



Ministerio de Sanidad y Consumo

Instituto  
de Salud  
Carlos III

Telemedicine and Information Society  
Research Area

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## **Final report on the KISA and Innovation Healthcare Study in Spain**

### **Personal Care Services for the Elderly and Chronic Patients using Information and Communication Technologies**

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Madrid, 7 December 2004

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Ministerio de Sanidad y Consumo

Telemedicine and Information  
Society Research Area

TITLE:

Knowledge intensive service activities and Innovation on Personal Care Services for elderly and chronic patients in Spain using ICT. Part of a project report for the OECD KISA study

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ABSTRACT:

The report is related to an OECD study about KISA and Innovation in some specific industries or sectors. The aim of the work is to analyse new health care management models for elderly and chronics patients (Home and mobile) using ICT. The focus has been centred on the knowledge intensive services activities (KISA) concerning a set of innovative Telehealthcare services aiming personal care for the elderly and the chronic patients in home and mobile.

The study is on a "problem area-opportunity" originated by actual user needs that are addressed by a cluster of innovative emergent Telehealthcare services provided by public, private and mix organizations.

One of the objectives of the study has been to analyse and characterize the associated innovation system by identifying actors, their interdependence and relationships in order to analyse how the involved organisations develop the innovative capacities using KISA obtained from internal and external sources.

Other objectives refer to the identification of the main driving forces and the observed resistances concerning the utilization of KISA.

According with OECD KISA study, final objective is to provide basis for informed recommendations to administrations on policy measures and programs on how promoting and improving the performance of innovation systems using KISA.

KEYWORDS:

Knowledge intensive service activities; Innovation: Telehealthcare

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# Final report on the KISA Healthcare Study in Spain

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## **Acknowledgement**

Active contributors to this report include researchers and experts from universities, corporations, healthcare providers and organizations representing consumers, housing and services for the aging, services providers, private and public insurers, human resources management, technology providers, ICT applications developers and RDT policy makers. A complete list of participants may be found on the appendix.

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# 1. Introduction

## 1.1. Object and scope

The KISA Healthcare study in Spain has centred on the knowledge intensive services activities (KISA) concerning a set of innovative healthcare services aiming personal care for the elderly and the chronic patients in home and mobile.

The focus of the study is on a innovation system based on a "problem area-opportunity" originated by actual user needs that are addressed by a cluster of innovative emergent healthcare services provided by public, private and mix organizations.

This innovation scenario has been selected because its social and economic importance, the growing demand of more and better solutions, the potentiality for using new technologies like mobile and Internet that are in the front of development policies, as well as for the perspectives of possibilities for KISA providers correlated with the expected market development.

## 1.2. Structure and Contents

El "Spanish KISA Healthcare Study" follows the research steps adopted by the OECD project. The two first steps are devoted to describe the main aspects and figures of the national health system and the social services in Spain. They also include a description of the nature and structure of the demand, the involved agents and the context of the ICT sector and R&D driving forces.

The third step studies the innovation system and KISA based on the analysis of the selected sample of innovative services provision for personal care of the elderly and chronic patients at home and mobile.

The fourth step discusses the implications for the innovation policy that are derived from the study concerning general situation, strategic issues, actuation framework, and recommendations to promote and develop innovation through the impulse of KISA in the context of a new generation of personal healthcare services supported by ICT.

At the same time, it is intended to contribute to the more general demand at OECD of generating relevant information for high-level decision taken and to identify opportunities for political action.

## 1.3. Objectives and Research questions

One of the objectives of the study has been to analyse and characterize the associated innovation system by identifying actors, their interdependence and relationships in order to analyse how the involved organisations develop the innovative capacities using KISA obtained from internal and external sources.

Other objectives refer to the identification of the main driving forces and the observed resistances concerning the utilization of KISA.

According with OECD KISA study, final objective is to provide basis for informed recommendations to administrations on policy measures and programs on how promoting and improving the performance of innovation systems using KISA .

## 1.4. Methods and tools used

Study has been based on information collected from the following sources:

*a) review and analysis of the literature, official documents and reports.*

Basic data has been obtained from OECD Health Data 2002, 2003; OECD DSTI STAN Indicators 2003 as well as from the Statistics National Institute of Spain (INE). Observatory for

Aging Reports from IMSERSO at Ministry of Labour and Social Affairs has provided useful data on elderly and status of current social services provision.

Other relevant data about the structure of the demand has been gathered from very recent reports produced by Farmaindustria Foundation and the Caixa Foundation.

It must be noted that literature on innovation systems in healthcare services is scarce. Whereas there is a growing number of published works on ICT driven innovations in healthcare, very few studies have specifically been devoted to analyse it in a systemic way.

*b) structured interviews*

performed to 16 key persons directly involved in the innovative system under study following the recommendations and guidelines discussed at Paris KISA Focus Meeting.

*c) experts panel consultation (stakeholders meetings)*

In addition to above, it has been considered highly convenient to held consultative meetings with high level experts representing different stakeholders and different interests and from different agencies and sectors involved, who have contributed with their knowledge and opinions: Health professionals, hospital management, geriatric specialists, health services authorities, medical insurance firms, telecommunications sector experts, nursing homes, telemedicine firms – new companies in a new economy, SME's (small and medium sized companies), experts in the field of research and the Universities, Internet health specialists and social/health management. A quick look at the list of participants demonstrates the extent and level of the contribution made in experience and strategic vision in this field.

Open discussions have been directed to obtain a holistic and comprehensive view of key issues as well as to detect favouring mechanisms jointly with often hidden and subtle barriers that might be determinant for a big scale deployment of the analysed "business models" for health and social care services.

Meetings, held in Madrid, Barcelona and Seville, have allowed gathering additional insights of different sensitivities and operational contexts from different Regions in the country. The result of these meetings has provided the nucleus of the central discussion, the fundamental concepts and the identification of strategic elements. Their contribution has been essential for this study.

Needless to say that the report includes many elements that have arisen from discussions and an exchange of opinions with other colleagues in Conferences, Scientific Committees and Work Groups.

## 2. KISA and innovation activity

### 2.1. Overview of the Spanish health sector

#### 2.1.1. General Aspects

The Spanish Health System is formed by the National Health Service whose principles and regulations are established in the Constitution (1978), The General Health Law (1986) and the Law of Cohesion and Quality (2003).

The basic principles are:

- universal coverage with free access to medical care for nearly everyone
- public financing, mainly through general taxation
- integration of different health services networks within the structure of the National Health system
- decentralization and regional organization based on health areas and basic health zones
- development of primary health care with emphasis on promotion, prevention and rehabilitation activities at this level.

On January 1, 2002, the management of health care benefits was turned over to the 17 Autonomous Communities that make up the regional structure of the Spanish State. The State however maintains a series of basic powers under central government authority.

#### 2.1.2. The role of the Central Government

In accordance with the current legal framework, the central government controls certain strategic areas, including:

- general coordination and basic health legislation
- financing of the system and the regulation of all the financial aspects of social security
- the definition of the benefits guaranteed by the National Health System
- international health affairs
- pharmaceutical policies
- graduate and post graduate training
- biomedical research
- regulation of biomedical devices

The Ministry of Health and Consumer Affairs is the Ministry Department with the greatest central government responsibilities, although in many matters other departments also exercise authority. This applies to the departments of Science and Education, Justice, Foreign Affairs and Agriculture.

#### 2.1.3. The role of the Ministry of Health and Consumer Affairs

The Ministry of Health and Consumer Affairs has the basic responsibility of guaranteeing the rights of citizens to health protection. It is in charge of coordinating public health and health services. It is responsible for designing health policies and basic health legislation.

Under the direct authority of this Ministry are:

- *El Instituto de Salud Carlos III* (Carlos III Health Institute) ([www.isciii.es](http://www.isciii.es)) - whose mission is to promote and coordinate biomedical research, including health technologies; training in public health and health services management; health information; evaluation of health technologies; awarding of scientific and technical degrees, and the development of technical functions and assessment. Included in this Institute are the Health Technologies Evaluation Agency, the National Health School, the Health Research Archive and a number of research centres: (CNIO) National Centre for Oncology Research, (CNIC) Cardiovascular Research Centre, (CIEN) Neurological Diseases Centre and the Foundation for International Cooperation.



- *The National Institute of Consumer Affairs* – which carries out inspections, arbitration, research, training and other consumer related activities.
- *The Spanish Agency for Medicine and Pharmaceutical Products* – which includes the Sub-directorate General for Health Products.

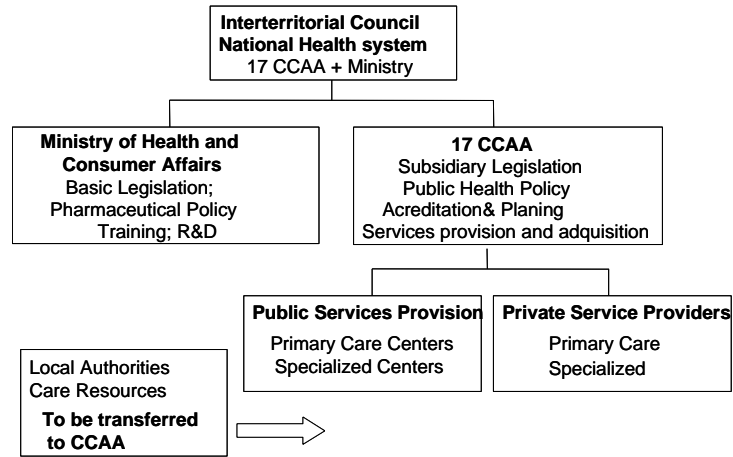


Fig. 2.1.1 Diagram of the structure of the National Health System and the entities that form it.

#### 2.1.4. The role of the Autonomous Governments

As mentioned above, the responsibility for providing health care was turned over to the 17 Autonomous Governments on Jan. 1, 2002, that have the power to plan and organize their own health services. They develop their health policies through the “Consejerías de Salud” (health departments) that in some cases are combined with the departments of Consumer Affairs, Wellbeing, Work or Social Security. Health benefits are organized through the Regional Health Services.

The inter-territorial Council of the National Health System (CISNS) acts as a coordinating body. It is presided over by the Ministry of Health and its members are the 17 Autonomous Communities. It is only an advisory body but it plays an important role in reaching a consensus on health care activities in Spain.

#### 2.1.5. Health Areas

In accordance with the current legislation in force, “health areas” are the basic structures of the health system. They are defined by geographic, socio/economic, demographic, cultural, transportation and existing health care resources conditions. They cover approximately 200,000 inhabitants, although this amount may vary from one to another. Each “Health Area” is linked to at least one “Reference Hospital”. “Health Areas” are responsible for managing Primary Health Care, providing health care for persons, families and the community, including the development of prevention programs, health promotion activities, and rehabilitation and healing care. This is done through a public network of “Health Centres”.

The “Health Area” also includes Specialized Outpatients’ Care through a network of Area specialties that depend on hospitals and in some cases are supported by the same Outpatient personnel that cover “area” consultations.

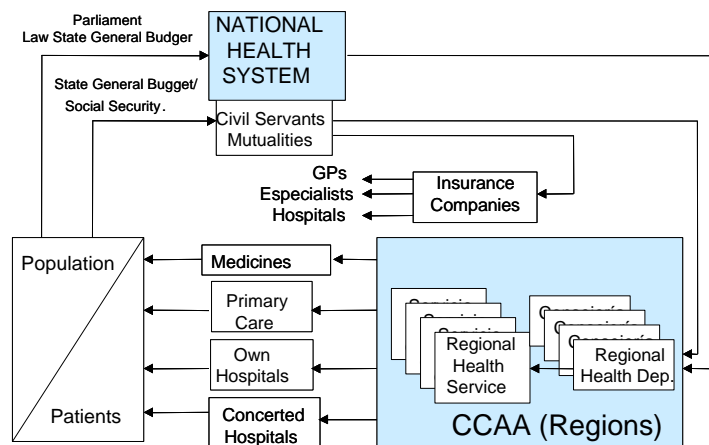


Fig. 2.1.2. Diagram of how the National Health Service operates in relation to financing, insurance and services provisions.

### 2.1.6. Basic Health Zones

A "Health Area" can include several "Basic Health Zones". In general they cover from 5,000 to 25,000 inhabitants. They are in general located around a Health Centre and what is called a "Primary Care Team" (EAP). There are 2,448 "basic health zones".

Hospitals and "Health Areas" are both managed by a General manager who is designated by the Regional Health Service. In the case of EAPs, the person in charge is the Coordinator who reports to the manager of the "Health Area".

The Autonomous Communities each have the authority to modify and restructure their management model so that their organization may vary. Nevertheless, there is a great similarity among all the Autonomous Communities.

### 2.1.7. The role of the Local Authorities

Local authorities are responsible for basic sanitation and environmental health. Their role in the National Health System has diminished considerably and their resources and powers have been taken over by Regional Governments.

Large municipalities have considerable resources and carry out important health works.

Social/health care rests in large part on city halls, many of which operate tele-assistance services.

On a local level, patient associations and citizen movements are very relevant.

### 2.1.8. Other health services providers

Other public resources are Military Health Care under the Ministry of Defence and prison health care under the Ministry of Justice, which is currently in the process of being integrated into the National Health System.

The public system provides its health services mainly through its own resources but it subcontracts between 15-20% of hospital provision to private, non-profit hospitals. Catalonia is the clearest exception in the public health system since most public hospital services are supplied by non-profit, private hospitals.

### 2.1.9. Mutual Insurance Companies for Civil Servants

In addition, there are three mutual insurance companies for civil servants that have an almost public role. They are MUFACE - General Benefit Society for State Civil Servants, ISFAS - Armed Services Social Institute, and MUGEJO - General Judicial Benefit Society. Together they are responsible for the health care of more than 2,500,000 people. The most important of these is MUFACE (<http://www.map.es/muface/muface.htm>).

The insured can choose either public care or private care based on the companies offering provision and insurance. If one chooses private health care insurance, the insured can choose among those entities that have an Agreement with MUFACE.

The choice between the Public Health System and an Insurance Company can be made each year. Each concerted Insurance Company offer within its list of services the possibility of a choice of doctors and care centres. They must offer at least two doctors for each speciality.

<b>HEALTH INSURANCE IN SPAIN IN 2001</b>		
	<u>%</u>	<u>Population</u>
Social Security	95,30	38.928.865
Mut. Civil Servants (Social Security)	1,57	640.804
Mut. Civil Servants (Private Provision)	1,75	713.090
<b>Total coverage Social Security</b>	<b>98,62</b>	<b>40.282.760</b>
Individual Private Insurance	1,01	414.178
Private Insurance Enterprises	0,23	95.730
No insurance, beneficency	0,06	23.444
No insurance, private physicians	0,03	13.676
No insurance, medical "igualada"	0,04	17.583
N.C.	0,50	204.237
Spanish population 2001(INE)		40.847.371

Source: Encuesta Nacional de Salud 2001 (Ministerio de Sanidad)

Fig 2.1.3. Health insurance in Spain in 2001

#### **2.1.10. The role of the Private Sector and Health Insurance Companies**

This role is minor but important. Ten percent of the population has voluntary private insurance. Some private services are contracted by the public sector. In Catalonia, as mentioned above, the situation is special due to historical reasons, with a large number of non-profit, semi-public entities.

Since 1995, the Autonomous Community of Valencia has contracted a private firm to run the new hospitals in two health areas (Alzira and La Plana).

#### **2.1.11 The Pharmaceutical Sector**

In Spain there are more than 300 pharmaceutical companies that manufacture medicines, 194 wholesalers and 19,222 pharmacies. This sector is regulated by the Medication and Health Products Agency under the Ministry of Health and Consumer Affairs.

#### **2.1.12. Public Health Spending**

In accordance with the data provided by the OECD, the period between 1997-2002 demonstrates that health spending in Spain has had a lower growth rate than the average rate in other European Union countries and the OECD. While growth has been 4.3% for OECD and 4% for the EU, Spain has remained at 2.6% annually. Therefore, in 2002, health spending per capita was in the amount of 1,646 dollars (1,346 euros) as compared to an average of 2,144 dollars (1,754 euros) in the OECD.

<b>CHANGES IN HEALTH SPENDING GDP %</b>						
Year	1960	1970	1980	1990	1996	2002
% PIB	1,7	3,6	5,4	6,7	7,6	7,6

Source: OECD health data 2004

Fig 2.1. 4. Changes in health spending GDP %

Finally, it should be pointed out that public health spending in Spain increases annually at a rate of only 2.4% in comparison to 4.5% and 4.1% in OECD and the European Union respectively.

The “2004 Report on World Health” by the World Health Organization shows that public health spending in Spain has decreased more than one point from 1997 to 2001, to the benefit of the private sector, which has increased one point. This report indicates that Spain is a part of a minority group of EU countries that have maintained stable or reduced their health spending in respect to their GDP. Specifically, Spanish health spending remained fixed at 7.5% of the GDP during the period under study by the WHO.

**2.1.13. The Hospital Network**

The table shows the number of hospitals in the census for dependency and care.

<b>HOSPITAL FOR DEPENDENCY AND CARE</b>					
	<b>General</b>	<b>Others Acute illness</b>	<b>Remote</b>	<b>Psychiatric</b>	<b>TOTAL</b>
<b>Nat. Health System</b>	167	13	5	5	190
<b>Other public Hospitals</b>	56	11	23	33	123
<b>Total public hospitals</b>	<b>223</b>	<b>24</b>	<b>28</b>	<b>38</b>	<b>313</b>
<b>Private non-profit</b>	54	39	33	21	147
<b>Private profit</b>	170	54	56	27	307
<b>Total private hospitals</b>	<b>224</b>	<b>93</b>	<b>89</b>	<b>48</b>	<b>454</b>
<b>TOTAL</b>	<b>447</b>	<b>117</b>	<b>117</b>	<b>86</b>	<b>767</b>

Source: INE (National Statistics Institute) 2004

Fig 2.1. 5. Hospital for dependency and care

**2.1.14. Health Professionals**

As stated by the National Statistics Institute (INE), the total number of registered doctors is over 190,000 and the number of nurses is over 220,000. Another important professional group are the pharmacists. The table provides further data

<b>REGISTERED HEALTH PROFESSIONALS IN SPAIN 2003</b>	
<b>Physicians</b>	190.665
<b>Odontologists and stomatologists</b>	20.005
<b>Pharmacists</b>	56.501
<b>Veterinarians</b>	24.737
<b>Podologists</b>	3.362
<b>Registered nurses</b>	220.769
<b>Source: INE 2004</b>	

Fig 2.1. 6. Registered health professionals in Spain 2003

The following table shows the distribution by Autonomous Communities

Health professionals by autonomous communities				
	Physicians	Pharmacists	Podologists	Registered nurses
<b>TOTAL</b>	190.665	56.501	3.362	220.769
<b>Andalucía</b>	30.262	9.363	584	33.847
<b>Almería</b>	1.850	658	22	2.221
<b>Cádiz</b>	4.254	1.238	95	5.376
<b>Córdoba</b>	2.999	879	62	3.728
<b>Granada</b>	3.993	1.396	38	3.539
<b>Huelva</b>	1.692	581	28	1.948
<b>Jaén</b>	1.994	727	49	2.964
<b>Málaga</b>	5.688	1.448	63	5.216
<b>Sevilla</b>	7.792	2.436	227	8.855
<b>Aragón</b>	7.162	1.538	76	7.179
<b>Huesca</b>	971	233		1.117
<b>Teruel</b>	672	194		800
<b>Zaragoza</b>	5.519	1.111		5.262
<b>Asturias (Principado de)</b>	5.604	1.258	34	6.346
<b>Balears (Illes)</b>	3.914	1.089	34	4.160
<b>Canarias</b>	7.285	1.950	46	7.763
<b>Palmas (Las)</b>	3.736	791	31	4.172
<b>Santa Cruz de Tenerife</b>	3.549	1.159	15	3.591
<b>Cantabria</b>	2.680	613	17	3.469
<b>Castilla y León</b>	12.207	3.594	142	14.491
<b>Ávila</b>	741	242	6	836
<b>Burgos</b>	1.621	471	28	2.030
<b>León</b>	2.059	661	19	2.745
<b>Palencia</b>	830	231	7	948
<b>Salamanca</b>	2.104	641	29	2.207
<b>Segovia</b>	739	245	12	728
<b>Soria</b>	551	132	6	590
<b>Valladolid</b>	2.711	674	24	3.332
<b>Zamora</b>	851	297	11	1.075
<b>Castilla-La Mancha</b>	6.325	2.286	94	8.288
<b>Albacete</b>	1.302	478	34	1.860
<b>Ciudad Real</b>	1.700	567	32	2.378
<b>Cuenca</b>	653	296	6	940
<b>Guadalajara</b>	820	269	8	779
<b>Toledo</b>	1.850	676	14	2.331
<b>Cataluña</b>	30.771	8.970	833	38.718
<b>Barcelona</b>	24.909	7.187	713	31.128
<b>Girona</b>	2.061	681	55	2.860
<b>Leída</b>	1.372	429	18	1.890
<b>Tarragona</b>	2.429	673	47	2.840
<b>Comunidad Valenciana</b>	18.634	5.718	282	20.407
<b>Alicante/Alacant</b>	5.561	1.587	105	6.285
<b>Castellón</b>	1.920	536	57	2.151
<b>Valencia</b>	11.153	3.595	120	11.971
<b>Extremadura</b>	4.315	1.441	85	5.872
<b>Badajoz</b>	2.677	865	52	3.224
<b>Cáceres</b>	1.638	576	33	2.648
<b>Galicia</b>	10.876	4.137	149	12.196
<b>La Coruña</b>	4.802	1.789	87	5.479
<b>Lugo</b>	1.304	477	19	1.819
<b>Ourense</b>	1.313	530	9	1.557
<b>Pontevedra</b>	3.457	1.341	34	3.341
<b>Madrid</b>	30.926	9.005	703	33.667
<b>Murcia</b>	4.701	1.365	78	4.633
<b>NAVARRA</b>	3.162	1.195	32	5.073

<b>País Vasco</b>	10.133	2.507	152	12.216
<b>Álava</b>	1.410	352		1.975
<b>Guipúzcoa</b>	3.174	769		3.954
<b>Vizcaya</b>	5.549	1.386		6.287
<b>La Rioja</b>	1.242	358	21	1.616
<b>Ceuta y Melilla</b>	466	114		828
<b>Ceuta</b>	255	51		447
<b>Melilla</b>	211	63		381

Source: INE 2004

Fig 2.1.7. Health professionals by autonomous communities

### 2.1.15. Health Plans

Chapter VII of the Cohesion and Quality Law of the National Health System provides basis for the joint elaboration of global health plans by the Ministry of Health and Consumer Affairs with the authorized bodies of the Autonomous Communities in relation to the most prevalent pathologies. It also provides for these global plans to establish criteria on the organization of services in caring for pathologies in a comprehensive manner within the SNS and determines minimum care standards and basic care models specifying recognized, effective action, tool evaluation and activity indicators.

