



REPORT

ICT research in European Union

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1. INTRODUCTION: THE SITUATION OF R&D ON ICT IN EUROPE

In launching the partnership for growth and jobs as a new start for the Lisbon strategy, the 2005 Spring European Council called knowledge and innovation the engines of sustainable growth and stated that it is essential to build a fully inclusive information society, based on the widespread use of information and communication technologies (ICT) in public services, SMEs and households.

Information and communication technologies are a powerful driver of growth and employment. A quarter of EU GDP growth and 40% of productivity growth are due to ICT. Differences in economic performances between industrialised countries are largely explained by the level of ICT investment, research, and use, and by the competitiveness of information society and media industries¹. ICT services, skills, media and content are a growing part of the economy and society.

In recent years, ICT developments have gained pace to arrive at the threshold of massive growth in information society and media, made possible by widespread fast communications, connecting multiple devices. Traditional content (such as films, video, music) is now available in digital formats, and new services that are 'born digital', such as interactive software, are emerging. The digital convergence of information society and media services, networks and devices is finally becoming an everyday reality.

The Commission proposes a new strategic framework, i2010 – European Information Society 2010, laying out broad policy orientations. It promotes an open and competitive digital economy and emphasises ICT as a driver of inclusion and quality of life. A key element of the renewed Lisbon partnership for growth and jobs, i2010 will build towards an integrated approach to information society and audio-visual media policies in the EU.

Drawing on a comprehensive analysis of information society challenges and drawing on wide stakeholder consultation on previous initiatives and instruments², the Commission proposes three priorities for Europe's information society and media policies:

- 1) **To create a Single European Information Space**, which promotes an open and competitive internal market for information society and media services. This includes addressing convergence, regulatory framework for electronic communications, roaming, radio spectrum, RFID, mobile TV, audiovisual media services, film/content online, copyright, media pluralism, media literacy, consumer protection, public sector information, electronic payment, electronic signature, security strategy, spam, safer internet.

¹ The services of the information society and media industries were already described in the 1998 Green Paper on convergence of the telecommunications, media and information technology sectors and the implications for regulation towards an information society approach - COM(97) 623 - and, taking into account new developments, in the 2003 Communication on the Future of European Regulatory Audiovisual Policy - COM(2003) 784. These services reflect the convergence now taking place between electronic communications services, information society services and broadcasting services and the emergence of new content services resulting therefrom.

² I.e. the eEurope initiatives and the communication on the future of European audiovisual regulatory policy - COM(2003) 784.

- 2) **To strengthen investment in innovation and research in ICT.** Issue areas here include: ICT research in 7th Framework Programme, European Technology Platforms, Joint Technology Initiatives; innovation; take up of ICT by EU citizens, businesses and administrations - ICT Policy Support Programme in the Competitiveness and Innovation Programme, ICT Task Force, eBusiness, standardisation, pre-commercial procurement, eSkills.
- 3) **To foster inclusion, better public services and quality of life through the use of ICT.** Issue areas addressed under this priority are eInclusion, e-Accessibility, broadband/digital divide, e-Government, eHealth, digital literacy, flagship initiatives: Intelligent Car, Digital Libraries, ageing/Ambient Assisted Living (in preparation), ICT for sustainable growth (in preparation).

ICT is crucial for growth and jobs in Europe. The ICT sector is a major contributor to the economy, while the adoption and skilful application of ICT is one of the largest contributors to productivity and growth throughout the economy, leading to business innovation in key sectors. **Research alone is not enough.** The benefits of ICT come from embedding them into products and services and the adoption of new business models, organisational change and skills. Businesses are getting productivity gains from ICT but still face a lack of interoperability, reliability and security; difficulties to reorganise and integrate ICT into the workplace and high cost of support. SMEs in particular have difficulties to adopt ICT. The Lisbon Strategy emphasises investment in research and innovation to generate growth and jobs. When Europe is successful at invention, it sometimes fails to innovate. i2010 will therefore actively seek to reduce barriers between research results and economic rewards.

The Commission has recently launched two major proposals to strengthen Europe's position in ICT; **the Seventh Research Framework Programme (FP7)** and the **Competitiveness and Innovation Programme (CIP)**³. In its proposal for FP7, the Commission asks for a substantial increase in the ICT research budget. This will contribute to closing the ICT gap with other leading economies if it is fully complemented by increases in private and public research spending.

The Commission will encourage the transformation of technological progress into innovative applications and services in the public and private sector. It will support approaches that are high risk and creative and building scale through private-public partnerships⁴ that mobilise the know-how, capabilities and financial resources of industry and research around strategic research priorities⁵. The Commission will prioritise its strategic research in areas where European added value is greatest and where impact on growth and jobs is highest. In FP7 the **technology pillars** are:

- technologies for knowledge, content and creativity - including cognition, simulation and visualisation;
- advanced and open communication networks;
- secure and dependable software;
- embedded systems;
- nanoelectronics.

³ FP7 proposes to attribute 1 800 m€ annually to ICT. The ICT Policy Support Programme of the CIP proposes 800 m€ for 2007 to 2013 to encourage take-up and use of ICT.

⁴ Including European Technology Platforms or Joint Technology Initiatives.

