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Preparing Europe's digital future
i2010 Mid-Term Review

Volume 1: i2010 — Annual Information Society Report 2008
Benchmarking i2010: Progress and Fragmentation in the European Information Society

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The diffusion of ICTs continued to advance in 2006/2007, along with their contribution to economic activity. They are not only becoming increasingly pervasive but are also being constantly refined through innovative high-tech activities. This report monitors the evolution of the information society in the European Union by developing indicators, benchmarking the performance of individual countries and analysing markets.

Progress in 2006/2007 was against a background of improved economic performance. The strength of the economic recovery in Europe was greater than expected, with real GDP growth of 2.9% in the EU and 2.7% in the euro area, the highest growth rate since 2000, supported both by employment and labour productivity growth. Enhanced productivity growth was underpinned by multifactor productivity growth across the entire economy, possibly fuelled by the increased diffusion of ICTs. However, the expected economic downturn in the US, the financial turmoil and high oil and food prices are expected to slow down the growth of the European economy to 2% in the EU (1.8% in the euro area) in 2008 and hence to reduce investment in and take-up of ICTs.

Despite a general improvement in performance within the EU as a whole, progress differs across Member States and ICT development remains fragmented. This report takes a close look at differences between countries and warns that uneven developments may reduce the capacity of the single market to deliver benefits for the European information society and the broadband economy.

1. ICTs AND ECONOMIC ACTIVITY

Previous editions of this annual report have discussed the impact of ICTs on labour productivity growth and identified three main channels:

- Technological progress in the production of ICT goods and services, which has made productivity growth faster in the **ICT sector** than in the rest of the economy.

- Declining prices for ICT goods and services, which stimulate **investment in ICTs** throughout the economy with immediate positive effects in terms of labour productivity growth. Since the mid-nineties, the distribution of capital has shifted from non-ICT investment to ICT investment in all major industrialised economies, although the shift in Europe has not been as pronounced as in the US[1].

- In the longer term, increased use of ICTs, accompanied by the reorganisation of business processes, which contributes to **efficiency gains** ('multifactor productivity growth') in the entire economy.

In the period 1996-2004, Europe witnessed an acceleration in productivity within the ICT-producing sector, and a deceleration in non-ICT sectors, though unlike in the US no acceleration was visible in ICT-using sectors. This is surprising as ICT prices are similar throughout the world. Some economists argue that the reorganisation of business processes takes time and that the impact will become visible in Europe at a later stage. Others point to structural problems of the European economy, such as more rigid labour and product markets.

[1] Evidence of these trends can be found in the 2006 edition of the i2010 annual report (p. 12).

New statistical evidence released in 2007, in the framework of the EU KLEMS project,[2] confirms previous analyses and provides additional insights at sector level and through international comparisons.

1.1. The ICT sector

ICT industries (manufacturing and services) represent around 5-6% of total GDP in the three main world economic areas (EU, US and Japan), but account for a much larger share of overall productivity growth thanks to rapid technological progress.

In the EU, the ICT sector prompted a 0.3% productivity growth over the period 2000-2004[3], driving about one fifth of the whole productivity increase. However, this contribution in the EU is lower than in the US (0.4%), both because the size of the ICT sector is smaller (5.3% of GDP in the EU as against 6.6% in the US) and because efficiency gains in the EU ICT sector were lower than in the US (5% as against 6.2%). The contribution of the ICT sector to overall productivity growth in Japan is similar to that in the EU: despite a larger weight in the total economy, productivity growth in the ICT sector was slower than in the US.

The efficiency of the European ICT sector is also reflected in the wages and salaries paid to ICT sector employees in the EU compared with the rest of the economy: €34,090 as against an overall figure of €19,887[4].

ICT goods account for a substantial share of total trade between the EU and its economic partners (Table 1). ICT goods represent 10.2% of all extra-EU exports of goods and 14.4% of all imports[5]. In particular, telecoms equipment and electronic components are the main sources of exports and computers the main source of imports. However, the overall trade performance of the EU in ICT goods is unsatisfactory. In 2006, it reported a €77.5 billion trade deficit, including €48.3 billion in computers, €20.9 billion in audio and video equipment and €14 billion in electronic components. The limited EU competitiveness in the ICT sector is linked to its lower capacity to innovate compared with other areas of the world.

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2 http://www.euklems.net/. The EU KLEMS project is funded by the European Commission and aims to analyse productivity in the EU at industry level.

3 Source: Commission estimates based on the March 2007 release of the EU KLEMS database.

4 2005. Source: Eurostat.

5 COMEXT statistics 2006. ICT goods include: telecoms equipment, computers, electronic components, audio and video equipment, and other ICT products.

Table 1: EU 27 IMPORTS AND EXPORTS ICT GOODS[6] (share of total imports/exports) to extra EU

ICT goods	extra EU exports *	% on total goods exported	extra EU imports *	% on total goods imported	trade balance *
Telecommunications equipment	30,068	2,6	33,965	2.5	-3,897
Computer and related equipment	25,905	2.2	74,251	5.5	-48,346
Electronic components	30,685	2.6	44,652	3.3	-13,967
Audio and video equipment	6,020	0.5	26,972	2.0	-20,952
Other ICT goods	26,006	2.2	16,366	1.2	9,640
Total ICT goods	**118.685**	**10.2**	**196,206**	**14.4**	-77,521

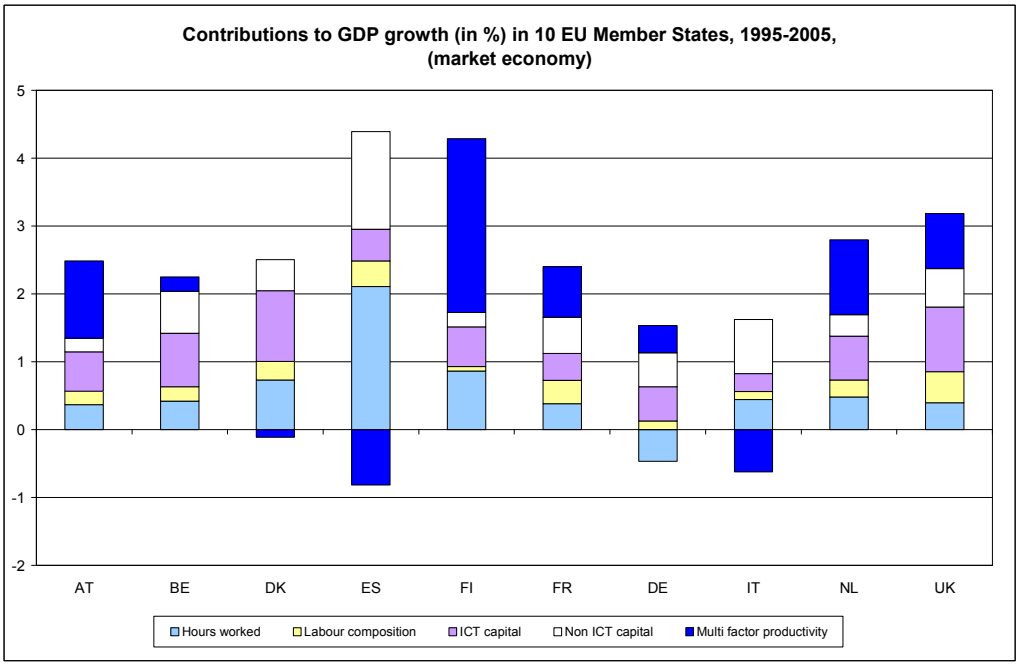
Source: Eurostat (COMEXT). * Data in millions of euros

1.2. Determinants of GDP growth and the role of ICTs

In the period 1995-2005, the US economy was the most dynamic of the three areas considered (EU, US and Japan), partly because of the contribution of ICT investment, but **mainly because of efficiency gains (multifactor productivity growth)**. US enterprises considerably improved their level of efficiency in the use of production inputs. In contrast, over the same period, **the average efficiency gains by EU enterprises were negligible**.

In most of the 10 EU Member States in Figure 1, in the period 995-2005, the average contribution of multifactor productivity to economic growth was limited and even negative in the case of Italy, Spain and Denmark. Finland is the main exception with a strong acceleration of this contribution (from 1% in the period 1980-1995 to 2.6% between 1995 and 2005).

Figure 1



Source: EU KLEMS database, November 2007

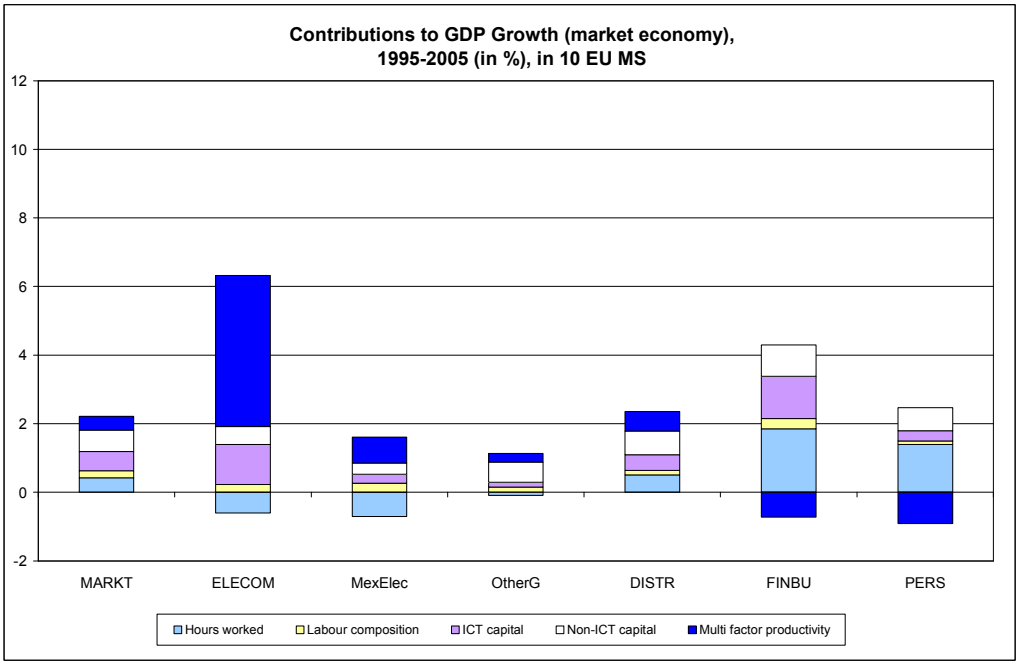
6 ICT goods categories based on OECD definition. Other ICT goods include office machinery and equipment, medical equipment, industrial process control equipment, and instruments and appliances for measuring, checking, testing and navigating.

1.3. The sector dimension

The comparison of the relative performance of the EU[7], US and Japan, (Figures 2, 3, 4) reveals that:

- Electrical machinery plus post and communications (ELECOM), which account for a substantial share of the ICT industries (IT, communication manufacturing and telecom services), was by far the largest contributor to GDP growth in the three economic areas, though less so in the EU than in the US and Japan.

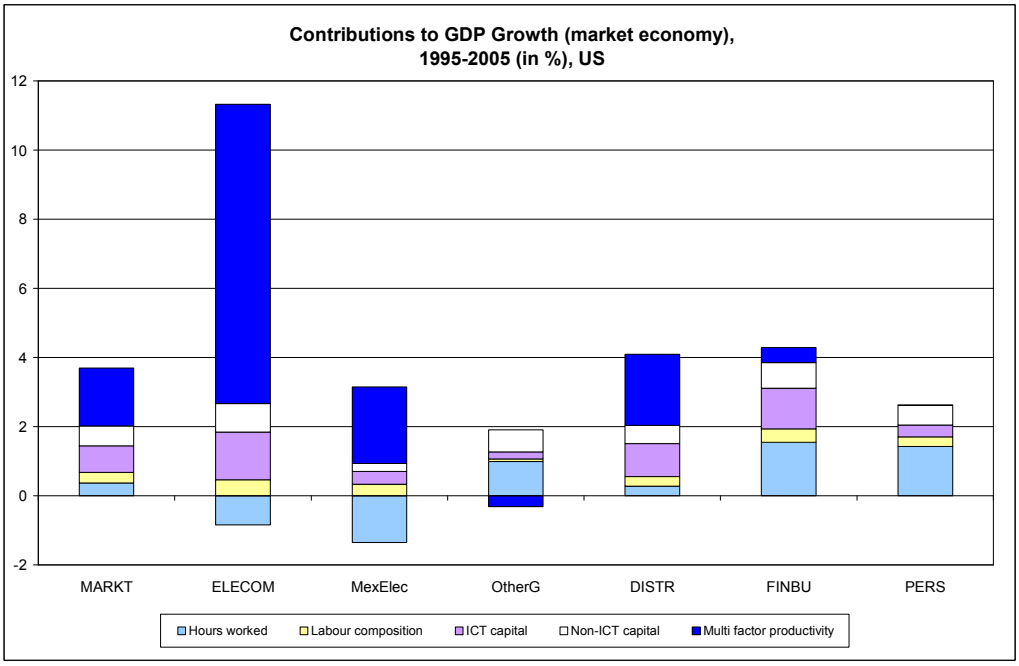
Figure 2



Source: EU KLEMS database, November 2007. MKT= Market Economy. Elecom= Electrical machinery, post and communication. Elecom= Electrical machinery, post and communication. Other G = Other goods producing industries. Distr = Distribution services. Fin Bu = Finance and business services. Pers = Personal and social services. 10 EU MS: BE, DE, DK, ES, FR, IT, NL, AT, FI, UK.

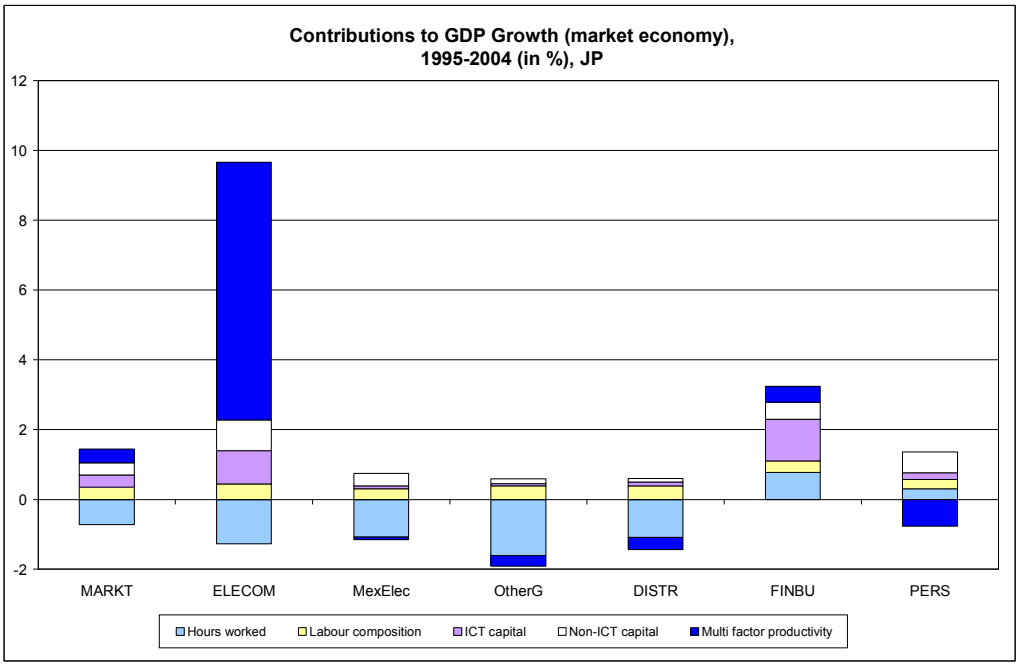
[7] Figure 2 covers only 10 EU Member States. However their GDP represents 86% of the EU GDP (2007).

Figure 3



Source: EU KLEMS database, November 2007

Figure 4



Source: EU KLEMS database, March 2007

- **All the remaining service sectors** (financial, business, personal, social and distribution) **in the US outperformed their European counterparts in terms of contribution to GDP growth** (Figures 2 and 3), mainly because of a significant improvement in the efficiency of their business processes. This is probably linked to the superior capacity of US businesses to adapt their organisation and make the best possible use of new technologies. Further analysis suggests that the source of this divergence may be related to ICT adoption by service industries. The use of ICTs delivers efficiency gains through the automation and

seamless integration of different processes along the whole value chain, provided that organisations are prepared to innovate the way their business is conducted. For distribution services, in particular, the case of Wal-Mart has often been cited as an example of the successful implementation of innovative business processes mostly based on the use of ICTs.