### 2.1.16. Action taken by the Ministry of Health and Consumer Affairs

In 1995, the Ministry of Health and Consumer Affairs approved the first National Health Plan that established the general framework and inter-sectorial action programs for all the different administrations. This Health Plan pointed out 14 priority areas, one of which is chronic illness. This National Health Plan became a reference for action by the Autonomous Communities and an outline for the elaboration of the Autonomous Health Plans that have been set in motion. In addition, the Cohesion and Quality Law approved in 2003, gives special attention to the treatment of the chronically ill and stresses coordination among the different levels.

### 2.1.17. Autonomous Community Health Plans

Several Autonomous Communities have activated health plans. This is true of Andalucía, Aragón, Castilla La Mancha, Castilla and León, Extremadura, Madrid, Murcia, Navarra, the Basque Country and Valencia.

All of them have specific sections regarding the chronically ill. In general they propose implementing and developing programs to coordinate primary and specialized resources in such a way that patient care is comprehensive and protocolized.

Another action area is collaboration with patient organizations in order to provide health education for both patients and their families.

The specific plans for diabetes worked out in Andalucía and Valencia deserve special attention and are described below:

### 2.1.18. Chronic patient care

The Spanish Health System leans towards specialized care and more specifically hospital care. In fact, 76% of health spending is devoted to hospitals in contrast to the average 57% in the European Union. This leading role for hospitals is not only reflected in the budget but also in the design for incentives for professionals and their prestige and acknowledgement by the sector and the population in general. These facts are directly linked to the limited capability of primary care professionals to make decisions and to the relatively minor importance given to their functions within the system.

Insufficient coordination between primary and specialized care is one of the traditional criticisms to the health system. More recently, the criticism has been directed at the lack of coordination between health care and social/health. The key idea is to “converge” instead of coordinating by overcoming an impervious administration and searching for a closer relationship between management and provision, strengthening local action and acknowledging and supporting family provision. The relevance of this problem in a progressively aging society is increasing.

A real coordination strategy is necessary between health care levels, whether between primary and specialized care or health care and social/health care.

In addition, territorial decentralization poses organizational challenges on various fronts. The first refers to patients outside their own territory and the functioning of trans-regional centres and services. The smaller Autonomous Communities do not have a complete portfolio of services and their patients must seek help outside their territory for certain treatments or tests.

#### **2.1.19. Improvement elements in care for chronic patients**

At present several difficulties have been detected in chronic patient care. Some of these are described below:

- A degree of heterogeneous coordination between health care levels and even within the same level and between the professionals involved in caring for the chronically ill.
- A variable degree of training for health professionals in order to sufficiently covers the needs of persons with problems.
- An unequal access to diagnosis, therapeutic and control resources
- A lack of means for adequate and continuous communication with the patient

## **2.2. Overview of the Spanish system of Research and Innovation**

### **2.2.1. Science and Technology Policy**

The National 2004-2007 Research, Development and Innovation Plan, following the achievements of the National 2000-2003 R+D+I Plan, is a new step forward in the planning effort for action financed by the National Budget. This effort is designed to optimise the existing resources through the strengthening of cooperation and coordination with the Autonomous Communities, the conceptualisation on the international scene and the design of the financial elements and ways of participation necessary to stimulate and promote these activities.

This marked the beginning of a new stage in the government's science and technology policy. For the first time the needs of the Spanish innovation system are being addressed from the perspective of an integrated system of technological innovation, in which research and development activities play a basic—though not unique— role.

These priorities take various criteria into account. On the one hand, the general framework of globalisation of science, technology and the economy. At the other, European integration, since the National Plan must complement or reinforce the actions of the European Union (in particular the Fifth and Sixth research and development Framework Programs and the actions financed with structural funds). Finally, the initiatives of the regional authorities (through their corresponding regional plans) with which specific mechanisms of cooperation are established.

In relation to the National 2000-2003 R+D+I Plan, it can be said that it has constituted a global strategy that includes public action in this area, from basic research to technological innovation, managed by the different ministerial departments involved in R&D that are financed by the National Budget or through other sources such as financing from European Union structural funds (FEDER and FSE).

The National Scientific Research, Development and Technological Innovation Plan is the instrument through which the public sector of the state promotes and reinforces scientific and technological activities, acting as an essential reference for scientific and technological innovation policies developed by the Spanish General State Administration.

Gastos en I+D Comparación Internacional 2001		
Pais	% Gasto en I+D respecto al PIB	% Gasto en I+D ejecutado por el sector empresarial
Austria	1,90	-
Alemania	2,49	70,5
España	0,96	52,4
Finlandia	3,40	71,1
Francia	2,20	62,4
Irlanda	1,17	68,5
Portugal	0,83	32,6
Reino Unido	1,90	67,4
Suecia	4,27	77,6
UE	1,93	64,5
EEUU	2,82	74,4

Fuente: OECD. Main Science and Technology Indicators. Mayo 2003/1. Otros países, datos no disponibles

Fig 2.2.1. R&D Spending. 2001 International Comparison  
(Spending % as per GDP- Spending % in R&D by the business sector)

The public R&D system has maintained a steady growth during the past six years in terms of size; the number of researchers has increased by 50% and improved in quality, since the percentage of articles by Spaniards has increased by 20% worldwide in this same period, as is also true of the frequency of other publications.

The number of researchers in the Spanish public system in relation to the working population lies within the norm for other European countries. In other words 3.5 researchers per 1000 employees in Spain is equivalent to 3.6 in France and more than the 2.7 found in Germany. However, the average resources available for each Spanish researcher, approximately 63,000 euros/year is much less than the 150,000 euros for a German researcher or 74,000 euros for a French one.

The funds for science, technology and innovation activities in the National Budget have increased significantly to more than 4 billion euros for 2004. This increase is found fundamentally in the credits that amount to 2 billion euros. Of the remaining amount, 600 million euros correspond to current expenditures in R&D public spending, 400 million in investment and 1 billion in transfers. These transfers finance participation in international programs (CERN, ESA...), and State foundations and associations, leaving only about 500 million for National R&D Programs, an amount for which specific programs and public research centres and companies compete.



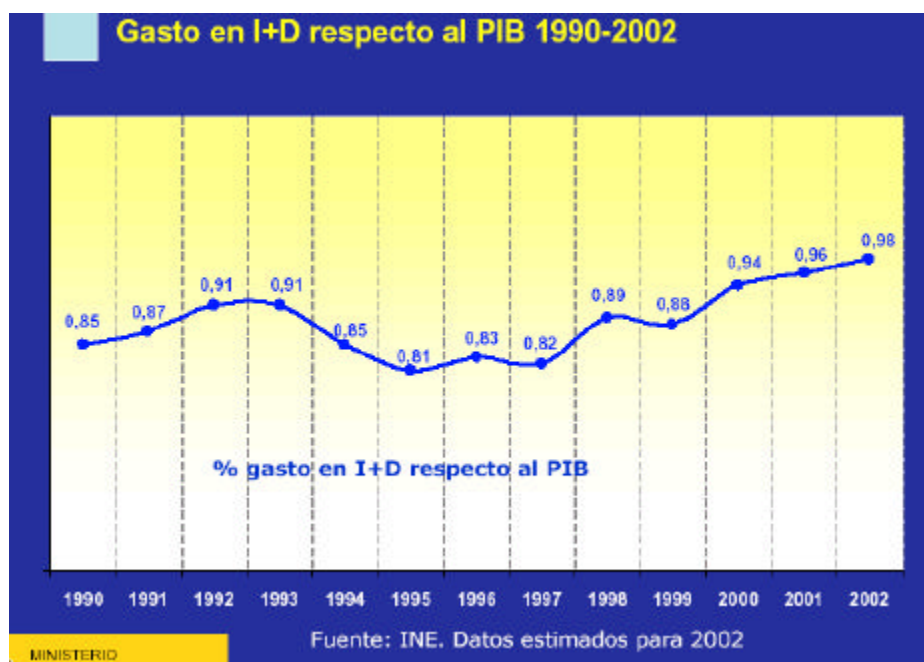


Fig. 2.2.2. R&D Spending as a percentage of GDP from 1990-2002

### 2.2.2. The National Scientific Research, Development and Technological Innovation Plan 2004-2007

The National Scientific Research, Development and Technological Innovation Plan 2004-2007 currently in force constitutes the strategic axis of Spanish R&D&I policy during the period of its application.

The Plan defines a series of objectives on which different actions will be built up. Some of the most noteworthy elements of the strategic plan are:

- Increasing human resources for R+D+I in both the public and private sectors.
- Reinforcing the rights and guarantees for researchers
- Strengthening the international dimension of Spanish science and technology, particularly in the European research world
- New action in larger installations
- Promoting the role of basic research and improving the communication of advances made to the general public

#### *Strategic Objectives*

There are three basic pillars to the national Research and Development Plan:

- A. Strategic objectives related to the Spanish System for Science Technology and Business:
  1. To increase the Spanish level of Science and Technology, both in size as in quality.
  2. To increase the number and level of qualified human resources, both in the public and private sectors.
  3. Strengthening the international dimension of Spanish Science and Technology, with special reference to European Research and Innovation.
  4. Reinforcing the role of the public system in generating basic knowledge.
  5. Improving the knowledge of the general public in regard to scientific and technological advances.
- B. Strategic objectives related to the coordination of the Spanish CTE System:
  6. Reinforcing cooperation between the State Administration and the Autonomous Communities and, in particular, improving the coordination between the NP for R+D+I and the Autonomous Communities.

7. Improving the coordination between the management bodies of the NP, as well as perfecting the evaluation and management procedures of this same Plan.
  8. Promoting cooperation and coordination among the different R&D institutions in the public sector.
- C. Strategic objectives related to competition in the business world.**
9. To enhance competitiveness and innovation in business
  10. To promote the creation of an innovative business fabric
  11. To contribute to the creation of favourable surroundings for R+D+I investments.
  12. Improving interaction, collaboration and association between the R&D public sector and the business sector.

The new NP for R+D+I for 2004-2007 forecasts reaching an R&D expenditure of 1.4% of the GDP in the final year of the plan.

In addition, the expenditure in innovation in respect to the GDP must exceed 2.1% in 2005 and 2.5% in 2007.

<b>National indicators of the science and technology system</b>			
<b>Concept</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
% I+D / GDP	1,03	1,10	1,22
% Innovation /GDP	1,84	1,90	2,10
% I+D industry	55,70	56,40	57,60
% on PGE	1,55	1,66	1,70
% National scientific production / total world	2,73	2,75	2,77
% Innovative companies / total companies	25,20	27,00	28,00
Increase rate new technology based firms	100*	40	60
% Patents EPO residents Spain / total	0,8	1,0	1,3
% Returns UE- RDT Framework Programme	6,1	6,4	6,5
*Data period 2000-2003 (PN I+D+I 2000-2003) EPO: European Patent Office			

Fig.2.2.3. National Science and Technology System Indicators

### **2.2.3. Participation of the business sector in the National R+D+I Plan.**

Business participation is one of the points stressed in the Plan since it is estimated that in 2005, the private sector will contribute more than 56% of the total investment, an amount which will have reached 60% as the plan comes to an end. According to the last estimates for this year, the contribution by the private sector for R+D+I will be approximately 54.5%.

This plan will attempt, not only to increase the technological and innovative capacity of business companies but also to promote an innovative business fabric and create favourable investment conditions in R+D+I while keeping in view the need for increased interaction between the public and private sectors. The goal is to reach 29 innovative companies per 100 instead of the 23.5 actually in existence now in Spain.

The Plan sets out various lines of action. First it establishes sector agreements with the different productive segments. In addition, and in order to motivate the necessary R&D investment, the National Plan foresees fiscal improvements in R&D through increased, direct deductions; increasing the deduction for research personnel expenditures; increasing the deductible base for the acquisition of patents, licenses and designs, as well as raising the limit applicable in deductions for R+D+I in ICT technologies. A fiscal certificate that will guarantee the R&D investments that will be binding as regards the Treasury Department will authorize all these deductions.

In addition to a fiscal framework the Plan also stipulates support for the creation of new technological companies through Incubators y risk capital, as well as an increased coordination of the public/private interaction through the support of scientific-technological parks; support for Offices for the Transfer of Research Results (OTRIS) and support for Technological Centres or

the creation of Technological Platforms. It will also give special attention to financial support for the creation of R&D units and intellectual and industrial protection rights.

RDT Total internal investment and % distribution by funding and execution sectors (1990-2002)													
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Investment R&D (MEur.)	2.559,0	2.881,0	3.245,0	3.350,0	3.294,0	3.550,0	3.853,0	4.039,0	4.715,0	4.995,0	5.719,0	6.227,0	7.194,0
Investment R&D/researcher (keuros)	67,9	70,9	77,9	77,3	68,8	75,0	74,6	75,0	78,2	81,1	74,6	77,8	86,3
<b>% Funding</b>													
Public Adm.	45,0	45,7	50,2	51,6	52,4	48,0	48,0	47,8	42,7	44,7	43,4	44,3	43,6
Firms & IPSFL	48,2	48,7	44,3	42,0	41,3	45,3	46,5	45,4	50,6	49,7	51,7	48,0	49,6
Foreign	6,8	5,6	5,5	6,4	6,3	6,7	5,5	6,8	6,7	5,6	4,9	7,7	6,8
<b>% Execution</b>													
Public Adm.	21,3	21,3	20,0	20,0	20,7	18,6	18,3	17,4	16,3	16,9	15,8	15,9	15,4
High Education	20,4	22,2	28,9	31,3	31,6	32,0	32,3	32,7	30,5	30,1	29,6	30,9	29,8
Firms	57,8	56,0	50,5	47,7	46,8	48,3	48,3	48,8	52,1	52,0	53,7	52,4	54,6
IPSFL	0,5	0,5	0,6	1,0	1,0	1,1	1,1	1,1	1,1	1,0	0,9	0,8	0,2

Source: INE

Fig.2.2.4. Internal R&D expenditure and its distribution by the financing and executing sectors 1990-2002

In addition, the plan proposes increasing to more than 29% the number of researchers in the business sector while the plan is in force, as well as increasing to 3,000 the new positions and contracts for research personnel in the public system and increasing to more than 3,500 the new contracts for doctors and technicians in the private system.

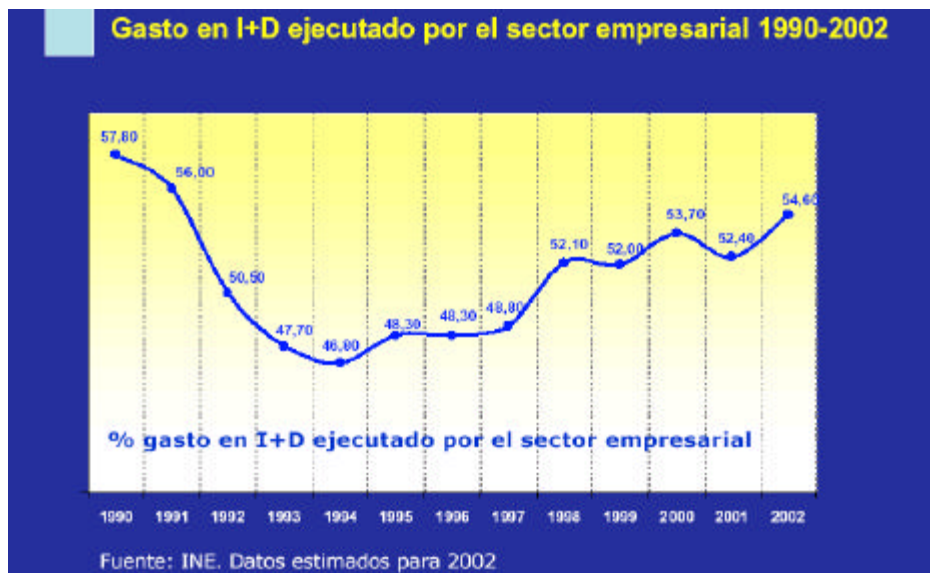


Fig.2.2.5 R&D Expenditure in the Business Sector 1990-2002

According to the R+D+I Activities Report for 2002, by the Inter-ministerial Science and Technology Commission, in 2002, companies received 40 million euros in subsidies in the amount of 60,000 euros on an average.

There are various discouraging elements for the participation of companies in R&D programs. In Spain there are management complexities in the funding for science, technology and innovation. Bureaucracy and an a priori control make it a cumbersome process. In addition

companies have to face administrative and financial obstacles as well as audits and bank guarantees. The new instrument for financing innovation is also coming up against bureaucratic obstacles.

#### 2.2.4. R+D+I Activities related to KISA-Health. Plan 1999-2003

The R&D activities in KISA areas related to the KISA-health study have been financed during the past few years within the National R+D+I Plan 1999-2003.

The most relevant programs to this end have been:

- The National Information Society Program (general)
- The Information Society Program. Specific action on Telemedicine
- The National Socio/Health Program

The executing data of the National R+D+I Plan gives us information on the structure of the most important KISA-Health (R&D) providers on a national level. As can be seen in the following Tables, concerning projects funded within the social/health area, the most important actors are the University research groups and those of the National Health System. There is only a very slight presence of business firms in obtaining R&D funds from the National Plan in the social/health field.

<b>National Social/Health Program. R&amp;D Projects funded according to 2002 execution project area and type of organization</b>						
<b>Organization Type</b>	<b>General</b>		<b>Aging</b>		<b>Health tech.</b>	
	<b>nº</b>	<b>Subvention</b>	<b>nº</b>	<b>Subvention</b>	<b>nº</b>	<b>Subvention</b>
University	5	153,4	20	369,2	16	943,4
Other Organisms and Public RDT	1	13,2	1	11,4	4	115,0
National Health System	9	192,2	7	249,4	19	791,2
SMEs			3	120,3	3	317,5
Non Profit Organizations			13	423,3	13	790,0
<b>TOTAL</b>	<b>15</b>	<b>358,8</b>	<b>44</b>	<b>1.173,7</b>	<b>55</b>	<b>2.957,1</b>

Fuente: Report of National RDT Plan 2003

Fig.2.2.6. National Social/Health Program. R&D Projects financed according to 2002 execution project area and type of organization.

In the Special Action Program of the Information Society, Telemedicine is the area with the fewest financed projects, although the amount assigned is significantly higher per project.

<b>Funding of RDT Projects on Information Society applications (2002)</b>								
<b>Institution</b>	<b>General</b>		<b>e-Commerce</b>		<b>e-Government</b>		<b>e-Health</b>	
	<b>Nº</b>	<b>Subvention</b>	<b>Nº</b>	<b>Subvention</b>	<b>Nº</b>	<b>Subvention</b>	<b>Nº</b>	<b>Subvention</b>
SMEs	51	1.231,7	11	206,7	4	48,5		
Firms (no SME)	64	1.337,1	46	695,7	17	630,4		
Non Profit private	28	1.918,3	6	401,7				
Universities							5	346,5
Other Organizations / Public Res. Centres	7	412,6			3	197,2	1	104,7
National Health System							9	435,5
Other	17	499,9	6	0,0	5	359,0	1	120,8
<b>Total</b>	<b>167</b>	<b>5.396,6</b>	<b>69</b>	<b>1.304,1</b>	<b>29</b>	<b>1.235,1</b>	<b>16</b>	<b>1.007,4</b>

Source: Instituto de Salud Carlos III, e Instituto de Migraciones y Servicios Sociales.

Fig.2.2.7. Funding R&D Projects on Information Society applications according to subject area and institution carrying out research (2002)

In the case of e-Health (Telemedicine), in 2002, an increase in the role of the National Health System followed by the University can be appreciated.

An in-depth analysis of financing for projects in the field of Telemedicine Strategic action included in the R&D+I National Plan, within the Information Society sector area. From the

period 2000-2003 the funding changes granted by the FIS for financing Telemedicine Research Projects observed an important increase in the year 2000 as compared to the 1999 budget. (it tripled in relation to the budget granted in 1999). A moderate increase is maintained in the 2001 allocation for telemedicine projects.

Relative to the number of projects, it is obvious that as many new research topics, as new research teams have been included. Attention should be paid to the budget's pluri-annual character, since most of the projects funded concluded their research later on. This is the reason why we can suppose that there are still 70 public funded research topics at work on the Telemedicine area.

Figure X shows the progress of the budgetary allocations for Telemedicine Strategic Action for the 2000-2003 period, in Euros, and shows the inter-annual variation. For this period 74 projects have been granted with an amount of **2.088.547,12€**. The budgetary allocation for this strategic action has experienced an important growth, which reached 951.666,61€ in the year 2001 (45,5% out of the total available for 2000-2003 period).

	Budget (€)	nº Proj.	Hospitals	Research Agencies	Technical Schools	Faculties	Foundati on/public business	Admon.	Other
<b>Budgetary Allocation 1999 (1999-2001)</b>	292.386,38	11	6	3		1			1
<b>Budgetary Allocation 2000 (2000-2002)</b>	844.494,13	27	16		6	4			1
<b>Budgetary Allocation 2001 (2001-2003)</b>	951.666,61	36	14	3	6	7	3	3	
<b>TOTAL (2000-2003)</b>	<b>2.088.547,12</b>	<b>74</b>	<b>36</b>	<b>6</b>	<b>12</b>	<b>12</b>	<b>3</b>	<b>3</b>	<b>2</b>

Source INSTITUTO DE SALUD CARLOS III

Fig. 2.2.8: National Plan for Research, Technological Development and Innovation 2000-2003. (FIS) Telemedicine Strategic Action

The budget approved in 1999 relative to the Telemedicine Program was 292.386,4€ for 11 projects to be developed in the triennium 1999-2001. This quantity corresponds to 1,21% out of total FIS financed activity lines.