⁵ Research in nanoelectronics will be supported and coordinated by the Commission according to the proposal of FP7 and in line with the vision and the strategic research agenda of the European Technology Platform on Nanoelectronics.

The co-ordination of the Commission's research and deployment instruments will be enhanced by focusing them on **key bottlenecks** such as interoperability, security and reliability, identity management, rights management and ease of use. Research and deployment instruments will be coordinated to demonstrate technological and organisational solutions in areas, where a shared EU level approach can help to build economies of scale and encourage investors.

The Commission also intends to encourage investment in ICT research and innovation in Europe through complementary measures. The Commission will support strategic co-operation between ICT research programmes by bringing together national and European-level activities and by building on the experience of shared infrastructures such as **GÉANT**.

In summary, to launch the i2010 agenda on raising investment in research and innovation the Commission will:

- Propose an 80% increase in Community ICT research support by 2010 and invite the member states to do the same
- Prioritise strategic ICT research around FP7 key technology pillars (2007)
- Launch research and deployment initiatives to overcome key bottlenecks that require both technological and organisational solutions (2006)
- Define complementary measures to encourage private investments in ICT research and innovation (2006)
- Make specific proposals on an Information Society for all in the Community Strategic Guidelines on Cohesion 2007-2013
- Define e-business policies aiming to remove technological, organisational and legal barriers to ICT adoption with a focus on SMEs
- Develop tools to support new patterns of work that enhance innovation in enterprises and adaptation to new skill needs

1.2 LATEST DEVELOPMENTS: i2010 IMPLEMENTATION IN 2006 AND ACTIONS FOR 2007/2008

Six years after the burst of the Internet bubble, the information society is on a steady growth path. A decade of investment in ICT is bearing fruit, fuelling innovation in ICT areas and transforming the EU into a knowledge-based economy. Since 2005, the ICT sector has become increasingly driven by the expansion in the software market and relatively less by the electronic communication segment. This reflects innovation trends requiring more pervasive software products. Large sales in systems software and eBusiness applications indicate that businesses are adopting new and more mature eBusiness solutions, even if these new investments may still be limited to large companies or early adopters of advanced eBusiness solutions.

The EU can build on these achievements to pursue its growth and innovation policies and all Member States recognise the key role of ICT in achieving the Lisbon goals. Compared to 2005, the Member States' 2006 National Reform Programmes put more emphasis on mainstreaming ICT policies.⁶

⁶ Implementing the renewed Lisbon agenda – A year of delivery, COM(2006) 816, 12.12.2006

ICT are identified as drivers of innovation, as tools for transforming government and business models and as instruments for improving our quality of life. Broadband, eGovernment and digital literacy - the priority areas identified in 2005 - show good if somewhat uneven progress among the Member States. ICT research and development, trust and security issues, and measures to reduce administrative costs for businesses and administrations emerge as new priorities in a number of countries. There are still disparities between the Member States, but in some areas, for instance broadband take-up, emergence of new services or eGovernment, the leading EU countries are also world leaders.

1.2.1 Information space

Digital convergence is finally coming of age. Although the process is by no means completed, convergence is now very much a reality. Policy makers need to ensure that the legislation impacting on converging sectors provides the legal certainty needed for stakeholders to innovate. The aim is to respond to technological changes in a way that promotes competition, consolidates the internal market and benefits users. A review of the main policy issues at stake indicates that the overall legal and regulatory framework is favourable for the further development of convergence.⁷

The majority of actions planned in the first pillar of i2010, to create a single European information space, have been launched. In 2006 the regulatory framework for electronic communications has been reviewed and amendments will be tabled by mid 2007. The discussion will continue in 2007 with a green paper on the future of universal service in electronic communications. Better and efficient use of radio spectrum as an important element of the regulatory review has been promoted, including by introducing more flexibility⁸. This will continue with proposals on common approaches to collective use of spectrum and to the digital dividend. The Commission will also address the concerns and threats to privacy revealed by its 2006 public consultation on radio spectrum identification (RFID).

The Commission will add further building blocks to European audiovisual policy, advancing the debate on media pluralism and media literacy. The new MEDIA 2007 programme, covering the period 2007-2013, will continue financial support for the European audiovisual sector. Furthermore, the Commission will outline measures to support the introduction and take-up of mobile TV across the EU.

With the arrival of new online services, market players are entering a learning process to develop new, multilingual and innovative content. The Film Online Charter, initiated by the Commission and agreed by business leaders in 2006, is a first milestone in this respect. The Commission is now exploring how the Charter can pave the way for a broader policy on online content to encourage the development of high quality and innovative online content.

On the policy side, the next challenge is to ensure that users are confident in the use of new services. In 2006 the Commission proposed a regulation to limit international roaming tariffs for the users of mobile services and in February 2007 it has launched a public consultation on the review of the consumer protection acquis at the European level.⁹

⁷ "The challenges of convergence", working paper for the i2010 High Level Group, 12.12.2006

⁸ Rapid access to spectrum for wireless electronic communications services through more flexibility, COM(2007) 50, 8.2.2007

⁹ Green Paper on the Review of the Consumer Acquis, COM(2006) 744, 8.2.2007, http://ec.europa.eu/consumers/cons_int/safe_shop/acquis/index_en.htm

Finally, the Commission complemented its new strategy for a secure information society by a communication on fighting spam, spyware and malicious software and will address cybercrime in 2007. It will evaluate the functioning of the European Network and Information Security Agency (ENISA) to decide if the agency's mandate should be extended and monitor the implementation of security measures to assess the need for additional action by 2008.

