Achieving the Lisbon Agenda: the contribution of ICT

A report for the Brussels Round Table
Indepen and Ovum
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This report was prepared by Indepen and Ovum for the Brussels Round Table (BRT). Members of the BRT are: Alcatel, BT, Deutsche Telekom, Ericsson, France Télécom, Philips, Siemens, Telefónica and Telecom Italia.

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Indepen	Phillipa Marks phillipamarks@indepen.co.uk	Ovum	David Lewin dml@ovum.com
	Brian Williamson brianwilliamson@indepen.co.uk		Les Brand lcb@ovum.com
Advisors	Professor Nicholas Crafts, Professor of Economic History London School of Economics		
	Dr Peter Radley Broadtech associates		

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Indepen
Diespeker Wharf
38 Graham Street
London N1 8JX
T +44 (0)20 7324 1800

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Ovum
Cardinal Tower
12 Farringdon Road
London EC1M3HS
T +44 (0)20 7551 9000

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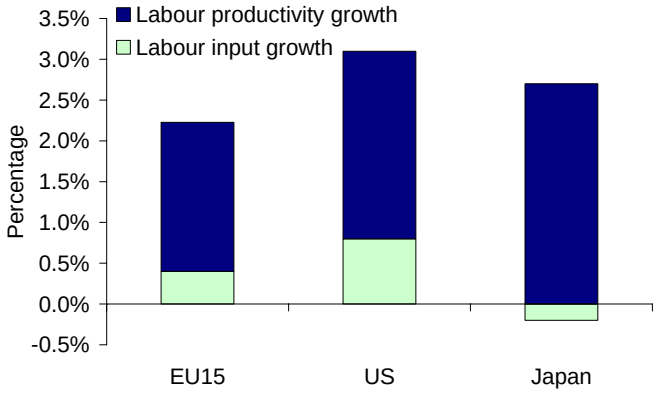
Executive Summary

The problem: Europe's productivity gap

The Lisbon Strategy target of Europe becoming the world's most competitive and dynamic knowledge-based economy will not be achieved by 2010 unless Europe's productivity performance improves significantly. Productivity matters because it is the main source of medium-term income growth. After 50 years of catching up with the US, European productivity growth has recently declined relative to the US. By 1995, European productivity was 94% of the US level, but since then one fifth of the catch-up has been lost. If no action is taken, Europe's relative economic performance will fall even further behind. Our medium-term forecasts show that real GDP growth in the EU-15 over the period to 2010 will be about 60% of that in the US and below that in Japan (see Figure 1). This is even after assuming some catch-up to US levels of productivity.

Figure 1: Forecast Average Annual GDP Growth for EU-15, the US and Japan 2005-2010



Source: Indepen forecasts

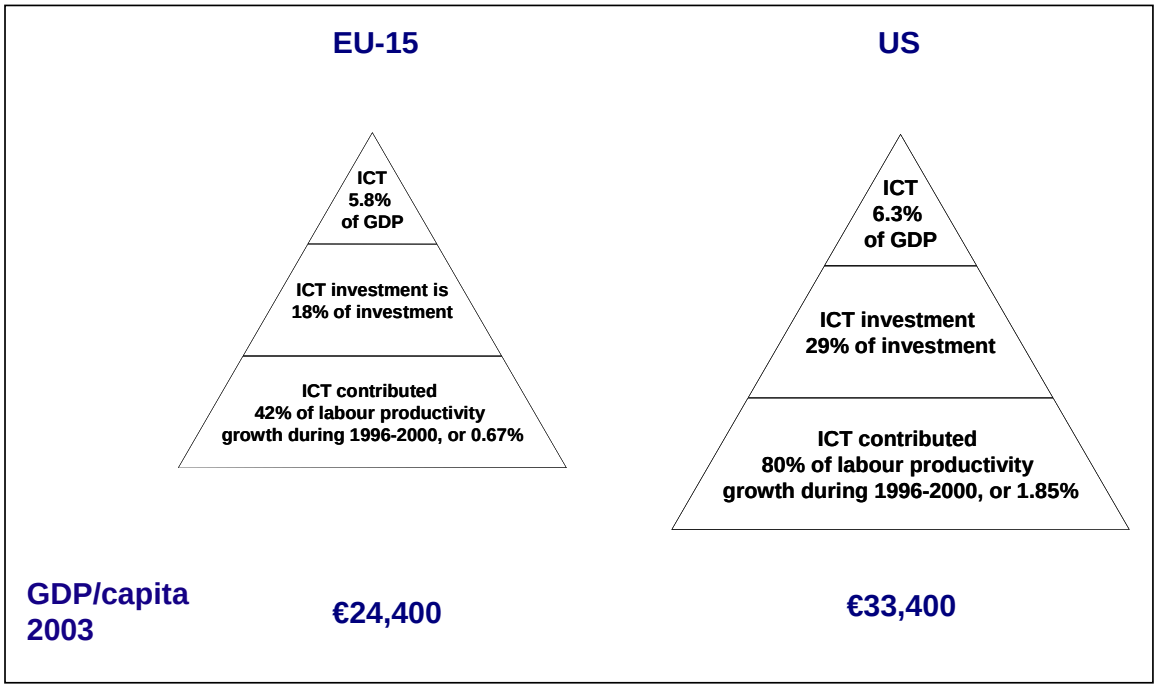
ICT has the potential to close the productivity gap

In the "information age", investment in information and communications technology (ICT) will underpin future economic growth. Consumers will benefit from the new services created, improved service quality and lower prices for existing services. Citizens' well-being will benefit from better public services and enhanced democratic processes. Moreover, ICT can facilitate European integration by allowing more effective cross-border provision and procurement of services.

So far, we have only seen the very beginning of the changes that will occur. ICT investment has had a major impact on the operation of only about one quarter of the private sector. Its use in the public sector is even more limited. ICT production is only a small part of the overall economy (about 6% of GDP) but it accounts for a much larger share of investment and productivity growth (18% and around 42% respectively in Europe). Figure 2 shows the opportunity that ICT offers, with the triangles scaled by GDP/capita.

Many of the productivity benefits of ICT have, and will come from networking computers, access to networked resources (such as the internet), e-commerce and the provision of public services online. Indeed, the take-off in the contribution of ICT to economic growth in 1995 coincided with widespread networking and use of the internet. The fact that communications services cannot be traded means a world class domestic sector is essential to reap the ongoing productivity dividend from ICT.

Figure 2: ICT as a share of the economy



Source: OECD, Indepen analysis

Investment in ICT in Europe has been low

Figure 2 shows a marked divergence in the pay-off to ICT investment in the EU compared to the US. ICT investment per head in Europe is currently at levels seen in the US twenty years ago. Simply increasing total investment in ICT will not in itself, however, deliver improvements in productivity and economic growth. To be productive, this investment also requires complementary changes in the way organisations are structured and function, and in human capital. Evidence suggests these changes can take more than five years to achieve.

So why is ICT investment lower in Europe as compared with the US? We argue this is a symptom of the lower profitability and effectiveness of ICT investment in Europe. This is caused by:

- difficulties in making investments in organisational change
- employment protection
- inappropriate educational and skill levels
- product market regulation
- low levels of service market integration across Europe.

These problems affect both the private and public sectors.

If ICT is to play a major role in accelerating productivity and economic growth in Europe, much as rail (and steam power), electricity, and road networks fuelled growth in the past, policy change is required. If Europe fails to exploit the full potential of ICT, then it will not meet the Lisbon Agenda. This report addresses the issue of what policies are required to stimulate the efficient diffusion and adoption of ICT in Europe.

How will the ICT sector in Europe change over the next five years?

Looking at the ICT sector as a whole, we will see modest growth in spend by end-users on ICT over the next five years. Nevertheless, by 2010, ICT spend will purchase roughly twice as much use of ICT equipment and services as it does today, as prices continue to fall and performance improves.

Over the next five years the European telecommunications market will change rapidly. We have identified twelve possible transformations, assuming no change in public policy. In summary

- Consumers will increasingly be able to access any content, anywhere, anytime. This will be made possible by:
    - investment in next generation IP networks and next generation access (fibre), though the extent of investment depends on regulation
    - interoperability between different platforms achieved through industry-led standardisation
    - continuing investment in ICT research and development (R&D).
- Competition will intensify with increasing cross-platform competition – between fixed, mobile, new wireless technologies and cable TV.
- Operators will seek revenue growth from a profusion of new value added services made possible by next generation networks (NGNs).
- Operators will face increased competition in the corporate market from IT companies.
- The sector will grow and consolidate to create pan-European operators as smaller players seek to achieve scale economies. Some players will exit the market as traditional services become less profitable or disappear.

There are considerable risks and uncertainties associated with these transformations. New wireless access technologies could fail, demand for 3G data services may be weak, and consumers may not buy the new content services NGNs can deliver. Regulation could inhibit these transformations and increase risk.

The need for policy change

Policy changes are needed to address both demand and supply side issues if Europe is to fully realise the economic benefits of ICT and, given the time lag associated with the necessary complementary changes in organisation structure and in human capital, action is needed now if Europe is to meet the Lisbon Agenda.

The next phase in ICT development has the potential to change communications infrastructure fundamentally. To invest in such circumstances, telecommunications operators will need a regulatory framework which gives assurances that, if risky investment succeeds, the return will not be regulated away. Operators need freedom to explore different retail pricing models to find those that succeed in growing the market. They also need to be able to migrate customers from legacy products to new technology-based services efficiently. They need to be able to do this without undue regulatory intervention.

Market flexibility, in particular labour and product market flexibility, has also been identified as an important factor enabling profitable use of ICT. Labour and product market policies that worked in the past now appear costly. Changes are required.

The extent of reforms required in the public sector is even greater than in the private sector. This is because of the political nature of public sector organisations and their inter-relationships, budget rigidities and difficulties in providing public sector employees with incentives to make the "right" choices when investing in ICT.

Policy recommendations

A theme that we develop in this report is the need to provide all users of ICT (private and public sectors, individuals and organisations) and network operators with appropriate incentives to invest in and use ICT, so as to promote innovation and economic growth.

The European framework for communications sector regulation provides a strong foundation, but we propose that some aspects are interpreted in a different way and that it is enhanced in some areas.

Promoting innovation and investment

Our first three recommendations are aimed at reframing the policy and regulatory framework for the communications sector so that it takes explicit account of the dynamic nature of communications markets and the wider economic benefits from ICT investment.

Key enabler 1: Take account of the spillover benefits from ICT

We recommend that when developing new legislation and policy the European Commission and national governments take account of the impacts on the ICT sector and use of ICT. Examples of areas to which this principle should be applied include e-money legislation, patents for computer-implemented inventions and EU funding for research and development.

Key enabler 2: Focus on the dynamic gains from market expansion

We recommend that NRAs are required to take account of the dynamic impacts of their decisions. This will involve placing more weight on innovation and investment relative to short-term price objectives. In particular, when balancing the risks between over- and under-investment, NRAs should make decisions in favour of promoting investment in communications infrastructure.

Key enabler 3: Allow operators to have retail price flexibility

We recommend that regulators should allow operators to have retail price flexibility for new services and flexibility to jointly price new and old services that can be provided over new common infrastructure.

Our fourth recommendation addresses the circumstances in which sector specific *ex ante* regulation should be applied. There is a presumption by NRAs that, whenever an operator has significant market power (SMP), *ex ante* regulation should be applied, leaving no room for competition policy to work. We argue that there is considerable scope for *ex ante* regulation to result in unintended and unanticipated adverse consequences. To limit these effects regulation should be focused on non-replicable facilities. This is a major departure from the current approach under which replicable facilities owned by SMP operators are generally subject to *ex ante* regulation.

Key enabler 4: Focus regulation on non-replicable facilities and use competition policy more

We recommend that ex ante regulation is focused on non-replicable facilities. This would ensure regulation was focused on areas where an operator clearly has monopoly power and so abuse is most likely to occur. Otherwise regulation by competition policy would apply.

We propose that regulators should pre-commit to roll-back regulation once regulated facilities are replicated in a given locality. Pre-defined triggers for the removal of regulation need to be decided and regulated prices must be set appropriately, taking due account of market risks, price dynamics and the external benefits of infrastructure competition.

As a short-term measure, the ERG Guidance could be changed so that NRAs must justify ex ante remedies on SMP operators in terms of the net benefits relative to the application of competition law.

Emerging markets

Emerging markets are treated differently from existing markets under the Framework Directive. The Directive states that market leaders in emerging markets should not be subject to inappropriate *ex ante* regulation but it leaves open the possibility that NRAs could intervene. Regulation of new content-based services is also under consideration by the European Commission, following the recent review of the Television Without Frontiers Directive (TVWF). Our fifth and sixth recommendations address these issues.

Key enabler 5: Commit not to apply sector specific regulation to emerging markets

We recommend that the European Commission commits not to add markets to the list given in the Recommendation on Relevant Markets and that NRAs commit not to regulate emerging markets, either for a fixed period of time or until certain market penetration levels are reached. When these triggers are reached the onus would be on the NRA to demonstrate the net benefits of ex ante regulation relative to the continued application of ex post competition policy.

Key enabler 6: Do not extend the scope of content and advertising regulation to audio-visual services offered over new communications platforms

The Television Without Frontiers Directive, and content and advertising regulation more generally, should not be extended to audio-visual services offered over new platforms, such as DSL, the internet and mobile phones.

Sector taxation

The communications sector is "taxed" by the imposition of universal service obligations (USO) which could in principle be funded from general taxation. Another current example of an ICT sector tax is given by the proposals to set levies on ICT equipment (e.g. mobile handsets and storage devices) to fund payment for content and to tax text messages. All such taxes risk inhibiting investment in ICT.

Key enabler 7: Do not apply sector specific taxes to ICT

We recommend that the ICT sector should not be subject to any sector specific taxes or levies (e.g. on devices), regardless of whether they are used to fund the achievement of public policy or other objectives.

Access to key resources

New broadband services are likely to require the provision of attractive content, and new broadband infrastructures are likely to be based on wireless technology.

Key enabler 8: Remove unjustified restrictions on access to premium content

The European Commission should continue its efforts to remove unjustified restrictions on access to premium content, so as to promote competition in markets for content services.

Key enabler 9: Adopt more flexible spectrum management

We support moves to introduce spectrum trading in Europe. The European Commission should facilitate the identification and dissemination of best practice in spectrum trading. The Commission should also adopt a technology neutral approach to the allocation of harmonised bands which takes account of convergence.

Making ICT investment effective in the private sector

Key enabler 10: Seek to achieve greater labour market flexibility

We recommend that those Member States with restrictive labour laws seek to make these more flexible, so as to give incentives for firms to invest in ICT, to enable "creative destruction" and to retain domestic employment. This may need to be twinned with policies for retraining displaced workers to speed up movement between jobs.

Key enabler 11: Promote product market flexibility

Member states should actively review regulations that impede product market flexibility with a view to determining areas where some relaxation would be beneficial. The proposed European Services Directive, which is aimed at achieving greater integration of services markets in Europe, will assist the effective use of ICT by business.

ICT use in the public sector

In the report, we identify a long list of impediments to the effective use of ICT in the public sector. There are EU-level policy initiatives aimed at addressing some of these issues and our recommendations given below seek to supplement these. We note, however, that many of the significant changes required can only be made at a national level.

Key enabler 12: Enable use of ICT in the public sector

In respect of the deployment of ICT in the public sector we recommend that:

- *more rigorous analysis of the costs and benefits of e-policy projects is undertaken at a national and pan-European level. A comprehensive measurement methodology is required and the European Commission could fund research in this area. Otherwise it will be difficult to know what constitutes good practice*
- *the benchmarking undertaken by the European Commission is reviewed with the aim of including the best practice countries outside Europe and collecting more data on the use of, rather than the supply of, e-policy services*
- *the European Commission develops and disseminates ideas on how to make government budgetary processes and fiscal policies more supportive of capital investment, including ICT investment*
- *the European Commission promotes e-policy services that are "joined up" across traditional departmental or agency boundaries by targeting its funding of e-policy initiatives on such projects.*

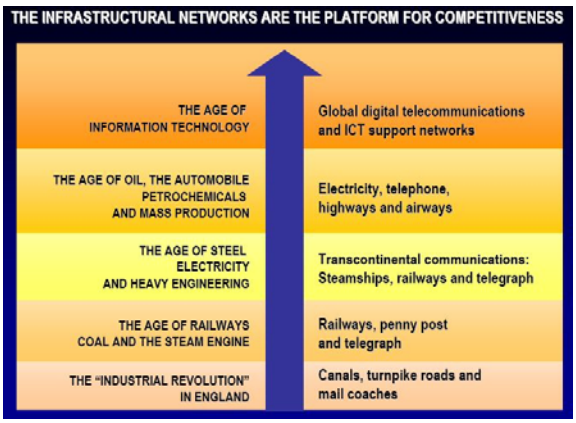
1 Introduction

The Lisbon Strategy target of Europe becoming the most competitive and dynamic knowledge-based economy by 2010, with improved employment levels and social cohesion, will not be achieved unless Europe's productivity performance improves.[1] ICT should be at the centre of the discussion about how to achieve the Lisbon Strategy.

This report addresses the issue of what policies are required to stimulate the diffusion and adoption of information and communications technologies (ICT) in Europe. The problem we are addressing concerns the recent poor productivity performance in Europe as compared with that in the US and a number of Asian countries. Productivity performance matters because it has a major impact on medium term income growth. After 50 years of catching up to the US level of productivity, so that in 1995 European productivity was 94% of the US level, the rate of European productivity growth relative to the US has declined so that one fifth of the catch-up has been lost since 1995. If no action is taken, Europe's relative performance will fall even further behind.

There is a growing consensus amongst academics and policy makers that ICT will underpin future economic growth, much as rail (and steam power), electricity and road networks have in past economic epochs (see Figure 1.1). However, investment in ICT in Europe has been much lower than in the US and a number of other countries. Per capita ICT investment in Europe is currently at levels seen in the US twenty years ago. If ICT is to play a major role in accelerating productivity and economic growth in Europe, then policy change is required to address barriers to the investment and use of ICT in Europe. Key policy issues concern the lack of flexibility in labour and product markets, and the risk of over-regulation of the communications sector.

Figure 1.1 The evolution of general purpose technologies



Source: Carlota Perez, October 2004[2]

[1] Commission sets priorities for catching up with Lisbon agenda, Press Release IP/04/74, Brussels 21 January 2004; Delivering Lisbon, Reforms for the Enlarged Union, Report from the Commission to the Spring European Council, COM(2004), 29 final/2, 20.2.2004; Facing the Challenge, The Lisbon Strategy for growth and employment, Report of the High Level Group chaired by Wim Kok, November 2004.(The Kok report).

[2] The new techno-economic paradigm and the importance of ICT policy for the competitiveness of the whole economy, High Level Conference "Looking to the future of ICT", Amsterdam, Carlota Perez, October 2004

There are a number of policy initiatives at a European Union (EU) level that address ICT development and deployment, including the *e*Europe initiatives, structural funds for linking telecoms networks, and the Research and Development Framework programme about one fifth of which is awarded for research in ICT. These initiatives have so far had limited success.

The *e*Europe 2002 action plan oversaw the achievement of on-line connectivity in many areas but not significant growth in the use of services. The mid-term review of the 2005 action plan also indicated that progress in broadband connectivity and on-line government services was largely supply driven.[3] In other words, users have not taken up the services sufficiently for the benefits from use of on-line services, namely productivity gains and job creation, to be realised. The contribution of *e*Europe to the Lisbon Strategy will be reviewed in 2005 with a view to providing contributions to the second phase of the Lisbon Strategy covering the period to 2010.

A further important element of the policy context for this study is the EU's New Regulatory Framework (NRF) for electronic communications services, which came into effect in 2003. The framework requires national regulators to impose sector specific (*ex ante*) regulation on operators who have significant market power in a relevant market.[4] A key objective of the framework is to promote innovation and investment, however, we argue the way the framework is applied is not conducive to this end.

This report, commissioned by the Brussels Round Table, provides an input to the Lisbon Strategy debate. The report has a number of objectives, namely:

- to analyse the effects of ICT, and communications in particular, on productivity, growth and employment in Europe and elsewhere;
- to provide a scenario for the development of the European ICT sector until 2010;
- to forecast the economic performance in Europe and in the US and East Asia in 2010;
- to assess and develop conclusions concerning policies that might be adopted to exploit the full potential of ICT in Europe, taking into account the potential future market environment and the potential future role of ICT in the economy.

The debate on the achievement of the Lisbon Strategy has been stimulated by a report commissioned by the Dutch Presidency and the Kok report.[5] The report from the Dutch Presidency identifies ten policy priorities relating to the field of ICT covering the need for skills and organisational transformation, standardisation, deployment of new technologies, creation of seamless consumer services, barriers to new investment, spectrum allocation, and consumer confidence and security. The Kok report's recommendations are broader in scope, covering the internal market, business and labour market reform, environmental sustainability and promoting the knowledge society through R&D and the use of ICT. This report differs from these earlier reports in that it has a particular focus on the contribution of communications to productivity growth and on policies in respect of the communications sector.

[3] *e*Europe 2005 Mid-term Review, Communication from the Commission, COM (2004) 18.2.2004

[4] As defined in the Recommendation on Relevant Markets

[5] Rethinking the European ICT Agenda, PWC, August 2004, Facing the Challenge, The Lisbon Strategy for growth and employment, Report of the High Level Group chaired by Wim Kok, November 2004.

The remainder of the report is structured as follows.

- In Chapter 2, we summarise evidence showing the role of ICT in determining productivity growth in Europe, the US and elsewhere and discuss the specific contribution of the communications sector to that growth. This Chapter considers ICT investment in terms of the demand from users of ICT. The scale of the gap between Europe and elsewhere is described and forecasts of future economic growth for Europe, the US and Japan are provided. These show the gap will not be bridged by 2010. Factors that determine the returns to and so the level of ICT investment are assessed. This analysis focuses on private sector impacts, as research on public sector impacts is much less developed. We discuss the reasons for this and report some case study evidence.
- In Chapter 3, we present a central scenario for the development of EU ICT markets over the next five years from a supply-side perspective. The scenario assumes no change in EU policy towards ICT and is only one of the many possible ways in which the EU ICT market might evolve. It shows the potential for significant change and uncertainty in the sector, with traditional revenue streams being eroded and new ones developed, increased cross-platform competition as convergence proceeds and existing networks being replaced by new networks. Conditions which will need to apply if risky investment in new networks and networks is to be forthcoming are discussed.
- In Chapter 4, we present 12 policy recommendations aimed at addressing the productivity gap identified in Chapter 2 and the conditions required for communications sector investment identified in Chapter 3. They address communications sector regulation, ways of making ICT use more profitable in the private sector and ways of stimulating effective take-up of ICT by the public sector.

2 Role of ICT in the Economy

2.1 Introduction

This chapter presents evidence demonstrating the crucial role that ICT, and within that communications, will play in determining future economic growth in Europe and elsewhere. The chapter is structured as follows.

We look at the role of ICT in transforming economic activity in Section 2.2, and the aggregate impact of ICT on the economy in Section 2.3. In Sections 2.4, 2.5 and 2.6, we look in turn at the direct share of ICT in economic activity, the level of private investment attributable to ICT and the productivity benefits from ICT in different countries. In Section 2.7, we consider spillover benefits from ICT and their role in explaining how a relatively small sector can have such a large potential impact on overall productivity growth and the impact on employment growth.

Section 2.8 considers possible impediments to the use of ICT in the public sector and illustrates experience of use using case studies.

Section 2.9 looks at the particular role of communications networks in reaping the benefits from ICT. Communications services are both non-tradable (they have to be purchased in the country of use) and subject to detailed economic regulation (which could be a source of competitive advantage or disadvantage for Europe). Possible transformations in communications networks over the period to 2010 are assessed in Chapter 3.

In Section 2.10 we examine reasons for differences returns to ICT investment in different countries. This evidence points towards possible policy changes that may be required in Europe to make effective use of ICT. These are discussed further in Chapter 4.

In Section 2.11, we look at the outlook in terms of ongoing productivity growth in ICT production and ICT use in qualitative terms and we develop a quantitative outlook for GDP and productivity growth for Europe, the US and Japan. We conclude that Europe will not resume productivity catch-up with the US without policy change – in other words Europe will not meet the Lisbon Strategy target of becoming the most competitive and dynamic knowledge-based economy by 2010.

Our conclusions are given in Section 2.12.

2.2 ICT is transforming economic activity

Nobel winner Robert Solow observed in 1987 that

> *"You can see the computer age everywhere but in the productivity statistics."*

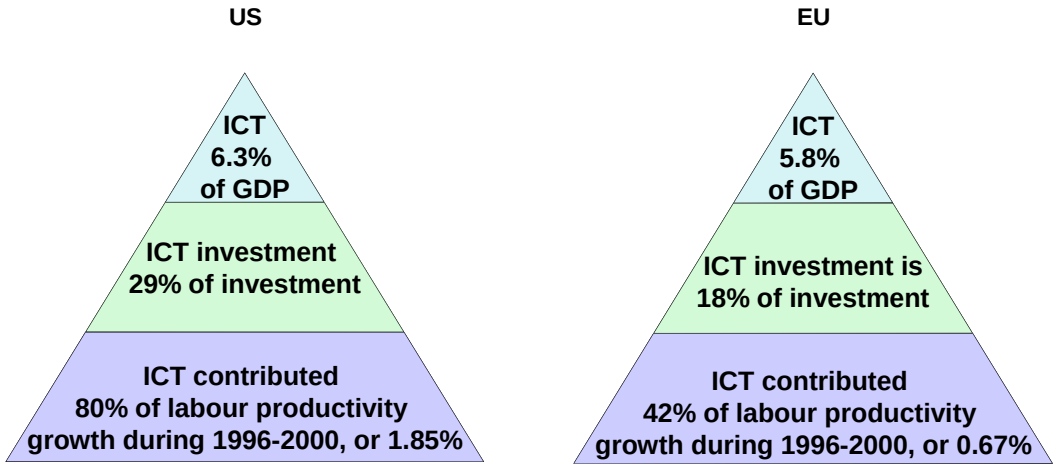
Evidence now suggests that you can see the computer age everywhere in the productivity statistics. Evidence of a clear relationship between ICT and overall economic performance is, however, comparatively recent. This understanding is summed up in the following:[6]

[6] OECD. 2004. "The economic impact of ICT – measurement, evidence and implications".

"ICT is having far-reaching impacts on economic performance and the success of individual firms...These impacts can be observed in firm-level studies for many OECD countries, but have only translated into stronger economic performance at the economy-wide or industry level in a few OECD countries." OECD, 2004

Figure 2.1 illustrates the pyramid of economic impacts of ICT in the EU and US. ICT is a relatively small share of GDP in 2001, yet contributed a disproportionate share of private capital formation (in 2001) and labour productivity growth during the period 1996-2000.

Figure 2.1: Pyramid of economic effects due to ICT in the US and EU



Source: Indepen charts based on Denis et al (2004) for productivity effects and Groningen Growth and Development Centre for ICT value added share of GDP and ICT investment share of private investment. The ICT shares and ICT investment shares are for the year 2001.[7]

A marked divergence in the payoff to ICT investment in the EU versus the US is implied by Figure 2.1. The fact that ICT investment in the US delivered greater overall productivity gains suggests that higher levels of ICT investment were more profitable in the US compared with Europe. A fundamental problem is to understand why returns to ICT investment in the US and Europe differ so much.

In the following sections we analyse the layers in the pyramid in Figure 2.1 from top to bottom in order to better understand the differences, before considering possible explanations in terms of the public policy and business environment. First, however, we briefly consider the magnitude of the difference in the contribution of ICT to economic outcomes in Europe and the US.

2.3 Aggregate economic impacts of ICT

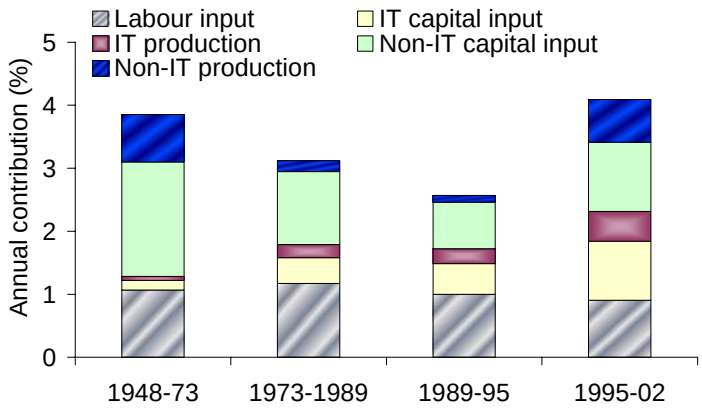
At the aggregate level ICT investment has contributed around 1% per annum to GDP or income growth during 1995-2001 in the US, Australia and Korea; and around half as much in Europe and Japan.[8] This contribution is substantial.

[7] Note that the EU share of ICT in business sector value added was higher at 8% of GDP in 2001. OECD 2004, "OECD Information Technology Outlook". Figure 1.14a.

[8] OECD. 2003. "ICT and economic growth – evidence from OECD countries, industries and firms." Table 2.1.

Figure 2.2 shows the longer term identification of sources of economic growth for the US for the period 1948-2002. It can be seen that IT production and capital input made the largest contribution to economic growth in the US during the period 1995-2002.

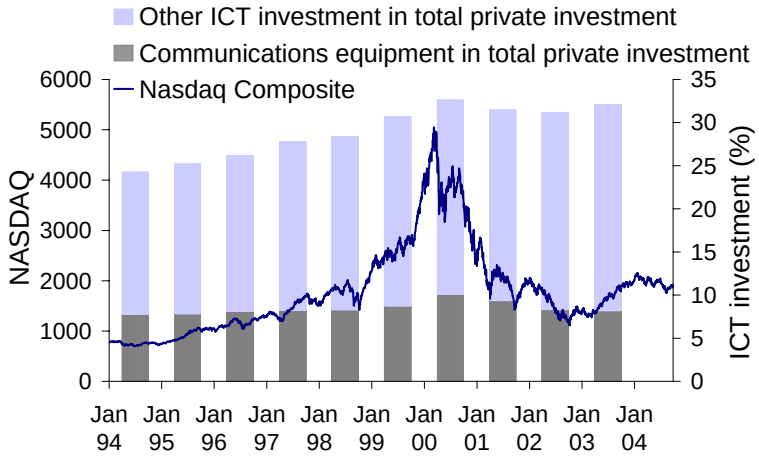
Figure 2.2: Contribution of IT and non-IT inputs to economic growth in the US



Source: Jorgenson. August 2004.

Consumers, not ICT producers, are the main beneficiaries from this economic growth. Consumers benefit from falling prices for ICT goods and services[9] and the capital market valuation of the ICT sector remains depressed (see Figure 2.3). However, there has been sustained investment in the sector which reinforces the view that consumers and not ICT company shareholders will be the main beneficiaries from ICT investment. Figure 2.3 also shows that the communications share of investment has not yet recovered. This may reflect a continuing overhang of capacity in communications infrastructure in some areas, and/or a view that new investment is not profitable given the prevailing regulatory environment.