The most participative entities for the 1999-2000 period, related to the number of projects and total budget approved, were the Hospitals with 6 projects out of 11 (55%) and an economic endowment of 219.290 € (75% out of the total). The average amount per project for the 1999-2000 period was 26.581 €.

The main thematic areas developed during this period were: telematic resources webs, telematic communication systems, telecare, tele-diagnostic as well as expert systems for treatment and diagnosis.

During the 2000-2002 period, there have been 27 telemedicine projects funded by NP, in the amount 844.494,13€. In relation with all other activity areas funded by the FIS, it represents 3.51%.

The hospitals have been the most participative entities within this period, related to the number of projects (16 projects out of 27, 60%) and total budget approved 483.895€ (57,3%). The average amount per project for this period has been 31.277 €.

The Key actions during this period focused on Expert Systems development to assist diagnosis, robotic assistants, sensors, and virtual models to assist diagnosis, telecare and teleradiology.

In 2001 call for proposals, to be implemented in 2001-2003 period, the total amount of money available to Telemedicine action reaches 951.666,61€, this figure represents 3,8% out of the total available to FIS financed activity lines.

Funding distribution by applicant entities for the 2001-2003 period is hugely diverse, however hospitals are still appearing as significant in relation to the total budget approved 637.617€ (67%). Concerning the number of projects, Hospitals appear as the most active entities with 14 projects out of 36 (39%), followed by Universities (7 projects, 20% out of the total) and technical schools (6 projects of the total, 16,6%). The average amount by project for this period reaches the amount of 26.435 €. Nevertheless, as related to the last period, there is less money available per project.

The Key actions during this triennium have focused on radiotherapy, bioengineering, Health Information Systems, artificial intelligence, treatment images and Telemedicine.

As we can perceive in figure Y, Hospitals appear with almost half of the approved projects (49% out of 74 for the 2000-2003 period).

**(FIS) Telemedicine Strategic Action by number of projects according to participative entities. 2000-2003.**

	Budget (€)	nº Proj.	Hospitals	Research agencies	Technical Schools	Faculties	Foundations/ public business	Admon.	Other
<b>TOTAL (2000-2003)</b>	<b>2.088.547,12</b>	<b>74</b>	<b>49%</b>	<b>8%</b>	<b>16%</b>	<b>16%</b>	<b>4%</b>	<b>4%</b>	<b>3%</b>

Source : INSTITUTO DE SALUD CARLOS III

Fig. 2.2.9 National Plan for Research, Technological Development and Innovation 2000-2003. (FIS) Telemedicine Strategic Action

Regarding the number of projects, we observe that new fields and new research groups have been incorporated. Nevertheless we should consider that most of the projects granted finished their research later because financial support is of a long-term character. We can therefore assume that there are still an important number of research fields going on in the Telemedicine arena based on public funding.

Despite the optimistic changes of the amounts granted for funding research projects, we note that investment in Telemedicine strategic action is still low in relation to the other areas managed by the FIS during the same period.

**2.2.5. Telemedicine Research. Spanish participation in the V EU R&D Framework Program**

The number of Telemedicine Research Projects in which Spain participated during the V European Union R&D+I Framework Program (32 projects) increased in comparison to those projects carried out during the IV R&D Framework and Demonstration Program (22 projects).

The analysis of the distribution of financing granted to actions 1.1 and 1.2 during the V Framework Program in the ICT area for key actions, allows us to observe how the dynamics surrounding ICT lead to already existing infrastructures that receive the highest percentage of Structural funds.

In the KA1 action, with 18% of the funding, several action lines are proposed: health (1.1), persons with special needs (1.2), administrations (1.3) and transportation and tourism (1.4). Financing for Telemedicine Projects in the V European Union R&D+I Framework Program, is found within the Action Lines (1.1) and (1.2), whose priorities are to achieve an intelligent management of health services, implement the expert systems applied to health care and the development of action for improvements in the field of e-health.

If we analyse the number of projects in which Spain has participated in proportion to the number of projects for each action, Spanish participation is noteworthy in projects concerning Persons with Special Needs (1.2). Spain is present in 52.48% of the total of approved projects. On the

other hand, taken in an absolute manner, the greatest number of projects (21) were obtained in the K.1.1 action, of which six were headed by Spain.

Spain heads 28.1% of the total number of projects in which it participates and the returns obtained by Spanish participants are equivalent to 8.98% of the total (122,636Meuros).

### 3. Innovation in Spain

#### 3.1. Analysis of the Situation

One of the general principles of the National Research and Innovation Programme is to contribute to increased competitiveness of enterprises in order to improve social well being and to create more employment by means of the application of knowledge and the incorporation of new entrepreneurial ideas to the productive process, in other words, through technological innovation. In the context of an increasingly globalized economy, the maintenance and increase in competitiveness relies on the ability to learn and even more on the ability to innovate. Technological innovation improves productivity and thus raises the per capita income, basic objective of long term growth. Support for the innovative enterprises will come from activities and instruments designed to improve the entrepreneurial environment and to promote investment by enterprises in intangibles.

This horizontal action has as its basic objective to strengthen the process of technological innovation in the enterprise sectors, by means of a set of activities, which accelerates the process of the incorporation of advanced technologies and the use of the results obtained in the public sector R&D activities. All of this aims at enriching the innovative entrepreneurial tissue and increasing the number of new innovative enterprises.

According to the latest INE survey covering the period 2000-2002, 20.6% of the total number of enterprises are innovative.

Innovation efforts in the business area have grown in the past few years in the manufacturing sectors, and particularly in services, but the number of enterprises turning to these types of mechanisms to improve their competitiveness is far below the European average, which is almost twice this number. The latest international reference is the European survey on innovation (Eurostat, 1999) that covers the period from 1994 to 1996. According to this survey, the percentage of European innovative enterprises was 51% in industry and 40% in services.

Public funding for Spanish enterprises is, at an average, half of that in the surrounding countries and in addition, its application does not follow the habitual outlines. It is based on loans and direct subsidies are very low.

<b>INNOVATION INDICATORS IN INDUSTRIAL ENTERPRISES OF MORE THAN 20 EMPLOYEES IN EUROPEAN COUNTRIES. 1996</b>			
	<b>% of innovative firms</b>	<b>Innovation Intensity (1)</b>	<b>% business based on new or improved products</b>
Total UE	59	3,7	32
Germany	69	4,1	45
Austria	67	3,5	31
Belgium	34	2,1	14
Denmark	71	4,8	21
Spain	29	1,8	27
Finland	36	4,3	25
France	43	3,9	21
Greece			
Holland	62	3,8	25
Ireland	74	3,3	32
Italy	48	2,6	27
Luxemburg	42		
Portugal	26	1,7	14
UK	59	3,2	23
Sweden	54	7,0	31

Source: Ministry of Industry.

Fig. 3.1.1. Innovation indicators in industrial enterprises of more than 20 employees in European countries. 1996



In the opinion of the experts, a large part of the productive fabric in Spain is dedicated to low or medium level technological work or the use of technology incorporated into equipment or semi-elaborated products that lead to short-term improvement in competitiveness, only slightly differentiated in a global market. This would explain why the average productivity in Spain in the second half of the past decade has grown one third less than the average in the rest of Europe.

On the other hand, the appearance of new technology-based companies is not frequent, therefore value added, employment and sales in these sectors have not increased at the normal European rate.

The productive structure in Spain demands few technological services and in consequence the offer is scarce. As a result, small enterprises cannot find funding for technology. The number of larger enterprises in the intensive technology sectors that incentive their suppliers and clients is also small.

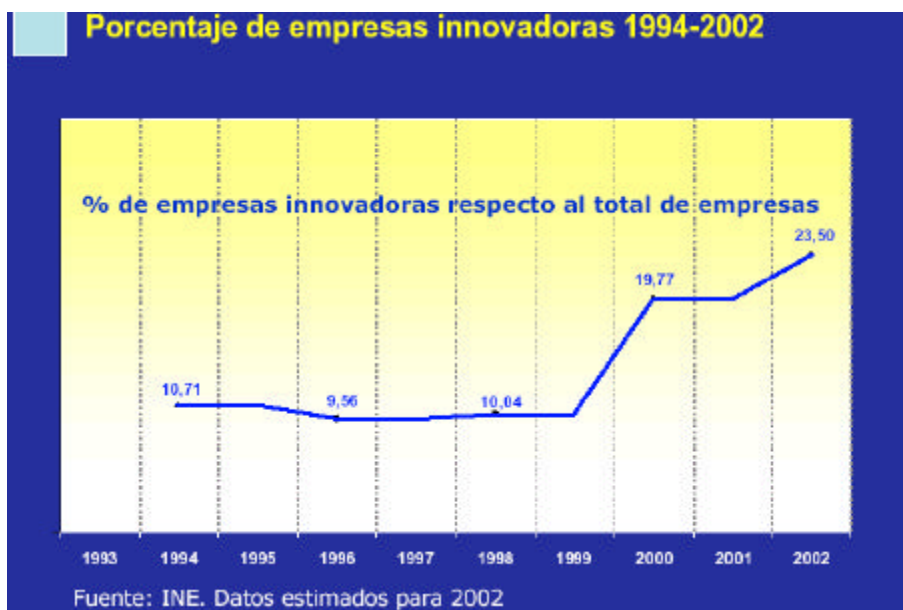


Fig 3.1.2. Percentage of innovative enterprises 1994-2002

The R&D public system is capable of producing scientific knowledge, but the same efficiency has not yet been reached in the creation of technological knowledge and still less in transferring it to our productive fabric.

A national strategy for technology and innovation has not been explicitly formulated. The current Science Law did not take it into consideration, and innovation policies in areas such as research training, scientific and technological infrastructures, and even new lines of research are left to the four year planning provided by the National R&D Plans.



Fig.3.1.3- innovation expenditures in respect to the GDP 1990-2002

In Spain, measuring spending on innovation is much more recent than on R&D. The first data obtained proceed from the Innovation Survey taken by INE in 1994 (the latest was done in 2002). On a communitarian level the existing data proceed from a communitarian survey on innovation taken by Eurostat.

The first Spanish surveys correspond to 1994 and 1996 and only refer to industrial enterprises. In 1998 it included service enterprises and telecommunications. In 2000 the survey included all service and construction enterprises in addition to industrial companies. It should be noted that in this survey, as compared to the previous years, those surveyed were only companies with 10 or more employees, investigating the whole of the economy except for non-market activities. In previous surveys the study included all enterprises with at least one salaried employee.

The total expenditure for technological innovation activities has increased in 2002, to 11.089,5 M euros, which represents a growth of 9.0% as compared to the year 2000, and an annual average growth of 4.4% in the period 2000-2002. In terms of the GDP, this expenditure supposes 1.59%. In regard to the size of the enterprises, 63.1% of spending on these activities was carried out by the larger companies (250 or more employees). On the contrary, 95% of all companies with this expenditure have less than 250 employees although the percentage of these companies in relation to the total number of SMEs (small & medium sized companies) is only 15.1% as compared to 43.4% of the larger enterprises.

Intensity in innovation measured as in the relation between expenditure and innovation and the turnover of the companies is a good indicator of the effort made by them in these matters. In 2002 this expenditure signifies 1.8% of the turnover for innovative activities and a 0.8% for the total number of enterprises. If we analyse them by size we observe that the SME companies offer a greater intensity by increasing the percentage to 2.6 of their turnover in comparison to 1.5% of the larger enterprises. However, if we consider the total number of enterprises, innovation intensity is greater in the larger companies (1.1%) as compared to the SMEs (0.6%). The duality between both types of companies is accentuated if we take into account the intensity in innovation of the companies with continuous R&D activities in which the percentage between spending in innovation and turnover for SMEs increases to 3.6% as compared to 1.3% for larger companies. This results in an average of 1.6% as a whole. Noteworthy among the innovative activities are internal R&D that generates 34.8% of the total spending in innovation and the acquisition of machinery and equipment for innovation (32.5%). The participation of other activities is distributed as follows: acquisition of external R&D 11.9%; design and other preparations for production and/or acquisition 7%; introduction of innovations in the market 6.7%; acquisition of other external knowledge 5.7% and lastly, training 1.4%.

The percentage of product or processes innovation enterprises in the period 2000-2002 has been 20.6%, representing an increase of 0.8 percentage points as compared to the period

1998-2000. If we also take into account those companies still working on innovations or with unsuccessful work (an absolute total entitled EIN), the percentage for 2000-2002 increases to 22.7%.

<b>SPAIN. GENERAL INNOVATION INDICATORS. 1994-2002</b>					
	<b>1994</b>	<b>1996</b>	<b>1998</b>	<b>2000</b>	<b>2002</b>
	<b>MPTS</b>	<b>MPTS</b>	<b>MPTS</b>	<b>MEuros</b>	<b>MEuros</b>
<b>INDUSTRIAL FIRMS</b>					
Total innovation expenditures	620.238	794.196	1.010.671	6.938	6.273,2
Number innovative firms	17.483	16.835	16.100	15.917	12.117
% innovative firms	10,71%	9,56%	10,04%		26,23%
Innovation Intensity (innovation expenditures/business figure)			1,64%	1,78%	1,29%
Number innovative firms performing R&D	4.360	5.531	4.742		
% innovative firms performing R&D	24,90%	32,85%	29,40%		
R&D Intensity (R&D expenditures/ total business figure)			0,51%	0,50%	
% business based on new or improved products			18,61%		
<b>TELECOM SERVICES FIRMS</b>					
Total innovation expenditures			129.86	336	1.445,8
Number innovative firms			90	105	207
% innovative firms			17,27%		18,40%
Innovation Intensity (innovation expenditures/business figure)			5,04%	3,28%	4,47%
Number innovative firms performing R&D			41		
% innovative firms performing R&D			45,60%		
R&D Intensity (R&D expenditures/ total business figure)			1,02%	1,41%	
% business based on new or improved products			19,26%		
<b>TOTAL SERVICES</b>					
Total innovación expenditures				2.943,7	4.675,0
Number innovative firms				10.624	14.077
% innovative firms					18,28%
Innovation Intensity (innovation expenditures/business figure)				0,48%	0,63%
R&D Intensity (R&D expenditures/ total business figure)				0,18%	
<b>TOTAL</b>					
Total innovación expenditures				10.174,	11.089,5
% GNP				1,67%	1,60%
Number innovative firms				29.228	32.339
% innovative firms				19,77%	20,64%
Innovation Intensity (innovation expenditures/business figure)				0,93%	0,83%
R&D Intensity (R&D expenditures/ total business figure)				0,28%	

Source: INE.

Fig.3.1.4. Spain. General innovation indicators. 1994-2002

New or improved products have generated 8.6% of the turnover in 2002 for Spanish companies taken as a whole. This percentage is reduced to 2.5% if we consider only the new products that have been put on the market.

In the services sector there are 14,077 innovative companies (15,513 if we include the EIN), representing 18.3% of all the enterprises in this sector (20.1% over the EIA total). The most

noteworthy enterprises are: R&D service companies (48.8%; 91.3% EIN); computer activities & related areas (44.7%; 53.1% EIN) and financing intermediaries (32.3%; 37.4% EIN).

SPAIN. GENERAL INNOVATION INDICATORS DISTRIBUTION OF SERVICE COMPANIES BY SECTORS. 2000 AND 2002								
	Nº innovative firms		% of innovative firms vs. sector total		Innovation Intensity (1)		% of the figure of new or improved products business	
	2000	2002	2000	2002	2000	2002	2000	2002
PTTs	180	207	20,63	18,40	3,09	4,47	70,34	14,78
PTT activities	75		11,51		2,31		2,67	
Telecom services	105		47,13		3,28		82,72	
FINANCING INTERMEDIATION	523	370	46,36	32,27	0,23	0,26	29,17	3,18
Services to enterprises	2.448	4.067	16,05	21,87	1,39	1,93	18,78	18,91
Computing	718	806	52,94	44,72	5,42	2,89	32,63	30,05
Software	458	555	57,21	47,81	5,00	3,52	36,21	28,32
Other related to computing	260	251	46,79	39,14	6,52	1,72	22,67	38,18
R&D services	110	104	70,73	48,80	62,21	92,92	38,79	43,33
Other firm services	1.621	3.158	11,80	19,05	0,47	0,73	12,72	14,64
Public Social and collective Services,	1.083	1.858	12,17	17,64	0,60	0,61	12,02	11,90
TOTAL SERVICES	10.624	14.077		18,28	0,48	0,63		10,40
TOTAL ALL FIRMS	29.228	32.339	19,77	20,64	0,93	0,83	23,46	17,02

(1) Innovation Intensity=(innovation expenditure/business figure)\*100.  
Source: INE.

Fig.3.1.5. Spain. General innovation indicators. Distribution of service companies by sectors. 2000 and 2002.

If we analyse innovation intensity in companies with innovative activities by economic sectors, outstanding (as is logical) are the R&D services with a 95.1%, surpassing the 1.8% of the total of innovative enterprises in 2002. These are followed by aeronautic and space construction – 19%; recycling - 7.1%; publishing, printing and reproduction - 6.8%; computer and connected activities – 6.7%; communications – 5.9%; pharmaceutical products – 5.8% and electronic equipment – 5%.

Cooperation activities in innovation have reached 16% of EIN companies in the period 2000-2002, a total of 5,684 enterprises although it should be kept in mind that one company may be cooperating with more than one unit.

The interlocutors for this cooperation have been primarily the providers who represent 43% of the total. Universities have also had a noteworthy role in cooperation with enterprises (29% of the total), and the experts and consulting firms (22.3% of the total). Other interlocutors have been, by order of importance, technology centres, clients, public R&D organizations, other companies in the same group, competing companies or other companies with the same activities and commercial laboratories and R&D companies.

Cooperation activities in innovation have fundamentally centred on other units situated in Spain by 93.1%. The remaining cooperation activities have taken place mainly with EU-AELC countries, the US, Japan, and countries up for EU membership.

TOTAL EXPENDITURE ON INNOVATION RELATED TO KISA (2002)							
	Innovation Total expenditures 2002 (K euros)	Innovation Total expenditures 2002 (% on total)	R&D Internal expenditures	R&D external expenditures	Expenditures equipment	External KISA	Expenditures on preparative design and preparations for production and distribution
<b>Services to firms</b>							
Computing	1.577.653	216,63	70,97	8,62	6,26	4,56	6,92
R&D Services	343.020	47,10	72,32	2,69	6,03	5,02	6,75
Other services to firms	728.254	100,00	87,94	1,83	1,65	0,18	7,82
<b>Social and Collective Public Services</b>	506.379	69,53	45,66	22,41	13,03	10,55	5,74
<b>TOTAL SERVICES</b>	179.132	24,60	20,08	13,81	48,48	3,96	10,49
<b>TOTAL ALL FIRMS</b>	11.089.510	1.522,75	34,77	11,91	32,51	5,72	6,96

Source INE

Fig. 3.1.6. Spain. Total expenditure on innovation related to Kisa (2002)

### 3.2. Venture Capital investment in high technology sectors

Venture or risk capital in Spain in 2002, has invested only 8% of the total investments in the European Union, two times less than Germany and three times less than the United Kingdom. The distribution structure among the different types of venture capital investments demonstrates that Spain invests only 15% of the total of this investment in seed money and for a start-up business, much less than the European average, which is a third of the total investment in venture capital (34%).

According to 2001 data, high technology sectors (communications, electronics, biotechnologies, health and medicine) supposed only 26% of the total risk capital investments; in EU-15, this participation was in the amount of 39%, in the US 79% and in Japan 42%.

The remaining risk capital financing is dedicated to other sectors of the "old economy". In Spain, the up and coming new technologies sector does not much influence the economy based on knowledge.

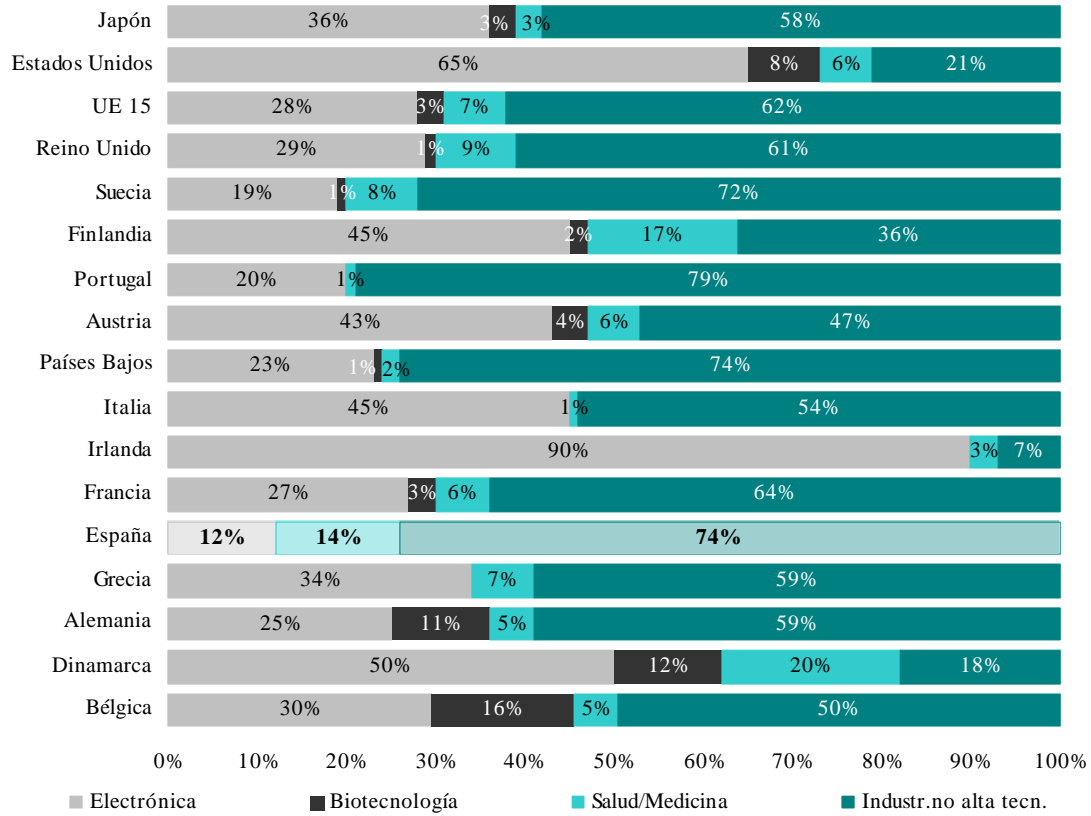
#### TOTAL RISK CAPITAL INVESTMENT IN THE G FOUR, SPAIN, EU, AND JAPAN.

