Task-Force on ICT Sector Competitiveness and ICT Uptake

Working Group 3

Innovation in R&D, manufacturing and services

TOPIC PAPER

October 2006

European Commission staff participated in this working group as observers and helped facilitate exchanges of views and information between its members. The views and opinions expressed in this report are those of the Working Group and do not necessarily reflect those of the Commission.

Working Group 3

Innovation in R&D, manufacturing and services

Coordinator: Olivier Baujard (Alcatel) with Christine Diamente (Alcatel)
Issue managers: R&D — Martin Spät (ESIA) & Mario Rebello (Microsoft); Manufacturing — Martin Spät (ESIA); Services — Corinna Schulze (IBM)

Members: Alcatel, Olivier Baujard, Christine Diamente; BT, Geoff Scott; COLT, Markus Reinisch; Commission, Maria Perogianni; Laura Pontiggia (as observers); CompTIA, Irene De Beni; Deutsche Telekom, Gernot Lang; ECTA, Ilsa Godlovitch; EIB, Olivier Debande; EICTA, Tony Graziano; EMF, Kjell Sehlstedt; EPO, Jean-Luc Gal; Ericsson, Magnus Madfors; ESIA, Martin Spät; ETNO, Michael Bartholomew; EuroCommerce, Anne Kanerek, Cécile Grégoire; European Software Association, Katrijn Otten; EVCA, Marie-Annick Peninon; Hewlett-Packard, Jan-Willem Scheijgrond; IBM, Corinna Schulze; Intel, Hans Mulder; Microsoft, Stéphane Ducable, Mario Rebello; NORMAPME, Freek Posthumus; Nortel, Thomas Reynaert; PREST, Luke Georghiou; SAP, Joachim Schaper; Siemens, Georg Haubs; Sun Microsystems, Daniel Berg; Swedish CCI, Nicklas Lundblad; Tele2, Jan Tjernell; Telefónica, J. Félix Hernández Gil; UNI-Europa, Morten Skov. Commission contact points for research-related information: Michael Arentoft, Bernard Barani, Wolfgang Boch, Erastos Filos, Charles MacMillan, André Vits. Representatives of ESIA participating ad hoc: AMD, Helmut Woessener; Freescale, François Escher; Infineon, Alfred Hoffmann; Micron, Fabrizio Fama; NXP Semiconductors, Merten Koolen; STMicroelectronics, Enrico Villa.

Steering note

Prepared by the industry associations

Issue

Innovation is a driver of economic growth, productivity, job creation and rising living standards. Innovation also promotes ICT competitiveness; in turn, competition leads to better products, improved consumer choice and, ideally, greater ICT uptake. Accordingly, innovation must be viewed as an integral part of the ICT value chain — essential for economic survival. At present, however, innovation is often perceived as something that should happen organically; inadequate attention has been given to how best to foster innovation. Similarly, little focus has been given to the changing nature of innovation.

Mandate

This working group will consider three distinct elements of innovation: R&D, manufacturing and services (i.e. turning the result of R&D into value-added products and services). More specifically, in the R&D space, the group will consider issues such as how to prioritise R&D in line with Lisbon targets; obstacles and incentives to private R&D investment; how best to strengthen links between universities, research institutions and industry; the synergies between R&D and manufacturing as a source of innovation, promotion of partnerships to stimulate private/public R&D investment; clustering; and focusing state aid to reward R&D innovation. In the manufacturing and service context, the group will address issues including employment conditions and working hours, sectoral incentive approaches; and ensuring effective knowledge transfer between R&D, manufacturing, and services. The group will seek to identify key barriers to innovation and provide policy recommendations regarding how to eliminate them.

ICT Task-Force

This working group is one of six under the ICT Task-Force. To see the reports of the other working groups and the overall report of the ICT Task-Force, please go to http://ec.europa.eu/enterprise/ict/taskforce.htm

Work Group 3:
Innovation, R&D, Manufacturing, Services and Human Dimension of Innovation

I- Executive Summary

The EC ICT Task Force Work Group 3 members confirm that innovation in ICT is crucial for Europe's competitiveness, social and economic growth. Innovation in ICT must be supported by **strong political leadership at all levels**: pan-European, Member State and regions. Moreover, **Task Force members firmly believe Europe needs a strong "Push-Pull Innovation policy",** in part by supporting and carrying forward the key actions announced in the recent EC Communication on Innovation and the "Aho Report- Creating an Innovation Europe", and the additional measures presented by Task Force members in the following chapters.

It must be noted that in general, the **European Union has a number of strategic advantages including its worldwide leadership in ICT equipment and services**, which must be better leveraged to respond to Europe's current social and economic challenges. For example, Europe today has excellent ICT infrastructure with over 80% broadband territorial coverage, a skilled population, technology know how in key areas such as telecommunications, consumer electronics and semi-conductors. Europe however also has a number of social and economic challenges including an ageing population, high expectations with regard to quality of life in particular in healthcare, environmental and transportation concerns. ICT provides a number of solutions to respond to these challenges, and the leadership, technology know-how all remain available within Europe's borders.

The Task Force members strongly believe that the ICT can respond to Europe's current social and economic challenges, and also permits European citizens to readily access innovative **solutions** which address key daily concerns including health care, environment, transportation and rural isolation.

The following sections on Innovation and R&D, the Semiconductors industry, Services and Innovation and finally, the Human Dimension of Innovation will address recommendations by the Task Force to improve innovation in Europe through priority actions by European public authorities.

Definition of Innovation and Current Initiatives:

1.1. A concise definition of innovation[1] is "*the successful production, assimilation and exploitation of novelty in the economic and social spheres*". The document from where this definition originates also warns the reader that "*according to the dictionary, the opposite of innovation is 'archaism and routine'. That is why innovation comes up against so many obstacles and encounters such fierce resistance*".

1.2. This latest comment sounds utterly relevant when applied to a working group focused on innovation. **The first and most detrimental obstacle to innovation would be to think of innovation *itself* in routine terms**. Two facets of this possible bias are detailed below.

- **Narrowing the definition of 'innovation'.**
  The Oslo Manual[2] provides a definition of 'innovation' as follows: "*An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organisation or external relations.*" (146) "*Four types of innovations are distinguished: product innovations, process innovations, marketing innovations and organisational innovations*." (155). Although this definition sounds comprehensive, it is actually restricting innovation to four sub-domains, potentially ignoring other forms of innovation that may be emerging. Additionally, this definition pertains to "*innovation in the business enterprise sector only*." (26) Even though the Task Force mandate is specifically focused on economical issues, the EU economy cannot be restricted to the 'business enterprise sector'.

- **Making the confusion between the object and its measures.**
  The goal of the Oslo Manual is to provide tools for collecting and interpreting innovation data. A prerequisite to measuring is the identification of a well defined 'object'. Once well defined in a restrictive manner, the object (here, innovation) can be studied in an objective manner through quantitative measurement. But there are evidences that innovation happens in novel forms that fail to be captured by current measuring tools. A logical mistake would be to restrict the goal of 'fostering innovation' to that of 'getting higher grades' on quantitative innovation assessment scales.

1.3. The Task Force mandate encourages participants to think 'in a creative, out of the box fashion'. The points made above also suggest considering innovation with new eyes. Countries from other continents also are letting their innovation policies evolve which, for the most influential of them, is expected to contribute to the emergence or consolidation of their leadership in the ICT sector. If failing to think in an 'out of the box' fashion, the EU bears the risk of being left behind while trying to catch up with traditional and 'proven' innovation practices. In a nutshell, Europe, a praised and recognized thought leader, is now facing the challenge of becoming a thought leader in innovation strategies. This may mean departing from current, even proven, practices to leapfrog other players in the global innovation race.

[1] Green paper on Innovation, European Commission, December 1995 (COM (1995) 688).
[2] The Oslo Manual, Guidelines for collecting and interpreting innovation data – 3rd edition – OECD Publishing, 2005

1.4. Two important reports have recently been published addressing the issue of Innovation in Europe: **"The Aho Report- Creating an Innovation Europe "** and the discussion note to the **informal Competitiveness Meeting of Finnish Presidency** in July 2006 "Demand as a Driver of Innovation- Towards a More Effective European Innovation Policy". Both reports highlight the importance of Innovation to Europe's Competitiveness but also draw on key "push-pull" aspects of R&D and Innovation:

"Push Aspects": the need to encourage R&D and investment through favourable innovation-friendly regulation, including "better regulation" and well defined intellectual property rights. Greater financing is equally important through structural funds, state aid, fiscal incentives and current funding mechanisms via the EC Seventh Framework Programme, European Technology Platforms and transnational EUREKA initiatives including CELTIC.