Figure 2.3: NASDAQ & share of real ICT investment in overall real private investment for the US



Source: Indepen chart based on Groningen Growth and Development Centre data and the NASDAQ

[9] Tamim Bayoumi and Markus Haacker. July 2002. "It's not what you make, it's how you use IT: measuring the welfare benefits of the IT revolution across countries." IMF working paper WP/02/117. http://www.imf.org/external/pubs/ft/wp/2002/wp02117.pdf

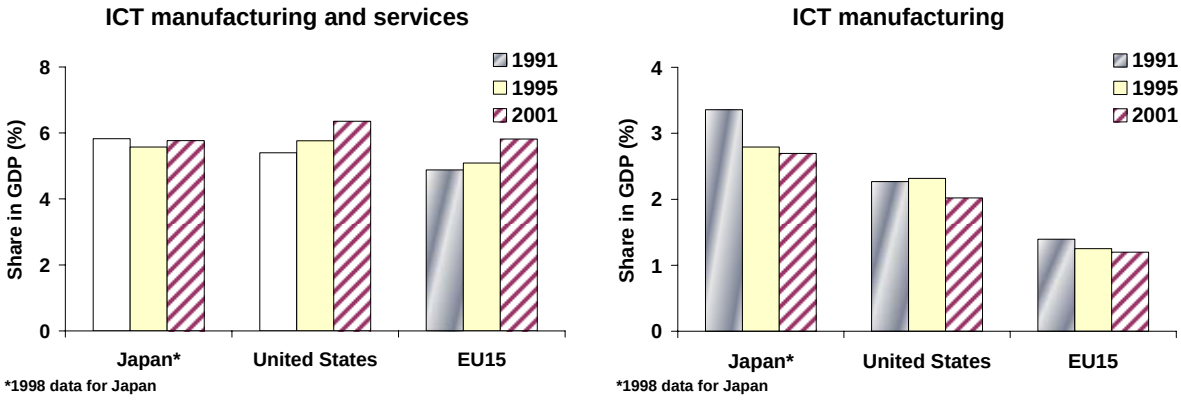
It is interesting to note that consumers (and not producers) were the primary beneficiaries of technical progress generally over the past 150 years.[10] This was, for example, evident in the railway share mania of the 1845 in the UK, which was followed by an equity crash but continued development of services.[11]

We next consider the economic impacts of ICT in greater detail, first explaining why an activity that comprises around 6% of GDP can have a large impact on the overall economy.

2.4 ICT share of economic activity

Figure 2.4 shows the share of ICT overall (manufacturing and services), and ICT manufacturing, as a share of GDP for Japan, the US and the EU-15.

Figure 2.4: Share of ICT in GDP



Source: O'Mahony & van Ark CD-ROM (2003)

The overall share of ICT in GDP has risen, while the share of ICT manufacturing has declined over the past decade. However, the relentless decline in the price of ICT equipment means that the quantity of ICT goods in the economy will continue to grow rapidly, even if the nominal share of GDP stabilises or declines.

Taking a longer term view, the share of ICT has grown, from around 1% of GDP in the 1960s to around 5% today. This is already large relative to, for example, electricity which makes up around 2% of GDP. Examining available evidence the OECD (2004) concluded that having a large ICT producing sector was neither a necessary nor sufficient factor for high productivity growth:

> "*Several countries (notably Australia and Canada) that are characterised by high ICT investment and use, as well as high multi-factor MFP growth, do not have a large ICT sector. In addition, one or two countries that do have a large ICT sector have not been among the high growth countries of the 1990s.*"

[10] William D Nordhaus. April 2004. "Schumpeterian Profits In The American Economy: Theory and Measurement." NBER Working Paper 10433. http://www.nber.org/papers/w10433

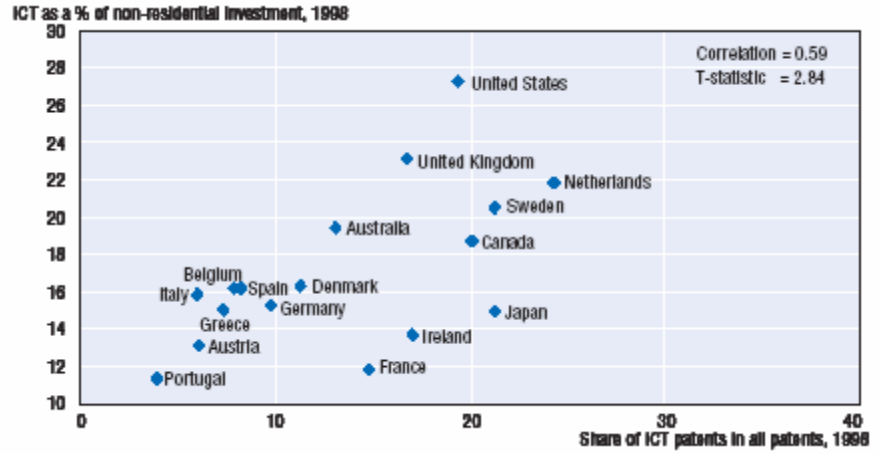
[11] Robert Miller. 2003. "railway.com – parallels between the early British railways and the ICT revolution." Institute for Economic Affairs Monograph 57.

Only a small number of countries can have large scale ICT manufacturing due to the global economies of scale involved, and some European countries have proved competitive in this area, with Intel building a state of the art chip fabrication plant in Ireland and AMD building their plant in Germany.

Other countries can nevertheless reap the benefits of ICT by importing chips produced in Ireland and Germany, or equipment manufactured using such components. While we conclude that a large ICT sector is neither a necessary nor sufficient condition to reap the benefits of ICT, a more nuanced story emerges from consideration of tradable versus non-tradable elements of ICT.

Figure 2.5 illustrates that there is evidence of a relationship between the share of ICT patents in all patents (a measure of domestic ICT innovation) and ICT investment. Some countries with a relatively small share of ICT manufacturing have a relatively high share of ICT patents in overall patents, for example the Netherlands. The relationship between ICT patents and ICT investment may be suggestive of a relationship between the location of the headquarters for ICT production, with associated ICT R&D, and the effective use of ICT.

Figure 2.5: ICT investment and the share of ICT patents in all patents



Source: OECD (2003), page 74

For non-tradable ICT services, for example, communications network services and some software services, a world class domestic sector is likely to be essential to reaping the ongoing productivity dividend from ICT.

2.5 ICT investment

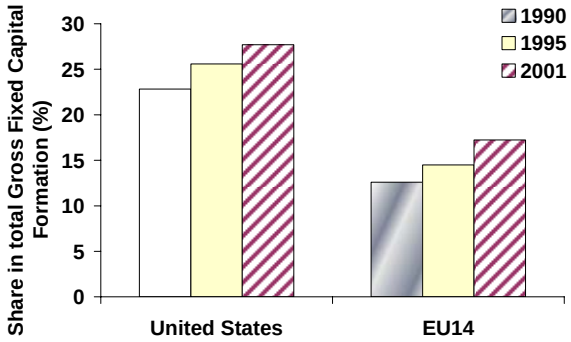
One indication of the growing importance of ICT is the level of ICT investment relative to overall investment in the economy. A characteristic of general purpose technologies is that they transform the capital stock of the economy over a period of time. Investment in ICT has also been identified as a key part of the US output and labour productivity acceleration:[12]

[12] Jorgenson. October 2004. "Information technology and the G7 economies." http://post.economics.harvard.edu/faculty/jorgenson/papers/handbook.extract.2001update10142004dwj1.pdf

"…investment in tangible assets is the most important source of economic growth in the G7 nations. The contribution of capital input exceeds that of total factor productivity for all countries for all periods."

Figure 2.6 shows the nominal share of ICT capital in overall private sector capital investment for the US and EU15 excluding Luxembourg.

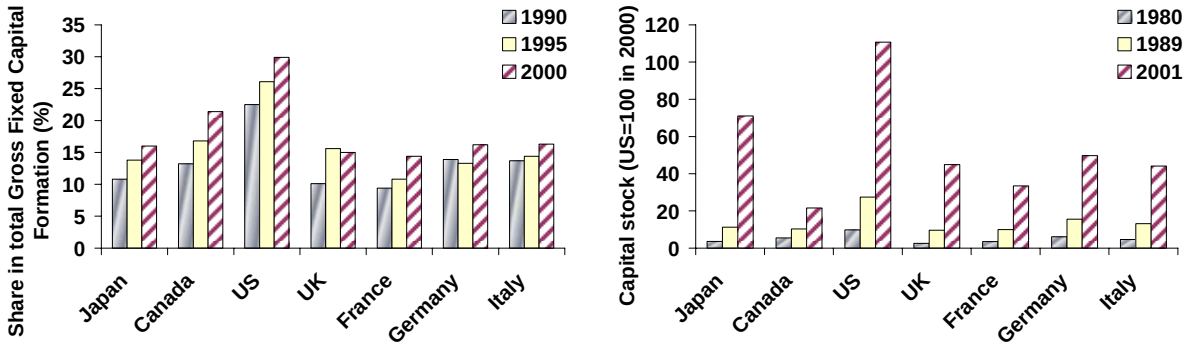
Figure 2.6: Nominal ICT share of private investment



Source: Timmer, Ypma and van Ark (2003)

The share of investment (gross fixed capital formation) attributable to ICT is around 29% of GDP in the US in 2001, and around 18% of GDP in Europe (i.e. below the US level in 1990). The disparity is even greater on an investment per capita basis. Per capita ICT investment levels in Europe are only now reaching levels seen in the US in the early 1980s i.e. the EU-14 are 20 years behind in terms of ICT investment. Figure 2.7 shows the US has invested more and has a far larger ICT capital stock than other G7 economies.

Figure 2.7: ICT investment share (left hand side) and accumulated capital stock per capita (right hand side)



Source: Colecchia & Schreyer (2002) and Jorgenson (2004)

Low private sector investment is a symptom rather than a cause of a lower return to ICT. The challenge is to understand why returns from ICT investment are much higher in the US. This is addressed in Section 2.10. We note, however, that simply promoting more ICT investment via investment incentives would not solve the problem, as the complementary investment required to produce higher productivity growth might not be forthcoming.

2.6 ICT is having a disproportionate impact on productivity growth

Robert Gordon (2004) has expressed the relative productivity performance of the EU and US as follows:[13]

> *"After fifty years of catching up to the U.S. level of productivity, since 1995 Europe has been falling behind. The growth rate in output per hour over 1995-2003 in Europe was just half that in the United States, and this annual growth shortfall caused the level of European productivity to fall back from 94 percent of the U.S. level to 85 percent. Fully one-fifth of the European catch-up (from 44 to 94 percent) over the previous half-century has been lost over the period since 1995."*

In this section, we present evidence to show that differences in ICT investment and use play a major role in accounting for the decline in Europe's productivity performance relative to the US. First, however, we make some comments about the appropriate productivity measure to use when making these comparisons.

There is a choice between using labour productivity (the ratio of total output to labour inputs) or total factor productivity (TFP) (sometimes called Multi Factor Productivity (MFP) which is the residual productivity growth after allowance for labour and capital input growth. Labour productivity is a useful measure of differences in economic performance over time since it takes account of overall changes in the workforce and in individual hours worked. Labour productivity growth therefore reflects the per capita income growth that can be achieved without the sacrifice of leisure time. This is important when comparing Europe with the US, given Europeans appear to place a higher value on leisure time than Americans as evidenced by the longer annual leave Europeans take.

TFP (or MFP) was thought to provide a better measure of technical progress, and therefore of sustainable productivity and income growth. However, this view has been questioned in recent academic work.[14] The main reasons for this are set out in Box 2.1. In essence, technical progress may be reflected in changes in the quality of capital and labour input over time and, therefore, measured TFP may in part reflect a failure to account for these changes. As researchers have found ways of accounting for quality change, so TFP measures have changed. In this report we present some estimates of TFP growth but focus on labour productivity growth.

Figure 2.8 shows the convergence and eventual cross over in hourly labour productivity growth and total factor productivity growth per person employed in the EU and US over the period 1966-2002.[15]

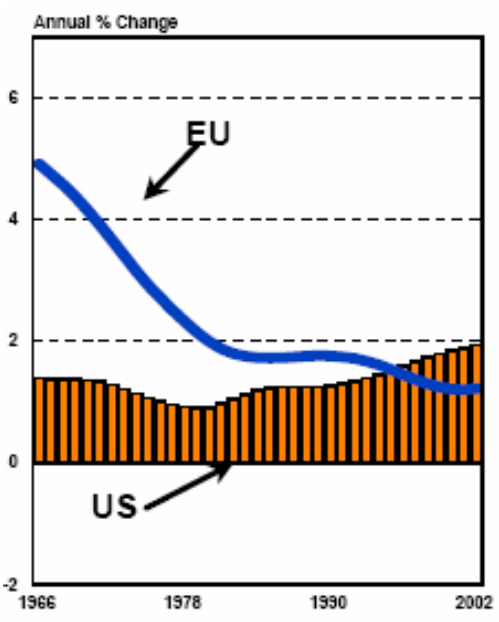
[13] Robert Gordon. August 2004. "Why was Europe left at the station when America's productivity locomotive departed?" NBER Working Paper 10661.

[14] Recent papers include: Jorgenson. 2004. "Accounting for growth in the information age"; Nicholas Crafts. "Quantifying the contribution of technological change to economic growth in different eras: a review of the evidence." Working Paper 79/03. http://www.lse.ac.uk/collections/economicHistory/pdf/wp7903.pdf; Oulton and Srinivasan. October 2004. "Productivity growth in UK industries, 1970-2000: structural change and the role of ICT." Paper presented to "Information Technology, Productivity and Growth" conference, National Institute of Economic and Social Research, London, 28-29 October 2004. http://www.niesr.ac.uk/Epke/finalconf.html. These papers also cite earlier literature addressing this issue.

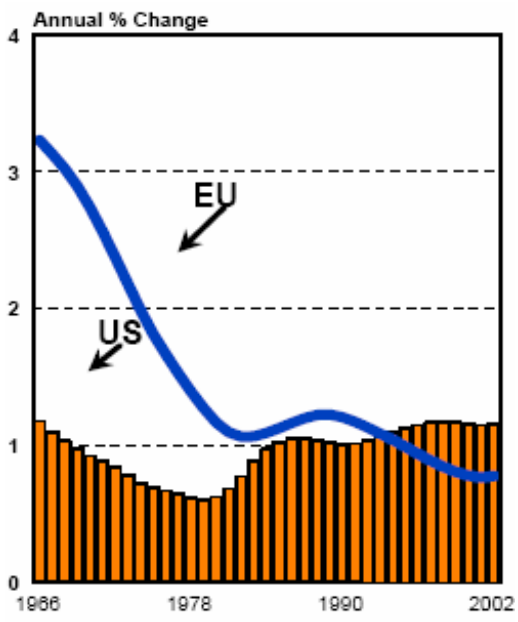
[15] Denis, McMorrow and Roger. July 2004. "An analysis of EU and US productivity developments (a total economy and industry level perspective)." Directorate-General for Economic and Financial Affairs. Economic Papers, N° 208. http://europa.eu.int/comm/economy_finance/publications/economic_papers/economicpapers208_en.htm

Figure 2.8: Labour and total factor productivity growth in the EU and the US

Labour productivity growth



Total factor productivity growth (TFP)



Source: Denis, McMorrow and Roger. July 2004. Graphs 2 and 3

Box 2.1: Different measures of productivity

Labour productivity measures the change in output after allowance for changes in labour input (both hours worked and labour force participation).

Another measure of productivity is Total Factor Productivity growth (TFP) or Multifactor Productivity (MFP) growth, which measures residual growth in output after allowance for labour and capital input growth (also referred to as the 'Solow residual'). TFP was traditionally thought of as capturing technical progress after capital and labour input growth were taken into account. However, as measurement of capital and labour input growth has improved to take account of input quality changes over time the residual attributable to TFP has reduced. Jorgenson has recently stated that:[16]

"I have been able to show that investment in tangible assets is the most important source of economic growth in the G7 nations. The contribution of capital input exceeds that of productivity for all countries for all periods. The relative importance of productivity growth is far less than suggested by traditional methodology of Kuznets (1971) and Solow (1970), which is now obsolete."

There are three main reasons why we consider labour productivity to be a more meaningful measure of productivity growth than TFP.

1) If technological progress is embodied in the quality of ICT capital goods – and computers are a clear case in point – then technical progress will drive an ongoing improvement in the performance price ratio of ICT. This increases the scope for profitable use of ICT and so results in capital deepening (the use of more capital per hour worked) and sustained labour productivity growth i.e. returns to capital are not diminishing over time. As Nicholas Crafts put it:[17]

"there are frequently quite sizeable differences between the underlying rate of technological change and measured TFP growth. Moreover, it seems clear that these may vary greatly over time such that comparisons of TFP growth between periods can be quite misleading."

2) TFP estimates may also be biased during periods of rapid change in the capital stock.[18] Whether the conventional TFP measure is too high or too low depends on how high the growth rate of investment in complementary capital is compared to the growth rate of the stock of complementary capital. In a steady state, the growth rates of investment and the capital stock must be equal. But in a boom, the growth rate of investment will exceed that of the capital stock. Hence we would expect a downward bias in the conventional measure during a boom.

3) TFP comparisons between different countries may be misleading. The embodiment of technical progress in capital goods implies that the price of ICT capital goods produced in one region (or country) may steadily decline, thereby enabling another ICT using region (or country) to use more ICT productively over time. Productivity growth in ICT production in the former region may show up as TFP growth, while productivity growth in the latter ICT using region will show up as capital deepening and labour productivity growth, but not necessarily TFP growth.

[16] Jorgenson. 2004. "Accounting for growth in the information age."

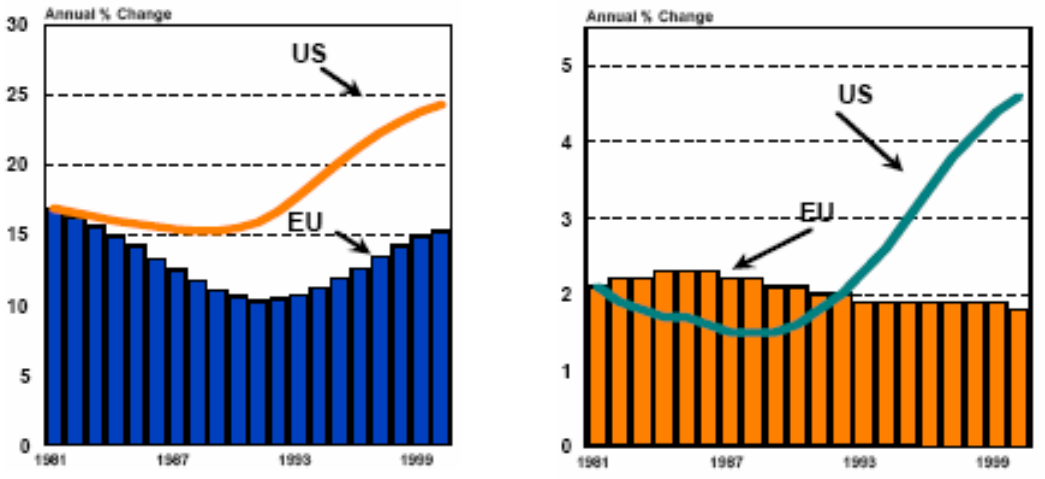
[17] Nicholas Crafts. "Quantifying the contribution of technological change to economic growth in different eras: a review of the evidence." Working Paper 79/03. http://www.lse.ac.uk/collections/economicHistory/pdf/wp7903.pdf

[18] Oulton and Srinivasan. October 2004. "Productivity growth in UK industries, 1970-2000: structural change and the role of ICT." Paper presented to "Information Technology, Productivity and Growth" conference, National Institute of Economic and Social Research, London, 28-29 October 2004. http://www.niesr.ac.uk/Epke/finalconf.html

Figure 2.9 shows the divergence in labour productivity growth for ICT producing and ICT intensive using private services respectively for the period 1981-2000.

Figure 2.9: Divergent impact of ICT on hourly labour productivity growth in the EU and US

ICT producing sector **Intensive ICT using private services**



Source: Denis, McMorrow and Roger. July 2004. Graph 8

The combined effect of ICT producing and intensive ICT using private services in terms of labour productivity growth was 0.67% and 1.85% pa in the EU and US respectively during the period 1996-2000. These growth contributions amounted to 42% and 80% of overall productivity growth in the EU and US respectively.

Observed productivity growth attributable to ICT is large relative to that of previous general purpose technologies. For example, labour productivity growth attributed to steam in Britain during the industrial revolution is estimated to have been around 0.65% per annum at its peak.[19]

The IMF has estimated the impact of ICT in Europe and the US.[20] Table 2.1 reproduces the IMF estimates of labour productivity growth for ICT-producing and ICT-using sectors of EU-15 economies and the US. Productivity growth in the ICT-producing sector is similar between the EU-15 and the US, but there is a large difference in the results for the ICT using sector. For the US, the contribution to productivity growth from ICT use is roughly double that from ICT production, as the ICT intensive using sectors are approximately 20% of GDP versus around 6% for the ICT producing sectors. In Europe, the ICT using and producing sectors make similar contributions to overall productivity growth.

[19] Nicholas Crafts. April 2004. "Steam as a general purpose technology: a growth accounting perspective." The Economic Journal, Volume 114.

[20] Marcello Estevão. October 2004. "Why is productivity growth in the Euro area so sluggish?" IMF Working Paper WP/04/200. http://www.imf.org/external/pubs/ft/wp/2004/wp04200.pdf

Table 2.1: Labour productivity growth across countries

	ICT-producing		ICT-using		Non-ICT		Total	
	1990-95	1995-01	1990-95	1995-01	1990-95	1995-01	1990-95	1995-01
Austria	6.8	3.3	3.9	2.7	3.6	1.9	4	2.3
Belgium	3	6.8	3.4	0.4	2	2	2.5	1.7
France	3.1	5.2	1.3	1.1	1.5	1.1	1.6	1.5
Finland	6.2	9.8	1.4	0.4	3	1.1	3.2	2.3
Germany	6.2	10.5	2.6	2.1	2.1	1.1	2.5	2
Greece	4.2	6.7	-1	4.1	1.3	2.4	0.9	3.1
Ireland	15.7	17.6	1.5	5.7	3.7	5.3	4.3	7.8
Italy	5.3	5.4	2.7	1.6	2	0.1	2.4	0.8
Luxembourg	8.2	4	0.9	-0.3	2.5	0.5	3.1	1
Netherlands	3.3	2	1	1.9	1.5	0.5	1.3	1.2
Portugal	10.7	5.6	0.8	1.9	2.1	3	2.3	3
Spain	3.3	3.8	-0.3	0.9	2.2	0.5	1.8	0.8
Euro area	**5**	**7.3**	**1.9**	**1.7**	**2.1**	**0.9**	**2.2**	**1.5**
Denmark	7.4	4	0.8	2.9	1.8	0.5	1.9	1.6
Sweden	6.5	-0.5	2.8	1.9	1.4	1.8	2.1	1.9
UK	9.5	8	2.1	3.3	2.9	1	3.2	2.2
EU	**5.8**	**6.8**	**2**	**1.9**	**2.2**	**1**	**2.4**	**1.7**
US	**7.4**	**8**	**1.2**	**4.8**	**0.4**	**0**	**1.2**	**2.3**

Source: IMF. 2004.

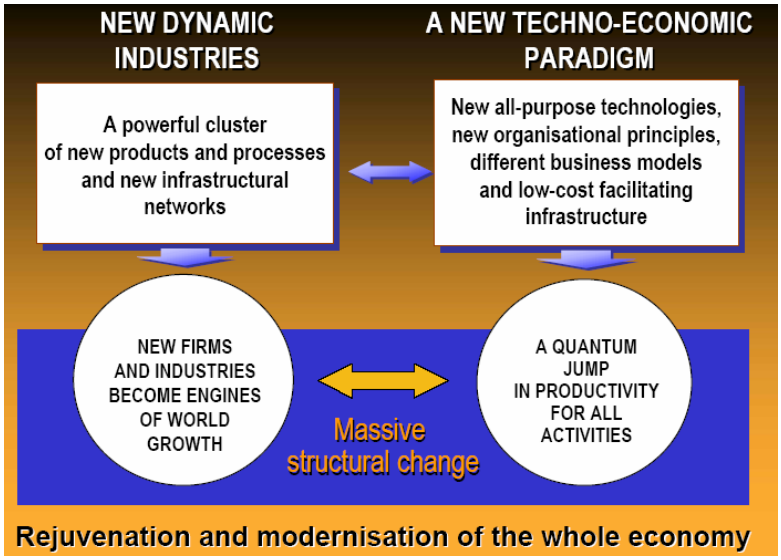
Significant differences are apparent in ICT-using sectors, both between countries and across time, with labour productivity in EU-15 countries exceeding that in the US during 1990-95 but decelerating to 1.9% pa during 1995-2001 versus a US acceleration to 4.8% pa during the same period. Variation in labour productivity growth across the EU-15 is also significant in ICT-using sectors, ranging from -0.3% pa in Luxembourg to 5.7% pa in Ireland.

The relative contribution of ICT use to productivity growth, as opposed to ICT production, may grow in future. The reason for this is that the price of ICT is falling rapidly and may already be offsetting demand growth, thereby stabilising the share of the ICT producing sector in the economy at around 6%. However, the flow of services from the sector is growing in real terms and complementary investments in ICT using sectors will allow increasing effective use to be made of ICT in many sectors of the economy. The story here is analogous to that for electricity which has had a profound impact on economic activity and society, but currently accounts for less than 2% of GDP in the EU-15.

2.7 ICT generates spillover benefits via “creative destruction”

Figure 2.1 showed that ICT is exerting disproportionate “leverage” on economic performance. This is a characteristic of “general purpose” technologies such as steam and electricity that are used as complementary inputs throughout the economy, and raise returns to other forms of investment such as organisational change. Figure 2.10 illustrates this dynamic process.[21]

Figure 2.10: Nature of technological revolutions



Source: Carlota Perez, September 2004

In addition to the direct contribution of ICT, there are widespread spill-over benefits throughout the economy. These spill-over benefits show up as high rates of productivity growth in the ICT intensive using sectors of the economy which include retail, wholesale and financial services; these currently comprise around 20% of GDP.

2.7.1 The need for complementary investment

The case of Johnson and Johnson (see the following box) illustrates the ways in which ICT exerts its overall impact via complementary investment.

[21] Carlota Perez. October 2004. The new techno-economic paradigm and the importance of ICT policy for the competitiveness of the whole economy High Level Conference "Looking into the future of ICT", Amsterdam. http://www.ictstrategy-eu2004.nl/pdf/Carlota_Perez.pdf

Box 2.2: IT and Organisational Change: The Case of Johnson and Johnson

The company wished to improve product customisation and variety. It made a large investment in computer integrated manufacturing and numerous changes in working practice. The existing workers had difficulty adapting and so the company concluded that the best approach to implementation was to introduce the new equipment in a "Greenfield" site with handpicked young workers. Significant productivity improvements were achieved.

Principles of Old Factory	Principles of New Factory
Designated Equipment	Flexible computer based equipment
Large WIP and inventories	Low inventories
Pay tied to amount produced	All operators paid same flat rate
Keep line running no matter what	Stop line if not running at speed
Thorough final inspection by QA	Operators responsible for quality
Raw materials made in-house	All materials outsourced
Narrow job functions	Flexible job responsibilities
Areas separated by machine type	Areas organised into work cells
Salaried employees make decisions	All employees contribute ideas
Hourly workers carry them out	Supervisors can fill in on line
Functional groups work independently	Concurrent engineering
Vertical communication flow	Line rationalisation
6 management layers	3-4 management layers

Source: Beyond Computation: Information Technology, Organisational Transformation and Business Performance; E Brynjolfsson and L Hitt, Journal of Economic perspectives, Fall 2000

The Johnson and Johnson case illustrates that a complete change to processes and management may be necessary to benefit fully from ICT. We refer to this process as "creative destruction" in the sense Schumpeter outlined in 1942:[22]

> *"The fundamental impulse that keeps the capital engine in motion comes from the new consumers goods, the new methods of production and transportation, the new markets...[The process] necessarily revolutionizes from within, incessantly destroying the old one, incessantly creating a new one."*

New skills replace old ones, firms who use ICT effectively prosper while others decline, and the spatial distribution of economic activity may change radically. Flexibility to allow and accommodate such change is likely therefore to be key to benefiting from ICT.

ICT is also thought to be contributing to the improved efficiency of markets including labour markets since ICT lowers barriers to knowledge and lowers the cost of matching supply and

[22] Schumpeter. 1942. "Capitalism, Socialism and Democracy."

demand of goods and services, and jobs and workers. It is difficult to identify and attribute these benefits to the ICT based on macroeconomic evidence since such benefits are diffuse and may involve relatively modest levels of ICT use.

2.7.2 Possible employment-productivity trade-off

One possible concern regarding the "creative destruction" resulting from ICT use might be the consequences for aggregate employment. However, evidence suggests that the productivity acceleration due to ICT is neutral or beneficial in terms of overall employment.

First, evidence points to an inverse relationship between productivity growth and the inflation-unemployment trade-off (known as the non-accelerating inflation rate of unemployment) so that a lower rate of unemployment can be sustained.[23] Second, more detailed sector specific evidence points to a positive relationship between employment and productivity growth in the ICT sector in particular:[24]

> *"The main findings are that the inverse relationship between employment and productivity growth has been much more prominent in manufacturing industries than in services industries. Secondly, during the 1990s, this relationship has turned positive in many industries, in particular in ICT-producing industries and in ICT-using industries in the service sector. Finally, the employment-reducing effects of productivity growth have remained considerably stronger in Europe than in the US."*

2.8 Use of ICT in the provision of public services

2.8.1 Introduction

Few things affect the quality of our lives as much as the quality of public services we consume – such as healthcare, education, policing, courts and public transport. The ability to communicate effectively with government and parliamentary representatives is important for the proper operation of democracy and for building trust in government. ICT offers the potential to improve both the quality of services and to facilitate communication between citizens and government. This is not simply about automating existing services; ICT also offers the opportunity to change the way services are delivered. Implementation of service delivery using ICT should involve greater service integration (across government departments), removal of duplication and provision of services and information at times and places (e.g. out of normal working hours and in the home or office) that are convenient for the user rather than the supplier. If these services are attractive they could act as a stimulus for individuals to become more ICT literate, invest in ICT (PCs and broadband) and use publicly provided internet access (e.g. in internet cafes or libraries).

Public sector activities are also economically significant, comprising 20% of GDP in Europe. With an aging population this fraction could rise as demand for healthcare and other support services rises. Productivity improvements in the public sector are therefore an important

[23] Laurence Ball and Gregory Mankiw, May 2002, "The NAIRU in theory and practice." NBER Working Paper No 8940.

[24] Bart van Ark, Robert Inklaar, Robert H. McGuckin and Marcel P. Timmer. April 2003. "The employment effects of the 'new economy'. A comparison of the European Union and the United States." National Institute Economic Review no. 184. http://www.niesr.ac.uk/epke/bartrev.pdf

element of improving overall productivity. If such improvements do not happen in a timely manner, then there is a risk that the public sector will act as a drag on the rest of the economy – making it relatively costly for business and individuals to deal with government, thereby reducing private sector productivity and imposing a growing tax burden.

These issues have been recognised by many national governments and by the European Commission. However, as we discuss further below progress on implementing ICT in government so far appears to have been more limited than in the private sector. We know from experience in the private sector that the gains from ICT can take a long time to be achieved in part because of the complementary organisational changes that are required. Such changes may be even more difficult to achieve in the public sector because individual units – departments or agencies – are large and interactions are complex, it is a more politicised environment and labour contracts may be more rigid than in the private sector. This simply underlines the importance of commitment by governments to effective ICT deployment. We return to this issue below when reviewing experience so far with the deployment of ICT in the public sector. First we provide examples of the benefits of ICT.

2.8.2 The benefits from ICT use in the public sector

Unlike the situation with the private sector, meaningful aggregate data on public sector output and productivity does not exist. This problem arises because in many countries the value of the output of the public sector has traditionally been measured as equal to the total value of inputs.[25] This means changes in output quality are not captured and the sector by definition shows no productivity growth. National statistical offices are aware of these issues but there is no common methodology for addressing them.[26]

In the absence of aggregate measures of public sector productivity we have sought to collect case study information concerning the costs and benefits of specific implementations, through a web-based search and discussions with staff at the e-Government section of the OECD and the *e*Europe section of DGInfoSoc and with BRT members. We found there is surprisingly little documentation on the costs and benefits of individual initiatives. Rather there is information describing specific applications, a small amount of quantitative information (more often giving benefits rather than costs) and a number of studies measuring the supply but not often the use of e-government services.[27]

A selection of case study examples is given in the following sections under the headings e-government, e-health, e-education and e-transport. We refer to the collective of all these areas as e-policy. Further examples are given in Appendix C.

[25] In some countries an assumed productivity adjustment is made (e.g. Germany) and in others output indicators are used to obtain volumes and then adjustments have to made to reconcile this with value data (e.g. UK).