Countries	2001		2002	
	M Euros	% total UE-15	M Euros	% total UE-15
Germany	2.709	23,3%	1.344	14,8%
France	1.282	11,0%	1.156	12,7%
UK	2.666	22,9%	2.543	27,9%
Italy	1.037	8,9%	870	9,6%
<b>Spain</b>	<b>874</b>	<b>7,5%</b>	<b>729</b>	<b>8,0%</b>
UE-15	11.626	100,0%	9.107	100,0%
USA	36.981	318,0%	18.699	205,3%

Japan 6.308 54,3% 5.896 64,7%

Source: Third European Report on Science and Technology Indicators. European Commission (2003).

Fig. 3.2.1 Total risk capital investment in the G four, Spain, EU, and Japan.



Source Third European Report on Science and Technology Indicators. European Commission (2003).

Fig 3.2.2. - Financial distribution of risk capital<sup>1</sup> by high technology<sup>2</sup> sectors in total percentages for this funding. 2001.

<sup>1</sup> Investment in venture capital: seed capital and new firms creation, expanding capital, and reposition restructuring capital.

<sup>2</sup> High technology: communications/ electronics, biotechnology, health/medicine.

## 4. The innovation system analysis

### 4.1. The Reference Model

The basic model used for the innovation system analysis is displayed in Fig 4.1. It is constructed around the "area problem-opportunity" that is in the centre of a mutual interaction between the "demand" and the "offer" in a framework "context" under "driving/obstructive" forces.

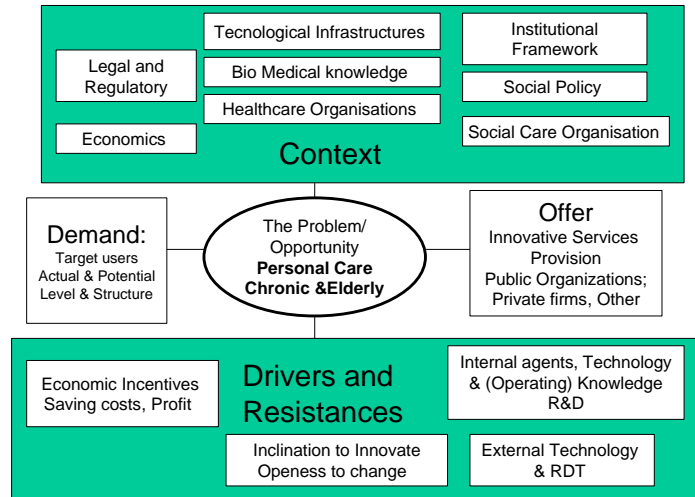


Fig. 4.1. The 'System of Innovation' as Problem/Opportunity Centred, adapted from Tether and Metcalfe (2003) "Services and 'Systems of Innovation' p. 28. CRIC. Univ. Manchester.

### 4.2. The innovation system studied

The "innovation system" object of the Spanish KISA Healthcare study is centred on the innovative cluster of ICT based provision of new class of personal health and social care services for chronic patients and the elderly at home.

It is a concrete "area problem-opportunity" originated from a current growing demand. A great variety and number of agents, sectors and sub-sectors interact around it forming an innovation system. It is important to realize on the dynamic nature of this innovation system that is subjected to variable changes in the components, their relationships and the environment. The rapid evolution of the new ICT technologies is one of the factors to consider but also the local demographic changes, the legal and social context, the organisational changes and the political framework are other sources of variability. Furthermore, by nature, new innovative market "opportunities" produce changes on current scenario and can induce instabilities proper of non-linear processes.

### 4.3. The "area problem/opportunity". Rationale

People today are living longer than ever before. According to statistics, the proportion of persons aged 60 years and older is expected to dramatically grow. The fastest growing group of the older population is the very old, that is, those who are 80 old years or more. The ageing of the population is having an impact on the provision of adequate services and is a cause for concern about spiralling costs of social and health care. While some of these areas are not amenable to the use of technology, such as funding issues, pensions and benefits, the care-related issues can be improved substantially by the deployment of ICTs.

There is a general recognition of the need of improvement of current healthcare models to match the actual requirements of elderly persons. As regards the provision of healthcare

services for elderly patients with chronic conditions, efforts have been underway for a number of years to pursue more effective and efficient alternatives.

There is a growing convergence about an integrative approach of providing healthcare and social services for the elderly. ICT allows one variety of healthcare and social services can be provided in a personalized way by the same platform. Even more a common ICT infrastructure (standards, protocols, tools) can support different operators providing personalized services according with user profiles and allowing different business models with public, private and mix implementation.

The convergence can be also observed from operators coming from different business areas such as healthcare, home care, security, tele-alarm, call centre operators, mobile telecom services, nursing services.

The Spanish society, as in other western countries, must face the challenge of demographic evolution, the growing demand of more and better health and social services, and the scientific and technological change.

Next years, according with experts opinion, the demographic change will produce an important burden for the healthcare system that will affect the quality of the services if current services organisations are not changed. Already, caring for the chronically ill consumes an important share of national spending on health care. The cultural and economic change also drives the demand of better care for chronic patients, the elderly, and other sensible groups.

Resuming, the challenge is to increase the quality and equity of care, for the double of aged persons, whereas avoiding unnecessary costs.

The current healthcare system is oriented to the illness and it is based on health problems episodes with the passive participation of the patients. This passive role also generates a delegation of care management responsibility.

One general approach is to shift the focus to the personal care in the patient common environment (home, workplace, or where he is). One strategy is to facilitate up-dated, reliable and precise information to the patient and consumer groups to support healthy life styles and to facilitate independent life. It is expected general costs can decrease making more emphasis in prevention and making a better management of controllable chronic illnesses avoiding the degeneration in major complications.

#### **4.4. The concept**

Along last decade, a great number of initiatives have been developed addressing the usage of e-health and telemedicine applications to new forms of care provision for chronic patients and elderly care. A variety of terms have been used to name these applications, i.e. Teleassistance, Home -Telecare, Tele-homecare; Home Health via Telemedicine, e-Personal Care, e-Disease Management

This study is centred on care services supported by ICT characterized by the coordinated and proactive approach to manage care and support for patients with chronic illness (such as diabetes, congestive heart failure, asthma, HIV/AIDS, cancer, and others) the elderly and other sensible groups.

The innovative services focus on elderly patients continuous care and looks for answers concerning access, users satisfaction, quality of care and the possibility to avoid needless transport or unnecessary visits to the hospital and then contribute to a home based care. That is especially useful for patients with associated problems of mobility and some functional disabilities. Elderly persons can be kept under constant surveillance by assistive telecare centres. If problems arise, it may be possible to take immediate remedial action. The chronically ill could thus be able to live an almost completely normal life, knowing that any problem would be detected and reported swiftly and then easily controlled by the remote medical centre. Personal monitoring and telecare concepts are converging with smart home, networked home and home automation approaches.

For the class of services we have analysed, it has been identified different types of service providers. They are: a) healthcare organisations (public or private); b) traditional home care and teleassistance providers; c) teleservices operators and ASPs, and d) new entrant firms.



Innovative companies are using telemedicine technology to provide these kind of personal e-services. Health authorities are interested because the potential to reduce direct medical expenditures, improve health status, and to cut lost workdays use of new tele-services to provide care and support to the chronically ill.

Chronically ill consumers who must manage their disease each day are interested in a more active and informed role in their health management and can benefit from the potentialities of web based and mobile technologies.

Much of healthcare tasks consist of the simple exchange of information between experts (physician and nurses) and patients. The traditional way to produce this exchange is to see a physician at his office. The most pressing and the most obvious place to impact healthcare costs, is in providing nursing services to the home. Many, if not most, of the home-health visits by nurses require the cognitive and observational skills of the nurse, but not their actual on-site presence.

#### **4.5. Central Actors**

Regarding the core service provision business analysed, it can be identified a set of central actors that interact acting from the demand side and the offer side. From the demand side, the most important actors are final users

##### Consumers/Patients

Every person who might benefit from the “care service”- for prevention, early detection, disease management and personal support. Focus on the active healthy, the vulnerable, and the chronically ill.

##### Family Caregiver

Responsible person looking after someone who is aging, who is alone, who has an illness. They may be local or at a distance.

##### Community

Consumer and patient organizations in a geographical area

Regarding the Offer side the front interface is played by

##### Care Providers

Every person, or team (physicians, nurses, rehabilitators, technics, etc.) that provide assistance to the consumer or the caregiver using electronic means and data generated at distance

##### Service Providers

Organizations and firms that install and maintain products and systems in homes, apartments, nursing homes, or clinics, including mobile systems using wireless connectivity for persons in common life environments.

#### **4.6. Analysis of the demand**

As in many countries, Spain is faced with a rapidly aging society. Over the next few decades, because of increasing life expectancy, the number of adults with disabilities and the elderly populations will grow dramatically. The fastest-growing component of persons who may need assistance for their long-term care support is the non-elderly disabled. These are people who are living longer lives due to advances in medical technology but who require support services to cope with chronic health conditions and functional limitations.

It is estimated that chronic illnesses will represent more than 60% of all diseases worldwide by the year 2020. A trend toward a marked increase in the incidence of chronic diseases is also apparent in developing countries and healthcare for the chronically ill has become a priority in Western societies.

In Spain, 19 million of persons can be classed as chronic ill according with a very recent study (Fundacion Farmaindustria, 2004). The more frequent health problems are rheumatic illness (29,4%), arterial hypertension (27,8%), cardiovascular problems (18%) and diabetes (14,4%).

Chronic patients have a high knowledge of their illness. This mean a change in the model of healthcare delivery, oriented to a more active patient that is asking for a new, not paternalistic, care approach.

It is estimated that between 5-7 million chronic patients are receiving medication

<b>Distribution of more frequent chronic health problems in Spanish population</b>		
	<b>% total patients</b>	<b>% patients under treatment</b>
Rheumatic	29,4	80,6
Arterial Hipertension	27,8	90,8
Cardiovascular illness	18,0	87,3
Diabetes	14,4	92,1
Collesterol	14,2	79,2
Respiratory	11,8	86,3
Depression/anxiety	10,9	87,8
Visual problems	10,7	49,1
Alergies	10,2	80,4
Digestive	8,2	80,2
Headache	5,2	76,4
Sleep disorders	5,2	65,5

Source: IMSERSO 2003

Fig 4.2. Distribution of more frequent chronic health problems in Spanish population

<b>Chronic multiple pathologies</b>		
	<b>Total</b>	<b>Treated</b>
Mean number of illness per person	1,84	1,76

Fig 4.3 Chronic multiple pathologies

<b>Coverage of pharmaceutical treatments</b>	
<b>Part of the medicines costs paid by the patient</b>	<b>% of chronic patients</b>
Totally	3,6 %
Partially	34,2 %
Free of charge (covered by public insurance)	60,9 %
NK/NA	1,3 %

Source: Fundación Farmaindustria 2003

Fig. 4.4 Coverage of pharmaceutical treatments

Medication of chronic patients represents an important share of total budget.

It is estimated that 3% of patients or family relatives are affiliated to an organisation. Most of the associations are at provincial (34%) and local level (23%). This fact is related with the size of the associations. The mean has 614 affiliated. The 30% have lower than 100 affiliated and only the 21 % have more than 400.

Some patient associations have a very active role in supporting the interests of represented patients, handicapped and consumers groups.

<b>Distribution of Patients Associations versus Illness</b>		
<b>Sample size, n= 758</b>		
<b>Illness</b>	<b>Number</b>	<b>%</b>
Alzheimer-dementia	125	16,50
Mental illness	116	15,30
Diabetes	79	10,42

Cancer	55	7,25
Sclerosis	46	6,07
Kidney	37	4,88
AIDS	32	4,22
Rare illness	32	4,22
Source: Fundación farmaindustria 2003		

Fig.4.5. Distribution of Patients Associations versus Illness

Regarding the potential demand from elderly people, data from the INE (Statistics National Institute of Spain) for 2003 shows 7 million persons are aged more than 65, being 1,6 millions more than 80 years old. This segment of population is growing at a pace of a cumulative 3,7% per year, that leads to expect 2 millions of persons on 2011 according with IMSERSO (Ministry of Social Security) studies. In this context, it must be signalled that 5% of homes are have 65 or older persons living alone.

<b>Demographic data Spain (2004)</b>		
	<b>Number</b>	<b>%</b>
Total population	41.837.894	100,0 %
> 65 years	7.169.437	17,1 %
Dependent persons > 65 year	1.909.221	4,5 %
Source: INE		

Fig. 4.6. Demographic data Spain (2004)

Other relevant data is derived from the INE 1999 study on handicapped, special needs and health status 1999. It is estimated the existence of 32,2% of the persons with 65 or more years old, that present one or several handicaps. It represents 2 million persons. Mobility problems are the first (21%), whereas domestic tasks problems are reported for the 15,2 %. Visual and audio deficiencies account for the 8,8% and 8,4% respectively. One of the major problems is concerned with dependence needs coverage.

<b>Degree of dependency of older than 65 years</b>				
<b>Degree of dependency</b>	<b>Number</b>	<b>% on</b>		
		<b>Elderly with dependency</b>	<b>&gt; 65 years</b>	<b>Total Spain</b>
Light	935.518	49%	13%	2,2%
Moderate	591.859	31%	8%	1,4%
Heavy	381.844	20%	5%	0,9%
Source: Imsero				

Fig. 4.7. Degree of dependency of older than 65 years

<b>Handicapped persons in Spain (1999)</b>			
<b>Age (years)</b>	<b>Number</b>	<b>Prevalence /1000</b>	
<6	49.576	22	
6-9	29.783	19	
10-15	38.501	15	
16-19	44.290	20	
20-24	59.048	19	
25-29	78.275	24	
30-34	107.631	33	
35-39	115.171	38	
40-44	115.080	42	

45-49	135.075	55
50-54	170.834	73
55-59	210.962	106
60-64	301.342	154
65-69	386.338	190
70-74	457.269	264
75-79	476.926	369
80-84	370.701	475
85 and more	381.418	636
<b>TOTAL</b>	<b>3.528.221</b>	<b>90</b>

Source: IMSERSO

Fig 4.9. Handicapped persons in Spain (1999)

According with recent studies, 94% of dependent persons live in their own home or with a relative. It is estimated 30% of persons in nursing homes might be cared at home.

<b>Current operating Resources for &gt; 65 years dependent persons in Spain</b>		
	<b>Number</b>	<b>% of dependent persons &gt;65</b>
Total assisted persons	560.019	7,76 %
Places in Nursing Homes	239.761	3,30 %
Home Care	197.306	2,75 %
Teleassistance	104.313	1,45 %
Day centres	18.639	0,26 %

Source: IMSERSO 2003

Fig 4.10 Current operating Resources for > 65 years dependent persons in Spain

#### 4.7. The ICT usage by potential consumers

The deployment of the Information Society in Spain is in retarded positions compared with other EU countries. However a relevant growth is observed. Data can be obtained from the Ministry of Industry, Commerce and Tourism (<http://www6.mcyt.es/indicadores/>)

The Table below presents data of general ICT equipment in Spanish homes. Penetration is very high for TV, Radio, and wired telephony. Last years a spectacular increase has been produced by mobile telephony.

<b>Equipment of ICT in Spanish homes</b>			
<b>% of devices per number of homes</b>			
<b>Equipment</b>	<b>Percentage</b>		<b>Difference 2003-2002 2001-1997</b>
	<b>2002</b>	<b>2003</b>	
Television	99,5	99,5	0,0
Radio cassette	77,1	90,0	12,9
Fixed Phone	90,2	88,1	-2,1
Mobile Phone	65,0	73,7	8,7
Video	67,1	72,6	5,5
Musical Chain	54,3	64,1	9,8
PC	36,1	43,3	7,2
DVD	11,4	27,3	15,9
Fax	2,7	4,3	1,6

Source: INE. Enquiry on equipment and use of ICT in homes. 2nd Semester 2003

Fig 4.11. Equipment of ICT in Spanish homes

According with available data (year 2002), the penetration of personal computers (PCs) in the Spanish homes is only the 32%. However, there are strong variations among Regions. I.e. Catalonia presents the 39,1 % versus only 25% in La Rioja. Also it must be noted that the most retarded Regions are also displaying the fastest growth.

PCs at home by CCAA (Region)						
CCAA	Total homes	Homes with PC	% Homes with PC			Increment 2002/2001 %
			2000	2001	2002	
Andalucía	2.307.000	729.012	26,2	27,3	31,6	15,8
Aragón	426.000	118.428	22,5	25,0	27,8	11,2
Asturias	365.000	99.645	23,3	25,6	27,3	6,6
Baleares	293.000	101.964	30,2	32,2	34,8	8,1
Canarias	571.000	168.445	23,3	25,3	29,5	16,6
Cantabria	171.000	51.300	25,9	27,3	30,0	9,9
Castilla - La Mancha	580.000	162.400	22,9	24,4	28,0	14,8
Castilla y León	871.000	221.234	20,5	22,5	25,4	12,9
Cataluña	2.217.000	866.847	33,9	36,1	39,1	8,3
Comunidad Valenciana	1.461.000	438.300	23,9	26,3	30,1	14,4
Extremad	358.000	105.610	23,7	25,7	29,5	14,8
Galicia	887.000	236.829	22,4	23,5	26,7	13,6
La Rioja	95.000	23.750	21,1	21,1	25,0	18,5
Madrid	1.809.000	700.083	34,7	35,8	38,7	8,1
Murcia	362.000	100.274	21,1	22,4	27,7	23,7
Navarra	185.000	61.605	28,0	29,0	33,3	14,8
País Vasco	714.000	219.912	26,3	26,4	30,8	16,7
<b>Total España (*)</b>	<b>13.672.000</b>	<b>4.405.638</b>	<b>26,9</b>	<b>28,9</b>	<b>32,2</b>	<b>11,4</b>

(\*) Unless Ceuta y Melilla.  
SOURCE Sedisi 2001, 2002

Fig 4.12. PCs at home by CCAA

Regarding the Internet access at Spanish homes, data from 2003 show that 25,2% of the homes have Internet connection of any type, using conventional telephonic lines, ISDN, ADSL or modem-cable. The growth is of 7,8% annually. Wide band is penetrating at good pace. ADSL is the dominant technology.

The low level of Internet availability by common citizens at home is a critical barrier for current deployment of some type of applications.

It seems very interesting the observation that is diminishing the number of users that have not found any difficulty. On November 2002 the value was quite high (62,2 %). It means that a high proportion of users have been with problems in some moment.

Home access to Internet			
% of homes with access to Internet			
Comunidad Autónoma	%		Dif. (2003-2002) vs. (2001-1997)
	2002	2003	
Andalucía	12,9	20,8	7,9
Aragón	19,4	25,8	6,4
Asturias	13,3	21,4	8,1
Baleares	20,9	29,8	8,9
Canarias	19,0	29,0	10,0

Cantabria	12,3	22,7	10,4
Castilla/León	12,4	21,0	8,6
Castilla/Mancha	7,6	14,7	7,1
Cataluña	23,7	32,7	9,0
C. Valenciana	15,2	22,9	7,7
Extremadura	4,0	14,3	10,3
Galicia	12,3	16,9	4,6
Madrid	25,9	31,7	5,8
Murcia	11,5	21,7	10,2
Navarra	18,2	26,7	8,5
País Vasco	21,9	32,2	10,3
La Rioja	14,1	20,7	6,6
Ceuta	17,0	26,7	9,7
Melilla	30,0	31,7	1,7
<b>Total Spain</b>	<b>17,4</b>	<b>25,2</b>	<b>7,8</b>

Source: INE. Enquiry 2nd Semester 2003

Fig 4.13 Home access to Internet

<b>ADSL Wide Band domestic access to Internet</b>	
<b>Date</b>	<b>% of homes with ADSL</b>
2000/10	0,8
2001/04	2,3
2001/06	2,9
2001/11	4,4
2002/06	14,0
2002/11	17,0

Source: Flash Eurobarometer 88 (October 2000) AIMC. Estudio General de Medios (April/May 01); Flash Eurobarometer 103 (June 2001); Flash Eurobarometer 112 (Nov 2001). Flash Eurobarometer 125 (June 2002); Flash Eurobarometer 135 (November 2002)

<b>Cable-Modem domestic access to Internet</b>	
<b>Date</b>	<b>% homes with Internet access using cable-modem</b>
2000/10	1,3
2001/ 06	3,4
2001/11	18,0(*)
2002/ 06	4,0
2002/11	6,0

(\*) Data of low reliability, but appears in the Flash Eurobarometer 112

Source: Flash Eurobarometer 88 (oct 2000); Flash Eurobarometer 103 (jun 2001); Flash Eurobarometer 112 (November 2001); Flash Eurobarometer 125 (jun 2002); Flash Eurobarometer 135 (November 2002).

<b>Internet users that have not found difficulties</b>		
2000/10	87,5	Flash Eurobarometer 88 (oct 2000).
2001/02	81,8	Flash Eurobarometer 97 (febr 2001).
2001/06	83,0	Flash Eurobarometer 103 (jun 2001)
2002/06	74,0	Flash Eurobarometer 125 y Annex (jun 2002)
2002/11	62,0	Flash Eurobarometer 135 (nov 2002)

Fig 4.14,15,16 domestic access to Internet by Band

#### 4.8. Analysis of the "offer"

The offer part of the innovation system of the Spanish study is characterized by a set of innovative emergent "e-care services" operated by public organisations and private firms. The Table 1 shows a representative sample of cases of real services provision that has been used for the study.

