WP 1 – REVIEW AND ANALYSIS OF NATIONAL FORESIGHT

D1.1ES – CASE STUDY

SPAIN – TECHNOLOGICAL FORESIGHT PROGRAMME (OPTI)

STATUS: PUBLIC

PARTNER RESPONSIBLE:
FZK-ITAS
Forschungszentrum Karlsruhe GmbH in der Helmholtz-Gemeinschaft,
Institut für Technikfolgenabschätzung und Systemanalyse
Germany

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AUTHOR:
The present report was prepared by **Knud BÖHLE, FZK-ITAS**

WHAT IS FISTERA?

FISTERA is a Thematic Network on Foresight on Information Society Technologies in the European Research Area.

The **FISTERA** network is supported by the European Community under the FP5 specific program for research, technological development and demonstration on a user-friendly information society (1998-2002).

The aim of the FISTERA Thematic Network is bring together on a systematic and extended basis, actors and insights in national foresight exercises on IST in the Enlarged Europe.

Main objectives:
- ◆ Compare results of national foresight exercises and exchange visions on the future of IST
- ◆ Provide a new forum for interactive consensus building on future visions for IST
- ◆ Contribute to the European Research Area through benchmarking and community building, by providing a dynamic pan European platform on foresight on IST

In order to meet these three key objectives, FISTERA will:
- ◆ Review and analyse the national foresight exercise outcomes (a country synthesis report)
- ◆ Build aggregate pan European Technology trajectories (a roadmap of potential develop-ments of key emerging technologies)
- ◆ Map the European IST actor space (an analysis of the EU IST actor space)
- ◆ Provide an IST Futures Forum (strategically selected scenario exercises that will look at wider aspects of applications of IST)
- ◆ Disseminate the results to a targeted audience by various means (a dynamic website at the address http://fistera.jrc.es, an e-mail alert service, publications, conference presentations, a "road-show" of workshops and a final conference)

Network Membership:
Core partners (coordinators, work package leaders):
- JRC-IPTS (Institute for Prospective Technological Studies), part of the European Commission's Joint Research Centre, Scientific Coordinator of the network.
- FZK - ITAS (Forschungszentrum Karlsruhe GmbH in der Helmholtz-Gemeinschaft, Institut für Tech-nikfolgenabschätzung und Systemanalyse), Germany.
- TILAB (Telecom Italia Lab – Scenarios of the Future), Italy.
- ARC/sr (ARC Seibersdorf research GmbH, Division Systems Research Technology-Economy-Environment, Seibersdorf), Austria.
- PREST (Policy Research in Engineering, Science and Technology) of the University of Manchester, United Kingdom.
- GCI (GOPA - Cartermill International), Belgium, Administrative and Financial Co-ordinator.

The group of **Members**, which is expected to grow over the duration of the contract, currently includes the following organisations: TNO-STB (The Netherlands), Danish Teknologisk Institut (Denmark), Tec-noCampusMataró (Spain), Observatório de Prospectiva da Engenharia e da Tecnologia-OPET (Portu-gal), ARC Fund (Bulgaria), IQSOFT (Hungary), Tubitak (Turkey), The Researchers' Association of Slo-venia (Slovenia), NMRC, University College Cork (Ireland) and BRIE-Berkeley University (USA). In addi-tion, McCaughan Associates (McCA) runs a group of High-level Experts to the Network Management Committee.

FISTERA Web site: http://fistera.jrc.es/

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Summary

The Spanish industry-oriented Foresight exercise was carried out in three cycles between 1998 and 2000. Foresight has been institutionalized in Spain in form of an observatory: OPTI, the Observatory of Industrial Technology Foresight. Activities still go on by means of the OPTI website (http://www.opti.org/), periodical publications, and new technology watch activities.

