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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

A Strategy for ICT R&D and Innovation in Europe: Raising the Game

{SEC(2009)289}

This Communication proposes a strategy to establish Europe's industrial and technology leadership in information and communication technologies (ICT), to make Europe more attractive for ICT investments and skills, and to ensure that its economy and society benefit fully from ICT developments.

Building on Europe's assets, the strategy seeks to step up the effort in ICT research and innovation (R&D&I) and to maximise its impact in today's economic context. It forms part of the preparations for a European plan for innovation and research, encompassing the main technologies of the future including ICT, as called for by the European Council¹.

1. ICT UNDERPINNING VALUE CREATION AND SOCIO-ECONOMIC DEVELOPMENT

ICT provides essential infrastructures and tools for knowledge creation, sharing and diffusion. It boosts the innovation capacity of all sectors and contributes to more than 40% of overall productivity growth².

The worldwide ICT market has reached €2 000bn and is currently growing at 4% per year. Europe represents 34% of this; however, the value added of its ICT sector amounts to only 23% of the total³. The sector represents 4.5% of European GDP and even more if the value added of ICT in other sectors is also accounted for.

ICT is also essential to address Europe's societal challenges. It brings unique responses e.g. to the growing needs for sustainable healthcare and ageing well, for better security and privacy, for a lower carbon economy and for intelligent transport.

The importance of ICT is reflected in R&D budgets worldwide, where ICT typically represents more than 30% of the total⁴. This also shows that we are still at the early stages of the ICT revolution.

Today, to compete on a global scale, Europe has to continuously reinforce a solid knowledge base in ICT, shape ICT developments and make the best use of ICT innovations at the earliest stage.

2. THE NEED FOR A STRATEGY

2.1. Leading the way out of the economic downturn

ICT provide vital tools to recover from the current economic slowdown⁵, to build robust economies, bring the efficiency gains needed in our public sector and cut the rising costs related to e.g. ageing, energy and the environment.

¹ European Council Conclusions, 12.12.2008

² EU KLEMS, 2007

³ European Competitiveness Report 2006; EITO 2006

⁴ OECD: ICT and Economic Growth, 2003

⁵ COM(2008)800

The current economic crisis risks to undermine the recent improvement in private ICT R&D investments. It is therefore all the more important to ensure that public policies create the right conditions for sustaining, and even increasing, the support for R&D.

A number of ICT innovations are today ripe for wider roll-out and deployment in modern infrastructures. For instance, broadband networks open up demand for new products and services; interoperable pan-European digital services such as e-signature, e-identification and e-procurement are important for the single market to function well; Intelligent Transport Systems contribute to a cleaner, more efficient and safer transport.

2.2. New opportunities for leadership

The economies that set the direction and pace of changes in ICT will also be those that will benefit most from ICT developments.

Europe has the opportunity to be in the lead to develop, master and shape the 'Future Internet' that will gradually replace the current web and fixed and mobile networks and service infrastructures⁶. Enabling the interconnection of trillions of devices at speeds beyond the hundreds of Mbits/s will change the way we communicate and access knowledge and bring radical transformations to production and distribution systems and to services in the private and public sector.

We will see increasing user participation with community networks, peer-to-peer systems and user-generated content providing new forms of digital content. People will not only have to be able to extract information but also to reason and learn about it.

Europe should also be at the forefront of the next-generation ICT components and systems, seizing new opportunities arising in nanoelectronics, photonics and organic electronics, as well as in intelligent systems for markets such as automotive and health. At the same time, it is crucial to lead in radically new technological paradigms and in new multi-disciplinary R&D at the frontiers between ICT and other fields.

Europe should as well lead the ICT transformations driven by its societal challenges. For example, it should be the forerunner in the development of ICT-based personalised health systems that will significantly improve diagnosis and treatment of diseases⁷ and prolong the independence of elderly people. Europe should also drive progress in ICT-based monitoring and control tools that will help optimise energy efficiency, safety and security in buildings and transport⁸.

Europe has recognised strongholds in ICT fields such as telecoms equipment and services, enterprise software, robotics, security technologies and photonics. It has also world leadership in ICT application markets such as telemedicine and medical equipment, in automotive and aerospace electronics, and in embedded ICT that underpins innovation in all products and services. These give us a pole position to master and shape ICT evolutions and seize the opportunities ahead.