Sample of representative cases of innovation cluster				
Target Demand	Service Provider	Service Name	Public/Private	Comments
Hypertension Chronic patients	Hospital Univ. Puerta de Hierro	AIRMED-Cardio	Public	Physician linkage
Congestive Heart Failure	Hospital Univ. Puerta de Hierro	AIRMED-Cardio	Public	Physician linkage
Oral Anticoagulant Therapy	Hospital Univ. Puerta de Hierro	AIRMED-Cardio	Public	Physician linkage
Preventive Assessment of Aging	Hospital Univ. Getafe	AIRMED Senior	Public	Physician linkage
Diabetic patients	Pulso Ediciones, Vodafone, Menarini, Siemens	MEDICAL GUARD	Private	Self care
Diabetic patients	Carpe-Diem, Sanitas	MEDCARE	Private	Case Management
Teleassistance for the elderly	Red Cross	Teleassistance	Non Profit	Call Centre
Teleassistance for the elderly	Eulen	Teleasistencia	Private	Call Centre
Teleassistance for the elderly	Quavitae	Teleasistencia	Private	Call Centre
Teleassistance for the elderly	Mapfre	teleassistance	Private	Call Centre

Fig 4.17. Sample of representative cases of innovation cluster

#### 4.9. The offered services

The analysis of existing offer in the market shows a variety of approaches that vary in focus, business model, and complexity and implementation details.

Home telecare services are deployed in two different ways: a) targeting particular groups of patients, and b) broadly to large groups of patients.

The first approach is followed for chronic illnesses such as diabetes, asthma, HIV/AIDS, etc.

The second is applied for elderly care and emergency systems.

Four main types of service models have been identified. They are: Model 1) Patient self-care focused; Model 2) Patient health control focused with asynchronous physician link; Model 3) Patient healthcare/social services focused with "Call Centre" and synchronous communication; Model 4) Personal emergency focused with Call Centre link.

##### *Services Model 1. Patient Self-care focused*

This model is focused on the patient that is only linked to the web services. An individual with a diagnosed chronic illness (i.e. diabetes) is allowed to access self-management tools available on a website. The individual may be offered a personal secure website to record and store information and provide suitable e-Health tools. Many of the current products give support to patients by enabling them to store personal health records and capture disease-relevant information that can be printed and shared with clinicians or used in self-management. These systems may offer also services of Information on disease-relevant contents and of Education by online educational program a Help-desk support patient for any question operating the

service. Physicians may recommend such tools to their patients and may even facilitate future exchange of information

*Services Model 2. Patient health control focused with asynchronous physician link*

Patient with a chronic illness (i.e. diabetes, asthma, hypertension, HIV) or enrolled in a health programme (i.e. tobacco retirement) is provided with a "patient unit" including monitoring instrumentation and communication terminal. He or she track daily progress, weight, and medications taken. He or she also measures and records specific indicators using the measuring devices. Then, he or she sends automatically or manually the data to the service centre via fixed or mobile phone lines.

The patient data is received and uploaded into the service centre in a database for patient's health record storage and analysis.

The physician responsible regularly logs on to the system to check patient progress, assisted by alerts flagging situations that require attention. If patient's status is good, the patient simply continues to regularly submit conditions indicators following the stated protocol.

Physician will contact (electronically) the patient regularly in an asynchronous way, to deliver messages of support or in response to a decline in the status, to advise or to provide care instructions such as adjust medication, diet, etc. If necessary the physician can contact patient by phone.

He may have also access to web services or mobile services (SMS, WAP) for information and educational purposes.

A Patient Management Office contacts the patient at the very beginning to deliver general education on operating the service and also it act as help desk for patients.

A Technical Unit is in charge of maintaining the system, update software versions, and to support all the actors in any technical aspect (devices, telecommunications, central computing machinery, etc.)

*Services Model 3. Patient health focused with "Call Centre" linkage and synchronous communication*

Patient with a chronic illness (i.e. diabetes, asthma, etc.), or enrolled in a health programme (i.e. tobacco retirement), are provided with communication terminals, fixed or mobile, allowing them to communicate with a Service Centre.

He or she track daily progress, weight, and medications taken. He or she also measures and records specific indicators using the measuring devices. Then, he or she sends automatically or manually the data to the "Call Centre". The data is received and uploaded into database for patient's health record storage and analysis.

Case manager (nurse or physician) regularly logs on to the system to check patient progress, assisted by alerts flagging situations that require attention and by other supporting tools.

Case manager contacts, using phone or videoconference, the patient regularly, to check personal status, to advise, and to provide care instructions such as adjust medication, diet, etc.

Case manager also provides patient with general education.

Responsible physician receives from the case manager alerts when patient status declines and is given regular summary of patient progress including flow sheets.

Communications are managed by the Call Centre attended 24x7. Web site services, such as described in Model 1 may also be provided.

*Service Model 4. Personal emergency focused with Call Centre link*

This kind of service, traditionally known as "teleassistance", was designed to provide dependent and isolated persons (usually elderly) with an emergency phone call system.

A special terminal is installed at the user home. An alarm phone call can be manually generated by the user by pressing a device (pendant, wrist) or automatically triggered by home sensors (fall detectors, fire, smoke, etc.). Alarm calls are received at a dedicated Teleassistance Call Centre that manages the service.

An Information System supports this Call Centre with data about home location, served people characteristics, relatives, etc.

This kind of service was originally designed to operate for the elderly at home using fixed phone lines. Now, it is expanding moving to provide mobile features by using GSM/GPRS as well as geographical positioning systems (satellite GPS and cellular). Other line of evolution is to include the monitoring of physical and preventive health parameters further than the simple



alarm function. Finally, the served population is expanding to include temporary dependent persons and special risk groups.

#### **4.10. Technology requirements**

##### *Patient equipment*

Most services for patient self-care (Model Type 1) require only Internet access using a standard PC with web browser.

For the operational Models Types 2 and 3, patients may use a variety of devices such as a common PC; a special device specially designed for the application and requiring not computer skills; home monitoring devices, a home monitoring integrated station, or a simple mobile terminal.

For the model of emergency call service (Model Type 4), special alarm detectors and user terminals are required. Also a variety of home sensors may be installed, including video surveillance systems. Domestic Wi-Fi and Bluetooth wireless systems are increasingly used technologies

Self-monitoring is a basic element of self-management for patients with chronic illnesses such as diabetes mellitus (measure of blood glucose level), congestive heart failure (weight) or asthma (peak flow). In some cases the patient make the measurements with standard measuring devices and then enter the data manually for sending to the central server.

In other cases, the devices are provided with electronics, embedded programs, and/or communication means for automatic data transmission, being all integrated in the form of a "patient station" including guiding menus and supporting programs to assist the patient.

Both approaches have different advantages and drawbacks. Manual entrance implies patient proactive involvement. On the other hand, automatic systems avoid transcription errors and can offer easy operation for some user groups.

A range of mixed solutions is being implemented by services operators. It is expected that patient devices will evolve according with new emerging technologies (i.e. wearable sensors, wireless body area networks, natural language processing, etc.)

Mobile computing and wireless communication technologies (including hand held devices, advanced cellular terminals, PDAs, etc.) offer greater mobility to the user. Mobile cellular communications, GSM and actually available GPRS and UMTS, are increasingly in the base of most innovative services. They allow extending the service to anywhere the patient may be, even globally.

##### *Technology requirements for professionals*

Physicians and nurses (case managers) require being equipped with means to communicate with the central service system and patient records database. Most implementations use Internet connection via corporative LAN, or individual access with PC using analog phone dial-up line from his own private office or home. The types of services (Type 2) involving on line synchronous communication with the patient are mostly performed at corporative premises using wired lines.

Special working stations and support tools are equipped for "Call Centres" operators.

In addition mobility is becoming common with a variety of implementations using portable PCs, PDAs, and mobile phone terminals. Connectivity is shifting from GSM-modem to GPRS and UMTS mobile data services. In this way professionals can perform their tasks independent of their location.

##### *Requirements for Service Provider*

The Service Provider has more severe technology requirements than the patient and professional entities. It can run the service infrastructures itself or has an external hosting arrangement with a vendor.

In general, a dedicated computer server is necessary to run the application and collect, analyse, and store patient's data. Also it is necessary computer support to manage information flows, as well as to produce and deliver personalized information to users and involved professionals.

Connectivity with external health information systems (i.e. electronic health records) should be required.

Additional servers must be implemented to support communication tools (e-mail, SMS, WAP)

Security functions are other important technological component. Patient information integrity must be granted. Buck-up servers must be implemented to avoid any gaps in providing service. Applications are using increasingly complex and highly personalized tools. Depending on the application's specific functionality, level of reliability, sophistication, and integration with other systems, varying levels of hardware and supporting infrastructure are necessary to support application.

Most of the Service Operators have integrated a dedicated technological platform developed in own premises or by local tech providers using a great number of separate components and some specific software.

In some cases, the building of tools for these new "telemedicine services" are the result of the maturation of products from initial simpler versions to more sophisticated ones after passing exploratory research and in deep evaluation pilot stages.

The trend toward broader products offerings is sure to continue. There are many existing pieces of software that have been developed in research labs that are failing to be commercialised or used apart from demo sites. Furthermore the international wave of research projects dealing with chronic patients home care, elderly care systems and e-health applications in general, will presumably a growing source of new potential products driving the market.

The current marketplace includes many of e-health tools. However, there are no discernible specific products in the national market.

#### **4.11. Acquiring technology**

There are three basic options: a) build, b) buy, or c) outsource

##### *a) Build*

Few telecare "Service Providers" are opting to build an entire system internally.

Regarding Model 1, those who adopt a build approach often develop a web site that acts as a shell tying together a variety of e-Health tools. Although some tools may be built in-house, others such as medical contents, clinical guides, news and other information sources, are often obtained in the marketplace. Even vendor-developed applications typically include elements acquired from other vendors, especially in the areas of medical knowledge.

Model 2 and 3 implies in addition medical instrumentation, physician/nurse equipment and software, and communication means. Technical complexity limits in house development option for organizations without sound I+D capabilities.

##### *b) Buy*

Service Providers who choose not to build can obtain assembled applications from system developers/vendors. The vendor marketplace now includes a large number of applications that can set up personal Web sites for patients and/or physicians and include many features and information resources.

Although there are single-disease focused products, also there are suites that cover several disease states and allow health services operators to serve a number of health programmes through a single platform thus permitting to manage an even broader population of patients.

Most often it is possible to customize products to include or omit some functions and modify content or presentation to tune health service operator (provider). Often modules and products are from foreign manufacturers. In those cases certain level of localization work must be done, at least language translation.

There is the potential option of using an application service provider (ASP). However ASP market is not minimally developed in this area.

##### *c) Outsource*

Organizations that do not wish to run their own service provision completely in-house can outsource case management, or outsource care responsibility for the group of patients entirely (i.e. Sanitas vs. carpe Diem for diabetic patients management)

## 4.12. Services Operation Organizations

The analysis of current market offer shows different types of “Services Providers”. Identified categories are:

- Public Healthcare Organizations
- Public Social Organizations
- Non Profit Organizations (Red Cross, Patient Associations)
- Private Healthcare Insurance/Providers
- Private firms/consortia

Regarding the last type, some subclasses can be also identified:

- New firms addressing specific patient groups (i.e. diabetes)
- New firms and/or consortia addressing home care services widely
- Firms and/or consortia with previous experience as suppliers in the medical market of medical specialties (i.e. providers of glucometers, infusion pumps, etc.)
- Firms and/or consortia with partnership well positioned in the overall medical market as suppliers of devices or services

## 4.13. Promoters

There are several types of organizations actually involved in promoting the new kind of e-services. Main promoters in the Spanish context are Public Healthcare and Social organizations. Other involved organizations are private insurers/providers. Patient and consumer associations are very active in pushing the development of supporting resources. They are becoming special partners in services operating consortia.

Pharmaceutical sector is a relevant player. Chronic illnesses treatments are a big share of medicines market. Pharmaceuticals companies are present, directly or indirectly, in most of the initiatives.

Finally it must be considered the promoting role of technological companies. Telecom operators are key actors in the Spanish case.

Table below resumes business objectives of these promoters

<b>Business Objectives of Sponsors of home care and personal telemedicine based Services</b>							
<b>Business Objectives</b>	<b>Potential sponsors</b>						
	<b>Public Authorities</b>	<b>Private insurers</b>	<b>Public care providers</b>	<b>Private care providers</b>	<b>Patients / Consumer Assoc.</b>	<b>Pharma. Companies /offices</b>	<b>Tech. vendors ICT/ biomedical devices</b>
Improved Patient Status / Reduced Service Utilization	X	X	X	X	X		
Excellence of service and care	X	X	X	X			
Consumers Satisfaction	X	X	X	X	X		
Physicians satisfaction	X		X	X			
Opportunity to Market Other products and services		X		X		X	X

Opportunity to integrate others products or services		X	X	X			
Third parties data usage	X	X	X	X	X	X	X

Fig. 4.18. Business Objectives of Sponsors of home care and personal telemedicine based Services

## **5. The Context and the Driver/Resistance factors**

### **5.1. The context environment**

#### **5.1.1. General**

The basic reference model includes the contextual environment. It refers mainly to the legal, administrative and social framework.

It is basic to note the double influence of healthcare and social sectors. Chapter 2 presented detailed data on the Health Care System, legal base, organization, economic and policy issues. In order to analyse the actual models and future scenarios on which to integrate and incorporate the innovations in this area, one of the determining factors to be taken into account for the development and marketing on a large scale of these type of products is that in Spain, in the present health care model provisions rest mainly on the public sector. However, we should also keep in mind that the healthcare provision as well as the disability and dependency areas have been specifically transferred to the Autonomous Communities (Regional Governments).

The family and social context in which care is delivered is changing rapidly. The increased number of one-parent families and the significant decline in birth rates implies fewer children and relatives will be available to provide care for the elderly than has been the case traditionally. In this sense, future scenarios in care for the chronically ill and the elderly must focus on the development of a network of personalized care/home care services that will take into account variables such as information, choice capacity, participation, safety and quality and consideration of consumer power.

#### **5.1.2. Chronic patients care**

Regarding current services provision, services to chronic patients is mostly supported by the public healthcare sector in a currently decentralised national health system. The core of "healthcare provision organisations" is formed by the regional healthcare public services dependent of the 17 Regional Governments, such as for example IMSALUD (Madrid); ICS (Catalonia); SVS (Valencia); SAS (Andalucia) and SERGAS (Galicia). All them operate through a well-established network of 550 hospitals and 164.000 beds. In addition, there are other public healthcare organisations depending from Defence Ministry and Municipalities jointly with non-profit organisations like the Red Cross.

The private insurance sector coexists with more than 40 companies operating in the country. The Healthcare sector has special characteristics that make it different from other service sectors. They must be taking into account for the development of strategies aiming to promote innovation and KISA utilization. Spanish Healthcare Sector is highly regulated; it is public; very fragmented and decentralised. The indirect payment structure makes it low sensible to costs and it is very influenced by social sensitive events.

#### **5.1.3. Social services provision**

Regarding social services for the aged persons (>65), the public offer includes home care aids; teleassistance alarms; and day care centres for dependent persons.

Following the report from the Observatory for Aged people for 2002 of the IMSERSO (Ministry of Labour and Social Affairs) 140.000 persons are actually receiving public home care aids. It is the most used service (2% of the population segment >65) followed by teleassistance services that are used by the 1%. Usually, the institutions responsible for the delivery of home aids are the municipalities or alternatively the territorial corporations called "Diputaciones Provinciales". In some cases the practical delivery of the services are contracted to entities that may be non profit, such as the Red Cross or to private specialised firms (Eulen, Mapfre, Quovitae). These private firms also offer their services, in free market regime, for any person that should desire to contract them.

The offer of Nursing Homes is mainly private, managing the 74% of places. The 15% of them are concerted with the public sector. The 3,19% of aged population (>65) is using it.

Architecture sector is active on home conditioning, new elderly adapted buildings, and Nursing Homes construction. It must be considered as an interested party and KISA suppliers.

#### **5.1.4. The new dependence care legal context**

The approval of the "Dependency insurance Law", currently under public debate, is judged as one key factor conditioning future prospects for elderly care. According with Government declarations, this law for Dependency Care would be approved before July 2005. It will define

the subjective rights to which two and one half million Spaniards will have access. It will list a number of basic benefits and, above all, will deal with financing the future National Dependence System.

This system is meant to offer universal coverage to those persons who cannot care for themselves and are not autonomous (dependent persons). It is foreseen that 90% of this coverage will be for persons 65 or over, but it will also cover the needs of the disabled that are not included in this age category.

This National Dependence System includes, on the one hand, the social/health aspect and the link with the National Pensions System. In respect to the portfolio of social/health benefits to be included in this National Dependence System, who and what institutions will be in charge of provision and management is under discussion at present (Autonomous Communities and City Halls).

It has been calculated that the National Dependence System that the government wishes to present in Congress, will presuppose a cost of 9,137 million euros annually, or 1.3% of the GDP. This amount should cover home-care, day centres and teleassistance for 100% of the most serious dependency cases and 12% of minor cases.

One of the problems not yet resolved is the question of financing and whether the application of the law will signify an increase in taxes.

Public authorities admit the need for an increased effort in social spending in order for Spain to reach the European average in this area. The distance in investments in social spending has increased in the past few years in comparison to the European Union, going from 5 points of the GDP in 1990 to 7.2 points in 2004. At present, home-care has coverage of 3%, teleassistance reaches 1.8% of the elderly, and an increase in homes for the elderly is also necessary, since only 42% of these are publicly funded.

## **5. 2. The driving forces and the resistances**

This is the other set of critical elements conforming the innovation system. It has been identified as one of the main drivers the ICT technological capabilities and the R&D push, both internally and externally to the offer agents. The knowledge associated to the operation of the ICT tools is central for facilitating innovative drive.

One of the characteristics to consider is the rapid change of available technology. Available ICT infrastructures, services penetration and tariffs structure are conditioning elements.

Results of the study agree with literature on general ICT applications for health, signalling mind openness and inclination to innovate as key driving elements. Simultaneously, their lack constitutes one of the most important barriers, often associated with some professional's resistance to change.

Of course, economic incentives are very important. One of the main barriers in implementing innovative developments based on ITC on a large scale is the availability of resources. There is growing evidence that investing in home care can save money while improving care and the quality of life for people who would otherwise be hospitalised or institutionalised in long-term care facilities.

The search for evidence on improvement of cost/effectiveness ratios is claimed for the public services assessment. It should be noted that one of the possible pitfalls could be analysing it only in terms of lineal cost, without medium and long-term studies on the benefits, in terms of patient satisfaction and well being. In other words we are still lacking in-depth analyses on the benefits derived from cost/efficiency and cost/life quality in the offer of these services.

Insurance companies and the private sector believe that there may be a large market in implementing new, innovative solutions based on these technologies for this segment of the population, from call centres and tele-alarms to more extended packages. However, this should go together with a suitable legal framework on dependency insurance. Another alternative propose by the experts could be the co-payment through "service checks". The service check would go to certain firms that would use it in home care and related services.

Expectancy of profit is logically in the base of private firms interest. Service rates and prices structures are elements of business models. The development of a private sector will heavily depend on the reimbursement schemes by public sector.

## 6. Use of KISA in the analysed innovation system

### 6.1. The KISA supply in the innovation system of Personal Care Services for the Elderly and Chronic Patients.

In this section we present results of the research performed with the experts interviewed in order to investigate the different types of internal and external KISA used in the process of developing and implementing key innovative, technologically driven solutions (ICT technologies) and new innovations in personal care for elderly and chronic patients.

This study is based in a sample of 16 persons who came from both, the health services world - health firms -specialists in the elderly and chronically ill from the private and public sector- as well as the technological world – telecommunications operators, ICT personnel, small and medium-sized ICT. As well as industrial associations and non- profit organizations.

As we have already defined them, KISAs are innovation services provided either internally or externally by a firm or organisation, with innovation activities. Fig 6.1 shows the typical structure of KISA supply. However, this classification depends on each type of e-care service provider. We have identified four types of service providers: a) healthcare organisations (public or private); b) traditional home care and teleassistance providers; c) teleservices operators and ASPs, and d) new innovative firms.

Innovation services may be related to a variety of innovation activities in an organization. Innovation is understood from a systemic point of view arising from the interaction between people, organizations and technologies and in a new way of developing new (service) products or processes, improving or creating new ways of producing the (service) products (also termed process innovation), new ways of delivering the (service) products, organisational or administrative innovation, etc.

Expert Profile	Number
Healthcare Public Managers	2
Healthcare Service Providers	3
Telemedicine SMEs.	4
Health Home Services (public)	1
Health Home Services (Private)	1
Telecom Operators	3
Industrial Associations	1
Non Profit R&D	1

Fig 6. 2.1. Expert Profile

Analysing the different internal and external KISA is rather complex, not only because it separates one service from another but also because even the people interviewed had trouble separating the internal from the external. We decided to include questionnaires on both, qualitative and quantitative data, in the interviews in order to obtain in-depth information on certain aspects that would otherwise not be answered.

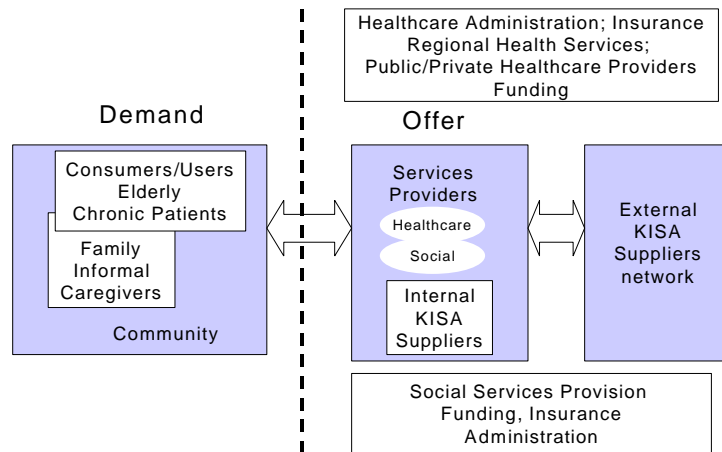


Fig. 6.1 Diagram showing the overall innovation system. It is differentiated the internal KISA from the external KISA supply.