The aim of the Technological Foresight Programme was to strengthen the national innovation system (NIS) by exploring future technological trends and the needs of Spanish industry, and by this means enhancing its competitiveness. Eight industrial sectors and eight sector specific industrial organisations were chosen to organise eight mixed expert panels. Each panel carried out a series of annual Delphi studies, with each year's survey focusing on a separate topic. All in all 26 Delphi surveys leading to 26 studies were carried out. More than 5000 experts, most of them stakeholders from industries, were involved, and the Delphi return rates were regarded as very high. Methods applied apart from panels and Delphi were the production of trend reports and scenario building activities in an ad hoc fashion.

Findings for each sector were presented in one report. Efforts however to synthesize findings and to develop a general vision have not been very intensive. Strengths of these sector foresight exercises were obviously their close link to industry and R&D policy. The foresight process is also regarded as successful in terms of awareness raising and network building.

1   Background and Objectives

Ten years after the end of the Franco regime and shortly after becoming member state of the European Union in 1986, Spain started to reorganize its research policy. The legacy of the Franco era was a highly centralised science and technology system, which was also not efficiently coordinated (cf. Héraud and Cuhls 1999). A National R&D plan was one policy instrument newly introduced to overcome the apparent deficiencies. The first R&D plan started in 1988 and ended in 1991, the most recent covers the period 2000-2003. A Spanish foresight programme was started in 1995 by ANEP, Agencia Nacional de Evaluación y Prospectiva. This agency, created in 1987, was basically related to the National R&D planning, evaluating project proposals. But it also carried out prospective analysis of its own in the order of magnitude of 10% of its budget. The idea behind this first programme was mainly to catch up with other European countries. There is another root of Foresight in Spain, namely the INIDES project (Identificación de las Necesidades de I+D de las Empresas Españolas), aiming at identifying the R&D needs of Spanish companies. This project was initiated by OCYT, the Spanish Presidential Directorate for Science and Technology (Oficina de Ciencia y Technología), and coordinated by COTEC, an entrepreneurial foundation. INIDES is more of technology watch type rather than a proper foresight project, but it remains nevertheless an important forerunner and an activity strengthening the interface between policy and industry.

Despite these early activities, for most observers real fully-fledged foresight in Spain starts with the establishment of OPTI, the Observatory of Industrial Technology Foresight (Observatorio de Prospectiva Tecnológica Industrial). This body was created in December 1997 by an initiative of the then Ministry of Industry with the aim to carry out foresight studies and technology watch with a focus on technological trends and the needs of Spanish industry. In 1999, OPTI acquired legal status as a Foundation with the support of and under the auspices of the Ministry of Science and Technology. The president of the Foundation is the Secretary of State for Science and Technology Policy underlining the close relation of OPTI to policy-making.

2   Organisation of the Foresight Exercise

OPTI works as a network with a small central infrastructure and co-operates with eight Technological Centres linked to industrial branches. As the focus is on industry, the areas to be studied are industrial sectors, including not only emergent areas, but also traditional sectors (!). "Each Centre has own technological capability and direct relations with the industries, mainly SME, and contributes with its specific knowledge to develop the OPTI activities" (OPTI website; visited January 2003). The OPTI Technological Foresight Programme comprised foresight in eight sectors of the economy: agro-food; energy; environment; chemistry (4 sub-sectors); information and communication technologies; transport (4 sub-sectors: air, rail, ship, car), basic and transforming manufactures; and traditional industries (footwear, textile, toys, wood and furniture, glass and ceramic and jewellery). OPTI carried out the planning of the foresight activities aiming to identify those technological trends and visions, which are especially relevant for the future development of the industry sectors chosen. A common methodology was applied for the investigation of all sectors: Expert panels, Delphi methodology and scenario building were combined.

3   Method and Procedure

The first step in the process was the selection of sectors (eight in the first stage of the study) and of independent technology centres specialised in these sectors. The sectors were selected by using indicators such as the contribution to GDP, the number of employees, their dynamic

in the Spanish economy. The Centres were selected for their technological excellence, their links with the industry and their knowledge of the needs and the opportunities of the enterprises.