⁶ COM(2008)594

⁷ COM(2007)860

⁸ COM(2008)241

In the process Europe should promote new, more flexible and more open models of innovation with lead users and innovation communities having significant roles in experience-driven R&D.

2.3. Underinvestment in ICT R&D and innovation

In the EU, ICT R&D accounts for a quarter of all private R&D spending, a third of all R&D employment, and a fifth of all patents⁹. Even so, the EU's ICT business sector spends less than half on R&D as its US counterpart, accounting for half of the total gap in private R&D spending.

In addition, there is a growing deficit in the EU of qualified skills in ICT R&D, resulting in several hundreds of thousands of unfilled posts¹⁰.

Europe has relatively few world-recognised ICT poles of excellence. This affects the attractiveness of Europe to pupils, students and researchers as well as to private investments. California alone attracts twice as much venture capital as the whole of Europe¹¹.

Pre-commercial procurement of ICT to modernise public services is today heavily underutilised in Europe. It represents less than €1bn in the EU against more than €10bn in the US¹². This not only affects the quality and efficiency of our public services; it also represents missed opportunities for opening up new markets for the European supplier base through the creation of competitive first-mover advantages.

2.4. Barriers to ICT business growth

Business entry, survival and exit rates are comparable across the EU and competing regions. In other parts of the world, however, successful new firms expand more rapidly, entrants display a higher dispersion of productivity levels and the more productive firms have a stronger tendency to increase their market shares¹³.

This suggests that barriers to growth pose a bigger problem than barriers to starting a business in the EU. The reasons why European SMEs are not growing are multiple, e.g. sub-optimal conditions for their access to markets, innovation and finance; excessive regulatory burdens.

2.5. Fragmented markets for ICT innovation

The fragmentation of the European market for innovative ICT products and services is one of the main factors behind the low investments and slow development of high-growth SMEs.

The framework conditions for regulation, standardisation and intellectual property right (IPR) regimes need to be adapted to new realities. Even with the liberalisation of the European telecom sector, a real internal market in telecoms has still not been achieved. Standardisation structures and processes must become more agile and reactive, and with a clearer distinction between missions requiring public intervention and those more related to market dynamics.

⁹ EC/JRC/IPTS: PREDICT

¹⁰ COM(2007)496

¹¹ E&Y: Global Venture Capital Insights and Trends report 2008

¹² COM(2007)799

¹³ European Competitiveness Report 2008

The IPR system also needs to be improved by the creation of a Community patent for innovative ICT companies to protect their inventions in the single market¹⁴.

The fragmented public demand for and slower uptake of ICT-based innovations in the public sector in Europe are also major weaknesses. There is often little collaboration between public authorities procuring innovative ICT-based solutions (e.g. for health, transport, energy) and those in charge of R&D/innovation. This means insufficient awareness of new public service needs, on the one side, and ignorance of technological innovations, on the other, as well as weak links between programmes for R&D/innovation and procurement.

2.6. Fragmented ICT R&D and innovation efforts

Despite recent pioneering efforts, such as Joint Technology Initiatives¹⁵ (JTIs) and Joint Research Programmes under the seventh EU Framework Programme for R&D (FP7), Europe's ICT R&D landscape remains fragmented¹⁶.

Little interlinkage can be seen in the 'knowledge triangle' between innovation, R&D and education policies that are often drawn up in isolation by different ministries or at different levels.

The consequences are: duplication of efforts, lack of critical mass, difficulties in addressing common challenges jointly and, in the end, sub-optimal returns on R&D investments.

2.7. Complicated funding mechanisms

The EU, the Member States (MS) and intergovernmental bodies have complementary policies and actions in place to support R&D&I in Europe. To provide guidance on the use of Community Funds, the European Commission (EC) has published the 'Practical Guide to EU funding opportunities for Research and Innovation'. However, potential beneficiaries are often confused when deciding which funding source is most appropriate for a given activity.

Although the 2008 Aho Panel ex-post evaluation of European ICT R&D concluded that the investment has been well managed and was effective in reaching its goals, and even with the improvements introduced with the launch of FP7, the Panel called for simpler and more flexible funding mechanisms by developing a more trust-based approach towards participants.