"Pull Aspects": the need to drive demand through public procurement[3] and the creation of leading edge markets in key public services. Europe needs to trigger more innovation by market pull from strong customer demand for innovative products and services.

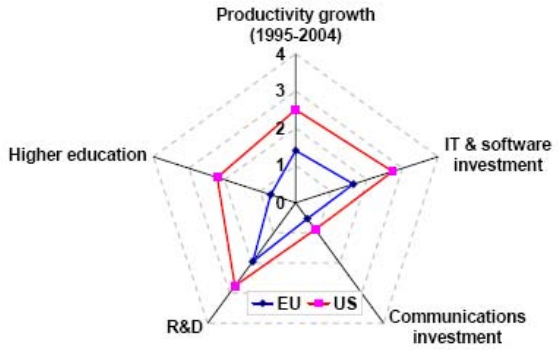
1.5 The European Commission also recently published a **Communication on Innovation "Putting knowledge into practice: A broad-based integration strategy for the EU"**. This Communication lists 10 broad action points on how to improve the framework for innovation in Europe with particular emphasis on: education, labour mobility, funding tools (structural funds, state aid, tax incentives), a favourable regulatory framework for key areas such as Intellectual Property Rights (IPR), lead-markets and public procurement.

All of these initiatives are critical to Europe in order to leverage the leadership areas which Europe currently holds in the ICT domain worldwide. The EC ICT Task Force fully endorses in particular the "Aho Report" and the EC Communication, and strongly urges that the European Commission and Member State authorities take these concrete actions forward.

[3] Pre-commercial procurement "building together innovative solutions that meet public needs", June 2006, European Commission.

Innovation, Productivity Growth and Global Competition:

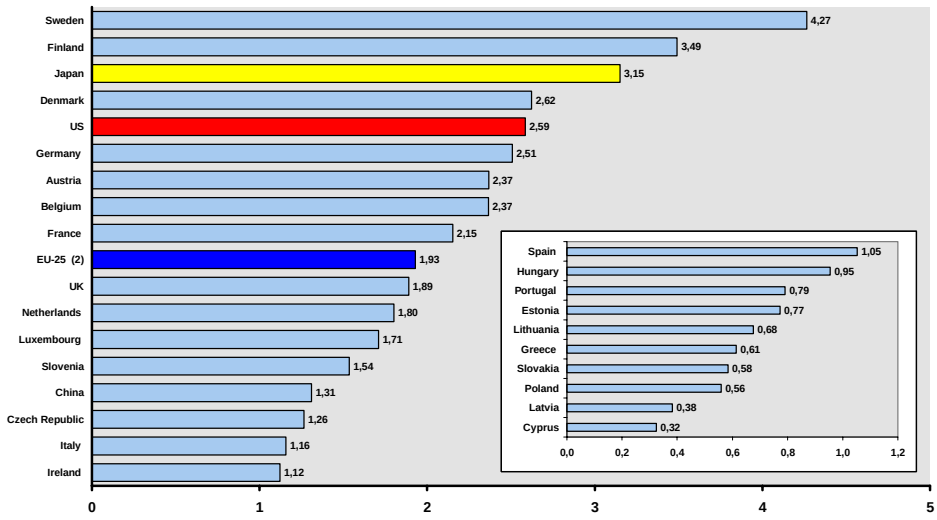
1.6. It is widely accepted that innovation is central to the growth of output and productivity. According to recent studies, the US achieves around three times the productivity payoff from ICT compared to Europe, with around 2/3 coming directly from ICT services: [6]



It has also been widely accepted that investment in ICT underpins future economic growth thus allowing European citizens and customers to benefit from: new services created including better public services, enhanced democratic processes, improved service quality and lower prices for existing services. ICT is also considered a key factor in facilitating European integration by allowing more effective cross-border provision and procurement of services.[7]

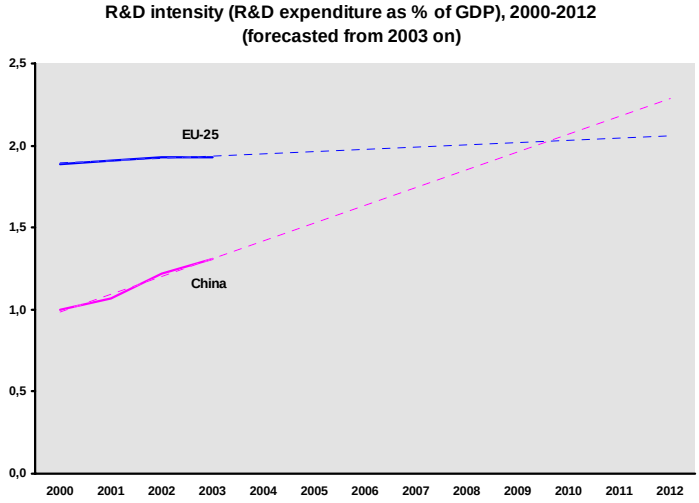
Europe however is currently investing less than other major regions in innovation, research and development. According to European Commission statistics, in 2003, EU R&D intensity was 1.93%, well below the US (2.59%) and Japan (3.15%), but above China (1.31%):[8]

Figure 2.2.1 R&D intensity (GERD as % of GDP), 2003 (1)



[6] "Restoring European Economic and Social Progress: Unleashing the Potential of ICT: Main Report", Indepen, January 2006, pp. 1-2.
[7] "Achieving the Lisbon Agenda: The Contribution of ICT", Indepen and Ovum, January 2005, p 4.
[8] Key Figures 2005 on Science, Technology and Innovation. Towards a European Knowledge Area. 19 July 2005, European Commission, DG Research, pg 2.

According to the same European Commission report, "if current trends for both China and the EU-25 hold on in the coming years, **China will have caught up with the EU by 2010 in terms of GDP allocated to R&D**":[9] (see graph below)



It must also be noted that major Chinese telecommunications suppliers such as Huawei and ZTE have recently entered the global ICT landscape and are proving to be strong competitors to global industry. Innovation in Europe must therefore respond to a strengthened internal market[10], but also **situate itself in the larger global market** in order to respond to global competition, **in particular competition from low-cost countries** such as China.

Summary of Overall Recommendations:

1.7 This report would like to emphasize the following recommendations that need to be prioritized alongside the current European Innovation Agenda.

Overall, Task Force members firmly believe Europe needs a strong "Push-Pull" innovation policy:

> The**"push side"** includes **strong funding** such as structural funds, state aid, EC Seventh R&D Framework Programme, a well-defined environment for IPR, and lastly, a favourable regulatory environment for future investment in ICT deployments.
>
> The **"pull side"** requires Europe to develop a **strong lead edge market policy** favouring its innovation in key sectors such as healthcare and in particular telecare as a response to ageing population or in applications such as tele-working as a response to growing transportation costs and rural isolation. A **pro-active European innovative public procurement policy** is also fundamental as done by other world regions to favour public and private procurement by large and small European companies.

[9] Key Figures 2005 on Science, Technology and Innovation. Towards a European Knowledge Area. 19 July 2005, European Commission, DG Research, pg4.
[10] The participants of this task force support the Finnish Presidency Report on Innovation which puts great emphasis on the Internal Market objective and to a well-functioning European domestic market which avoids fragmentation.
[14] The European Semiconductor Industry: 2005 Competitiveness Report, EECA ESIA, pg 2.

In particular, Task Force members would like to highlight the following specific recommendations for urgent action by European authorities:

1. The EC must play a key federating role in fostering **better exchanges of "innovation best practices" between Member States and regions.** This includes the following steps:

i) Any Member State that wishes to replicate innovation best practices in other European regions should be authorized ex-ante and encouraged to do so.

ii) In the long term, the EC might consider the creation of a "light" and flexible **European Agency of Innovation** which would have the key objective of making regional best practices known, and federating stronger links between the regions, with the overall objective of favouring large-scale European projects with global leadership ambitions in key ICT sectors (eHealth, eMedia, Mobile TV…).

iii) EU should push existing funding mechanisms (cohesion and structural funds, state aid, tax incentives, EIB loans) across European regions for innovation initiatives.