The potential KISA related to innovation in personal care services for elderly and chronic patients includes:

- Research and development
- Management and administration
- Consulting
- Human resources management
- Finances and accounting
- Marketing
- Turn key systems
- Planning
- Training

## 6.2. Assessment of KISA supply system

The research questionnaire was organised through a set of four questions related with the following issues:

- The degree of each KISAs utilized in their Organization/ enterprise
- Which are internal/ external KISAs.
- Which for this specific case study are internal/external KISAs.
- How is the KISA learning processes.

### 6.2.1. The degree of each KISAs utilized in their Organization/ enterprise

Before analysing what KISAs are internal or external in the company or organization, it has been evaluated first which of the identified potentially knowledge-intensive service activities (KISA) can be considered to incorporate a greater density and use of intensive knowledge in our case study.

In this sense, experts were asked to grade from 0-5 those activities they felt were most knowledge intensive, 0 being the lowest score.

Those interviewed graded very high (from 4-5) those activities related to "Training" and "Research". Thus, according to the persons interviewed within this case study, these activities suppose a greater source of knowledge.

"Planning" activities are also scored quite high (4) in a degree of knowledge supply.



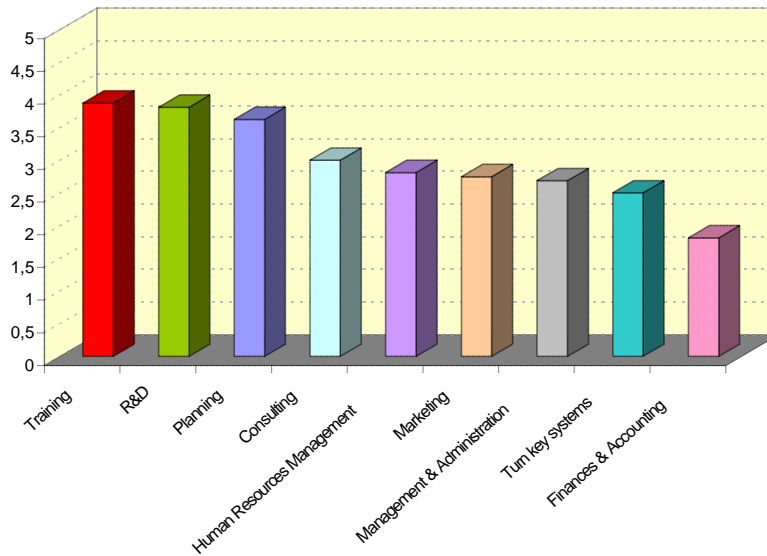


Fig 6. 2. 1 Perception of the different KISA activities by rank

The experts consulted agreed that the KISAs with the lowest degree of knowledge-intensive activities are those related with “Management & Administration” and “Finances” services regardless of the background of the expert.

It is interesting to note that almost all those interviewed coincided unanimously about those KISA that in the opinion of the different actors and, for the particular case study analysed, suppose a greater need of specific knowledge. The evaluation has been the same whether the interviewee was a services provider from the health services world or from a services company involved in technological development. In other words, research, training and planning related activities are considered by the experts to contain a greater degree of knowledge-intensive activities.

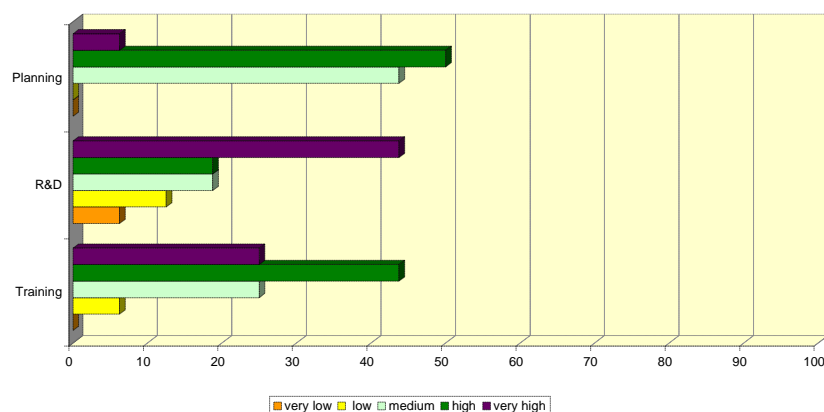


Fig. 6.2.2 KISA higher ranked

Fig. 6.2.2 shows in detail how the sample evaluate the variables as higher KISA: Planning with 50% high, training 40% high and 25% very high, R&D more than 40% very high. More than 15% of the sample considered planning as a very knowledge-intensive activity. Training and R&D were evaluated as highest KISA (50% of the sample)

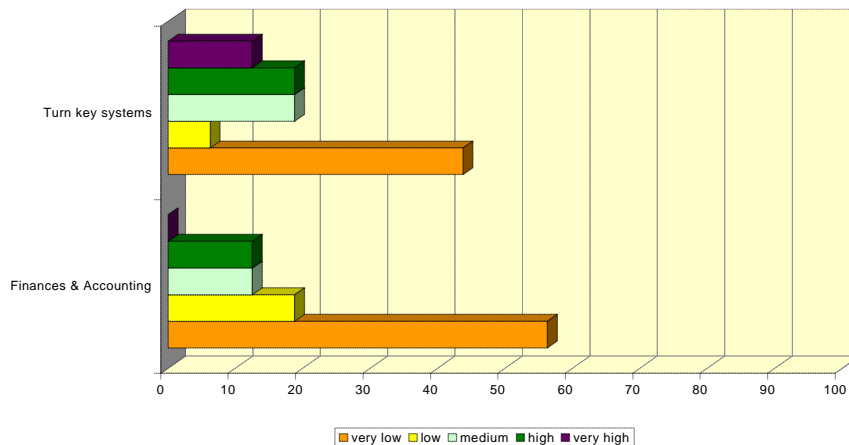


Fig. 6. 2. 3. KISA lower ranked

Fig. 6.2.3 shows how the pool evaluate the variable as lower KISA: Turning key systems: 40% very low and finances and accounting more than 50% very low.

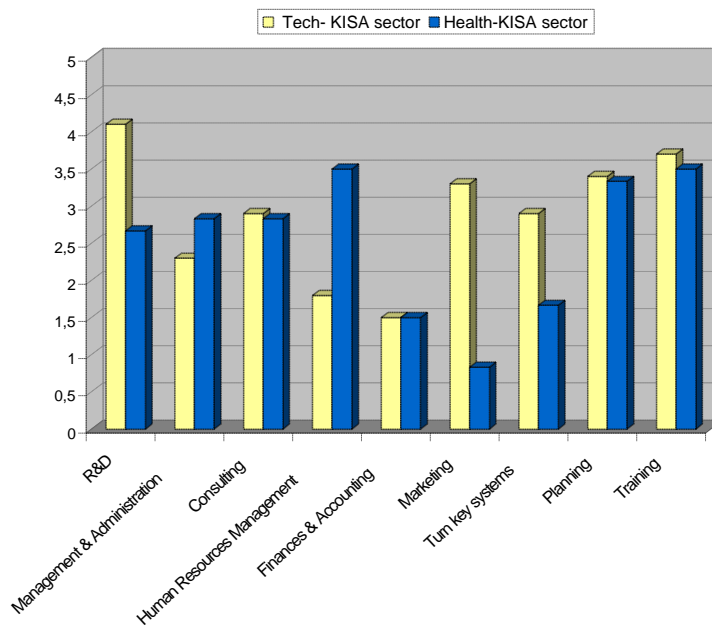


Fig. 6. 2. 4. & 5. KISA versus the polled experts profile

The results concerning the valuation related with the two main polled groups according with their health / technological background are shown on the graphics 6.2.4 and 6.2.5 In this regard the KISA most knowledge intensive used in the case study in opinion of the interviewers from health organizations culture are "Human resource management", "Planning" and "Training". On the contrary, the most knowledge intensive for the experts consulted coming from technological companies are "R&D", "Planning" and "Training" but they evaluate with a high degree of intensive knowledge "Marketing" and "Turn key systems" activities also.

### 6.2.2. Which are internal/ external KISAs

Of the KISA analysed above, it has been evaluated, according to the different stakeholders, which activities are considered internal by the companies/social/health services providers. The analysis was done on all those companies/organizations that carry out innovative activities in personal care provision for the elderly and chronically ill and are in the field of technology (private) or in the field of health services providers (public or private) or a mixed public/private concern. In other words, which are crucial and essential for the know-how and development of the line of business and that therefore must make up a part of the core of the company, according to the interviewees.

Of those KISA considered internal by all the interviewed, “Research”, “Training”, “Human Resources management” and “Planning” are those in which all the experts consulted coincide unanimously. However only some of them consider as internal activities in regard to the hard nucleus of its business, those activities relative to “Marketing” and “Turn key systems”. That proceeds mainly from certain sectors of the business world and more specifically the SME’s sector (small and medium-sized enterprises). The SME’s products, processes or services, in many cases, are destined to finding specific solutions that integrate all the possible options for a specific problem and to do this they have among their personnel specialists in the development of turnkey systems.

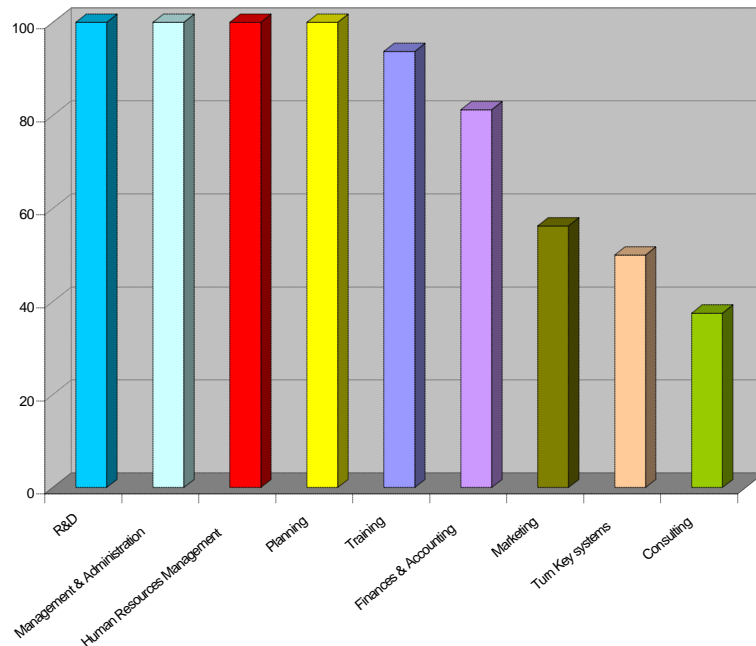


Fig. 6.2.6 internal KISA ordered by rank

As far as external KISA is concerned, all agree on classifying consulting, technical and legal assistance and turnkey systems activities as external and in some cases also include training and research.

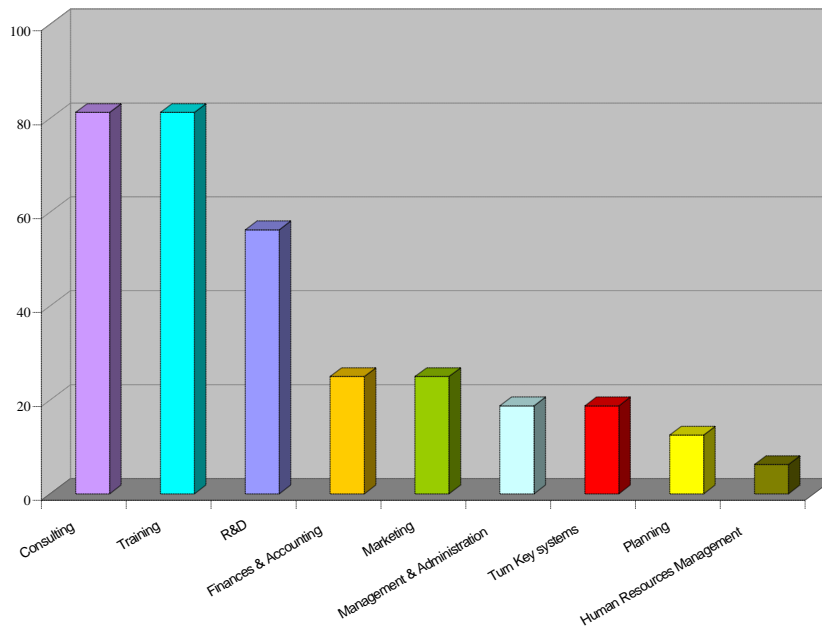


Fig. 6.2.7 External KISA ordered by rank

Fig. 6.2.8 shows that the 56 % of those interviewed stressed that in their company or organization, knowledge intensive activities related to the fields of Research and Development not only use those related to the knowledge of their own personnel, but also take into account and use the knowledge and development of actors external to their business. The 75% consider the same to be true of training activities. Other activities evaluated as both internal and external are management and administration by the 19 % of those interviewed and consulting by the 18 %.

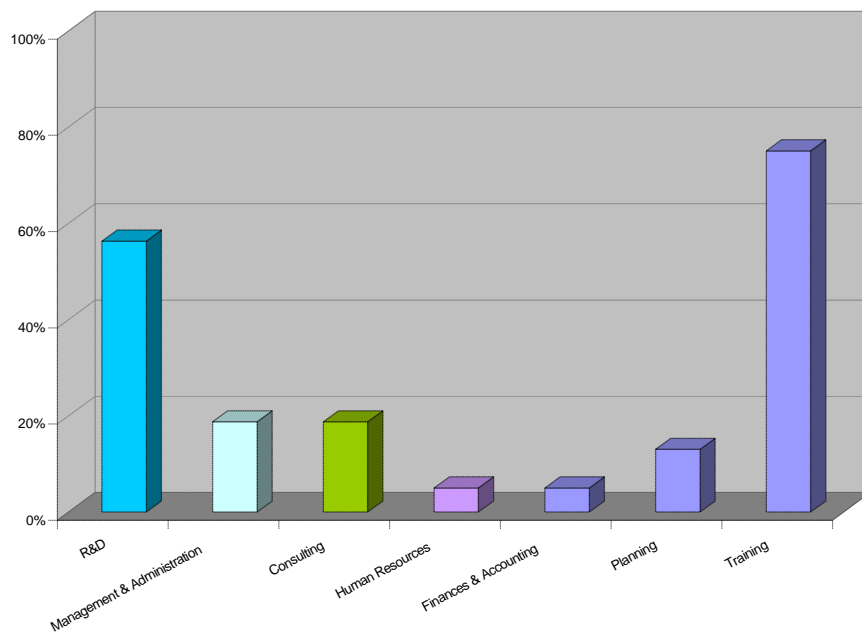


Fig. 6.2.8. Comparative both internal & external KISA supply

When we analysed each variable from the point of view of expert's background, the results shows some interesting differences (Figs 9, 10 and 11). Fig. 6.2. 9 show that the poll coming from technological companies consider as internal to the core business, in major or minor degree, all of KISA but "Consulting".

But, when experts from the health organizations were asked, the perception of internal KISA varies from ones to others. The results, as is showed in graph 6.2.10, stressed that "Planning", "Human resources Management" and R&D are mainly internal. Nevertheless R&D is seen more than an 80% as an external activity also training is considers both external (100%) and internal (80%).

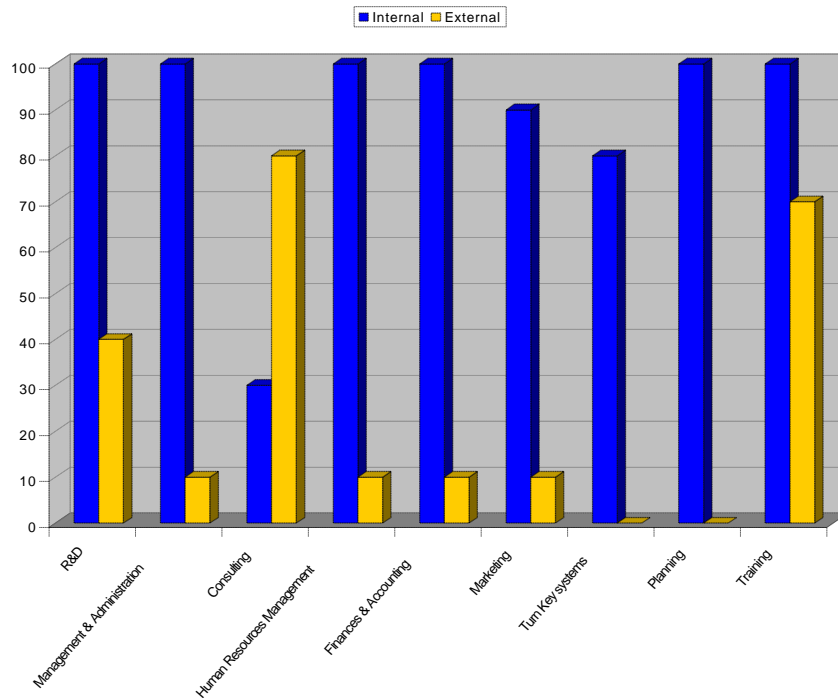


Fig. 6. 2. 9. Overview from the technological sample profile.

Marketing, Consulting and Turnkey Systems in the other hand are perceived as only external. Fig. 6.2.11 resumes the perception about internal/external Kisa's between the two different expert's backgrounds.

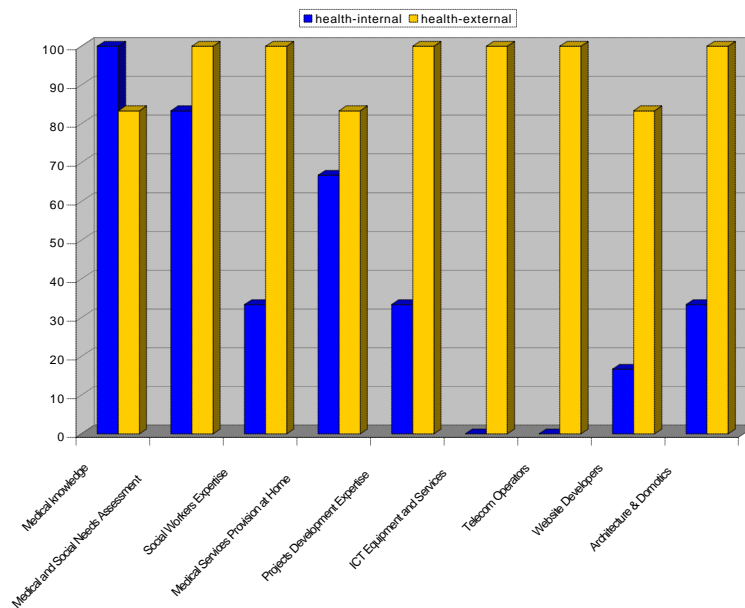


Fig. 6.2. 10. Overview from the health sample profile

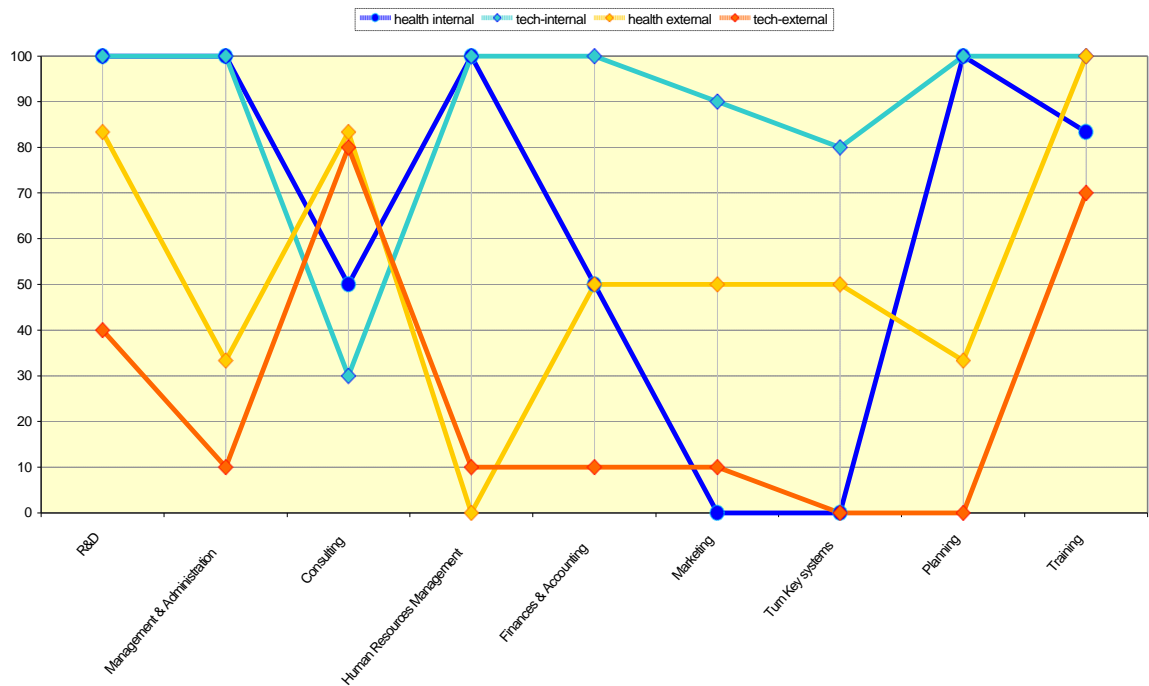


Fig 6.2.11. Comparison health& technological sample profile

### 6.2.3. Which for this specific case study are internal/external KISAs

After analysing the main KISA suppliers, it has been identified along the study others specific KISA that may be considered intrinsic to this specific innovation case study. Then we have considered very interesting knowing in detail and being able to make a distinction between those specific knowledge intensive services activities. In other words, to analyse the KISA activities that might be useful for developing innovative activities in their line of business linked to the development of new products, processes, or services.