[26] Work on developing some meaningful output measures for government is reported in "Atkinson Review: Interim report. Measurement of Government Output and Productivity for the National Accounts", HMSO, July 2004

[27] See for example "On-line availability of public services: how does Europe progress?, Report of the Fourth Measurement, October 2003 Cap Gemini Ernst and Young for DG Information Society

2.8.2.1 The benefits of e-government

Central and local governments in Western Europe are estimated to have spent €31.5bn on IT alone in 2003 and this is forecast to rise to €41.1bn by 2008.[28] By contrast, we note that the federal government alone in the US spends around $50bn a year on IT.[29]

The types of services provided by e-government include:[30]

- providing information;
- on-line form filling (e.g. obtaining official documents such as passports/identity cards, registering births and deaths, licence applications);
- on-line transactions (e.g. for claiming benefits or paying tax);
- on-line procurement by government departments;
- on-line interactions with elected representatives;
- automating back office systems, such as benefit and tax systems.

In qualitative terms the benefits from these services are:[31]

- benefits to users: time and money savings, access to new markets (e.g. through e-procurement, job information), improved access to information, ability to communicate views to government, increased access to and use of government services and higher levels of user/citizen satisfaction, increased business opportunities (e.g. through promoting attractions to tourists);
- benefits to government: reduced costs of providing services and of procurement[32], improved service delivery (speed, reliability, quality), better information, increased service use;
- wider benefits to society: reduced corruption, enhanced democracy, enhanced trust between citizens and government.

Against these benefits need to be set the costs of implementing the new systems and the costs to users of accessing them (e.g. hardware, software and time costs).

Table 2.2 gives some examples of the benefits to government of e-government implementations. The example given in the box below also illustrates the benefits for government, in terms of reduced cost, and importantly for users, in terms of improved satisfaction and significantly greater use of the service.

[28] See "IT spending on e-government continues to grow in Western Europe", e-government news 14 October 2004. IDA of the European Commission. Forecasts were produced by IDC.

[29] E-Government Strategy, Office of Management and Budget, Office of the President of the United States, February 2002.

[30] e-government is defined by the OECD as the use of information technologies, particularly the internet, as a tool to achieve better government.

[31] See Evaluating e-Government: developing methods and identifying benefits, P Foley and S Ghani, August 2004, OECD and IECRC.

[32] For example in Italy an e-procurement system adopted by the Ministry of Economy and Finance was found to have reduced the total costs of goods and services by 30%. See The-Government Imperative, OECD 2003.

Table 2.2: Economic Benefits of e-Government implementations

Project	Activity	Economic Benefit
Centrelink, Australia	Information service for citizens, started in 2001.	Breakeven over two years. A$8.9m benefit after four years
State of Kansas	Online job listings, enhances job searching, reducing benefit payments.	Saves nearly $9m a year in unemployment compensation
US One-stop for business legal information	Federal government initiative to assist with businesses' legal compliance.	Businesses will save at least $275m annually
Australia: e-tax	Tax returns can be filed online	A$15.5 million in accrued benefits by 2004 over a 5 year period
Singapore: Tax e-filing	Tax returns can be filed online or over the phone.	Saves S$20m a year
CAL-Buy Online Procurement System, US	State of California's procurement project, saving $37 per purchase	Cost savings $9.7m a year
OGC, UK: e-tendering	Allows tendering to take place online.	£13m saving over 4 years. Reduces costs by £37m
ServiceArizona	Allows citizens to register vehicles. Online processing is about $4 less than a counter transaction.	Saves more than $1m a year
The Dolphin project, Ohio	Automation of the Ohio Bureau of Workers' Compensation Scheme, cost $15m.	Saves over $120m a year
Washington State Combined Application program	Combined the benefit programs of a few agencies, cost $400k	Saves $6.37m a year

Source: Evaluating eGovernment: Developing methods and identifying benefits, Foley and Ghani, August 2004.

Box 2.3 Best practice for Citizen Services delivered by public sector organisations in eight European countries: Germany, France, Italy, Netherlands, Poland, Spain, Sweden and the UK

In 2004 Momentum surveyed 2600 public sector organisations in Europe concerning the impact of ICT on organisational performance in a study for Cisco. Of the 1100 respondents, 40% were in the healthcare sector and 60% were from national (10%), regional (24%) or local (66%) government.

Key Results

- The most significant reasons for investing in networked applications, cited by almost 80% of respondent organisations, were the desire to improve citizen satisfaction and the desire to accelerate the organisation's processing speed. Cost savings, the need to expand their organisation's capacity, and to meet new types of citizen demands were mentioned by 70% of organisations;
- Since installing the new systems, citizen satisfaction ratings for respondent agencies had improved 29% over the previous 12 months, and time to resolution of the citizen's request or need had improved by 28% over 12 months;
- The number of citizens using the service has risen by 23%, and the number of cases filed online is up by 15%;
- The number of cases resolved per employee is up by 21%, and average cost per case resolution fell by 12%;
- New best practice is also thought to be capable of raising service volume capacity by 30-50% by those who have invested in the new technologies;
- Both annual operating costs and revenues collected had improved on average by 15% over the previous 12 months for respondent organisations.
- The full step change to new best practice techniques – i.e. allowing longer than 12 months to capture all the benefits, and ignoring temporary glitches – is estimated by those who have undertaken the investments to be capable of yielding 35-55% efficiency gains;
- The biggest barrier to faster adoption of networked applications, cited by 20% of respondents, is internal resistance to change; 15% cited cost ('lack of budget') as the primary barrier.

Source: "Net Impact 2004: From Connectivity to Productivity", Momentum Research

2.8.3 The benefits of e-health

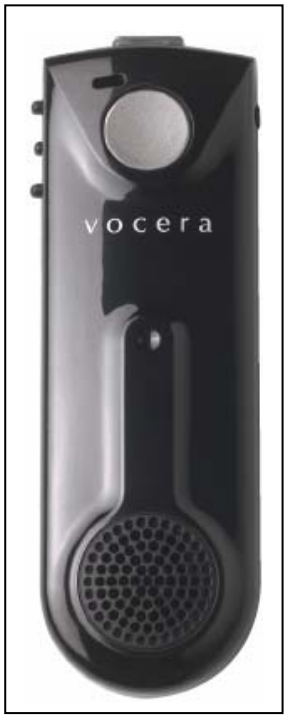
e-health involves the use of ICT to: provide health information and deal with queries from individuals and health professionals and providers on-line and over the phone; provide medical consultation and diagnosis remotely; monitor patient status remotely; improve communications between health professionals and make better use of their time; and streamline patient record keeping. Costs to the health services and patients can be reduced while the quality of care can be improved (e.g. by having access to better information and specialist staff located remotely). The former is particularly important in the context of an aging population which will impose increasing demands on Europe's healthcare systems.

The use of healthcare services across Europe by citizens would also be facilitated by the on-line availability of patient records across Member States.

The box below illustrates some of these benefits.

Box 2.4 e-health solution brings substantial time saving

Hospital staff need to be in constant contact with each other in order to do their jobs properly. Nurses, doctors and ancillary staff need to communicate which each other, often when the person they need to reach is physically far away, even in another building. Finding the right member of staff is often time consuming, involving phone calls, paging, public announcements and even searching through the ward on foot. This is especially troubling when a quick response is vital, for instance in life-threatening situations when a nurse needs the advice of a doctor.



A communications system has been developed to help solve this problem. The Vocera badge (pictured), is a small wearable device, which weighs less than 2 ounces and can be worn by all medical staff. The device uses voice recognition technology to allow completely hands-free operation: the user says the name of the person or department they want to speak to, and a two-way conversation is started. The device uses Wireless LAN networking and Voice over internet Protocol to integrate with hospitals' existing networks. This means that staff at any networked site can talk with staff at any other site. The system can also handle conference calls, and staff can initiate calls with the normal telephone network from their badge.

A study carried out at St. Agnes Hospital in Baltimore found that communications using the new device were five times faster than traditional communication methods. The study concluded that the Vocera produced a 4% saving in time, equivalent to 3,400 hours a year for a single nursing unit. There was a decrease in public announcements of 94%, and most staff believed they saved more than 30 minutes per eight-hour shift. The advantages of this e-health technology are clear.

Source: Vocera Communications: Vocera Benefits Study at St. Agnes Hospital (prepared by First Consulting Group)

2.8.4 The benefits of e-learning

e-learning involves on-line access to educational materials by students who may be located in existing educational facilities, or elsewhere, as well as the provision of teaching on-line to those who cannot access schools or colleges. e-learning provides a means to increase educational performance and skills, both of which are essential if Europe is to become a knowledge based economy. e-learning is particularly relevant for the provision of life-long learning in Europe if the aging population is to be kept actively employed, which is a priority for the Lisbon Strategy in 2004.[33]

[33] Delivering Lisbon, Report from the Commission to the Spring European Council, COM(2004) 29, Brussels 20.02.2004

The box below gives an example of e-learning initiatives. In this area it is perhaps not surprising that there are few indicators of outputs given that it will take some time to see and isolate the effects of e-learning on educational and job performance.

Box 2.5 Alberta's e-learning programme

Alberta's e-learning department sponsors a well-known example of forward-looking educational programme for all citizens. The starting point was already excellent – Alberta was ranked top of all Canadian Provinces and OECD countries in a detailed survey in 2000 for reading, and in the top three for mathematics and science – but the Provincial government was determined to improve on this.

Although 80% of Alberta's three million citizens live in Calgary or Edmonton (the capital), the other 20% are spread over two thirds of a million square kilometres of lakes, forest and mountain. With many tiny remote communities, distance and small scale could have been problems. The government decided to build a 'SuperNet' to give broadband access to 422 remote communities, and within each community to link houses to schools, hospitals and other important facilities. All communities are charged equally for access, regardless of distance from Edmonton, and some 2,100 schools across Alberta are being linked through the SuperNet.

Fort Vermillion, 800 kilometres north west of Edmonton, is a good example. It has 800 people and 15 schools, but many schools are too small to teach specialist languages, advanced science lessons, or technical skills. Some high schools have only 12 pupils, but cannot be merged because of the geographical distances within the community. By having webcams at each end, streaming broadcast quality pictures, and splitting the screens in front of them, pupils and remote teachers can participate in remote classes or smaller video-conference tutorials. "Geography is no reason for mediocrity" summarised the Fort Vermillion schools superintendent. Parents are brought into the programme as well, by being able to follow their child's lessons remotely, and checking online their child's progress reports.

Being hardwired the SuperNet is free from SPAM and unwelcome pop-ups. By having a centralised curriculum, electronic testing and progress reports, the education authority can monitor all schools' progress online and move resources rapidly to nip any problems in the bud. IT support is centralised, so teachers do not have to double up as computer repairmen, and purchasing for 600,000 pupils gives the Province considerable market power to drive down prices.

This buying power can also be used to purchase high quality content cost-effectively. For instance the Province has commercial deals with National Geographic to provide access to a vast range of video, text, photo material, GEO-Kits, and teacher materials which has been digitised and put through the wires to complement normal geography and science lessons. Or in Grade 12 Social Studies students examine selected digitised news reports to understand the effects of ideological bias on the presentation of news, before discussing their own ideological viewpoints online. A Grade 6 Maths class contains not only the digitised teaching programme but also parent support materials to help parents reinforce the concepts just learned, help children with their homework, and provides answers for the printable activity sheets.

2.8.5 The benefits of e-transport

The use of ICT in transport offers amongst other things the potential to reduce congestion (and so costs to users and business), improve the reliability of public transport services (for example, through the use of real time traffic information), reduce accident rates (for example, diagnosing vehicle performance problems in advance through remote vehicle monitoring) and allow individuals and businesses to plan journeys in a more efficient manner, thereby saving travel time, reducing air pollution and transport costs.

The box below gives an example of the benefits from congestion charging in London, none of which would have been possible without the information and communication systems that underpin this scheme.

More generally, the cost of congestion in Europe is estimated at €120bn p.a. or 2% of GDP.[34] Even quite modest (say 1%) savings in congestion through the use of on-line traffic and related information systems would be significant. Reductions of the order of those achieved in London would imply a saving of around €35bn per annum. The provision of information and emergency response systems (to quickly attend to accidents) on a pan-European basis would help achieve such savings so that freight trucks use the road system in an optimal manner.

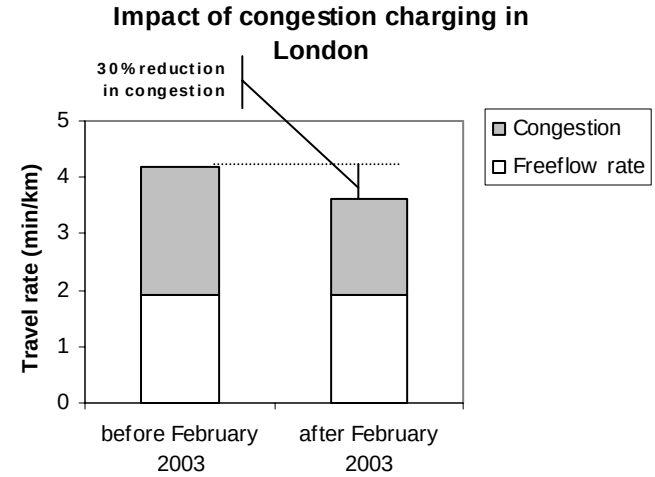
[34] Ticket to the Future : 3 stops to sustainable mobility, UITP 2003.

Box 2.6 Congestion charging in London: an e-transport success

Before February 2003, the average daytime speed on roads in central London was 14 km/h, similar to the speeds achieved in the nineteenth century.

The Mayor of London introduced the central London congestion charging scheme in February 2003. Drivers who enter a central charging zone between 7am and 6:30pm on weekdays have to pay a daily £5 congestion charge. Certain vehicles, such as taxis, motorcycles and alternative fuel vehicles are exempt from the charge. The scheme was intended to reduce road congestion, encourage commuters to switch to alterative means of transport, and provide funds for improvements to public transport.

The scheme uses a network of digital cameras to check that drivers have paid the charge, removing the need for physical barriers or toll booths. Drivers can pay over the internet, by text, in public phone booths, at newsagents, or through a call centre, and 46% of congestion charge payments are made by text message or over the internet. Drivers can pay in advance, and companies can participate in a fleet scheme to minimise administration costs.



Source: Transport for London

Despite widespread predictions that the scheme would result in chaos, it has been trouble free and is now widely held to be a success. Two years after the scheme started, congestion has decreased by 30%, journey times have decreased by 14%, and journey reliability has improved by 30%. When valuing the benefits of reduced traffic delays, improved reliability, reduced waiting time at bus stops and less pollution, Transport for London estimates the annual benefits at £180m. The annual cost of the scheme is £130m, yielding a net benefit of £50m per year.

Source: Transport for London: Impacts Monitoring – Second Annual Report: April 2004

2.8.6 Issues in Implementing ICT in the Public Sector

The e-Europe mid-term review noted that government services are increasingly available on-line but that in many fields progress is supply and not demand driven, meaning that usage of on-line services is still low and so the benefits from these services, in terms of productivity, jobs and user satisfaction have not yet been realised.

The major impediments to the effective implementation of ICT in public services are now well understood.[35] As the OECD put it, e-Government is more about modernising and reforming

[35] "The e-Government Imperative", OECD 2003, E-Government Strategy, Office of Management and Budget, 2002, eEurope mid-term review, CEC, COM(2004) 108 final, 18 February 2004.The Death of Distance 2.0, Frances

government than about using electronic technology and this has not been adequately recognised. Specific issues with the implementation of ICT in the public sector that have been identified in research are:

- Initiatives are not citizen/business centric – the focus of ICT investment in government has been on meeting internal government needs, such as revenue collection (e.g. tax) and cost reduction, rather than citizens' needs.
- There has been too much focus on "e" rather than government – agencies have used IT to automate existing processes rather than to create new approaches to service delivery and information provision that are made possible by the use of ICT.
- Silos in government – institutional and budgetary boundaries between departments and agencies inhibit the creation of new integrated services based on the use ICT. Problems of interoperability are largely caused by institutional arrangements rather than technical difficulties.
- Inappropriate incentives – public employees have few incentives to co-operate with other departments, implement measures to remove their jobs and/or take responsibility for effective ICT delivery.
- Inappropriate budgetary processes – it is more difficult under annual budgeting for government departments to make a case for investment funding which has a pay-off a number of years hence than for projects with more immediate but smaller returns. This means there is an inherent bias against capital investment.[36] This is made worse by the fact that the immediate response of all governments to budgetary pressures is to cut capital rather than operating expenditure, and investment in ICT suffers as a consequence.
- Labour contracts – there are difficulties in achieving the manpower reductions that justify the ICT investments because staff cannot be easily redeployed or made redundant.
- Legal and regulatory barriers – electronic processes often do not have the same standing as paper processes, and privacy and security of data held on and communications over electronic systems must be assured.
- Limited take-up and use of ICT amongst some of the heaviest users of government services – the elderly and the most disadvantaged are large users of government services but often have the lowest levels of access to ICT. This is part of the "digital divide" issue.
- The value of the net economic benefits of using ICT in the public sector are not well understood. While there are many examples of interesting and seemingly beneficial implementations of ICT in the public sector, there has been little rigorous appraisal of their costs and benefits. The benefits to users or to other parts of government are often not counted in appraising schemes. There has also been no international benchmarking of the performance (assessed in terms of the net benefits) of similar projects, such as on-line tax services.

Cairncross, Texere, 2001. Barriers to e-government are discussed in "Cultural barriers to e-government", Professors Margetts and Dunleavy, in Better public services through e-government, UK National Audit Office, April 2002 .

[36] The UK Government in a study of 14 projects found that payback periods could be as long as 12 years and that the average was around 5 years. See Foley and Ghani (2004) op cit.

Citizen and business expectations of the quality of service delivery and interaction with government are rising. As the private sector continues to apply ICT to improve service delivery the pressure for reform in government will grow. What is not yet clear is whether the public sector is able to reform itself in ways that will allow the effective implementation of e-government, e-health, e-education and e-transport. The implications for policy are discussed in Chapter 4.

2.9 Role of communications networks within ICT

Communications networks are important in relation to achievement of existing, and future achievement of benefits from ICT for the following three reasons:

i. Communications network infrastructure is a non-tradable good. It is one component of ICT that must be produced efficiently within Europe to reap the benefits of ICT.

ii. High speed communications networks are an essential input to taking advantage of almost all anticipated future ICT innovations (see the list in Section 2.11). This has been the case for some time. Widespread networking of computers, via the internet and world wide web, coincided with the pronounced productivity acceleration due to ICT in some countries from 1995.

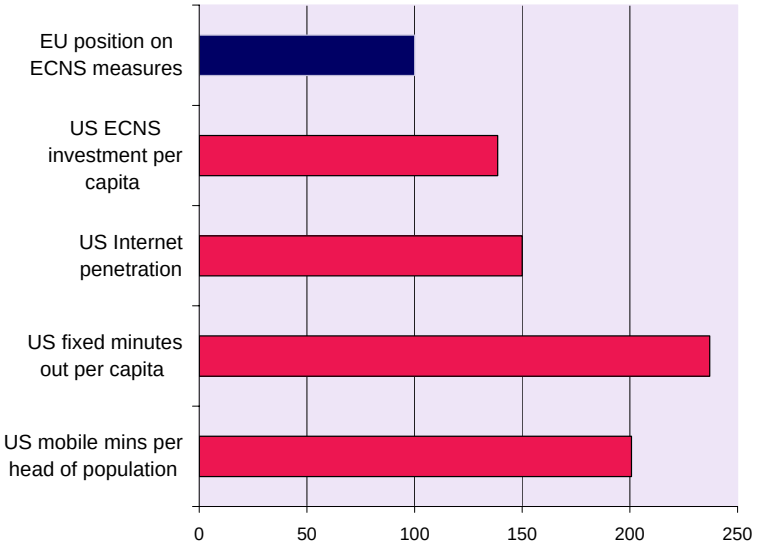
iii. Communications network services are subject to subject to "Metcalfe's Law", namely the benefits of use grow more than proportionately with the number of users connected to the network.

In the sections below we expand on these points.

2.9.1 Communications network services uptake

Figure 2.11 summarises the current position of the EU-15 compared with the US on a number of measures of communications use and investment. The US is ahead on all measures except mobile penetration, though even there US mobile users have much higher calling rates than EU subscribers. Investment in communications networks, and the take-up of broadband in Europe, has lagged also that in the US and parts of Asia (see Figure 3.12, Chapter 3).

Figure 2.11: ICT Sector Development: US versus EU 2003



Source: EITO and ITU

2.9.2 Networking and the ICT productivity acceleration

In the past few decades, the use of computers and internal networks in organisations such as manufacturing firms and banks allowed gains in productivity. Increasingly the benefits of ICT are related to use of the internet, and communications and commerce between firms, or directly between firms and customers in the services and information services sectors. The following box summarises a number of commentators' views on this development.

Box 2.7 Role of communications networks in reaping the benefits of ICT

Alan Greenspan, Chairman of the Federal Reserve, April 2000:

"The full value of the computing power could be realised only after ways had been devised to link computers into large-scale networks."

Dirk Pilat, Economic Analysis and Statistics Division, OECD, 2004:[37]

"Finally, the largest economic benefits of ICT are typically observed in countries with high levels of ICT diffusion. OECD data show that the United States, Canada, New Zealand, Australia, the Nordic countries and the Netherlands typically have the highest rates of diffusion of ICT. ICT networks in these countries have now spread throughout the business sector and will increasingly be made to work to enhance productivity and business performance."

A study of Finnish micro-level evidence on business productivity concluded that spillover benefits of ICT in the services sector depend crucially on the internet:[38]

"…it seems that the excess productivity effect of ICT-equipped labour typically ranges from 8% to 18%. The effect tends to be larger in services than in manufacturing. The effect is often much higher in younger firms and can even be negative in older firms. Since organisational changes are arguably easier to implement in younger firms and recently established firms have by definition a new structure, we interpret this as evidence for the need for complementary organisational changes. Manufacturing firms seem to benefit from ICT-induced efficiency in internal communication whereas service firms benefit from efficiency in external communication."

e-commerce offers the potential to significantly reduce transaction costs, increase competition and thereby reduce prices and increase choice.

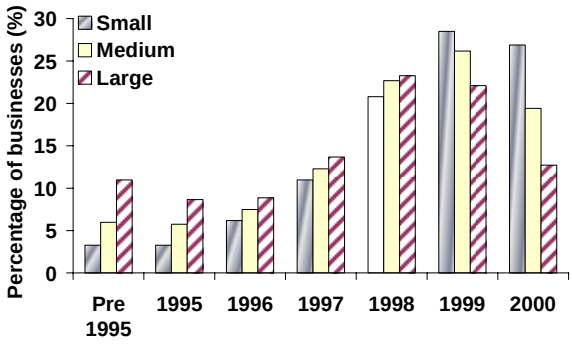
Analysis of data from a UK survey of firms shows the adoption of networking technologies increasing over time (see Figure 2.12) and points to e-procurement (the purchase of inputs using the internet), as opposed to computer networks, as having a positive impact on firm level productivity.[39] The evidence also suggests the gains from e-procurement relate to the impact on market prices.

[37]Dirk Pilat. 2004. "The impact of ICT on economic growth – an overview." In European Information Technology Observatory – EITO 2004. Page 245.

[38]Mika Maliranta and Petri Rouvinen. "ICT and business productivity: Finnish micro-level evidence." Chapter 10, page 232, in OECD (2004).

[39]Clayton, Criscuolo, Goodridge and Waldron. "Enterprise e-commerce: measurement and impact." Chapter 11 in OECD (2004).

Figure 2.12: Adoption of network technologies by firm size in the UK



Source: ONS (2004), page 243

Another UK study found that e-buying and e-selling have significant and positive impacts on productivity:[40]

> *"Among companies operating in the production sector we find that both e-buying and e-selling have a positive effect on productivity, while in companies operating within the service sector selling on the internet is comparatively more important in improving productivity performance. This shows that for these companies the internet has been an excellent device for expanding their business but that more can be done to enhance the productivity impact of buying on the internet."*

A further example is given by on-line bookstores which offer consumers lower prices (around 9-16% differences have been found); greater product variety; and search tools that make it easier to find a book than in a brick and mortar store. One study found that increased product variety of online bookstores enhanced consumer welfare by $731- $1,030 million, between 7 and 10 times as large as the gains from lower prices. While the former benefits would not necessarily show up in productivity or GDP statistics, they would not be available without the internet.[41]

The example of Dell given in the box below also shows the impact on business productivity from use of communications.[42]

[40] Ana Rincon, Catherine Robinson and Michela Vecchi. 2004. "The Productivity impact of E-Commerce in the UK, 2001: Evidence from microdata."

[41] Brynjolfsson, Hu and Smith. November 2003. "Consumer surplus value in the digital economy: estimating the value of increased product variety at online booksellers." *Management Science*. Vol 49, no 11.

[42] L Affuso and L Waverman, The Impact of Electronic Infrastructure on Economic Growth and Productivity, A report for the UK Performance and Innovation Unit, February 2002.

Box 2.8 Dell – Competitive Advantage from Virtual Integration using the internet

The advantages Dell obtained from use of electronic communications to sell its products and manage its supplier relationships were as follows.

Selling direct – eliminated resellers' margins

Inventory – 6 days compared with industry average of 36 resulted in significant cost advantages given cost component prices were falling 8-12% per quarter

Overall cost advantage – up to 10%

Information flow – improved flow of information from customer to vendor to supplier means the company is more response to customer demands

Faster time to market – 7 days from the release of a new Intel microprocessor compared with 8 weeks or more for less internet enabled competitors, thereby giving competitive advantage

Source: Affuso and Waverman, London Business School (2002)

These examples all point to benefits from the use of internet. The diffusion of broadband and development of wireless data services, and future development of high speed broadband, can be expected to continue to drive this trend.

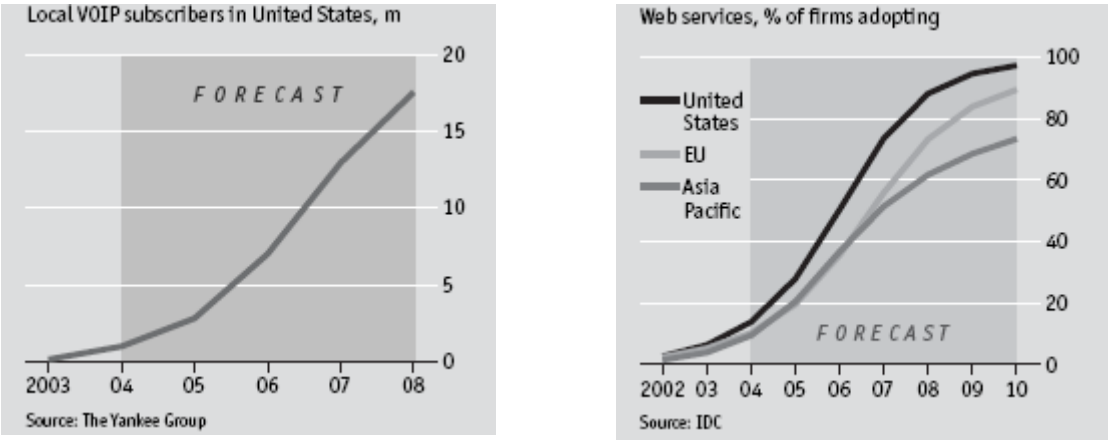
2.9.3 Metcalfe's Law and the development of network services

According to Metcalfe's Law, the benefits from the use of networked services grows more than proportionately with the number of users – approximating quadratic rather than linear growth. A ten-fold increase in service penetration from 9% to 90% would therefore result in a up to a 100-fold growth in social benefits. Metcalfe's law suggests that the pace of rollout of new services dominates consideration of whether their price is initially fully competitive – indeed the potential to earn "excess" returns is a key driver of the development and deployment of new networks and services.

Viewed in relation to Metcalfe's Law, the penetration of household broadband, digital consumer content such as online music and digital photography; and business internet based services including e-buying and e-selling, web services, and voice over the internet (VOIP) are in their infancy. Figure 2.13 shows how two of these examples are expected to develop in the medium term.[43]

[43] Andreas Kluth. 30 October 2004. "Make it simple: a survey of information technology." The Economist.

Figure 2.13: Growth of VOIP and web services



Source: The Economist (2004).

These developments will potentially deliver large social benefits, and create new demands in terms of communications network requirements.

2.10 Reasons for differences in returns to ICT investment and productivity dividend

There are a number of possible explanations for differences in returns in terms of productivity and profitability to ICT investment in different countries which we now explore. In doing so we draw on evidence from other countries in addition to the US and Europe.

We consider, in particular:

i. Whether the benefits from ICT in the EU-15 will match those in the US, but with a lag since substantial investment in ICT in Europe occurred somewhat later.

ii. Differences in the cost of ICT. ICT is relatively more expensive in Europe.

iii. Differences in capital taxation (the taxation of profits). Capital taxation is higher on average in Europe than in the US, with notable exceptions such as Ireland. (New member states also have lower corporate tax rates than the EU-15 on average.)

iv. Differences in skills levels. To the extent that skills levels differ the issue is similar to that for investment, namely why do incentives to acquire relevant skills, or institutional impediments to skills acquisition differ?

v. Market rigidities which form barriers to "creative destruction" in Europe. These rigidities include barriers to business reorganisation, delayed and costly business start-up, labour market rigidities that restrict labour shedding and/or payment a premium for relevant skills. Incentives for ICT use will also depend on the degree of competition in ICT using sectors.

These possibilities are now considered in greater detail.

2.10.1ICT benefits are subject to a lag

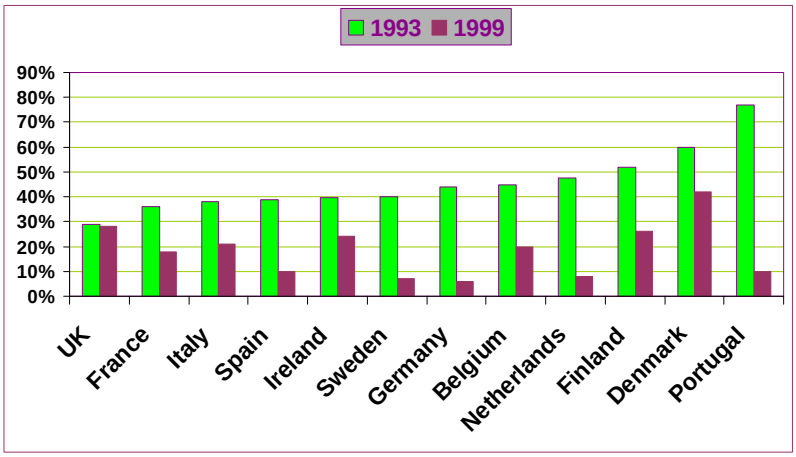
One possibility is that ICT investment is occurring later in the EU-15, and benefits will follow with a lag. There is some evidence from both aggregate and firm-level studies that the benefits of ICT investment may take five or more years to be fully realised.[44]

However, while partial catch-up in terms of productivity growth is plausible on these grounds – and has been incorporated in our forecasts in Section 2.11 – we do not consider that the gap with the US will be closed without policy action in Europe for two reasons. First, ICT investment has consistency been below that in the US (Figures 2.6 and 2.7). Secondly, the complementary changes required to realise the full benefits of ICT will happen very slowly, if at all, given constraints on land use change, market entry and labour shedding in a number of European countries.

2.10.2Differences in the cost of ICT

Figure 2.14 shows that while ICT appears to be more expensive in Europe than the US (comparing like with like is not straightforward), the gap has narrowed.

Figure 2.14: Price differential for ICT investment relative to the United States



Source: de Serres (2003)

However, in a sector where the underlying rate of price decline for semiconductors accelerated from 40% pa to 60% pa from 1995, a difference in price levels of 20% could not explain a lag in investment levels of over a decade between the EU and the US.

2.10.3Differences in capital taxation

Capital taxation could be important since it reduces returns to both ICT investment and complementary investment (which is thought to be 4-5 times the level of ICT investment).

[44] See Computing Productivity: Firm Level Evidence, MIT Sloan paper 4210-01, Brynjolfsson and Hitt (June 2003) of the MIT Sloan School of Management. Basu, Fernald, Oulton and Srinivasan. October 2003. "The case for the missing productivity growth: or, does information technology explain why productivity accelerated in the United States but not the United Kingdom?" NBER Working Paper 10010.