2. Prioritize **collaborative R&D partnerships** via currently developed European Technology Platforms (eMobility, NEM, NESSI…) and new Joint Technology Initiatives (Artemis and ENIAC) for well financed projects in the upcoming EC Seventh Framework Programme for R&D.

3. **The semiconductor industry** is a key industry in Europe for the entire ICT innovation cycle, with a major enabling role and a quite specific R&D and manufacturing situation. This warrants **specific measures dedicated to securing a global level playing field** with other industrialized regions in the world, achieving stronger support for manufacturing in Europe and strengthening ICT clustering potentials.

4.Launch a specific action to develop innovation ICT **services for innovation** in Europe. This includes providing research funding for innovation in services at all levels (European and national), create an academic discipline and research area aimed at improving the teaching of services innovation, create measures to promote entrepreneurship and learn from best practices in other Member States.

5. Focus on the **Human Dimension of ICT** by developing a shared vision with all stakeholders regarding the human factor impact on innovation process. This includes promoting schemes for lifelong education and training, establishing IT councils between industry and higher education institutes, and creating specific education initiatives aimed at attracting postdoctoral experts in Europe.

SECTION II: INNOVATION AND R&D.

Introduction to innovation and R&D:

We have only scratched the surface of what information communication technology (ICT) can do to improve people's lives and how it can drive growth and opportunity not only across Europe but across the globe. We also know that innovation is the heartbeat of growth and opportunity. In fact, the role of innovation in economic growth and productivity is well established. But for innovation to thrive, local conditions must be supportive. Research shows that economically powerful innovations originate primarily in advanced economies where commitments to a "knowledge capital eco-system" are strong. These commitments include investments in research and development, developing greater manufacturing capacity, barriers to starting new business models and services are relatively low, investing in human capital and respecting intellectual property rights (IPR), as well as having a stable and predictable regulatory environment which promotes investment in future deployment.

Key Features of ICT Innovation and R&D:

ICT relies on R&D more than any industrial sector, and the very nature of the ICT industry **requires short innovation cycles** which respond to new market demand. The semiconductor industry for example spends up to 20% of the annual revenues for R&D14. This R&D intensity is outstanding compared to other important industry sectors as automotive or chemistry. The short innovation cycles also more conducive to small companies. The will help to stimulate more innovative SMEs, especially if measures on support, working flexibility and entrepreneurship are taken on board.

The ICT industry also **depends upon an incubator climate** to flourish and produce value. Knowledge generation is always linked to knowledge diffusion which itself depends upon knowledge clusters for producing fast learning curves and generating momentum. Incubator climates like the ones found in Silicon Valley, Bangalore, Israel, Grenoble or Dresden serve as clusters in this respect. These ICT clusters all rely on important preconditions for success: access to capital, a highly skilled workforce, respecting intellectual property rights, as well as an open mind set for a multicultural society and a stable political and economic environment.

To sustain the success of a technology cluster requires another intersection – that of research and production. For example, the **proximity of research centres and manufacturing facilities**, as well as universities typically benefits technology transfer because it minimises delay and it expedites the knowledge transfer. Where research and manufacturing meet, effective networks between companies and research institutes emerge, attracting human capital which includes engineers, researchers and academics to share knowledge and experience, thus stimulating and accelerating the innovation eco-system and processes in a geographic area.

The development of such **technology clusters** has had an additional and significant macro-economic impact in terms of innovation, productivity and competitiveness. Besides the immediate effects on local economies and job creation, the unique position of the centres qualifies them to become global poles of competitiveness. These clusters are based on high standards of research and innovation, and promote advanced technology development

objectives in a chain of seamless interaction between industry, public and private research labs and universities.

ICT is also the innovative driver of applications in other key sectors such as automotive, industry, banking, government, and others. Innovations as ESP and ABS in the automotive sector, asynchronous electric drives for high speed trains, cash cards for banking purposes, or health cards for government demonstrate how electronic components are pushing more traditional industries into the future.

The dramatic efficiencies created throughout these many market sectors by the introduction of integrated circuits are due to the famous Moore's Law. Under this law, which is really a self-fulfilling prophecy for doubling the number of transistors on an IC every two years, the prices for semiconductor functionalities have diminished rapidly. Ten years ago, one Megabit DRAM cost USD 9. Today, that same one Megabit costs less than three cents of a dollar. This trend will continue as new applications and processes become more affordable for consumers which will drive the development of new products and services into the marketplace across Europe and the globe.

SWOT ANALYSIS: Innovation, R&D, Semiconductors, Services.

Strengths	**Weaknesses**
✓ Manufacturing science ✓ Technology know how ✓ Clustering examples ✓ Skilled European citizens ✓ Strong services industry ✓ Leading European ICT players in telecoms, semiconductors and consumer electronics ✓ Leading European users (citizens and industry) ✓ Good research programmes including FP, EUREKA, CELTIC	➢ Fragmented technology policy ➢ Fragmented markets ➢ Application & leverage of IP ➢ Poor interaction research & industry ➢ Access for SMEs to top institutes and capital ➢ Unattractive conditions for academia and research institutes ➢ Larger project funding out of scope of EU ➢ Heavy bureaucratic procedures for research programmes
Opportunities	**Threats**
➢ Tax incentives for R&D ➢ Incentives for co-operations industry/universities ➢ State aids for innovative/leading edge technologies ➢ Incentives for new technologies in the sciences ➢ Excellent research initiatives including ENIAC; Artemis, NEM, eMobility, NESSI.. ➢ Increase coordination and complementarity between EU and MS research programmes	➢ Not enough public R&D spending for ICT ➢ Insufficient number of skilled researchers in Europe ➢ Brain drain at university level and research centers ➢ Slow decision making processes and solutions in EU to address ICT issues (eg: FP7, research programmes, SME access) ➢ Lack of innovation programmes that bring research to market

R&D Options and Recommendations for ICT Innovation and R&D:

The aims of the recommendations below are to promote innovation and competitiveness by creating a global level playing field in R&D in Europe, as well as investing in new technologies that will keep Europe globally competitive.

ICT Task Force members call upon the European Commission to:

1. Foster better exchanges of innovation best practices between regions:

European regions today already have a number of excellent innovation initiatives which should be better leveraged across the EU. Three key examples are:

Flanders Region in Belgium: (www.ibbt.be)

Both the Belgian national government and the region Flanders government have established a number of measures to make it one of the leading innovation centres in Europe and worldwide. This includes a combination of:

- **Fiscal measures at Member State level: for research under a collaboration framework with universities or research centres (50% income tax withheld on the gross salary of company researchers. Also fiscal advantages for R&D personnel (PhD and MS in engineering of up to 25% on gross researcher).**
- **Belgian Innovation Premium for innovators within companies**
- **A public fund set up by the Flemish government (Arkimedes: 75Million Euros) dedicated to promotion of innovation and growth from the innovation process to the first intervention of venture capitalists.**
- **Regional Centres of Excellence, strategy research centres and technology transfer institutes: An excellent case in point is the IBBT: Interdisciplinary Institute for Broadband Technology: aims to combine groups from Flemish universities and research institutions into a cohesive interdisciplinary research centre in the field of information society. It is "demand driven" and constitutes an important benefit for industry technological innovation while positioning Flanders as an international scientific leader in all aspects of ICT communications, applications and infrastructure.**
- **Flanders Innovation Pact (3% Barcelona agreement): projects for industrial basic research activities receive a subsidy of 50% overall project costs (additional 10% for SMEs); projects for industrial development activities receive a subsidy of 25% (with an additional 10% for SMEs). SMEs can also appy for loans of up to 80% of project costs. Project for strategic basic research in specific R&D programmes with industrial relevance gain a full subsidy of 100%.**

Innovation Agency in France: (www.aii.fr)

In 2005, France created an innovation agency as a means for renewed industrial policy focused on the high tech sector. The main mission is to prompt European high tech companies to invest more into research and innovation to strengthen Europe's industrial share on global scale. Support is provided only if there is an identifiable risk that cannot be taken by industry on its own and focuses on development, manufacturing, all the way to market commercialization. Key sectors such as ICT, energy, environment, transport, biotechnology,

health and chemistry have been targeted. Over 1.7 Billion Euros have been dedicated to projects over the period 2006-2007. The programmes are open to participants from European countries following the "best-in-class" critieria.