Responsibility for each sector study lay with the technology centres assigned. Each technology centre established its own expert panel, which in turn identified the broader number of experts to be consulted through the Delphi survey by co-nomination method, defined the topics of the questionnaire, and analysed the results of the survey. The Foresight Programme was organized as an iterative process in as much as one study per sector was carried out each year with a shift of focus every year. The total of 26 Delphi questionnaires was sent to 5000 specialists with an average return rate of 32% (after the second Delphi round). The information obtained from the questionnaires was analysed by the expert panels and additional experts. Since four studies were performed for the transport and chemical sectors, a total of 26 studies were produced. The results were published in three reports (OPTI 1999, 2000, 2001) and are available at OPTI's website.

The core element of the Spanish Foresight programme was the series of Delphi surveys addressing a diversity of issues including technological, environmental, economic and social issues, as well as the competitive position of Spain in different areas with respect to productivity, commercialisation and marketing. The Delphi method applied to identifying driving forces can be regarded as state of the art. For each statement, experts were asked to indicate:

- Importance: high medium, low, irrelevant
- impact on economic development, life quality, employment
- date of materialization: up to 2003, from 2003 to 2008, from 2009 to 2014, never
- scientific position of Spain relative to other countries (high, medium, low) with respect to S&T, innovation, production, commercialisation of technologies
- barriers: social, technological, legal, economic, environmental
- recommendations: collaboration with external enterprises, incorporation of S&T in enterprises, cooperation of firms, research, support from administration, diffusion of results

The foresight exercise led to lists of specific recommendations panel by panel. Working groups were set up for each sector after the study to identify "mega-trends", often defined in terms of broad generic policy objectives, and promising areas and technologies.

Such conclusions were fed into the definition of the Spanish national R&D plans and of the Spanish position in the negotiations leading to the definition of the European 6th Framework research programme. Results have also been published through books and, at the request of the Ministry of Industry, a document summarising the main project results was also produced. With OPTI a permanent organisation was set up to disseminate results, digest and present the results for policy formation, and develop further studies in new sectors

4   IST in the Spanish Foresight Exercise

4.1   General findings on IST

Spain is unique in as much as under the auspices of OPTI an organisation close to industry was responsible for the ICT sector studies, namely "La Fundación Instituto Catalán de Tecnología" (ICT). As Spain does not see its strength in developing basic ICT technologies the perspective was on the application level and the widespread deployment of applications. The three reports

of the ICT panel focused on "Digital content industries" (1999), "ICT and the emerging digital economy" (2000), and "Convergence of infrastructures and services in the telecommunications sector" (2001). ICT was also a topic in other sector studies addressing especially the potential of ICT with respect to modelling, design, simulation, control, and remote services. In addition, a study was devoted to the changes by automation in traditional branches. It is worth noting that the strong industry orientation is very visible in the composition of experts with about 80% of experts addressed in the Delphi surveys coming from industry.

ICT in the OPTI studies 1999-2001

Digital content industries (1999): Taking a closer look at the focus of this prospective study it turns out that digital content industries are understood in a very broad sense including all activities which have to do with the generation, production, processing or distribution of digital content. Software developers and telecommunication operators are thus included. In addition, the questions raised in the Delphi survey appear to be quite general and seldom specifically focussed on eContent issues.

The general picture derived from the Delphi exercise is the following: Massive use of ICT applications in the professional environment is expected already till 2003. This includes widespread use of professional information sources, use of intelligent agents, e-mail use as very important for inner organisational communication and also the use of multimedia editors to produce content. High speed internet and broadband networks are important for the further development of the infrastructure to carry digital content. Infrastructural change is however a mid-term undertaking going on rapidly between 2004 and 2008. The common technological platform will be the internet plus intranets and extranets. The development of accompanying measures like broad use of encryption and digital signatures or the establishment of appropriate tax regulations, intellectual property rights, and further laws is also a mid-term expectation. Looking at specific applications, e-commerce, telework, distance learning, G2C services, health services, and virtual communities are all expected to take off in the medium term.