- The Japanese economy had the lowest GDP growth among the three economic areas and posted a fairly flat performance in the majority of economic sectors, with the exception of electric machinery, post and telecommunication, business and financial services (Figure 4).

1.4. Additional insight from micro-level analysis

Macro-level analysis points to efficiency gains in the use of production inputs as the factor explaining the difference in economic growth between the US and the EU in the period 1995-2005. This suggests that increases in ICT investment do not guarantee stronger multifactor productivity growth. General framework conditions, such as the degree of competition in a market, are likely to be of fundamental importance for the innovative capacity of an economy. Statistical evidence suggests that the main role of ICTs as a contributor to productivity growth is their capacity to enable improvements in the way business processes are organised. Several studies based on empirical evidence at enterprise level seem to confirm this hypothesis. In particular, a 2007 analysis based on econometric modelling of enterprise-level panel data for the period 1998-2000[8] looked at the relationship between productivity growth, ICT investment and organisational change for the UK:

- ICT investment generates significant productivity gains when its implementation is accompanied by the restructuring of business processes and changes in enterprise organisation.

- The changes necessary to secure the return on ICT investment tend to emerge only after some time, while there could be short term negative effects due to the fact that implementing these changes calls for some human resources to be temporarily diverted from direct production.

- The general economic environment and in particular competitive market pressures are crucial in determining the propensity of businesses to innovate their organisation and business processes. Cultural factors and management styles could also play a role: evidence shows that US-owned multinationals in the UK undertake more organisational change than UK-owned companies, all other things being equal.

1.5. Conclusions

ICT production and diffusion in the economy have proved beneficial to innovation, productivity growth and economic development to an extent linked to the capacity of different economies to reap the benefits from ICT investment. Europe has been able to benefit from ICTs only recently and its capacity to reap future benefits may be constrained if investment and consumer spending fall in 2008 as a consequence of an economic slowdown. However, Europe is far below saturation levels in most information society indicators. Furthermore,

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[8] Crespi, G. et al. (2007), Information Technology, Organisational Change and Productivity — Centre for Economic Policy Research, Discussion Paper No 6105.

continued innovation in, for example, wireless technologies and machine-to-machine communications are promising avenues for further productivity gains.

2. SINGLE INFORMATION SPACE

2.1. Market Developments

The telecoms sector

The telecoms sector is the biggest single component of the ICT sector, representing about 44% of its market value[9] and 2% of GDP[10]. In 2007, the telecommunication services market was estimated at roughly €300 billion with nominal growth slowing down to 1.9%[11]. Thanks to declining prices, however, the real growth of the telecoms market is up to 3% with the sector remaining dynamic and driving around 12% of overall labour productivity growth[12].

The telecoms market in the EU is characterised by declining revenues in the fixed voice sector, driven by increasing competition, falling prices and substitution by mobile voice services. In the mobile sector, which now generates around 50% of total revenues, voice services are starting to show signs of flattening out, whereas the share of mobile data services is increasing and expected to grow by around 8% in 2007. However, data only represent 17%[13] of total mobile revenues. Fixed broadband services experienced the highest growth in the sector, with around 14% in 2007. While this rate is still strong relative to the other segments of the telecoms sector, the average revenue per user (ARPU) is expected to decline in 2007 due to levelling off in the growth of broadband lines and the fall in prices.

Market developments differ across the EU Member States. The overall positive figures for the EU are partly due to growth in the new Member States, where the possibilities for organic growth are higher than in the mature markets of the old Member States. In the latter countries, the decline in average revenue per user in the mobile voice segment is not yet offset by growth in the market for value-added services through high-speed mobile networks (3G), despite the extended coverage and improved transmission capabilities of advanced mobile networks.

Leading EU operators are reacting to the slowdown in the European electronic communications market by following different strategic paths. These strategies can be summarised as follows:

(i) **Investment in non-domestic developing markets**. Revenues generated in developing markets represent an increasing share of total revenues and currently more than offset the decline in home markets. The large European operators have expanded their footprint and made a number of acquisitions in recent years.

(ii) **Cost-cutting, including through deployment of next-generation networks and sourcing initiatives**. Investment in high-speed networks is driven by the need to reduce

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9 EITO, 2007.
10 Estimate based on Eurostat figures.
11 EITO, 2007 Update.
12 Estimate based on EU KLEMS.
13 EITO, 2007 Update.

operating costs and open new markets based on IP multimedia subsystems. Linked to this is the addition of new activities such as corporate IT services based on IP networks and a further concentration on specific corporate needs. Major operators have also divested other businesses not considered part of their core activities.

(iii) **Development of innovative business models**, including bundling of services, fixed-mobile convergence, more sophisticated user-tailored approaches, and marketing of value-added services. Growth is expected to come from the addition of new services to existing customers.

Software and IT services

Software and IT services represent about one third of the entire ICT market and are its most dynamic component (Table 2). The main growth drivers for this segment are storage, security and business management software.

Table 2: EU market *growth rates

	2006/2007	**2007/2008**
Software	5.9%	5.7%
IT services	6.7%	6.4%

Source: EITO autumn edition 2007 * EU without Malta and Cyprus

According to a forecast by a leading market analyst, software and IT services are expected to continue growing strongly for the next three years, with the EU and US markets experiencing similar trends (Table 3):

Table 3

	Software CAGR 2006-2011	**IT services CAGR 2006-2011**
Europe*	7.8%	7.2%
USA	7.9%	7.2%
Japan	4.8%	3.6%

Source: Gartner Dataquest Market Databook, September 2007 Update; CAGR = compound annual growth rate.*Europe in its geographical sense, not just limited to the EU.

The Internet is changing business models in the software market. Service and service-oriented software, e.g. **SaaS** (**Software as a Service**) and **SOA** (**Service Oriented Architecture**)**,** is now a significant driver of growth. Enterprise software for content, collaboration and communication based on the Internet, which can be used for both intra and inter-organisational communication, is expected to see a worldwide growth rate of 13.9% in 2006-2011[14]. In the same way that users are playing a greater role in online content through web 2.0 applications, enterprises are using these applications to obtain direct input from employees.

[14] Source: Gartner Dataquest Market Databook, September 2007 Update.

Enterprise 2.0, the business equivalent of web 2.0, may be about to follow the rapid rise of social networking sites.

In 2007 and 2008, SMEs are expected to increase investment in software for hosted services deployed over the Internet (SaaS — software as a service). This software does not require great investment, as it can simply be rented when needed as a hosted service and hence offers a particularly convenient business model. This development promises to enhance the ability of SMEs to exploit ICT benefits in the near future.

Furthermore, integration platforms are becoming increasingly SOA oriented which can integrate standard software with different kinds of applications. Despite currently low market volumes, SOA has the potential to become a significant growth driver. The emergence of the 'Internet of Things', connecting a multitude of devices such as PDAs, RFID tags, cars, etc., may also increase demand for SOA-based services.

Open source software is also expected to increase its contribution to the dynamics of the software market. Market spending on open source products does not adequately reflect their use, since business models based on open source software mostly do not rely on the sale of software licenses. Instead, open source production often contributes to generating other streams of revenues, e.g. service-based revenues, especially in secondary markets (e.g. financial sector, electronic equipment). Indirectly though, price competition is stimulating the adoption of open source solutions and reducing the growth in system infrastructure and tools software[15]. According to a 2006 study[16] for the European Commission, open source will have a significant impact on the European economy. Defined broadly, open source-based services could reach a 32% share of all IT services by 2010, and the open source share of the economy could rise to 4% of European GDP by 2010. Open source is already directly behind 29% of the software developed in-house in the EU (43% in the US) and provides the natural model for software development for the secondary software sector. The strong open-source community of active developers, small firms and the secondary software industry in the EU are a strength for the European ICT sector. However, this contrasts with Europe's generally low level of ICT investment and the low rate of open source adoption by large industry compared to the US.

The software market is setting a trend where ICTs — in the form of software services — are becoming more pervasive thanks to the Internet infrastructure. This ubiquitous development is confirmed by a recent survey[17] of IT professionals and chief information officers (CIOs), who cited web services/SOA and open source as the most important areas for their customers in terms of software services (Figure 5).

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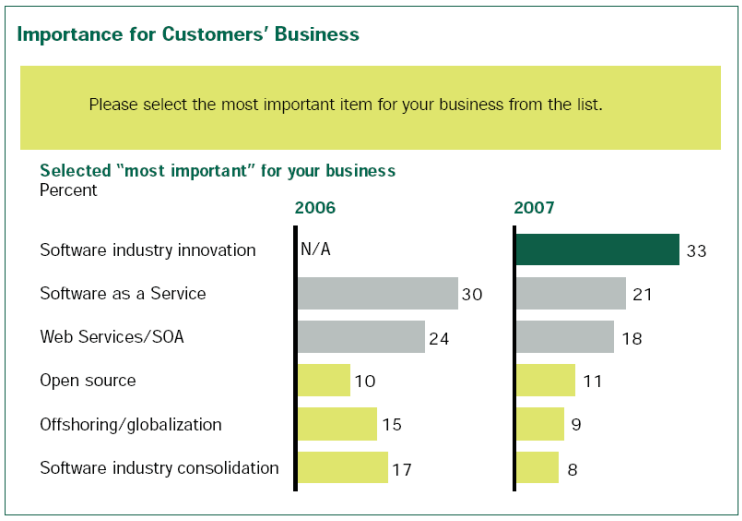
15 EITO Update 2007.

16 Study "Economic impact of open source software on innovation and the competitiveness of the Information and Communication Technologies (ICT) sector in the EU", November 2006, UNU-MERIT, the Netherlands.

17 The Enterprise Software Customer Survey 2007 from McKinsey & Company and Sand Hill Group examined the strategies of 475 senior IT and business executives.

Figure 5



Source: McKinsey & Company and Sand Hill Group, 2007

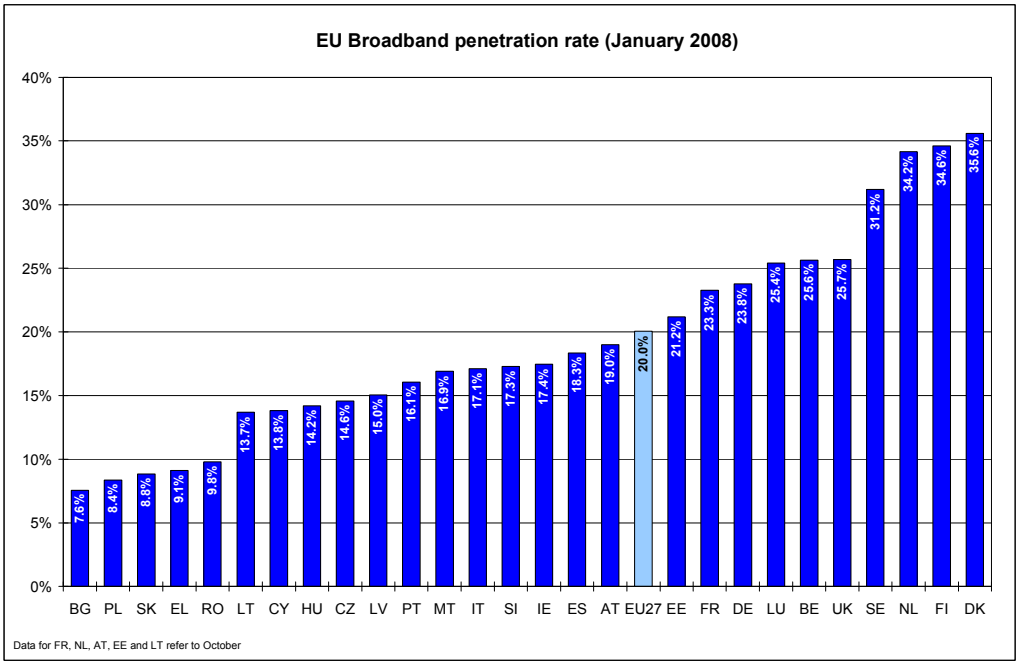
2.2. The broadband economy

The European Commission has been closely monitoring developments in the broadband market, both from a regulatory and a policy point of view, using a number of indicators that address various market features. These include broadband take-up, coverage, competition, speeds, prices and usage. While broadband penetration has traditionally been used as the main benchmark for setting broadband objectives, market developments suggest that there is an increasing need to look at other variables as well. Countries with similar penetration rates may follow different development patterns resulting in significant differences with regard to both supply and demand. This section looks at a number of developments in the broadband market in 2007 and concludes by highlighting the need of proposing a composite index to provide a broad perspective and facilitate benchmarking.

Penetration rates

Growth in broadband penetration continued in 2007 but large gaps remain between countries. In January 2008, there were an estimated total of 99 million broadband lines in the EU, an increase of 23.8% over the preceding year. This represents an average broadband take-up of 20% of the EU population (Figure 6). Denmark, Finland, the Netherlands and Sweden top the EU league with penetration rates above 30%, and maintain their position as world leaders well ahead of Korea, the US or Japan.

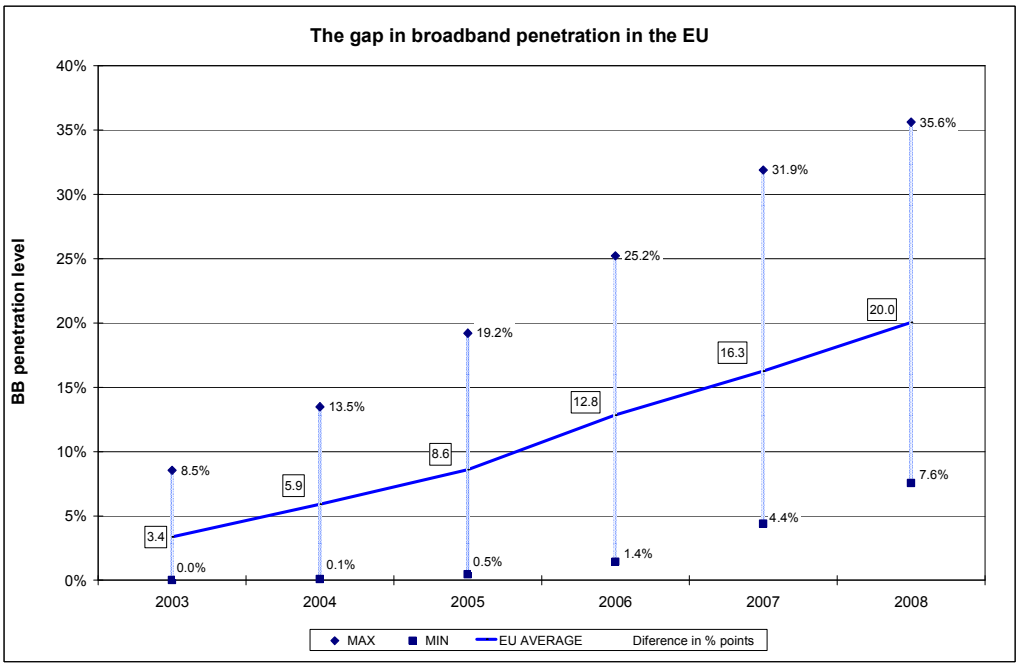
Figure 6



Source: EC services based on COCOM data

Time series data indicate that the difference between the most and the least developed countries in terms of broadband penetration is widening. The gap increased from 8.5 percentage points in 2003 to 18.7 points in 2005 and 28 points in 2008 at EU level (Figure 7).