France has also created regional poles of excellence to stimulate regional employment as has been the case in the Flemish region.

The Finnish ICT policy:

The Finnish Ministry of Trade and Industry with support from the Prime Minister has over the past 15 years had a leading role in the promotion of intensive ICT use in enterprise. This is a mix of support measures and direct government intervention in areas where that created the potential for use.

Typical examples are:

1. The clusters around the main cities across the countries, where a local development centre works together with the local county government and the main industrial groups to create a close weave of enterprise exchange in target areas,
2. Example is the Karelia region that from a rather depressed area after the USSR collapse became a sophisticated one leading in e.g. eInvoicing and small/big company integration,
3. Finland is one of the more advanced countries in eFinance and leads in eInvoicing across borders with the Living Lab project,
4. The government provides at highly subsidized cost expert advise from Business Angel consultants, closing the gap of entrepreneurship; this gives start-ups a much better chance to succeed and fosters innovation in practice
5. Further generous support is available to go to the market with new products; it bridges the gap in support for European programs that simply do not allow enough speed in implementation.
6. Like in other countries TIEKES is the national ICT institute that does a lot of the more structural development and research.

The Finnish government made a Nordic strategy in 2004 and now revised the ICT strategy with all players, including the development centres and SME entrepreneurs with the politicians and ICT experts of the national institute TIEKES. It is this comprehensive approach including all players with the regular update and the supporting means that has created a lot of new companies and innovative ideas in Finland. It is often forgotten that apart from Nokia there is no large ICT company in Finland. But we expect that in the coming 2-3 years a lot of the drive for innovation will come from Finland from the small players.

There are many other initiatives which exist across Europe, but which lack exposure beyond the regional level.

EC ICT Task Force members would therefore recommend:

1. **The EC must play a federating role in fostering better exchanges of "innovation best practices" between Member States and regions through the following steps:**

- Any Member State that wishes to replicate innovation best practices in other European regions should be authorized ex-ante and encouraged to do so.
- In the long term, the EC might consider the creation of a "light" and flexible European Agency of Innovation which would have the key objective of making regional best practices known, and federating stronger links between the regions, with the overall objective of favouring large-scale European projects with global leadership ambitions in key ICT sectors (eHealth, eMedia, Mobile TV…).
- EU should push existing funding mechanisms (cohesion and structural funds, state aid, tax incentives, EIB loans) across European regions for innovation initiatives.

2. **Prioritize Collaborative R&D Partnerships:**

- The current **ICT European Technology Platforms** (eg. eMobility, NEM, NESSI…) and **Joint Technology Initiatives** (eg ENIAC, Artemis) which are being developed must be supported with **adequate funding levels** in the upcoming EC Seventh Framework Programme.

- The practice of collaborative R&D partnerships such as **ICT European Technology Platforms and Joint Technology Initiatives** should continue to be enhanced and promoted around a limited number of large ICT projects. It should be actively promoted not just horizontally among companies in the same segment, but **involve entire ICT supply chains**, as well as emerging computing science based research and universities. In practice, cooperation along the supply chain is happening and has shown its positive effects in Europe. On Small business PIN-SME is trying to **include the SMEs** more in these developments. This alone should induce more stakeholders to mobilize highly creative and innovative potential that remains under-exploited.

3. **Reform EU State Aid Policy to create a global level playing field:**

While DG Competition is currently carrying out a public consultation on State Aid and Innovation, ICT Task Force Members would like to offer the following comments:

- The current reform should take into account the evolution of the knowledge based-economy and its constant and quick innovation process. The linear model of innovation with sequential R&D stages has become outdated. The obsolete, artificial distinction between "industrial research" and "experimental development" should be abandoned. **Instead, a single category "industrial R&D" with allowable aid intensity of at least 50 % should be created**. This category should speed up the innovation process to face global competition and should also include the development of commercially usable prototypes, pilot projects, experimental production and product testing.

- The framework should foster a level playing field, not only within the EU, but also worldwide. The European Union should take benefit **of the use of State Aid for R&D and Innovation to face the worldwide competition in particular in key sectors such as telecommunications and ICT.** Internal Market and possible distortion between Member States is important, but in the face of global competition, companies in the EU should not suffer from a disadvantage vis-à-vis their competitors outside the EU, where rules and controls on R&D subsidies generally do not exist and generous incentives schemes often apply.

4. **Prioritize leading edge markets and a European public procurement policy:**

Creating a technology market pull is a more successful strategy than solely technology push. U.S. Department of Defense projects, like the development of the Internet, show how sophisticated medium or long term procurement projects that are part of a comprehensive approach can foster the competitiveness of an industry. Similar activities are possible in Europe today: car to car communication, mobile ultra broad band networks, health, telecare, and embedded systems may serve as incubating projects for new innovative products and services.

As stated by the "Aho Report " and EICTA's recent White Paper on Innovation[15] , firms only invest to the extent that they can expect a sufficiently attractive return. Therefore to trigger more innovation in Europe, market pull from strong customer demand in Europe for innovative products and services is essential. Europe has a pool of innovative technology leaders and a significant market of users. It therefore has the potential **to create lead markets for ICT technology intensive goods and services** by fostering the deployment of innovative technologies. With Europe's current enormous social and economic challenges (ageing population, rural isolation, transportation, environment, security…), public authorities can play a leading role to launch innovative markets with important growth potential.

- European authorities must play a leading role to **launch pan-European innovative lead markets** with important growth potential. There are a number of key sectors worth leveraging EU leadership including **healthcare, remote homecare, mobility (teleworking, Mobile TV), digital content, eLogistics, transportation, security and monitoring.** These initiatives are fragmented

[15] "i2010 Increasing Innovation, Research and Development in Europe for ICT Excellence". ICT Industry White Paper Addessing the Second Pillar of the i2010 Initiative, EICTA, September 2006.

across Europe and need to be leveraged on a pan-European scale in order to respond to increased European large-scale private investment and citizen demand for these services.

- A simple and direct measure that could be easily taken in the short-term by authorities is to mandatorily **pre-cable new housing and business development sites in Europe** with fibre and indoor broadband radio solutions to promote innovative European technologies, applications and services.
- On **innovative public procurement**, key areas such as health, mobility and security need to highlighted. A significant amount of European public procurement should be dedicated to innovative products and services and to underpinning R&D in the ICT domain.

5. Support emerging innovation strategies based on openness. [16]

The term open innovation has been proposed as opposed to closed innovation to describe the process of "combining internal and external ideas as well as internal and external paths to market to advance the development of new technologies"[17]. However benefits of openness in innovation extend beyond this[18]. When dealing with innovation, the specificities of the ICT sector must be taken into account. One of the most salient is the production of both material/physical (e.g. consumer electronics) and information/digital (e.g. software) goods – and compounds of them. Material and information goods are extremely different and it is necessary to set up an innovation policy for the ICT sector that differentiate between these various kinds of artifacts. Emerging models of innovation based on openness leverage the 'non rival' nature of information goods and gain increased global impact while relying of continuous, incremental, peer production practices that are poorly captured by traditional innovation measurement techniques. Open source software is one example of collective work, often performed by individuals or companies and which delivers quality and sustained innovation without protection of creation being a central motivation[19].

[16] The following recommendations have been proposed by Objectweb and do not meet the consensus of Task Force members, in particular the recommendation on IPR.

[17] Definition borrowed from www.openinnovation.eu

[18] Open Standards, Open Source and Open Innovation: Harnessing the Benefits of Openness – A report by the digital connections council of the committee for economic development, April 2006.

[19] See e.g.: 'Perfectly Competitive Innovation', by Michele Boldrin (University of Minnesota and Federal Reserve Bank of Minneapolis) & David K. Levine (University of California, Los Angeles), 2002

Recommendations:

- Academic studies of innovation based on openness should be supported through adequate funding from independent sources (e.g. through instruments such as EC-funded research projects). Appropriate metrics and measurement methodologies need to be developed. Such metrics need to be elaborated in an "out of the box" fashion, so to reflect not only direct economic impact in the ICT sector, but also the enabling effects and externalities of innovation based on openness.