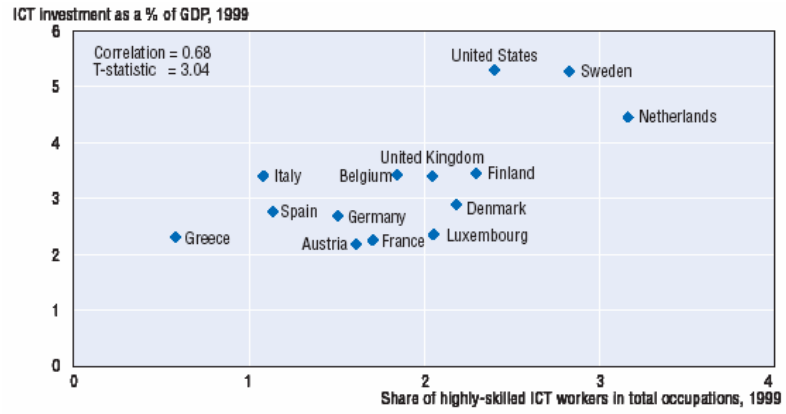
The effective top statutory tax rate on corporate income for the EU-15 was 31.5% in 2004 (ranging from 12.5% in Ireland to 38.3% in Denmark) and averaged 21.5% for the 10 new member states.[45] By comparison the corporate tax rate in the US was around 35%.

Corporate taxation therefore does not appear to be a key factor in explaining differences in ICT investment between the EU and the US, although it may in part account for the attractiveness of Ireland as an inward investment destination for ICT production in Europe (alongside other factors such as a skilled and young workforce). Accession countries may also attract such investment, particularly if they maintain relatively low rates of corporate taxation.

2.10.4 Skills levels

Figure 2.15 shows ICT investment as a share of GDP versus the share of highly-skilled ICT workers in all occupations in 1999. While there is a broad relationship between the two, a lack of investment in ICT human capital, as with a lack of investment in physical capital, may reflect low underlying returns to ICT investment. Simply promoting the production of more highly skilled ICT workers would not then necessarily lead to better outcomes overall.

Figure 2.15: ICT investment is associated with high skills in ICT



Source: OECD (2003), Page 69.

Jorgenson has shown that growth in college-educated workers contributed about a third of a percentage point, while non-college workers add another tenth of a percentage point to the increase in value added growth in the U.S. economy of 1.85 percentage points comparing 1995-2000 with 1990-1995.[46] This may reflect a premium on having a flexible and highly skilled workforce as a complementary input to ICT investment.

[45] EC Taxation and Customs Union Directorate-General and Eurostat. July 2004. "The Structure of the Taxation Systems in the European Union".

[46] Dale W. Jorgenson, Mun S. Ho and Kevin J. Stiroh. June 2004. "Growth of U.S. Industries and Investments in Information Technology and Higher Education."
http://post.economics.harvard.edu/faculty/jorgenson/papers/jhs_revised_criw1.pdf

In addition, as Crafts has pointed out, vocational based skills – historically arguably a strength in Europe – may be ill-suited to reaping the benefits of ICT where adaptability is required:[47]

> *"Relative to the United States, the traditional European strength in human capital has been in workers with strong vocational training and the relative weakness has been in the production of college graduates. In the earlier postwar period, countries like Germany obtained substantial productivity advantages from their training systems geared to producing craft qualifications. In the ICT era, however, it is strength in depth in higher education that has paid off."*

2.10.5 Barriers to "creative destruction"

If reaping the benefits from ICT involves a process of "creative destruction" whereby new industries replace old, old industries are re-engineered with different processes and management structures, economic activity is relocated and new skills replace old skills, then barriers to this process could slow the diffusion and profitable use of ICT.

Dismantling old institutional arrangements that have become an impediment to economic and social progress is unlikely to be easy, since vested interests are likely to have built up around existing arrangements. Accession states may prove more capable in this regard. While they start from a lower base in terms of ICT capital, they are in effect rebuilding their economies and may therefore be able to put in place institutional arrangements that are compatible with ICT investment. However, one study concluded that while accession countries had benefited from ICT use in manufacturing, further reforms are needed for accession countries to benefit from ICT use in the services sector.[48]

The following box surveys growing evidence that creative destruction – and institutions that support rather than impede it – is key to benefiting from ICT.

[47] Nicholas Crafts. November 2003. "Fifty Years Of Economic Growth In Western Europe: No Longer Catching Up But Falling Behind?" Stanford Institute of Public Policy Discussion Paper 03-21. http://siepr.stanford.edu/papers/pdf/03-21.pdf

[48] Bart van Ark and Marcin Piatkowski. March 2004. "Productivity, Innovation and ICT in Old and New Europe." Research Memorandum GD-69. http://www.ggdc.net/pub/gd69.pdf

Box 2.9 Evidence on the need for "creative destruction"

An examination of economic history published in 1986 reached the following conclusion:[49] *"social capability [involves] adjusting steadily to the requirements of technological opportunity. The educational and institutional commitments induced by past development, may, however, stand as an obstacle."*

A OECD study (2003) reached the following conclusions in relation to ICT:[50] *"Empirical evidence suggests that labour market regulation may also have a negative impact on productivity growth by lowering incentives to invest in ICT and to engage in private R&D, in particular in industries where taking advantage of new opportunities requires significant labour re-allocation."*

A study for the European Commission (2003) identified creative destruction as key factor:[51] *"More restrictive product and labour markets in many European countries may discourage entry and posterior growth of new firms, reduce innovative efforts, technology spillovers, and competitive pressures, which affects negatively productivity growth…"*

Empirical evidence surveyed by the OECD (2004) supports this conclusion:[52] *"Countries with a business environment that enables this process of creative destruction may be better able to seize benefits from ICT than countries where such changes are more difficult and slow to occur."*

A 2004 study of past productivity booms in the US reached similar conclusions:[53] *"The experience in the United States suggests that extended periods of strong productivity growth are characterized by innovations in technology that are accompanied by changes in organizational structure and business financing arrangements and by investments in human capital. Underlying these determinants of productivity growth, however, is a more fundamental factor: the willingness of society to transform itself dramatically…"*

Professor Crafts (2004) concluded that ICT may be "special" in terms of appropriate public policy:[54] *"there is some reason to think that ICT is less compatible with European incentive structures than investment in other types of capital."*

The following box sets out a case study in relation to retail and wholesale trade in Europe versus the US.[55] Creative destruction has played a central role in the productivity acceleration in the US, and product and labour market flexibility has been identified as a contributing factor to this success story.

[49] Abramovitz. 1986. "Catching up, forging ahead, and falling behind." Journal of Economic History, Volume 36.

[50] de Serres. 2003. "Structural policies and growth: a non-technical overview." OECD Economic Department Working Paper No 355. Page 16.

[51] Ana Rincon and Michela Vecchi. December 2003. "Productivity performance at the company level." In O'Mahoney and van Ark. 2003. "EU productivity and competitiveness: An industry perspective." Pages 201-202.

[52] OECD. 2004. Page 16.

[53] Roger Ferguson and William Wascher. Spring 2004. "Distinguished Lecture on Economics in Government: Lessons from Past Productivity Booms." Journal of Economic Perspectives, Volume 18(2). Page 25.

[54] Professor Nicholas Crafts. April-June 2004. "Fifty years of economic growth in Western Europe – No longer catching up but falling behind?" World Economics, Volume 5(2). Page 143.

[55] McGuckin, Spiegelman and van Ark. October 2004. "The US advantage in retail and wholesale trade performance: how can Europe catch up?" http://www.niesr.ac.uk/Epke/confppt/DistributionPerspectives-Retail.pdf

Box 2.10 Wholesale and retail trade – productivity performance in the US and EU

The US trade sector experienced a significant acceleration in productivity growth around 1995, almost doubling the trend growth rate of the previous twenty years. Retail trade jumped from 2.5% labour productivity growth between 1979 and 1995 to 7.9% between 1995 and 2002. Wholesale trade experienced a similar acceleration. On the other hand European productivity performance in the sector stalled post-1995. Since the trade sector comprises approximately 15% of employment and 10% of GDP in developed economies this difference had a large impact on aggregate economic performance. Together retail and wholesale trade accounted for just over 50% of the economy wide productivity differential between the US and EU of 1.1%.

All US retail productivity growth can be attributed to new stores displacing old ones.[56] ICT has enabled a series of innovations in the trade sector including the linking of bar codes to inventory control, daily stock replenishment, direct ordering from manufacturers (and movement from warehousing to a distribution model), and the sharing of real time information between stores and manufacturers so the latter can plan their production. These initiatives are most advanced in general merchandise stores, with only one-third of so called "efficient consumer response" practices adopted by the average retailer in 1997.

ICT investment has played a strong role in the transformation, with investment in the US growing far more rapidly during the 1980s than in Europe. Throughout the 1990s ICT investment in the sector was comparable in the US and EU, though the US continues to benefit from its head-start. Wal-Mart has led in implementing successive waves of productivity enhancing innovations in the US retail sector and now accounts for around 9% of retail sales in the US, and worldwide receipts of $250 billion annually and earnings in 2003 of $9 billion. Growth and profitability have provided powerful incentives for further innovation at Wal-Mart, while competitive pressure has pulled the rest of the sector along, thereby pushing aggregate economy wide productivity growth.

In terms of policy enablers in the US, flexible opening hours for stores, early deregulation of trucking and flexible land use policies and a common market (the US) have been identified as key factors. In contrast, Germany has inflexible trading hours and the UK is more restrictive in terms of land use. In addition, Europe deregulated trucking later and a lack of market integration in Europe limits the potential to achieve economies of scale. Behavioural differences also play a part as families in the US generally have two cars and face less congestion, and can therefore more readily travel to large scale stores.

At an aggregate level there is growing evidence that labour and product market rigidities impede the diffusion and use of ICT, and that innovations in the service sector driven by ICT result in increased economies of scale (for example, in financial services and retail trade). These requirements raise challenges for Europe in terms of service market integration and economic liberalisation.

[56] Lucia Foster, John Haltiwanger and C.J. Krizan. 1998. "Aggregate productivity growth: lessons from microeconomic evidence." NBER Working Paper 6803.

In a statistical study of regulation and ICT, controlling for a number of different factors at once, Gust and Marguez found that:[57]

> *"the decision to invest in information technologies is unique from other types of investment goods, as IT spending depends more sensitively on educational levels and is more restrained by restrictive regulatory practices than other types of investment."*

Under some specifications, employment protection had a positive impact on total investment but a negative impact on ICT investment. This correlation could reflect the fact that employment protection legislation causes firms to substitute capital for labour. However, for ICT capital, where complementary management changes are required to benefit from ICT, employment protection produces a net negative effect on investment.

We have also looked at various measures of product and labour market flexibility and their relationship with ICT expenditure. None of these indicators is ideal in that they summarise complex national positions, and ideally they would be compared with the productivity payoff from ICT rather than ICT spend. Nevertheless they are indicative and corroborate the story that emerges from case studies, namely that flexibility is the key to the creative destruction required to reap the benefits of ICT.

The OECD (2003)[58] compared indices of labour and product market flexibility with ICT investment as a share of GDP in 1998 and found that flexibility was associated with higher levels of ICT investment. However, updated indices of labour and product market regulation are currently not available from the OECD.

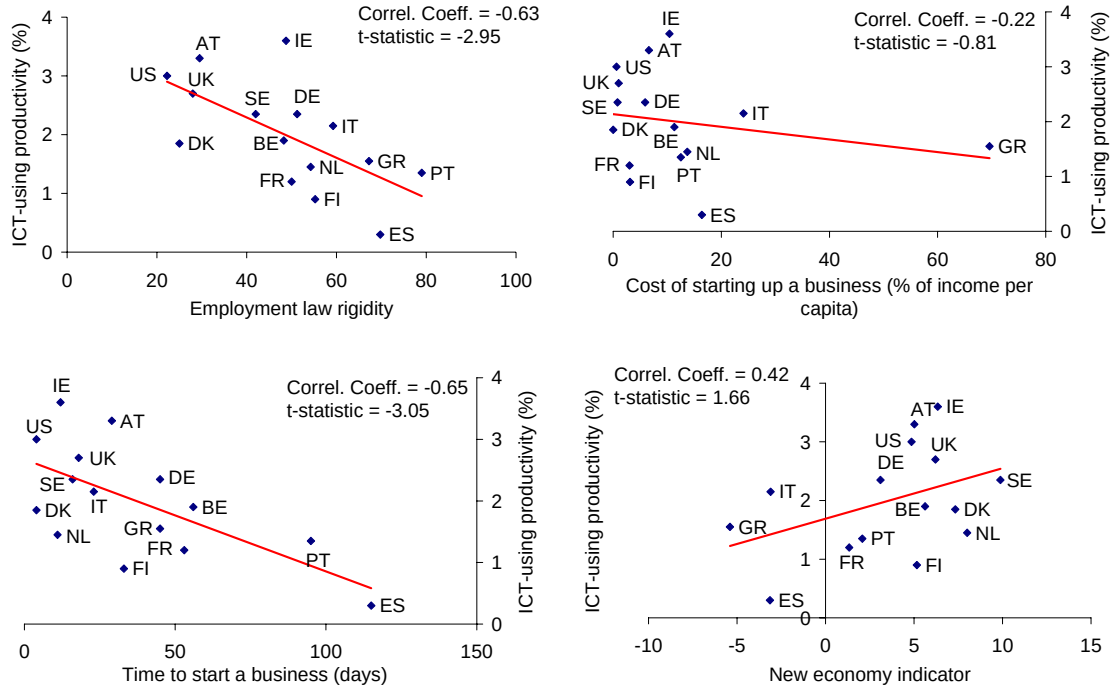
We have looked at more recent indicators of labour and product market flexibility and plotted these against the trend in labour productivity for ICT intensive using services during the period 1995-2001 (Appendix B provides details of the data sources behind these figures and includes the names corresponding to the country codes in the charts). The results are presented in Figure 2.16.

We find that employment law rigidity and time to start a business are both strongly negatively correlated with productivity growth in ICT using sectors. The cost of starting a business, and the 'new economy' indicator (where a larger index value corresponds to greater labour and product market flexibility and macroeconomic stability) show weaker relationships of the expected sign.

[57] Gust and Marquez. 2004. "International comparisons of labour productivity growth: the role of information technology and regulatory practices." Labour Economics, Volume 11. Page 53.

[58] OECD 2003 "ICT and economic growth – evidence from OECD countries, industries and firms".

Figure 2.16: Relationship between productivity growth in ICT intensive using services and various measures of product and labour market rigidity



Source: Indepen charts based on IMF 2004 data on labour productivity growth, the World Bank ("Doing Business" 2004) for the cost of starting a business, employment law rigidity and time to start a business and Groningen Growth and Development Centre for the "new economy indicator".

Note that a high value for the new economy indicator corresponds to greater labour and product market flexibility (and macroeconomic stability)

2.11 Outlook for the EU, US and Japan

There are good reasons for thinking that a strong productivity and growth impact attributable to ICT will be ongoing – deepening in sectors where it is already large, and spreading to sectors and countries where the impact has so far been modest. We list a number of reasons for this conclusion below:

- Even if underlying technical progress in terms of ICT stopped, the full impact of its use would take decades to be realised. Experimentation, learning and complementary investment in terms of organisation change are required to fully exploit the technology, and existing technologies such as broadband are at a relative early stage in their deployment.
- ICT producing and ICT intensive using sectors of the economy currently constitute 20% and 30% of GDP in the EU-15 and US respectively. Given declining prices for ICT and diffusion of learning in terms of how to use ICT it seems reasonable to expect that productivity impact of ICT will spread beyond the current ICT intensive using sectors. ICT has the potential to have a far reaching impact on government which accounts for 20% of GDP (excluding transfers), though this transformation may take a long time given weak incentives and barriers to "creative destruction" in the government sector.

- ICT has far greater potential for underlying technical progress than previous general purpose technologies such as electricity and steam. Moore's Law, which predicts a doubling in the number of transistors per chip every few years, has persisted since it was formulated in 1965 (allowing capabilities, size and power consumption to improve exponentially). Moore's Law is expected to continue to apply in the medium term – but not forever.
- Readily foreseeable innovations that depend on Moore's Law will continue to drive the emergence of new services and productivity gains throughout the economy. To give one example, Radio Frequency Identification (RFID) tag prices are expected to fall to levels required for application at the retail sales point within a decade.[59]
- Moore's Law is also driving the development of supercomputers that can usefully simulate real phenomena such as protein folding, global climate, and engineering systems at a cost and on time scales that will expand the frontiers of human knowledge and technology. Supercomputers will also ultimately allow the use of completely different approaches to design, including evolutionary methods based on random variation and selection.
- ICT involves the more effective creation, dissemination and use of knowledge (including software) which can in principle continue indefinitely. Innovations such as Google have turned the internet into a much more powerful source of knowledge.[60]
- ICT services are currently complex, and there is enormous scope for simplification which would promote diffusion and use. Web services - standardised software that wraps itself around existing computer systems – could describe the components inside such systems and post the description so that other computers use the software inside the wrapper. These services are currently in their infancy, but are expected to grow rapidly.[61]
- ICT will allow real time machine-machine interactions, which will facilitate much more effective use of information and more effective "control" within systems, firms and the wider economy. This has been achieved at the machine level, for example the "fly-by-wire" Boeing 777 has roughly 1000 computers and 150,000 sub-systems organised via protocols and networks.[62] Real time "control" will increasingly extend beyond the boundaries of a single machine or firm.
- The extension of the internet down to the level of everyday devices to allow the components of systems to be dynamically assembled based on need, rather than fixed by the boundaries of each device, has still to occur.[63]

There are few medium term forecasts of GDP or overall productivity growth which focus specifically on the productivity acceleration due to ICT, and anticipated future relative performance across countries. One exception is the forecasts of GDP produced by the Economist Intelligence Unit for the period 2004-2008. The Unit's report concluded that:[64]

[59] Steven Ashley. August 2004. "Innovations: penny-wise smart labels." *Scientific American*.

[60] The Economist. 16 September 2004. "How Google works". In Technology Quarterly.

[61] Andreas Kluth. 30 October 2004. "Make it simple: a survey of information technology." The Economist.

[62] Marie E. Csete and John C. Doyle. March 2002. "Reverse Engineering of Biological Complexity." *Science*, Volume 295. Pages 1665.

[63] Gershenfeld, Krikorian and Cohen. October 2004. "The internet of things." *Scientific American*.

[64] Economist Intelligence Unit. April 2004. "Reaping the benefits of ICT - Europe's productivity challenge."

"Most observers, subscribing to the time-lag theory, believe the benefits of ICT will eventually materialise in a wider range of European countries. Nevertheless, the majority of European countries seem unlikely to match the US performance in ICT-led productivity growth in the near future. The Economist Intelligence Unit's forecasts suggest that, on current trend, most European countries show no sign of closing the gap in growth with the US."

The OECD Economic Outlook 2004 provides medium term projections for GDP, labour productivity and employment growth,[65] whilst Jorgenson 2004 considered the growth potential of the US and Japan based on productivity and employment growth assumptions.[66] We consider this information alongside the IMF productivity growth estimates reported in Table 2.1 as a basis for our outlook for the impact of ICT on economic performance in the EU-15, US and Japan through to 2010. Table 2.3 summarises available projections.

Table 2.3: Medium term labour productivity and employment growth – forecast and historical trend data (% pa)

	EU-15	US	Japan
OECD 2004 (for 2006-2009)			
- Potential labour productivity growth	1.5	2.5	1.5
- Potential employment growth	0.4	0.8	-0.2
Jorgenson (for 2002-2012)			
- Potential labour productivity growth	NA	1.64	2.86
- Potential employment growth	NA	1.0	-0.5
IMF (for 1996-2001)			
- Labour productivity growth (total economy)	1.7	2.3	2.9

Our forecasts are based on a number of transparent assumptions, and are forecasts of average underlying trend rates rather than an attempt to forecast actual levels of economic activity allowing for short term departures from trend. We forecast GDP growth rates for the period 2005-2010 based on the following assumptions in relation to labour input growth, labour productivity growth, the share of ICT in the economy and ICT investment.

Labour input. We assume that growth in labour inputs follows the OECD potential employment growth estimates i.e. +0.4% pa, 0.8% pa and -0.2% pa for the EU-15, the US and Japan respectively. In the EU-15 the aging population will eventually decrease labour input, assuming retirement ages remain fixed. However, by 2010 the old-age dependency ratio will only increase from 26% to 27% for the EU-15.[67] We note that US GDP growth during the period 1995-2000 of 4% pa was driven, in part, by unsustainable levels of labour input growth since hours worked grew at a rate of 2% pa – double the rate of labour force growth (Jorgenson 2004).

[65] OECD. June 2004. "OECD Economic Outlook." No 75.

[66] Dale W. Jorgenson and Kazuyuki Motohashi. March 2004. "Potential growth of the Japanese and U.S. Economies in the information age."

[67] High Level Group. November 2004. "Facing the challenge." Page 51. http://europa.eu.int/comm/lisbon_strategy/pdf/2004-1866-EN-complet.pdf

Labour productivity growth. Since labour productivity is the underlying driver of income growth per capita, and because the policy choices discussed in Chapter 4 are aimed at influencing productivity growth, the labour productivity growth assumption is the key factor of interest in these forecasts. However, there are significant differences between OECD projections, those by Jorgenson, and the IMF historical estimates of labour productivity growth. We use as our starting point the IMF estimates of the 1996-2001 trends for the total economy, ICT producing and ICT using sectors will correspond to that during the period 1995-2001 estimated by the IMF and reported in Table 2.3 above (sub-economy level forecasts are not available from the OECD).

Our view, developed earlier in this Chapter, is that a significant part of the difference between EU and US productivity performance is due to structural factors in Europe which reduce the productivity payoff from ICT use, and therefore lead to lower investment in ICT. As discussed in Chapter 4, this situation is unlikely to change in the absence of policy reform.

We do however consider four alternative sets of assumptions for the EU and US. First, under "trend" assumptions we assume the EU and US continue their respective 1996-2001 labour productivity trends. The other two assumptions include a European partial "catch-up" assumption (in the productivity growth rate but not in productivity levels), and a US "acceleration" under which ICT use spreads and intensifies.

Under EU catch-up we assume that some, but far from all, of the difference in EU-US productivity growth potential is due to lagged effects – particularly in the wholesale and retail trade sectors. To allow for this possibility we consider a scenario where EU-15 productivity growth exhibits 30% catch-up with US productivity growth progressively over the period 2005-2010. While the assumption of 30% catch-up is based on a judgement, it is supported by the fact that Europe has benefited less than the US from the use of ICT in the wholesale and retail trade, and some catch-up should be achievable in the absence of policy change. However, a range of factors such as planning restrictions, restrictions on shop trading hours, labour market rigidities and more limited integration of the European market vis-à-vis the US (which limits the scope to exploit economies of scale) all imply that any catch-up will be limited without policy change.

Under US acceleration we assume that the US widens its lead in the use of ICT as best practice spreads, in particular in the wholesale and retail trade sectors which have contributed substantially to productivity growth in the recent past, but for which only around a third of the sector has currently adopted best practice in relation to the use of ICT. In this case we assume that the contribution of ICT to productivity growth in the US increases by a third of the contribution during 1996-2001 of 1.85% pa (an additional 0.6 percentage points per annum) progressively over the period 2005-2010. We also assume that productivity growth in the ICT using sectors also increases by one-third (it would have to increase by slightly more than this if productivity elsewhere remained unchanged, but this assumption is a first approximation).

ICT producing and using shares of output. We assume these remain constant at current levels, implying declining employment given above average productivity growth. While demand for ICT is growing prices are falling, and on balance we expect the sector to grow little if at all in nominal terms as a share of GDP.

ICT investment. We assume that ICT investment remains constant at current levels as a proportion of private investment under the trend assumptions, and shifts proportionately with changes in productivity growth under the EU catch-up and US acceleration scenarios.

Details of the projections are set out in detail in Appendix A. Our starting point in 2005 is based on the OECD Economic Outlook published in June 2004. The results are summarised in Table 2.4.

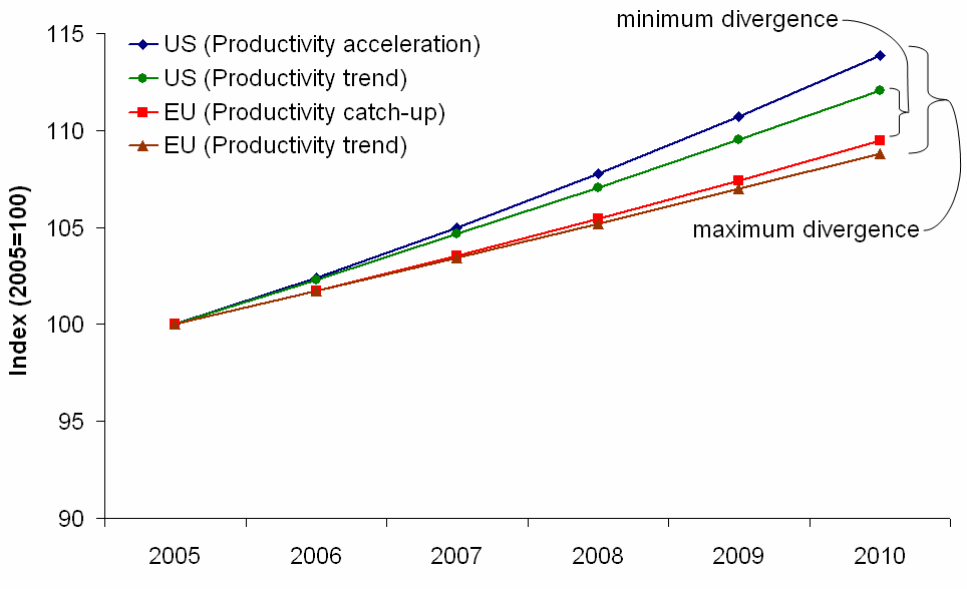
Table 2.4: Summary of forecasts for 2005-2010 (%)

	EU-15		US		Japan
Forecasts	Trend	Catch-up	Trend	Acceleration	Trend
Real GDP growth pa	2.1	2.1 - 2.3	3.1	3.2-3.7	2.7
Assumptions					
Labour input growth pa	0.4	0.4	0.8	0.8	-0.2
Labour productivity growth pa	1.7	1.7 - 1.9	2.3	2.4-2.9	2.9
ICT production – share of GDP	5.8	5.8	6.4	6.4	5.8
ICT using services – share of GDP	21.5	21.5	25.6	25.6	19.0
ICT investment – share of GDP	2.7-3.2	2.7-3.2	4.1	4.1	3.5
ICT production – productivity growth	6.7-6.8	6.7-6.8	8	8	5
ICT use – productivity growth	1.7	1.7-1.9	4.8	4.8-6	2.9

Source: Indepen analysis

Under all the four scenarios productivity, and real GDP, in the EU versus the US and Japan continue to diverge rather than converge i.e. the EU growth rates are lower. Figure 2.16 illustrates the growing divergence in labour productivity growth under the two alternative scenarios for the EU versus the US over the forecast period (starting from a common index value of 100). Overall, while our outlook allows for the possibility of partial closure of the productivity growth gap with the US, there is continuing divergence of productivity and GDP levels over the period 2005-2010.

Figure 2.16: Labour productivity growth for the US and EU under the four scenarios



Source: Indepen forecasts

2.12 Conclusion

After years of catching up to the US level of labour productivity, since 1995 Europe has been falling behind. Differences in labour productivity growth in ICT use account for a large part of the reversal, with productivity growth in ICT intensive using private services decreasing in the EU-15, and increasing substantially in the US for the period 1996-2001 versus 1990-1995.

ICT production and use accounts for a staggering 80% of the labour productivity growth in the US during the period 1996-2000. Evidence suggests that the contribution of ICT already exceeds that of these earlier "general purpose technologies" such as steam/rail and electricity, and there are strong grounds for expecting a large ongoing economic contribution from ICT, both from improvements in technology and services and from diffusion of existing technology and services for which existing penetration levels are low in many instances.

A pattern of boom and bust in equity valuations has also characterised previous general purpose technologies, and ICT appear to be no exception. Investment in ICT and a strong contribution to productivity growth from ICT continued post the 2000 dotcom crash in the US. The main beneficiaries of ICT have turned out to be consumers, not producers.

ICT investment in the EU-15 lags that in the US by over a decade and is currently around 18% of private investment versus 29% in the US. This reflects lower returns to ICT investment in Europe, in turn reflecting differences in the business and public policy environment.

The size of the ICT sector itself does not appear to be important in explaining differences in performance. The sector is roughly the same size in the EU and US, at around 6% of GDP. An important part of ICT sector is tradable and, since many of the benefits arise from effective

use of ICT, countries such as Australia have been among the main beneficiaries even though they are not significant producers of ICT.

The size and quality of non-tradable ICT services, in particular communications networks services, may however be crucial to reaping the potential future benefits of ICT. In Chapter 3 we examine the transformations that may characterise the communications sector by 2010, thereby enabling productivity gains from ICT.

We conclude that labour and product market rigidities, barriers to the entry of new firms, and barriers to competition (and European integration) in ICT using sectors can be expected to reduce the payoff from ICT, thereby lowering investment and the productivity dividend. The primary reason for this is that benefiting from ICT necessarily involves "creative destruction" whereby new firms, skills, and organisational approaches must replace the old in order to benefit fully from ICT. In Chapter 4, we examine these policy questions in greater detail and focus in particular on regulatory policy in relation to communications networks and content.

3 Market development 2005-2010

3.1 Introduction

Before we can develop policy recommendations on how to deal with the problems identified inn Section 2, it is important to consider how EU ICT markets will develop over the next five years. Any policy measures adopted now will take several years before they are fully effective. So we need to formulate them with future market and industry developments in mind.

We set out in this chapter a carefully considered, central, and coherent scenario for the development of the EU's ICT markets through to 2010. The scenario is based on market estimates and projections developed by Ovum, through its Euroview service and more than a dozen major research programmes, together with estimates and projections developed by the EITO.[68] These sources provide actual historic data to 2003. Our estimates for 2004 are one year projections from this base year.

This scenario:

- assumes no change in EU policy towards ICT. The idea is to provide a picture of what is likely to happen in the absence of policy change. It quite deliberately says nothing about policy implications. This is left until Chapter 4
- focuses on the 15 states which were members of the EU prior to May 2004. The markets of the 10 accession countries are in a much less developed state than those of the EU15 and their inclusion would provide a misleading scenario.
- presents revenues at outturn prices unless otherwise stated
- is only one of many possible ways in which the EU ICT markets might evolve.

The scenario is in six main sections:

- Section 3.2 briefly lists the main technology drivers of change in the ICT markets
- Sections 3.3, 3.4 and 3.5 provide central scenarios for the development of mobile services, fixed network services and software/IT markets respectively
- Section 3.6 considers how quickly telecommunications operators might shift from network to content based services
- Section 3.7 brings together the previous sections to provide overall forecasts for the ICT markets of the EU-15
- Section 3.8 compares market developments in the EU with equivalent developments in the markets of trading rivals
- finally Section 3.9 looks at how the industry which supplies EU ICT markets might change over the next five years.

[68] European Information Technology Observatory 2004.

3.2 The main drivers for change

The ICT markets of the EU have changed rapidly over the last five years. We predict that they will change as much or more over the next five years. These changes are driven by a number of ongoing technological developments.

First, and most importantly, the price performance of processors keeps improving dramatically year on year as a result of Moore's Law. Over the past five years this has:

- led to much more powerful PCs, much better graphical user interfaces, a much faster internet and broadband over copper becoming a commercial reality
- made it practicable to digitise virtually all content
- lead to the development of a wide range of consumer devices such as I-Pod, PDAs, camera phones and home wireless networks which make it increasingly possible for end users to enjoy content "anywhere, anytime"
- given us powerful portable devices, such as mobile terminals and notebook PCs, to view and process that content via wireless networks using WiFi, UMTS and Bluetooth interfaces.