Figure 7



Source: EC services based on COCOM data

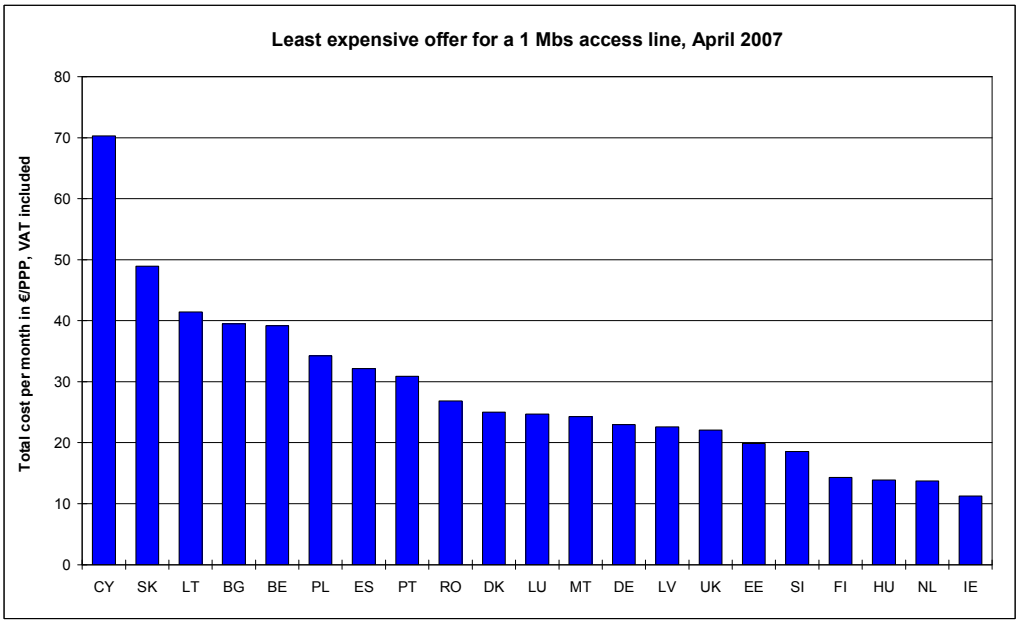
Another significant development in 2007 was that, for the first time in the last five years, the year-on-year increase in the number of new lines declined at EU level, from 21.1 million new lines in 2007 to 19.1 million in 2008. The decreasing growth in more developed broadband markets is not being fully offset by growth in developing markets. However, these figures

refer to fixed access broadband lines only. In a number of Member States, wireless broadband technologies have made significant inroads and such developments will be taken into account in future analysis[18].

Prices

Gaps in penetration rates and different stages of market development are also reflected in price differences. In more developed broadband markets, operators have been introducing new services and bundled products, pricing policies with attractive discounts, or upgrading download and/or upload speeds at low or no extra cost. In developing markets, however, operators can still add new subscribers and have less need for making innovative offerings. Prices for similar products tend to be higher in countries with lower broadband take-up. For instance, the least expensive offer for broadband access with a nominal download speed of 1 MBps was priced at €49 in Slovakia, while consumers in the Netherlands were charged €14 for a product with similar speeds (Figure 8)[19].

Figure 8



Source: EC services based on data from Van Dijk [20]

The price comparison[21] conveys a picture of fragmented markets:

- There are still significant differences between Member States in retail prices for similar products.
- On average, when all speed brackets are considered, broadband access costs tend to be higher in the new Member States than in the EU15, with the exception of Latvia.
- There is an inverse, although not very strong, relation between broadband penetration and broadband prices, i.e. countries with higher broadband penetration tend to have lower

18 The Communications Committee has adopted a new methodology for data gathering which will include data on mobile broadband access.

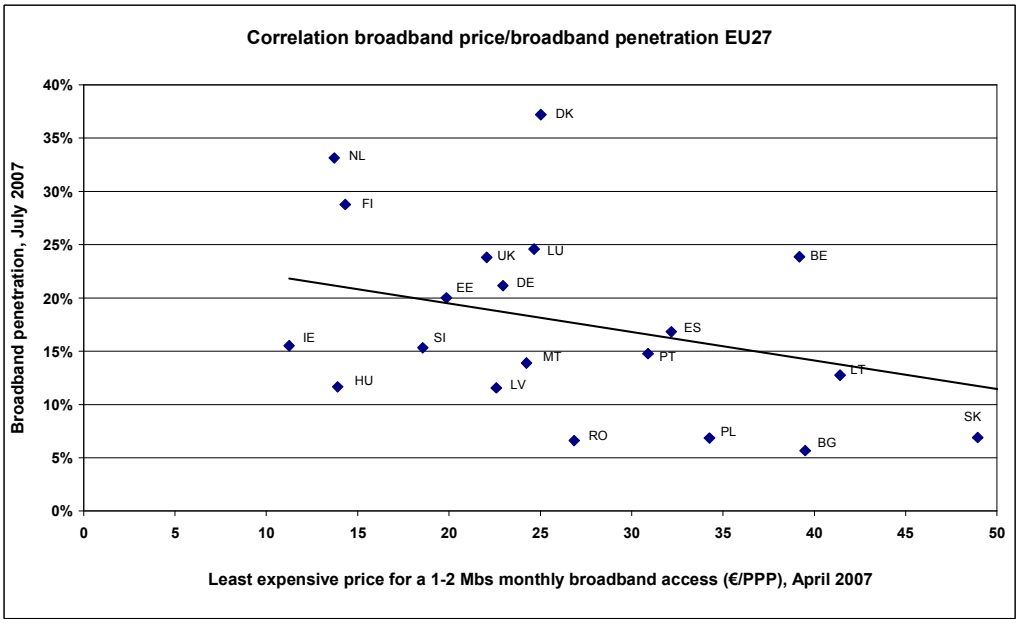
19 Comparisons are based on purchasing power parities to eliminate differences in price levels

20 Study: "Broadband Internet Access Costs", Van Dijk – Management Consultants, (forthcoming).

21 The price analysis was conducted for various speed brackets and led to very similar conclusions.

prices (Figure 9). Other factors besides prices (coverage, choice, availability, quality of service, PC penetration, income, education and other socio-economic factors) are also important in encouraging broadband penetration.

Figure 9



Source: EC services based on data from COCOM and Van Dijk.
EL: out of scale. Data on prices for AT, CZ, IT, FR and SE not available

- Although broadband access is still offered as a separate product, the bundling of products (broadband access and telephony and/or television) is becoming more common in a number of countries. The percentage of households that purchase combined packages offering more than one communication service is higher in countries with high broadband penetration rates, with the exceptions of Finland and Italy. On average, one in every five households has subscribed to a bundled offer.

Coverage

Broadband coverage has rapidly grown in the last three years, but gaps between countries remain together with gaps between urban and rural areas.

DSL networks, which 80% of EU broadband subscribers use for fast Internet access, are good proxies for broadband coverage. Cable modem networks are concentrated in more densely populated areas and their availability is limited compared to the widespread presence of public telephone networks. Other alternative technologies, whether wired or wireless, are still marginal in several Member States.

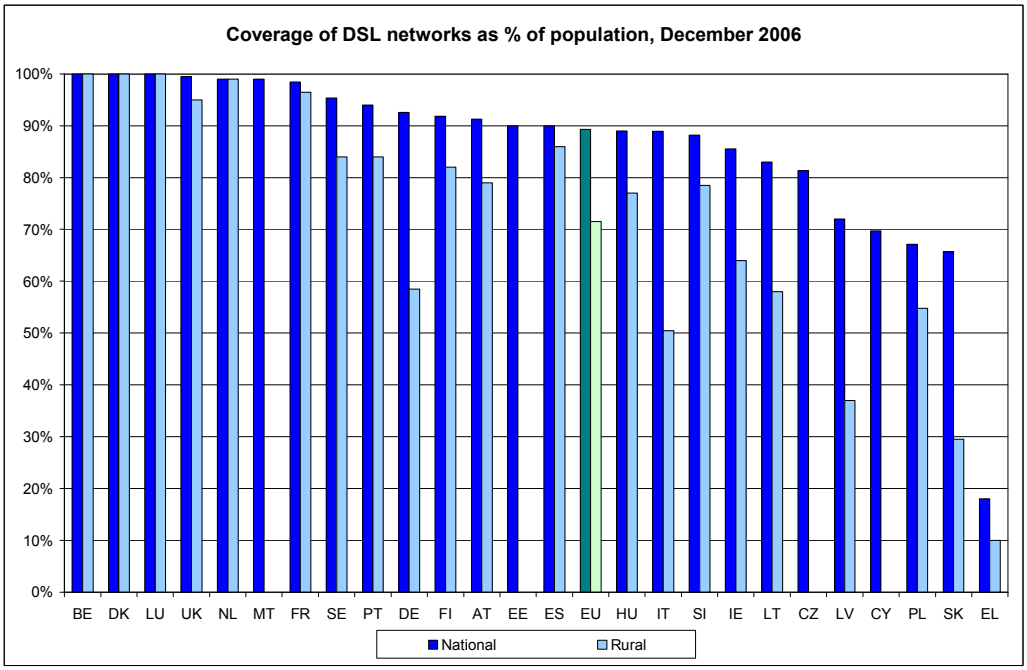
At the end of 2006, the average (EU25) level of coverage of DSL networks was 89%, i.e. telephone switches serving 89% of the European population had been equipped with DSL technology (Figure 10).[22]

22 The limited reach of xDSL technologies means that availability and choice of service depend on the distance between the local switch and the subscriber's premises, so the figure for eligibility, i.e. the proportion of the population that could effectively opt for a DSL connection, is less than 89%.

Differences in coverage between Member States persist, and a number of countries — Greece, Slovakia, Poland, Cyprus and Latvia — still have some way to go before achieving full coverage. Progress in extending DSL coverage has been good in some of these countries but not very promising in others.

Figures for the national coverage of DSL networks also hide a gap between rural and urban areas in several countries. Deployment costs largely depend on a country's topography and population density, and full coverage remains a challenge in a number of countries. Greece, Slovakia, Latvia, Italy, Poland, Lithuania and Germany show a large gap between coverage in urban and rural areas. On average, at EU25 level, 94% of the population in urban areas are able to subscribe to a DSL connection, as against 72% of the rural population.

Figure 10



Source: Idate, "Broadband Coverage in Europe" 2007 [23]

Speeds

The average rate of download speeds that European citizens subscribe to are slow compared to other regions. Average EU speeds are about 1 MBps[24] with limited upload speeds. For the EU as a whole, the percentage of subscribers to cable modem and xDSL products with speeds below 1 MBps is declining, while the percentage of subscribers with access to speeds between 1 and 2 MBps has risen from 23% to 32%. Nevertheless, the 512 Kbps to 1 Mbps range remains the most common (34% of subscribers), closely followed by the 1–2 Mbps bracket. Only a small fraction of European subscribers have broadband speeds above 2 Mbps, and access speeds above 8 Mbps are still marginal (5% of cable modem and DSL subscribers) (Figure 11).

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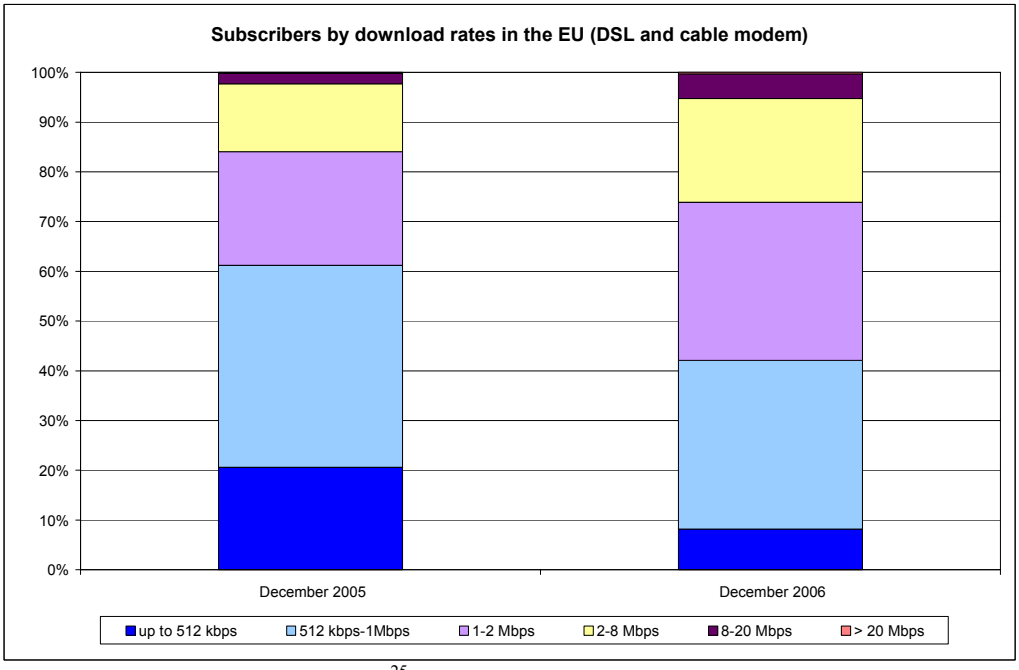
[23] Available at http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/broadband_coverage_10_2007.pdf

[24] Data as of December 2006. Several operators have increased advertised speeds since then.

Fast connections such as fibre are used by only 1.2% of European subscribers concentrated in a handful of countries. The picture is similar to developments in the United States, but in Japan there are more fibre users than ADSL subscribers, and in Korea 30% of users subscribe to fibre-to-the-home. The increasing importance of user-created content points to a need to improve upload speeds and move towards symmetric high-speed solutions. In some countries, demand for bandwidth is already stimulating the development of fixed-access networks that bring fibre closer to end users and increase capacity.

Figure 11



Source: EC services based on data from Idate[25]

Several announcements of investment in high-speed networks are being made across European countries. Various solutions are being envisaged that include both pure fibre-to-the-home/building models as well as fibre-to-the-node. High-speed access networks will enable the transmission of bandwidth-hungry content and services, from multimedia entertainment to interactive commercial and public personal services and bring improved upload speeds.

Competition

Market competition remains one of the main drivers of broadband adoption. As the number of broadband lines in the EU has risen eleven times from almost 9 million in July 2002 to 99 million in January 2008, the market share of non-incumbent operators in the retail market has increased from 37% to 54%.

Countries with alternative platforms (cable and DSL) were the first to benefit from competition as cable operators started offering broadband and telephony services on top of their traditional broadcasting services. In parallel, the effective application of sector regulation has been instrumental in increasing opportunities for alternative operators in the broadband market, especially in countries where platforms other than DSL do not exist. A more recent

[25] op. cit. footnote 23.

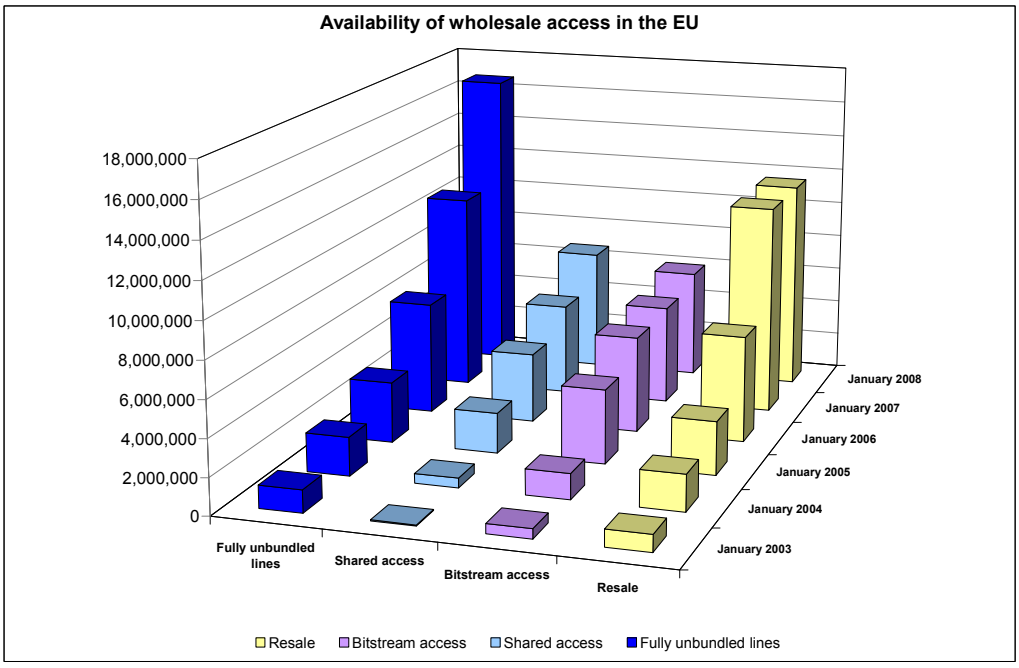
development is the increasing growth in broadband access using other less traditional technologies (fibre, wireless local access), especially in the last two years.

