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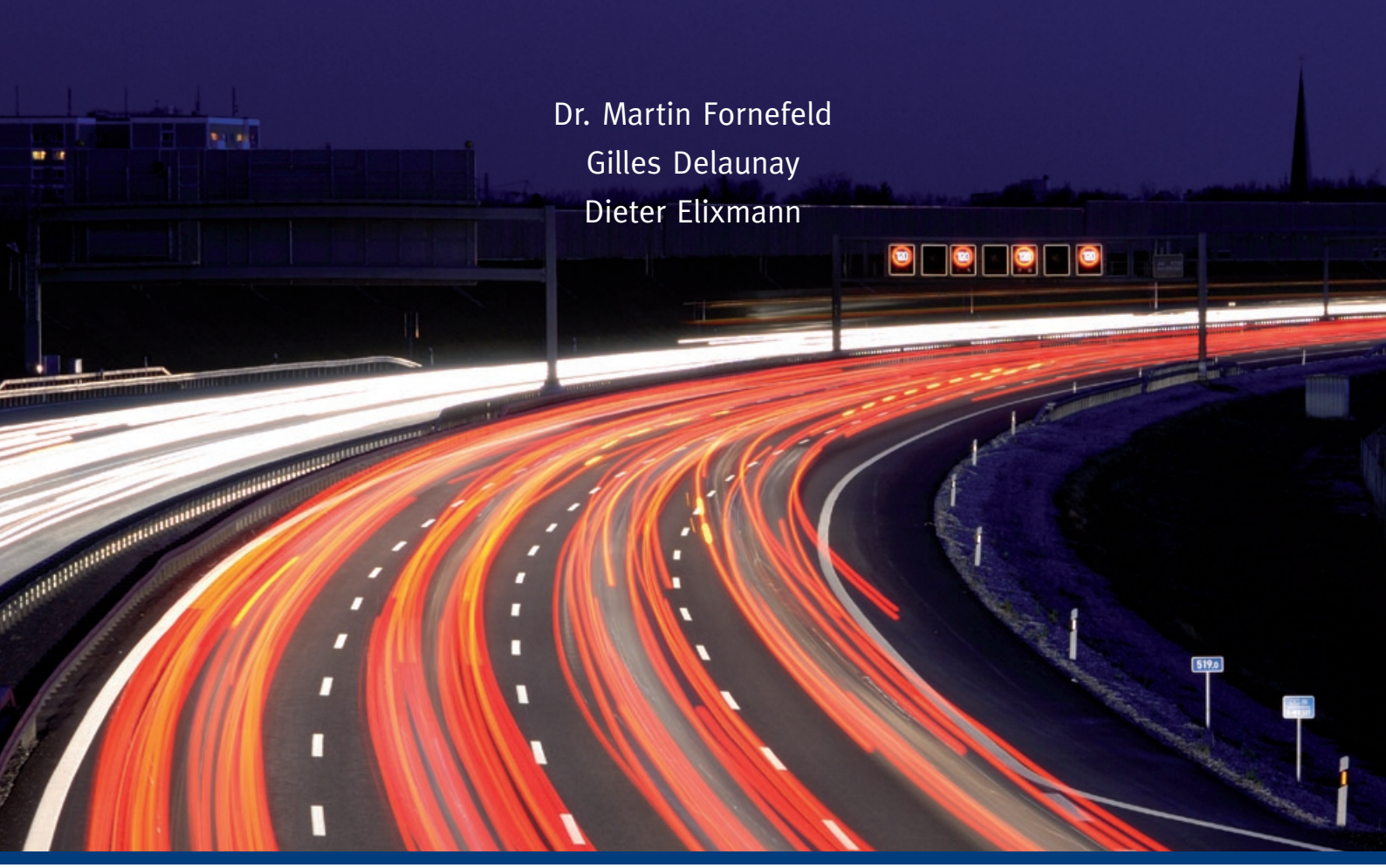

The Impact of Broadband on Growth and Productivity

A study on behalf of the European Commission
(DG Information Society and Media)

Short version – selected extracts from the full text

MICUS
Management Consulting GmbH

Contents of the short version

This short version of the text is a collection of selected extracts from the full study. The full text of the study and annexes can be downloaded free of charge from ***www.micus.de****.*

Extract 1: Contents (original pages 3-4)

The opinions expressed in this study are those of the authors and do not necessarily reflect the views of the European Commission.

MICUS Management Consulting GmbH

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Extract 2: Executive summary (original pages 5-7)

The Lisbon strategy aims to make the EU "the most dynamic and competitive knowledge-based economy in the world" by 2010. It was relaunched in 2005 and refocused on the creation of growth and jobs. The objective of this study is to assess the contribution of broadband internet telecommunications to this strategy by evaluating its impact on growth and productivity.

Studies of the development of broadband generally focus on the provision of telecommunications services. In order to analyze all economic impacts, this study broadens the scope of attention by considering the use of value-added services over the telecommunications infrastructure. Three composite indicators establish a portrait of broadband adoption in Europe between 2004 and 2006, on the basis of statistical data from the European Commission and Eurostat:

- development of the broadband infrastructure
- readiness of the population to use broadband-based technologies: IT skills, affinity towards new technologies, awareness for the benefits of broadband
- integration of broadband-based services into companies' processes.

The following telecommunications technologies are considered "broadband": ADSL, VDSL, cable modem, fibre optics, wireless, satellite internet, mobile broadband (UMTS, HSPA) and internet through the electric power transmission network (Powerline). Predictions about the development of the broadband infrastructure over the period 2006–2015 are founded at the country level on a review of the development plans of the main telecommunications services providers. Broadband penetration is expected to reach 81% of all households by 2015, including households using broadband over mobile technologies and which do not subscribe to a fixed-link telecommunications access. The VDSL and FTTH/B infrastructures are unlikely to be developed on a wide scale in Europe before 2010.

In order to support the analysis with concrete results, two regional broadband development programmes were investigated, in Cornwall (UK) and Piedmont (IT). Both programmes focus on the adoption of value-added broadband services in companies and in public services. Four years after the start of the actnow programme, 10% additional yearly growth and 7% additional productivity increase per year in the business services sector can be observed in Cornwall as compared to the rest of the country. Two years after the start of the WI-PIE programme, the regional IT observatory recorded progress of 9% per year on average in the regional broadband-related economic indicators.

Previous assessments of the impact of broadband on growth were based on statistical correlations between broadband development and economic prosperity. In order to provide a more detailed understanding of the way broadband impacts the companies' activity, the present analysis models broadband-related productivity improvement, structural displacements within the economy and innovation-driven growth.