In 2007-2008, the Commission will:

- Make proposals for the review of the regulatory framework for electronic communications, launch a debate on the future of universal service and continue to develop a coordinated framework for a flexible and efficient management of spectrum, in particular with respect to collective use of spectrum and the digital dividend;
- Assess policy needs for media literacy and propose comprehensive approaches to RFID and to mobile TV;
- Promote a comprehensive approach to the development of high quality innovative content;
- Follow up on the security strategy with a communication on cybercrime, evaluate ENISA to decide on a prolongation of its mandate and assess the need for additional action in the security field (2008).

1.2.2 Innovation and ICT R&D

Boosting research and innovation is at the centre of the Commission's strategy for growth and jobs. The EU has a target of 3% of its GDP dedicated to R&D, 2% of which should come from the private sector. The EU is still far from this target, with some 1.9% of GDP spent in R&D. The 2006 Annual Progress Report on Lisbon stresses that all Member States have set a national R&D investment target and that if all of these targets are met, the EU will reach a R&D level of 2.6% of GDP in 2010.

ICT industries account for a large share of aggregate business R&D spending (26% in 2003¹⁰). As emphasised by the ICT Task Force, increasing ICT R&D expenditure is key if the EU is to reach the 3% objective. European research and innovation receive a major boost with the launch of the Seventh Framework Programme for Research (FP7) that will run from 2007-2013. The EU will invest over €9 billion in ICT, the largest single item in FP7. The Commission will continue to cooperate with the nine European ICT Technology Platforms set up to strengthen partnership with industry and achieve a critical mass of research in strategic fields. Two of the platforms will provide the basis for Joint Technology Initiatives (JTIs), a new type of initiative that will pool EU, Member State and industry funds into public-private research partnerships to boost European cutting-edge research.

The EU is also committed to improving the framework conditions for innovation¹¹, and has identified 10 key actions to this end.¹² The Commission is working on identifying relevant policy gaps to ensure that the EU's standardisation policy for the ICT sector meets the challenges of today's fast moving markets.

¹⁰ Commission Services estimate based on OECD/Eurostat survey of R&D expenditure 2003

¹¹ An innovation-friendly, modern Europe, COM(2006) 589, 12.10.2006

¹² Putting knowledge into practice: A broad-based innovation strategy for the EU, COM(2006) 502, 13.9.2006

It will also encourage public authorities to cooperate and reinforce the role of the EU public sector as a first buyer of innovation and/or pre-commercial products and services, thereby opening up new lead market opportunities for among others ICT-based products and services.

Innovation does not only arise from research but is increasingly driven by users of technologies or organisational change. The ICT policy support programme (ICT PSP) in the Competitiveness and Innovation Programme (CIP) stimulates innovation and competitiveness through promoting wider uptake and best use of ICT by citizens, governments and businesses, in particular SMEs. In 2007 the ICT PSP will focus on the role of the public sector as a user and will address three main themes: efficient and interoperable eGovernment services; ICT for accessibility, ageing and social integration; and, ICT for sustainable and interoperable health services. In 2007 the Commission will continue the review of the policy needs to promote and facilitate **eBusiness** in the framework of *eBusiness W@tch* and eBSN¹³). It will respond to the call of the ICT Task Force to design a long-term **eSkills** strategy, including the link with education and training.

In 2007-2008, the Commission will:

- Propose JTIs on nanoelectronics (ENIAC) and on embedded systems (ARTEMIS) for decision by the Council;
- Review standardisation for ICT;
- Address the potential of pre-commercial procurement for improving the quality of public services and Europe's innovation performance;
- Continue policy coordination for ICT uptake, review eBusiness policies and trends and define any necessary policy measures;
- Address the need for action in the field of eSkills and employability as part of the follow-up to the ICT Task Force.

1.2.3 Inclusion, better public services and quality of life

Inclusion

As innovation transforms the role of users, there is a growing need to keep all users are on board. The eInclusion conference in Riga initiated this reflection process, with a Ministerial Declaration laying out political guidance for further action. As a next step the Commission will outline its vision for the 2008 eInclusion initiative, building on extensive consultations. It will review progress in the field of eAccessibility and consider the need for further action, including proposals for legal measures.¹⁴

The Commission will continue its support for bringing high-speed broadband access to all Europeans. This will feed the ambitious Commission initiative on "Regions of economic change" launched under the Structural Funds.¹⁵ As a further delivery on the commitments in the Riga Declaration, the Commission will **review measurements and policies on digital literacy, in close relationship with** education and training.

¹³ <http://www.ebusiness-watch.org/> and http://ec.europa.eu/enterprise/e-bsn/index_en.html

¹⁴ The Commission will for example include a provision aiming at making audiovisual media services accessible to people with visual or hearing disability in its amended proposals for the Audiovisual Media Services (AVMS) directive.