- The European IPR policy should keep a balance between the need to protect innovation and the opportunity to favour incremental innovation in an open context[20]. As examples, the burden of proof should be on proponents of new rights and registration of prior art should be facilitated so to reduce the risk on incremental innovators; for digital goods, this may be achieved by facilitating (with regulatory and technical measures) or even automating on-line registration of prior art at no cost.

- Technical means for remote inter-personal communication, telecommuting, collaborative online work and management should be improved. This should include public incentives which would create demand for such systems and result in a pull effect on the ICT sector itself (need for broadband networks, adequate telecommunication services, etc). Open standards play a pivotal role in the development of infrastructures software in the information society: two features are essential to the deployment of the information infrastructure needed by the information society: one is a seamless interconnection of networks and the other that the services and applications which build on them should be able to work together (interoperability)[21].

- When dealing with information goods, and in a very much "the fab is the lab" fashion, Virtual clusters should be put in place as alternative to traditional clusters. This would bring answers to the increase of transportation costs and environmental impact and give opportunities for enhanced territory management. Such virtual clusters should be targeted to great challenges and provide the necessary environment (in terms of infrastructure and services) to facilitate the leverage of open innovation.

- In order to leverage innovation based on openness for the benefit of the ICT sector, bridges should be built between communities with *grass-root* structure, academia and the business world. This may be achieved through 'meta-organizations' able to federate both individual and organizations around innovative activities based on openness. The European Institute of Technology[22] could play an important role in this. It should include a virtual, distributed unit targeted to innovation based on openness. Activities should be structured according to the best practices of current

[20] „Ten priority actions to achieve a broad-based innovation strategy for the European Union", MEMO/06/325, September 13, 2006 – Action #7

[21] "Europe and the global information society", Bangemann report recommendations to the European Council, (May 26, 1994) – http://europa.eu.int/ISPO/infosoc/backg/bangeman.html

[22] „Ten priority actions to achieve a broad-based innovation strategy for the European Union", MEMO/06/325, September 13, 2006 – Action #2

innovative communities (e.g. open source software, Wikipedia[23] and similar initiatives, etc). Learning, research and creation would be mixed in a single overall process, innovative production be peer-reviewed and registered as prior art in real time and made available to all in an open way, so to impact the industry and civil society at large through appropriate business models.

- In parallel, appropriate funding mechanisms should be designed at the European level to facilitate the deployment of open innovation systems, leveraging on EU public funding and debt and equity instrument of the EIB group.

[23] http://www.wikipedia.org

Section III: Innovation in ICT Manufacturing: The Semiconductors industry.

3.1. ICT Manufacturing - Critical importance of semiconductors

For the ICT industry to fully play its enabling role for the economy as a whole, and to assert its competitive advantage ICT manufacturing is challenged to provide most advanced technology and production capacity.

Adequate access to ICT producing industries for all economic actors, from large companies to SMEs, and at all geographic levels of the Region is a prerequisite to winning the productivity race. At the same time ICT producing industries will only survive if they are able to exploit and leverage the innovation potential of R&D for advanced technologies.

The ICT producing manufacturing sector covers a very large basis of industrial activity ranging from office, accounting and computing machinery; to insulated wire and cable; semiconductors and other electronic components; communication and broadcasting equipment; radio and TV receivers; medical and measuring equipment and industrial process control.

Overall ICT manufacturing still represents a sizable share of the total ICT sector: on average for the EU25 about 20% turnover, 25% employment, 10% enterprises, with significant differences among member states. Although its share in GDP is on average not more than 10% ICT manufacturing capacity in Europe continues to play a significant and vital part of the European industry in terms of employment, productivity, and contribution to leading end-user segments such as automotive, industrial goods, medical equipment, transportation, and financial services.

Semiconductors are at the heart of the ICT value chain and their manufacturing makes up a major part of ICT manufacturing - hence the critical importance to stress here the role the semiconductor industry plays for ICT overall.

Because Semiconductors play a key enabling function for the industry at large, it must be highlighted here that innovation in the semiconductor industry is closely tied to the manufacturing of chips that rests on most advanced and innovative process technologies.

The enabling function of semiconductors works the best and can exert its push and pull effect when a strong interdependence exists between the innovative providers of semiconductor devices and the manufacturers who are integrating silicon-based systems solutions in the production of electronic equipment or end user products.

So far Europe has greatly benefited from the proximity between locally based semiconductor manufacturers and end-user equipment manufacturers' applications in industry segments such as wired and wireless communications, automotive, consumer and industrial equipment goods, computer and electronics.

3.2. Importance of innovation in semiconductor manufacturing

The semiconductor industry still operates under a vertically integrated approach from customized systems solutions to device engineering and complex chip design to R&D and process technology innovation, approach in which manufacturing plays key role. In Europe there are today over 100 semi-conductor fabs for diffusion (so called front-end manufacturing) belonging to more than 20 companies, mainly located in Germany, France, Italy the Netherlands, the U.K. and Ireland.

In the semiconductor industry a fully equipped production line is a prerequisite for research and innovation. A consequence of increasing process complexity, the investment required to set up semiconductor diffusion facilities has increased dramatically too. The cost for a leading edge fab with front-end production lines has doubled between two technology generations; today to set up a new 300 mm fab amounts to at least 2,5 billion € and have to be depreciated and re-earned within five years. For that reason the semiconductor industry has investment intensities of about 20 % of the turn over with research intensities of the same magnitude.

Therefore, ICT manufacturing, and in particular semiconductor manufacturing, faces the challenge of providing the most advanced technology and production capacity while at the same time having access to significant capital investment in order to assert its competitive advantage versus other world regions. In Europe, capital investment for the semiconductor industry in recent years has been approximately 8 percent of total world investment only. If this trend were to continue, or even deteriorated, the very existence of critical manufacturing infrastructures in Europe would be at risk.

A detailed comparison of tax and investment incentives shows a significant difference between Europe and the other regions. A “model fab” study, using actual tax incentives and cost information for different locations concludes that governmental support outside Europe, associated with favourable production conditions, have eliminated the attractiveness of Europe for the semiconductor industry. As a consequence, capital investment in Europe has, as already mentioned, substantially declined in recent years and if the situation does not change, local manufacturing will continue to be reduced. (See: Comparison of establishing a "model fab" in Europe vs. Asia-Pacific, in: 2005 Semiconductor Competitiveness Report, ESIA)

3.3. R&D and innovation of process technologies: "The Fab is the Lab"

There is a converging industry view that between advanced R&D, innovation and leading edge manufacturing there is a very strong relationship that is today the prerequisite for competitive success in the global market.

In order to face the competitive challenge, innovation and investment in most advanced process technologies capable to manufacture the ever rising complexity of chip sets is critical.

The capacity to design and produce chips using the most advanced technologies requires very sophisticated processes and production equipment that a scientific lab is unable to provide. The Fab is the Lab is a reality that deserves highest attention when recommending measures for R&D innovation in ICT.

A typical chip production process consists of about 500 process steps like etching, implanting or photolithography. In the semiconductor industry every single process step has to have an efficiency of at least 99.99 %. In order to establish that a newly invented process step has an

efficiency of 99.99 % vs. say only 99%, a large number of repetitions of the same process step within the full process line have to be conducted and measured in order to achieve statistic significance. Moreover, the new process step has to prove its efficacy as far as chip performance is concerned before it becomes an end product: A fully equipped production line therefore is an absolute prerequisite for research and innovation.

Semiconductor industries based in Europe have found ways to actively cooperate on the process technology development, while remaining competitors on product development. Several research programmes have been launched under the Eureka umbrella, like Jessi and Medea, which have strengthened the technology capability in Europe and have been a catalyst to join efforts in the entire electronic food chain so as to recover any gap versus major players of the USA, Japan or Asia-Pacific regions.

At the same time, European industries and research institutions (e.g. IMEC-Leuven, CEA-Leti-Grenoble, Fraunhofer-Dresden) have developed a manufacturing science that so far has allowed them to remain competitive and capable of fast ramp up of mass production. This science includes deep knowledge of methods, tools, process steps and engineering knowledge that enable the fast improvement in the mechanical and electrical yield of newly developed processes and products. However, there is pressing need from both the industry and specialized research labs to keep pace with the ever accelerating scientific development of emerging new technologies.

3.4. **The proximity of research and manufacturing is key**

The importance of technology clusters extends increasingly to the world economy. It is the power generated by creating clusters of common interests, aligning IP and standards, innovative chip designs with the most advanced process technologies, systems intelligence with applications matching consumer expectations that makes a decisive difference in the global economy.