- Process improvement: According to the available literature, companies adopting broadband-based processes improve their employees' labour productivity on average by 5% in the manufacturing sector and by 10% in the services sector. Due to the slow adoption of broadband-based value-added services in Europe and in particular among SMBs (3% per year on average), the macro-economic broadband-related productivity improvement in Europe evaluates to 0.29% on average per year over the period 2004–2006.
- Specialization in knowledge-intensive activities: The development of broadband allows the acceleration and automation of information flows between companies, which enables an increased specialization in knowledge-intensive activities. This structural evolution in business environments generates a displacement of 725,000 jobs per year in Europe from traditional economic sectors to the business services sector. This displacement mostly concerns activities, such as IT services, engineering, accounting, legal and financial services or research activities, generally described as knowledge-intensive business services (KIBS). It yields a productivity improvement of 0.15% per year at the European level and fosters innovation.
- Broadband-based innovation: Service innovation and process innovation in knowledge-intensive activities strongly rely on broadband technologies. This kind of innovation is crucial for the development of new markets and economic growth in developed economies. Results from the model assess the creation of 440,000 jobs in the business services sector in 2006 and 549,000 jobs in other economic sectors due to broadband-related innovation in knowledge-intensive activities. This employment creation compensates for the loss of jobs due to process optimization and structural displacements within the economy. The impact of broadband on employment is positive, with a net creation of 105,000 jobs in 2006 in Europe.

According to the model, process improvement, increased specialization in knowledge-intensive activities and broadband-based development of innovative markets resulted in a growth of the European Gross Value Added (GVA) of € 82.4 bn per year (+0.71%) in 2006. The impact of broadband on national economies depends on the level of broadband development: in the most advanced European countries, broadband-related GVA growth reaches 0.89%, whereas in the countries with less-developed broadband, this growth is limited to 0.47%.

The speed of broadband development is not neutral as regards economic impact: the successful development of innovative activities, which constitutes a large share of the positive impact of broadband, requires remaining at the forefront of worldwide development. Three scenarios quantify the importance of the speed of adoption of value-added online services:

- The base case corresponds to a constant adoption rate until 2015 equal to the European average over the period 2004–2006. According to the model, broadband development would in this case contribute to the creation of 1,076,000 jobs in Europe and a broadband-related growth of the economic activity of € 849 bn between 2006 and 2015.

- In the best case, the European average adoption rate increases progressively until 2015 up to the adoption rate observed in the most advanced European countries over the period 2004–2006. In this case, broadband development would contribute to the creation of 2,112,000 jobs and € 1080 bn of economic activity between 2006 and 2015.
- In the worst case, the European average adoption rate decreases progressively until 2015 down to the adoption rate in the less-developed European countries over the period 2004–2006. In this case, broadband development would result in the creation of 345,000 jobs and € 636 bn of economic activity.

In order to maximize the economic benefits of broadband, action at the political level is necessary:

- **Develop the broadband infrastructure.** E-inclusion in the less-advanced European regions and the development of the fibre-to-the-home (FTTH) infrastructure in the most advanced areas are major challenges for a successful development of the knowledge society in Europe.
- **Rely strongly on education for a long-term development of the knowledge society.** Spread IT skills within the population and increase autonomy in the learning process by developing the online availability of educational and technical resources.
- **Foster the use of online technologies in businesses, public services and by individuals.** E-government should become the rule, not the exception, for the exchange of information between public services and companies (B2G) as well as within public services (G2G). Business services providers and professional organizations should be incited to play a role in the adoption of online services in SMBs.
- **Promote the development of innovative online services.** Innovation policies are key to maximizing the benefits from broadband development by increasing internal markets for online services and exporting high value-added technologies and services to the rest of the world.

Broadband internet is a general-purpose technology with a strong impact on knowledge-intensive activities in all economic sectors. It is essential to the creation of sustainable jobs and economic activity in fast-growing, high-value-added economic sectors. A strong integration of value-added online services into the companies' processes, key to a high economic impact of broadband, results from the combined development of the telecommunications infrastructure and the improvement of people's readiness to use broadband technologies.

Extract 3: Case study in Cornwall (original pages 46-47)

In order to describe the development of broadband and its key impacts in a specific context, two regions have been selected as case studies: the actnow programme in Cornwall (UK) and the WI-PIE programme in Piedmont (Italy) demonstrate how broadband was successfully made available throughout an entire region and how the availability of broadband can change economic prospects and social life in the region.

The case studies serve as an illustration of the sustainable economic and regional effects that broadband can trigger and support. Moreover, certain patterns of the impact of broadband on growth that are described in a more analytical way in subsequent chapters can be recognized in the case studies.

3.2.6 The regional impact of broadband in Cornwall

Broadband has become indispensable

In 2005, actnow conducted a survey on the various impacts of the actnow programme on businesses [76]. Even though the report focuses on the benefits of broadband at a micro-economic level, it gives a good impression of the positive effects of broadband for the region. According to this survey, most of the companies using broadband have experienced lower costs for telephone, mail and printing (over 75% of the responses) and felt that broadband has improved their business performance considerably: of the 700 respondents, 81% declared that broadband is crucial for their activity. Many examples of companies are given which could not have carried out their business (or not as successfully) without the help of broadband.

Actnow has also changed the image of Cornwall, from a rural laggard to a region where it is worth living and working. It became more attractive for investors, for innovative businesses and for young people who are returning to the region. According to actnow, about 4300 broadband-related jobs have been created since 2002 (including through start-ups) and the contribution to the annual GDP of Cornwall has been about € 140 m.

A boost to the regional economy

Without broadband, Cornwall could not have achieved the highest level of start-ups using new technology in the UK. In 2004, 37% of the start-ups in Cornwall used new technologies – it should be noted that the ICT sector only accounts for about 1% of the jobs in Cornwall ([85] p. 19). According to LINC ([85] p. 20), the "investment in broadband technology has been a significant boost to Cornwall and the Isles of Scilly, given its peripheral location".

	Cornwall	South-West	UK	EU25
ADSL coverage (2006, % inhabitants) [2], [3]	99%	--	99%	85%
ADSL penetration (2006, % households) [2], [3]	37.1%	33.1%	30.5%	29.4%
Start-ups using new technology (2004, % companies) [2]	37%	29.9%	--	--
Use of e-commerce among businesses (2006, % companies) [1], [3]	41%	--	--	38%
Number of jobs created [1]	4300	n.a.	n.a.	n.a.

Table 5 – Cornish development in comparison
Source: (1) actnow, (2) LINC ([85] p. 19f.), (3) Eurostat.