Secondly, we have seen much greater interoperability between devices and networks. At the network level the internet is a seamless interconnection of thousands of IP networks. Indeed the internet protocol is now close to being the common transmission protocol for all digital information. It is already the protocol of the internet. It is rapidly taking over all corporate networking – whether wide or local area, data or voice. By 2010, we expect IP will become the dominant protocol for the carriage of all telecommunications services. At the applications level Microsoft's dominance of productivity software has undoubtedly had a profound impact on the ability of users across the world to work together on many applications.

Thirdly, the use of fibre optics and laser technology has had a major impact on both the speed at which digital data can be transmitted (eg transmission based on wave division multiplexing) and the cost of storage, for example CDs and DVDs. For example, technologies such as DWDM have massively increased the capacity of long distance cables and, providing bandwidth requirements are big enough, massively reduced the unit cost of international bandwidth. As a result, the cost of a Gigabit per second of bandwidth on a high capacity route fell from around $600 in 1988 to around $8 in 2002.

Finally, we have, from time to time, seen the development of new algorithms which have had major impacts on ICT markets. For example, the Google search algorithm improved dramatically the value of the world wide web for most users. This has boosted end user demand for PCs and broadband access to use the internet.

3.3 Developments in the mobile services market

3.3.1 Introduction

Figure 3.1 presents our scenario for the development of the mobile services market over the next five years in the EU15 group of countries. Revenues are expressed in outturn rather than constant prices (constant prices can be obtained by adjusting for the level of price

inflation which is running at around 2% pa in the EU).. The "Notes" column of Figure 3.1 (and subsequent figures) is referred to in the text to highlight features of the table.

Figure 3.1 Mobile services market development – EU15

Item	*2004*	*2007*	*2010*	*Note*
Subscriptions in EU15 (m)	327	363	390	1
Penetration of population	87%	96%	103%	2
% of mobile subscribers using				
2G only	73%	32%	14%	5
2.5G or 3G (1)	27%	68%	86%	
3G (2)	<1%	30%	78%	
Capex by mobile operators (€bn)	20	21	22	4
Mobile terminals shipped (m)	136	146	150	6
% basic voice only	44%	2%	0%	
Voice minutes in total (bn)	1850	1950	2000	7
% originated by mobile networks	26%	36%	48%	
% of revenues from non voice	16%	23%	28%	8
ARPU (€ pa)	363	385	410	9
Mobile revenues (€bn)	119	140	160	
GDP (€bn)	9582	10589	11570	
Mobile revs as % of GDP	1.2%	1.3%	1.4%	10

(1) 2.5G = GPRS, EDGE and basic CDMA2000

(2) 3G = W-CDMA and CDMA 2000 EV-DO or EV-DV

Source: mobile@ovum, Euroview, and other Ovum advisory services; revenues at outurn prices; GDP from Euromonitor

3.3.2 Subscriber demand

We will see a continued steady growth, at around 3% per annum, in the number of subscribers (Note 1). As a result, mobile penetration levels will reach over 100% by 2010 (Note 2). This reflects the fact that a growing number of mobile users will take out more than one subscription.

3.3.3 Changing technologies

Mobile operators will roll out their 3G networks gradually, keeping investment to the minimum required to satisfy licence conditions in the early part of the study period, whilst using GPRS and EDGE technologies to explore and identify profitable data services. They will roll out 3G networks within the existing levels of capital expenditure (Note 4). But this roll out will be complete in most member states by 2010. As a result the proportion of subscribers using W-CDMA services will grow from less than 1% in 2004 to 78% by 2010 (Note 5). We assume in our scenario that the EU will continue to use a single 3G technology in an effort to replicate the success of GSM, while maximising competition between mobile operators.

Mobile operators will also take a cautious approach to subsidising 3G terminals. They will focus early marketing efforts on the business market and the top end of the residential

market, with the emphasis on high-speed data applications. This is reflected in mobile terminal shipments, which will remain relatively stable whilst the proportion of basic voice terminals shrinks from 44% in 2004 to virtually zero by 2010 (Note 6).

3.3.4 Traffic and revenue growth

We will see increasing substitution of mobile voice calls for fixed voice calls. Today around 25% of voice calls are originated on mobile terminals (in the UK this proportion is growing by 3 percentage points each year and in the US nearly 40% of voice calls are now originated or terminated by mobile terminals). This proportion will rise to nearly 50% by 2010 as the mobile price premium declines because of competitive pressures and the rollout of 3G networks (Note 7). As the percentage of voice calls carried by mobile networks grows we will see substantial bundling of fixed and mobile services, both by mobile operators (e.g. in partnership with VoIP based ISPs) and by fixed operators buying services as MVNOs. Such bundling is already very successful in the US.

We will see more limited substitution of fixed lines by mobile subscribers. Today around 10% of households are mobile only. We predict that this figure will rise little over the next two to three years. The remaining households will keep fixed line services, partly because voice calls are cheaper and of higher quality, but mainly in order to gain access to the internet. But we could start to see stronger access substitution by 2010 as 3G services become universal and as prices for 3G data services start to fall significantly.

We will also see a significant growth in data revenues as end users buy multi-media terminals and use 2.5G and 3G services. Most data traffic will consist of messaging (SMS, MMS), music downloads and video clips. Other applications, such as location based services, will generate significant revenues per bit carried but relatively few bits. Overall we expect ARPU to grow from €340 per annum now to €410 per annum in 2010 (Note 9), while the proportion of this ARPU generated by non-voice applications will grow from 16% to 28% (Note 8). There are three main effects here:

- fixed mobile substitution leads to growing voice revenues per user
- competition leads to lower mobile voice prices and drives down voice revenue per user
- the development of new 3G applications means more data revenues.

Mobile revenue as a proportion of GDP will continue to grow - from 1.3% to 1.5% by 2010 (Note 10).

3.3.5 Other developments

There are four other potential major developments in the mobile services market which we can anticipate but where there is considerable uncertainty and where outcomes may depend on a regulatory policy. We have not attempted to quantify these developments and there could be other developments which will be totally unexpected.

Fixed-mobile integration: In theory, fixed-mobile integration, in which an intelligent device acts as a fixed services terminal in the home, the office or at a WiFi hotspot, and as a mobile terminal in other circumstances, is an attractive proposition. But the success of fixed-mobile integration services is by no means guaranteed:

- technical problems have prevented fixed mobile integration developments working satisfactorily in the past
- fixed incumbents are worried that NRAs will intervene if they are the first to launch such services and so they are waiting for others to make the first move.

The signs are now more positive however. Several mobile operators are considering whether or not to offer bundles of fixed and mobile service in partnership with ISPs using voice over IP on broadband connections. This could prompt the fixed incumbents to action. At the same time wireless technology has moved on considerably and many of the technical problems which affected early fixed mobile integration developments are now resolved.

Overall fixed mobile integration services could have a major impact on the dynamics of the mobile services market over the next five years and significantly increase competition within it. But it is too early to predict what will happen with any confidence, let alone quantify these effects.

The impact of WiFi: WiFi (IEEE 802.11x) has been available since 2001. It is now embedded in virtually all new notebook PCs. By 2003 there were over 70,000 public hotspots world-wide in airports, hotels and coffee bars where users can access public wireless LANs. By 2010 we expect all mobile terminals to include WiFi data cards and access via WiFi to be bundled into regular mobile services. So:

- WiFi represents an opportunity for mobile operators to supplement revenues from their main stream services, offering customers the opportunity to use public Wi Fi services without taking out a separate subscription
- WiFi also represents an opportunity for fixed network operators to compete with the mobile operators for end user spend, providing they can find suitable charging mechanisms.

The impact of WiMax: WiMax (IEEE 802.16x) is a new technology for wireless metropolitan area networks. Strongly backed by Intel, WiMax should be deployed from 2005 on in notebook PCs and networks. Potentially it offers:

- a highly cost effective way for fixed AltNets to serve corporate customers and for mobile operators to provision base station to base station controller links within their networks
- a cost effective replacement for WiFi hot spots or for backhaul from WiFi hot spots to a core IP network
- a way to provide mass broadband in areas where copper loops are too long to deliver adequate bandwidth using DSL
- a technology with which fixed network operators can provide limited city wide mobility to customers.

It is too early to say which, if any, of these possible applications will have major market impacts.

MVNOs: We will see growing numbers of MVNOs over the next five years. In some cases the operators will negotiate deals with MVNOs:

- to enable them to reach segments of the mass-market e.g. T-Mobile and Virgin in the UK
- to provide innovative value added services, especially for 3G networks, or
- to implement services in the corporate market e.g. systems integrators with 3rd or 4th mobile operators.

In other cases, we might see NRAs mandate MVNO access. In Denmark this has led to an industry in which 25% of mobile service revenues are billed by MVNOs. However, the scope for such mandated access is now limited by the procedures of the new EU regulatory framework and it is not clear which member states will mandate such access. Overall we expect 5% to 10% of mobile service revenues to be billed by MVNOs by 2010.

3.4 Developments in fixed services markets

3.4.1 Introduction

Figure 3.2 presents a quantified summary of our scenario for general trends in the fixed services markets. We look in more detail at consumer and business markets later in this section.

Figure 3.2 Fixed services markets – general trends – EU15

	2004	*2007*	*2010*	*Note*
Sources of revenue (€bn)				
voice - calls and narrowband access	86	75	65	1
Internet access and service	23	35	49	2
enterprise services (1)	38	42	46	3
total	147	152	160	
GDP (€bn)	9582	10589	11570	
Fixed services revs as % of GDP	1.5%	1.4%	1.4%	4
Voice minutes in total (bn)	1850	1950	2000	5
% originated on fixed networks	74%	64%	52%	
Capex by fixed telcos (€bn)	18	18	18	6
% lines served by media gateways of NGNs	<0.1%	13%	33%	7

(1) Corporate network services of all kinds but excluding access to and use of the PSTN

Source: Ovum Euroview, ITU, financial analysts reports; revenues at outturn prices

3.4.2 Revenues

The source of revenues for fixed network operators will change rapidly over the five years of the study period:

- revenues from basic voice call plus narrowband access will fall sharply. At the moment revenues are falling at around 2% to 3% per annum. We expect this to accelerate to 4% per annum under the combined effect of fixed mobile substitution (Note 5) and competitive pressure from VoIP services (Note 1)

- revenues from broadband and internet access together with internet subscriptions will grow strongly so as to largely offset this decline (Note 2)
- revenues from enterprise services will grow steadily in line with GDP growth (Note 3).

As a result fixed network service providers will see revenues grow relatively slowly. So the proportion of GDP spent on fixed services (revenues excludes any revenues which fixed operators might generate from related markets such as IT services or content) will decline (Note 4).

3.4.3 Use of IP network services

We will see a shift from circuit switched to IP based services. This trend, already strong in corporate networking, will extend to mainstream fixed services over the next five years.

Five years ago many AltNets had plans to build next generation IP networks. Few of these plans were implemented following the collapse of invested confidence in the sector in 2000. Now AltNets face financial difficulties and the opportunity to invest in next generation networks is more likely to be taken up by the fixed incumbents. There are two main drivers:

- next generation IP networks offer potential for a wide variety of new revenue streams. In many countries, for example, fixed incumbents might justify investment as a way of gaining access to some of the €30 to €40 per month which consumers are willing to pay for appropriate multi-channel TV services.
- competitive pressure to reduce costs. In an industry where the price performance of equipment improves at 10% per annum operators with circuit switched networks that are 10 or more years old have a strong incentive to invest in new networks. Moving to a single multi-functional network based on the latest technology offers operating costs savings in terms of maintenance and provisioning.

Depending on the regulatory environment, we will see a gradual roll out of next generation IP networks over the study period. Pioneering incumbents may come close to completing their roll out by 2010; others will not reach completion before 2015. Overall, we predict that 33% of fixed network connections will be served by the media gateways which replace local switches in a next generation network (Note 7). This roll out does not imply a significant increase in capex above current levels (Note 6).

3.4.4 Consumer market for fixed services

We predict significant changes in the way consumers access fixed network services over the next five years. These are quantified in Figure 3.3.

Figure 3.3 Changes in consumer markets for fixed network services – EU15

	2004	*2007*	*2010*	*Note*
Access to fixed network (m connections)				
copper pair	142	131	118	1
fibre in loop	4	10	18	1
fibre to building	1	2	4	1
wireless	0.5	1.2	3	2
coax	14	11	9	3
hybrid fibre coax	50	68	85	3
total	212	223	237	
Broadband penetration per household	14%	32%	50%	4
% over 2Mbit/s	0%	na	10-30%	5
Home networks (m)	5	23	57	6
Home network penetration per household	3%	12%	30%	
Broadband supplier				
incumbent retail	56%	na	43%	
DSL reseller	17%	na	21%	
LLUer	5%	na	16%	7
CATV operator	20%	na	15%	
other	2%	na	5%	
	100%		100%	

Source: broadband@ovum; revenues at outurn prices

We expect:

- the number of copper loops in the incumbents' access networks which serve consumers to shrink from 142 million to 118 million by 2010, as a greater proportion of homes are in apartment blocks that are served by fibre and as incumbents run fibre out to the cabinet to enable VDSL connections. We do not however predict wholesale migration to VDSL. For many loops a combination of ADSL2+, together with use of MPEG4 compression technology, will be sufficient to enable incumbents to offer IP TV without the need to move to the more expensive and risky VDSL (Note 1)
- we may see significant use of wireless technologies such as WiMax by 2010 (Note 2)
- CATV operators will make growing use of hybrid fibre-coax as they compete with the fixed incumbent to offer triple play bundles of TV, voice telephony and broadband access to consumers (Note 3).

The combined effect of these changes in access technology is that the proportion of households with broadband access will rise sharply - from 14% today to 50% by 2010 (Note 4). At the moment virtually all of these broadband connections offer speeds under 2 Mbit/s. By 2010 we expect somewhere between 10% and 30% of households with broadband to be running at speeds over 2 Mbit/s as operators offer IP TV (Note 5).

We will see fixed operators, and especially incumbents, in many member states using their next generation network to enter the IP TV market in an attempt to boost their ARPU. This will lead to strong competition between CATV operators and fixed incumbents to supply triple play service bundles (i.e. telephony, broadband internet access and video services) to consumers as both parties struggle to win the incremental €30 to €40 per month which customers are prepared to pay for appropriate bundles of pay TV and video on demand services. Such bundles also reduce customer churn.

In competing with the CATV operators the telecom operators will try to exploit the superior upstream (from user to network) speed offered by ADSL. This should help to stimulate peer to peer applications which require high upstream speeds such as music and video swaps, video conferencing and on-line gaming. It should also help stimulate demand for home video surveillance applications.

In countries where there is already strong competition between satellite-based operators and cable TV operators in the pay TV market the telecoms operators may decide to only offer voice telephony and broadband access.

We will also see change in the way mass broadband services are supplied. After a slow start in many member states we will see substantial growth in the proportion of broadband services provisioned over unbundled local loops. ISPs who provide a bundle of voice over IP and fast internet access services will be the main customers for unbundled loops (Note 7).

The speed with which consumers will switch from circuit-switched voice to voice over IP is difficult to quantify. We expect:

- only a modest proportion of traffic to use the PC to PC or PC to phone VoIP services offered by service providers such as Skype;
- most CATV operators and ISPs to use VoIP technology to provide the voice element of the service bundle which they offer to consumers;
- a growing proportion of customers connected to the incumbent's next generation network to use voice over IP from their home[69].

Home (wireless) networks will play an important part in the development of the consumer broadband market (Note 6), allowing multiple PCs to share the same broadband connection and printers. They will also play an important role in the development of IP TV by directing bits from the DSL connection to the TV set in the living room rather than to the PC in the study or bedroom. We expect use of home networks to grow from 3% in 2004 to 30% by 2010.

The picture set out above represents a composite nature for the average EU 15 member state. But we will see considerable variation between individual countries. The biggest variable is the level of competition to the incumbent from CATV operators. As Figure 3.4 shows CATV network penetration varies considerably across the 15 member states.

[69]Many subscribers who are moved onto a media gateway of a next generation network will initially continue use their existing circuit switched telephone.

Figure 3.4 The variation in CATV penetration across the EU15

Member state	*% homes passed by CATV network*	*% growth in last 4 years*	*Subscribers 2001 (m)*
Austria	53%	17%	1.2
Belgium	100%	3%	3.8
Denmark	71%	8%	1.1
Finland	59%	14%	1.0
France	35%	58%	3.4
Germany	83%	21%	21.8
Greece	na	na	na
Ireland	78%	42%	0.6
Italy	1%	na	0.1
Netherlands	94%	7%	6.2
Portugal	60%	190%	1.1
Spain	29%	1200%	0.5
Sweden	65%	9%	2.1
UK	50%	80%	3.6

Source: OECD

3.4.5 The business market for fixed services

The way in which business customers gain access to fixed services will also change dramatically as shown in Figure 3.5.

Whilst fibre access, including fibre in the loop or fibre to the building, will grow from 2% to 9% of residential connections it will grow from 6% to 20% for business customers (Note 1). Fibre will be provided to the largest business sites and so could well in excess of 50% of business traffic. We may also see a substantial increase in the use of fixed wireless broadband access as WiMax starts to roll out. But this is unlikely to represent a substantial proportion of business connections by 2010 (Note 2).

We are already seeing a dramatic change in the way large corporate customers provision the networks which link their many sites together. Traditionally, corporate customers have used leased lines and, more recently, frame relay and ATM to do this but now we see move to the use of IP VPNs. By 2007, IP VPNs will have overtaken these traditional methods of corporate networking in terms of connections (Note 3) while revenues from IP VPNs will dominate those from other corporate networking services (Note 4).

Figure 3.5 Changes in business markets for fixed network services

	2004	*2007*	*2010*	*Note*
Access to fixed network (m connections)				
copper pair	57	56	52	
fibre in loop	2	4	7	1
fibre to building	2	4	7	1
wireless	0.1	0.5	1.1	2
hybrid fibre coax	1.2	2.0	3.2	
total	62.3	66.5	70.3	
Corporate networking connections (m)				
leased line network connections	0.5	0.4	0.3	
frame relay connections	0.4	0.3	0.2	
ATM connections	v small	v small	v small	
connections to an IP VPN	0.2	0.6	1.0	3
total	1.1	1.3	1.5	
Corporate data services revenues (€bn)				
frame relay service	3.3	2.4	1.6	
ATM service	0.5	0.3	0.2	
IP VPNs	1.6	3.6	5.6	4
total	5.4	6.3	7.4	

Source: enterprise@ovum, broadband@ovum; revenues at outurn prices

Currently most IP VPNs are used for data alone. But now there is a fast growing trend to adding voice services. In particular, the IP PBX market moved in 2004 from one in which customers were early adopters to one in which mainstream corporations were using IP voice for the first time. We expect that by 2010:

- 90% of on-net voice traffic and 50% of off-net voice traffic from large businesses will use IP services
- for small and medium enterprises the corresponding proportions will be 40% and 25%.

We will also see many large organisations outsource their corporate networking requirements to service providers as part of a wider IT outsourcing contract. IT service companies like IBM, EDS and CSC are obvious suppliers here, with the telecoms operators acting as their subcontractors. But we will also see the telecommunications operators themselves offering full outsourcing to corporate customers for IT and network services. As part of such deals telcom operators will offer hosted IP telephony in competition with the IP PBX suppliers.

3.5 Developments in the software and IT markets

3.5.1 Introduction

Figure 3.6 presents a quantified summary of our scenario for the development of the software and IT markets of the EU15 group of countries. This sector of the ICT market consists of three main sub sectors:

- computer hardware (PCs, servers, main-frames and peripherals)
- IT services (systems development, systems integration, IT support and outsourced IT services) and

- packaged software (operating systems, productivity software and application software).

Figure 3.6 Trends in the software and IT markets of the EU15

	2004	*2007*	*2010*	*cagr*	*Note*
Revenues (€bn)					
hardware	72	75	77	1.1%	1
software licences and maintenance	37	41	46	3.7%	2
IT services	111	136	167	7.0%	4
total	220	252	290	4.7%	
% of IT services revenue from outsourcing	45%	52%	58%		5
Open Source software (€bn) (1)	0.7	2.8	6.7	46%	3
Open Source as % of software revs	2%	7%	15%		3
e-commerce sales (€bn) (2)	474	2432	4134		6
As a % of GDP	5%	23%	36%		
Spend on security (€bn)	0.8	1.4	2.2		7
As % of software spend	2.2%	3.4%	4.8%		

(1) Both licence fee and support services

(2) Both business to consumer and business to business. From EITO

Source: Ovum Euroview; revenues at outurn prices

3.5.2 Hardware

After several years of falling revenue the computer hardware sector is growing again. We project continued growth through the five years to 2010 (Note 1). Although this growth will be below GDP growth rates, this does not mean that the capacity of the installed base of hardware will not grow. Moore's Law suggest that the performance of this installed base will grow at a rate well in excess of 10% per annum over the period. Apart from the virtual demise of the workstation, replaced by high powered PCs, we do not expect to see any dramatic change in the type of hardware products offered or the suppliers who provide them.

3.5.3 Software

The revenues from licensing and maintenance of software, excluding markets for embedded software, will grow at just under 4% per annum over the study period (Note 2). The industry will remain dominated by four players - Microsoft, IBM, Oracle and Sun. These players are highly profitable, generating operating profits of 30% compared with 10% in the rest of the industry, and together account for 60 to 70% of end user revenues. The high costs to end users in switching software supplier, together with a move by business to adopt suites of software rather than applications specific products, will help consolidate the position of the big four.

We will see a trend, led by government bodies, towards use of Open Source software over the next five years (Note 3). But we do not expect Open Source software to account for more than 15% of software revenues by 2010. Most of this 15% will come from support services and installation charges rather than software licence fees.

3.5.4 IT services

A growing number of companies are outsourcing the provision of their corporate IT, together with telecommunications, to third parties as a package. This trend is stronger in the US and the UK than in the rest of the EU. It is also strongest in the finance of public sectors. We expect it to drive growth in IT service revenues at 7% per annum (Note 4), with outsourcing revenues growing at 11% per annum while revenues from systems integration, systems development and support services grow only in line with GDP. As a result IT outsourcing revenues will grow from 45% to nearly 60% of IT service revenues by 2010 (Note 5). Strongly associated with the growth of IT outsourcing is a move to business process outsourcing (BPO), often to low labour rates countries outside the EU. So we will find IT service companies offering BPO themselves or partnering with organisations which do.

In interpreting Figure 3.6 it is important to note that the rapid growth in the IT services sector largely reflects a decision by large businesses to contract-out IT services rather than to employ in-house staff. This trend will almost certainly lead to more productive delivery of IT services. But this productivity effect is relatively small when compared with the growth in IT service revenues.

3.5.5 Major drivers and barriers to use of IT

We have identified three major drivers and two major barriers to increased use of software and IT over the next six years.

Driver 1: e-enablement of processes. We are now starting to see large scale e-enablement of processes across all types of organisations – both commercial and the public sector – so as to:

- lower the costs of transactions through process automation, minimising data entry and self provisioning by customers
- cut time to market for new product developments
- improve customer service in terms of speed of response and information available
- reduce error rates and hence cut the very substantial costs of rectifying errors.

In response suppliers are developing software, like IBM's WebSphere and Microsoft's new operating system code named Longhorn, which are designed to make it as easy as possible for applications developers to e-enable processes for web based access. The growth in the use of the internet at broadband speeds will help to reinforce this trend, whether for internal processes within an organisation, for business to business processes or for business to consumer transactions.

Reflecting this trend the EITO[70] predicts that the value of good services sold via the e-services (business to consumer and business to business) will grow from 5% of GDP in 2004 to 23% by 2007 (Note 6).

[70] European Information Technology Observatory (EITO) 2004.

Driver 2: increased interoperability. Over the past decade we have seen a strong trend to make interoperability between software from different suppliers easier. We expect this trend to continue given:

- the apparent growing recognition by the four leading software providers that it is in their best interest to co-operate to maximise interoperability between their products and so grow use of IT and hence the overall size of the software market
- the growing number of initiatives which the software industry has started to promote standards and interoperability at e.g. OGSA, OASIS, W3C, WSi
- the way in which governments are using their procurement policies to reward those who support certain standards and make their products interoperable with the products of other suppliers
- the development of web services which provides a way in which end users can, via the internet, get legacy software systems to interoperate

Driver 3: on demand computing. On demand computing could have a fundamental effect on the way which end user organisations pay for and use both software and hardware over the next five years. Developed largely by IBM, on demand computing is designed to:

- allow businesses to expand the processing power available to them and the number of software licences they require only for the time they need it. For many organisations such requirements fluctuate significantly over the year. On demand computing makes a higher proportion of an organisation's costs variable and reduces the risk of financial losses if there are sudden cut backs in demand
- cut down substantially on the network, processing and storage capacity they need in order to provide suppliers, customers and partners with the services they require. With many different organisations sharing the use of computing and network resources, and each having different patterns of demand, it is possible to create substantial economies of scale through on demand computing.

Revenue from on demand computing is not new revenue however. It represents a transfer from existing revenue streams. But it offers a more effective way of using the ICT stock than the current approach in which large organisations self provide to meet their individual requirements. It also provides a model which could encourage more businesses, and especially SMEs, to invest in ICT by aligning the cost of IT more closely with the revenues generated.

Barrier 1: lack of security of IT applications. As more machine critical applications use networked IT services, end users are paying more attention to ensure that these applications are secure. There are two main types of threats:

- those which lead to down time and wasted resources. SPAM now takes up a high proportion of internet capacity; worms lead to poor performance and reductions in available storage; and viruses can lead to complete failure of computing systems
- those which lead to interception of personal or commercially sensitive data and to financial fraud. Over the past few years such concerns have slowed the development of e-commerce and internet banking.

These threats will not go away. We will see a constant battle between the attackers and the defenders of IT applications. Figure 3.7 lists some of the initiatives which suppliers are taking today to reduce security threats.

We can expect new threats and new initiatives to counter them throughout the five-year period. As a result of these dynamics we expect that the proportion of software revenues spent on security to rise from around 2% in 2004 to 5% by 2010.

Figure 3.7 Initiatives to deal with attacks on IT applications

Initiative	Organisations involved
Development of security software that is not susceptible to buffer overflow based attacks	AMD, Intel, Motorola
Attempts to authenticate email senders	Microsoft and IETF members
Filter software to remove SPAM And viruses for email users	Various suppliers
More secure operating systems	Microsoft Longhorn development
Improvements in IEEE 802.11I standard to remove WLAN vulnerabilities	Various suppliers
Authentication of users with focus on biometric technologies	US Government and selected US suppliers
Development of simplified sign on and mobile authentication software	Liberty Alliance

Barrier 2: increased regulation. Regulatory authorities have recently developed regulation designed to protect end user privacy, to prevent financial fraud (following the Enron and WorldCom scandals) and to prevent money laundering. In some cases, the regulators have attempted to make the directors of companies personally liable for breaches of these rules. Compliance has therefore become a boardroom issue.

Perhaps more serious for the development of IT applications are new financial regulations designed to control the use of e-money. Financial service regulators in several member states have proposed interpretations of the e-money Directive which, if implemented, could severely damage certain forms of e-commerce.

3.6 The move from infrastructure to content based services

As traditional telecommunications markets mature and revenue growth rates slow to GDP levels we will see both fixed and mobile operators pay more attention to generating revenues from content and value added services. Entertainment services are a particular target where there is already a substantial market. We estimate that TV subscriptions and advertising alone generated around €55 billion in revenues in 2002.[71] The telcos are new entrants who could generate substantial new revenues as well as taking market share from the incumbent satellite, cable TV and terrestrial broadcasters.

[71] TV International Source Book 2003.

Figure 3.8 presents projections of the possible scale of the new revenue streams which the telcos might generate. These projections are highly speculative. All of the applications for which we forecast revenues are new and all depend upon the operators meeting consumer needs for content – not a market in which most telecommunications operators have a track-record of success. There are also problems with access to premium content which need to be overcome for these forecasts to be achieved. Telecommunications operators are new entrants into the digital content markets and the incumbents, such as cable and satellite pay TV operators, often have exclusive deals on major sports events and the most popular films.

Figure 3.8 Projections of content based revenues for telcos in the EU15

Value added fixed networks revenues (€bn)	***2004***	***2007***	***2010***
Broadband tools (1)	0.5	2.2	4.6
Broadband entertainment (2)	0.5	3.7	9.0
Total	1.0	5.9	13.6
Total fixed network services (3)	148	158	174
Value added as a % of total	0.7%	3.7%	7.8%
Value added mobile networks revenues (€bn)	***2004***	***2007***	***2010***
m commerce (4)	0	0.5	1.2
Entertainment (5)	2	7	12
Premium content (6)	1	5	8
Total	3	12.5	21.2
Total mobile services	119	140	160
Value added as a % of total	2.5%	8.9%	13.3%

(1) eg anti SPAM and network firewalls
(2) Online premium content, gaming and IP TV
(3) Valued added plus revenues from overall ICT forecasts
(4) Includes m shopping, m ticketing and unattended PoS purchases

Source: broadband@ovum and mobile@ovum; revenues at outurn prices

For fixed operators the development of broadband creates substantial opportunities to sell a wide range of new services to consumers. These include:

- multi channel pay TV services
- video on demand services
- peer to peer broadband services such as on-line gaming, video and music swaps, and video conferencing.

There are also opportunities to sell consumers access software such as SPAM filters and firewalls.

For the mobile operators the relatively high price of bandwidth and characteristics of the terminal devices constrain the content which they can sell to end users. But the fact that this content can be delivered "anywhere, any time" and can be linked to the user's location enhances its value considerably. There are three main revenue streams here:

- m-commerce such as m-ticketing and online purchases

- premium information such as location based information
- premium content such as music and video clips.

The scenario of Figure 3.8 suggests that:

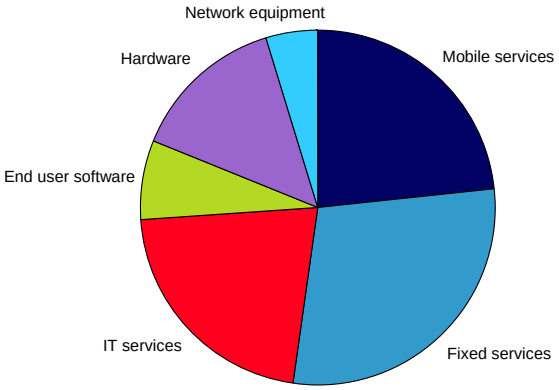
- value added services will grow from virtually nothing in 2004 to represent around 10% of the revenues of telecommunications operators by 2010
- mobile operators generate a higher proportion of their revenues from these value added services than fixed operators and will continue to do so in 2010.

3.7 Forecasts for the ICT markets of the EU

Figure 3.9, 3.10 and 3.11 provide estimates and forecasts for the EU's ICT markets as a whole by combining the findings of the last three sections. We have already commented on many of the features of these forecasts in previous sections. But the following additional points worth noting:

- Figure 3.9 shows that end user spend on telecommunications services accounts for well over 50% of end user spend on ICT
- Figure 3.10 indicates that:
    - mobile service revenues will exceed fixed service revenues by 2007
    - software and IT spend will grow more quickly than telecommunications spend for the first time in more than a decade
- Figure 3.11 shows that, at constant prices, market growth rates will largely reflect GDP growth rates:
    - spend on mobile services will grow most strongly, but still at rates well below those observed in the past
    - we will see real growth in end user spend on software and telco spend on mobile networks
    - but at constant prices we will see declines in end user spend on fixed services and hardware and in telco spend on fixed networks.