Spain's level in science/technology, innovation, production and commercialisation is regarded as medium in the European context. Although most technologies are imported, skills and opportunities are identified regarding development of software and applications, and their diffusion into businesses. The authors of the study are in favour of more deregulation of the telecommunications area to achieve more competition and lower prices, and at the same time better quality and faster construction of a high-speed broadband infrastructure.

With respect to the digital content industries the authors see promising perspectives with respect to industrial development and to quality of life. The future seems to be bright especially for big publishing houses and media companies, while opportunities for SMEs depend on the proper identification of niches. As most important measure to improve industrial development more cooperation between industrial companies and R&D centres is recommended, and increased support from public administration.

ICT and the emerging digital economy (2000): This study endeavoured to find out how the Internet changes value chains in many sectors and how this leads to new business models. The focus of the study is on the application level in four areas: Internet as basic infrastructure, development of electronic commerce, supply of digital goods and services and B2C retail markets of tangible goods.

In the term 1999-2004, an explosion of B2B commerce is expected in many economic sectors. It is also expected that access to internal company information via Intranet as well as to exter

nal sources via portals will be commonplace. To support the information search, a role for software agents seems likely. In addition, considerable growth of e-commerce is expected to which mobile applications should contribute considerably. It was said that WAP would play an important role (2000, p. 388).

For the time between 2005 and 2009 maturation of B2B commerce is expected with the integration of front-end and back-end systems. The development of extranets allowing for the integration with external partners, suppliers and clients, will contribute to this B2B development. The present corporate culture with an aversion to change and the organisational structure of companies are regarded as barriers. One of the major problems is also a lack of qualified ICT personnel, but this problem, following the authors, should be resolved in medium term by suitable actions of formation and education.

In the B2C area, barriers to the development of e-commerce seem to be the present shopping habits, little experience with distance selling, lack of trust, perceived risk of fraud, lack of technical knowledge together with complexity of technical solutions.

The findings of this report are to a large extent congruent with those of 1999, although more statements seem to depend on "Zeitgeist".

Processes of technological convergence in the field of ICT (2001): In the 2001 study, the Internet is seen as one of the principle motors of convergence. It is expected that 3G mobile networks and fixed Internet will converge. The future infrastructure is envisaged as broadband at reasonable costs.

In the timeframe 2001 to 2005, growth of e-commerce and particularly electronic markets is expected as well as the integration with back office applications. Interestingly, geographical services are regarded as type of "killer application" for 3G mobile. A new wealth of personalized mobile services which adapt to the location where the user is, are expected. Also Bluetooth is expected to become the de facto standard avoiding cables between devices, making their use more simple and convenient.

For the time span 2006 and 2010, all communication networks will migrate towards IP technology and will be used for all media types. Broadband in place, streaming of quality video and audio data is expected at moderate prices. In addition, e-Commerce via interactive TV looks promising and generalized use of 3G mobile phones with multimedia capacity and easy to use man-machine interfaces are expected.

Spain is prepared for mobile services and interactive TV at the level of infrastructure and services. It is held that this future can be predicted based on the good acceptance of 2G mobile phones and of digital TV already today. The "hype" of mobile communication and m-commerce is apparent in the findings. Even so, the difficulties of UMTS to take off because of the financial situation of most operators are also recognised.

Technologies of automation in traditional industrial sectors
This study on automation in traditional industries, based on a Delphi survey in 1998, was coordinated by INESCOP (Technological Institute for Footwear and its Related Industries) covering a broad spectrum of traditional industries. Traditional industries are composed of 40,000 companies with about 600,000 employees. Most of the companies are SMEs and have an average of 14 workers. A panel of 18 experts had by brainstormings defined 75 topics, which were later reduced to 30. 147 experts were addressed in the Delphi exercise with 75% coming from

industry. 82% of experts came from the region of Valencia, which is famous for its traditional industries.