¹⁵ Regions for economic change, COM(2006) 675, 8.11.2006

In 2007-2008, the Commission will:

- Set out a vision for a comprehensive policy on eInclusion (2007) and prepare the European initiative on eInclusion for 2008;
- Review progress in eAccessibility and propose further actions, if needed;
- Support awareness raising (major event on broadband for rural communities in 2007) and exchange of best practice (website) on bringing high-speed broadband access to all Europeans;
- Launch the regional networks "Better ICT connections between regions" and "Bringing eGovernment to regions and businesses " as part of the initiative of regions for economic change;
- Review digital literacy measurement and policies.

Better public services

In 2006, online public services grew more mature most visibly in the areas of eGovernment and eHealth. Member States are making progress in their national eGovernment initiatives and are cooperating on common EU level activities to reach the ambitious goals of the eGovernment action plan by 2010. In 2006, the EU eHealth portal was launched. All Member States have completed their eHealth strategies and a compilation of national good practice in the field of eHealth will be made available.

Member States acknowledge the European dimension of public ICT-enabled services and have identified key enablers to reach cross-border interoperability. In the framework of the IDABC programme, the Commission will revise the European Interoperability Framework in 2007.¹⁶ The Commission will also issue a recommendation on eHealth interoperability and will launch measures in support of an innovation-friendly eHealth market in the area of personal health monitoring and management. By 2008 the objective is to put in place health information networks based on fixed and wireless broadband, as well as mobile infrastructures and Grid technologies.

During 2007-2008, large-scale pilots under the ICT policy support programme will continue to support better public services in areas such as eID, secure document transmission between administrations, eProcurement, eParticipation, emergency patient data and electronic prescribing. The large-scale pilots in the area of eProcurement and eID will also be supported by the ongoing work of the IDABC programme in these fields.

In 2007-2008, the Commission will:

- Continue to support the implementation of the eGovernment action plan, including by pursuing its efforts to integrate and transform its own administration, and revise the European Interoperability Framework;
- Issue a recommendation on eHealth interoperability, promote an innovation-friendly eHealth market and establish an interoperable health information network (2008);
- Launch large-scale pilot projects under the CIP.

¹⁶ <http://ec.europa.eu/idabc/en/document/6227>

Quality of life

ICT are not only a driver of innovation and competitiveness, but also change the way people live and communicate. i2010 responds by focusing on areas where technological innovations could significantly improve quality of life: ageing, cultural diversity, intelligent cars, and climate change.

In 2007, the Commission will launch a flagship initiative on Ageing well in the information society. This will comprise a research initiative on Ambient Assisted Living (AAL), based on Article 169 of the EU Treaty, integrating technologies into products and services to ensure a continuum from advanced research to deployment. This will be complemented by longer-term research in FP6 and FP7 and deployment activities under the CIP, such as home care for elderly.

The Digital Libraries and the Intelligent Car flagship initiatives are being implemented. The Commission issued guidance on digitisation, online accessibility of cultural material and digital preservation, and on scientific resources. The Member States were asked to bring eCall back on track. In 2007 the Commission will assess progress on the Intelligent Car and on negotiations on the voluntary introduction of eCall in vehicles. New ICT-based technologies are essential not only for greater resource efficiency but also to achieve qualitative shifts towards radically different, more sustainable economic and social consumption patterns. In 2007, an i2010 flagship initiative will be developed to address priorities such as energy efficiency and environmental sustainability.

In 2007-2008, the Commission will:

- Launch the flagship initiative on "Ageing well in the information society", propose the Article 169 AAL initiative and launch pilots under the CIP focusing on independent living and chronic disease monitoring;
- Review the implementation of the recommendation on digitisation and online accessibility of cultural material and digital preservation (2008)
- Assess implementation of the Intelligent Car flagship and of eCall;
- Develop a flagship initiative on ICT for sustainable growth.

1.2.4 Identifying future trends

The Lisbon strategy has made innovation a top priority and the EU has developed a comprehensive policy agenda for this purpose. ICT are widely recognised as a key enabler for innovation. To build on the achievements of i2010 in 2005 and 2006, the EU has to take a more forward-looking approach and tighten the link between ICT policies and Lisbon priorities. Policy makers also have to understand how new economic and societal developments can extend the benefits of the information society to new groups and foster competition and European industrial leadership while including society at large. Therefore the following three issues should be addressed in the i2010 mid-term review 2008.

A new wave of innovation in networks and Internet

The information society is becoming a reality. Low cost networks, extended by mobile or wireless networks, allow seamless connection and use of applications and services integrated in the network and these are becoming more widely used in society.

This move is supported by emerging technological trends such as the migration towards very high-speed networks, ubiquitous wireless technologies, web 2.0, the Internet of Things, Grids, new network architectures, web-based services, user interfaces, user-created content and social networking.

These trends will affect the business and working environment, providing new industrial opportunities and new solutions for eBusiness and employment, thus improving the work-life balance. They will also extend the role of users as innovators. This is already visible in the explosion of user-created content.

Even though many aspects of future networks and the Internet will not be realised for some time, obstacles to the development of the information society can already be identified. These concern issues from investment in higher bandwidth, net neutrality, through spectrum availability to security. An early debate with stakeholders on longer term developments ought to look at the need for possible policy action.