In January 2008, DSL lines represented 80% of the overall market, but after four years of continuous growth, this rate is declining and other technologies are increasing their market share. The EU average hides significant differences between Member States: while DSL represents 84% of all lines in EU15 countries, cable and other technologies dominate with 51% of the market in the Member States that joined the European Union more recently.

In the DSL market, regulation has enabled alternative operators to access the network of the incumbent operator. The increase in competition within this segment has been remarkable: while incumbents in 2002 controlled 87% of DSL lines, this share has declined to 56%. In addition to the entry of new operators, the nature of competition is also changing with many countries experiencing a gradual move from service-based competition to infrastructure-based competition using local loop unbundling (LLU).

Progress in the strengthening of effective competition is visible as LLU increases its relative share (Figure 12).

Figure 12



Source: EC services based on data from COCOM

In January 2008, LLU (fully unbundled lines and shared access) accounted for 12.8% of active PSTN (public switched telephone network) lines in the EU. Fully unbundled lines grew by 54% over the year, shared access by 34%, bitstream by 10% and resale remained stable. These figures confirm the steady growth in LLU, together with flat growth in resale and a recovery for bitstream after almost flat growth in 2006.

The overall progress of competition is good, but significant differences persist between Member States. While some disparities reflect different stages of development of national markets, it appears that markets with comparable penetration rates might be following different underlying competition models. The correlation between platform competition and broadband penetration decreased in 2007, suggesting that other aspects, including socio-

economic factors, may have increasing importance in explaining different developments in broadband markets.

Usage

Gaps in broadband development correlate with differences in terms of usage, with advanced services being increasingly adopted in more developed markets. There is a strong relation between broadband penetration and the use of Internet services. For instance, around 80% of individuals in countries with high broadband take-up access the Internet regularly, as against the EU average of 51% and 10% in countries with lower broadband penetration. In the latter, the percentage of households connected to the Internet but without broadband access is still very high — up to 70% in Greece or 64% in Romania.

The chief reason given for not using broadband is the perception that fast Internet access is not needed. Other main reasons are the lack of broadband availability and excessively high prices. These perceptions hold true both in more and less developed markets.

Differences in the usage of simple services such as e-mail are not large but this is the case for advanced services such as the downloading of games, music and movies, IPTV or web radio which require minimum speeds. In some Member States, these are either not yet affordable or worst not available to many consumers, and this results in increasing usage gaps.

Indicators of broadband performance

Many factors impact on the take-up of broadband services in the European Union and result in gaps between Member States. Differences are visible not only in terms of penetration rates but also of coverage, speeds, prices and level of usage. National markets with comparable penetration rates can show significant differences in broadband prices or speeds. The result is that the overall broadband adoption in the European Union is very fragmented. The degree of competition is an important determinant of take-up, but other factors may be just as significant in determining the impact of broadband in our societies and economies. The close monitoring of these factors is therefore crucial in order to provide a fair, reliable picture of how the broadband market is evolving in each Member State and in the European Union as a whole.

Composite indicators can be useful tools in benchmarking the overall performance of countries. Such indicators measure multi-dimensional concepts that cannot be captured by a single indicator. In the coming months, the Commission will develop, in consultation with the Member States, a 'broadband performance index' to compare broadband developments in the Member States, describe the broadband environment and provide insights into the prospects of further progress in this area.

2.3. Online content: A year of try-out

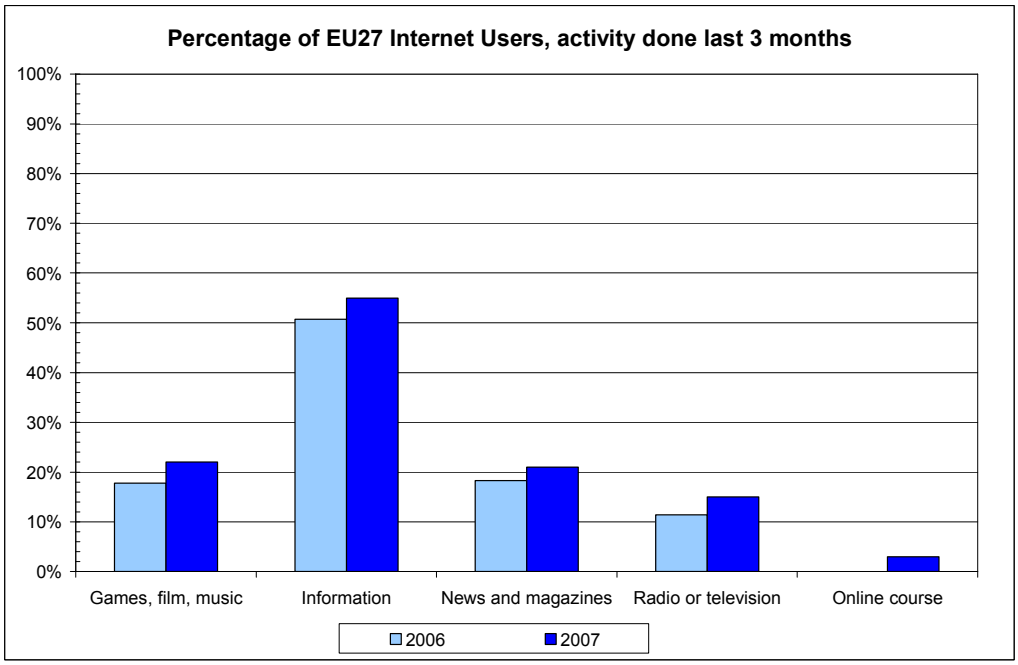
Online content in Europe developed rapidly last year, but at a highly uneven pace. The overall use of online media by the public is growing fast across the whole of Europe, with areas such as user-created content, online games and online advertising all showing considerable developments. However, several forms of commercial content were held back by the lack of widely attractive services and fast broadband access in parts of the EU. In 2007, significant commercial sales markets could be established only in a handful of countries for some types

of content. For most indicators, there are no EU-wide data on this point, partly due to the commercial market being experimental. Most content traffic still seems to be in advertising-supported markets, in the domain of user-created content, in public services or otherwise outside the commercial sphere. Making services broadly available and consumer-friendly currently appears to be the most important challenge.

The overall use of online media by the public grew significantly across EU27 in 2007 (Figure 13). TV and radio had the largest growth, with 31%, while games, film and music grew by 24%. Sweden and the Netherlands saw over 80% growth in the use of web-based TV or radio, while growth was 55% in the UK and 40% in France. The Nordic countries along with the Netherlands lead the way in total online media use.

Young people are more active users, and their online activities have started to cut into offline activities. According to one recent survey[26], 82% of 16-24-year-olds used the Internet daily, exceeding television use by the same group, which declined to 77%. According to Ofcom data[27], around a third of users in five major countries felt that online activity led to cutbacks in offline activities.

Figure 13



Source: Eurostat Community Survey of ICT Usage in Households and by Individuals, 2007

User-created content and social networks experiencing rapid growth

User-created content experienced especially rapid take-up, confirming the Internet as a medium of two-way communication, but now on the richer level facilitated by broadband access. 24% of European citizens posted or participated in online fora in 2007, up from 18% in 2006, with Estonia the most active country at 44%.[28]

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26 Synovate/SPA study for the European Interactive Advertising Association, 'EIAA Mediascope Europe Study'. Countries: UK, DE, FR, BE, NL, ES, IT, the Nordic countries.

27 Ofcom Research, 12/12/07, 'The International Communications Market 2007', October 2007 data.

28 Eurostat Community Survey of ICT Usage in Households and by Individuals, 2007.

Content types span the full range from video, books, photos and music to blogging on social network sites, social bookmarking, micro-blogging and product reviewing. The rise of both advertising-supported and revenue-sharing social networks and web 2.0 services has boosted the development of the participative web, while at the same time further blurring the lines between private communication and publishing, between income-generating activities and creative hobbies. Furthermore, this rapid growth creates significant differences between usage measurements conducted only months apart.

Although no official pan-European figures exist for participation in social networks, some ad hoc sample surveys have been undertaken. A December 2007 industry study[29] examined ten Western European countries, finding that 42% of users spent time on social network sites, with mail and search being the most popular online activities. Ofcom data from October 2007[30] suggests that social networks are used by 39% of Internet users in the UK, 17% in France, 12% in Germany and 22% in Italy. *Usage* figures for creative content are usually markedly higher than content *contribution* figures and, in the same four countries, between 42% and 44% of Internet users uploaded photos.[31] Another industry survey[32] suggests that in the UK, 20% of Internet users contribute to user-generated content and social network sites, while 9% of German users contribute to video sites alone.

Online content markets: individual countries succeeding in different markets

While user-created content has experienced massive growth all over Europe, the picture for the commercial content market is more diverse. The number of users of audiovisual content in general, including games, grew by 24% across EU27 in 2007.[33] For audiovisual content only, an industry study[34] covering ten Western European countries found that the number of users increased by 150% from 2006 to 2007. These developments are highly fragmented: a single country can lead in one area but be falling behind in another, while many countries still have underdeveloped markets in several types of content.

In **online music**, for instance, the UK is the clear number one market in Europe, with €103 million in revenue; Germany is second at €53 million and Italy third at €35 million[35]. The total European market has annual revenue of almost €300 million. Currently, online sales account for about 4% of the total European music retail market, and growth is expected to continue in the coming years, reaffirming the positive outlook for the future market in online music.

In the **video-on-demand** market, the Nordic countries are clear leaders, with only France and Germany having significant markets in the rest of Europe.[36] In the third quarter of 2007, Sweden was the single largest market, but with no more than 449 000 individual streams or downloads. While a quarter of Europeans watch video online, the commercial download market is still not attracting a significant audience. By contrast, the BBC launched a new part-streaming, part peer2peer-based service in the UK near the end of 2007. This service alone

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29 op. cit. footnote 26.
30 op. cit footnote 27.
31 Ibid.
32 IBM Institute for Business Value, 2007, 'The end of advertising as we know it'.
33 Eurostat Community Survey of ICT Usage in Households and by Individuals, 2007.
34 op. cit. footnote 26.
35 ScreenDigest Broadband Media Intelligence Database and Games Intelligence Database 2007/2008.
36 Ibid.

skyrocketed to over 250,000 streams *per day* in the weeks around the turn of the year from 2007 to 2008, averaging 25 minutes per stream, with 'long-tail' content being a key factor.[37]

In **IPTV**, France and to a lesser extent Belgium are leading the way. Of the 7.3 million subscribers in Europe, France alone has more than 5 million, and growth has been rapid.[38]

The **online gaming** market is currently the most solid market across Member States, and growing rapidly. Massive online role-playing games were expected to obtain over 3 million subscribers by the end of 2007, with revenues surpassing €300 million in 2007, a growth of 28% in one year.[39] The market is still behind the US market, which had about 4 million users. Take-up seems to somewhat follow the take-up of broadband, with Germany as the largest market and France growing most rapidly.

This picture of fragmented development has several possible explanations. On one hand, the access to reliable, high-speed broadband is important, Furthermore, factors like access to licensed content and services clearly matter. However, countries with otherwise quite similar user bases can still miss out on one type of content while doing well in another, suggesting that local situations as well as the availability and attractiveness of the services on offer locally are key factors.

Business model innovation and the introduction of new services

Growth of the online content market has brought opportunities to test innovative services and new business models. Downloaded content has become available on a cross-platform basis with improved interoperability. In the case of online music, there are stores offering optional DRM and varying quality levels; artists have tested out flexible online sales models on an individual basis and taken advantage of new outlets and sales channels through social websites, online aggregators or online malls; there are offers combining creative-commons licensing and free downloading while still retaining collection society backing and airtime royalties. There is evidence from specialist stores and record labels that these innovations have resulted in a much larger share of revenue coming from online offerings including various types of subscriptions, flexible formats and up to studio quality high-definition sound. Fixed-license schemes linked to broadband or mobile subscriptions also have been launched, as well as advertising-supported services. Direct-to-mobile or direct-to-music-player sales are now available in several Member States.

Online advertising, where it has been measured, has been growing solidly. Spending on advertising in the reporting countries[40] was expected to pass €11.5 billion in 2007, an increase of 38% since 2006. This growth marks an accelerating shift from traditional to online advertising, with the European online advertising market closing the gap to equivalent US spending on advertising, estimated at €13.6 billion in 2007.[41]

Overall, Europe still seems to be at an experimental stage, with very few large-scale operations, and it is too early to point to any single model as the most successful and most

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37 Ibid.

38 Ibid.

39 Ibid.

40 IAB Europe, December 2007; countries surveyed include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Poland, Slovenia, Spain, UK, Norway and Turkey.

41 Ibid.

acceptable for consumers. For much content, there is still a wide gap between user activities and expectations in general and the use of commercial services. It is also still clear that the difficulty of licensing across borders hinders or blocks the roll-out of new services, leading to many new innovative services only being available outside the EU or in just one or a handful of Member States, or even from only a single operator. Take-up of broadband remains an obstacle to various degrees, given the wide differences in take-up among Member States. However, the obstacles are becoming less significant, there are now examples of success in most areas to build on, and advanced general use is growing strongly among European Internet users. The growth in participative web services has been impressive. All in all, the online content picture is solid and expectations for the coming two or three years should still be high.

3. INNOVATION AND R&D

3.1. R&D: Opening up innovation systems

Knowledge and innovation comprise one of the four priority areas agreed by the 2006 Spring European Council as the pillars of the renewed Lisbon Strategy, the new partnership aimed at securing sustainable growth and jobs. Member States have followed up this decision by setting targets and taking steps to increase investment in research and development. The commitments by the Member States have been complemented by the adoption of the Seventh Framework Programme (FP7)[42], which increases EU-level funding by 75% compared to the previous programming period and provides a framework and financial support for major public-private partnerships.

But much more is needed to attain Europe's objectives, including the target of 3% R&D intensity[43] by 2010. EU R&D intensity has stagnated since the mid-nineties. In 2005, less than 1.9% of GDP was spent on R&D in the EU27, a level still significantly lower than in the US (2.67%), Japan (3.17%) or South Korea (2.99%). Sweden and Finland are already well above the 3% targets, while Germany, Denmark, Austria and France are the only other Member States with R&D intensities above the EU average. If Member States achieve the R&D intensity targets announced in their National Reform Programmes, average R&D expenditure in the EU will increase to 2.5% in 2010. However, the trend towards the internationalisation of R&D beyond the traditional regions is making it possible for new emerging economies such as China to rapidly catch up. If current trends continue, China will be at the same level as the EU by 2009 in terms of R&D intensity[44].

R&D investment, at both EU level and worldwide, is concentrated in a few sectors, and a large share of overall spending on total business R&D is accounted for by investment in ICT research. In the EU, the share was about 26% in 2004, but this average figure masked large disparities among the Member States, from 63% in Finland to around only 8-9% in the countries at the lower end of the EU ranking.

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42 Seventh Framework Programme of the European Community for research and technological development for the period 2007 to 2013.

43 R&D expenditure as a percentage of GDP.

44 European Commission, 'Towards a European Research Area. Science, Technology and Innovation. Key figures 2007'.

Investment in ICT R&D is among the fastest growing R&D efforts worldwide according to company data from *The 2007 EU Industrial R&D Investment Scoreboard*[45]. At world level, between 2005 and 2006, the highest R&D growth rate was seen in 'pharmaceuticals & biotechnology' (+15.8%), followed by 'technology hardware & equipment'[46] (+13.1%) and 'software & computer services' (+12.9%).

Sectoral analysis sheds further light on the difference in R&D growth between EU and non-EU companies. Table 4 takes a closer look at R&D investment by EU companies in significant ICT sub-sectors:

Table 4: EU companies R&D investment by sector.

