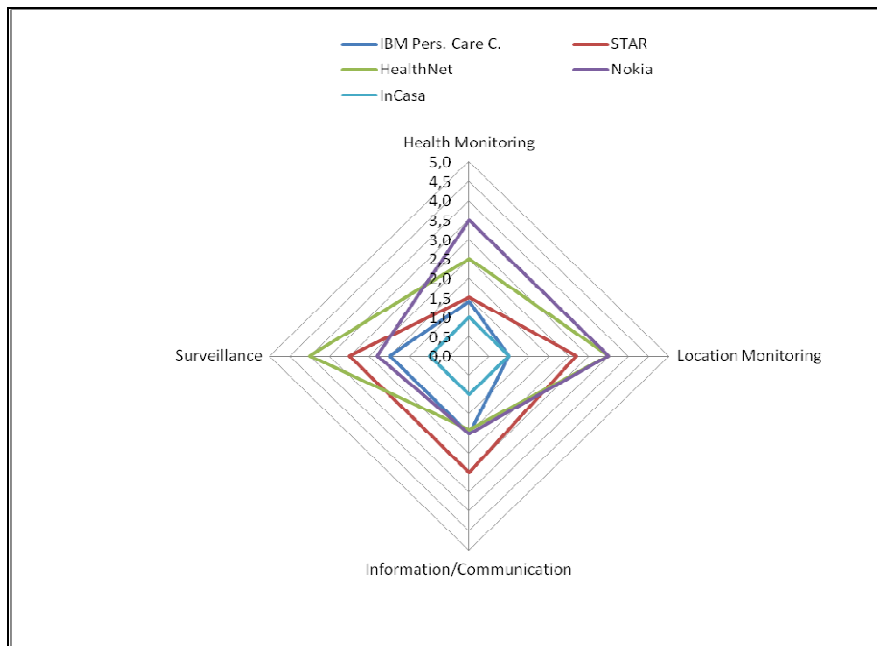

Figure 18 – inCASA positioning vs main competitors

The inCASA's strong advantage relies on a high level of system flexibility and scalability, representing a clear strength for market deployment in the private and public health sector.