3. A STRATEGY FOR LEADERSHIP

To reinforce its strengths and seize new opportunities in ICT, Europe needs to raise its game. A more efficient and systemic strategy for ICT R&D&I must address both supply and demand, cutting across the innovation cycle and 'knowledge triangle' with more user-producer interactions and better interlinking of policies at regional, national and EU level – in line with EU's broad-based innovation strategy and building on the European Research Area.

This requires resources and stakeholders to be mobilised along three interlinked paths:

¹⁴ COM(2008)465

¹⁵ Artemis & Eniac

¹⁶ COM(2008)468

- (1) Raise both public and private investments in ICT R&D&I in Europe and increase their efficiency
- (2) Prioritise ICT R&D&I in Europe into key areas and reduce the fragmentation of efforts
- (3) Facilitate the emergence of new public and private markets for ICT-based innovative solutions

3.1. Raise investments and increase their efficiency

Europe must step up its investments so that within a decade we see a **doubling of ICT R&D investments** in value.

1. It is important to ensure that public policies create the right conditions for sustaining the support for R&D.

Annual commitments to **EU-level ICT collaborative R&D under FP7 will increase from €1.1bn in 2010 to €1.7bn in 2013.**

Member States are invited to **match this budget increase** in their national programmes by re-orienting some existing public resources and by seeking new ways of securing public and private funds, while avoiding substitution effects and ensuring that private investors continue to compete for the best ideas. In light of budgetary constraints, Member States are also encouraged to explore ways to increase the efficiency of public spending on ICT R&D.

The *EC* will continue to **monitor and compare investments** in ICT R&D in the EU⁹.

2. Increased public procurement of ICT innovations and R&D will increase the quality of our public services and create competitive first-mover advantages.

Member States are invited to engage in more strategic and extended use of public procurement of ICT innovations and R&D and to explore the use of **pre-commercial procurement**¹¹.

The *EC* will support actions to promote **experience sharing** and examine ways of providing **incentives** for jointly implemented pre-commercial procurement.

3. Raising public spending on ICT R&D is essential but not sufficient to attract private investment. The schemes pioneered in the **JTIs** under FP7 have shown how industry is attracted to **public-private partnerships (PPPs)** that speed up innovation, thanks to shared technology development strategies, pooling of resources and more agile and lean operations.

The *EC* will examine other fields where combined strategies and resources are important, **such as the Future Internet**, to see how **PPPs** could boost innovation and competitiveness. It will also explore how PPPs could develop in ICT application and service areas, possibly with other themes in FP7 e.g. through coordinated calls.

4. Another important additional source of support to ICT R&D&I is available through **Cohesion Policy**.

Member States and regions are encouraged to maintain their allocations for R&D&I investment, including co-funding the construction and fitting out of **ICT R&D facilities** and support to new approaches such as user- and experience-driven R&D.

5. A special effort is needed to further facilitate the access of businesses, not least SMEs and medium-sized enterprises, to **venture capital, private equity and loans** for ICT R&D.

The *EC* will set up **platforms for more intensive dialogues** between investors and ICT innovators across Europe. It will pursue the effort to provide guarantees for investments in high-growth companies in ICT through the European Investment Fund, the Risk-Sharing Finance Facility under FP7 and other **EIB instruments**. It will also support worldwide **awareness raising of European technologies** and related business opportunities.

In addition, the *EC* will pursue its policy to encourage **further participation of SMEs** in ICT in FP7 and beyond.

Member States and regions are invited to reinforce their efforts in this field, notably through more **focused cluster policies** and **support for innovative SMEs**, i.a. through the Treaty Art. 169-based Eurostars initiative, within the rules defined by the risk capital guidelines, the R&D&I framework and the recent General Block Exemption Regulation.

Member States' national and regional managing authorities may opt to participate in **JEREMIE** and use the **ERDF** to foster new business creation and SME expansion.

3.2. Prioritise and reduce fragmentation

Europe needs to better coordinate its policies and concentrate and specialise its resources, not least for the emergence of **world class poles of ICT excellence in Europe**.

This entails stronger collaboration between the Community, the MS, the regions, industry and academia, with the Community acting mostly as facilitator of multilateral transnational collaborations.