In terms of ICT implementation and deployment in the traditional industries expected till 2004 the study pointed out:

- computer networks for the internal communication of companies were regarded as very important;
- business software and applications taking into account the specific needs of specific sectors and the needs of SMEs;
- advanced rapid prototyping technologies, which were regarded as very important for industries to increase productivity. The creation of industry specific prototyping centres for SMEs was recommended;
- Real time quality control systems were regarded as developments important for these industries;
- The use of robots and automata in the warehouses of SMEs were regarded as most important for employment in traditional industries. The authors however do not clearly state if their finding implies the creation of new jobs or the loss of old ones.

Expectations ranking high for the period 2005 to 2009 were that:

- automation in these industries would lead to more healthy jobs,
- the new skills needed would lead to higher qualifications of the workforce and more flexibility within the company;
- automatic process control in the phases of planning and programming of production would be important for the development of industries although not in place today;
- simulation of the entire production process was regarded as important for industrial development;
- the establishment of sectoral centres for collection and recycling of specific residues was regarded as important for quality of life and the environment;
- the strength of Spain in mobile localization technologies was expected to lead to the optimization of transport.

All in all, automation in these industries is highly required to keep pace with competitors. The type of worker needed will change, and the low qualification of most workers at present might turn out as a barrier to change. A special study on the effects of the labour demand is recommended, following the opinion of the study, no increase of employment seems likely, however.

ICT in other sectors
The first OPTI study (1999) identified technology trajectories for the different sectors studied. In the following (Table 1) we depict those technology trajectories which indicate the application of ICT.

Sector	ICT based technology trajectories
Agro-food: Technologies for food conservation	Modelling of external and interior factors of influences for technology optimization
	Development of rapid methods for analysis and control
Energy: Renewable Energy	Automatic remote control systems for centres of mini hydraulic systems
Environment: Management and treatment of industrial waste	Development and application of systems for environmental management
Fine Chemistry	Simplification and automation of processes
Information and Communication Technologies: digital content industries	Interactive broadband networks
	High speed Internet
	ATM telecommunication networks
	Encryption
	Digital signatures
	Expansion of domestic applications
	DVD
	Generalization of Java
	Extension of Intranets and Extranets
Transport: Air	Technologies of design and modelling
	Integration of high end computing systems, wireless and communication via satellite
	Systems for air transport management
Basic and Transforming Manufactures: Metal processing	General application of laser technology at industrial level
Traditional Industries: design technologies	CAD systems integrated with production systems
	Integration of simulation facilities into CAD systems
	Sector specific CAD/CAM beyond general purpose software

Table 1: ICT technology lines for different sectors (OPTI 1999)

The summary of the third OPTI report (2001, p. 411f) highlights eight fields in which ICT is crucial in non-ICT sectors (Table 2). The potential of controlling, monitoring, simulation, and remote services are mainly pointed out here:

Sector	ICT based developments
Agro-food	Consumer information systems on food
Energy	ICT for monitoring, controlling and simulation of transport processes, distribution, storage and final use of energy
Environment	Dependable and transparent information systems about reuse of water
	Monitoring and on-line control technologies about water resources
Fine Chemistry	Maximum automation of paper industries
Transport:	Increased speed of car design and development
	More flexible fabrication; standardisation of major components
	Telematic control systems for the rational use of and intelligent distribution of different traffic systems
Basic and Transforming Manufactures	Added value services for machine-tools operated by the manufacturer like tele-services, tele-maintenance, communication, and access to technical data via broad band Internet

Table 2: ICT in non-ICT sectors (OPTI 2001)

Despite the interesting findings, due to the parallel organisation of studies, no overarching vision on ICT has been developed by OPTI.