5   Conclusions

The healthcare industry is one of several enterprise sectors receiving greater attention above all form ICT industry. Telecommunication operators, for instance, are interested in the development of eHealth services to differentiate their source of revenues by exploiting the technologies (relaying on reliable, secure and high-capacity networks) and expertise, enabling the deployment of eHealth applications for clinical use such as: mobile videoconferencing between clinicians for immediate remote diagnosis or remote monitoring of patients with chronic diseases at home. The diagram below indicates the key factors of the eHealth industry in terms of the present intensity and rivalry of the industry, the power of suppliers, the power of customers, and the new menaces due to new competitors or due to substitutes products.
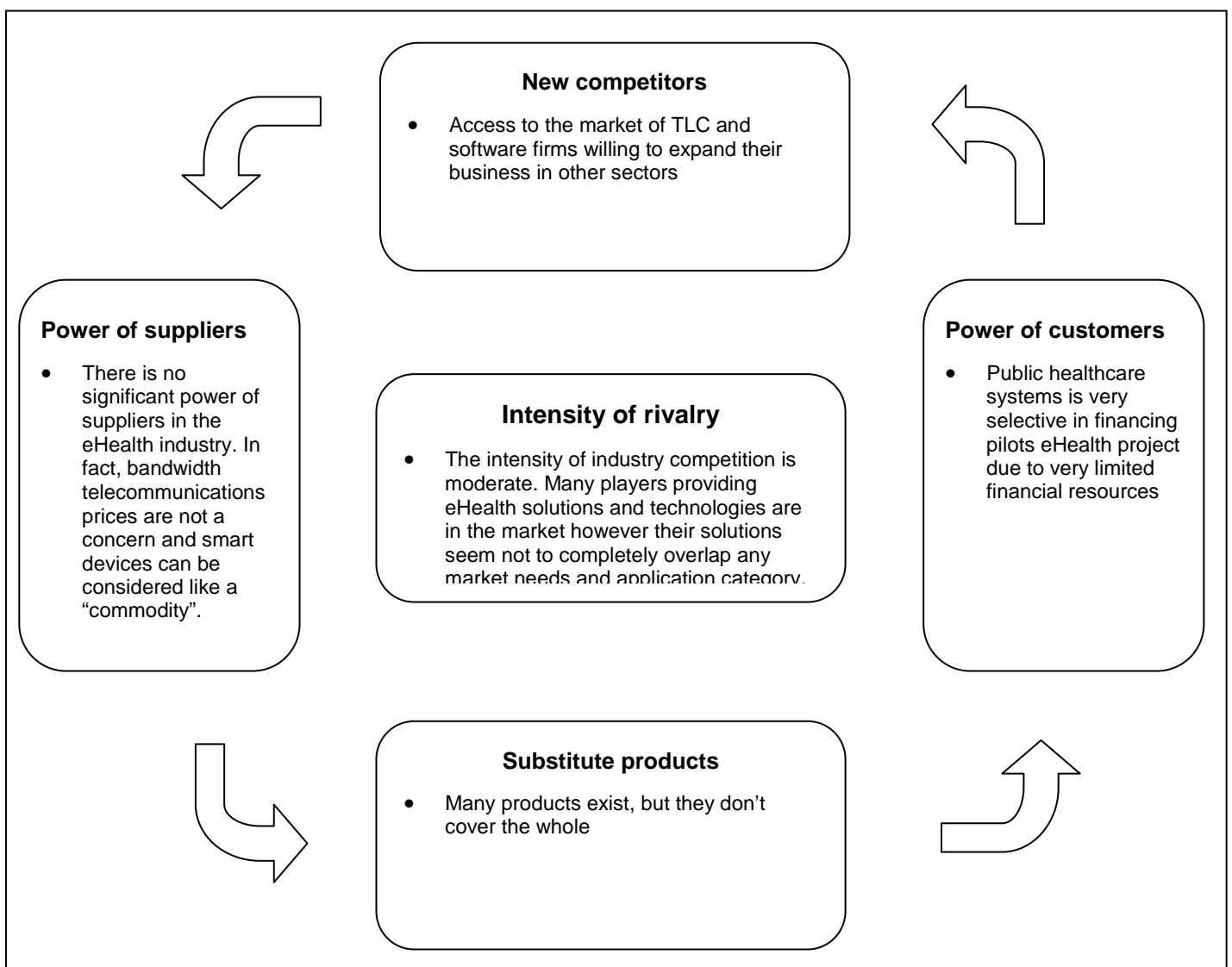
New competitors

- Access to the market of TLC and software firms willing to expand their business in other sectors

Power of suppliers

- There is no significant power of suppliers in the eHealth industry. In fact, bandwidth telecommunications prices are not a concern and smart devices can be considered like a "commodity".

Intensity of rivalry

- The intensity of industry competition is moderate. Many players providing eHealth solutions and technologies are in the market however their solutions seem not to completely overlap any market needs and application category.

Power of customers

- Public healthcare systems is very selective in financing pilots eHealth project due to very limited financial resources

Substitute products

- Many products exist, but they don't cover the whole

Figure 19 – eHealth industry competition

One of the most significant barriers in the industry to a scalable deployment of eHealth services is the market fragmentation due to the different organisation of NHS existing healthcare provision in Europe that differs within the same country where Regions have different level of autonomy. Application developers and vendors are fragmented too, offering applications, handsets and devices, which in many cases are restricted to a particular platform. In addition, the deployment of eHealth services within healthcare organizations may be a slow process that requires strong financial resources to develop and roll out customised applications.