	Change 2006-2005 %		**CAGR 3 years — %**		**R&D intensity 2006 (% R&D/sales)**	
	EU	**Non-EU**	**EU**	**Non-EU**	**EU**	**Non-EU**
Fixed-line telecoms	21.6	2.2	12.8	-3.7	1.6	1.6
Telecom equipment	5.6	17.9	-0.2	9.2	11.6	11.4
Software	15.5	12.9	11.2	5.8	13.8	15.1
IT services	3.2	3.4	-7.6	3.2	3.1	5.8

Source: *The 2007 EU Industrial R&D Investment Scoreboard* (JRC — European Commission)

In 'fixed-line telecoms' the rise in R&D expenditure is attributable to just a few companies, mainly BT but also France Telecom and TDC. This investment can to a certain extent be explained by NGN-related research. However, R&D intensity in the sector is still moderate. The 'software' sector appears to be very research-intensive (13.8%) and characterised by growing R&D investment. SAP is by far the leading EU company in this respect. In 'telecom equipment' the increase in R&D investment in 2006 over the previous year is moderate but the compound annual growth rate is declining, although the sector continues to have high R&D intensities. The rise in 2005/2006 is partly attributable to the three major companies in this sector; Nokia, Ericsson, and Alcatel-Lucent. The research intensities of EU ICT companies are more or less equivalent to those of their main international competitors. Growth in R&D investment in fixed-line telecoms and software is higher in the EU, but EU companies are falling behind in telecom equipment.

National accounts data show that ICT R&D spending per capita in 2006 was just above €50 in the EU, whereas the US and Japan spent more than €200 per capita. However, focusing only on shortfalls in R&D investment does not provide a complete picture of the effort that the EU needs to make to better exploit the full potential for innovation and competitiveness. The EU shows a persistent innovation gap with its main international competitors, especially with the

[45] http://iri.jrc.es/research/scoreboard_2007.htm (JRC European Commission).

[46] This includes computer hardware, telecom equipment, etc.

US, but the 2007 European Innovation Scoreboard[47] shows that the gap has been decreasing, particularly for some innovation indicators including broadband penetration and ICT expenditures. It is important to adopt a more holistic approach to R&D and innovation and look at the entire innovation system, at sectoral level as well. This is especially true in a globalised economy where R&D is becoming increasingly internationalised and easily transferable. In these circumstances, only fully functioning and integrated national innovation systems will be able to retain and attract investment in R&D.

Sectoral innovation systems

The process of innovation is nowadays understood as a systemic model in which innovation arises from complex interactions between individuals, organisations and the environment in which they operate (enterprises and their R&D, universities, research institutes, institutions and their public policies). Research is only one among several components in successful innovation. While recognising that research, as the source of invention, is a major contributor to innovation, policy intervention should also focus on the critical importance of other parts of the innovation system, in particular where they affect the flow of knowledge among various actors.

Within an innovation system approach, identifying a failure means identifying deficiencies in the functioning of the system, i.e. identifying those systemic components that are lacking, inappropriate or are not working (for example, weak knowledge transfer between universities and industry). Public policy intervention is then required to address these system failures by targeting the factors at the source of the failure.

Unlike the 'national system of innovation' (NSI)[48] approach, which considers the flow of technology and information among people, enterprises and institutions from a geographical perspective, the sectoral innovation system concept[49] provides a framework for examining factors that affect innovation in specific sectors. The assumption is that innovation and technological change have different rates, types and trajectories depending on the sector in which they take place. Actors and institutions within a sector all exert a major influence on innovation.

The analysis of a sectoral innovation system is based on three building blocks: *knowledge and technologies; actors and networks* (including individuals, firms, research and financial organisations and their interactions)*;* and *institutions* (including norms, routines, common habits, established practices, rules, laws, standards, etc).

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47 The EIS attempts to benchmark, on a yearly basis, the innovation performance of Member States, drawing on statistics from a variety of sources, primarily the Community Innovation Survey. http://www.eis.eu

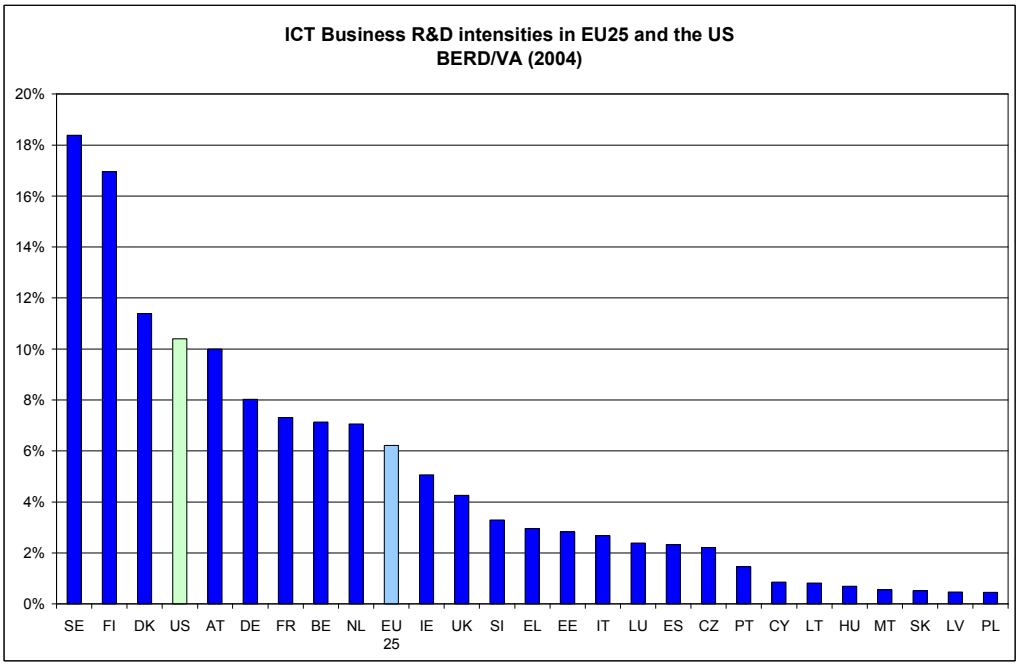
48 Freeman, C., 1987, "Technology and Economic Performance: Lessons from Japan", Pinter, London; Lundvall, B-Å. (ed.), 1992, "National Innovation Systems: Towards a Theory of Innovation and Interactive Learning", Pinter, London; Nelson, R. (ed.), 1993, "National Innovation Systems. A Comparative Analysis", Oxford University Press, New York/Oxford; Patel, P. and K. Pavitt, 1994, "The Nature and Economic Importance of National Innovation Systems", STI Review, No 14, OECD, Paris; Metcalfe, S., 1995, "The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives", in P. Stoneman (ed.), Handbook of the Economics of Innovation and Technological Change, Blackwell Publishers, Oxford (UK)/Cambridge (US).

49 Malerba, Franco (ed.), 2004, "Sectoral Systems of Innovation. Concepts, Issues and Analyses of Six Major Sectors in Europe". Cambridge University Press.

Using this approach, the following analysis[50] attempts to explain the factors that affect the global competitiveness of EU countries from the perspective of the innovation systems of their ICT sectors. The analysis focuses on the actors and the institutions (and their systematic interactions) involved in the generation and transfer of knowledge relevant to innovation and its commercialisation within the ICT sector in question, but also pays a great deal of attention to the sector's R&D intensity.

Regarding R&D intensity[51] (Figure 14), the ICT sectors of Sweden, Finland and Denmark, where the BERD/VA[52] ratio exceeds 11%, stand out as exceptionally research-intensive, with levels above the US. Another group, where research intensities range between 10% and 4.3%, can still be characterised as very research-oriented. In a third group of countries, comparatively little is invested in ICT R&D/VA, i.e. 3.3% to 2.2%. Finally, there is a group of countries where ICT BERD does not play any significant role, with the BERD/VA ratio remaining around or largely below 1%.

Figure 14



Source: IPTS-REDICT based on data from Eurostat, OECD, EU KLEMS and national statistics

R&D intensity is a very important factor, but it is not the only one nor is it the most relevant for a full understanding of the differences in innovation across Member States. This requires a deeper insight into the typical features and characteristics of ICT innovation systems in the various countries through the analysis of qualitative information on the building blocks of the sectoral innovation system approach. The result of this analysis shows that ICT innovation

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50 The analysis is based on preliminary results of a study carried out by a consortium of ISI-Fraunhofer, TNO, ArcSystem GmbH and IAE-HAS for the Joint Research Centre (JRC–IPTS) of the European Commission in the context of a larger project on R&D in the ICT sector in Europe, launched by the European Commission.

51 R&D intensity here is calculated as $BERD^{ICT}/VA^{ICT}$, using national accounts data. This is the R&D intensity of the ICT sector.

52 BERD is Business Expenditure on R&D and includes all R&D carried out in the business sector (as opposed to government, higher education and private non-profit sectors) in a given country, regardless of the source of funds. VA is value added.

systems and policies in the EU Member States vary considerably, confirming the very **fragmented picture of ICT innovation systems** and the persistent wide differences in research and innovation performance **across Europe**.

Among the very innovation-oriented countries — those with ICT R&D intensities above the EU average — three (Sweden, Finland and the Netherlands) have ICT innovation systems characterised by relatively dense, very specialised, highly innovative and dynamic networks (partly market-, partly policy-driven) linking universities, polytechnics, public research organisations and industrial firms. A common feature of these innovation systems is their strong dependence on one or few large companies dominating the ICT sector. This dependence has certainly been very beneficial for their economies, but it could prove dangerous since innovative activities outside the interest of these companies risk being neglected.

Denmark, Austria and Belgium can also rely on a comparatively well-developed and well-functioning ICT innovation system which can be described as market-based and competitive, although more an important sub-sector of the national innovation system than a complete innovation system in itself.

The ICT innovation systems of Germany and France can be characterised as decentralised, diverse and institutionalised with an important role played by intermediary institutions. These same characteristics can be found in the UK ICT innovation system, although with an R&D intensity below the EU average. An explanation for the lower ICT R&D intensity of the UK could be that its innovation system is characterised by the high involvement of foreign firms, which tend to spend less on R&D than UK-owned firms[53]. Large foreign-owned firms seem to rely more on R&D input from overseas and to spend less on R&D within the UK. In addition, in the ICT sector the UK only has few large R&D players in high R&D-intensive sectors such as software and electronics. The ICT innovation systems of the countries with ICT research intensities below the EU average are very diverse.

The ICT innovation systems of Italy, Spain, Portugal and Poland are quite heterogeneous. They are rather fragmented, with low levels of interaction among the various players, which are all present but not really integrated. There is no synchronised horizontal cooperation between the public bodies in charge of innovation and university-industry linkages are poorly developed.

The ICT sectors in Slovenia, the Czech Republic, Hungary and the Slovak Republic are characterised by the dominance of foreign-controlled activities. Foreign investors have outsourced their production to these countries, attracted by skilled labour forces and wage advantages, but their level of ICT R&D spending remains low. The links between research institutions and the business sector are weak. Even though Ireland has one of the most dynamic economies in the field of ICTs, its R&D capabilities are not particularly well developed and the ICT innovation system shows some weaknesses, especially in terms of the low level of industry-academia collaboration.

The ICT innovation systems in the remaining Member States are quite fragmented and not particularly well developed.

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[53] DTI, 2005, "R&D Intensive Businesses in the UK", DTI Economic Papers No 11.

The analysis of the different ICT innovation systems shows that the ICT sectors with R&D intensities above and around the EU average are in countries that also have well-developed and well-functioning innovation systems. If the innovation system within the sector is not functioning well, investment in R&D will not bring the expected benefits.

This type of analysis can also identify which parts of ICT innovation systems work well within the EU and which need policy support. The EU must do more to strengthen its well-functioning national ICT innovation systems and to help the weaker ones catch up.

A stronger research base and, at the same time, improved mechanisms for effective knowledge transfer are essential for the competitiveness of the European ICT sector and for the creation of favourable conditions for retaining and attracting more business R&D. This is particularly relevant in a globalised economy where R&D is easily internationalised and moves towards countries offering 'winning' innovation systems, i.e. those characterised by close relationships between the business sector and research organisations, excellent universities and good collaboration between academia and the private sector.

Open innovation

The need for policy makers to focus on the functioning of the entire innovation system and on improving the knowledge transfer process becomes even more important with the emergence of new ways of innovating brought about by globalisation and the diffusion of ICTs.

The High-Tech Campus Eindhoven (HTCE) — the key element in the adoption of open innovation by Philips

The HTCE houses over 40 technology-based companies and institutes employing several thousand people in developing ground-breaking technologies and products through the open innovation model. Open innovation involves creating the environment and structures to promote interaction, networking and knowledge-sharing, leading to joint projects and joint ventures among the HTCE companies.

Philips Research can spin in ideas and innovations from outside, enriching the services it can offer Philips' business divisions. It can also spin out technologies from its own extensive IPR portfolio to high-tech companies in the HTCE, which can bring innovations to market more quickly. For the other companies on the campus, networking and cooperation on ideas is reinforced by shared facilities and technology.

Many companies are developing open-innovation models where value is created from the exchange and transfer of knowledge through networks, rather than from the knowledge generated within the firm itself. Companies are looking for other ways to increase the efficiency and effectiveness of their innovation processes by actively searching for new technologies and ideas outside the firm, but also through cooperation with suppliers, customers and lead users, as well as academia, open-source communities, inventors, innovation labs, innovation intermediaries, start-ups and even competitors. Furthermore, the results of the innovative process can go to market in many different ways, in addition to being released to the public through the company's own marketing and sales channels: e.g. through technology and IPR out-licensing and sales, joint ventures and spin-offs.

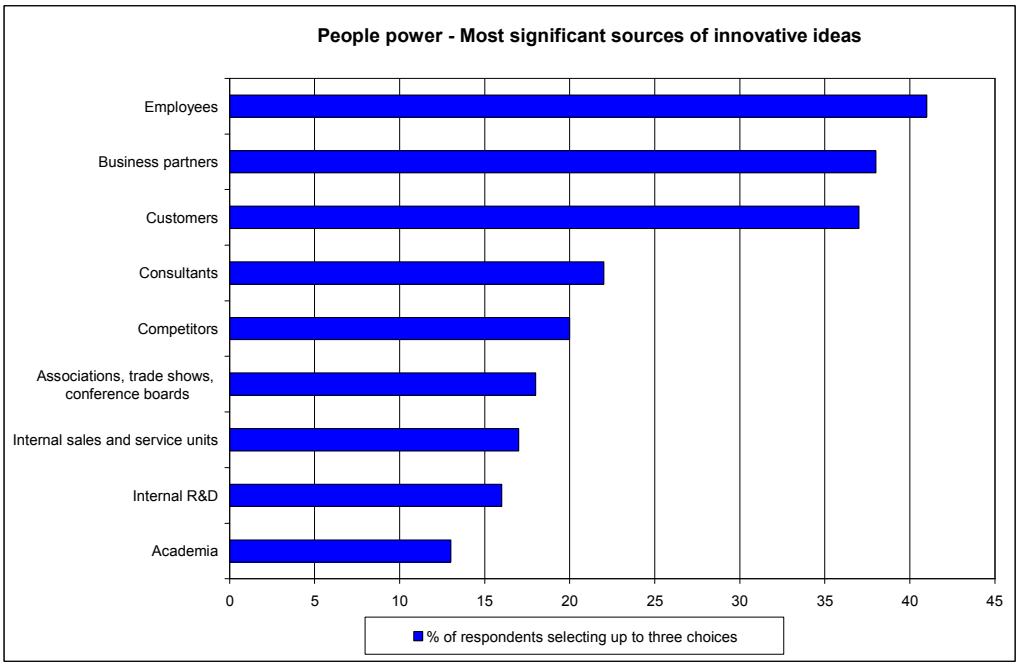
The ICT sector is one of the leading sectors with regard to open innovation, and these changes in business strategies would not have happened without ICTs as a key enabler. The technological success of open source software, such as Linux and Apache, has played an important role in spreading open innovation thinking.

Partnerships continue to be at the heart of the ICT innovation process, as public-private and industry-academia collaborations in R&D and innovation help Europe master and shape ICT development and use. Collaborative research is used not to substitute but to complement internal resources in the innovation process, enhancing innovation input and output. The result is that today a larger percentage of innovative products within a company have elements that originated from outside the company than was the case in the past. In such an open and collaborative innovation model, the flows of knowledge between the various players of the innovation system in its broad sense are as crucial as internal research capabilities.

An important aspect of this new innovation strategy is the role played by consumers and end-users (user-driven innovation). The user turns out to be a true source of innovation for a company engaging in open innovation.