The proximity of research and manufacturing facilities benefits technology transfer and the creation of an Eco System of Global Centres of Excellence (see semiconductor clusters such as Dresden, Grenoble and the Nijmegen-Eindhoven-Veldhoven-Leuven area, or the development of semiconductor facilities in Ireland, Catania and Avezzano).

Where research and manufacturing meet, effective networks between companies and research institutes emerge, attracting engineers, researchers and academics to share knowledge and experience, thus stimulating and accelerating the innovation processes in a geographic area. Customer proximity provides competitive advantage: in the case of electronics, access to funding and leading edge equipment in the case of commodities, as well as a highly skilled work force, are essential in determining investment patterns.
The development of such technology clusters has had an additional and significant macro-economic impact in terms of innovation, productivity and competitiveness. Beside the immediate effects on local economies and job creation, the unique position of the centres, based on their high standards of research and innovation, advanced technology development objectives along with the seamless interaction between industry, public and private research labs and universities, qualifies them to become global poles of competitiveness.

3.5. **Recommendations for Innovation in ICT Manufacturing**

1. Ensure a global level playing field for ICT manufacturing investments, in particular for the semiconductor industry:

Establishing an even level playing field addresses the necessity to reach comparable incentives and regulations in terms of market entry, factor costs and legislative environment between regions and/or nations, thus avoiding disadvantages like the ones the European semiconductor industry is experiencing today[24].

- Device a European industrial policy that ensures a level playing field across the board for large R&D / manufacturing investments, tax advantages, access to production factors, import and export regulations requires the adoption of appropriate incentives and funding schemes, closing legislative gaps, offering attractive international cooperation opportunities and partnership initiatives.

- Implement measures in order to fight against unfair competitive advantages by urging concerned states in other world regions to eliminate support schemes that may distort international trade rules based on free competition and industry competitiveness;

- or provide incentives of equal importance and relevance as those prevailing in other regions and ensuring that they fall under the tight remit of global trade and competition rules and do not endanger the free trade environment which the industry depends upon.

2. Support very large ICT manufacturing investment projects, in particular in the semiconductor industry

Investing for ICT manufacturing in Europe looks at factors that have a sustained effect on the competitiveness of the European semiconductor industry. Focusing on stronger capabilities in R&D, technical education and industry partnerships will impact the future orientation of the industry's economic environment and can be determinant for its sustainability and competitiveness over time.

- Similar to other industrialized regions, create a specific Sectoral Framework for the Semiconductor Industry implementing policies that facilitate access to, and availability of, short and long term risk capital able to attract new and ongoing investments in strategic electronic manufacturing and counterbalance artificial advantages that other world regions provide.

- Focus on projects in the leading edge technologies and new diffusion plants that are essential for the future of the semiconductor industry, as other governments have recognized. Thanks to an industry-proven leverage effect, any incremental support will additionally create high-skilled jobs, induce indirect job creation and enable leading innovation for breakthrough technologies to be developed and manufactured in Europe.

[24] See: comparison of establishing a model fab in Europe vs. Asia-Pacific, in: 2005 Semiconductor Competitiveness Report, ESIA.See also recent examples of packages in Texas or New York or FT July 13, 2006 'Beijing to finalize chipmaker policy'

(Note: The current European multi-sectoral framework for big investments allows European state aid intensities of less than 15 % for the same investments, and this only in poorer regions of Europe, since the European state aid policy is more a matter of regional than industrial policy. In other words: this is a prerequisite for innovation and research in the semiconductor industry without which the fabs are at risk to be leaving Europe).

3. Dedicated measures for investing in ICT manufacturing activities in Europe

- Implementation of a generalised tax credit system on R&D and technology innovation for priority ICT manufacturing activities, in particular in the semiconductor industry.
- Strengthen the leading role of existing future-orientated programmes focused on technologies that are able to ensure a leading edge role, programmes such as Medea+, ENIAC, and Artemis in particular, together with some other European Technology Platforms.
- Promote effective and globally competitive clusters or centres of excellence / poles of competitivity between all concerned stakeholders, with a particular focus on increased three-way cooperation between industry, university and government.
- Facilitate multiple partnerships among ICT manufacturing players– thereby also encouraging co-opetition. Setting up a limited number of mega-projects relevant to the ICT manufacturing community is essential for its future presence in Europe.
- Recognize use of and reward synergies between R&D and manufacturing within companies (e.g time-to-market, time-top-volume).
- Better align the educational system in Europe with ICT industry priorities in order to maintain and enhance competitiveness.

Section IV: Innovation in Services

Traditionally considered as a heterogeneous 'left-over' collection of activities that are not included in the agriculture or industry sectors, the services sector has, until recently been a neglected area of economic policy making[25].

However the services sector in the European Union (EU) is growing considerably and now accounts for over 70% of total EU economic value added[26]. Services are essential for the efficient operation of an economy, facilitating commercial transactions and enabling the production and delivery of goods and other services. Services are provided by a mix of large and small actors, but 99% of the services are provided by SMEs, with in IT alone 350,000 companies and an estimated 1 million employees[27]. As companies learn to trade products and services in new ways, often through ICT, services have become a pillar of the European economy. A country with an open, dynamic and efficient service sector enjoys a competitive advantage in the production of both goods and services, as compared to countries with less developed service sectors.

When we think of services we may not appreciate the breadth of economic activity that they encompass: the engineer's network design, the barber's haircut, the doctor's diagnosis, the waitress's service, the architect's building plans, the carpenter's craftsmanship and the consultant's business strategy.

What is a Service?

The term *services* covers a broad range of activities that is difficult to encapsulate in a single definition.[28] Services are activities that produce value by providing solutions to customer problems. Services may create change in the customer or the customer's assets. The service sector includes everything from child care, to legal advice, to custom software development and management consulting. In some cases, it is not easy to separate services from the goods with which they are associated, such as an extended warranty purchased with a consumer electronic device or the rental of an automobile. Services can also be embedded in a manufacturing process, as manufacturers procure inputs, such as inventory management and logistics services, from service providers, rather than perform these functions themselves.

[25] European Trend chart on innovation in services.
[26] OECD, growth in Services, p.1.
[27] Reference?
[28] UNCTAD Manual of Statistics 2005, p.208.

Over 70% of EU employment is in the services sector and this figure is set to rise in the coming years[29]. Services have been the source of most job growth over the last decade.
One misconception about the growth of the service sector is that it is creating more low skill, low value jobs than high skill, high value jobs. While the service sector includes some low-skill jobs, many other service jobs require high levels of skills or advanced education to perform complex tasks in the information economy. In fact, the percentage of employees with a college degree is greater in the service sector than in the manufacturing sector[30].

For the purpose of the recommendations of the ICT Competitiveness Task Force, we focus on innovation in ICT services, ICT-enabled services and knowledge-intensive services. The pace of growth in business services (i.e. those supplied to other firms, such as computing, financial, legal, consulting, advertising and marketing services) is spectacular, even measured against those of other services sectors. A Commission Communication on business services[31] noted that they provide 8.5 % of total employment in the EU, and 15.3 % of value added (more than banking, insurance, transport and communications services combined).

However, as know how becomes easier to duplicate, competitors catch up even faster. Continuous innovation in the services sector is a must. The provision of services can increasingly be done elsewhere. In particular low- and medium skilled jobs, which are not culturally, time-zone, geographically, or language dependent can be easily provided from any location. The issue we have to address at a European level is how to best create high value jobs. EU policy makers and national governments need to establish the right framework conditions to support companies in creating demand and supply for high-value services. An urgent call to action to become more systematic about services innovation is necessary.

Transforming Europe into a knowledge intensive and globally competitive services economy is, even with sufficient investment for research in software and services, not straightforward. This requires a paradigm shift through complementary investments and changes, e.g. in human capital, organisational change, education, trust and security. It is paramount that we manage the transformation to a European services economy not only from a technological but also from a socio-economic and human capital perspective.

In this respect we warmly welcome the European Commission's intention to adopt a Communication on Innovation in Services and would hope that funds are made available for studies and sharing of expertise on services as a top priority for the EU. We strongly hope that more in-depth analysis will reveal that the services sector is, contrary to a widely held misconception, creating high-skill, high-value jobs.