Although Cornwall's GDP still lags behind that of the UK and the EU, it has improved relative to the EU25 average from 68% (2000) to 76% (2004) [53]. Since 1995, the GVA of Cornwall grew by more than 60%. Only since the start of the Objective One programme in 2000, has the GVA of Cornwall grown at a higher rate than the national economy and the region of which it is part (see Figure 28).

The strongest impact occurred in the business services sector

The strongest growth has occurred in "real estate, renting and business activities" (NACE section K) and "retail, wholesale and repair" (NACE section G). It reflects the fact that the service industry in Cornwall is of greater importance than the manufacturing industry.

Source Figure 28: LINC ([85] p. 4)

Section K is of specific relevance when trying to isolate the impact of broadband on the economy: it includes all "computer and related activities" and thus companies offering business services who are major beneficiaries of broadband usage. Therefore, in the following discussion, the development of section K in Cornwall is described with regard to GVA, productivity and employment.

Figure 28 – Gross Value Added, 1995–2003

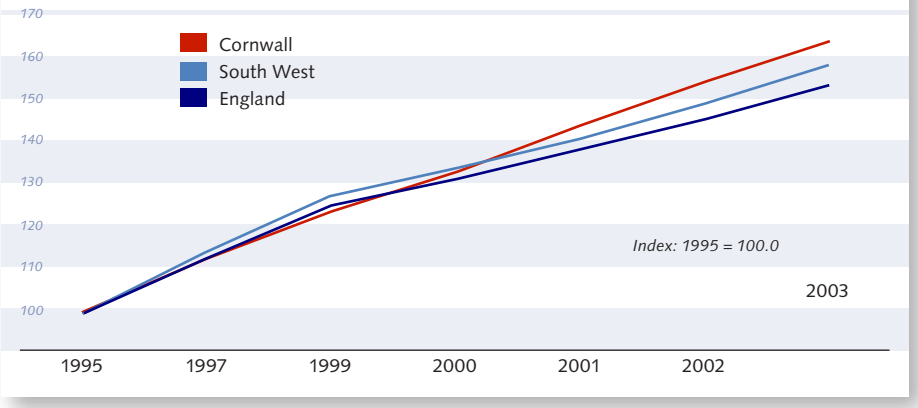
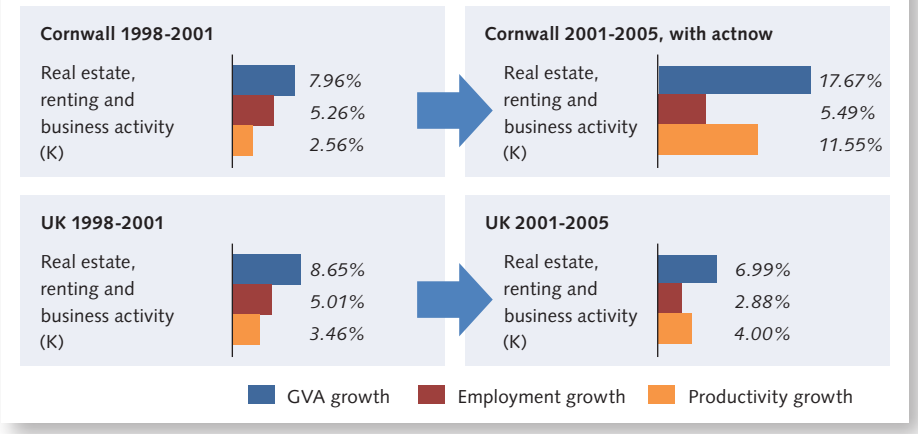


Figure 29 – Yearly growth in GVA, employment and productivity in Cornwall and the UK



The GVA of section K in Cornwall (see Figure 29) increased about 8% between 1998 and 2001. The increase was slightly lower than that at the national level. Between 2001 and 2005, however, the situation turned around: whereas at the national level the increase in GVA became smaller, it more than doubled for Cornwall. The GVA in this sector in Cornwall increased by almost 18% between 2001 and 2005 (compared to 7% in the UK).

Source Figure 29: figures from ABI/ National Statistics, UK

Between 2001 and 2005, Cornwall could maintain and even slightly improve growth of employment in section K, compared to the period 1998 to 2001. In contrast, at the national level, the increase in employment dropped by more than 40% during the same period.

Productivity in Cornwall is low (which is reflected in its lower wage level). This is partly due to the economic structure of Cornwall, with high shares of activity in economic sectors with low productivity ([85] pp. 15, 22 f). In contrast, in the business services sector, productivity rose considerably after broadband became available in Cornwall. Yearly growth in productivity more than quadrupled and reached 11.5% between 2001 and 2005. During this same time period, productivity only increased by 4% across the UK in the business services sector.

Extract 4: The impact of broadband on productivity (original pages 82-84)

4.4.3 The impact of e-business at the macro-economic level

Broadband penetration in companies

Broadband connectivity: the demand from companies is high

The "Community survey on ICT use in enterprises" provides indicators of the penetration of broadband into companies by country, economy sector and size of the company (column 1 in Table 15). The evolution of these indicators between 2004 and 2006 allows for the calculation of the percentage of companies subscribing to broadband each year (annual adoption rate, column 2 in Table 15). Broadband penetration among companies is quickly progressing all over Europe:

- Broadband penetration among small companies is very high (71.5%) and is still quickly growing (14.2% per year), while broadband penetration among large companies has reached saturation (95.4%).
- Broadband penetration in the services sector (78.2%) is significantly higher than in the manufacturing sector (70%).
- Broadband penetration in the less advanced broadband countries is much lower than in the developed knowledge societies, although this gap is diminishing. The large western European countries have been very successful over the period 2004–2006 in developing broadband penetration among companies (13.6% per year).

Obviously, policies aimed to make broadband available in businesses are successful. The demand from companies is high, even among small and medium firms.

Broadband penetration (connectivity) 

EU27 broadband connections (% of enterprises, source: Eurostat)	Broadband penetration rate (2006)	Broadband annual adoption rate (2004–2006)
EU27 average	74.5%	+13.2%
By size of the company		
Small companies (<50 empl.)	71.5%	+14.2%
Large companies (>250 empl.)	95.4%	+4.9%
By economic sector		
Manufacturing sector	70.0%	+14.9%
Service sector	78.2%	+12.6%
Business services (K)	84.9%	+11.7%
By country group		
Less developed knowledge societies	52.3%	+12.7%
Quickly developing	66.4%	+8.4%
Large industries	78.7%	+13.6%
Advanced knowledge societies	82.3%	+9.3%

Table 15 – Broadband penetration in enterprises by size, economic sector and country group
Sources: Community survey on ICT use in enterprises, our calculations

Online services

As previously stated at the micro-economic level, having a broadband connection in a company does not have an impact on productivity unless online technologies are

integrated into the company's processes to improve the exchange of information with the business environment.