A user's perspective on innovation

With the emergence of new services, the next challenge is the user. The rise of user-created content is opening further perspectives for a more creative and innovative Information Society. In the same way that users exploited open source software to develop new collaborative processes, they are now using ICT to create and exchange their own content in innovative ways. This is raising new challenges, notably with regard to legal liability for content distribution, the re-use of copyright protected material and the protection of privacy.

Consequently, the traditional vision of the users will change in the information society. Nevertheless policies aiming at lifting the obstacles to wider use of ICT - as defined in i2010 - will not become obsolete. With the 2008 eInclusion initiative, i2010 has an inbuilt focus on users and the interest of consumers is already present in the Commission's ICT policies. One recent example is the Commission proposal on roaming to eliminate unjustified charges on consumers.

Improving framework conditions

The EU innovation strategy sees the completion of the internal market as the way forward to ensure effective competition and provide sufficient scale to help large companies and many SMEs to compete globally. Therefore the Commission has planned a revision of the internal market strategy aiming at enhancing innovation and implementing better regulation.

One of i2010's main objectives is to create a single information space. Up to now, the emphasis has been on networks and content regulation. The EU – even if progress has been made – with its 27 separate markets is still far away from a single information space. Markets for online services are already global but many EU consumers avoid buying goods and services via the Internet from another Member State. Legal concerns are still an obstacle for enterprises to engage in eBusiness and in some areas regulatory barriers generating potential obstacles to competitiveness have been identified.¹⁷

We need a broader perspective taking into account new trends. For instance, the Internet enables patients to look around for treatment anywhere in the EU or beyond, and similarly doctors to provide services at a distance. This impacts on the organisation of services and has implications for public finances. Reflection on the internal market should therefore go beyond the assessment of legal obstacles addressed in the review of the regulatory framework on electronic communications and the Audiovisual Media Services Directive. Building on the work of the ICT Task Force, the reflection must tackle barriers that hinder the provision of pan-European online services, explore how ICT can reinforce the internal market and try to assess the cost and risks of fragmentation of the European information society.

¹⁷ <http://ec.europa.eu/enterprise/ict/taskforce.htm>

2. THE MAIN ACTORS AND PROGRAMMES FUNDING ICT R&D

The i2010 initiative contains a variety of policy instruments across a wide range of issue areas. Hence i2010 actions are financed from several sources.

- Ensuring the best use and uptake of ICT by EU citizens, businesses and administrations is one of the key objectives of the i2010 strategic framework. The [ICT Policy Support Programme \(ICT PSP\)](#) under the Competitiveness and Innovation Programme (CIP) aims at stimulating innovation and competitiveness through the wider uptake and best use of ICT by citizens, governments and businesses and in particular SMEs. ICT PSP will be running from 2007 to 2013 with a budget of €728 million.¹⁸
- The research activities in i2010 are supported by [Seventh Framework Programme \(FP7\)](#). The objective of ICT research under FP7 is to improve the competitiveness of European industry, as well as to enable Europe to master and shape the future developments of these technologies so that the demands of its society and economy are met. The EU Member States have earmarked a total of € 9.1 billion for funding ICT over 2007-2013, making it the largest research theme in FP7.

The MEDIA 2007 programme will provide a €755 million boost to Europe's film industry from 2007 to 2013. Almost 65% of the budget will help broader circulation of European works to other countries in Europe and worldwide.

- The [Safer Internet Programme plus](#) supports actions to tackle illegal and harmful internet content. This €45m programme (2005-2008) supports cooperation among the different actors from mobile operators to child welfare NGOs.

The EU's own Framework Research Programmes can only ever be a small fraction of all research funding – public and private – across the EU. With the cost of cutting-edge ICT research spiralling upwards, research must be better coordinated across Europe, which is why in many cases the main industrial and academic research stakeholders in certain fields have formed European Technology Platforms and Joint Technology Initiatives.

European Technology Platforms participants define, at the European level, a common strategic research agenda, and address technological and non-technological issues for implementing it. **Joint Technology Initiatives (JTIs)**, on the other hand, are long-term public-private research partnerships. Often resulting from the work of a Technology Platform, each JTI combines private sector investment and national and European public funding, including grant funding from the Research Framework Programme and loan finance from the European Investment Bank.

Technology Platforms bring together companies, research institutions, and any other organisations, with a view to defining, at European level, a common strategic research agenda (SRA) which should mobilise a critical mass of national and European public and private resources. They also address technological and non-technological issues for implementing this agenda.

¹⁸ ICT PSP builds on the aims of the previous e-TEN, Modinis and e-Content programmes.

European Technology Platforms (ETPs) help industrial and academic research communities in specific technology fields to co-ordinate their research and tailor it to a common "strategic research agenda" (SRA), which sets out research & development goals, time frames and action plans for technological advances, mobilising a critical mass of national and European public and private resources.

The main goals are to improve the impact of public and private research, to increase investment in European research, and to facilitate common approaches to technology progress and uptake. The benefits include improving the structure and coordination of research activities; partnership building for resources; consensus building on strategies for technology development; and the exploitation of research results and acceleration of innovation processes.