In a survey[54]of business leaders on the sources of innovative ideas, the wide use of sources other than internal R&D, such as business partners, consultants and customers, suggests that many companies are turning to more open innovation models (Figure 15). In particular, the use of customers as a significant source of innovative ideas confirms the emergence of a user-driven innovation model.

Figure 15



Source: IBM "The Global CEO study 2006", based on interviews with 765 CEOs and business leaders

User-generated or user-created content is becoming an increasingly important aspect of the information society. In this context, user-driven innovation is expanding on a trend and embeds user value-generating activities deeper within the value chains of information society business models.

54 IBM, "The Global CEO study 2006", based on interviews with 765 CEOs and business leaders.

Open source potentially saves industry over 36% in software R&D investment, and this substitution of internal R&D allows companies to increase profits or engage in further innovation[56]. This also means that companies can take on more risky innovation projects, as the financial risk is lower. One of the best examples of user-driven innovation is the open source community. Open source is developed by lead ICT users, either single individuals or employees or university staff (at least 570,000 individuals worldwide[57]).

Nokia Maemo Tablet[55]

The Nokia Maemo Tablet PC 770 — a product promoted by Nokia for use in the Nokia 770 Internet Tablet and 800 — is based on an open source core. Nokia contributed around only 200,000 lines to the already existing open source core of around 15,000,000 lines. In other words, only 1.5% of this product was developed internally by Nokia: a significant substitution of in-house R&D with external R&D.

Westwood Studios, an example of user involvement in the innovation process

At the beginning of 2001, Westwood Studios, a developer of computer games, introduced its first toolkit for consumers, which has developed into what is now a software editor allowing computer game aficionados to build new graphic environments (e.g. maps and missions) into their games. Nowadays, Westwood Studios consumers do detailed design work and engage in week-long innovation exercises that, according to managers at Westwood, yield valuable content for the product.[58]

Generally companies can involve users in different ways:

- Weakly — by listening to consumers using e.g. online surveys, market research methods, etc.
- Moderately — by interacting with lead users by letting them test pre-commercial products
- Strongly — by extracting 'sticky' knowledge from users by letting them become part of the R&D and innovation process, using for instance ICT toolkits.

However, the protection of intellectual property rights (IPR) is not typically addressed in these models other than that, in most cases, the innovating company retains all rights, except of course for open source development, where IPR issues are addressed separately.

3.2. ICT uptake by enterprises 2005-2007

Connectivity and basic ICT uptake have visibly progressed since 2005: By 2007, 77% of all businesses had a broadband connection (97% of large enterprises and 77% of SMEs) and 77% were using the Internet for dealing with banks. In addition, enterprises started making significant use of e-government services, stimulated by progress in the greater availability and sophistication of online public services (Figure 16).

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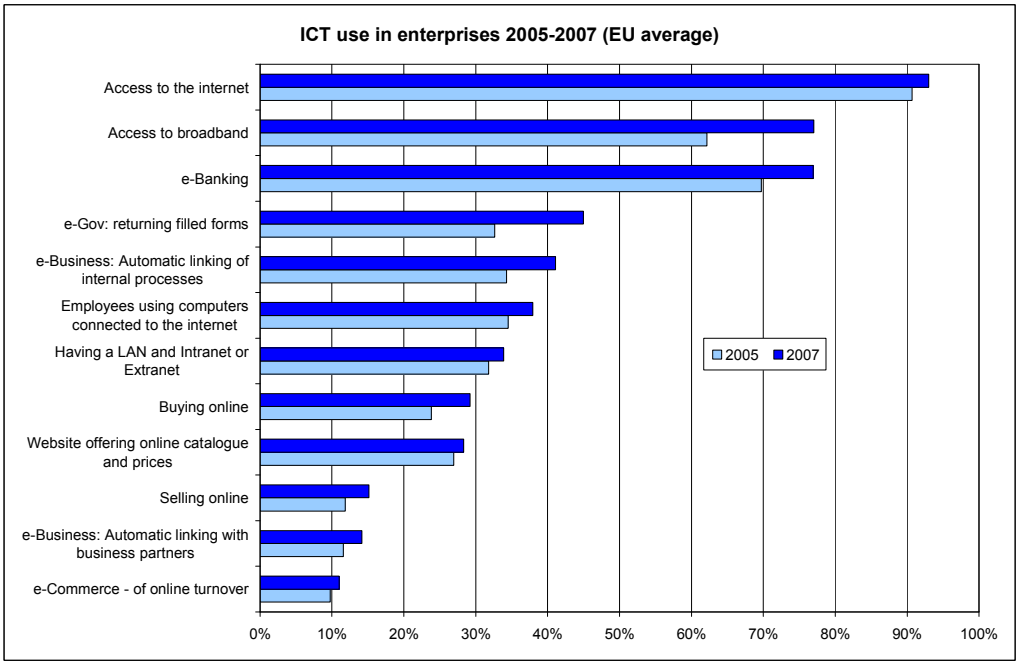
55 The Nokia Maemo Tablet PC 770 was analysed in a study conducted for the European Commission on the 'Economic impact of open source software on innovation and the competitiveness of the Information and Communication Technologies (ICT) sector in the EU', 20 November 2006. Lead contractor: UNU-MERIT, the Netherlands.

56 Study on the: Economic impact of open source software on innovation and the competitiveness of the Information and Communication Technologies (ICT) sector in the EU. 20 November 2006. Lead contractor: UNU-MERIT, the Netherlands

57 Study on the "Economic impact of open source software on innovation and the competitiveness of the Information and Communication Technologies (ICT) sector in the EU", p. 46, 20 November 2006, UNU-MERIT, the Netherlands.

58 Lars Bo Jeppesen, 2003, "The implications of user toolkits for innovation", Copenhagen Business School.

Figure 16



Source: Eurostat, Survey on ICT use in EU enterprises. Data refer to all the enterprises, excluding the financial sector. [59]

As highlighted in section 1, the uptake of ICTs by businesses yields important economic benefits as long as it is accompanied by investment in business reorganisation. However, evidence of the potential impact of ICTs on the efficiency of enterprises is mixed: while progress has been made in the use of applications for the automatic exchange of information inside enterprises (now practiced in more than 40% of EU businesses, in particular large enterprises), the use of ICTs for transactions with business partners is still limited to a small subset of enterprises. Only 15% of all enterprises are selling online[60] and slightly fewer have established automatic links with their business partners. The challenges hampering electronic linking beyond enterprise boundaries are interoperability and standards issues as well as legal concerns, and are particularly burdensome for SMEs.

Differences in ICT take-up across Member States are becoming increasingly evident. A comparison of average take-up levels across countries[61] shows that they range from 27% to almost 59% (in 2007), with the degree of fragmentation remaining basically constant over the period 2005-2007[62] (Figure 17).

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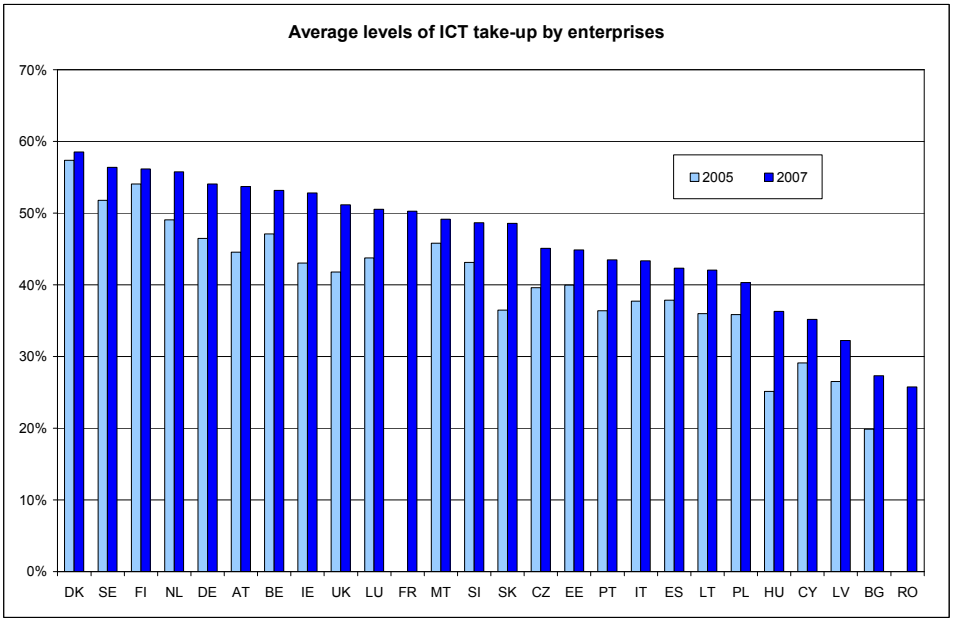
59 All the indicators listed in the chart are expressed in terms of % of enterprises, except for online turnover (as % of total enterprise turnover) and the % of employees using computers connected to the Internet (as % of total employment)

60 Via the Internet or other computer-mediated networks (at least 1% of turnover).

61 The average take-up in each country is equal to the mean of the indicators shown in Figure 16, except for those not expressed in terms of % of enterprises.

62 A relevant statistical test does not support the hypothesis of different levels of variability among countries, between 2005 and 2007.

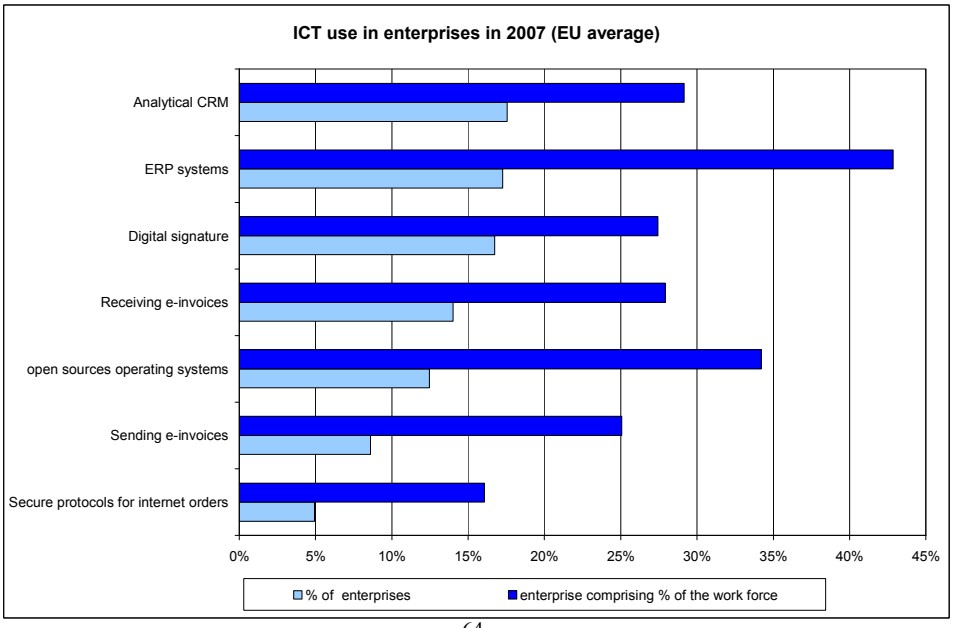
Figure 17



Source: Commission estimates based on the Eurostat Community Survey on ICT use in EU enterprises. Data refer to all the enterprises, excluding the financial sector.

The deployment of ICTs in business processes requires significant investment, which is more likely to be carried out by large organisations. Investment requirements are one of the main sources of the gap in ICT take-up between SMEs and large businesses. Data weighted by enterprise size indicate that the impact of ICTs on the economy is larger than suggested by aggregate un-weighted data[63].

Figure 18



Source: Eurostat, Survey on ICT use in EU enterprises [64]

63 The weighting factor is the number of persons employed. Statistics weighted by enterprise size have been made available by Eurostat starting from the 2007 edition of the survey.

64 Employment weighted figures on the use analytical CRM (Customer Relationship Management) have been estimated by Commission services on the basis of Eurostat data.

For example, the use of digital signature is limited to 17% of all enterprises, but these same businesses employ more than one quarter of the workforce in the EU. The difference is even more striking when considering the use of ERP[65] systems, which require significant investment and are usually implemented in large and complex organisations: the 17% of all EU businesses using ERP systems represent 43% of the EU economy in terms of employment.

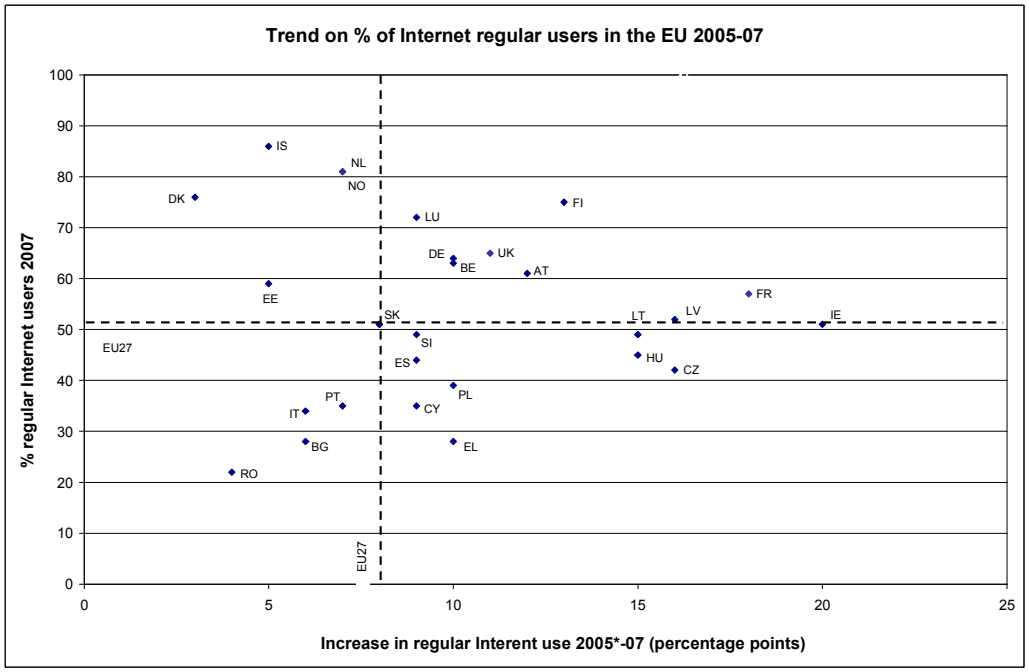
Overall, the uptake of e-invoicing is still low in the EU: only 9% of enterprises (representing the 25% of the economy) are sending them to their business partners. Obstacles include lack of standardisation, legal uncertainty, especially in international transactions, and lack of affordable software solutions. However, the take-up of e-invoicing is a good example of the gaps and differences across Member States. While in Northern countries enterprises sending e-invoices represent more than 40% of their economies, in most of the new Member States the move from paper to electronic invoices has just started.

4. INCLUSION AND PUBLIC SERVICES

4.1. eInclusion

The i2010 initiative has succeeded in bringing more and more people online: 2007 was the first year when over half of the EU population used the Internet regularly (51% of EU citizens accessed the Internet at least once a week, up 8 percentage points over 2006). Regular Internet usage has risen across the whole EU27, albeit at different rates (Figure 19).

Figure 19



Source: Eurostat, Community Survey of ICT usage in Households and by Individuals. EU data without Malta. *2006 data used for BG, RO and FR no 2005 data available** Sweden was the only country decreasing its rate in Internet regular use by 1 % point since 2005 (currently being 75%) and for that reason has not been included in the chart.

65 Enterprise Resource Planning.

In 2007, more than 50% of population were regular Internet users in 16 countries. Growth was very fast in Ireland (20 percentage points), France (18), in the Czech Republic and Latvia (16) and in Hungary and Lithuania (15). Despite good progress, some Member States still had both low percentages of regular Internet users and low growth rates (Bulgaria, Italy, Portugal and Romania). Denmark, the Netherlands, Iceland and Norway top the table and are close to saturation, with nearly the entire adult population using the Internet regularly in 2007[66].

Despite this progress, 40% of the EU population have never used the Internet. This issue is addressed by the i2010 eInclusion initiative. A Communication adopted in 2007[67] measured progress since 2005 on the various eInclusion targets set by the Riga Ministerial Declaration[68], which include halving the disparities in Internet use and digital literacy levels between disadvantaged groups and the EU population as a whole by 2010.