Technological fragmentation is also a key barrier to the deployment of eHealth applications. For basic information applications, deployment is easily achievable with support systems in place, as they largely require only low-range handset functionality such as voice and SMS. The eHealth industry structure is, therefore, quite complex due to the number of possible links in the value chain outlined in the following figure, in which myriad of players work in the health value chain some of whom occupy differing positions.
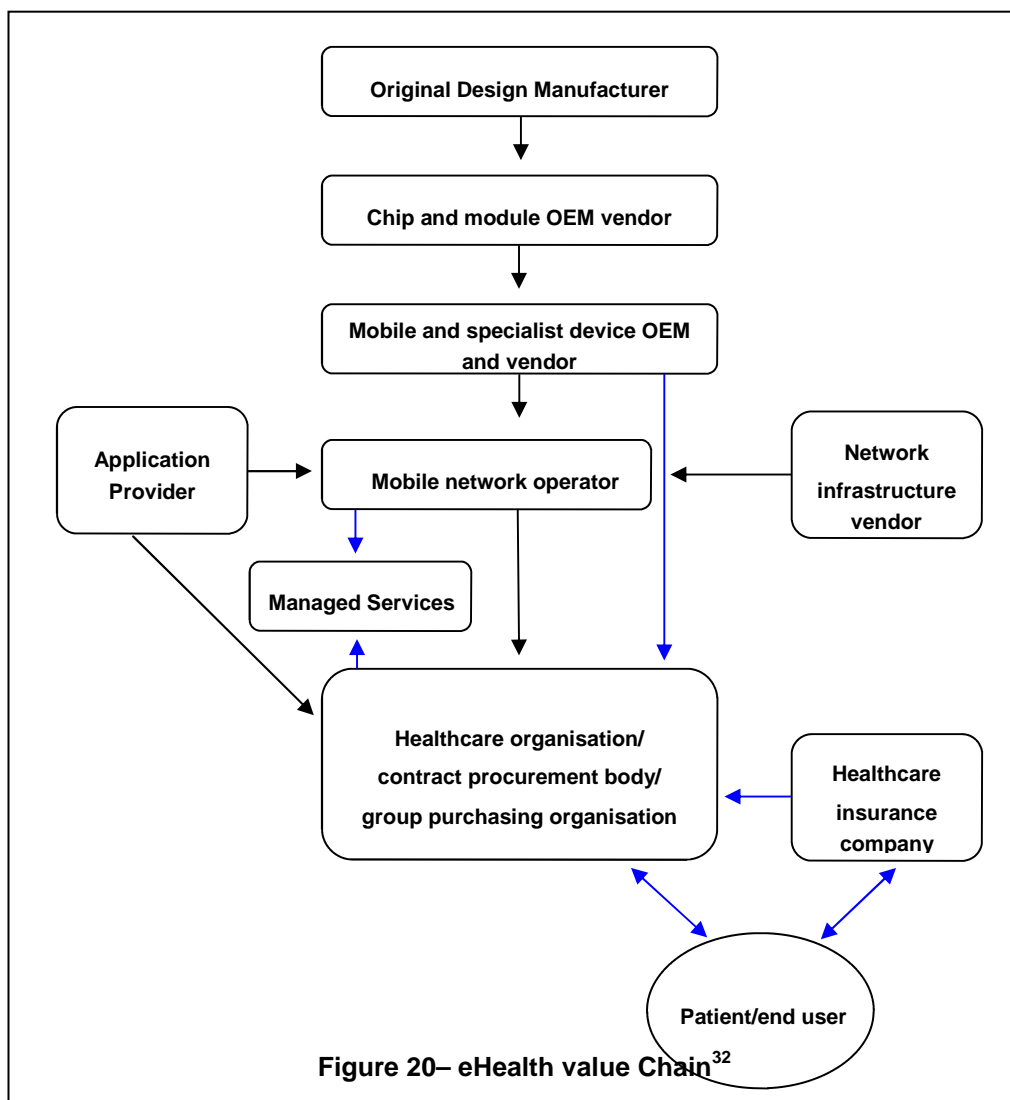

Figure 20– eHealth value Chain[32]

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[32] Mobile Healthcare: Markets and Trends for M-health Applications, Informa, 2009.