ETPs created to date in ICT are: [Artemis](#): Embedded Systems, [eMobility](#): the Mobile and Wireless Communications Technology Platform, [ENIAC](#): Nanoelectronics, [EUROP](#): the European Robotics Platform, [ISI](#): Satellite Communications, [NESSI](#): Networked Software & Services, [NEM](#): the Networked and Electronic Media Initiative, [Photonics21](#): Photonics, [EPoSS](#): Smart Systems Technologies

Other initiatives have been launched by industry and ICT stakeholders which may develop into ETPs in the future. Two of these Platforms (ARTEMIS and ENIAC), moreover, have led to proposals for [Joint Technology Initiatives](#). Joint Technology Initiatives. In a limited number of cases, the scope of the RTD objectives and the resources involved justify setting up long-term public-private partnerships in the form of "Joint Technology Initiatives" (JTIs). JTIs aim to achieve greater strategic focus by supporting common ambitious research agendas in areas that are crucial for competitiveness and growth, assembling and coordinating at European level a critical mass of research. They therefore draw on all sources of R&D investment - public or private - and couple research tightly to innovation.

JTIs may become operational by setting up a Joint Undertaking under Article 171 of the Treaty to create a single, Europe-wide and industrially-driven R&D programme that will help EU industry to achieve world leadership. JTIs will combine, for the first time, a critical mass of national, EU and private resources within one coherent, flexible and efficient legal framework; they also ramp up R&D investment in Europe by providing incentives to industry and Member States to increase their R&D expenditure. Two JTIs are currently being prepared in the following ICT domains:

- **Embedded Systems** - take a look at the [Artemis European Technology Platform](#), which provided its Strategic Research Agenda as a key input.
- **Nano-electronics** - take a look at the [ENIAC European Technology Platform](#), which provided its Strategic Research Agenda as a key input.

3. THE MAIN ACTORS AND PROJECTS ACTIVE IN ICT R&D

Europe accounts for around one third of global ICT sales, which are growing at 5% per year, with double digit growth in emerging markets such as India and China. Europe is a global leader in electronic communications, accounting for 40 to 50% of the revenues of the world's largest players¹⁹. Europe is also strong in sectors such as nano-electronics, micro-systems and embedded systems. Investment in research and innovation is crucial for the ICT sector to continue delivering jobs and growth in the short and long term. However, as Table 1 shows, Europe is seriously under investing in ICT.

Table 1 - Investment in ICT Research (2002)²⁰

ICT R&D ²¹	EU-15	US	Japan
Private sector investments	23 B€	83 B€	40 B€
Public sector investments	8 B€	20 B€	11 B€
Inhabitants	383 m	296 m	127 m
Investments / inhabitant	80 €	350€	400€
ICT R&D as % Total R&D	18%	34%	35%

Source: IDATE (for EU-15); OECD

Strategic ICT research is needed to assure Europe's leadership in areas where it has recognised strengths (e.g. nanoelectronics, embedded systems, communications) and in emerging areas (e.g. web-services, cognitive systems). Targeted research is needed on bottlenecks such as integrated solutions, ease of use and security. This also supports Europe's international competitiveness in crucial areas such as standards and R&D location decisions. Europe needs higher ICT research investment to reach the Barcelona target of 3% of GDP on R&D.

The landscape of ICT R&D actors both from the private and public sector is enormous due to the multifaceted situation of 25 countries working together. However, databases of projects and actors have been established in the past and can be viewed at:

<http://istresults.cordis.europa.eu/index.cfm?section=home&tpl=home>

¹⁹ OECD Information Technology Outlook 2004.

²⁰ Comparable data for EU 25 will be available by the end of 2005.

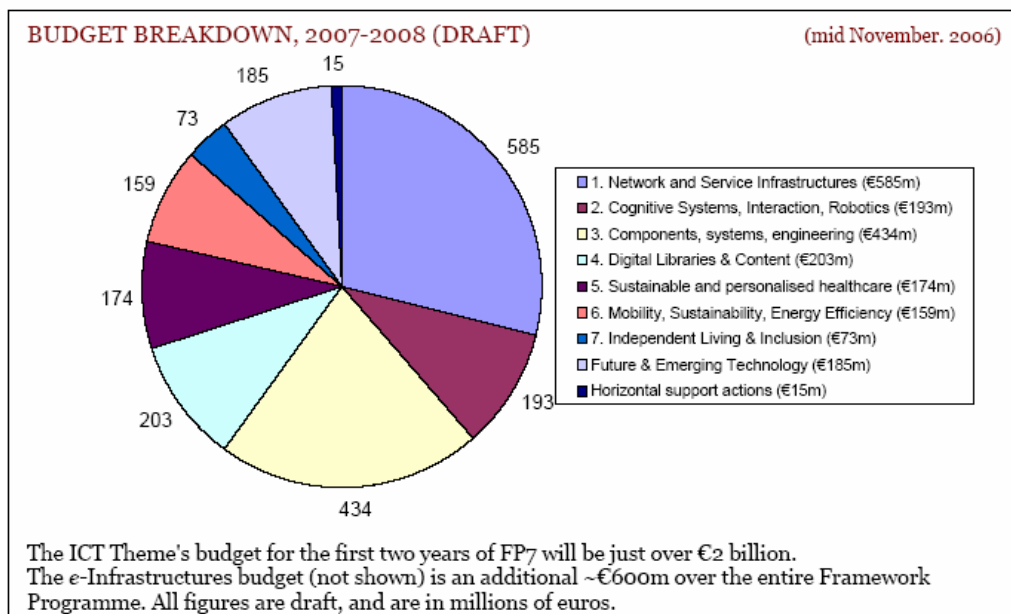
²¹ "Investment in ICT Research, Comparative Study", IDATE 2002.