At the macro-economic level, the composite indicator of the use of online services (introduced in Section 2.1.3 of this study) takes into account both e-business penetration and e-business intensity among companies. It can be calculated for a particular economic sector and a particular group of countries, or by size of the company (column 1 in Table 16). The online services included in this indicator are e-banking, e-government, online after-sales services, e-commerce, access to a company's IT system from outside the company, etc. (see Section 2.1.3).

Use of online services: inequalities are growing

By comparing values from the "Community survey on ICT use in enterprises" in 2004 and 2006, it is also possible to evaluate the progression rate of the e-business indicator over this period (column 2 in Table 16). The results show that inequalities are growing:

- The use of e-business technologies in small companies (fewer than 50 employees: 21.4%) is still significantly below e-business use in large companies (more than 250 employees: 37.5%). This gap has been growing between 2004 and 2006.
- Companies in the services sector, in particular business services, use more e-business technologies than in the manufacturing sector. This gap has been growing wider between 2004 and 2006.
- Companies in the most advanced knowledge societies use e-business twice as much as in the less advanced countries. This gap is still dramatically growing. The use of e-business in the quickly developing knowledge economies is almost as high as in the large western European countries.
- Overall in Europe, the use of online services increases by about 3% per year. This is an essential indicator of Europe's transition to a knowledge society: efforts should be made to raise this adoption rate.

Use of online services

EU27 e-business (% of enterprises, source: Eurostat)	Online services composite indicator (2006)	Online services annual adoption rate (2004–2006)
EU27 average	23.1%	+3.0%
By size of the company		
Small companies (<50 empl.)	21.4%	+2.8%
Large companies (>250 empl.)	37.5%	+4.1%
By economic sector		
Manufacturing sector	20.1%	+2.7%
Service sector	25.6%	+3.2%
Business services (K)	26.6%	+2.9%
By country group		
Less developed knowledge societies	14.4%	+1.8%
Quickly developing	21.5%	+3.1%
Large industries	22.6%	+3.3%
Advanced knowledge societies	29.3%	+4.1%

Table 16 – Use of online services in enterprises by size, economic sector and country group

Extract 5: The effects of outsourcing (original pages 86-87)

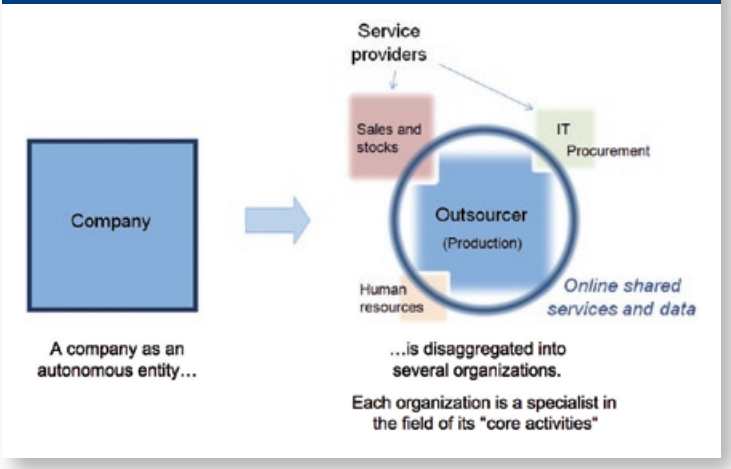
4.5 Outsourcing and business networks

In the 20th century, information on paper or analogue support (magnetic band or film) was difficult to copy, transport or integrate into automated systems. The dominant organizational model of many industrial companies was adapted to this constraint of "slow information": choices, development strategies and management of the different functions of a company were made centrally.

Broadband changes organizational structures

In a society where large quantities of information can flow quickly between companies, other organizational structures become more efficient. Companies tend not to work as "autonomous entities" any more, but rather buy services from other, more specialized providers (see Figure 46). The provision of services is not only a hierarchical relationship: both client and provider may take initiatives, innovate, give new possibilities to their business partner. Such distributed structures would not be possible without broadband infrastructures able to bring all participants of the business network close to one other in a virtual space.

Figure 46 – A company: from an autonomous entity to a network of specialized organizations



The analysis of the productivity improvements due to organizational changes in business environments requires a focus on the relationship between companies. The following model analyzes the productivity improvement due to business-process outsourcing. This kind of relationship between companies is strongly conditioned by the presence of a broadband link between customers and service providers.

Outsourcing and off-shoring

- **Outsourcing** is the decision for a company to entrust part of its activities (production of goods or services) to another company. In many cases, the supplier is located in the same geographic area as the outsourcer. The supplier may take over some production facilities and employees that were originally part of the outsourcing company.
- **Off-shoring** is the decision for a company or an investor to move some activity to another country, in general to a lower-cost country. The off-shored facility may still belong to the same company. In this case, the activity is off-shored, but not outsourced.
- **Business-process outsourcing (BPO)** is the decision for a company to outsource some of its knowledge-intensive activities to another company. Some examples of BPO activities are IT management, human resources management, accounting, procurement and legal services [60]. The provision of these services requires high competencies: the outsourcing decision does not only aim to reduce costs but also to benefit from the service provider's competencies. This kind of outsourcing requires intensive exchange of information between the outsourcer and the service provider. Its development is strongly related to the development of broadband telecommunications.

Examples of innovative networks and process improvement in customer–supplier relationships

- The aeronautics industry has been a pioneer in the development of collaborative virtual spaces, where several partners from different regions of the world can work on the same digital prototype. Technical innovation on the prototype is not only due to the work of the main company (the assembler) but takes advantage of the innovation potential from each parts provider. Synergies and cross-pollination of ideas between all specialists working on the same prototype in real time increases this innovation potential (see the case study on Dassault from the e-business-w@tch [24] and the analysis of the supply-chain by Boeing [123]). Other industrial sectors, such as the automotive industry, also develop ecosystems where the leading assembler or OEM takes advantage of process improvements and initiatives pushed by its suppliers (see the case study about SupplyOn from the e-business-w@tch [24]).
- Not only parts providers but also business services providers are in a position to introduce constant improvement into the processing of information flows. These improvements do not only raise the productivity of the considered company, but also of its customer companies. Notable examples from the e-business-w@tch case study database [24] are advo24 (a law office) and Heistermann (facility management). Netpack from Cornwall (see Section 3.2.5) implemented online catalogues and e-payment functionality for customers that were not in a position to initiate such process innovations themselves. Crucial process improvements are introduced by providers of procurement services (for example, webEDI), human resources management services (for example, e-learning) and accounting services (for example, XML standards for the exchange of data with banks and public services).