Figure 3.9 End users spend on ICT in the EU15 – 2004



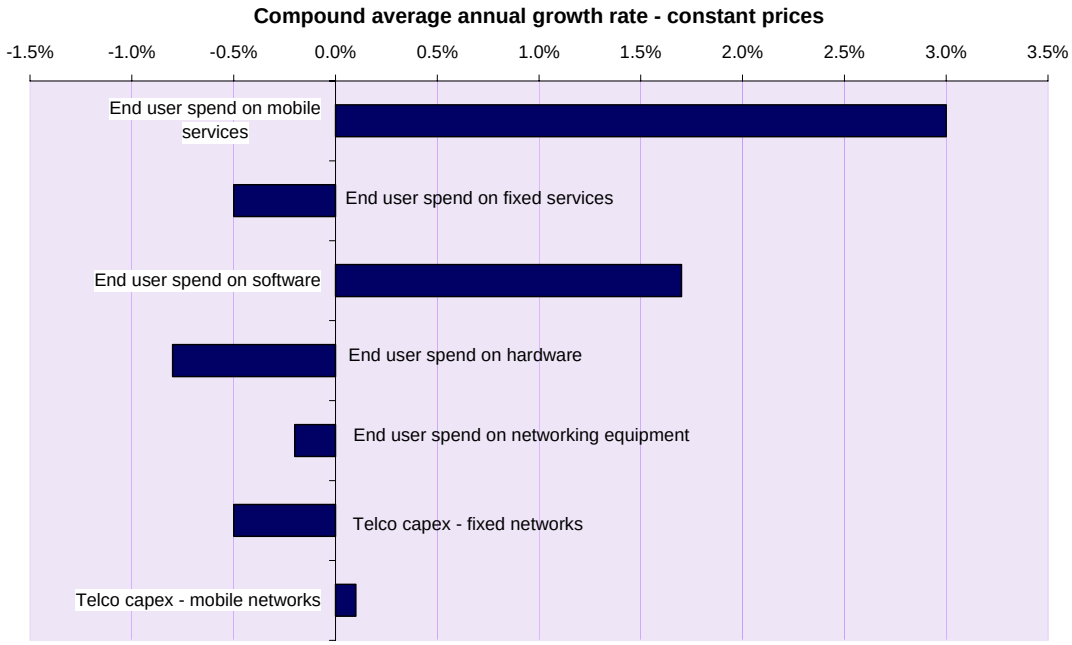
Total EU15 end user spend on ICT in 2004 of €510 bn

Figure 3.10 Overall forecasts for end user ICT spend in the EU

	2004	*2007*	*2010*	*cagr*
Telecoms - end user spend				
Mobile services revenues (€bn)				
voice	100	108	115	2.4%
data, image video	19	32	45	15.4%
total	119	140	160	5.1%
Fixed services revenues (€bn)				
voice	86	75	65	-4.6%
Internet access and service	23	35	49	13.5%
enterprise services	38	42	46	3.2%
total	147	152	160	1.4%
Total telecoms service revenues (€bn)	266	292	320	3.1%
% revenues from mobile	45%	48%	50%	
Software and IT - end user spend				
IT services	111	136	167	7.0%
Software licences and maintenance	37	41	46	3.7%
Hardware	72	75	77	1.1%
Total	220	252	290	4.7%
End user spend on telecoms equipment (€bn)				
Total	24	26	27	2.0%
Total end user spend on ICT	510	570	637	3.8%
End user spend as a % of GDP				
Fixed telecoms	1.53%	1.44%	1.38%	
Telecoms	2.8%	2.8%	2.8%	
Software and IT	2.3%	2.4%	2.5%	
Total ICT	5.3%	5.4%	5.5%	

Source: previous tables; revenues at outturn prices

Figure 3.11 Market growth rates at constant (2004) prices



3.8 The EU vs the US and Asia

We have already identified (In Chapter 2) a substantial gap between the EU and the US in terms of levels of investment in ICT and use of ICT. Based on our forecasts, which assume that current policies and regulation in the EU are maintained, we do not expect that the EU will close this gap over the next five years.

Figure 3.12 presents the key forecasts which are available across the three regions. The table indicates that:

- the EU will grow its investment in ICT less than its trading rivals in the short term
- we expect the EU15 to make greater use of high speed mobile services than the US by 2007 but to continue to lag behind East Asia
- the EU15 will close the gap on its trading rivals in terms of broadband penetration as demand moves towards saturation levels. But it will still lag behind in 2010.

Figure 3.12 The EU vs trading rivals – 2004 to 2010

	2004	*2007*	*2010*	*Source*
High speed mobile data				
Mobile connections - 2.5G and 3G (m) (1) (2)				
EU15	101	258	na	mobile@ovum
US	56	102	na	mobile@ovum
East Asia	60	122	na	mobile@ovum
Mobile penetration - 2.5G and 3G				
EU15	27%	68%	na	
US	19%	35%	na	
East Asia	34%	70%	na	
Growth in ICT investment per year				
EU15	3.5%	na	na	EITO
US	4.3%	na	na	EITO
Japan	5.0%	na	na	EITO
Broadband penetration per 100 population				
EU15	7	16	25	broadband@ovum
US	9	20	26	broadband@ovum
East Asia	17	24	29	broadband@ovum

(1) 2.5G = GPRS, EDGE and basic CDMA2000

(2) 3G = W-CDMA and CDMA 2000 EV-DO or EV-DV

(3) US current estimates of EV/DO variant of CDMA 2000 not known

(4) Japan + S Korea

3.9 Industry transformation

3.9.1 Introduction

The market and technology developments of Sections 3.2 to 3.6 will lead to a change in the EU ICT industry which delivers ICT by 2010. We set out below our most likely scenario for the shape of this industry and the levels of competition which it will generate. Again we stress that this scenario, while the most probable, is only one of a wide range of possible scenarios for industry transformation. For example, in Chapter 4, we note ways in which regulation could block or inhibit these transformations.

3.9.2 Key changes in the ICT industry

Figure 3.13 summarises the key changes in the industry. It indicates that:

- the telecommunications services industry is dominated by EU suppliers and accounts for 55% of the ICT industry in terms of end user spend. This sector will go through a period of substantial change over the next five years – partly as a result of consolidation and partly as a result of the introduction of next generation IP networks which make possible new forms of innovation-based competition.
- the telecommunications equipment supply industry will have a better time in the next five years than in the last five, following the collapse in investor confidence in the telecommunications sector in 2000 and 2001. But market growth will be limited as telecoms operators maintain rather than grow capex. As a result we expect to see

further consolidation between EU and US players to counter the growing threat from East Asian suppliers

- the IT services industry will still be dominated by a mix of US and EU companies in 2010 which will use low income countries to provide their systems development capability. Growth will be driven by end user demand for IT outsourcing which will bring many of the large telcos into the IT services market. We will see at least one Indian company in the top ten or even in the top five IT services players in the EU
- we will see little change in the software or hardware supply industries. The big four software suppliers (Microsoft, IBM, Oracle and Sun) will continue to dominate the software industry, to generate high profits, and to acquire innovative start-up software companies to maintain their position. US suppliers like IBM, HP, Dell and Sun will continue to dominate the supply of hardware, procured and assembled in the Far East

Figure 3.13 ICT industry changes – 2004 to 2010

ICT Segment	Origin of main suppliers	Market size (bn €)		Main changes
		2004	2010	
Telecoms services	Almost all EU	266	320	Major new service providers enter market to use NGNs Fixed and mobile operators compete in same market for voice revenues Fixed incumbents compete with CATV operators in consumer market for triple play revenues
Telecoms equipment	Balanced between EU, US and East Asia	61	68	Limited consolidation in EU to counter expansion of East Asia suppliers
IT services	Mix of EU and US suppliers	111	167	US dominance grows Gradual consolidation Fixed incumbents enter the market Market growth driven by a move to outsourcing of IT services
Software	US dominated	37	46	Little change
Hardware	Business segment dominated by US suppliers Consumer segment a mix of US and East Asia suppliers	72	77	Little change

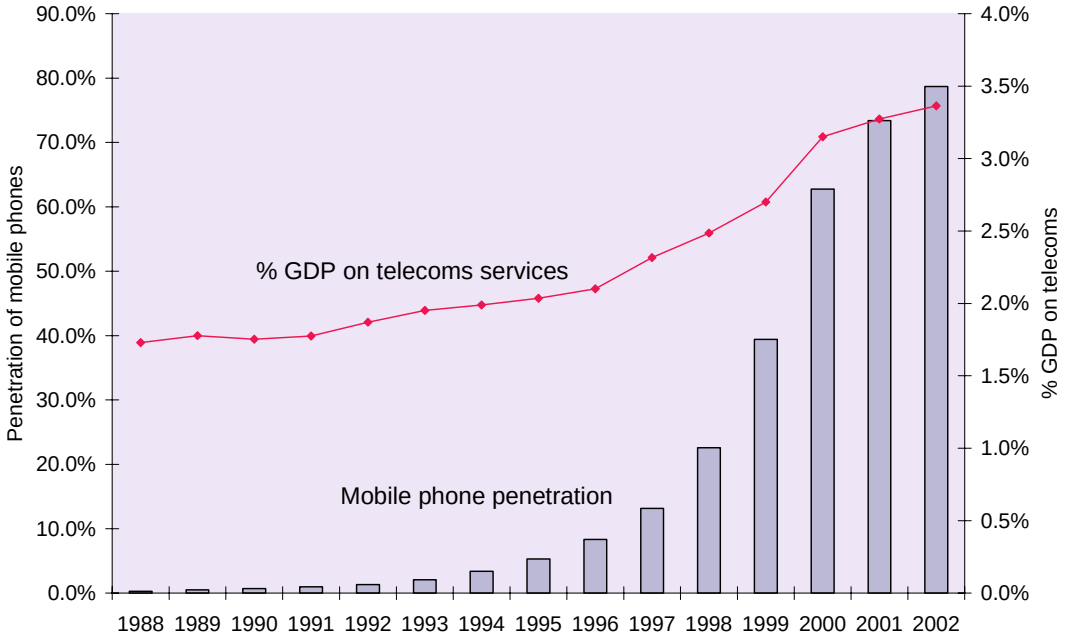
Source: Ovum; revenues at outurn prices

3.9.3 Transformations in the telecommunications industry

For 30 years users in developed countries have spent a roughly constant 1.5% to 2% of GDP on telecommunications. Then in the early 1990s this proportion grew rapidly as demand for

mobile telephony expanded. Figure 3.14 illustrates this using data for France, Germany, Italy, Spain and the UK.

Figure 3.14 Telecoms spend as a % of GDP and the penetration of mobile telephony in France, Germany, Italy, Spain and the UK



Source: ITU

This phase of market expansion is now over. We expect end user spend on telecommunications, excluding the effect of any moves by telcos into related content or IT service markets, as a proportion of GDP to remain roughly constant at 2.8% between now and 2010 while the spend on fixed network services will decline as a proportion of GDP. This lack of revenue growth reflects growing competition and falling prices. Faced with this market slow down telecommunication operators, and especially fixed network operators will, over the next five years, focus on:

- cost reductions so as to grow profits
- consolidation and acquisition so as to grow revenues
- finding new sources of revenues.

In combination we expect that these pressures will lead to 12 transformations in the EU telecommunications industry over the next five years.

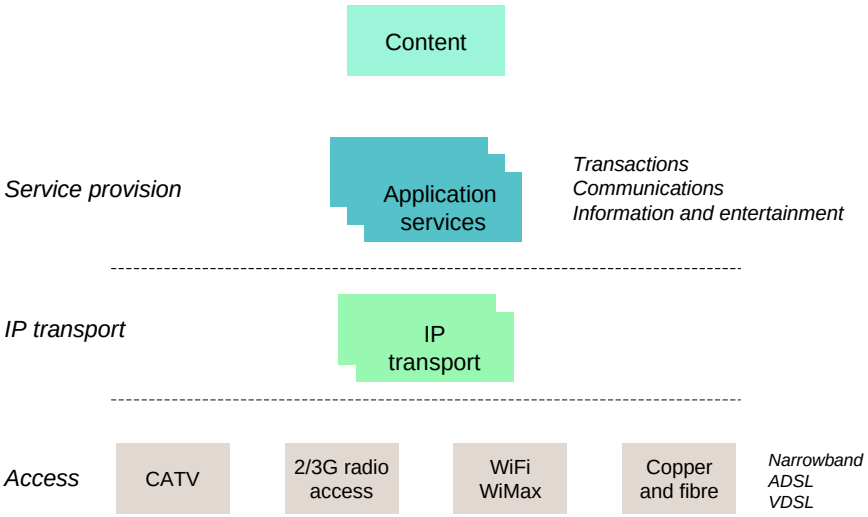
The impact of next generation networks (NGNs)

Transformation 1: *fixed network operators will roll out next generation IP networks over the next five years. The pace of this roll out will depend upon the regulation to which NGN services are subject. Some incumbents may virtually complete roll out by 2010. Others will not complete roll out until 2015.*

The case for fixed incumbents rolling out next generation networks is now strong. NGNs:

- provide a single network infrastructure to replace a number of logically separate networks. This should substantially cut operating costs for provisioning and maintenance
- offer much greater price performance than the circuit switch networks they replace, which are typically 10 to 15 years old
- offer the potential for a wide variety of new revenue streams. In many countries for example fixed incumbents might justify investment as a way of gaining access to the €30 to €40 per month which consumer are willing to pay for appropriate multi-channel TV services.
- NGNs lead to a separation of telecommunications network into three independent layers - access, IP transport, and service provision as shown in Figure 3.16. This will in turn lead to different forms of competition as described in Transformations 2 and 3.

Figure 3.16 The architecture of a next generation network



Transformation 2: *many new service providers will enter the market to offer innovative new services on the IP transport network of the NGN of the incumbent (or one of its rivals) in competition with the incumbent's own retail arm.*

The architecture of NGNs moves intelligence to the edge of the network. This lowers entry barriers substantially. Rather than having to build their own network entrants can simply connect their SoftSwitch and application servers to the IP transport network of the incumbent or one of its IP transport rivals to offer services. This is a new form of service based competition. Unlike circuit switched service based competition, which is based largely on price arbitrage, this competition will be based primarily on the ability of services providers to differentiate through innovation.

Transformation 3: *we will see strong competition between rival IP transport operators for the business of key customers such as the mobile operators, the large corporate customers, and ISPs seeking low cost IP transport.*

In many member states circuit switched AltNets are now building their own IP transport networks to compete with the fixed incumbent, using as they do the oversupply of transmission capacity which was built in the period leading up to the collapse of invested confidence in the telecommunications sector in 2001. Some will build sub-scale networks and fail. But others will survive to compete vigorously with the fixed incumbent.

Efforts to find new sources of revenues

Transformation 4: *the slow down in market growth in traditional services will lead telecommunications operators, both fixed and mobile, to seek new revenues from value added services and delivery of digital content which the roll out of broadband services makes possible.*

Operators will both acquire and partner with value added service providers and they will seek deals and partnerships with content providers. It is unlikely that we will see them acquiring any major content providers for two reasons. First there is general agreement that the merger of content providers and telecommunications operators which have taken place (e.g. AOL with Time Warner and Universal Studios with Cegetel and SFR) have not worked well. Secondly, there is an inherent conflict here between the interests of the parties. Telecommunications operators want a wide range of content to make their services attractive to customers, while content providers want to maximise their audience and so they want multiple distribution channels.

Transformation 5: *we will see strong competition developed between incumbent telcos and IT service providers for the spend of large corporate networks.*

There are three developments which lead to this transformation:

- the move by large companies to IP for all communications is blurring the boundary between local area and wide area networks
- fixed incumbents are entering the adjacent market of IT services in response to demand by corporate customers for one stop outsourcing of their IT and telecommunications requirements. The incumbent telcos see this move both as a way to increase revenues and as a way of preserving a direct customer relationship with their corporate clients[72]. We have already seen Deutsche Telekom acquire the IT service company Debis. We can expect similar acquisitions by other telcos over the next few years.
- we will see IT service companies becoming service providers on the incumbent's next generation networks. This is a major threat to the incumbents. IT service players have a good understanding of the needs of corporate customers and are able to operate globally, giving them economy of scale advantages over national telcos.

[72]In the recent past IT service companies have won an increasing number of outsourcing deals in which they are prime contractors and the telecommunications operator acts a subcontractor. To retain direct customer relationships with such businesses the telcos need to bid as prime contractor.

Increases in cross platform competition

Transformation 6: *fixed and mobile voice services will increasingly compete in the same economic market.*

There are a number of factors which will lead to this increase in competition between fixed and mobile voice calls:

- on current trends mobile originated voice calls will constitute around 45% of voice calls by 2010
- the smaller mobile operators, keen to fill their networks, will offer “big bucket ” price packages which will reinforce this trend
- by 2008 the roll out of 3G technology will start to lead to significant reductions in the unit costs of voice calls, so further reducing price premiums for voice.

Voice competition will also intensify as VOIP services are used more widely.

Transformation 7: *fixed incumbents will compete fiercely with CATV operators for consumer spend.*

In many countries, the fixed incumbent and the CATV companies will both offer triple play bundles of fast internet access, voice telephony and multi-channel TV, with the fixed incumbent using its next generation network to deliver IP TV to its customers. Other smaller service providers, such as the ISPs, will also enter this market. However in some countries, where there is already strong competition between satellite and CATV based service providers of pay TV, the fixed incumbent may decide that entry is not commercially viable. In such countries competition between the fixed incumbent and the CATV operator will probably be restricted to bundles of voice telephony and broadband access.

Transformation 8: *services based on alternate wireless technologies such as Bluetooth, WiFi and WiMax, will lead to growing competition for mobile operators from fixed operators.*

Fixed operators without mobile subsidiaries, for example in the UK and Ireland, are now developing their networks to offer “mobility services” in which terminals with multiple wireless interfaces use fixed line services in the home office or WiFi hot spots and use a mobile network elsewhere. Such services will lead to increased competitive pressure on the mobile operators, and especially on the high speed data services offered by the mobile operators, by creating substitute products. WiMax technology, if successful, will further increase this competitive pressure.

However fixed incumbents with mobile subsidiaries are less likely to develop such mobility services in the short term. There are two main reasons:

- as the owners of the leading mobile operator in their country they have fewer incentives to develop such services
- they are nervous about the response they may provoke from the NRA. So they will probably wait until rival mobile operators start to offer such services, for example in partnership with ISPs offering voice over IP.

Consolidation effects

Transformation 9: *AltNets with businesses based on circuit switched technologies and using carrier selection and call origination services from the fixed incumbent will start to disappear because of:*

- technology obsolescence. The most price sensitive customers who currently use these services will migrate to VoIP services offered in conjunction with fast internet access by ISPs
- regulatory change. In some member states fixed incumbents will lose SMP on voice telephony markets as fixed and mobile voice markets coalesce. So they will no longer be obliged to provide AltNets with carrier selection and call origination services.

To survive, these AltNets will reposition themselves to become ISPs offering voice over broadband services. In some cases we will see them merge with existing ISPs.

Transformation 10: *fixed AltNets with directly connected customers will merge so as to gain greater economies of scope and scale and so compete more effectively with the fixed incumbent.*

- In particular we expect to see consolidation within the CATV industry in several member states.

Transformation 11: *corporate AltNets will reposition themselves in order to survive.*

- Corporate AltNets currently generate unsatisfactorily low margins, typically EBITDAs of 10% compared with 30% to 40% for fixed incumbents, and face a crowded and fiercely competitive market in which there is considerable oversupply of transmission capacity on major routes. We will see:
    - some AltNets fail, and their assets and customer base transferred to others at fire sale prices
    - some use WiMax technologies to reach their corporate customers in a more cost effective way
    - some of the larger AltNets succeed in the wholesale market for IP transport (see Transformation 3)
    - some repositioning themselves to provide service and content to corporate users over the next generation networks of fixed incumbents
    - some being bought by IT service companies looking for additional expertise in corporate networking.

Transformation 12: *small single country mobile operators will be bought by one of their larger rivals.*

- In several member states there are small, single country, mobile operators with market shares of less than 10%. Given the substantial fixed costs of providing the minimum network coverage necessary to compete in the market place, these operators have relatively high unit costs and often find it difficult to generate sustained profits. Now

that subscriber demand is close to saturation the prospects for increasing market share to viable levels are poor. So it will make growing sense for the bigger mobile operators in the country to acquire them, thereby strengthening their own competitive position. NRAs and national competition authorities may intervene to prevent a reduction in the number of mobile operators. We discuss this issue further in the next section.

3.10 Conclusions

The general conclusions we draw from the scenarios presented in this chapter are as follows. Looking at the ICT sector as a whole:

- we will see only modest growth spend by end users on ICT over the next five years. If we exclude growth in IT services (which largely represents a decision to outsource tasks previously carried out in house) then, at constant prices, spend will grow at less than 1% per annum
- despite this relatively static spend, the continued price/performance improvement of ICT means that, by 2010, ICT spend will purchase roughly twice as much use of ICT equipment and services as it does today[73]

Looking more specifically at the telecommunications sector:

- supply of telecommunications is both the biggest part of the ICT sector in terms of end user spend and the segment of the industry which will change most in terms of structure and source of revenues over the next five years
- unless there is some change in ICT policy, we will see virtually no growth in the amount which telecommunications operators spend on upgrading their networks. Financial analysts are currently predicting zero growth in capital expenditure (at constant prices) by the telecommunications operators over the next few years

The EU telecommunications market may be static in terms of spend, but it is in a state of rapid change and we are likely to see more fundamental changes over the next 6 years:

- by 2010 50% of households will have fixed broadband access and over 70% of mobile users high speed data access
- we will see large scale enablement of business processes so that, by 2010, over 30% of commercial transactions will use e-services
- a move from circuit switched to next generation IP networks will be under way. These new networks will make possible the delivery of a complete new set of content rich services as well as much more cost effective delivery of traditional services. Equally importantly they potentially open the way to new forms of competition based on service innovation
- we will see much stronger infrastructure based cross platform competition:
    - between fixed and mobile operators for end user spend on voice calls

[73] Assuming 2.5% GDP growth each year and an annual 12.5% improvement in price performance of the ICT equipment and services.

- between traditional fixed operators and cable TV operators for consumer spend on triple play bundles of TV broadband access and voice telephony and

- between mobile operators and fixed operators who will use new wireless technologies, such as WiFi, WiMax and Bluetooth to provide a wireless edge to their network

- by 2010 content based e-entertainment services could generate over 10% of revenues for telecommunications service providers, assuming issues concerning access to premium content are resolved. With higher bandwidth access (over 2Mbit/s) and next generation networks rolling out by 2010, the EU15 should, depending on the investment climate created by policy makers and regulators, be on the brink of realising the vision of "anywhere, anytime" access to content for a significant proportion of the population of the EU15.

These changes in the telecommunications sector will generate considerable risks and uncertainties:

- it is clear from the number of promising access technologies which have failed in the recent past that there are substantial technology risks in deploying new wireless access technologies
- demand for 3G data services, on which mobile operators depend for a return on their investment over the next five years, is uncertain
- the risks for fixed operators in moving to NGNs are even greater. As well as the technology risks of moving such large scale networks to IP, there are large demand uncertainties. Will consumers buy the new content based services which NGNs can deliver? There are also major regulatory risks. Will regulators allow the incumbent to migrate customers, both retail and wholesale, away from legacy products in a speedy and cost efficient way?
- the investment which telcos will make in access network fibre is especially risky. Almost all the costs are fixed and are incurred in advance of any knowledge of the demand for new high bandwidth services. It is expected that these services will generate significant additional revenue per customer, but they may not. It is extremely difficult to predict mass market demand. Determining what value added services users will buy, under what price structures, and through which distribution channels, is largely a matter of trial and error. There will inevitably be surprises.

To invest in such circumstances telecommunications operators will need a regulatory framework which gives:

- assurances that, if they succeed with risky investment, the return will not be regulated away
- freedom to explore different retail pricing models so as to find which succeeds in growing the market
- freedom to migrate customers from legacy products to new technology based services efficiently and without undue regulatory intervention.

In the next Chapter we consider whether the current regulatory framework meets these requirements.

4 Public Policy Implications

4.1 Introduction

This section discusses the policy implications of our findings from Chapters 2 and 3, and our recommendations for changes to existing policies and regulation. We refer to these recommendations as "key enablers". They address communications sector regulation, ways of making ICT use more profitable in the private sector and ways of stimulating take-up by the public sector.

Figure 4.1 shows the structure we have used to develop our recommendations. The key points from Chapters 2 and 3 are given in the top box and provide the main reasons why policy should change. They are discussed in Section 4.2.

We then identify two broad sets of policies aimed at stimulating innovation and investment, and making ICT use in Europe more effective. They are discussed in Sections 4.3 and 4.4, respectively. In Section 4.3, we focus on policies specific to the communications sector. We argue for policies that take account of the dynamic nature of telecoms markets, focus *ex ante* regulation on non-replicable facilities, require regulators to commit not to regulate emerging markets, ensure sector specific taxes are not applied to ICT and provide appropriate access to content and spectrum resources.

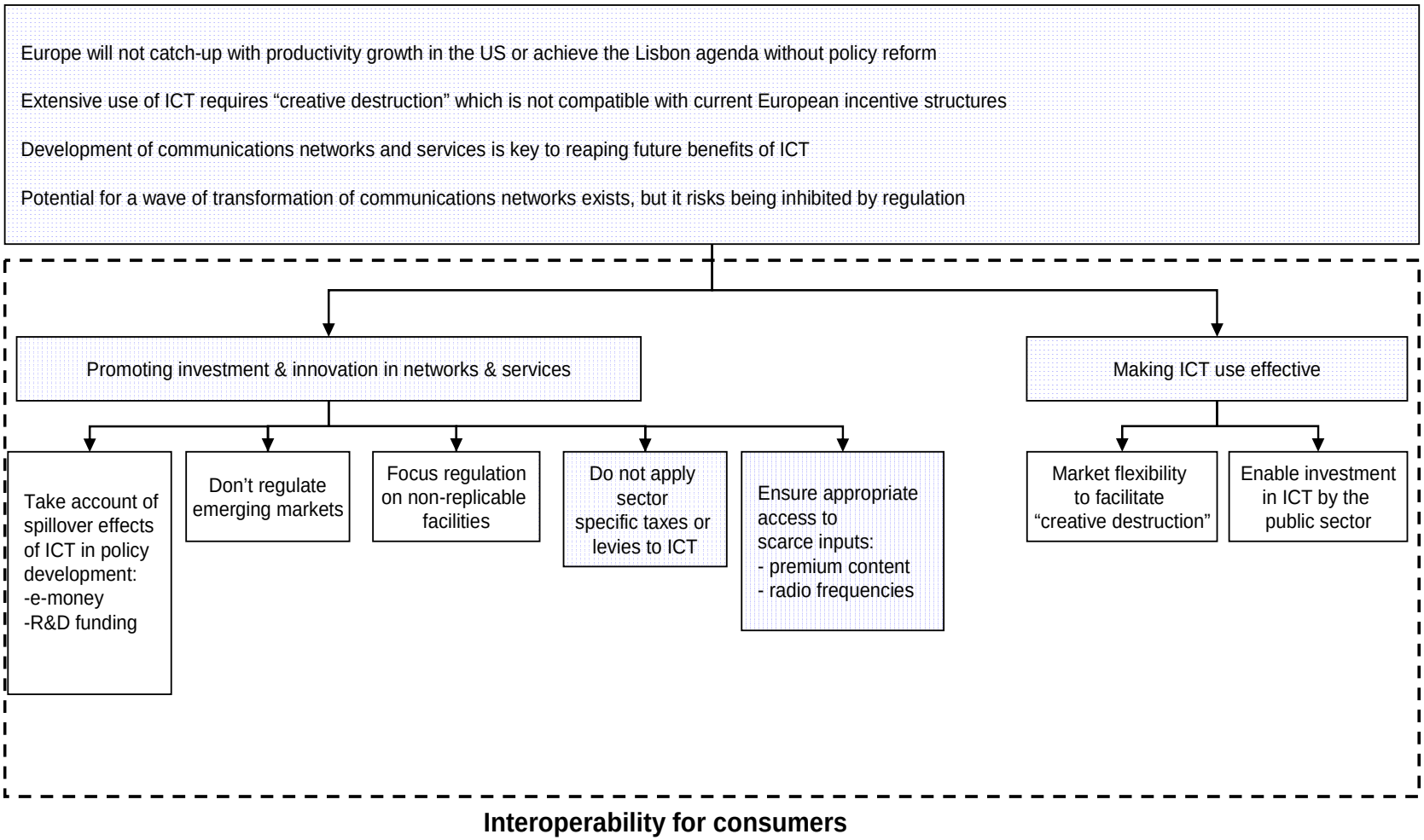
The policies discussed in Section 4.4 are concerned with making labour and product markets more flexible and enabling more effective investment in ICT by the public sector.

We have placed a dotted line around the whole policy area to indicate the need for all these policies to work towards creating the conditions required to provide consumer focused interoperable services – so as to move towards the vision of "any content, anytime, anywhere".[74] For this vision to be realised, networks and services need to be technically interoperable and open standards or protocols for exchanging data between different standards, are required. Standards may be developed by industry or through government initiatives. Experience suggests that industry-led standards initiatives, with government playing a facilitating role, are more likely to result in successful market outcomes than government mandated standards.[75] The latter should be a last resort used only when market-led processes fail.

[74] Breakthough 4, PriceWaterhouseCoopers, August 2004, "Rethinking the European ICT Agenda,", for the Ministry of Economic Affairs, The Netherlands

[75] P Swann (2000), "The Economics of Standardisation", for the Department of Trade and Industry, December 2000.

Figure 4.1: Framework for developing recommendations



4.2 The policy challenges

The communications market over the next five years will be very different from the market during the 1990s and even the 1980s.

- Since the dotcom crash in 2001, financial markets have been cautious about investing in telecoms ventures and more sensitive than in the past to the risk of regulators capping returns on risky investments.
- Investments undertaken during the late 1990s led to spare capacity in networks which is currently supporting demand growth, but this will run out at some point and new capacity will need to be funded. It is not clear that regulated rates are sufficient to pay for this new capacity.
- There is considerable external pressure for change from technology developments leading to new infrastructure and services and as IT companies seek to enter the communications sector.
- Operators will need to decide whether to undertake risky investments in new infrastructure (wireless and fibre), next generation networks and NGN services. Changes of this magnitude with telecom companies in private ownership have not happened in Europe since the late nineteenth/early twentieth century. In this regard, we note that the development of the mobile industry took place in the absence of sector specific regulation.

In developing our recommendations we have been mindful of this context.

The analysis given in Chapter 2 points to an urgent requirement for European policy makers to take actions to remove the labour and product market impediments to the private and public sector use of ICT, if productivity and economic growth in Europe is to catch up with that in the US and some countries in Asia. Effective use of ICT requires organisational change. This is facilitated by low cost entry and exit in labour and product markets, and there is the risk that apparently minor impediments (e.g. shop trading hours) could have major impacts.

The findings in Chapters 2 and 3 also point towards the need for communications sector policy and regulation to focus on:

- encouraging the investment needed for economic catch-up;
- encouraging competition in infrastructure and new services based on service and pricing innovations rather than price arbitrage;
- providing communications operators with the freedom to offer pricing innovations and service bundles that will grow the market for new services;
- enabling access to the scarce frequency and content resources needed for the development of competitive networks and new content-based services.

In Chapter 3, we described 12 industry transformations that could occur over the next five years. Regulation should not block or inhibit these transformations. Examples of ways in which this might happen are given in Table 4.1. This suggests that there should be a narrow focus for regulation, with adequate returns where regulation remains and flexibility elsewhere.

Table 4.1: Potential market developments and regulatory distortions

Market developments	Potential regulatory distortions
More cross platform competition and convergence between services will change the boundaries of markets	Definitions of markets subject to regulation do not keep up with market developments
	Access competition is stifled by continued requirements for incumbents to offer regulated prices (with implicit cross subsidies) in competitive markets
Telcos and IT companies compete for the business of large corporate customers	Telcos' ability to compete is restricted by regulation (publication and unbundling requirements) whereas that of IT companies is not
Telcos seek to invest in NGNs, fibre and VDSL	Regulators require open access to new networks and facilities at regulated returns and impose restrictions on price flexibility and bundling, which deters investment
Consolidation amongst Altnets occurs as VOIP undermines their business model, as competition from new networks intensifies and to achieve economies in operation	Regulators artificially support Altnets through access pricing

4.3 Promoting innovation and investment

4.3.1 Take account of the spillover benefits from ICT

Given the importance of ICT in determining future economic growth, there is a strong case for public policy in general to be developed taking account of impacts on ICT, much in the same way that environmental impacts are often taken into account. The reason for doing this is that, like environmental impacts, ICT has spillover effects which market interactions may not take into account.

We propose that the EC and national governments should take account of the impacts on the ICT sector and use of ICT when appraising the pros and cons of different policies. There are a number of important areas of EC policy where this approach should be applied.