4. THE MAIN ICT R&D THEMES

Information and Communication Technologies (ICTs) are critical to creating jobs and improving quality of life across Europe. Although the ICT sector is itself worth 6- 8% of the EU's GDP, their importance goes well beyond that - ICTs are also vital to:

- meeting the globalization challenge by boosting innovation, creativity and competitiveness throughout the economy;
- delivering cutting-edge science in all scientific and technological areas;
- making Europe's large public sector more efficient, and modernising sectors ranging from education to energy;
- tackling social challenges, improving quality of life and meeting the challenge of an ageing society.

Europe must therefore master these technologies to remain competitive and safeguard its quality of life, which is why ICT research is one of the key themes of the EU's Seventh Framework Programme (FP7) for Research and Technological Development, which will fund research across Europe from 2007-2013 (see box). Tackling the Challenges EU research funding is deliberately focused on seven key Research Challenges to ensure Europe becomes a world leader in ICTs. Three Challenges aim at industrial leadership in key ICT sectors, while four are driven by socio-economic targets. Within each Challenge, the Programme will fund an array of collaborative research projects, each bringing together public and private organisations across Europe to help the EU pool its scientific, industrial, financial and human resources. Small and medium-sized enterprises are actively encouraged due to their vital role in innovation and economic growth. Research partnerships will also be forged with advanced and developing countries, supporting European competitiveness and helping international development.



Challenge 1 - Pervasive and trusted network and service infrastructures

Tomorrow's information infrastructure will connect together billions of people, countless organisations and literally trillions of devices - PCs, mobile phones, servers, sensors and much more. This infrastructure will underpin economic development in all EU regions, and will be at the origin of new services and business opportunities throughout the economy. Mastering the development of this infrastructure is essential to reaping the benefits of ICTs in areas as diverse as manufacturing and home healthcare. It is an immense challenge to make this network and service infrastructure more robust, resilient and secure.

Challenge 2 - Cognitive systems, interaction and robotics

Providing the next generations of ICTs with more intelligence will create many new opportunities in a range of sectors. Research here will focus on developing ICT systems that are more aware of what is going on around them, and will be able to learn, reason and interact with people more naturally. These robots and "smart artefacts" will thus better serve our needs in the real world. Instead of forcing users to learn how to use the machines, the machines will learn how best to work with us. Applications in areas as diverse as manufacturing, education, healthcare, public safety, environmental protection and service robotics are expected.

Challenge 3 - Components, systems and engineering

European firms are currently among the world's leaders in supplying electronic components to industries as varied as transport, telecoms, consumer electronics and medical equipment. Europe also enjoys leading positions in technologies such as photonics, plastic electronics, flexible displays and micro/nanosystems. Europe is well positioned in the global race to develop these technologies and to embed intelligence into products, services and processes. This Challenge will support European industry and academic researchers in this strategic field and ensure that these new technologies meet the needs of European business & society.

Challenge 4 - Digital libraries and content

ICTs enable us to access, create and share content widely. They also allow us to learn better, and to preserve and enrich our cultural heritage. Every day, however, brings us face to face with the shortcomings of current technologies, and the way they are used. We are often overwhelmed with information. We still have limited eLearning tools. And we are still just discovering the opportunities that ICTs offer for developing our cultural assets and reinforcing our creative potential. Research under this Challenge will therefore help develop digital libraries, enabling us to easily create, interpret, use and preserve cultural and scientific resources, and revolutionise learning through adaptive and intuitive ICTs.

Challenge 5 - Sustainable and personalised healthcare

Sustaining Europe's healthcare systems is a major challenge, with healthcare already accounting for around 9% of EU GDP. The health sector is information intensive, so e-Health is emerging as an important new industry, with e-Health spending predicted to account for around 5% of the total health budget by 2010. Research under this Challenge will improve the quality, availability and effectiveness of healthcare by developing ICTs to improve everything from healthcare administration to biomedical imaging, from personalised, home-based care to the creation of new medicines.

Challenge 6 - Mobility, environmental sustainability and energy efficiency

With traffic congestion rising, 40,000 people dying on the roads annually and fuel consumption and air pollution continuing to grow, Europe faces serious challenges on its roads. Air pollution and climate change, moreover, are not Europe's only environmental challenges. ICTs can help improve safety, optimise natural resource use, design smarter and cleaner processes, and predict and manage the environment. Research in this Challenge therefore covers a lot of ground. 'Intelligent car' research will make transport systems safer and more energy efficient, as well as support Europe's automotive industries, while new 'mobility services' will ensure transport resources are used more efficiently. Infrastructure and manufacturing plants, such as power networks, chemical plants and oil pipelines, will also be made more resilient, secure and energy efficient, while new systems to monitor and react to environmental risks will be developed.