We also appreciate the work of the 'Trend Chart' initiative on innovation in services which is collecting supportive information in the Member States to promote innovation in the services sector and the establishment of an expert group on innovation in services. Exchanging best practices among Member States is crucial. There is also a need to improve the flow of reliable statistics and we appreciate the Commission's work already under way, however more efforts are necessary, especially at the level of Member States.

Innovation in services is a critical factor in increasing competitiveness and accelerating economic growth. Governments should create "innovation ecosystems" to promote

[29] OECD, growth in Services, p.1.
[30] OECD, Promoting Innovation in Services, p.26.
[31] 'The contribution of business services to industrial performance' COM (1998) 534 final.

innovation in services by pursuing an integrated, coherent approach across a number of policy areas, including the following:

Enhance existing research schemes to embrace services sciences

Government innovation policies, R&D budgets and programs have historically focused on hard sciences and manufacturing. This needs to be rebalanced given the fact that services are the source of most jobs and economic activity. How these programs are designed is important, because the innovation process in services can differ from that in manufacturing.

In addition to continuing fundamental research in science, technology, engineering and mathematics, there is an increasing need for multidisciplinary research into the role of services and how to improve them. There has been a fundamental shift in the way enterprises — small, medium, and large — exploit external niche services, collaborating and sharing services with specialized partners worldwide in order to produce goods and new services faster, cheaper, and better. In addition, small companies possibly only a few people strong, services boutiques and services organisations are beginning to emerge rapidly over the web to offer specialized services. These are as diverse as home-bound call-centers, advice on social issues or the provision nutritional information to needy social groups. The phenomenon of 'services commons' is beginning to spread across globe because of the rapid reduction in the costs of creating and providing services. Predicting the impact of these changes is difficult - understanding the micro- and macro- dynamics of services are major challenges and need dedicated research efforts. In this respect it will be an important challenge to develop methods and models that fit the small operators, as so far most organizational improvement studies focus on the large organizations. Too little attention has been spend on how to optimise smaller operators and link the service efficiencies to the way they operate.

Research funding plays an important role in stimulating service sector innovation. Research could help solve problems that ICT services providers face in managing and ensuring the reliability of complex service delivery systems. Research can also aim at better understanding the non-technical aspects of service-sector innovation, in particular organisational innovation, drawing on advances in the social sciences and management.

- The European Commission and the Member States should establish dedicated R&D programs to address the challenges ICT services face in managing and ensuring the reliability of complex service delivery systems and better understanding the non-technical aspects of service-sector innovation, in particular organisational innovation, drawing on advances in the social sciences and management. Our ability to analyse, design, deliver and manage innovation in services, in both industrial and social contexts will help developing a competitive advantage with respect to other global players. Research priorities identified by the NESSI (Networked European Software and Services Initiative) and other initiatives such as PIN-SME should be actively promoted.

- The European Commission and Member States should support organizations that work in sector-related clusters and to stimulate the innovation cycle of services in these areas.
    - Belgium has an abundance of pharmaceutical related services, due to the well established pharmaceutical industry.
    - Netherlands has developed considerable expertise in IT services related to the logistics sector, due to the mature logistics industry there.

- The European Commission and the Member states should create a tax environment to support the service sector. Where appropriate R&D tax credit that includes R&D in services and business processes should be implemented. We must ensure that tax laws do not hinder the development of an efficient domestic service sector or discourage service exports.

Provide Skills & Education for the Services Economy

Skilled and creative employees are a fundamental factor in the innovation process and a major source of competitive advantage. In the Agricultural Age, land and farm production defined competitive advantage. In the Industrial Age, it was raw materials and manufacturing capability. Today, it is the ability to create and apply intellectual capital based on multidimensional expertise – increasingly in the area of services. Workforce skills must include both technology and strategic expertise. An understanding of technology – its current capabilities as well as its future potential – is now integral to business decision making. Importantly, these skills are not static, requiring continual refreshing through life-long learning and retraining.

In the past IT services were all about "repair and maintenance." Today, services are about optimizing business. There is a lack of people in Europe with both IT and business skills which understand the new role of IT services and who be interested to work at a European level. This is probably the biggest challenge for Europe: create a mobile workforce which can operate across the cultural and language barriers.

The continuous renewal of employees at the larger companies and the trend to outsource work to other continents will provide the SMEs with a valuable source of IT-workers that can mostly cope with the SME-user business needs. But also for this category of IT-workers there is a need for continuous updating of technical level. This should be completed with adaptation courses to make them match better with the IT-SME world of thinking and operating.

Consequently we need to adapt education and training policies to rapidly changing requirements for new skills and create a new discipline for services sciences. Services science is a multidisciplinary field that seeks to bring together knowledge from diverse areas to improve the service industry's operations, performance, and innovation.
In essence, it represents a melding of technology with an understanding of business processes and organization. It is a shift from a technology-centric view to a holistic view that encompasses both technology and business. Professionals need new skills and education in a variety of fields to yield the best results in service industries. It is critical to develop and foster a broad perspective that includes research from many areas, including economics and law.
Germany and Finland recently organized a series of high level conferences on service innovation & services science to foster a stronger collaboration between business, government, and academia on this topic.

- Governments, industry and universities together must enable the creation of a new academic discipline on Services sciences, Management and Engineering to bring together ongoing work in computer science, operations research, industrial engineering, business strategy, management sciences, social and cognitive sciences, and legal sciences to develop the skills required in a services-led economy. Also schools should be involved in this process. There will be a change from ICT workers with specialized technical skills towards hybrid professionals with competencies in

business or scientific areas beyond traditional ICT who will be able to respond to the challenges of a more dynamic service oriented economy. Well targeted education policies will have a significant positive effect on the competitiveness of the European ICT and knowledge service providers given the sector's dependability on highly skilled workers.

- The European Commission and the Member States should increase eSKill knowledge at SMEs, use the IT-SME and eEnabler infrastructure better and create continuous learning programs that keep the IT-worker up to speed.

Creating New Working Environments & Employment

In OECD countries, most employment growth over the last decade was due to services, and in particular business services[32]. Services are the only part of the European economy that has generated a net employment gain over the past two decades (now accounting for over 70% of all jobs). However, it is important to recognize that the ICT marketplace is continuing to change – and change dramatically – and that the skills and working methods needed in that changing marketplace have to be further developed. This is all happening fast, and in many different dimensions.

More ICT customers/clients are buying on the basis of business value, and not on the basis of technology. This will result in a major restructuring of enterprises in Europe including the virtualisation of enterprises. Work will be more mobile, migrating back and forth between centres of activity as people with the right skills migrate to where work is needed. In this context the modernisation of working environments will be crucial.

More people will work in more flexible arrangements including self-employment and teleworking. This could raise issues in a variety of policy areas including employment legislation. It will be crucial to anticipate and facilitate change to help to improve our competitiveness and will contribute towards a better quality of European working life.

- The European Commission and Member States should promote employment policies that provide greater adaptability of firms and workers to better anticipate and facilitate change. By transforming Europe into a services economy we will move 'up market' to secure higher level jobs in management, problem solving and creative thinking. Participation of SMEs in this process should be guaranteed as more flexibility in work and employment will allow them to increase their competitiveness.
- The European Commission and Member States should promote economic conditions that would allow for more mobility between senior researchers, technologists and managers in industry and academia to improve realisation of the value of the intellectual property created in Europe leading to a more dynamic entrepreneurial culture.

Removing barriers to the Internal and Global Market for Services

[32] OECD, Promoting Innovation in Services, October 2005, p.9.

Despite the service sector's large share of the economy, services account for only 20% of intra-EU trade. Trade in services at a global level accounts for 20% exports. One reason for the low level of trade in services is that significant trade barriers exist across a range of services sectors in many countries.
ICT is enabling trade of many knowledge-based services and creating tremendous opportunities for exports to other Member States. Many successful services companies owe their existence and success to the opening up of markets. Opening services markets will create fresh opportunities for firms to develop new, often ICT-related, services and meet emerging global demands. In many ways business services companies are the model enterprise in the new economy – they trade heavily in 'knowledge' products, are often built primarily in intangible assets (such as people) and are particularly well placed to exploit the potential of the new ICT marketplace.