4.5.1 Examples of outsourcing in a small or medium company

In the knowledge society, the production of business services increasingly requires specialized competencies and dedicated technical tools. Companies of all size consider entrusting such activities to specialized professionals, instead of producing these services internally. Broadband has made possible the transfer of internal business services to other companies.

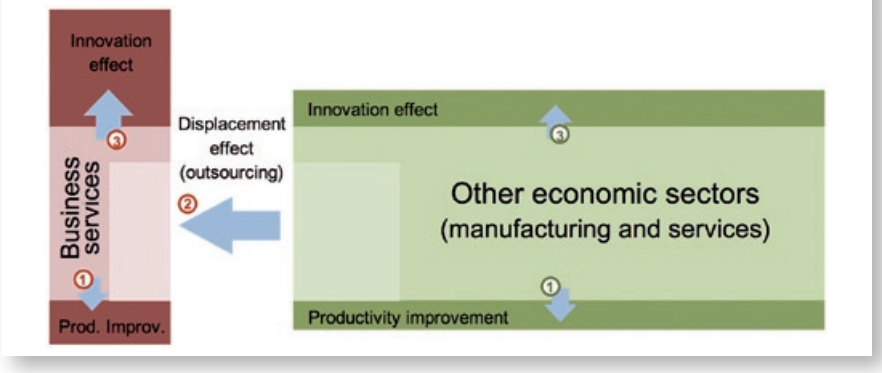
The following examples illustrate how a company can outsource some processes to improve its competitiveness:

- Procurement: small and medium companies are too small to benefit from price reductions on large quantities of raw materials. A procurement service provider can bundle their orders, find the best provider, and organize the regional logistics to distribute the raw materials to its clients. Storage of materials at each customer's site is reduced, as the risk of shortage is managed at the regional level. The service provider and its clients use broadband to communicate on orders, planning, logistics, invoices, the choice of providers, etc. See also the case study from the e-business-w@tch database: Centralia [24].

Extract 6: Macroeconomic results – Impact on employment (original pages 101, 103-104)

5.4.2 Results of the analysis

Figure 55 – Combination of the three broadband-related impacts on growth



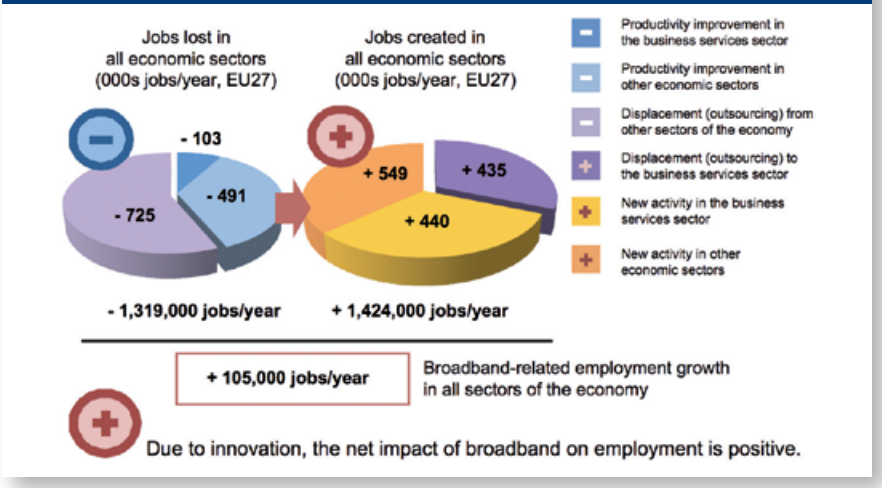
The aggregated results from the business services sector and the rest of the economy highlights the displacement of more than 1.3 million jobs from traditional sectors of the economy to the business services sector or to new activities in the same economic sector. In the model, this displacement is due to three effects:

- employment reduction due to broadband-related productivity improvement (see 4.4)
- outsourcing from traditional sectors of the economy to the business services sector, fundamentally made possible by the development of broadband (as described in 4.5)
- innovation in business services both in the KIBS sector and in-house business services. As described in Section 5.3, this innovation cannot be considered separately from broadband development.

The net jobs creation has its roots in a broader structural phenomenon

The resulting net employment creation of 105,000 jobs per year has its roots in a structural phenomenon that affects the jobs of more than 1 million people each year.

Figure 60 – Employment growth, all sectors, base year (2006)



The employees losing their jobs in the process of broadband-related productivity improvement are highly-educated, experienced office workers. Although their IT skills are not up to date in all cases, their competencies are key to the development of the most dynamic and innovative sectors of the economy. Lifelong learning should ease the integration of these workers into new activities.

The results from the model show that net job creation is positive. This positive result is largely due to innovation. In order to be successful in Europe, the development of broadband has to be closely associated with innovation policies providing the best conditions for the creation of new services. Innovative services improve the competitiveness of all companies in the European economy, including in the manufacturing sector. Understanding and fostering innovation in the services sector is necessary to guarantee that broadband-related changes in employment are positive.

5.6 GDP growth and country groups

There are important disparities in broadband use between the European member states. On the basis of about 30 indicators, we defined four groups of countries (see Section 2.2.1):

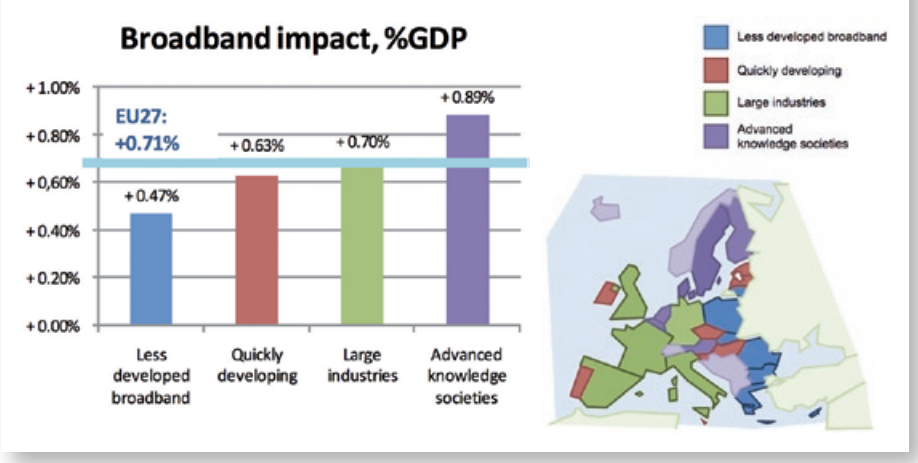
- Less-developed knowledge societies are countries with a historical handicap in the development of telecommunications infrastructures, still at the beginning of their implementation of policies oriented to the knowledge society.
- Quickly developing countries are historically lagging in the development of telecommunications infrastructures, now successfully catching up with advanced countries in the use of broadband.
- Large industries are large economic powers, confronted with the problem of generalizing changes quickly enough and at a large scale.
- Advanced knowledge societies are countries leading and experimenting the development of a successful knowledge society.