4.2   Analysis of National Strengths and Weaknesses

The analysis of strengths, weaknesses, opportunities and threats (SWOT) practically belongs to the standard "toolbox" of foresight methodology. After having carried out the three consecutive Spanish Foresight studies on IST, a mixed group elaborated on the findings identifying six major technological areas, the co-evolution of which will determine the development of the information society. Prosperity in these areas requires underlying technological capability. An attempt is made to define the Strengths and Weaknesses of Spain with respect to these capabilities as shown in Table 3.

Technological Areas One to Six					
technological platforms			applications and services		Content
Internet	**Mobil communi-cation**	**Ubiquitous computing**	**eBusiness**	**Applications and software**	**Content**
In Spain: due to insufficient de-regulation, high costs, less user-friendliness and less technical quality of net-works	financial situation of telecoms due to costs of UMTS licences difficult, and protesting citizens due to perceived health risks by emissions	ultimate end-users device not so clear; mix of PDA and mobile phone expected; conver-gence of TV and PC expected soon; "killer appli-cation" maybe location services short term; mid-term maybe wear-ables	exponential growth of e-commerce ex-pected with B2B taking the lead; B2B requires complete integra-tion and electronic markets; B2C in Spain compara-tively low; per-ceived security and trust problem	trend towards middleware e.g. API, but Spain not advanced in this	revision of free content paradigm needed; Spanish content on Inter-net too low; some media markets threatended by global players of media industries.
Required technologies / **Position of Spain relative to EU**					
equipment and fixed line commu-nication networks (routers, fiber, terminals etc.)	equipment and wireless commu-nication networks (antenas, base stations etc.)	microelectronics (chips, memory, Bluetooth, WLAN etc.)	eCommerce solution and integrated busi-ness solutions (ERP, CRM etc.)	basic software (operating sys-tems)	Protection and management of intellectual prop-erty (watermark-ing, DRM, etc.)
very low	**middle / low**	**very low**	**middle**	**very low**	**very low**
equipment and computer net-works (server, fire walls, LAN etc.)	user equipment	periphery (optical memories, screens, key-board, set-top boxes,	electronic pay-ment systems	application soft-ware	payment systems (micropayment systems)
very low	**very low**	**very low**	**middle / high**	**middle**	**middle / low**
intelligent soft-ware; network administration software	network admini-stration and secu-rity software;	reloadable batter-ies	security technol-ogy (PKI, encryp-tion, SSL etc.)	software engi-neering	access devices (e-Books, set-top-boxes, game platforms,
middle	**middle**	**low**	**middle / high**	**middle**	**very low**
application soft-ware (browser, editors, agents, security etc.)	application soft-ware (APIs, WAP, location services)	application soft-ware and decod-ing	software solution for logistics and distribution (e-marketplaces)	----------	digital paper, digital ink
middle / high	**middle**	**middle**	**middle**	------------	**very low**
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Table 3: Six major technological areas (OPTI 2002)

Strengths and weaknesses with respect to major trends have been presented systematically for OPTI 2000 and 2001. In these studies the position of Spain is compared explicitly with the one of the EU, although it is not stated on which basis this ranking has taken place. OPTI 1999 is less systematic in this respect. The information on strengths and weaknesses is more scattered and the positioning is not clearly related to other countries. As an aside it is worth highlighting that Network Computing is the only trend which all Spanish experts said would never happen.

time horizon	OPTI 1999 content industries	OPTI 2000 digital economy	OPTI 2001 convergence
to come true within 5 years from date of study	− widespread use of electronic information in professional contexts (till 2003) **favourable**	− development of B2B e-commerce **middle**	− geographical localisation services for users of mobile phones **favourable**
	− generalized use of e-mail for organizational communication (till 2003) **favourable**	− Use of digital signatures and certificates for Internet transactions **favourable**	− Bluetooth as standard for short distance data transmissions **not favourable**
	− widespread access of companies and organizations to the Internet (till 2003) **favourable**	− development of m-commerce **middle**	
to come true within 10 years from date of study	− extension of the Internet model by intranets and extranets for information, communication and transactions (till 2008) **favourable**	− development of B2C e-commerce **middle**	− broad deployment of UMTS **not favourable**
	− internet access in more than 50% of households (till 2008) **favourable**	− integration of e-commerce with other applications at company level **middle**	− implementation of Internet2 **not favourable**
	− B2B-eCommerce **favourable**	− overcoming the lack of qualified labour in the field of ICT **favourable**	− wide deployment of interactive TV **favourable**