One policy area concerns the e-Money Directive. This came into effect in 2002 and is now under review[76] because it imposes high compliance costs on small transactions using pre-pay mobile phone cards (e.g. paying for car parking and other small value goods and services) and more generally may block future transactional services offered using mobile phones.[77] If those developing the legislation had had to take account of the potential costs of the Directive on the development of the mobile sector, and more generally the ICT sector, then this problem might have been avoided.

A further policy area is EC funding of research and development in the ICT sector. The Barcelona European Council of 2002 called for Europe's investment in R&D to approach 3% of GDP by 2010 and for an increasing proportion of R&D to be funded by the private sector.

[76] The Commission has held a recent consultation on these issues with a view to determining whether changes to the e-Money Directive are required. "Application of the E-money Directive to mobile operators, Consultation paper of DG Internal Market", 10 May 2004.

[77] For example, Nokia plans to test a system by which bus travellers can pay for tickets by passing their phone over a smart-card reader installed on buses. http://news.bbc.co.uk/1/hi/technology/3975419.stm

An action plan has been implemented to achieve these objectives.[78] Significant public funding continues to be provided for R&D because of the spillover effects this has in terms of stimulating innovation and improving a country's ability to absorb innovations from elsewhere.[79] Examples of public funding are given by the European Community Framework Programmes and the EUREKA programme.

The issue of concern for this report is the priority given to ICT in the allocation of these funds. In particular, it is important that these priorities take account of the important role of ICT in underpinning future economic growth in the information age and the wider economic and social benefits that ICT creates (see Chapter 2). In this regard, we note that the *e*Europe advisory group has expressed concern that ICT is not given sufficient importance in future European R&D programmes.[80]

A related issue is patent protection of computer-implemented inventions. A draft Directive on computer-implemented inventions has been proposed by the European Council,[81] with the purpose of clarifying and harmonising what is patentable in the EU.[82] The debate around the Directive should also take account of the spillover benefits from ICT and the fact that over 80% of Europe's ICT industry depends on inventions which are implemented by computers.

Key enabler 1: Take account of the spillover benefits from ICT

We recommend that when developing new legislation and policy the European Commission and national governments take account of the impacts on the ICT sector and use of ICT. Examples of areas to which this principle should be applied include e-money legislation, patents for computer implemented inventions and EU funding for research and development.

4.3.2 Dynamic Regulation

The new European framework for communications sector regulation introduced in 2003 is intended to be better adapted to more complex and dynamic markets than the previous regulatory regime.[83] This is achieved through the application of the competition law concept of dominance and the approach to market analysis used by competition authorities.[84] In this section, we argue that the way the framework is being implemented by NRAs means it does not currently take due account of the dynamic and uncertain nature of communications markets.

If the dynamic nature of the ICT market was taken into account in regulatory decision making, then NRAs would:

[78] For a review of progress see "R&D investment targets and current trends", European Commission, Research Directorate General, Directorate M, 24 September 2004.

[79] Griffith, Redding and van Reenen, "Mapping the two faces of R&D: productivity growth in a panel of OECD industries, *Review of Economics and Statistics*, Volume 86, Issue 4, November 2004.

[80] *e*Europe Advisory Group, "Workgroup No1: Digital Divide and Broadband Territorial Coverage", 29 September 2004.

[81] "Proposal for a Directive of the European parliament and of the Council on the patentability of computer-implemented inventions", 18 May 2004.

[82] http://europa.eu.int/comm/internal_market/en/indprop/comp/

[83] Recital 25, Framework Directive op. cit.

[84] Commission Guidelines on market analysis and the assessment of significant market power, 2002/C 165/03.

- assess the benefits of policies taking account of the dynamic gains from market expansion and spillover benefits in addition to the benefits from price reductions;
- recognise the need for price and service flexibility and the problems of getting prices right given that costs are highly uncertain and risks difficult to quantify.

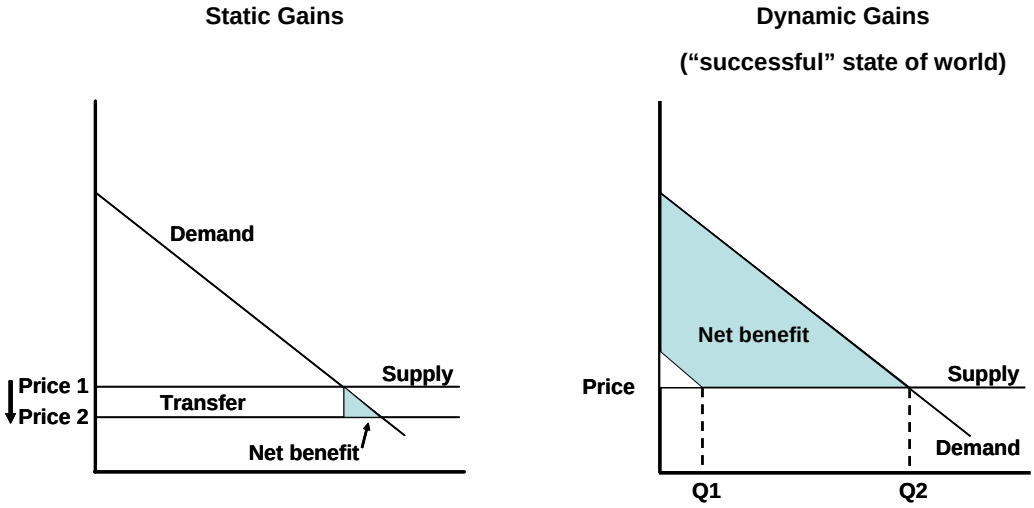
These issues are discussed below.

4.3.2.1 Focus on the dynamic gains from market expansion

Demand for new services will grow over time and the welfare gains from service expansion can be very large, as welfare grows more than proportionately to the increase in the quantity consumed.[85] This is illustrated in the right hand side of Figure 4.2 where the growth in demand is shown by the demand curve moving to the right and the welfare gain is shown by the shaded area.

When regulators analyse the welfare impact of interventions they do not typically take account of these gains over time.[86] Rather they adopt a static framework in which the benefits of price reductions are measured by the coloured triangle shown in left hand side of Figure 4.2. The risk that the regulated price will be "wrong" and, in particular, is likely to be biased downwards (as we discuss below in section 4.2.1.1)) is not taken into account. This means that the risk regulation could make market expansion unprofitable, and the benefits shown in the right hand side of Figure 4.2 are consequently forgone, does not enter regulatory decision making.

Figure: 4.2: Static versus dynamic analysis



Source: Indepen chart

The European Regulators Group (ERG) note that[87]

[85] The importance of new services to economic analysis, and their absence from orthodox analysis, was highlighted by Romer who analysed the impact of trade barriers on the introduction of new services. "New Goods, Old Theory, and the Welfare Costs of Trade Restrictions", P Romer, *Journal of Development Economics*, 43. Crandall and Haussman have made similar points in the context of new telecoms services. Robert W. Crandall (Editor), James H. Alleman (Editor). December 2002. "Broadband: Should We Regulate High-Speed internet Access?"

[86] This focus on price reductions is also evident in the Kok's report discussion of ICT.(p 19, Kok Report op. cit.)

[87] p62 of the Common Position on Remedies, ERG 2003.

"It is also clear from Article 8(2) of the Framework Directive that this is not just a static view of competition as the NRA has to ensure that competition is promoted by encouraging efficient investment and innovation"

However, so far we see little evidence of regulators applying dynamic analysis. This suggests they do not attach sufficient weight to investment and innovation objectives.

In addition, the presence of spillover benefits from ICT means that when regulators are balancing the risks of over and under-investment they should err on the side of promoting investment in telecommunications, including investment in competing infrastructure. While in principle one would aim for the right amount of investment, taking account of spillover effects, this is impossible to achieve in practice because of market uncertainties and lack of relevant information. This means the costs involved with alternative errors should be explicitly addressed. Under-investment involving non-supply or a failure of sustainable infrastructure competition to emerge is likely to be far more damaging than the alternative of over-investment that might arise from leaving more decisions with the market. This is because, in the former case, the spillover benefits of ICT on productivity and economic growth would be forgone.

Key enabler 2: Focus on the dynamic gains from market expansion

We recommend that NRAs are required to take account of the dynamic impacts of their decisions. This will involve placing more weight on innovation and investment relative to short-term price objectives. In particular, when balancing the risks between over- and under-investment, NRAs should make decisions in favour of promoting investment in communications infrastructure.

4.3.2.2 Recognise need for price flexibility

A period of dynamic change necessarily involves a process of search by market players to discover what approaches to pricing work best in growing the market. If many consumers are unwilling, or at least initially unwilling, to pay for new services in which they have no experience, price flexibility may be key to growing the market particularly where network externalities are present. Setting retail prices at a high level initially and then reducing them rapidly as the market develops is standard practice in IT markets, for example. Telecom operators need the same flexibility when they introduce new services or when seeking to recover new investments that allow the joint provision of new and existing services. This is not generally permitted under *ex ante* regulation.

Experience in the mobile sector illustrates how innovation in retail pricing (e.g. pre-pay and two-part tariffs) can help grow the market – ultimately increasing willingness to pay as experience and network effects take effect. The development of the low cost airline industry provides another example of a sector where substantial benefits and market growth have flowed from, at least in part, price flexibility (e.g. one way, time sensitive fares).

Key enabler 3: Allow operators to have retail price flexibility

We recommend that regulators should allow operators to have retail price flexibility for new services and flexibility to jointly price new and old services that can be provided over new common infrastructure.

4.3.3 Focus regulation on non-replicable facilities

The Framework Directive provides the basis on which access to networks and related electronic communications services are regulated by NRAs. The Framework Directive states that:

> *"It is essential that ex-ante regulatory obligations should only be imposed where there is not effective competition, and where national and Community competition law remedies are not sufficient to address the problem."* [88]

There is, however, a presumption within that Directive that some *ex ante* regulation will continue to be required[89], i.e. where it is necessary to ensure the development of a competitive market. Consequently, the Framework Directive provides that certain electronic communications service providers and operators will be designated as having significant market power (SMP) (equivalent to dominance) which may carry with it *ex ante* obligations. This is intended to apply only to the 18 markets recommended by the Commission and in accordance with guidelines for market analysis drawn up by the Commission[90]. The Commission's approach, and that of NRAs, is to be consistent with the principles of competition law.

While, *ex ante* remedies may only be applied by NRAs if an operator has SMP in any of the markets identified in the Recommendation on Relevant Markets, what is less clear is whether *ex ante* regulation must be applied if an operator is found to have SMP in one of the markets. The quote given above refers to both the absence of effective competition and a situation where Community competition law remedies are not sufficient. Article16(4) of the Directive makes no mention of the sufficiency of competition law. It states that:

> *"Where a national regulatory authority determines that a relevant market is not effectively competitive, it shall identify undertakings with significant market power on that market…. and the national regulatory authority shall on such undertakings impose appropriate specific regulatory obligations"*

We also note that the ERG has concluded that

> *"There is a presumption that ex ante regulation is appropriate on the 18 markets in the Recommendation if a position of SMP is found. It is therefore not necessary for national authorities themselves to determine whether competition law by itself would be sufficient to deal with competition problems in the markets included in the Recommendation……..*
>
> *Where market analysis reveals that competition on the market is not effective, and the NRA designates one or more operators as having SMP on that market, at least one appropriate ex ante remedy must be applied."*[91]

[88] EC Directive on a Common Regulatory Framework for Electronic Communication Networks and Services, Recital 27.

[89] ibid, Recital 25

[90] Framework Directive, Articles 15 and 16.

[91] P9, ERG Common Position on the approach to Appropriate remedies in the new regulatory framework, ERG, 23 April 2004.

This approach leaves no room for competition policy to work. *Ex ante* regulation applies until markets are effectively competitive, at which point competition policy will be unnecessary (because no operator will have market power to abuse).

This is unlike the situation in markets that are not subject to *ex ante* regulation, such as IT and media markets with which telecoms increasingly competes. These markets are presumed to be competitive unless companies within them can be proven to have abused a dominant position. The holding of a dominant position is not illegal and is deemed consistent with a well functioning market. A central tenet is that the abuse of this position, not the position itself, is harmful and is deemed illegal. By contrast, the *ex ante* regulatory framework starts from the premise that dominant operators will abuse these dominant positions and, if unchecked, will earn excessive profits. Regulation is therefore imposed in advance (i.e., it is *ex ante*) of any evidence of abuse of a dominant position.

A similar concern has been identified in the US and, while the European Framework might be viewed as more rational by design, due process and the courts in the US might lead to better outcomes for converged markets over time:[92]

> *"Antitrust and regulation have starkly contrasting traditions on mandated access. As the internet, computer software, and telecommunications ("New Economy") industries converge, affected firms will increasingly seek clear and consistent legal rules. Moreover, courts reviewing the FCC's decisions in this area are increasingly pressuring the Commission to devise a regulatory regime more compatible with economic theory and antitrust policy."*

The choice between the use of *ex ante* regulation versus competition policy involves a trade-off between the risks of market failures versus regulatory failures. Regulatory failure and its costs will be higher the less complete the knowledge of the regulator and the more complex the relationships between actions and consequences. If there is uncertainty about these relationships, which is more likely if there is competition and rapid innovation, then mistakes will be made.[93] The scope for regulation to result in adverse unintended and unanticipated consequences in the case of telecoms markets is therefore considerable. One way to limit these effects would be to focus regulation on non-replicable facilities. These are facilities that cannot be technically or economically replicated by another operator.

[92] Joseph Farrell & Philip J. Weiser. Fall 2003. "Modularity, vertical integration, and open access policies: towards a convergence of antitrust and regulation in the internet age." *Harvard Journal of Law & Technology*, Volume 17 (1). Page 86.http://jolt.law.harvard.edu/articles/pdf/v17/17HarvJLTech085.pdf

[93] Dobbs and Richards (2004) argue that the tests used under the new regulatory framework for market definition are ill-designed to offer policy advice where there are risky investments and uncertain demands. They argue there is a bias toward finding overly narrow economic markets and hence SMP when in many cases market power does not exist. Dobbs and Richards (2004), "Innovation and the New Regulatory Framework for Electronic Communications in the EU", *European Competition Law Review*, Vol. 25 Issue 11, 2004

Key enabler 4: Focus regulation on non-replicable facilities and use competition policy more

We recommend that ex ante regulation is focused on non-replicable facilities. This would ensure regulation was focused on areas where an operator clearly has monopoly power and so abuse is most likely to occur. Otherwise regulation by competition policy would apply.

We propose that regulators should pre-commit to roll-back regulation once regulated facilities are replicated in a given locality. Pre-defined triggers for the removal of regulation need to be decided and regulated prices must be set appropriately, taking due account of market risks, price dynamics and the external benefits of infrastructure competition.

As a short-term measure the ERG Guidance could be changed so that NRAs must justify ex ante remedies on SMP operators in terms of the net benefits relative to the application of competition law.

It is important to recognise that this is a major departure from the current approach, under which replicable facilities owned by SMP operators are subject to *ex ante* regulation. We are suggesting that where SMP is found the appropriate remedy would be one focused on non-replicable facilities. We suggest our proposals are implemented through guidelines to regulators, assuming this is feasible under the current legal framework. If this is not feasible then the Framework Directive would need to be modified.

Two practical issues that NRAs will need to address when implementing this proposal are

- how to decide when facilities are replicable or not?
- how to roll-back regulation from replicable facilities?

4.3.3.1 Deciding whether facilities are replicable

Market evidence showing duplication of facilities is the best test of whether they are replicable or not. There are two complementary ways in which this might be achieved. First, by ensuring that, as far as possible, regulated prices for access to facilities are "right", in the sense that they are the prices a market would deliver. If the prices are "right" then replication could be expected to occur where it is economic. Second, via a regulatory pre-commitment to roll-back regulation wherever and whenever replication is demonstrated. The second issue is dealt with in the next section and here we address pricing issues.

There are a number of reasons why regulated prices are likely to be too low:

- *ex ante* regulation does not take account of the possibility of failure because it assumes normal returns for regulated entities. Above normal returns are required to compensate for the risk of failure. Failures do happen. For example, initially even 2G services failed (e.g. one UK operator gave back a licence) and we have seen the

same happen with 3G licences. The difficulty is that *ex ante* returns are not observed. However, we do know the direction of bias. As Haring et al put it:[94]

> *"If the regulator appropriates the gains from successful innovations or (worse) forces the firm to give those gains to its competitors, the odds become "Heads, I lose; tails I break even."*

- the option value of the investment is not taken into account.[95] Many investments are irreversible and so lead to a loss of flexibility for the investor. Access users take advantage of this flexibility by not committing to their own investments. Dotecon (2003) set out a number of ways in which this value might be priced, including market benchmarks, the prices of leases and creating a market for access contracts of different durations.[96]
- the external benefits of infrastructure competition relative to access-based competition are not taken into account.
- where assets are long lived and replacement asset prices are expected to decline over time, the efficient competitive price path will be above that which a static assessment based on either historic or replacement costs would suggest.[97] Mandy and Sharkey (2003)[98] show that static LRIC models could substantially under (over) estimate dynamic competitive prices when asset prices are falling (or rising). It is calculated that when investment costs are falling by 11 per cent per annum for switches, prices should be 50 per cent higher than those calculated using a static model. The error involved in static estimates can therefore be large.
- unrealistic network models which do not reflect that fact that real networks develop over time may be used in costing (particularly in Long Run Incremental Cost Models). In 2003 the FCC *"tentatively conclude that our TELRIC rules should more closely account for the real-world attributes of the routing and topography of an incumbent's network in the development of forward-looking costs."*[99]

If prices are too low then replication is unlikely to occur[100] and the case for regulation becomes self-fulfilling. There will inevitably be uncertainties when setting prices. However, given the factors listed above we argue that NRAs should err on the high side when setting regulated prices so as to encourage infrastructure investment. This is contrary to the "neutral" position advocated by the ERG which we do not think takes due account of the factors listed above and the spill-over benefits of ICT investment.[101]

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[94] P 62, John Haring, Jeffrey H. Rohlfs & Harry M. Shooshan. April 2002. "Propelling the broadband bandwagon." Prepared for United Kingdom Office of Telecommunications and Office of the e-envoy. http://www.ofcom.org.uk/static/archive/oftel/publications/broadband/other/spr0802.pdf

[95] Robert Pindyck. February 2004. "Mandatory unbundling and irreversible investment in telecoms networks." NBER Working Paper 10287.

[96] Dotecon and Criterion Economics, October 2003, "Competition in broadband provision and its implications for regulatory policy", prepared for the Brussels Round Table.

[97] P Marks and B Williamson, 2004, "Profitability tests in competition law and *ex ante* regulation", *Utilities Policy*. www.indepen.co.uk/panda.html

[98] Mandy, D and Sharkey, W, 2003. 'Dynamic pricing and investment from static proxy models', Federal Communications Commission OSP Working Paper Series #40.

[99] FCC. 15 September 2003. "Review of the Commission's Rules Regarding the Pricing of Unbundled Network Elements and the Resale of Service by Incumbent Local Exchange Carriers." Paragraph 52.

[100] Unless new entrants believe (without doubt) regulators' promises to remove regulation once replication occurs.

[101] P14, ERG op.cit.

4.3.3.2 Mechanism for rolling-back ex ante regulation

The issue of how NRAs might remove regulation from replicated facilities where operators have SMP then arises. Article 12 of the Access Directive requires that NRAs take account of "the economic and technical viability of using or installing competing facilities". An approach that would be consistent with this would be for regulators to commit in advance to remove regulation once investment is replicated by one or more competitors in a locality (i.e. there is evidence that supply of the activity or facility is contestable). This approach recognises that some geographic sub-markets may be competitive while others are not. For such a policy to be credible to investors, and so for it be capable of affecting their behaviour, regulators would need to commit to it in advance.[102]

To illustrate how this might work in practice take the example of bitstream services. If a specified number of competitors purchase unbundled local loops to provide broadband at a particular local exchange, and supply services for a specified time period, then regulatory obligations in respect of bitstream would be removed at this exchange. If there was concern that competition policy would not prove adequate to deal with any potential abuses at this exchange, then the threat of re-regulation could be used.

Such approaches have been adopted, for example, in the case of interconnection at the local exchange in Hong Kong, where there must be three competitors are each exchange, for facilities deployment on particular routes by the FCC, and for Australian airports, where regulation has been removed but there is always the threat of re-regulation (see Box 4.1).

[102] Brian Williamson. October 2004. "Commitment and adaptability in telecoms regulation." http://www.indepen.co.uk/panda/docs/commitment_and_adaptability_october_15.pdf

Box 4.1 Achieving regulatory withdrawal via commitment

Interconnection at the local exchange in Hong Kong

The Hong Kong regulator is implementing a scheme whereby for buildings that are connected by at least two self-built customer access networks of local fixed telecommunications network operators, mandatory interconnection will be withdrawn. The regulator has put in place transitional arrangements whereby mandatory interconnection is withdrawn for new customers after two years and for existing customers after three years. The withdrawal of regulation will be fully implemented by June 2008, except for buildings meeting the "essential facilities" criterion. *OPTA Press Release, 24 September 2004*

Self-provisioning trigger in the US

The FCC delegate to state commissioners the authority to declare that mandatory unbundling is not required where there is sufficient evidence of facilities deployment on a particular route, specifically where three or more unaffiliated competing carriers each have deployed transport facilities on a particular route.[103]

Price surveillance and threat of regulation - Australian airports

In 2002, *ex ante* price regulation was removed from Sydney, Melbourne, Brisbane, Perth, Adelaide, Canberra and Darwin airports and the airports are now subject to price monitoring under the Prices Surveillance Act 1983.

The Australian Government has stated that it would consider re-introducing price controls if it formed the view that an airport operator had unjustifiably increased prices. Its criteria for evaluating prices is that at airports without significant capacity constraints, efficient prices broadly should generate expected revenue that are not significantly above the long-run costs of efficiently providing aeronautical services.

This approach demonstrates a reversal of the burden of proof, thereby allowing greater commercial freedom subject to the threat of regulation.

4.3.4 Emerging markets

In this section, we address issues concerning the scope of electronic communications network and services regulation and broadcasting regulation.

4.3.4.1 Regulation of electronic communications markets and services

Emerging markets are treated differently from existing markets under the Framework Directive. The Directive states that market leaders in emerging markets should not be subject to inappropriate *ex ante* regulation and NRAs are expected to forbear from premature

[103] FCC. 21 August 2003. Report and order and order on remand and further notice of proposed rulemaking. In the matter of: Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability. Paragraph 405.
http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-03-36A1.pdf

imposition of *ex ante* regulation on the grounds that this may unduly (and inappropriately) influence the market development.[104]

This policy position leaves open the possibility that NRAs will intervene in emerging markets. In this section, we argue that NRAs must commit not to regulate emerging markets if investment is to be forthcoming and we suggest possible mechanisms for making these commitments.

Key enabler 5: Commit not to apply sector specific regulation to emerging markets

We recommend that the European Commission commits not to add markets to the list given in the Recommendation on Relevant Markets and that NRAs commit not to regulate emerging markets, either for a fixed period of time or until certain market penetration levels are reached. When these triggers are reached the onus would be on the NRA to demonstrate the net benefits of ex ante regulation relative to the continued application of ex post competition policy.

Examples of such commitments given by regulators in Hong Kong and the US are given in the boxes below.

Box 4.2 Hong Kong commitment not to regulate interconnection with fibre at the local exchange[105]

OFTA, the Hong Kong Telecommunications regulator, announced in July 2004 that mandatory interconnection would not be extended to fibre-based customer access networks. This policy was regarded as supporting the Hong Kong Government's policy objective to encourage investment in the roll-out of competitive fibre-based telecommunications infrastructure.

[104] Recital 27, Framework directive; para 32, Commission Guidelines on market analysis and the assessment of signififcant market power, 2002/C 165/03.

[105] Review of Type II Interconnection Policy, Statement of the Telecommunications Authority, 6 July 2004.

Box 4.3 US Federal Communications Commission's (FCC) commitment not to unbundle fibre

The FCC announced an unconditional commitment not to require the unbundling of fibre optic cables in August 2003:[106] On 14 October 2004 the FCC broadened and clarified the scope of the commitment to include fibre-to-the-curb:[107]

"Today's action builds on those broadband principles, and relieves incumbents from unbundling requirements for fiber-to-the-curb (FTTC) loops, where fiber is extended within 500 feet of a customer's premises. The FCC found that FTTC networks can deliver many of the same benefits as FTTC loops. FTTC networks offer enhanced capability for providing advanced services, including the ability to offer voice, multi-channel video, and high-speed data services. The new rules free companies to choose between FTTH or FTTC networks based on marketplace characteristics, rather than disparate regulatory treatment."

Responding to the FCC decision, SBC Communications has said it will:[108]

"dramatically accelerate its plan to build a new fiber-optics network into neighborhoods, providing 18 million households super high-speed data, video and voice services in two to three years — rather than five years as previously announced."

The importance of commitment

Credible commitment is one of the key ingredients of a healthy market where parties need to invest in relationships, commit resources to innovation and invest in assets whose value depends on the actions of other parties.

For example, a manufacturer of car parts will be reluctant to invest in developing and manufacturing components tailored to a specific model unless there is a credible commitment from the manufacturer to purchase a sufficient quantity of the parts at an adequate price. The risk is that, once the part has been developed, the car manufacturer could renege on the understanding and offer a price that covered production costs but excluded development costs. This is known as the "hold-up" problem in industrial economics, and the "time-inconsistency" problem in macroeconomics.

Achieving regulatory commitment to a future set of actions is central to the provision of services from infrastructure networks where sunk investments (i.e. investments with no value in other uses) and innovations are required to deliver services such as telecommunications, energy and water efficiently. Where commitment is absent, public ownership tends to be the default outcome for "utility" industries, since private investors will not commit funds. In the communications sector, the lack of credible commitment might hamper the emergence of

[106] FCC. 21 August 2003. Report and order and order on remand and further notice of proposed rulemaking. In the matter of: Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability. Paragraph 272. http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-03-36A1.pdf

[107] FCC. 14 October 2004. "FCC removes more roadblocks to broadband deployment in residential neighbourhoods." http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-253127A1.pdf

[108] SBC Communications. 14 October 2004. "SBC To Rapidly Accelerate Fiber Network Deployment In Wake Of Positive FCC Broadband Rulings." http://www.sbc.com/gen/press-room?pid=5097&cdvn=news&newsarticleid=21427

infrastructure competition since not only are the incumbent's sunk assets at risk, but so also are the assets of new entrants to the market.

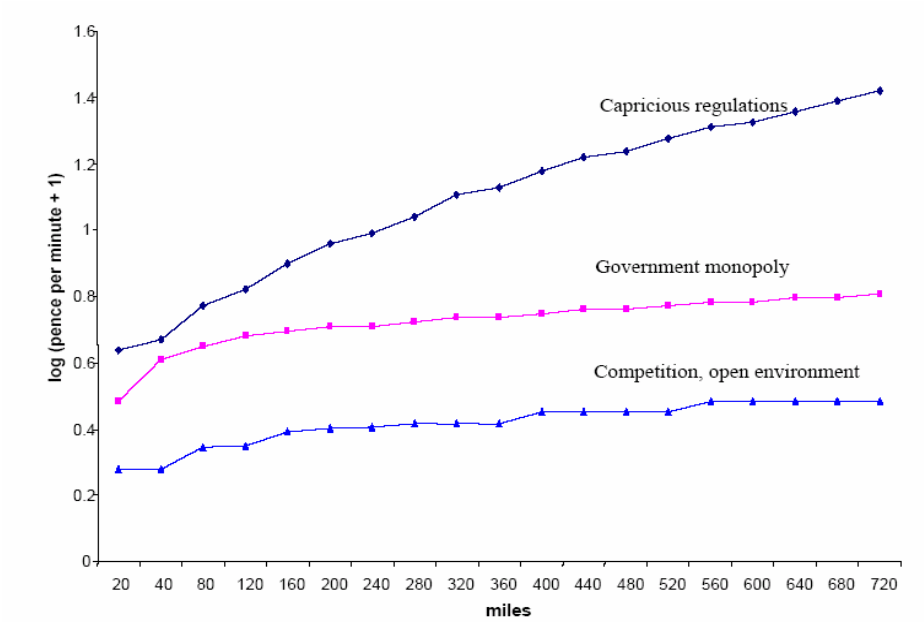
A lack of credible commitment will involve costs of various kinds, perhaps the most visible has been an elevated cost of capital. However the risk of expropriation is not necessarily reflected in the observed cost of capital and will more likely show up in terms of inefficiently low levels of investment and innovation, or short-termism and a lack of specialisation (since returns must be made quickly or assets re-deployed in the face of a risk of expropriation).

There is a range of theoretical and empirical evidence pointing to a commitment problem in relation infrastructure investment. In a comparative study of telecommunications regulation Levy and Spiller found that:[109]

> *"...performance can be satisfactory with a wide range of regulatory procedures, as long as arbitrary administrative action can be restrained."*

A study of regulation and outcomes in deploying fixed voice networks across Europe from the 1870s onward also points to the benefits of credible commitment.[110] As can be seen from Figure 4.3, greater investment and lower prices were evident in those countries where telephony operators operated in competitive environments (e.g. Scandinavia) and were not subject to capricious regulation, for example unanticipated royalty payments and a threat of expropriation of assets.

Figure 4.3: Average long distance prices for voice telephony by market structure and distance



(1895)

Source: Wallsten (2003)

[109] Brian Levy and Pablo Spiller. 1994. "The Institutional Foundations of Regulatory Commitment: A Comparative Analysis of Telecommunications Regulation." Journal of Law, Economics and Organisation, Volume 10(2).

[110] Scott Wallsten. March 2003. "Returning to Victorian Competition, Ownership, and Regulation: An empirical study of European Telecommunications at the Turn of the 20th Century". http://www.wallsten.net/papers/wallsten_europe_telhist.pdf

There is also now some recognition among regulators of the need for credible commitment as a signal to investors:

> *"…ways must be found to reassure investors that returns will not be 'regulated away' after the investment is made." Para 4.7,* Ofcom Phase 1 Strategic Review Consultation, 2004.

> *"Regulatory credibility will, to a large extent, depend on how far the regulator can pre-commit."* Doug Andrew, Group Director, Economic Regulation, the Civil Aviation Authority.[111]

Regulators have authority to override their own previous decisions.[112] This makes it particularly difficult for them to commit credibly to not expropriate the gains from investment and innovation, once these have occurred. In order to achieve good outcomes regulators must then selectively tie their hands. This is a particular issue in the context of emerging markets.

Application to emerging markets

The EU Recommendation on Relevant Product and Service Markets[113] states that in:

> *"new and emerging markets, in which market power may be found to exist because of "first-mover" advantages, should not in principle be subject to ex-ante regulation."*

While it may not be practical to define emerging markets in advance, because of market uncertainty,[114] investors still require some degree of certainty over whether a new service is likely to be regulated or not.

This certainty could be provided by

1. The EC committing not to add emerging markets to the list of markets given in the Recommendation on Relevant Product and Service Markets. This is not to say that such markets would never be regulated but rather the burden of proof would be shifted to the NRA to justify any regulation that might be proposed.

2. Regulators committing not to apply *ex ante* regulation at either a wholesale or a retail level to new services and products (for the reasons given above) unless certain triggers or thresholds are reached. When these triggers are reached the onus would be on the NRA to demonstrate the net benefits of *ex ante* regulation relative to the continued application of *ex post* competition policy.

   Two possible triggers are time (i.e. regulators commit not regulate for a fixed period of time) and market penetration. In the case of a time trigger, there is an analogy with

[111]Doug Andrew. September 2002. "Effective governance and the principal-agent problem – lessons from aviation regulation." In CRI Proceeding 30 - Regulated Industries - the "Governance Contract". (page 50).

[112]Unfortunately appointing a benevolent regulator does not solve the commitment problem. If the regulator cannot commit hen the expropriation of the firm's investment is socially optimal ex post but not *ex ante*.