We need to achieve a legal and administrative framework, which allows for cross-border movement of services within the EU, ideally enabling enterprises to easily export innovative services business models beyond national borders. In this context business would like to remind the importance of the mutual recognition and country of origin principles for the creation of the internal market in services as laid down in the EC[33] treaty.
Furthermore, the European Commission should pursue an ambitious free trade agreement on services under the umbrella of WTO.

- The European Commission and the Member States need to foster the creation of an Internal Market for knowledge intensive services beyond the provisions currently discussed in the Services Directive and support and secure an ambitious outcome in the WTO Doha Round, including significant market-opening commitments in services from as many countries as possible. In recent decades, services' share of GDP has grown significantly, yet the growth in services as a share of total exports has not kept pace. This implies that there is tremendous opportunity for expanded trade in services as the global economy grows, especially considering how many IT-enabled services are now more readily tradable. Lowering or eliminating existing trade barriers should spur further growth in the sector, by opening up new opportunities to start up companies, compete, and create jobs. Businesses and citizens will benefit from greater choice of high quality services, increased market opportunities, and also better employment possibilities.

Entrepreneurship & Services

Europe needs a change of climate to foster entrepreneurship and improve the adoption of innovative ICT services. This change will not only benefit the ICT industry, but society at large.

- Member States should implement innovative eGovernment services which deliver benefits to citizens and organizations. As we can already see in some new member states, the introduction of ICT services in the public sector stimulates a positive behavioral change and improves entrepreneurship of the organizations it serves. The public sector has a large role to play in leading by example.
- Member States should be promoted via industry clusters and SMEs to:
    - Facilitate the creation of new businesses,

[33] Art. 49 of the EC treaty.

- Create economic development programs to promote regional innovation “hot spots” and create more dynamic and innovative industry clusters,
- Support participation of small and medium businesses in these programs, since smaller companies are a major source of job creation.

- The European Commission should provide for an intellectual property regime that strikes a proper balance between incentives for innovation and the promotion of collaboration and diffusion of innovations throughout the economy.

Section V: The Human Factor in ICT Sector Innovation.

Introduction

There is a European working-life tradition, which, to a greater extent than in other part of the world, values dialogue and good relations as strategic production factors. This capacity and willingness to cooperate should constitute a basis for a successful innovation policy for economic and social progress. This approach results in countries that have, in relation to the surrounding world, greater manpower costs being able to develop compensating IT strategies, where the power of technology to interact with and improve the employee´s knowledge and learning needs become strategic. Rather than compensating human intellectual and reflective capacity, IT constitutes a source of increased innovation and development in working life in cooperation with its users.
The "human factor" has a decisive role since innovation arises from complex interactions between individuals, companies, research institutes, customers and suppliers.

Innovation system and diffusion of knowledge

The innovation system must support creating rapid, easy and cheap access to a large amount and wide variety of knowledge diffusion and distribution. The success of innovation policy is determined by the rate and efficiency with which new knowledge is diffused. An effective process of knowledge diffusion needs to be matched by competence in order to make use of new knowledge. Companies must be able not only to acquire information but also to integrate and absorb it.

A flexible and mobile labour market is vital for diffusion of knowledge. Knowledge is to a great extent connected to employees (human capital), and diffusion of knowledge and new combinations of knowledge is therefore heavily reliant of the readiness, ability and incentives of the labour force to migrate between employers. New forms of work organisation can make better use of the competences and creativity of staff.

Creating a company culture open to innovation by placing the emphasis on all employees creativity and commitment, openness, mutual trust and supportive to dialogue. A foresighted knowledge management will foster creativity, design, new production methods, shop-floor innovation and quality. It is important to organize the accumulation and transmission of internal knowledge. Accumulated experience in the workforce is a critical knowledge asset and contributes to specific competitive advantages.

Competence is a fundamental prerequisite for the ICT-sector

The level of competence can be of vital importance for the innovation activity in SMEs. Research reports in Denmark and Sweden points to the fact that SMEs employing their first academic engineer and thereby raising their technology level have a very positive development in employment, turnover and productivity.

In the 1996 EU Commission Green Paper (Living and working in the information society) it was stated that growth based on increased IT use in working life presupposed increased development of skills among employees and new forms of organisation in working life.

In order for the ICT industry in Europe to be world wide competitive, access to competent personnel is required at all levels. Supply of competence is consequently a key issue that,

when broadly defined, stretches from the use of IT in schools to the development of research education within strategically important areas.

All responsible actors must work actively to promote technical training at all levels and also qualitatively that is the professional content and level and relevance to industry.

It is important to create a training structure to support the strategy for innovation. The employees at all skill levels must have the competencies to manage the rapid development. Employability and life long education and training are important tools for structural changes in the knowledge society.

Access to graduated manpower is of decisive importance to the IT industry. A crusial aspect in this context is the falling numbers of students of scientific and engineering disciplines in the EU, in comparison with the main competitors. The global competition will require even higher ambitions in a perspective of 15-20 years.

The size of the intake and the number of degrees from IT courses have varied over the years. It is a matter of fact that work to ensure the interest of pupils at upper secondary school in IT-related courses should also be given priority in the future.

Post-graduate education is of vital importance for competence and competitiveness within the IT sector. The largest part of IT-related research conducted in universities and research institutes should be in close cooperation with business.

With respect to attracting, developing and keeping academic talent, Europe continues to lag behind other leading marketplaces. Europe suffers a substantial brain drain due to better conditions to work in the US for academia and researchers. To address this problem, Europe needs to work with academia, along with leading European and global industry leaders to develop a vibrant career development programme that supports the vital role of scientific research community in a broad-based innovation strategy. For example, there is a need to establish a stronger PhD programme that goes beyond the current levels and develop scholars in new emerging sciences and technologies, as well as foster fellowship programmes for early-career scientists. The conditions for research and researchers in Europe must be in world class.

Recommendations to the European Commission:

- **Promote an innovation-friendly spirit at all levels in society.**

EC Communication on Innovation advocating the EU can only become comprehensively innovative if all actors become involved. An action plan to make Europe knowledge-based and innovation-friendly involving the business sector, public authorities at national, regional and local level, civil society organisations, trade unions and consumers should be given high priority.

- **Promote the development of a shared vision of social partners regarding the human factor impact in the innovation process.**[34]

The enterprise is at the heart of the innovation process. A common value-base regarding innovation for the employer and the employees will foster innovation. Example: The Industry Committee in Sweden was formed by 12 employer organisations and 7 trade unions, which signed the Industrial Agreement in 1997. Since the start innovation and R&D have been areas of high priority offering considerable scope for consensus between parties. (The Swedsih Reform Programme for Growth and Employment 2005-2008).

- **Promote schemes for lifelong education and training**

"The growth of productivity is based ultimately on creativity and on the ability of work organisations to use and develop the creativity of their members. A work environment that encourage creativity is also closely linked with lifelong learning, entrepreneurship and business formation. Systematic efforts have been invested in developing work organisations and ways of working since 1996, which saw the launch of the first national working life development programme." (The Finnish National Reform Programme 2005-2008)

- **Stimulate the sharing of successful experiences.**

Intensified and focused benchmarking.

- **Create a training structure to support the strategy for innovation.**

The CIP (Competitiveness and Innovation Programme) must be used as a tool to underpin development of professional skills such as the ability to use new technology, to cooperate across organisational and professional barriers, to adapt to new demands and conditions quickly.

Recommendations to Member State governments:

- **Establish IT councils in interaction between the industry and higher educations involved.**

The industry should, in cooperation with social partners, start a dialogue with universities and other education providers. The objective of such a dialogue is to enhance common understanding of the competence that is required to improve the ICT sector in the long run. (Ongoing in Sweden).

- **Establish a dialogue forum between public stakeholders, the industry and trade unions.**

The innovation process affects both business and public life and thereby the interaction between them. Actions taken will affect the other actors. It is important that the stakeholders affected can have a constructive dialogue in all important matters. Example: The Swedish Ministry of Industry is currently running a dialogue forum in the ICT sector.

- **Stimulate upper secondary school pupils to select IT-oriented courses.**

For instance the Swedish project "Choose IT".

[34] The following recommendation has been proposed by EMF/CF and is not supported by several members of the Task Force.

- **Foster fellowship programmes for early-career scientists**

Develop new and expand ongoing programmes.

- **Increase postdoctoral training programmes**

Example: The “discipline hopper” fellowship at the UK Medical Research Council.