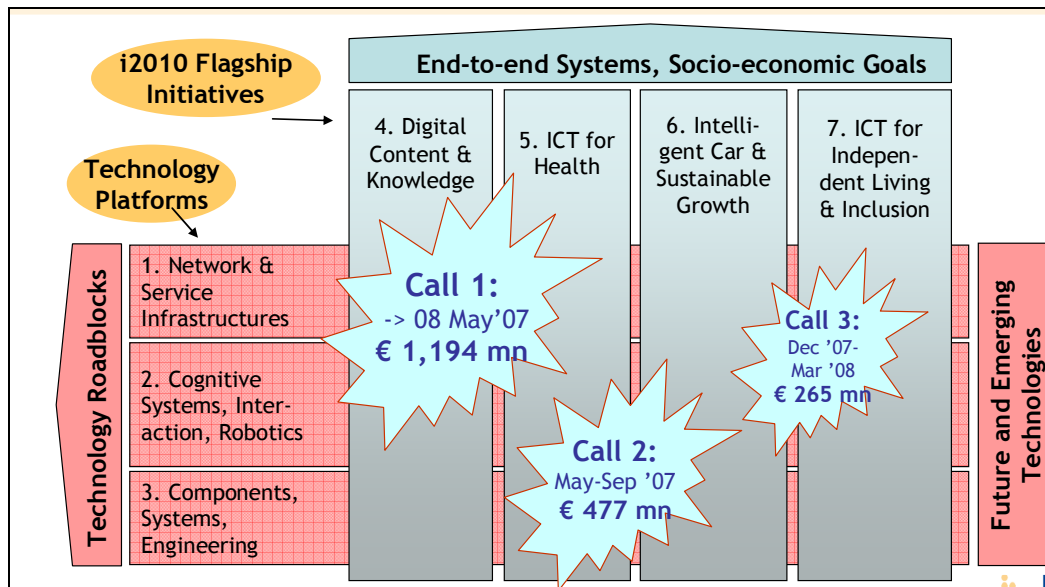
Challenge 7 - Independent living and inclusion

While ICTs offer many advantages to European society, their impact will not be fully felt until all Europeans can use them. But European society is changing – the proportion of population over 65 will increase from 20% to 28% between now and 2025, and by 2050 the old-age dependency ratio will have risen by over 160% from the 1985 level. ICTs can help meet this challenge: extending the time elderly people can spend living independently in their preferred environment, for example, and providing a new generation of products and services to help integrate people at risk of exclusion. Such systems both address pressing societal needs and offer major opportunities for European industry. The ICTs themselves, however, have to change, becoming more userfriendly, personalised and accessible to all.

i2010 FLAGSHIP INITIATIVES

Delivering the Information Society requires more than just research. In four critical areas, Flagship Initiatives have been launched under the Commission's i2010 initiative to underline the full potential of ICTs to improve quality of life in Europe:

- **European Digital Library:** making Europe's diverse cultural and scientific heritage (books, films, maps, photographs, music, etc.) easier and more interesting to use online for work, leisure and study. It builds on Europe's rich heritage, combining multicultural and multilingual environments with technological advances and new business models;
- **Intelligent Car:** ICTs for smarter, safer and cleaner vehicles, helping reach Europe's goal of cutting road fatalities in half by 2010;
- **ICT for Independent Living in an Ageing Society:** improving social inclusion by providing people, particularly the elderly, with ICT tools to support their health, well-being and mobility. The new applications will also help to substantially improve ICT take-up across Europe;
- **ICT for sustainable development:** tackling the unsustainable trends which are undermining economic growth and reducing quality of life for all Europeans. ICTbased environmental monitoring and management tools will optimise the use of natural resources and will play a key role in attaining sustainable development.



Beyond the Challenges Future and Emerging Technologies

As well as addressing today's challenges, the ICT Theme also looks further ahead, complementing the Challenges with longterm, high-risk, 'purpose-driven' research. Known as Future and Emerging Technologies (FET), the idea is to support pioneering research with a high potential for significant breakthroughs. This is the research 'at the fringes' that may become tomorrow's radical innovations - the sort of work that opens up entirely new markets. FET will therefore explore radical interdisciplinary avenues, delivering proofs-of-concept for new options and demonstrating new possibilities. It will strengthen Europe's science and technology base in new and emerging areas, refine new visions to the point where they attract industrial investment, and establish new interdisciplinary research communities within European science and industry. eInfrastructures ICT-based research infrastructures – from supercomputers to genetic databanks and high-speed networks - are essential to high quality research. Yet they are increasingly expensive to maintain and develop. Europe must therefore get better use out of what it has, and pool its resources to provide its scientists and engineers with world-class facilities. Hence the Capacities programme, where the e-Infrastructures strand will oversee the improvement of dedicated digital infrastructures that allow European researchers to work together more effectively. Powerful new software techniques - crucial to tackling the biggest challenges facing European science and industry in areas as diverse as manufacturing and drug design – will also be developed. Work in this area to date has already led to GÉANT, the world's most powerful research network.