1. The first level of coordination is the development of **shared strategies and policies** across the EU.

Member States are invited to **strengthen the dialogue** established within the National ICT Research Directors Forum and to include stronger interactions with groups such as the ICT Advisory Group and the ICT-related European Technology Platforms (ETPs).

In essential sectors, such as nanoelectronics and web-based services, a **shared European vision** is urgently needed not only for R&D but also and above all for the whole innovation and skills development chain and for the role of public policies in boosting competitiveness.

The *EC* will **strengthen stakeholder groups**, building on the work done in ETPs, to draw roadmaps from R&D through to commercialisation, and to propose public policy priorities for the development of essential sectors in Europe.

2. A step further must be taken when **pooling of resources** is necessary to address a challenge.

Based on experience gained from EUREKA, the JTIs and the Ambient Assisted Living **Joint Research Programme**, the *EC* will examine other fields where common action could create the necessary critical mass, either in response to specific societal challenges, e.g. ICT for energy efficiency, or to achieve precise goals with industrial drive.

3. Another area where more multilateral collaboration between Member States and their regions is important is the area of **ICT R&D infrastructures and knowledge-based innovation clusters**, building on experience with the GÉANT high-capacity electronic communication network and the EGEE Grid infrastructure.

Member States and regions are invited to strengthen their collaboration in **planning, implementing and sharing infrastructures for ICT R&D&I**, particularly in areas requiring large investments, e.g. nanoelectronics, organic electronics and photonics; high-performance computing facilities; and experimental facilities for networks, software and services. This is essential to concentrate efforts, specialise and nurture high-calibre innovation and knowledge clusters.

The *EC* will provide support for **collaboration platforms between the Member States** in this area.

4. New instruments such as **ICT Knowledge and Innovation Communities (KICs)** under the European Institute of Innovation and Technology (EIT) will play a key role in bringing the relevant industries, entrepreneurs, R&D institutes and universities closer together.

Knowledge hubs play a key role in mobility of researchers between industry and academia, which is a principal factor for **making ICT research careers more attractive**.

The *EC* encourages the EIT Governing Board to take full account of the opportunities and challenges of ICT in defining priority areas for KICs.

5. There is a growing deficit in the EU of qualified skills in ICT R&D.

The *EC* will pursue its support for the '**New Skills for New Jobs**', '**digital competences**' and '**e-Skills initiatives**'¹⁷, including actions to encourage youngsters and women to choose ICT careers.

¹⁷ COM(2008)868; SEC(2008)2629; COM(2007)496

3.3. Facilitate the emergence of markets for innovation

The EU should be able to **produce and commercialise the equivalent of its share of the global ICT market**. This requires the right conditions to be in place for the growth of ICT companies, and more intense collaborations to open up new EU-wide markets for innovations.

In addition to general policy measures creating more favourable conditions for business developments in the EU, the public sector as a procurer of ICT solutions can play an instrumental role in driving ICT innovations.

1. **ICT R&D&I policy must help drive forward other policies** - for health, energy, transport etc - to enable Europe to innovate faster in vertical markets and to modernise its services in response to societal challenges.

Member States and regions are invited to promote closer collaboration between users and producers of ICT innovations in different corners of governments and administrations. This should lead to **shared roadmaps of public service needs that ICT can help address**.

Member States and regions are also encouraged to work closer together on defining and implementing **public demand for ICT innovation**. This should enable procurers to share the risks and costs inherent in innovation and R&D, to ensure interoperability and coherence of solutions and to exploit economies of scale.

Furthermore, *Member States* and regions are invited to facilitate the emergence of markets for innovation in ICT as a means to raise both ICT investment and diffusion.

In this context, the 'Regions for Economic Change' initiative¹⁸ is an important facilitator of interregional cooperation.

The *EC* will support **experience sharing** at all levels.

2. Ensuring **interoperability** and the emergence of **standards** is essential to foster innovation uptake on a large scale within the EU.

The *EC* will pursue its effort to revise the **ICT standardisation process**, including through a White Paper planned for spring 2009. A priority list of actions will be established to eliminate barriers to the development of markets for ICT innovations. This list of actions will include suggestions to improve the relationship between researchers, standardisation organisations, ICT fora and ICT consortia.