In the case of health organizations, this would mean the specific knowledge used when offering their services. In this framework, the interviewed experts were asked which specific KISA they used and which were internal/external to their organization or company. The KISA identified were

- Medical knowledge
- Medical and social needs assessment
- Social workers expertise
- Medical Services provision at home
- Project development expertise
- ICT equipment and Service Providers
- Telecom Operators
- Website developers
- Architecture & Domotics

In the case study under research, the public and private companies and organizations are mixed. A wide range of companies including those in telecommunications, software, remote care, nursing homes for dependent people, social services, public hospitals, health management, SMEs and firms specialized in developing telemedicine among others, all compete in this segment of the market in giving value added assistance and services to patients.

Specific case study internal KISA

If we analyse the internal and external KISA items mentioned above, according to the profile of the company/organization, depending on whether it has a technological or social/health base, we find that the KISAs differ according to the business core.

The core of internal kisa's is formed mainly by projects development expertise and medical knowledge.

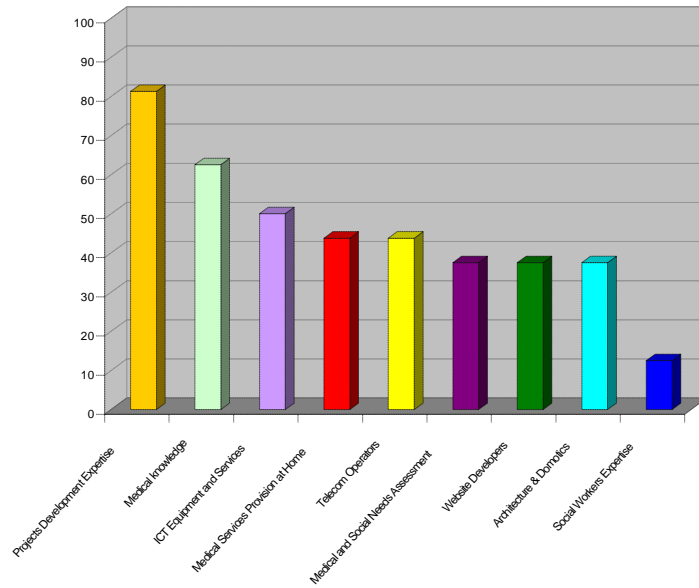


Fig. 6.2.12.internal specific case study KISA ordered by rank

In regard with those activities that are perceive as external we must stressed that social worked expertise is considered as external by 100% of the experts, that means that not only the technological poll but the interviewers coming from the health background, need to supply this expertise from personnel out of their company/ organization. This is not the case for others specific health-social activities, as medical knowledge, services provision at home or social workers expertise that is perceived in some cases as internal to their organization.

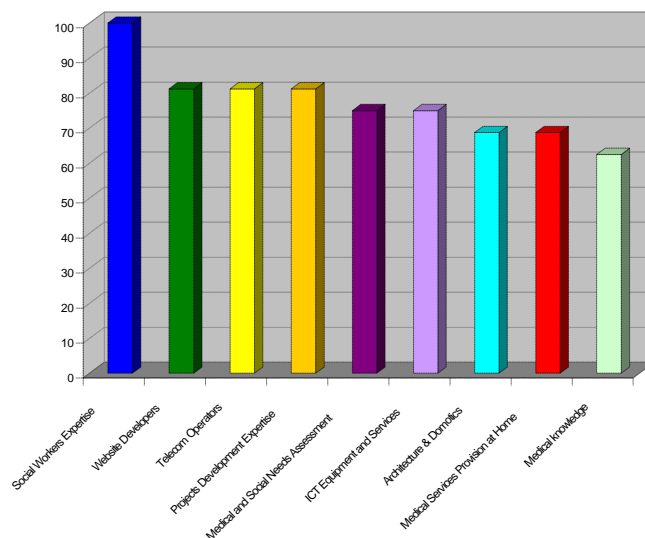


Fig. 6.2.13.external specific case study KISA ordered by rank

Regarding those valuated as both internal & external is shown in graphic 14. The project development expertise is perceived both for more than 40% of the experts. Other KISAs consider external & internal in minor degree are medical knowledge and medical and social needs assessment.

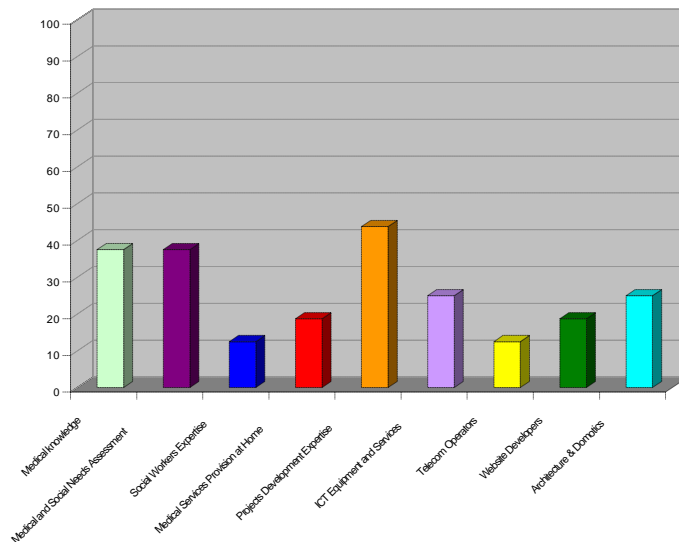


Fig. 6.2. 14. Both Internal & External specific case study KISA supply

a) The core of internal KISA's regarding to technological profile, graphic 6.2.15, is fundamentally those activities linked to project development. The 100% of the interviewed consider this activity as absolutely essential to the company in order to set innovative products in motion. Other activities considered internal and necessary for the development of an innovating business activity are those KISA that imply knowledge on information and communication technologies and equipment services. These are the most interrelated with the products aimed at the end user. Subjects related to web platforms are not yet altogether included in the activities of the enterprises personnel.

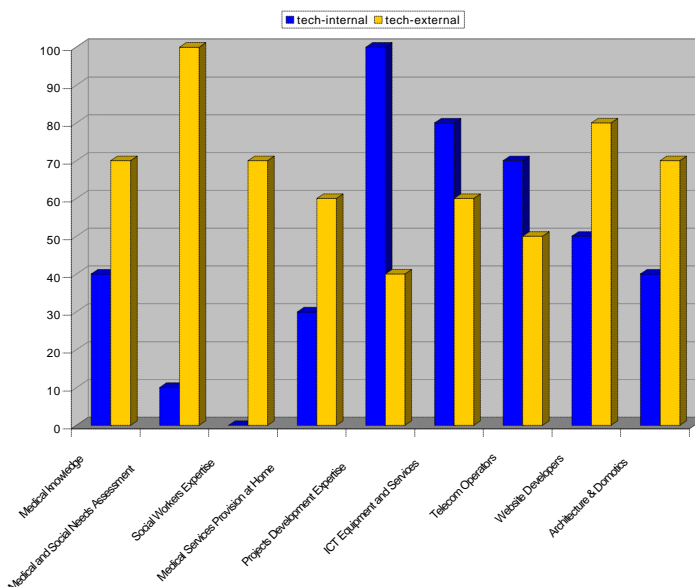


Fig. 6.2.15. Overview KISA: Technological Profile Experts pool



b) On the contrary, the internal KISA activities for social/health companies or organizations, graphic 16, are those related to the care and treatment of the patient. The experts consulted evaluated medical knowledge as 100% internal, which means that it is absolutely essential for the development of innovative activities in the analysed case study. In minor degree medical and social needs assessment is perceived as internal by 83,3% of the experts. However, those KISA associated with knowledge providers in the field of social workers expertise and medical services provision at home are evaluated as necessary for the innovative activity of their organization, although in some cases they must search for and obtain it in an external manner. As we obviously could expect the ICT equipment & Services and Telecom operators, are seen as external KISA for the health/social sample. It is interesting to note that some activities, which in a general way were found to be very important in the discussion panel were not highly valued.

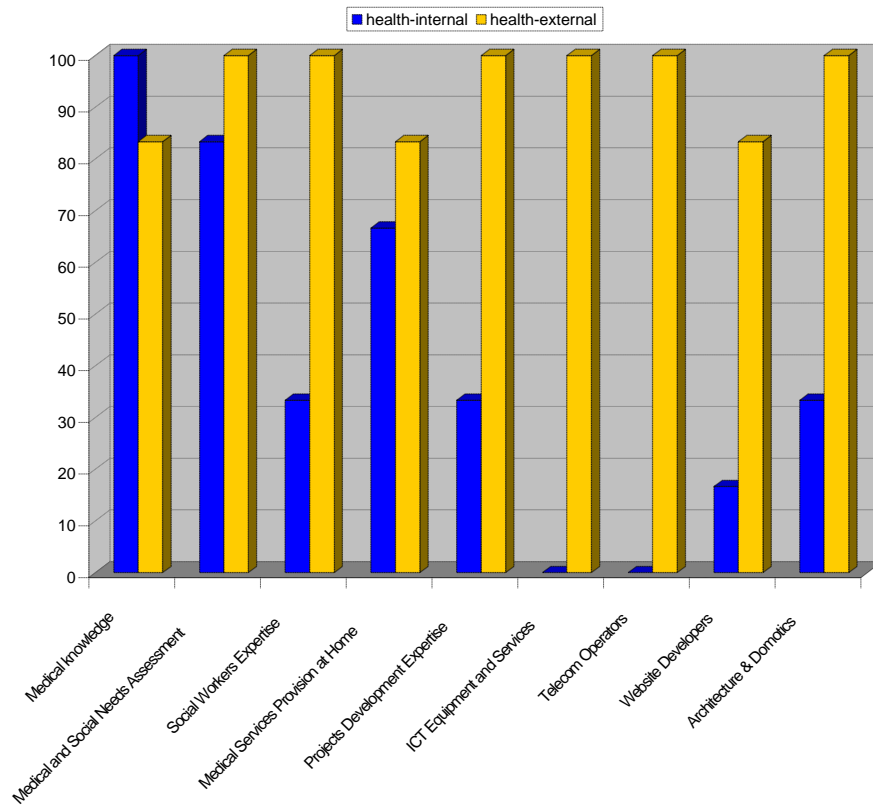


Fig. 6.2.16. Overview KISA: Health Profile expert's pool

#### 6.2. 4. How is the KISA learning\* processes.

We have investigated the learning process to have a better understanding in the experts opinion, of how the acquisition and transmission of knowledge for those KISA specifically used in the analysed case study takes place.

Therefore, we asked those polled about the ways or processes mainly used for the acquisition, transmission, apprenticeship and incorporation of knowledge used specifically when creating, developing, implementing and, when relevant, commercialising new products, processes and innovative services. The analysis was carried out for each of the specific KISA analysed in depth in the 6.3 section.

When faced with the acquisition and transmission of knowledge, for the development of innovative activities in their line of business, it has been considered enlightening to know how

\* In this section we use the term learning to name the complex processes of incorporation's knowledge for the specific KISA.

the transmission of that knowledge takes place through the different actors that intervene in the different KISA. In this sense we have classified them into:

- Formal learning
- Informal learning
- R+D Projects
- Interaction with other agents
- Technological vigilance

Formal apprenticeship includes: training, courses, conferences, workshops etc. Informal learning refers to work meetings, sessions for setting innovative products, processes, or services in motion, informal presentations of new products, etc. Other manners of acquisition/transmission would be participation through partnerships in joint R+D+I projects or by using the interaction with agents that are external to the core business, patient associations, consumers, foundations, etc. Finally, we considered other possible way using technological vigilance or surveillance by means of patents, scientific publications, clinical tests of new products, etc.

The question was phrased to be answered by a multiple response; in other words, the person polled could choose one or more ways of acquiring knowledge in the Company/organization for every specific KISA.

**KISA LEARNING ITEMIZED**

Medical knowledge  
Medical and social assessment  
Social care expertise  
Home-care providers  
Development projects specialists  
ICT providers and equipment  
Telecommunications operators  
PLATFORM-WEB design  
Architecture and Domotics  
Legal expertise

The results, are displayed in Fig. 6.2.17 and 6.2.18 reflect that for this niche of companies/organizations, whether from the technological or health care worlds, the acquisition of knowledge through the participation in joint R+D+I is for 60% of those polled the main source of learning activities, and independently of analysed KISAs. This percentage rises to 65% if we calculate the median (this data varies greatly depending on the KISA under study). The second one most cited is the incorporation of new knowledge, through non-conventional training, whether coming from contacts or informal meetings, which was chosen by 54.3% of the sample.

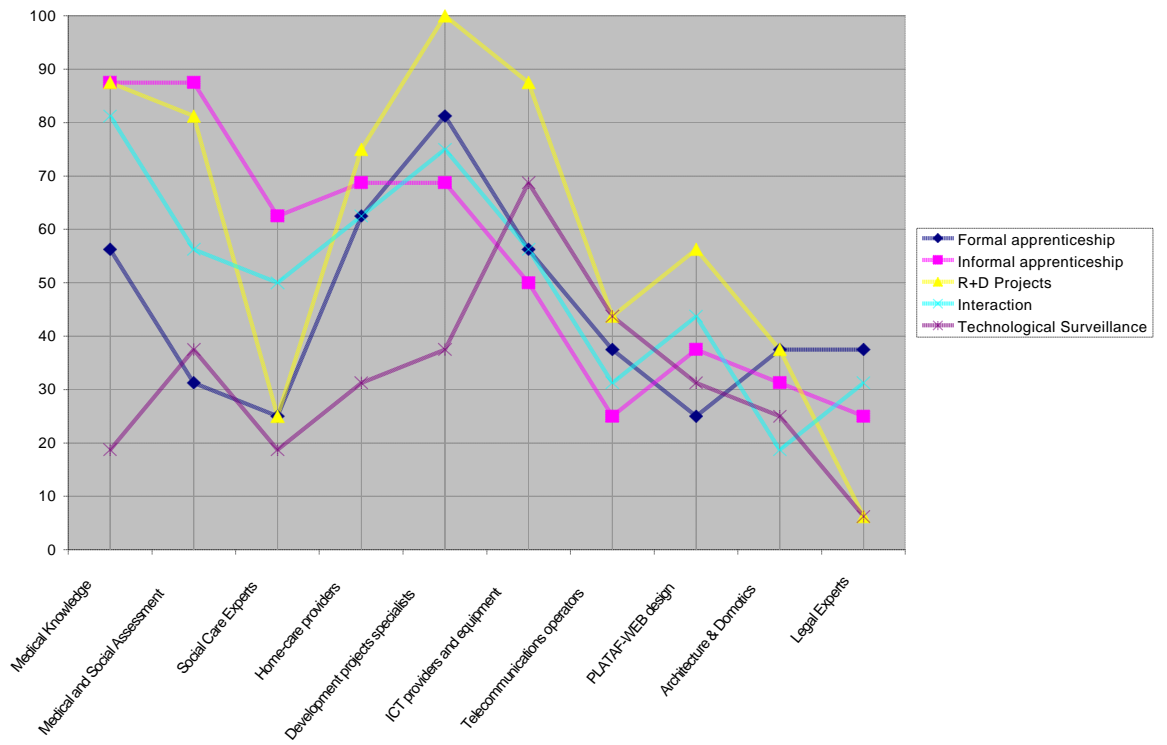


Fig. 6.2.17. KISA learning procedure vs. items

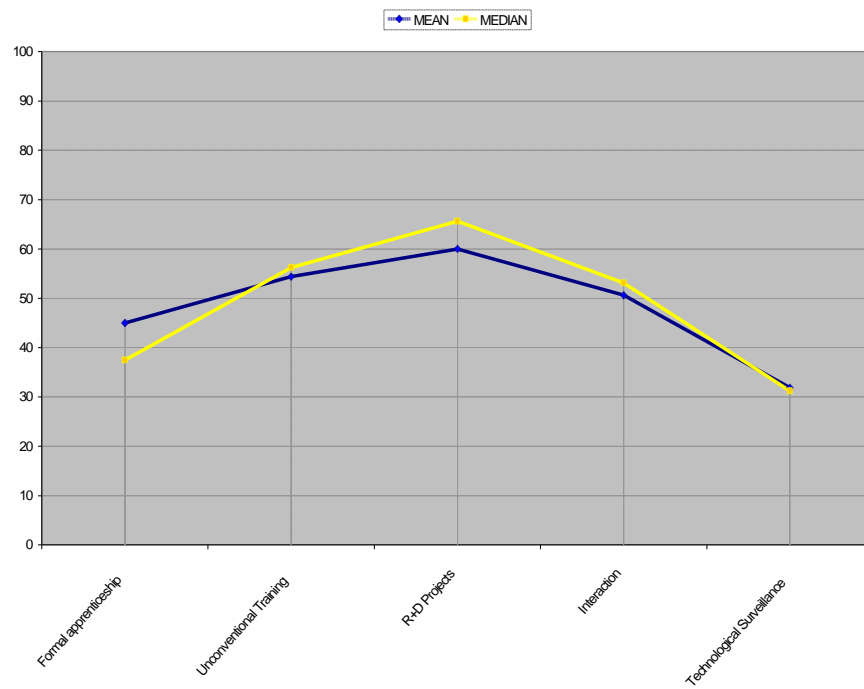


Fig. 6.2.18. KISA learning modalities (mean & median)

### 6.2.4.1. Health Specific KISA learning

Concerning those KISAs that are used in a more significant manner from the point of view of health-social care specific Knowledge (Fig. 6.2.19), the experts consulted pointed out “Medical knowledge” and “project development” putting into work and developing new innovative products, processes and services are the mainly used. It can be observed that the answer is closely related with the 6.3 question.

In this KISA's the knowledge is attained mostly through non-conventional learning and participation in Research and Development projects as we show for medical knowledge, medical and social assessment, social care expertise and home-care providers. Nevertheless, the learning processes related to the development project specialist are perceived through R&D projects and formal learning. That may be because this KISA is in between technological and social healthcare innovation activities.

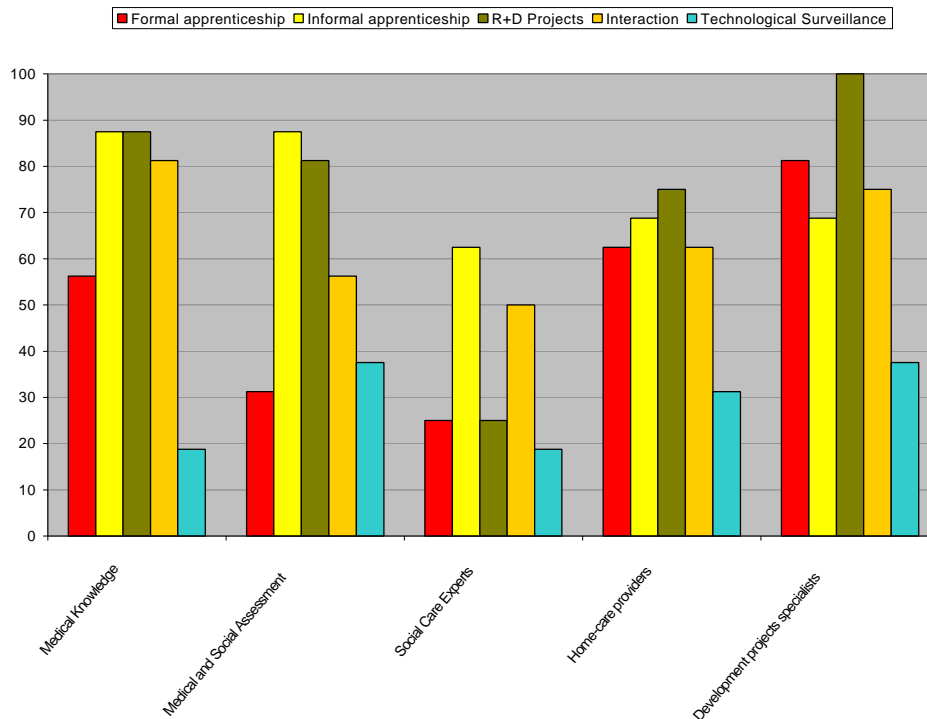


Fig. 6.2.19. Health specific case study learning KISA

### 6.2.4.2. Technological Specific KISA learning

Curiously enough, in regard to the specific KISA in the technological field, those most valued are also learning processes through participation in R&D projects, but contrary to Social/health KISA the technological vigilance and formal apprenticeship are the most pointed out by the experts.

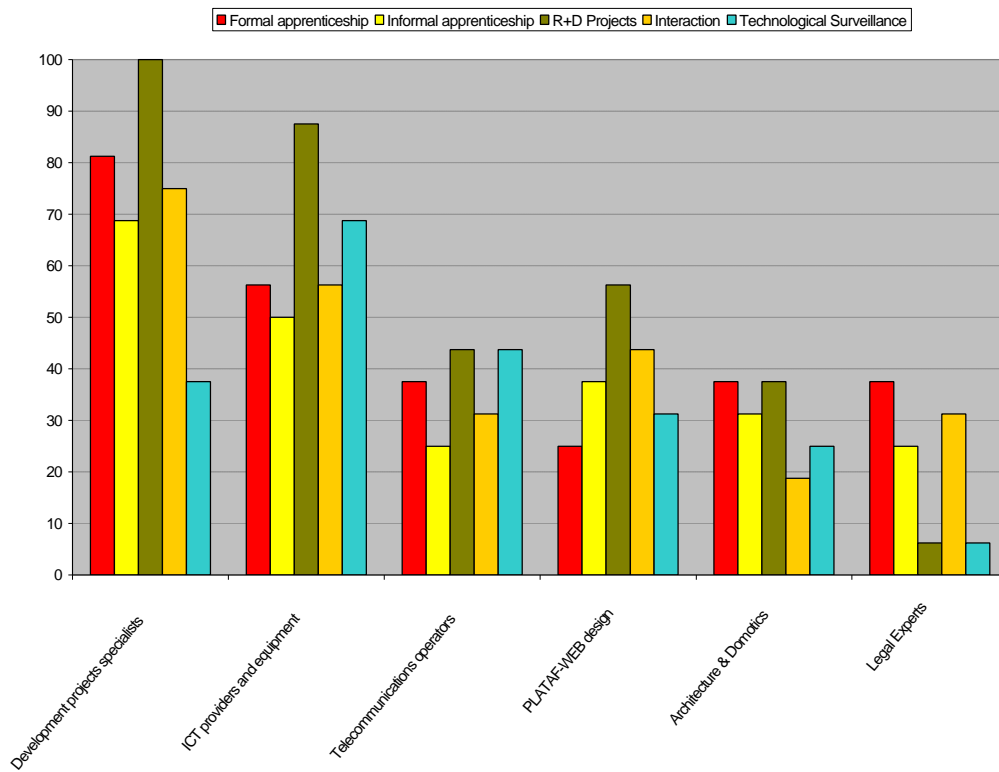


Fig. 6.2. 20. Technological specific case study learning KISA

## 7. Discussion

### 7.1. General

In spite of the increasing relative weight of services, most of the analysis on innovation relay on innovation for industrial production. In our study, Innovation has been considered from a systemic approach. It is considered the result of complex non-linear interactions, encompassing humans, organisations and technologies.