The most advanced countries will get the most benefit from broadband, as they quickly move toward highly innovative markets while improving labour productivity. The annual broadband-related growth in these countries is evaluated as 0.89% of the GDP and will continue to increase.

The most advanced countries get the most benefit from broadband

By comparison, countries with less-developed economies take less advantage of broadband: annual broadband-related growth is evaluated as 0.47% of the GDP. This advantage, though, is growing along with broadband development. The example of the quickly developing knowledge societies shows that countries with less-developed economies benefit from focusing on broadband development.

Figure 62 – GDP growth when there are undifferentiated policies at the European level, base year (2006)



5.7 Conclusion

Broadband internet fosters innovation and the development of service markets, thus creating new fields of activity for European educated workers. The development of these new services occurs through the transfer of workers and competencies from traditional sectors of the economy to the most dynamic sectors. As the model shows, broadband has a positive impact on productivity, growth and employment levels.

According to the model, 1.3 bn jobs are lost each year in Europe in traditional sectors of the economy, while 1.4 bn jobs are created in dynamic sectors. The development of new markets creates more than 100,000 jobs per year and increases the European GDP by € 82.4 bn per year (0.71%).

Extract 7: Infrastructure development scenarios (original pages 104-107)

6.1 Broadband coverage and penetration: development of the infrastructure

The following forecasts are based on a model used to simulate the development of the broadband infrastructure until 2015 in the 27 EU member states. This model was specifically developed for this study by WIK, a German research and consulting institute specializing in telecommunications infrastructure markets.

Scenarios are based on the development plans of the internet service providers

The construction of the model is primarily based on the available, published information about the development plans of incumbent telecommunications service providers and their facilities-based competitors in 15 member states. The analysis of press releases, annual reports and the available literature on the development of next-generation networks has been completed, in more than 10 member states, with interviews of experts in the broadband telecommunications sector. Less comprehensive information on the telecommunications markets in the remaining 12 member states has also been collected. The results obtained at the country level were aggregated for each country group and the EU27. More information about this model is given in Annex 7.

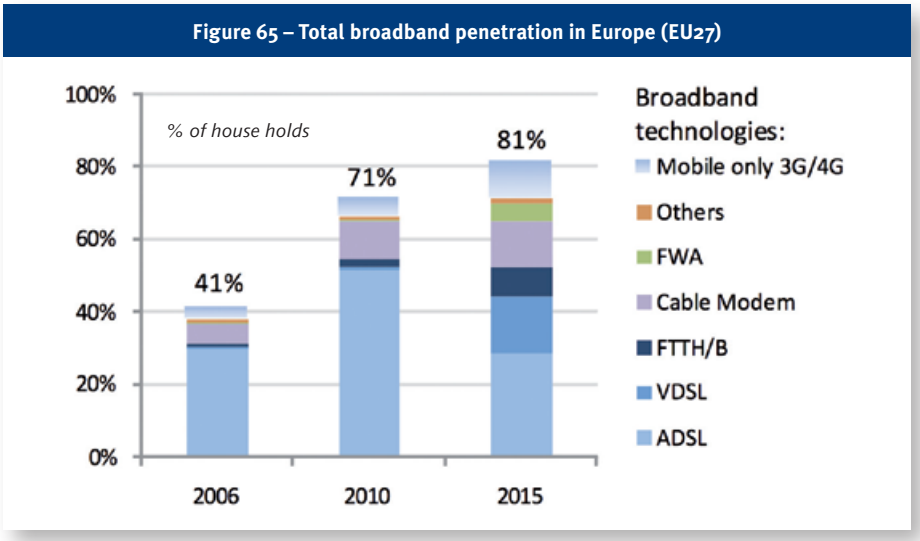
6.1.2 Broadband penetration

The deployment of physical broadband infrastructure is a prerequisite for an increase in broadband penetration. The latter also depends on adoption parameters such as income, willingness to pay, etc. In areas already covered with fixed-link broadband, as is the case in most parts of the large European countries, an important increase in penetration can be sustained without any major investment in the existing infrastructure.

"Mobile-only" households will not subscribe to fixed-link broadband

The following scenario takes into account the fact that a certain number of households use mobile broadband technologies only and do not subscribe to a fixed broadband connection. In order to represent the total broadband penetration, the figures below include mobile-only households using broadband over 3G or 4G mobile networks.

Figure 65 – Total broadband penetration in Europe (EU27)



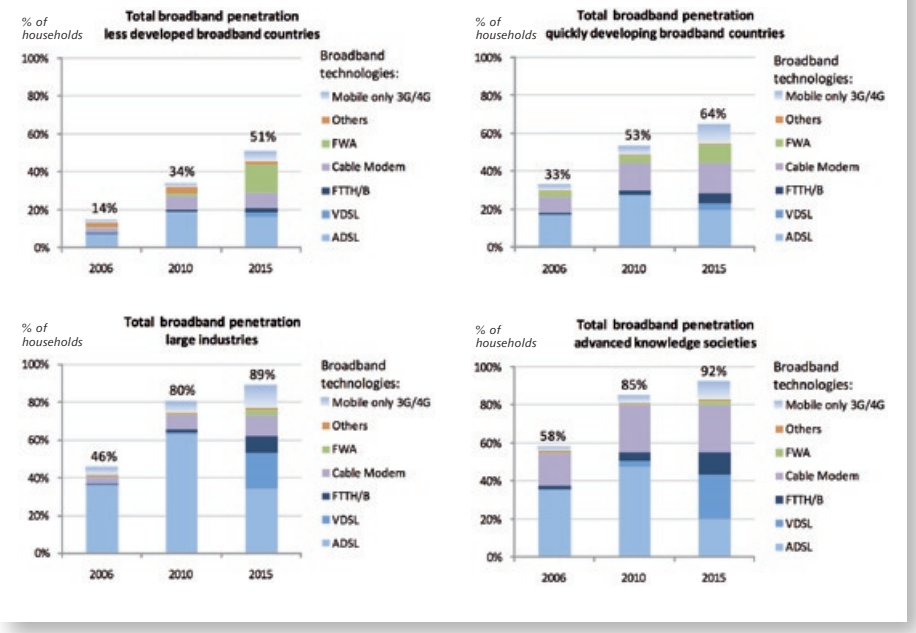
The total broadband penetration is expected to grow to 81% of all households in Europe by 2015 (see Figure 65).