To monitor disparities in Internet use and digital literacy over time, two penetration rate ratio indexes were used to measure the difference between potentially disadvantaged groups and the EU average, which has been shown to be the most appropriate way to track and analyse such disparities over time[69] These show that there remain large disparities in Internet use and digital literacy levels between the overall EU population and the various disadvantaged groups.[70]

Comparison of Internet use by socio economic group between 2005 and 2007 shows there has been some reduction in disparities (Figure 20). The most disadvantaged groups are those aged 65-74, the retired and economically inactive, and those with low education. For each of these groups, average Internet use has moved closer to the EU average. This is not the case for those living in Objective 1 Regions for whom relative Internet use has declined. Students, the highly educated and young people remain at the top, but Internet use has declined relative to the average possibly because their usage rates are close to saturation while the average continues to grow. Average Internet use by citizens living in rural areas, women and the middle aged is close to the EU average and the relatively small difference has declined since 2005.

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66 Note that those younger than 16 years of age and older than 74 are not included in the Community ICT survey.

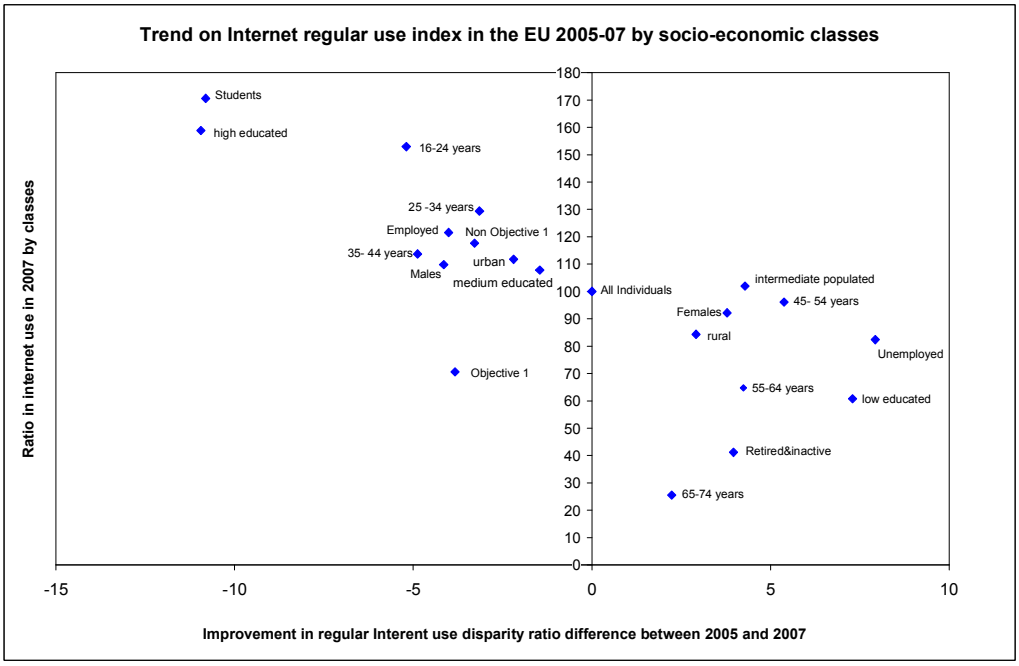
67 *European i2010 initiative on e-Inclusion - to be part of the information society* COM(2007) 694 http://ec.europa.eu/information_society/activities/einclusion/policy/i2010_initiative/index_en.htm.

68 The Riga Ministerial Declaration is available at http://ec.europa.eu/information_society/events/ict_riga_2006/index_en.htm.

69 See "Benchmarking from a policy perspective - eInclusion report", December 2006, http://ec.europa.eu/information_society/eeurope/i2010/docs/studies/wp5_benchpol_e-inclusion.doc.

70 http://ec.europa.eu/information_society/activities/einclusion/docs/i2010_initiative/rigadashboard.pdf.

Figure 20



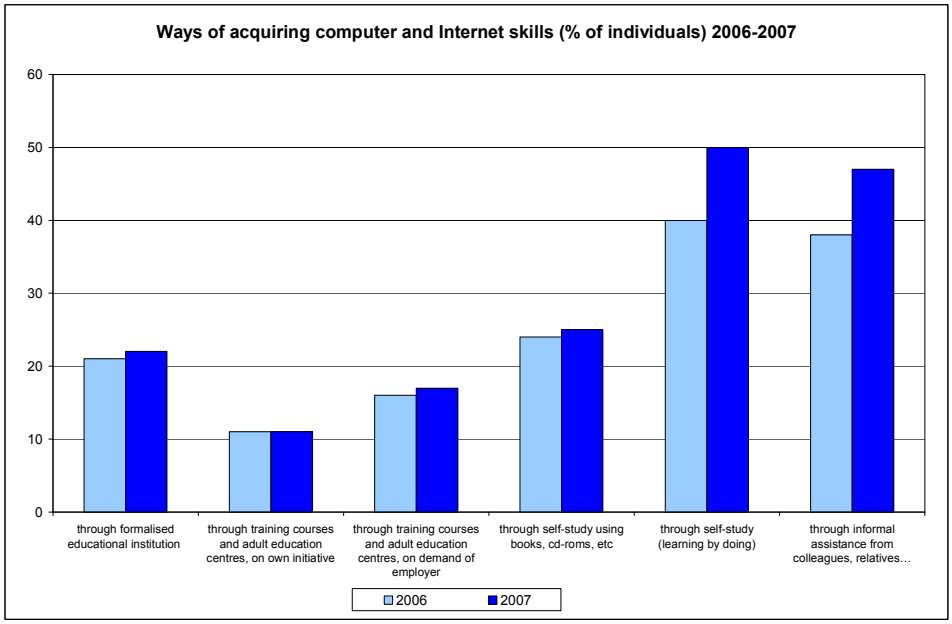
Source: Commission services based on Eurostat, Community Survey on ICT usage in Households and by Individuals. EU data without Malta

These findings, in particular that the elderly and the economically inactive are furthest behind but that women and the unemployed are getting closer to the average, is consistent with the results from the digital literacy disparity index[71]: Being in the labour force and of active working age facilitates access to the Internet and hence becoming digitally literate and a regular Internet user. Individuals outside the labour force (economically inactive) and/or in retirement age are less likely to be digitally literate. More detailed analysis of digital literacy levels by Member State and by socio-economic group will be reported in the Digital Literacy Review expected in 2008.

The Community Survey on ICT Usage in Households and by Individuals shows that there is also a trend towards obtaining and upgrading computer and Internet skills from informal sources (Figure 21).

[71] Measuring progress in e-Inclusion, Riga Dashboard, European Commission 2007. http://ec.europa.eu/information_society/activities/einclusion/docs/i2010_initiative/rigadashboard.doc

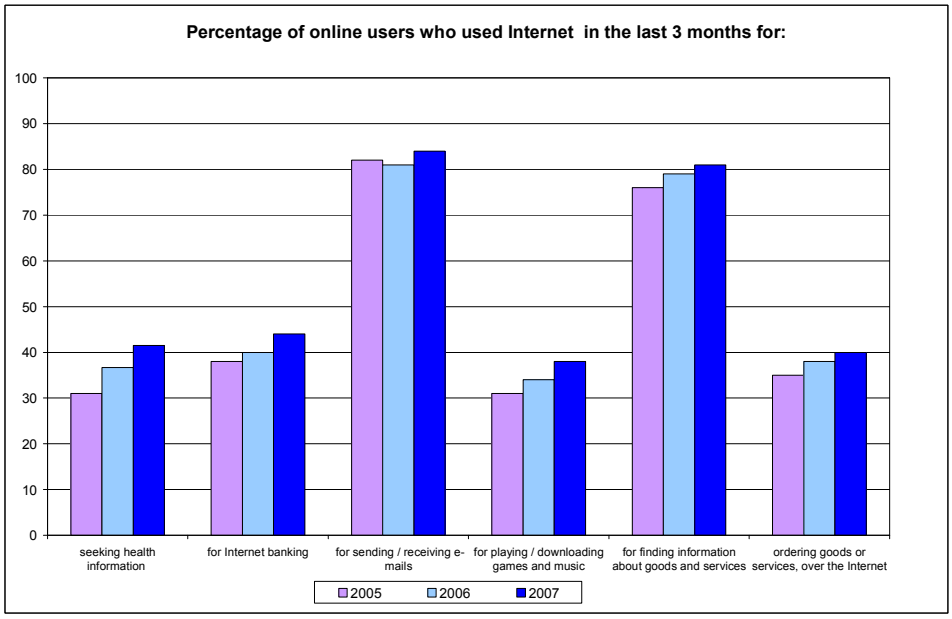
Figure 21



Source, Eurostat Community Survey on ICT Usage in Households and by Individuals between 16-74 years old (2006-07). EU27 without Malta.

The importance of Internet usage and digital literacy is underlined by the growth in online activities. As public and private services become increasingly available online, and at better quality, those people unable to access them face greater disadvantage. Since 2005, online activities have increased significantly in areas such as eGovernment, searching for health information and online transactions. The progress has been remarkable, given that such activities are normally performed less frequently or seasonally. Sending e-mails and online searches for goods and services remain the most common activities (Figure 22). [72]

Figure 22



Source, Eurostat Community Survey on ICT Usage by Households and by Individuals between 16-74 years old (2006-07). EU27 without Malta.

[72] Other activities were already commented on in section 2.3

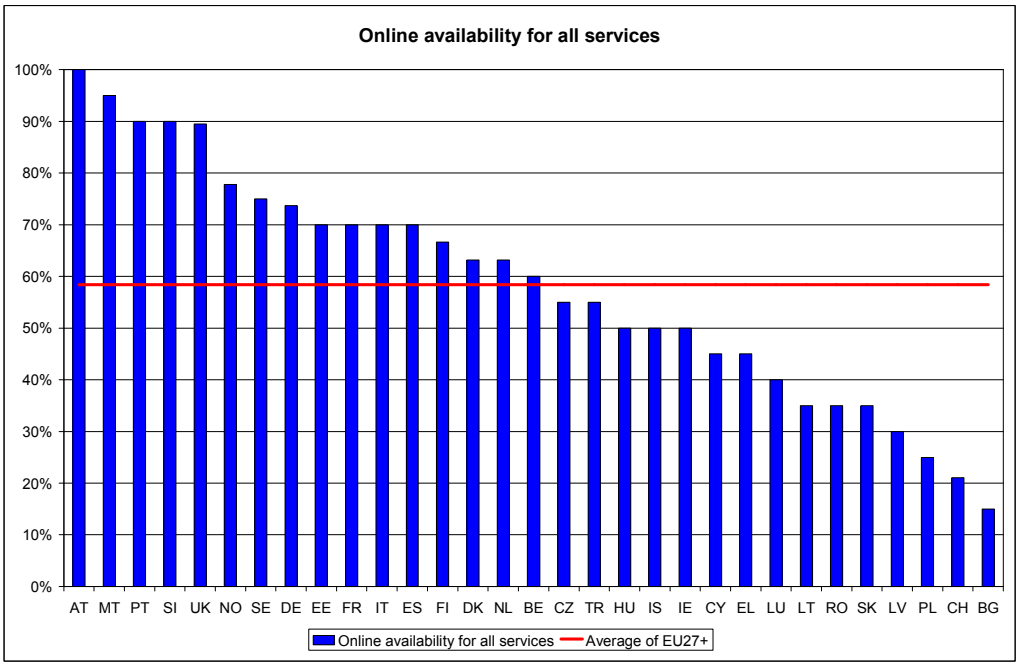
4.2. eGovernment

Europe continues to make progress in the supply of online public services and thereby is making major steps towards the goals of the Lisbon Strategy and the i2010 eGovernment action plan. Businesses are well served and suitably engaged. Citizens are generally less well served despite the fact that they are increasingly exposed to and versed in web services. This has the effect of widening the gap between the public and commercial online worlds. The challenge is to close this gap, delivering an experience that is attractive to citizens and meets their needs efficiently, consistently and economically.

Basic services[73] in all Member States are available online, and there has been a significant increase in the level of sophistication. However, there is a variation of around a 50 percentage points between the most and least advanced countries.

In terms of **full online availability**[74], Europe advanced from 50% in 2006 to 58% of basic services in 2007. This is the largest percentage increase for a single year since 2001. The gap between the leader (now at 100%) and the worst performer is 85 percentage points. This variation reflects the inherent difficulty in ensuring the full delivery of integrated ('front-to-back-office'), interoperable services, particularly in large and decentralised countries. Among the top ten performers, only three (UK, FR, DE) are large Member States (Figure 23).

Figure 23



Source: Cap Gemini, "The User Challenge. Benchmarking the supply of online public services" 2007

There is a strong correlation between the **sophistication** and availability of eGovernment services. Five countries achieve 90% or above on both measures. Austria retains its leading position, followed by Malta, Slovenia, Portugal and the United Kingdom (the first of the large

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73 Basic refers to the 20 services (12 for citizens, 8 for businesses) used to benchmark online availability of public services (full definition in "The User Challenge" Report, see next footnote)

74 All online availability figures are taken from "The User Challenge: Benchmarking the supply of online public services", European Commission 2007, available at http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/egov_benchmark_2007.pdf

countries). Modest size has enabled rapid progress. However, a number of small Member States have not yet embraced eGovernment to the same degree. There are also a number of previously progressive 'old' countries whose progress has faltered somewhat over recent years.

eGovernment is still progressing faster for business services than for services intended for citizens. The EU average for company registration fully available online, a good indicator for a business-friendly environment and crucial to the Lisbon agenda, is 79%. It is 100% in fifteen Member States, but in seven others (FI, NL, EL, BG, RO, LV, SK) it remains only at 50%. VAT and corporate tax declaration are both close to 100%, while the EU average for electronic procurement is 81%.

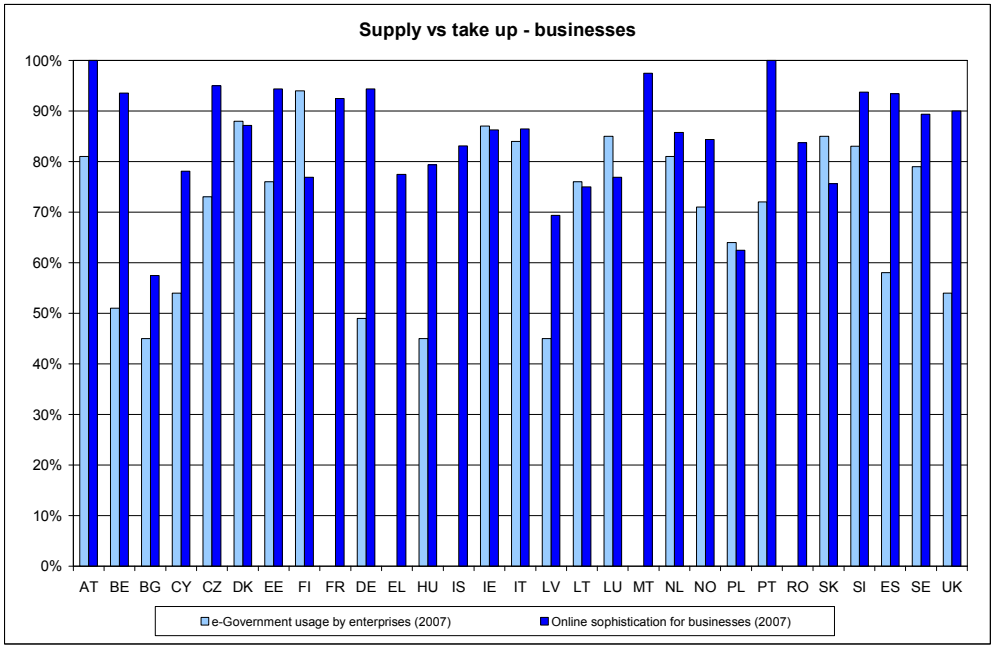
The situation is different for citizens. Sophistication stands at 70% and full online availability for services at 50%. The gap between the leader (Austria — 100%) and the worst performer exceeds 90 percentage points, although in some countries (UK, FI, NO, SI) citizens are now served as well as businesses.