The *EC* will accelerate and reinforce, through the ICT part of the Competitiveness and Innovation Framework Programme (CIP), a set of pan-European pilots to test, validate and deploy **innovative ICT solutions, in particular for public sector services**. The CIP will also support **SMEs piloting** highly innovative technologies and services, and the development of **open platforms for user-driven innovation**.

¹⁸ COM(2006)675

The success of these pilots will depend on the continued support and participation of national, regional and local authorities in the *Member States*, and they must be supplemented by actions at regional and local level.

3.4. European-scale projects spanning from R&D to deployment

To speed up the achievement of specific societal goals, the *EC* is considering how to support a set of **focused projects of significant scale and duration that cut across the innovation cycle** to develop modern pan-European service infrastructures.

Building on lessons learnt on PPPs in the JTIs, in the CIP pilots and from the Lead Market Initiative, each project would mobilise a critical mass of resources, including grants for R&D, pre-commercial procurement and support for innovation and deployment. Examples are:

- (i) **Innovative ICT solutions for sustainable healthcare.** Efficient chronic disease management requires precise and reliable devices for health status monitoring and personalised treatment. R&D is also needed for efficient access to medical knowledge, data analysis and exchange. Testing and validation of new care processes is essential, as is certification and standardisation.
- (ii) **Innovative ICT solutions for energy efficiency.** Dynamic pricing in the utility grid requires new electronic trading platforms. Power quality management demands new decentralised monitoring and control systems and smart metering.
- (iii) **An electronic identity management (eID) infrastructure,** as basis for trustworthy services in e-government and e-commerce. Today, a plethora of solutions result in fragmentation, closed solutions and lack of user control and transparency. Ongoing FP7 projects and CIP pilots constitute important steps towards an EU-wide project to implement an effective eID infrastructure.

Further considerations will take place as part of the preparations for the European plan for innovation and research by **testing and validating cases** that would benefit from orchestrated efforts.

3.5. Simplification and streamlining

Investments must be well managed and administrative burdens cut to make it more attractive for innovative companies, in particular SMEs, to participate in local, national and EU-level actions, and to make high-tech R&D&I more effective.

The *EC calls on the Parliament and Council* to support a **new drive to cut red tape** and allow greater flexibility in programme procedures. Public authorities at all levels are invited to support the EC in developing a more risk-tolerant approach to supporting R&D in Europe.

3.6. International cooperation

International cooperation addressing scientific and technological challenges should strengthen the global position of European R&D, industry and technologies, as partners share expertise, develop common roadmaps, standards and interoperable

solutions. International responses to global socio-economic challenges should promote EU policy goals in the solutions.

The *EC* will **seek global partnerships** to tackle some of the future grand challenges in ICT R&D such as the Future Internet, quantum information processing and communication, or bio-inspired ICT.

Member States have already been invited to **define together priority areas** where a coherent EU effort would have more impact¹⁹.

4. CONCLUSIONS

As the world's largest economy and representing the largest share of the world's ICT market, Europe can have legitimate ambitions for its businesses, governments, R&D centres and universities to lead developments in ICT, to invest more in ICT innovations and to grow new business.

If Europe manages to step up its investments, pool its resources, when needed, and ensure competitive and innovation-friendly markets, then we could anticipate a landscape where, by 2020:

- Europe has **doubled its private and public investments in ICT R&D**, doubled venture capital investments in high-growth ICT SMEs and tripled its use of pre-commercial procurement in ICT;
- Europe has nurtured **an additional five ICT poles of world-class excellence**, measured by private and public investments in the pole;
- Europe has **grown new innovative businesses in ICT** so that one third of all business expenditure in ICT R&D is invested by companies created within the last two decades;
- Europe's ICT sector **supplies at least the equivalent of its share of the global ICT market**.

This Communication proposes a combination of 'demand pull' and 'supply push' for ICT R&D&I in Europe. This involves increased investments in programmes on both the supply and the demand side, stronger collaboration between stakeholders and support for projects that cut across the innovation chain.

The strategy should open markets with clearer demands from users, allowing for shorter innovation cycles, faster responses to socio-economic challenges and new opportunities for industry in Europe. It should result in more rapid returns on investments and thus greater attractiveness of Europe for investors, companies and researchers.

Member States are invited to endorse the proposed strategy and to encourage national and regional authorities and private stakeholders to participate in the preparation of future actions.

¹⁹ COM(2008)588