These results can be detailed by country group. Quickly developing countries have concentrated their broadband development in urban areas to date. In most of these countries, many rural areas are not covered by the telephone

infrastructure. ADSL is likely not to be easily deployed in these regions. The fast development in urban areas could be followed by a period of slower development, with mobile and fixed wireless access playing an important role (see Figure 66).

A change in the technology mix, with a higher share of fast connections (VDSL and FTTH/B), has an impact on the average bandwidth available to individuals and companies. Early VDSL and FTTH/B development in the most advanced knowledge industries will increase the bandwidth available to users in the next few years. Due to later development of new-generation technologies, this effect will be delayed in the large countries.

Figure 66 – Broadband penetration until 2015 – detail by country group



Infrastructure development in the two other groups will increase coverage and penetration with a more limited impact on the average bandwidth. FTTH/B development in the main cities, though, will provide companies with the same connection speed as in the other European capital cities.

Extract 8: Scenarios – The impact on growth between 2007 and 2015 (original pages 109-111)

6.2.2 Seize the chance of innovation: speed matters!

Innovation, or the creation of new activity, is sensible to the "prime" effect. The most advanced users have the best experience of the limits and undeveloped potentials of today's technologies and organizations. They are the most eager to improve them, push back the limits and overcome challenges. Innovators are advanced users whose problems cannot be solved with today's solutions.

The first player in a market is likely to get the most benefit from it

The first player in a market is likely to get the most benefit from it, become popular and stay a step ahead of his competitors. In an open, global economy, being in the group of innovative countries is necessary to get most of the benefits of innovation and not simply follow the pioneers.

On the other hand, not being at the head of international development would make our markets vulnerable to better products and services coming from other parts of the world and slow down our innovative activity. In a competitive environment, the early bird catches the worm.

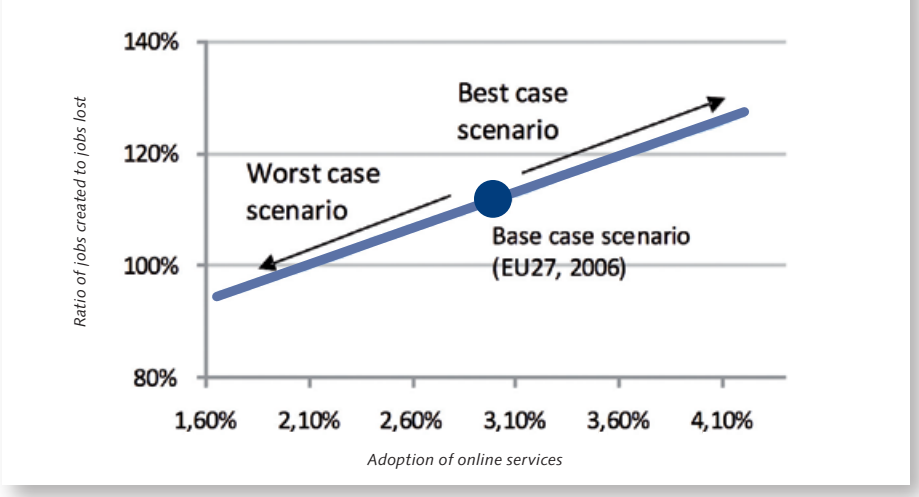
More jobs are created in the case of a faster adoption of online technology

In the model, a faster adoption of online technologies increases the benefit of innovation. The ratio of the number of jobs created to the number of jobs lost (see Section 5.3) is higher in the case of a faster adoption of online technology.

It has been previously established that the ratio of jobs created to jobs lost in the base year was equal to 112%, with an adoption rate of online services equal to 3%. In the large developed countries, the adoption rate of online services is as high as 3.3%, with a ratio of jobs created to jobs lost equal to 116%. The relationship between the adoption of online services and the benefits of innovation is considered linear around these two points.

In the best-case scenario, the adoption rate of online services increases from 3% to 4.12%. Accordingly, the ratio of jobs created to jobs lost increases from 112% to 126%.

Figure 73 – The evolution of the jobs created through broadband-related innovative activities as a function of the adoption of online services



In the worst-case scenario, the adoption of online services decreases from 3% to 1.84%. The ratio of jobs created to jobs lost decreases from 112% to 96%. In this scenario, there are fewer jobs created than lost: the net impact of broadband on the employment is negative.

In a global economy, the speed of adoption of online services has an impact on the number of jobs created.

Accelerating the broadband development in Europe is essential to creating innovative activities and seizing the benefits of the knowledge society. Too slow a development, compared to other regions of the world, would result in a broadband-related net loss of jobs due to outsourcing and process optimization.

In a global economy, comparison with other regions of the world matters

6.2.3 The impact on employment and GDP

Between 2006 and 2015, net job creation in the base scenario increases slightly, because the share of the business services in the economy grows (see Table 22). The contribution to GDP growth remains stable.

In the best-case scenario, net job creation increases and has an impact on the annual GDP growth.

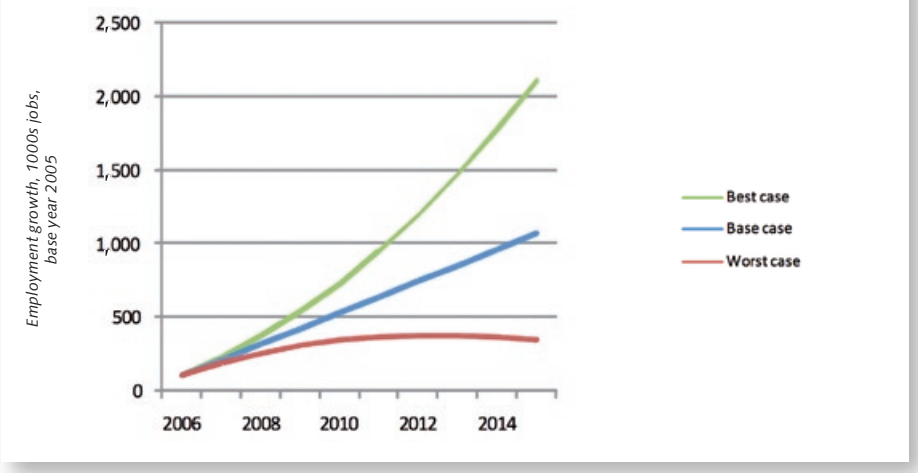
In the worst-case scenario, the impact on employment is negative when the ratio of jobs created to jobs lost is below 100%. Even when jobs are lost, the displacement of more than 1 million jobs each year from low-productivity sectors of the economy to high-productivity sectors will yield an increase in GDP of 0.37%.