For more advanced applications, developers are required to set up flexible platforms to take into account different needs of different healthcare organizations; for an entire suite of applications to be deployed within a hospital, eHealth providers must select from a myriad of platforms and technologies, which is a long and costly process. Devices with advanced operating systems, PDAs, Internet-enabled handsets with mobile broadband, mobile computers and specialist devices are a requirement for many advanced clinical applications devices. Therefore, rolling out an application within a healthcare organization may be an expensive, slow and arduous process.

Public funding is a key leverage for a large usage of eHealth solutions among patient/users at home, however public healthcare systems have very limited financing to invest in new services, and therefore innovation should combine the real need for reducing healthcare expenses and real benefits for users. Differently, in private health markets, access to innovation is greater than in publicly-financed markets and telecoms vendors and operators do not have to negotiate with public bureaucracy in order to roll out healthcare applications.

Taking into account the information and data provided in this market analysis, some indications of key factors governing the future telehealth market may be highlighted, as shown in the diagram below.

Market drivers:	Market constrains:
- Increasing demand due to the ageing population needing continuous care - Increasing demand due to rising number of people with chronic diseases - Strong pressure to reduce hospital expenses due to budget cuts - Deployment of various funding measures at EU level supporting innovation and deployment of telemedicine and telemonitoring service	- Geographical and cultural diversities due to fragmented national health and social security systems. - Lack of awareness about ICT technologies for telemedicine and telecare of potential customers - Unclear perception of telemedicine and telecare services - Interoperability issues due to the presence of heterogeneous devices and software - High costs involved in deployment of telehealth systems

The demographic trend toward an aging population and the growing incidence patients with chronic illnesses are going to place more pressure on healthcare systems. Remote monitoring of a patient in his home, using wireless and mobile technologies, may contribute to reduce hospital overheads and public spending on healthcare services.

Almost all the European Countries are affected by public fund shortages. The recent economic crisis has contributed to worsen the situation, leading to a strong reduction of public budgets for healthcare systems. Telehealth may represent an affordable solution for keeping up healthcare quality services with a reasonable investment.

Awareness of telemedicine benefits by users patients and health professionals is a crucial element for the success of telemedicine. However, geographical and cultural diversities may slow down a broader market penetration. Evidence on large scale benefits needs to be developed and presented to leaders and users (both patients and professionals) to enable further investment in telemedicine processes that not only improve access to quality care but also promise to achieve more for less in a sector traditionally constrained by resources and unequal geographical coverage of skills and quality of care.

An updated legal framework both at EU and national level, relating to accreditation and authorization schemes to provide telemedicine services, as well as the protection of personal data related to health, are among the legal areas which intervene for a rising telemedicine service usage.

The inCASA solution will take advantages of market drivers and market opportunities by developing a system that will:

- Provide the increasing elderly European population with telecare services assisting them in their home by using non-intrusive and state-of-the-art technologies

- Provide the increasing elderly European population with telemonitoring services for health conditions monitoring by using state-of-the-art personal health systems and integrated telemedicine services

- Provide doctors and health professionals with more comprehensive monitoring data for understanding remote user's social/physical conditions and diagnostics, allowing an early decision making for personalised care

- Integrate its solutions with home automation ones in order to allow a remote control of electronic devices to cover the special necessities of the elderly and to make active ageing a reality.

The inCASA partners' technological expertise and the effective participation of users will allow us to deploy a market-driven solution to respond to the real market needs by offering a flexible and scalable platform where the integration of devices and sensors will not be a concern due to the underlying platform. The choice of existing technologies will contribute to set a services addressing the widest number of users at a reasonable cost, taking into account the budget limitations suffered by both public and private healthcare systems.

Therefore, the final outcome of inCASA is to shift patient telehealth and telemonitoring services from high priced services, mainly due to the cost involved in customization of devices to suit individual needs, to more affordable ones based on those using standard technologies and easy-to-use man-machine interfaces.

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