Table 4: Strengths and weaknesses of Spain in the EU Context (OPTI 2000. 2001)

4.3 IST Visions

In the context of the Spanish Foresight Programme, scenarios of IST developments, especially of digital content industries have been developed by Francesc Mañà, (Mañà 2000). The time horizon chosen is 2010.

The eContent market has a supply side with authors and intermediaries as the major types of actors, and on the demand side potential users are distinguished as techno-optimists or techno-pessimists. Techno-optimists are positive about new technologies and believe that these technologies can make their lives easier; techno-pessimists stay away from technology if possible and use them only in cases where alternatives are not available. This distinction leads to three scenarios called the "traditional" one, the "literati" one and the "mobile" one.

The "traditionalists" have no interest in technology and prefer paper-based information. Often they will be elderly people with difficulties to adopt new technologies, and there will be others with low income and/or education. Nevertheless it is assumed that via web TV at home and the PC at work new sources of information will be used gradually. They won't be too interested in e-commerce, i.e. obtaining paid information. What everybody would like to have seems to be especially important to stimulate this group: user-friendly devices and interfaces, trust, security and privacy.

The "literates" are introduced as those information oriented and willing to substitute bulky paper works by electronic information. They would use e-Books as well as digital paper if it would help them fulfil their tasks. Advances in end-user devices are important here. New technology must add value to convince this group. If technology and content are of good quality this group will pay for it. This group is open minded, middle aged or younger, with a higher income level and probably higher education. Their work is determined by use of huge amounts of documents.

The "mobiles" are characterized as people for whom "any time, anywhere" is especially important. End user devices like portables, mobile phones, and PDAs, and also later on wearables will be important for this group. The development of this scenario depends on the evolution of these devices and the development of volatile information needs (news, stock exchange, financial data etc.) where timeliness and speed are most important. Costs for UMTS will be more important than costs of devices. This scenario is particularly interesting for intermediaries. There should be a market for transaction-based purchase of tickets, reservations, and shopping in general. This group is imagined as young and middle aged, have a high income and are very positive about new technologies which support mobility. They will have higher education and their jobs require mobility.

5   Other Important Results of Spanish Foresight

In general, the outcomes derived from the process are said to be at least as useful as the specific technical results and policy recommendations of the studies. Information exchanges, networking activities, and policy debates have led to new ways of communication across different societal groups and contributed to changing attitudes towards innovation and the importance of future planning when developing science and technology strategies. Particularly relevant has been the strengthening of communities of experts concerned with technology futures and technology watch activities. The foresight exercise contributed to building up a common culture oriented to develop and to use technology as an instrument to answer the future needs of society. In the eyes of OPTI (as expressed in IPTS-ESTO 2002) policy making has been eased by the growing recognition in Spain of Foresight as a tool to inform science and technology strategies. The national innovation system has changed: new institutional forms have been developed in which non-profit organisations (e.g. OPTI) work with industry, government and research organisations. In other words: more refined analysis of the issues at stake and a better awareness of the longer-term challenges have been achieved. In this sense, a new type of innovation policy has been implemented in Spain.