EU27	2006			2010			2015		
	Best case	Base case	Worst case	Best case	Base case	Worst case	Best case	Base case	Worst case
Adoption of online services	3%	3%	3%	3.50%	3%	2.47%	4.12%	3%	1.82%
Net jobs creation (000s jobs/year)	103	103	103	192	107	37	339	110	-20
Contribution to GDP growth	0.71%	0.71%	0.71%	0.87%	0.71%	0.55%	1.09%	0.71%	0.37%

Table 22 – Results of the scenario: impact of broadband on the economy (per year)

The results above are cumulative over the years. In the base case, a total of 1,076,000 jobs will be created between 2006 and 2015 (see Figure 74). In the worst case, broadband development will result in a creation of 345,000 jobs in Europe between 2006 and 2015; while in the best case, 2,112,000 jobs could be created.

Figure 74 – Broadband-related employment growth (EU27) 2006-2015 (cumulative)



In all three scenarios, the impact of broadband development on GDP is positive (see Figure 75). In the base case, the European GDP will have a broadband-related increase of € 850 bn between 2006 and 2015. In the worst case, broadband-related effects would result in an increase in GDP of only € 636 bn by 2015; while in the best case, € 1,080 bn cumulative GDP growth could be achieved.

Extract 9: Recommendations (original pages 112-114)

7 Recommendations

The development of the broadband infrastructure, a high education level, the adoption of online services and the support to innovation are four essential strategic lines for the improvement of the economic impact of broadband in Europe. The concrete implementation of these strategic lines depends on the level of broadband development in each country.

The recommendations below are aimed at maximizing the economic benefits from broadband and the development of the knowledge society in each European member state.

7.1 Develop the broadband infrastructure

The development of the broadband infrastructure should foster innovation

The development of European businesses should not be impeded by insufficient broadband infrastructure. Rather, the broadband infrastructure in Europe should foster innovation.

At a low level of broadband development, broadband access should be guaranteed in the most important points in urban areas (universities, public libraries, large companies). If possible, these points should be equipped with access to the fibre-optic infrastructure, in order to remain on par with the most advanced regions of the world.

In the next development steps, priorities should progressively be set to tackle broadband coverage in suburban, rural and remote areas, in order to increase e-inclusion. Whenever possible, demand-driven levers should be used to encourage private parties to invest in the development of the infrastructure.

This infrastructure development can be achieved through an efficient private market, without the need for public financing. Policies, though, should guarantee that the market-monitoring agencies have enough power to fulfil their mission.

Nevertheless, not lagging behind other regions of the world in the development of the broadband infrastructure development is only the minimum required to take advantage of broadband. A successful broadband strategy should aim to be at the forefront of the worldwide broadband development, in order to promote innovative use of the digital network. To that aim, the development of mobile broadband networks and FTTH infrastructure are major challenges for a successful development of the knowledge society in Europe. Such ambitious development is not possible without an efficient and clear strategy from political authorities.

7.2 Rely strongly on education for long-term development of the knowledge society

Education is crucial to the development of the knowledge society and the achievement of broadband-related economic benefits.

Developing competencies in science and technology is essential

In an early stage of the development of the knowledge society, a rapid increase in the quantity and quality of the available competencies in science and technology is crucial. To that aim, it is necessary to organize the development of education channels in science and technology, and in particular in computer technologies. If possible, the support of IT companies should increase the efficiency of this modernization of the educational system. An increase in the share of graduates in science and technology in the early stages of the knowledge society should foster the businesses' technical affinity and spread IT skills by taking advantage of their "viral" effects.

In a more advanced stage of the knowledge society, the priority should be to provide IT skills to teachers in elementary schools and lifelong learning, in order to spread a high level of IT skills through all age groups of the population.

Provide online resources for autonomous learning

Furthermore, developing autonomy in the learning process is essential to prepare students to use a quickly evolving technology in an innovative context. To that aim, professors and universities across Europe should be encouraged to provide educational content and technical resources online in their own language.

7.3 Foster the use of online technologies in businesses, public services and by individuals

Promoting the use of online services is essential to the modernization of the economy, broadband-related productivity improvement and structural change towards high value-added activities.

Develop e-government to foster the use of online services

The development of e-government is the most direct way for governments to foster the use of online services by businesses and individuals. In an early stage, example e-government services should be developed, in particular for the exchange of information between businesses and public services. In a later step, e-government processes should be made the rule, not the exception, in the exchange of information between businesses and public bodies.

Apart from the development of e-government, other policies can be set in order to foster the use of online technologies in businesses. For example:

- Foster the development of the business services sector. Business services providers are "broadband leaders": they raise broadband awareness among their customers and support them in the adoption of online technologies.
- Incite professional organizations to play a role in the adoption of online technologies. They have access to a large base of members and are also often involved in vocational training and spreading competencies: their responsibility in the adoption of online technologies among small and medium companies should not be under-valued.

7.4 Promote innovation

"Innovation is the priority"

Broadband is an enabler for technology-based innovation, both in the services sector and in the manufacturing sector. Innovation is the most important factor for economic growth in developed countries: "[In developed markets,] innovation is the priority" [33]. Innovation policies are key to getting maximum benefits from broadband development by increasing internal markets and exporting high value-added technologies and services to the rest of the world.

Modern innovation policies include:

- Promote technology transfer from laboratories or universities to companies. Foster entrepreneurship and the creation of start-ups on university campuses.
- Rely on SMBs for economic growth. Support them in the acquisition of competencies through vocational training and research. Foster professional organizations supporting SMBs.
- Promote company networks to make competencies meet. Develop networking platforms or dedicated programmes to encourage contacts and partnerships between companies from different backgrounds.
- Promote synergies between small, innovative businesses and large companies willing to develop innovative markets.
- Bring innovation back to school: improve access to new technologies and technical skills for teachers and students.

The European Union has already done a lot in that area. This effort has to be sustained, in particular to support technology-based, non-technical innovation, such as process innovation or service innovation.

The full text of the study and annexes
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www.micus.de

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