The analysis of the innovation system implies to understand how interact the different actors and stakeholders. Some of the analysed aspects included the study on how emerge the new services; who are driving it; who makes conceptual designs as well as to identify incentives and resistances.

Identified key actors in the analysed innovation system are National and Regional Governments, Public Administrations, Insures, ICT companies, Biomedical Devices Manufacturers, Universities, R&D groups, non profit organisations, healthcare providers both public and private, care professionals, consumer groups, and consultants.

Intended achievements are cost efficiency; quality of care; accessibility; users satisfaction; needless transport; continuous care; prevention testing facilities; patients empowerment.

Innovative outcomes refer to a variety of results of using KISA, including new products, re-engineered processes and new systems.

The analysis of the innovation process proposed has been directed to understand how the different stakeholders participating in the development of innovative solutions interact. In this sense we have tried to analyse the model by reaching the answers to the following questions:

- How do the new personal care services arise?
- Who promotes them?
- Who designs them?
- What are the incentives?
- What problems arise with their implementation?

We have also stressed which, in the opinion of the interviewed experts, are the products, processes and services that are considered the most relevant innovations in this field.

In addition we also tried to discover those areas with the largest offer in Telemedicine and what needs will be provided for and required in the near future both from the supplier and customer/user points of view for these services.

We have also tried to identify the technologies that the experts feel have been very relevant in the development of this sector. Finally, we have analysed the problems of implementation, the obstacles met with and the bottlenecks and barriers so that new innovations can be generated in this segment of the market.

We have relied on the basic model proposed by Tether and Metcalfe (2003) adapted to our particular case as described in Section 4. Innovation is observed using a systemic approach, as a dynamic learning process resulting from the mutual interaction of the services providers (offer agents) with the users (target demand) around a problem-opportunity area.

The object of the case study (problem-opportunity area) has been the provision of new care services to chronic patients and elderly using ICT technologies.

This area problem-opportunity and the overall innovation system have been carefully reviewed with the help of expert's panels and the expert's structured interviews. It included the study of the "innovative service", the "demand", and the "offer" that are key actors of the market, but also the "context" and the "drivers/resistances".

Healthcare services present a high interaction and interdependence between the service provider and the user of the service, as well as between the service provider and the technology supplier. In the Spanish Healthcare Study, it exists a strong correlation between the healthcare innovation and the ICT technology platform that makes it possible.

ICT technology and R&D are key KISA types, but also it is important to consider other types of KISA such as pointed out by the study.

## 7.2. The problem/solution opportunity for innovation in health/social e-care services using ICT

Significant increases in life expectancy, a growing elderly population, advances in medicine, the ICT revolution, and socio-economic policies are setting the stage for long-term care challenges this century. There is a general effort in most countries exploring new service provision models to improve the current situation and to meet the demands of a growing elderly population in ways that ensure sustainability in the future.

When dealing with care for the elderly we are concerned with quality of life and quality of care, personal responsibility, independent living, entitlements, homes of the future, and the organization of care systems.

The blurring of the boundaries between health, social and personal care is directly influencing the new models for service provision to the elderly population. e-Care is emerging as a valuable and comprehensive approach to coping with the need to coordinate social, personal, and health-care provision. Such models, supported by ICT, have the potential to improve the overall quality of life of citizens while reducing the management burden. Access, quality, and cost-effectiveness can and must be maximized through the application of information technology and virtual organization theory.

The sector is characterized by: a) growing demand; b) insufficient offer, and c) high growth potential.

There is a growing demand driven by demographic, health and social factors whereas there is a crisis of traditional family structures of support. Current offer of services is clearly insufficient, irregular and fragmented. There is a low development of social services and healthcare services must be reengineered to cope with chronic patient demands. The sector has a high capacity of growth because of the new expected public insurance framework, and it needs to incorporate technology. There is a clear opportunity for personal e-Care services implementation. Future scenario is envisaged as a synergistic network of services oriented to the optimisation of resources. It must be noted the needs for professional training of the persons to be involved in the provision of this new kind of services.

## 7.3. The Demand

As stated before, there is growing number of potential individual users that are not well served by current care services. The demand is formed by several types of clients and purchasers.

Regarding final users it can be distinguished two main classes: specific illness groups (i.e. diabetes, congestive heart disease, asthma, VIH/AIDS, etc.) and general users (general home care, elderly teleassistance, etc).

Regarding enrolment type it is important to distinguish users that are personally contracting and paying directly the service, from those that received the service under the coverage of private insurance, or from public insurance system. Even if the type of service is the same the nature of "demand" is different as consequence of the different business model.

A point that merits special attention is the analysis of products, processes and services. Not only those already developed by also new ones implemented and the demand for these by the end-user. Here there seems to be agreement on some of the variables influencing users demand:

- Comprehensiveness in the care for the disabled and dependent
- Sufficient and sustainable financing
- Guaranteed access to the resources and services
- Judge dependency and disability according to a homogeneous, functional evaluation system.
- New care models based on preventing deterioration and marginality and oriented towards social integration, rehabilitation and encouraging a greater degree of autonomy (self-care), in accordance with each particular case.
- Comprehensive and personalized services that guarantee long-term care, continuity and integration of resources, and safe, quality services.
- Financial co-responsibility according to personal and family financial situations.

According to the consulted experts, the future model for personal care for the elderly and chronically ill should include a portfolio of services available from the health administration.

The health administration has defined two objectives and ends in this portfolio but it has still not worked out the structure and organization of the system.

Health management experts forecasts the development of a multi-assistance model that would facilitate access and an optimisation of the available resources in addition to monitoring the satisfaction of the users.

There seems to be wide agreement on future areas. One of these fields is home equipment. A majority of the panel members believe that the market will expand for those products, processes or services that will help the elderly lead a more independent life. One of the driving factors on which all seem to coincide is the demand for new products, processes and services that will lengthen that independence. There is therefore a niche in the market for products designed to facilitate health care in the home but this new niche could be friendly and amicable.

The new innovative initiatives in e-care the experts perceive would have in many cases to be developed through the interaction between partners in the different industrial sectors.

Gathered information reveals patients and consumers are most interested on access to proactive care supports, accessible a usable for all. Their needs and preferences are made explicit by the Associations that also act as political influential force.

There is general vision on the need for putting on the market services (processes and systems) providing added value to the user and not only technologies. There are technological developments that are not adapted to the needs of end users. The quality of service is important, as well as personalized care.

This market will require the establishment of protocols in regard to the safety and quality of these new products. Users demand systems preserving confidentiality.

Data are scarce on consumer usage of e-Health tools beyond basic information sources, and little is known about how those currently online obtain disease management tools.

It is observed that adoption of the new systems by patients depends on the modality of enrolment and associated payment. In all cases physicians are the most influencing "mentors" for patients.

A key issue is the relatively low level of Internet access from the consumer homes. PCs penetration is also modest. However, TV and mobile telephony have a very high level of use. In this context applications are moving to the use on mobile services that are now receiving additional impulse by the GPRS and UMTS deployment.

## **7.4. The Offer**

The offer varies in provider's nature, served products and business models. As described in Section 4 main classes of service providers are: healthcare organisations (public or private); traditional home care and teleassistance providers; teleservices operators and ASPs, and new emergent firms.

Analysed operating business models vary. There are private for-profit operators offering services for particular persons. Contract uses to have fees schemes of renting services paying certain amount per month. The provider supply patient's devices and technical support.

Other business model is based on private provider working under third party private insurance contracts with total or partial costs coverage by final user.

Public funding by Healthcare and Social Organisations is by large the most important market element. Public authorities are acting with different models. One is to provide services by their own care services. Other alternative is to relay on subcontracting external care providers, either private for-profit or non-profit (i.e. Red Cross, NGOs). Intense discussions are on co-payment schemes in public insurance services.

In spite of some pioneering organisations, primary care units, hospitals, and insurance companies are still in the initial stages of offering e-care tools to their patients. Regional Healthcare authorities are in search of healthcare cost control and to improve services to the chronic ill. Traditional teleassistance companies are expanding their market to new user groups and adding new monitoring features such as localization services.

Private initiatives are formed by different type of firms. Some are traditional companies with experience in health/social care services provision and new emergent firms/consortia addressing the new market opportunity.



The range of private promoters includes companies from Telecom operators, ICT vendors, Insurance companies, biomedical equipment and pharmaceutical industry.

Venture capital, from public and private sources, is also present.

One of the final conclusions from the expert panels stresses that the answer for health service providers must come from the marketing of concrete services: Coherent and integrated solutions. New services must be integrated through the already existing structures. Having new innovative technology is fine as long as there is an added value for the end user, but also for the provider. In this context, traditional care service providers must devote much effort to the reengineering of processes and the implementation of new procedures

## **7.5. The Context**

The National Health System legal foundations, structure, organization and resources have been extensively described in Section 2. Also, main policy issues and the issue of chronic patients care have been pointed out. Geographical decentralization of healthcare provision to the 17 regional governments (CCAA) is a basic constrain of practical programmes implementation. It also explains the different existing approaches of business models existing in the public sector, and the fragmentation of the market. Most experts have stressed this as a very important factor in developing an equitable policy for the care of the dependent elderly within the Spanish framework.

The Spanish model for a system of personalized care for the elderly comprises both health and social care that are found in separate Departments. The experts judge it is essential inter-sectorial actions should be planned for developing this new market. Also it is signalled the importance to consider the issue of inequality derived from poverty, lack of resources, gender, and action taken on pension policies. In this sense, future scenarios in care for the chronically ill and the elderly may be focus on the development of a network of personalized care/home care services that will take into account user information, choice capacity, participation, safety and quality and consideration of consumer power. In future scenarios it will be very difficult to demarcate the concepts of social and health care and how to apply it.

Regarding Social services the most important context element is the specific law on dependency that is under preparation to be launched next years. It is expected that would open a new market of services.

Demography is a key contextual element that is pressing to both the healthcare and the social system. As explained before, social and health affairs depend on separate departments, so market is also fragmented from these administrative and funding separate lines.

Economic constrains are acting on two opposite directions. On one side are cutting public health and social expenditures, but on the other side are forced to reengineering services and introducing new technologies to cope with the rising costs of older traditional services operation.

## **7.6. Drivers and resistances**

Technology is a key drive of emerging e-health applications. The potential of the Internet, cell phone communications, portable devices and electronic instrumentation in the development of e-Health services for patient monitoring and follow-up is evident from the study. Advances in sensor technology, wireless communications and computing technologies are expected to facilitate the development of new tools and models of services to support independent living and enhanced quality of life for the elderly and the chronically ill.

Innovative enabling assistive technology may exploit ambient intelligence, embedded computing and wearable devices. Infrastructure and usage models for wearable sensors that measure physiological parameters and other personal data in users' daily environments are currently the focus of increased study. Sensors can be integrated into the environment in which users live their everyday lives. An increasing number of R&D works are addressing home monitoring.

Emerging and innovative new care services for homes, nursing homes, collective residences, assisted social facilities, etc. create the need for a new range of KISA to support care professionals and organizations. New models of services for personal management and

independent living support must be conceived and put into practice. New developments relating to wearable devices, presence technology, pervasive computing, smart sensors, jointly with electronic fabrics, batteries, and wireless body and personal networks should make it possible to overcome some of the current limitations on implementing services to facilitate personal ambulatory care, follow-up and monitoring independently of place and time.

Telemedicine is now thoroughly accepted as being more an organizational formula than a technology; this is even more evident in types of applications for the management of elderly and the chronically ill. Innovation in emerging e-services for health care is always a high-risk endeavour, more so when it involves new ways of organizing the provision of patient care.

There are isolated solutions, but there are no standard solutions on the market for application on extended segments. There is also confusion in terminology when referring to this kind of e-Health and telemedicine services.

Many R&D projects have been developed and many good ideas have been launched on this area. Nevertheless, many of these initiatives seems to diverge following not synergic independent approaches concerning technical solutions either care and business models. This situation is proper of emerging active fields with new market entrants. Whereas it is highly demanding knowledge intensive tasks (R&D, marketing, etc) also may generate KISA development dispersive efforts.

A barrier is the lack of incentivating mechanisms in the Health Administration for adopting innovative solutions already on the market on a larger scale. One example is the glycemia test sent by Internet, thus saving time and transfers, improving life-quality and the monitoring of these patients. This would suppose for the companies in this sector to begin marketing this new service. However, when submitting tenders, if this is not adjusted through other mechanisms, the payer will choose the traditional solution, "glucose strips".

Therefore, one of the proposals is to incorporate some kind of incentive for innovation. The possibility arises that new, innovative products based on these technologies could be accompanied by some kind of stimulus in order to facilitate their marketing and to therefore promote a repercussion for dedicating time, money and effort (human resources, technology and capital) by the private sector in the search for new products and systems. This new culture would require a new vision of the needs of this group and this would probably come from user associations.

## **8. Policy implications and suggested recommendations**

### **8.1. General**

It is obvious that the potential growth of the analysed innovation market would stimulate the KISA usage and transmission at all levels. On the other hand the success and diffusion of the new services will benefit from proper KISA supply system.

Thus two main policy approaches can be envisaged: a) addressing “market development” (top-down), and b) promoting KISA production, transmission and usage both internal and external (bottom –up).

### **8.2. Market development. The issue of the diffusion of innovation into wider practice.**

For market development actuations attention should be paid to the key factors influencing the diffusion and adoption of new ICT innovations in health/social care and particularly those referred to the telemedicine services.

It must be observed that the innovative services are being disseminated to different types of organizations public and private, and there is variety in the organizational relationships with the recipients of the innovation and the actual payers.

Participants in the study suggest a number of factors that may influence the successful adoption of the innovations by the market. Some of these factors have been described in previous literature on new ICT technologies diffusion in healthcare. These factors depend on the own nature of the innovation, but also on the implementing organization and the users context. Signalled factors are: the roles of senior management and clinical leadership; the extent to which changes in organizational culture are required, and the amount of coordination needed across departments or organizations.

In today’s cost-conscious and highly regulated environment, there is growing concern over the limited resources available to ensure the adoption of effective and beneficial health care innovations. It becomes all the more important to assess the new ICT based services. This addresses the need for the generation of credible supportive data of new services assessment.

Evidence-based practice is in vogue, and peer-reviewed evidence of improved quality or the benefits of an innovation certainly made clinicians and managers more interested in favouring the adoption of the innovative services. Such scientific data, however, can be insufficient for health/social responsables neither for firm’s executives. It is important to prove that the service delivers benefits to the institution or the private firm.

For many managers, it is far more important to be able to understand the kind of evidence that can motivate users enrolment, particularly for business oriented providers. Making a “business case” to people who control the buying capability requires different language and data from that used to present a “clinical case” or “quality improvement case.”

Administrators may be more impressed by results drawn from their own or similar operating organizations than by data published in scientific journals. It is essential to show how the innovation, if successfully adopted and sustained, fulfils the strategic business goals of the organization.

No matter how simple or evidence-based a change in practice seems, adopting the studied telemedicine innovation often means altering beliefs, norms, and values embedded in the traditional organization of a particular services provision in a particular place under long cultural roots. Staff members had to think differently about their roles, their goals, and their interrelationship with other departments and disciplines, but what is more important with patients.

Long-term sustainability of the ICT based innovations is a key issue in public healthcare organizations. The process of embedding new methods takes long time. There should be a plan in place from implementation to sustain the service, further than pilot of R&D implementations. Operating a new care service that requires organizational change is a full-time effort that must be backed by substantial resources.

It is a detected fact, that barriers arise when the implemented services requires coordination across disciplines, departments or in particular different organisations. The potential success of the offered services depends on the characteristics and resources of the implementing organization, and on the degree to which people believe that the innovation responds to immediate and significant pressures in their environment. The relationship between the dissemination infrastructure and the adopting users affects the speed of adoption. The perceived ability of an innovation to reduce external threats can influence the speed of its diffusion. The development of e-Care in the networked-based knowledge society should be characterized by globalisation of the solutions, the requirement of interoperability, and organizational and cultural changes. Optimising and using a heuristic vision is fundamental in developing innovative solutions that will meet the expectations for this new market (knowledge generated by the surroundings).

Taking into account the above analysis, the following policy suggestions are derived:

- a) Policy of increasing funding for services modernization programs in health/social care using e-health and telemedicine innovative services.
- b) Apropriated policies should target efforts toward supporting organizations that have or can develop strong senior management support for adoption of the innovation. A connected action should be to educate opinion leaders and high-level managers on the potentialities of ICT innovations for their “business” operation.
- c) Other suggested policy is to identify and support clinical champions who can enhance buy-in from patients and consumers. Success is linked to one or more strong champions, who acted as change agents, were central to the initial adoption, sustained implementation, and diffused the innovation to additional organizations or settings.
- d) Other line of supportive actions should address developing simple methods of collecting and reporting data that will be credible to the healthcare and social services organizations, and that demonstrate the electronic service is fulfilling the organization's strategic goals.
- e) Prospective research can anticipate changes in the external environment and demonstrate how the innovation can help the services providers adapt to market and regulatory pressures.
- f) It should be recommended to establish a plan for sustainability from inception, and invest adequately in the infrastructure needed to manage the dissemination and diffusion process taking care of the characteristics of each particular case.
- g) A key point is having a good knowledge of the demand and analysing both the public and private market. More studies are needed to evaluate and quantify the market (analysis of the demand). More information should be made available to users, the health administration and health services, given their purchasing capacity and promotion of innovations.

### **8.3. Promotion of KISA production, transmission and usage**

Promotion of KISA production, transmission and usage must refer to the key internal and external KISA identified in the study as well as the preferred learning (knowledge acquisition) modality.

From the study results, described in Section 6, it has been identified the different internal, external and mixed KISA and their assessed relevance.

Regarding general internal KISAs, most valued ones were: “R&D”; “Management and Administration” “Human resources Management” and “Planning” activities. On the other hand the most relevant general external KISAs, as identified by the experts group, were “Consulting” “Training” and “R&D” too. It must be noted that “R&D” and “Training” are both highly ranked for Internal and External supply.

When analysing the KISAs for the specific application, it appears that the most valued internal KISAs are by rank order: "Projects development expertise"; "Medical knowledge", "ICT"; "home Medical services"; and "Telecom".

Regarding external KISAs the rank was: "Social workers expertise"; "Website Develop"; "Telecom"; "Projects development"; "Medical and Social needs assessment"; "ICT"; "Domotics"; "Home Medical Care" and "Medical knowledge".

Regarding policy formulation it must be noted that "R&D" is basic but not the unique KISA resource to consider. "Management and Administration" "Human resources Management" and "Planning" activities are KISA to promote both internally at the own organisations implementing the innovation (e-care service) and in potential external KISA providers.

It must be noted that most of the innovation promotion programmes (nationally and internationally) are focused to R&D activities. Policies should be refocused to wide the scope of innovation support policies to cover those other signalled areas.

Furthermore, the specific application KISAs represents a wide range of knowledge capabilities that asks for more specific actions in promoting technical (ICT) and application centred knowledge (medical/social services).

Technical KISAs are mostly externally obtained for the majority of the innovation implementers (public and private).

Clearly, healthcare organizations relay on quite well developed internal KISA concerning health aspects, but internal communication is not often working properly.

It is very interesting to note that the analysis of the preferred learning approaches for KISAs showed the execution of R&D projects as the first choice, followed by unconventional training and Interaction. Formal training and Tech Vigilance were lower in ranking.

Therefore, promotion of KISA generation seems to be stimulated by supporting projects development and non-conventional training on the specific areas identified.

It is interesting to note that, regarding national internal market, apparently the current operators are not much concerned about intellectual property issues.

Regarding "R& D" and Projects implementation, one of the issues is the low installed R&D capability by the private companies in Spain. The level of innovation at the enterprises is lower than the mean of the 15 EU. In addition R&D expenses are even lower. The reduced dimension of internal R&D is a critical issue for KISA usage. Furthermore it makes difficult for the companies to obtain potential aids form national and EU research programmes.

From the experts vision, the development of the "future" integrated e-Care services would require a blending of technology and health service expertise and it will depend on strategic partnerships between provider organizations and technology companies working in common projects or by establishing interactive links for KISA transfer.

Implementation success, as described for market development, would require cooperative developments involving many actors and special, often subtle knowledge types. The wide development of the proposed new business models should require the sharing of a common know-how between the technical companies, the organisations, the patients and the professionals. This call for policies facilitating KISA Networking.

From all above is clear that Innovation policy must be refocused to cope with KISA generation, communication and usage. KISA diffusion does not occur spontaneously. It requires the existence of links translating the KISA from the generator (i.e. research setting) into the users (i.e. the service operators). It should be desirable to consider the creation of dedicated means to facilitate networking KISAs producers and users supporting cooperation between users and producers of KISA. The closeness of the relationship built a sense of mutual commitment to the innovation, and creates momentum for change and adoption in the broader sector of e-Health and telemedicine services. Distant relationship made KISA diffusion more difficult and innovation success more challenging.

## Appendix 1: EXPERTS PARTICIPANTS

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