According to the Community surveys on ICT use in businesses and households,, 2007 saw a significant improvement in the **take-up** of eGovernment services, both by individuals and businesses. For individuals, 30% of Internet users have interacted online with public authorities in one way or another. This represents a 6 percentage point increase relative to 2006, but still lags behind the figure for businesses (66%). However, the development is very encouraging, and is likely to signal a positive trend after years of slow growth in take-up.

Nearly half of individuals and 61% of businesses have used eGovernment to obtain information. Where sophistication is concerned, nearly 22% of citizens were able to fill in forms online, up 10 percentage points since 2005, compared with 46% of businesses.

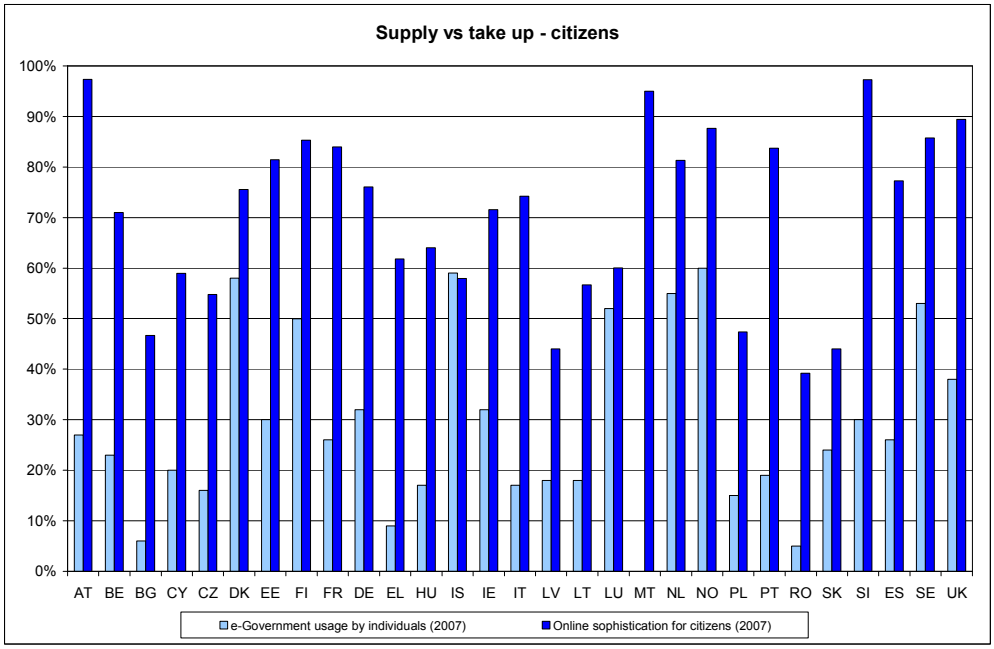
However, a substantial gap between supply and take-up remains in most countries. The difference is much more marked for citizens than for businesses. Those that have achieved both high take-up and a high level of sophistication include the Nordic countries, the Netherlands, and Luxembourg (Figures 24 and 25).

Figure 24



Source: Cap Gemini "The User Challenge. Benchmarking the supply of online public services" 2007, and Eurostat, Community Survey on ICT use in Enterprises, 2007.

Figure 25



Source: Cap Gemini "The User Challenge. Benchmarking the supply of online public services" 2007, and Eurostat, Community Survey on ICT use in Households and by Individuals, 2007.

Monitoring of the full availability and take-up of eGovernment services does not convey the full picture for eGovernment developments, however. The Commission has carried out an analysis of the user experience and the elements important to this experience. The factors looked at were: the provision of a legally recognised, secure electronic identity; the accessibility of the service via alternative channels such as call centres, kiosks, mobile phones and TV; and, compliance of websites with the International Accessibility Guidelines. These **'User Centric Measures'** deliver a mixed result, the most striking finding being that only 5% of websites make specific reference to their compliance with international accessibility guidelines.

With a plethora of public administration websites available and the use of conventional search engines to access public services, there are clear efficiency benefits from delivering a **national** portal as a convenient trusted and branded route to public services. The Commission has now for the first time conducted an assessment of national portals, and the findings are very positive. Analysis of the availability of basic services, personalisation ('my portal'), and consistency of layout demonstrates that European governments have invested in delivering good national portals and that they are considered as cornerstones of national eGovernment strategies.

4.3. eHealth

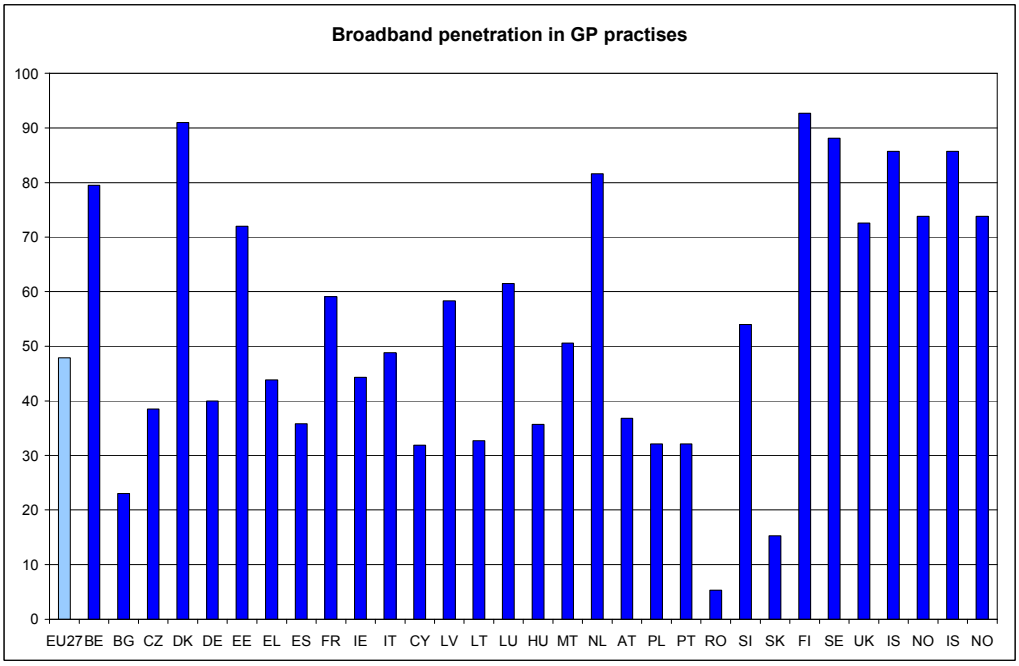
In 2007, the Commission launched the Lead Market Initiative which sets out an agenda for the deployment of innovative eHealth services. The EU currently has a worldwide lead in the deployment of regional/national health information networks, and this lead could be turned into significant market opportunities for eHealth systems and services both within the EU and on world markets.

The Lead Market Initiative was also intended to address economic challenges in the health sector: health spending is rising faster than GDP and is forecast to reach 16% of GDP by 2020 in OECD countries. As the population ages, the costs of long-term healthcare are rapidly increasing, with serious implications for the sustainability of current health and social care systems. The Lead Market Initiative will focus on developing services and markets that can help make the sector more efficient (for example, by extending independent living and continuity in long-term care through the development of telemonitoring and telemedicine). While most eHealth investment has until now focused on generic ICT infrastructure in primary and secondary health care, future growth is expected in specialised eHealth services such as e-prescriptions, electronic health records, telemonitoring and homecare.

The GP survey

A telephone survey of general practitioners (GPs) across the EU27 in 2007 yielded positive results regarding the availability of computers and Internet use in primary health care: over 87% of GPs are using computers in the EU27 and 66% are using them routinely during consultations. About 70% use the Internet, although still only about half of practices are connected through broadband (Figure 26). Furthermore, there are wide differences across countries: Denmark having the highest broadband penetration (91%) and Romania the lowest (about 5%).

Figure 26



Source: Empirica, "ICT use among General Practitioners in Europe" 2008.

There are wide variations in connectivity between countries, which translate into differences in the efficiency of eHealth systems: Denmark, Finland, Norway and the Netherlands are the countries with the largest number of GPs connected to other health actors, while Latvia, Romania, Bulgaria, and Greece have the lowest overall connectivity.

eHealth potential is greatly enhanced where there are dedicated electronic health networks directly connected to other health actors (such as hospitals, insurance bodies, health authorities, pharmacies, etc.). From this point of view, GPs are still not sufficiently connected. Even though 55.2% have access to at least one other institutional network, rates are generally lower for secondary health care connections (hospitals or specialists) and other health actors such as pharmacies (Table 5).

Table 5: Percentage of GP IT systems connected to different health actors

	Laboratories	Secondary health care*	Pharmacies	Patients' homes
EU27	38.8	24	6.8	2.0
BE	74.4	64	4.4	1.3
BG	6.8	8	2.9	2.9
CZ	24.0	10	1.6	4.3
DK	82.8	77	77.4	44.8
DE	67.6	9	2.0	2.8
EE	52.7	38	10.0	2.0
EL	4.1	6	2.2	0.3
ES	30.5	30	3.7	0.6
FR	31.5	17	1.0	0.3
IE	39.9	23	0.5	1.0
IT	9.7	15	0.7	1.0
CY	6.9	10	1.4	0.0
LV	0.6	0	0.0	0.0
LT	8.0	7	2.3	0.4
LU	38.2	14	0.0	3.2
HU	12.4	12	0.0	0.0
MT	9.8	14	3.3	2.2
NL	71.7	73	72.1	5.4
AT	25.8	34	5.4	1.7
PL	10.5	10	3.7	1.7
PT	1.8	21	1.8	0.0
RO	2.0	1	1.0	0.3
SI	20.4	17	4.9	3.9
SK	5.7	5	3.8	1.9
FI	89.2	82	3.2	2.0
SE	68.5	47	67.0	3.0
UK	77.1	52	5.1	1.6
IS	68.9	50	13.6	1.0
NO	78.9	76	3.4	1.0

Source: Source: Empirica, "ICT use among General Practitioners in Europe" 2008. Practice computer system connected to various organisations (selective: original list included pharmacies, laboratories, health authorities, other GPs, specialists, hospitals, patients' homes, insurance bodies, other care) via Internet or dedicated electronic network (cf. indicator annex for more information), % values.* Connecting to at least one other secondary care provider (hospitals, specialist practices).

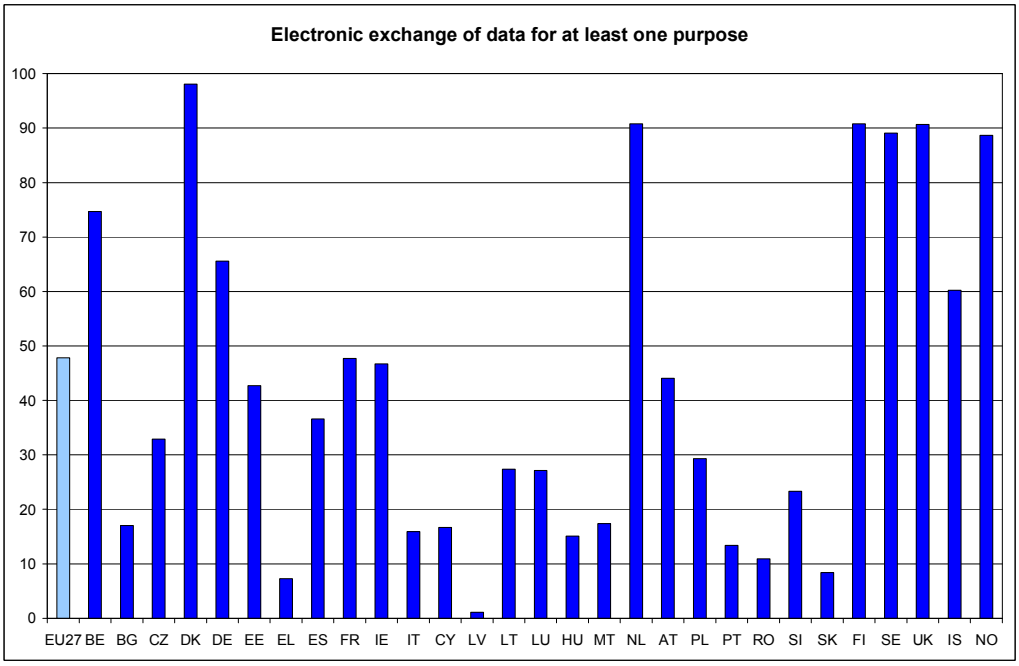
Connectivity to secondary care health actors (i.e. hospitals and specialists) is more frequent in smaller countries such as Denmark, Norway, the Netherlands or Belgium, probably because issues of interoperability between regional health systems in larger countries represent a significant challenge.

Finally, GP connections to pharmacies and patients' homes are not yet developed except in Denmark, which is leading in overall GP connectivity. Connectivity with other health actors is a prerequisite for implementing services such as telemonitoring, eReferral and ePrescription, which are key components of the European eHealth agenda.[75]

Those countries most advanced in terms of *access and connectivity* tend to perform above average in the *use* of networks for professional purposes. In Denmark, for instance, email is used extensively for communication between doctors and patients, with about 60% of GPs doing so (as against the EU average of 4%). Other examples include Finland and UK (77% and 53%, respectively, for making appointments with other care providers) and Sweden (9% using telemonitoring vs the 1% EU average). Similarly, wide differences can be observed in the exchange of patient data by electronic networks or the Internet (Figure 27).

[75] See eHealth Action Plan, eHealth LMI, and eHealth ERA study and roadmaps: www.ehealth-era.org/.

Figure 27



Source: Empirica, "ICT use among General Practitioners in Europe" 2008.

A positive and consistent result across countries is the high percentage of GPs using the Internet and computers for their own continuous education (with a EU27 average of 82%).

The GP survey generally shows that differences in eHealth are currently particularly acute across countries. More eHealth benchmarking analysis at other health care levels and regionally will be performed during 2008 in order to assess further the existing gaps in deployment, take-up and use of electronic services for health.

5. CONCLUSIONS

The Commission's Strategic Report on economic reform across Europe[76] demonstrates that the Lisbon Strategy is contributing to the recent much improved performance of the EU economy. However Europe will need to press ahead with further economic reforms at both Community and national level to cope with the impacts of global financial uncertainties and higher commodity prices. ICTs play a crucial role in stimulating labour productivity growth through their impact on innovation and efficiency. Progress is being made in all the main information society areas, but fragmentation between Member States is increasing, weakening the benefits of the Single Market.

Throughout the first three years of the revised Lisbon agenda, there has been an increasing focus by Member States on the mainstreaming of ICT policies, thanks to better recognition of the importance of ICTs as a source of innovation, competitiveness and growth. Countries increasingly recognise the need for greater cooperation within and among government organisations. The most frequent initiatives undertaken by Member States focus on the spread of eGovernment, broadband and digital skills in education. National plans are increasingly

[76] COM(2007) 803.

addressing a variety of ICT areas, often with dedicated strategies along the lines of the EU i2010 initiative, but commitments are uneven across the European Union.

In general terms there is a need to bring forward more innovative policies, speeding up action on the interoperability of cross-border eGovernment services, stimulating business take-up and including e-skills strategies within lifelong learning and skills policies. Measures should also take into account the important changes that ICT developments in network capacity, in wireless and mobile technologies as well as in collaborative applications are bringing to economies and societies.

The Lisbon reform process will be crucial, and needs to ensure progress while stimulating uniform development across Member States. The European Union is characterised by fragmentation for most of the information society indicators considered in this report.

All countries have strengths and weaknesses, with indicators both above and below the EU average. However, not all are equal and information society development is uneven. Three groups of countries can be distinguished:

- The most advanced countries: Denmark, Finland, Iceland, Netherlands, Norway, Sweden. Austria, Belgium, Germany, Luxembourg and the UK are close to this group.
- The least developed: Bulgaria, Cyprus, Greece, Poland and Romania. For these countries, more than 75% of the indicators are lower than the EU average.
- The remainder, with values above and below the EU average.

The pattern of information society development has remained largely unchanged: more advanced in the Nordic countries plus the Netherlands and the UK and lagging in many of the countries of eastern and central Europe and the Mediterranean. The accompanying Staff Working Document with country chapters sheds more light on individual performances.