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OPTI, MCYT, CDTI, ICT: Tecnologías de la Información y la Comunicación. Tendencias tecnológicas a medio y largo plazo. Madrid 2001

Annex 1: Tabular Overview

Spanish Foresight Programme (OPTI) 1998-2001 / Spain		
Categories, Criteria & Questions	**Answers**	**Comments**
Project promoter / initiator	– Ministry of Industry; and Ministry of Science and Technology as follow up	– The ministry of industry has been changed to the one of Science and Technology
Agency or organization responsible for the foresight activity	– OPTI = Observatorio de Prospectiva Tecnológica Industrial Fundación – Coordinator EOI = School of industrial organisation – 8 Technology centres responsible for a given sector	– OPTI was founded in 1997; in 1999 it adopted legal status of a foundation; despite this status the link to the Ministry remains very strong with a state secretary being its president. – EOI coordinated the 1999 and 2000 studies, not the last one.
Scope / areas covered	– meso / eight industrial sectors	– "The Ministry of Energy and Industry wanted elements to define its policies and to support decision making in companies" (ESTO 2001)
Time horizon	– 15 years	– despite this time horizon most respondents seem to have had the short term future in mind
Societal dimension	– the sectoral approach includes social questions like employment, competitiveness etc.	– basically we deal with technology foresight aiming at S+T policy priority setting
European dimension	– R&D policy is aware of European programmes and funds – within the work of panels and the Delphi surveys the European dimension is hardly present – ICT SWOT carried out later with reference to position within EU	
Major explicit objectives	– strengthening the Spanish innovation system – priority setting in innovation and R+D policy – informing industries about promising technologies in the medium and long term – search for industrial competitiveness – orientation of research centers	– questions: What technologies should the Government administration support ? – what should industries concentrate on? – where should they invest?
Second order objectives and indirect effects	– new communication patterns between policy and industry; – catch up with EU practices – awareness of future technology trends within industry sectors	– benefits of "the process" ; maybe second order legitimation
Impact	– support to the preparation of the National R&D Plan and Spanish position in EC FP6. Guidance for industrial associations & private companies – raising awareness; Helping private & public sectors in future thinking, support to the innovation plans of R&T Centres	– role of establishing an new type of National Innovation System
Target groups	– decision makers in industries and policy	
Participation	– c. 6000 experts, stakeholders	– experts only; some say there was not enough long-term knowledge, and not enough social knowledge involved

Major Characteristics	– industrial foresight – sector oriented foresight – decentralized – institutionalised, permanent foresight agency allowing for post-processing – investigating also traditional sectors	
Methodology	– expert panels – two round Delphi – scenario building – desk research	– three consecutive Delphi surveys in each industry sector with a shifting focus
In which way have IST been included and treated in the FS exercise?	– there was a special organisation and a corresponding panel carrying out the three ICT Delphis – ICT was also considered in other panels	– findings of the ICT panel and findings of the other panels about iCT were not brought together in a systematic way
Strengths/opportunities weaknesses/threats identified in IST	– application software in general and epayments, and security applications in particular look promising – in the fields of hardware, network technology, basic software competitiveness appears to be weak	– location services as well as e-commerce look promising; hurdles are lack of deregulation, 3G licensing debts, free content culture; not enough Spanish content on the web.
Dissemination	– for each year's activity a report has been published – there are seven special bulletins reports written after publication of the main studies, which summarize the findings and identify major trends in the sector and associated technologies – there is also a quarterly news bulletin which contains synthesis information and scenarios – OPTI has its own website with the information freely available – OPTI publishes an OPTI bulletin, and – a trimester bulletin derived from the cooperation with the Patent Office presenting results of technology watch in two sectors. – An international conference 2001; national & regional workshops – Media campaign	– the 26 Delphi surveys and the reports are not publicly available – one special bulletin of relevance for FISTERA is devoted to ICT (Tecnologías de la Información y la Comunicación. Tendencias tecnológicas a medio y largo plazo) – one of these quarterly bulletins is on "Possible Scenarios for the Digital Contents Industries" (Posibles escenarios para las industrias de contenidos digitales Estudios de prospectiva 2000-2001) – literature talks also of a special "summary document" requested by the ministry and the publication of books. It is not clear if these documents have been published and if they are separate publications – ESTO 2000: "… Foresight awareness has clearly increased, with the Foresight conference on 16th-17th" – October 2001 conference receiving about 200 participants, a level of interest that would have been difficult to imagine just three years ago."