[113]Commission Recommendation of 11/02/2003, C(2003)497

[114] Ian Dobbs and Paul Richards. 2004. "Innovation and the new regulatory framework for electronic communications in the EU." *European Competition Law Review*. Volume 25(11), forthcoming.

patent law which protects the exploitation of property rights for a fixed period of time. A similar approach could be adopted with emerging markets, giving innovators a pre-announced period of time in which their property rights would not be limited by *ex ante* regulation. When the time period starts would need to be made clear by the NRA. In the case of market penetration, the idea would be that *ex ante* regulation may have a role when markets are mature. This might be judged by the level of market penetration, say 50%, or by the rate of growth in market penetration having fallen to low levels (say less than 5% p.a.).

We consider that both sets of actions should be taken.

4.3.4.2 Regulation of new content services

Television broadcasting services are regulated by the Television Without Frontiers (TVWF) Directive, while information society services are subject to much lighter regulation under the e-commerce Directive.[115] The TVWF Directive places minimum standards on advertising, access to major sports events, the protection of minors and the promotion of the production and distribution of European works and was reviewed in 2003. Although the Directive has not been changed, subsidiary legislation has been produced to clarify its application in a number of areas. A number of medium-term issues have been postponed for further discussion and research, including the regulation of audiovisual content. This further discussion will address the issue of whether certain new media services that arguably fall in between information society and traditional broadcast services, for example broadcasts of news or sports clips to mobile phones, should be regulated or not.

Consistent with our approach to regulation of telecoms services, we argue that scope of the TVWF Directive should not be extended to new audiovisual services. These services are at an early stage in their market development and it would seem disproportionate to regulate them when they are ill-defined and their market and social impact is at present unclear. Also, unlike analogue broadcast services, users will be able to define and limit access to undesirable content carried on new services (e.g. through the use of filtering software, parental controls and smart search engines). It would therefore seem premature to impose any additional regulation, particularly as this could risk the development of the services at all.

Key enabler 6: Do not extend the scope of content and advertising regulation to audio-visual services offered over new communications platforms

The Television Without Frontiers Directive, and content and advertising regulation more generally, should not be extended to audio-visual services offered over new platforms, such as DSL, the internet and mobile phones.

4.3.5 ICT sector specific taxes

The communications sector is "taxed" through the imposition of universal service obligations (USO) which could in principle be funded from general taxation. Other current examples of an ICT sector taxes are given by the proposals to set levies on ICT equipment (e.g. mobile

[115] Child protection measures apply to all services (including information society services) under the Council Recommendation on the protection of minors and human dignity, September 1998 and the update announced in the Communication on the Future of European Regulatory Audiovisual Policy, COM(2003) 784, 15 December 2003.

handsets and storage devices) to fund payment for content and proposals in Italy to impose a tax on SMS message to fund other tax cuts.[116] We oppose the imposition of such taxes and levies on economic efficiency grounds.

Key enabler 7: Do not apply sector specific taxes to ICT

We recommend that the ICT sector should not be subject to any sector specific taxes or levies (e.g. on devices), regardless of whether they are used to fund the achievement of public policy or other objectives.

The reasons why we take this position are:

- placing special taxes on a sector that is essential to future competitiveness and economic growth in Europe risks inhibiting this growth;
- it is inefficient in economic terms.[117] US research indicates that the welfare cost of funding the USO through cross subsidy is roughly three times the cost of funding the USO by general taxation.[118] Funding public policy objectives through general taxation or addressing the public policy problem more directly (e.g. by making transfers to specific groups such as those who cannot afford telecom services or putting in place more effective methods of copyright enforcement) are likely to be more efficient.

Under the Universal Service Directive certain obligations apply only to undertakings enjoying SMP or which have been designated as a universal service provider. [119] Typically NRAs designate the incumbent fixed operator as the universal service provider and this entity must provide affordable access to public telephony at a fixed location, voice calls and data communications at rates sufficient to support internet access, directory enquiry services, directories and public pay phones. The Commission will review the scope of the USO in 2005.

In deciding whether the scope of the USO should be changed or redefined, the Commission is required under the USO Directive to take into consideration:[120]

- the services available to the majority of users and whether lack of availability or non-use of those services by a minority of users results in social exclusion;
- whether the availability and use of specific services conveys a general net benefit to all consumers such that public intervention is warranted and the services are not provided to the public under normal commercial circumstances.

From time to time there have been suggestions that the USO should be extended to include the provision of broadband and mobile services. This would need to be justified with reference to the criteria of social exclusion and general net benefit. As shown in Chapter 2, there could be significant economic benefits from increasing the availability of use of

[116] Italy text tax sparks outrage, BBC News World Edition, 13 November 2004. www.bbc.co.uk

[117] In setting policy to maximize welfare in a second-best setting it is not desirable to tax the use of inputs. Peter Diamond and James Mirrlees (1971) "Optimal taxation and public production 1: Production efficiency and 2: Tax rules", *American Economic Review*, vol. 61, pp. 8-27 and 261-78.

[118] Crandall, Hahn, Litan and Wallstein, May 2004, Universal Broadband Access: Implementing President Bush's Vision, AEI- Brookings Center for Regulatory Studies, May 2004.

[119] Chapter II of the Universal Service Directive, 2002/22/EC, 7 March 2002.

[120] Annex V of the Universal Services Directive op. cit.

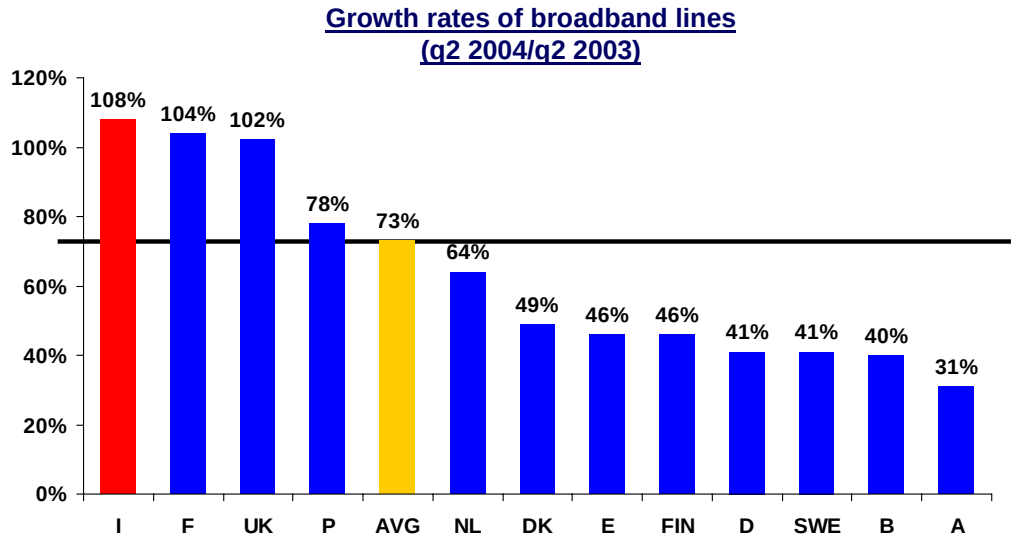
broadband services – fixed and mobile. However, we consider that the USO should not be extended, as the existing USO provides an adequate safety net. Rather, if governments wish to promote economic growth through accelerated adoption of broadband services, then this should be funded from public funds. An example of public subsidies for broadband is given in Italy, where the government has provided a €75 subsidy for each broadband subscriber on a technology neutral basis (see the box below).

The rapid take-up of mobile phones in recent years means there could be a case for narrowing the current scope of the USO by allowing relaxing obligations in respect of call boxes. Penetration of mobile phones on average in the EU 15 is now around 85% and in the accession countries ranges from around 50% in Poland to over 90% in Slovakia and the Czech Republic.[121] As mobile phone use has grown use of call boxes has fallen meaning that the cost of the service has risen while its usefulness has declined substantially. The Commission should consider whether the obligations in respect of call boxes are proportionate and if there is a case for removing universal service obligations to provide call boxes in locations where national networks have mobile phone coverage.

Box 4.4 Incentives for Broadband in Italy

In the 2003 budget law, the Italian Government introduced measures to stimulate demand for broadband services. Every new broadband subscriber benefited from a €75 discount on his bill, and the success of this measure has led to a €50 discount being proposed in the draft 2005 budget law.

Telecom Italia estimates that the incentives had the effect of increasing the number of subscribers by around 25%. The net cost of the gross €30m subsidy is estimated to be €14m after the impact of the additional revenues on VAT and other tax revenues is taken into account.



Source: Telecom Italia, based on ECTA DSL Scorecard, 2004

[121] Mobile Communications, August 3, 2004

4.3.6 Appropriate access to scarce resources

4.3.6.1 Premium content

As discussed in Chapter 3, new video services using premium content, such as films, sports and niche programming, will be a driver of broadband take-up and potentially a growing revenue source for fixed and mobile operators. It will also provide the basis for head-to-head competition between different platforms.

At present rights to use content are sold by the rights holders to distributors (e.g. cinemas, TV broadcasters, video and DVD producers) with conditions on many aspects of the rights including

- the time period for which rights are sold (e.g. rights to football matches are sold for a number of years);
- the platforms on which the content may be distributed (rights for all platforms may be sold as a bundle or in separate pieces);
- the timing of distribution from first release (e.g. pay-TV services may show films five months after the cinema release);
- the number of times and countries in which the content may be shown.

All these conditions, such as long exclusivity clauses and hold-back clauses, limit the possibility for new media to access content rights thereby preventing distribution of content to end-users. In some countries in Europe new platform providers (fixed and mobile) have not been able to obtain access to premium content because the rights have already been sold to the incumbent broadcasters and, although these rights may be re-tendered at some point, there is concern that the incumbents will be able to retain the rights by paying most for them.

Premium content largely comprises major league football matches and popular films. Borrowing terminology from telecoms regulation it could be described as non-replicable. In a convergent environment where new media could in principle compete with traditional platforms, access to content under competition rules is key to creating a level playing field among all players.

The European Commission (DG Competition) has initiated a number of investigations in this area covering film and music distribution on the internet and the sale of sports rights by UEFA and the English and German football leagues. The Commission's decisions on the UEFA and, more recently, the German Bundesliga cases required UEFA and the German Football Federation to engage in more transparent processes for the tendering of rights, to unbundle the rights into disaggregated packages for shorter durations, to offer rights for transmission over mobile networks and the internet, and to allow clubs to sell certain rights. The commitments under the Bundesliga case have been published and are legally binding.[122] A similar approach has been proposed by the Commission in the case of the English Premier League.[123]

[122] Commitments of the Ligaverband in Case COMP/C.2/37.214 – Joint selling of the media rights to the German Bundesliga, DG Competition, C-2 D(2004); Notice on the Joint selling of media rights to the German Bundesliga, OJEC, 2004/C229/04, 14 September 2004.

[123] Notice on the joint selling of the media rights of the FA premier League on an exclusive basis, C115/3, 30 April 2004.

These cases and the accompanying comments by the Commission indicate that it is seeking to liberalise broadcasting rights in connection with new media such as 3G mobile and the broadband internet. It is our view that the position taken by the Commission in these cases should be extended to contracts for other types of premium or non-replicable content and should be applied by national competition authorities/regulators. This will help promote the development of competition in the supply of new services and thereby increase consumer welfare.

Key enabler 8: Remove unjustified restrictions on access to premium content

The European Commission should continue its efforts to remove unjustified restrictions on access to premium content, so as to promote competition in markets for content services.

4.3.6.2 Radio spectrum

The growth in cross platform competition over the next five years will come from competition between telecom operators and cable operators and from wireless applications, in particular mobile services and broadband fixed and nomadic services, such as WiFi and WiMax. The economical and rapid deployment of wireless services requires radio spectrum to be made available in a timely manner. If existing national and European regulatory frameworks allowed greater flexibility in spectrum in use this could mean new services will come to market more quickly.

EU legislation which impacts upon spectrum management includes:

- The spectrum management policy framework (notably the Spectrum Policy Decision[124] and Radio Spectrum Policy Group Decision[125]);
- The new regulatory framework for electronic communications and services (notably the Framework Directive[126] and Authorisation Directive[127]);
- The "New Approach" Directives which govern the placing of electronic communications equipment onto the market (notably the Radio and Telecommunications Terminal Equipment Directive[128]).

In addition, in some frequency bands, specific harmonisation measures constrain NRAs in how spectrum is used.[129] Harmonisation more generally is undertaken by the ECC within the CEPT. Although adherence to CEPT measures is voluntary the Spectrum Decision (para 12) notes that the Commission could adopt implementation measures with the assistance of the Radio Spectrum Committee, comprising representatives of member states and chaired by the Commission. Frequency assignments are generally determined at a national level but are

[124] Decision 676/2002/EC, on a regulatory framework for radio spectrum policy in the European Union, OJ L 108, p. 1

[125] Decision 2002/622/EC, on establishing a Radio Spectrum Policy Group, OJ L 198, p.49

[126] Directive 2002/21/EC, on a common regulatory framework for electronic communications networks and services, OJ L 108, Articles 8 and 9

[127] Directive 2002/20/EC, on the authorisation of electronic communications networks and services, OJ L 108, Articles 5-8

[128] Directive 1999/5/EC, on Radio Equipment and Telecommunications Terminal Equipment and the mutual recognition of their conformity, OJ L91, p. 10

[129] In particular the GSM Directive, the UMTS Decision, the ERMES Directive, the DECT Directive and the Satellite PCS Decision.

subject to the provisions of the Authorisation Directive which require assignment processes to be transparent, non-discriminatory and proportionate.

Approaches to making this framework more flexible have been suggested in a number of studies and include:[130]

- introducing trading of rights to use spectrum, so that these rights can be bought and sold like rights to use of other resources. Trading ranges from a simple transfer of ownership, to leasing and aggregation and disaggregation of licences;
- allowing liberalisation of spectrum use, so that service and technology limitations on the use of bands are removed or reduced and are replaced by a set of interference constraints.

Spectrum trading and liberalisation have been adopted in the US, where the FCC has recently adopted spectrum leasing rules[131], in Canada, Guatemala, New Zealand and Australia. A number of countries in Europe plan to introduce at least simple trading of licences and others are considering more complex forms of trading. For example, the UK government plans to introduce trading and liberalisation in a phased way over the next five years.

A recent study for the Commission found that the benefits of trading and liberalisation in the EU would be substantial – around €8-9bn per annum - and recommended that the Commission should oblige member States to introduce trading and liberalisation through the use of appropriate binding measures.[132] The Radio Spectrum Policy Group[133] has been asked by the Commission to advise on spectrum trading matters and it has consulted on the issue. It found there was general support for secondary trading and for an EU approach based on promotion of discussion and exchanges of national experience and identification and promulgation of best practice.[134] We agree with this position, but consider that more experience with trading in Europe and demonstration of the benefits in practice are required before any specific harmonisation measures are considered.

Flexibility in spectrum use would also be facilitated by a technology neutral approach to the allocation of harmonised bands. In this regard, we suggest that the Commission considers rescinding Directives constraining the technology that may be used in spectrum allocated to

[130] Study on conditions and options in introducing secondary trading of radio spectrum in the European Community, Analysys and Dotecon for the EC, May 2004; Review of Radio Spectrum Management, Professor Martin Cave, for the UK Department for the Trade and Industry and HM Treasury, March 2002; The costs and benefits of relaxing European measures for frequency harmonisation and equipment standardisation, Indepen and Aegis Systems, for Ofcom, March 2004

[131] FCC Adopts Spectrum Rules and Streamlined processing for Licence Transfer and Assignment Applications, and Proposes Further Steps to Increase Access to Spectrum through Secondary Markets, FCC, May 15 2003. Report and Order and Further Notice of Proposed Rulemaking, FCC, October 6, 2003.

[132] Analysys and Dotecon, May 2004, "Study on conditions and options in introducing secondary trading of radio spectrum in the European Community".

[133] This group was established under Commission Decision 2002/622/EC. The role of the RSPG is to advise the Commission on radio spectrum policy issues, on co-ordination of policy approaches and on harmonised conditions necessary for the functioning of the internal market.

[134] RSPG Sub-group on spectrum trading, Report from the RSPG Consultation, RSPG04-43. http://rspg.groups.eu.int/documents/meeting_documents/index_en.htm

2G mobile, ERMES and DECT. The relevant Directives are no longer necessary for harmonisation purposes and potentially constrain future use of the bands they cover.[135]

Key enabler 9: Adopt more flexible spectrum management

We support moves to introduce spectrum trading in Europe. The European Commission should facilitate the identification and dissemination of best practice in spectrum trading. The Commission should also adopt a technology neutral approach to the allocation of harmonised bands which takes account of convergence.

4.4 Making ICT use effective

In Chapter 2 we reviewed evidence which points to the importance of making labour and product markets more flexible, so as to increase the benefits organisations may gain from use of ICT. This section discusses the policy implications of this finding.

4.4.1 Labour market flexibility

There are a number of ways in which labour markets could be made more flexible including

- changing regulations so that recruitment and redundancy of employees becomes quicker and cheaper;
- removing restrictions (e.g. collective bargaining agreements) which prevent employers offering market driven wage differentials to workers with different skills and experience;
- improving skill levels and providing opportunities for retraining.

For those firms competing in a global market, such as telecom equipment manufacturers, flexibility to recruit employees and make them redundant, and pay market determined wages are essential to being internationally competitive. Jobs will increasingly move to less regulated, low cost environments if this flexibility is not available in Europe.

We disagree with the Kok report's conclusion that flexibility is solely about skill levels and retraining. The evidence presented in Chapter 2 indicates that to capture the benefits from ICT, things have to be done differently. In many situations, this will mean firms will need to change the types of people they employ (see the Johnson and Johnson case study in Chapter 2) and attract new employees. The Kok report notes the need to attract and retain a highly educated labour force (including the best scientific brains in the world). We suggest an important element of this is having the flexibility to pay attractive salaries to employees.

Concern has been expressed in both Europe and the US that ICT will result in a net loss of jobs, partly because of efficiency gains and partly because electronic communications allow the outsourcing or relocation of jobs to lower cost economies (e.g. India). The standard arguments in favour of trade liberalisation suggest that employment will not fall over the

[135] This issue is analysed more fully in "The costs and benefits of relaxing European measures for frequency harmonisation and equipment standardisation", Indepen and Aegis Systems, A study for Ofcom, March 2004

medium term, although in the composition of employment may change and this may lead to short-term job loss and may disproportionately affect employment in some regions.[136]

Forrester predict that in the US offshoring will result in job losses to 2015 of the order of 300,000 per annum, which is very small compared with the "normal" creation and destruction of around 30m jobs each year in the US economy.[137] Netting-off jobs in-sourced to the US from other countries (e.g. for legal, medical and accounting services), then the numbers are even smaller. Indeed, the US has a very large trade surplus in services, at $51.1bn in 2003, which suggests the net balance of in- and outsourcing is in the US's favour. Box 4.5 gives an example of how outsourcing can create jobs.

Recent evidence on the net balance of trade for in-sourcing and outsourcing of business, computer and information services for a number of countries shows that service outsourcing is generally small, say, when compared with materials outsourcing.[138] In 2002 the countries with the biggest surplus were the UK, the US, Hong Kong, India, Singapore, China and France, whereas those with the biggest deficit were Russia, Italy, Korea, Indonesia, Japan and Germany. This research also finds that there is no evidence of a negative impact of offshoring on employment in either the US or the UK.

Box 4.5 Example of outsourcing resulting in domestic job growth

A US firm wished to make software that would allow biotech companies to exploit better the new human genome research. This was only viable if the coding work was outsourced to India. The business is now very profitable and employs six engineers in the US for each engineer employed in India.

Source: The Muddles over Outsourcing, J Bhagwati, A Panagariya and T Srinivasan, Journal Economic Perspectives, Fall 2004

http://www.columbia.edu/~ap2231/Policy%20Papers/JEP_Outsourcing_Final.pdf

Analysis by McKinsey (2004) comparing the impacts of offshoring in the US and Germany shows the need for reform of labour laws in Germany if it is to reap the same gains from outsourcing as those enjoyed by the US.[139] McKinsey finds that for every dollar of spending that US companies transfer to India there is a net gain to the US of $0.13 through cost savings to businesses, increased exports to India, repatriated earnings and the additional economic output created when US workers are re-employed in other jobs. By contrast, for Germany it is estimated that every euro spent offshore (mainly in moving jobs to Eastern Europe) there is a net loss of €0.2. The main factor explaining this difference is that the value from re-employing German labour is much lower than that from re-employing US labour. This is attributed to more restrictive labour laws in Germany as compared with the US.

[136] Advanced Institute of Management Research, November 2004, "Offshoring of business services and its impact on the UK economy", L Abramovsky, R Griffith and M Sako; Amiti, M. and Wei, S-J. (2004), "Fear of Outsourcing: Is It Justified ?", NBER Working Paper No. 10808.

[137] Reported in Muddles Over Outsourcing, Bhagwati et al (2004), Journal of Economic Perspectives, Fall 2004.

[138] Amiti and Wei (2004), "fear of Outsourcing: is it justified?", NBER Working Paper 10808, September 2004.

[139] How Germany can win from offshoring, Diana Farrell, McKinsey Quarterly, 2, November 2004.

Key enabler 10: Seek to achieve greater labour market flexibility

We recommend that those Member States with restrictive labour laws seek to make these more flexible, so as to give incentives for firms to invest in ICT, enable "creative destruction" and to retain domestic employment. This may need to be twinned with policies for retraining displaced workers to speed up movement between jobs.

4.4.2 Product market flexibility

The evidence presented in Chapter 2 indicates that member states also need to consider improving product market flexibility. This would involve reducing the time and money costs of setting up and shutting down businesses, and removing restrictions on business location, on competition (i.e. deregulate) and other aspects of business operation (e.g. opening hours). The package of measures that might be adopted will vary from country to country depending on their starting point and policy priorities.

We also noted in Chapter 2 that there are economies of scale associated with effective use of ICT in the services sector. Greater integration of the European markets in the services sector is required to take advantage of these economies.

Key enabler 11: Promote product market flexibility

Member states should actively review regulations that impede product market flexibility with a view to determining areas where some relaxation would be beneficial. The proposed European Services Directive, which is aimed at achieving greater integration of services markets in Europe, will assist the effective use of ICT by business.

4.4.3 ICT in the public sector

In Chapter 2, we identified the following impediments to the effective use of ICT in the public sector: inappropriate focus, incentives for public servants, and budgetary processes; rigid labour contracts; silos in government; the value of ICT being poorly understood; and limited take-up of ICT amongst heavy users of public services.

There are a number of EU-level policy initiatives aimed at addressing some of these issues, including the e-Government Communication (and its attached list of actions); the e-health action Plan, the e-learning plan, the e-Europe Action plan, studies examining the impact of eGovernment and e-health initiatives and funding for R&D, pilot and implementation programmes for national and pan-European services.

These policies are particularly focused on:[140]

- encouraging national governments to put in place plans for e-Government, e-health and e-learning;
- promoting the exchange of best practice;
- benchmarking progress within Europe;
- fostering closer co-operation between stakeholders;

[140] e-Government Communication and the Action Plans for eEurope, e-learning and e-health.

- promoting interoperable systems across Europe, particularly in the health arena (e.g. the e-health insurance card[141] and interoperability of electronic health records);
- accelerating the deployment of ICT in the provision of public services through pilot programmes;
- issues of privacy, security and trust;
- digital divide issues.[142]

Areas where we have specific suggestions concern best practice dissemination, international benchmarking and the complementary organisational changes required in government to realise the benefits of ICT.

4.4.3.1 Best Practice Dissemination

Measuring the scale of the net economic benefits from e-policy projects, the time they take to be realised and understanding their drivers is crucial to knowing what best practice is, getting best value from ICT expenditures and persuading finance ministries and senior management to allocate funds for investment in e-policy.

We therefore support strongly the development of appropriate methodologies for the evaluation of the costs and benefits of e-policy and for governments to be encouraged to put in place monitoring programmes to track these costs and benefits over time. We suggest that the Commission sponsors work on methodological issues. The chosen methodology should then be implemented in EC funded pilot programmes and the EC should seek to promote use of the method at a national level. Such methodological work is required because approaches used so far to appraise e-policy initiatives have generally been very partial and government centric (i.e. do not count user benefits). In addition, evaluation of the benefits is not likely to be straightforward given the need to control for factors other than ICT on, for example, health and educational outcomes and measuring these outcomes themselves is difficult. Hence, guidance is necessary. Intermediate measures of outputs rather than outcomes may need to be used, and we note these are increasingly being used by governments to justify their expenditures and to account for the performance of public services.

Failures as well as successes can be instructive. Most of the literature we have read in the course of this work presents projects as successes rather than failures (and we have done the same in earlier sections), although there is often not sufficient data reported to know which situation applies. We think it is important that failed projects as well as projects thought to be successes are appraised and, in its work on best practice dissemination, the Commission should collect information on failures and reasons for failures so that the mistakes made can be avoided in future.

Finally, benchmarking is a central element of the *e*Europe Action Plan and a key theme of the Lisbon agenda is Europe's performance relative to that of other countries – particularly the US

[141] Such cards can reduce fraud, improve quality of care and reduce multiple examinations. In Germany BITKOM estimates such a card would have a payback period of about 4 years. "Health Card brings in the bonuses", Press Release, BITKOM, 15 June 2004. .

[142] The issue of how to bridge the digital divide in terms of broadband territorial coverage in rural areas was addressed in a recent report of the *e*Europe Advisory Group's Expert Chamber. The report concluded that the private sector is likely to deliver broadband access to all but the most sparsely populated areas. Work Group No1: "Digital Divide and Broadband Territorial Coverage", *e*Europe Advisory Group, June 2004.

and Asia – which can only be assessed using benchmark data from these countries. The mid-term review of the Plan noted the need to provide comparative data for countries outside as well as within Europe.[143] This point does not appear to have been picked up in the Updated Action Plan. We suggest that the Commission identifies best practice countries and comparable data are collected or constructed.[144] A key question in doing this is what data should be collected for benchmarking purposes. So far, the data collected have focused on the supply of services, with no regard to their cost or use. We recommend that the Commission undertakes a review of the benchmarking data it collects with a view to considering whether more user-focused data could be collected (say through tracking surveys).

4.4.3.2 Complementary organisational and budgetary change

The more intractable issues concerning the organisation of government, budget processes, fiscal policy, labour contracts and incentive structures have not really been tackled by specific policies at a European level. While these are primarily issues for national governments, the Commission could play an important role in developing and disseminating ideas for reform.

Budgetary processes and fiscal policies that would support capital labour substitution and so be more ICT friendly. The public sector has never been through a programme of capital for labour substitution on the scale that will be required over the next few decades. It is therefore not surprising that budget processes and fiscal policies are not well suited to long-term investment. Approaches used in the private sector are not readily transferable to the public sector because it is much more difficult withhold future funding if the investments fail and there is no capital market discipline. New approaches to budgeting are therefore required.[145]

4.4.3.3 Providing incentives for user-oriented service delivery through cross-departmental working within government.

A first step towards transforming the way government delivers services is to promote cross-departmental working to provide integrated services. This could simply involve joint use of infrastructure and ICT services and single portals for access or more complex integration of health, welfare and social services. One role the Commission could play would be to explicitly focus any funding of pilot programmes on projects that cross traditional departmental boundaries, provide the user with a new service that integrates elements from different parts of government and seek to reduce duplication within government.

Key enabler 12: Enable use of ICT in the public sector

In respect of the deployment of ICT in the public sector we recommend that:

- *more rigorous analysis of the costs and benefits of e-policy projects is undertaken at a national and pan-European level. A comprehensive measurement methodology is required and the European Commission could fund research in this area. Otherwise it will be difficult to know what constitutes good practice*

[143] See section 4.1 of the Mid-term Review, 18 February 2004.

[144] We understand that OECD may also be initiating some work in this area.

[145] These issues are also being considered by the World Bank. Leipziger D (2004), "Infrastructure and Growth: the Role of the Public sector", presented at Public Expenditure and Growth Seminar, World Bank, October 2004.

- *the benchmarking undertaken by the European Commission is reviewed with the aim of including the best practice countries outside Europe and collecting more data on the use rather than on the supply of e-policy services*
- *the European Commission develops and disseminates ideas on how to make government budgetary processes and fiscal policies more supportive of capital investment including ICT investment*
- *the European Commission promotes e-policy services that are "joined up" across traditional departmental or agency boundaries by targeting its funding of e-policy initiatives on such projects.*

4.5 Summary of recommendations

In summary, our recommendations are as follows. These are organised by the two key themes of promoting innovation and investment making investment in ICT profitable.

4.5.1 Promoting innovation and investment

Key enabler 1: Take account of the spillover benefits from ICT

We recommend that when developing new legislation and policy the European Commission and national governments take account of the impacts on the ICT sector and use of ICT. Examples of areas to which this principle should be applied include e-money legislation, patents for computer-implemented inventions and EU funding for research and development.

Key enabler 2: Focus on the dynamic gains from market expansion

We recommend that NRAs are required to take account of the dynamic impacts of their decisions. This will involve placing more weight on innovation and investment relative to short-term price objectives. In particular, when balancing the risks between over- and under-investment, NRAs should make decisions in favour of promoting investment in communications infrastructure.

Key enabler 3: Allow operators to have retail price flexibility

We recommend that regulators should allow operators to have retail price flexibility for new services and flexibility to jointly price new and old services that can be provided over new common infrastructure.

Key enabler 4: Focus regulation on non-replicable facilities and use competition policy more

We recommend that ex ante regulation is focused on non-replicable facilities. This would ensure regulation was focused on areas where an operator clearly has monopoly power and so abuse is most likely to occur. Otherwise regulation by competition policy would apply.

We propose that regulators should pre-commit to roll-back regulation once regulated facilities are replicated in a given locality. Pre-defined triggers for the removal of regulation need to be decided and regulated prices must be set appropriately, taking due account of market risks, price dynamics and the external benefits of infrastructure competition.

As a short-term measure the ERG Guidance could be changed so that NRAs must justify ex ante remedies on SMP operators in terms of the net benefits relative to the application of competition law.

4.5.2 Emerging markets

Key enabler 5: Commit not to apply sector specific regulation to emerging markets

We recommend that the European Commission commits not to add markets to the list given in the Recommendation on Relevant Markets and that NRAs commit not to regulate emerging markets, either for a fixed period of time or until certain market penetration levels are reached. When these triggers are reached the onus would be on the NRA to demonstrate the net benefits of ex ante regulation relative to the continued application of ex post competition policy.

Key enabler 6: Do not extend the scope of content and advertising regulation to audio-visual services offered over new communications platforms

The Television Without Frontiers Directive, and content and advertising regulation more generally, should not be extended to audio-visual services offered over new platforms, such as DSL, the internet and mobile phones.

4.5.3 ICT sector specific taxation

Key enabler 7: Do not apply sector specific taxes to ICT

We recommend that the ICT sector should not be subject to any sector specific taxes or levies (e.g. on devices), regardless of whether they are used to fund the achievement of public policy or other objectives.

4.5.4 Access to key resources

Key enabler 8: Remove unjustified restrictions on access to premium content

The European Commission should continue its efforts to remove unjustified restrictions on access to premium content, so as to promote competition in markets for content services.

Key enabler 9: Adopt more flexible spectrum management

We support moves to introduce spectrum trading in Europe. The European Commission should facilitate the identification and dissemination of best practice in spectrum trading. The Commission should also adopt a technology neutral approach to the allocation of harmonised bands which takes account of convergence.

4.5.5 Making ICT investment effective

Key enabler 10: Seek to achieve greater labour market flexibility

We recommend that those Member States with restrictive labour laws seek to make these more flexible, so as to give incentives for firms to invest in ICT, enable "creative destruction"

and to retain domestic employment. This may need to be twinned with policies for retraining displaced workers to speed up movement between jobs.

Key enabler 11: Promote product market flexibility

Member states should actively review regulations that impede product market flexibility with a view to determining areas where some relaxation would be beneficial. The proposed European Services Directive, which is aimed at achieving greater integration of services markets in Europe, will assist the effective use of ICT by business.

Key enabler 12: Enable use of ICT in the public sector

In respect of the deployment of ICT in the public sector we recommend that:

- *more rigorous analysis of the costs and benefits of e-policy projects is undertaken at a national and pan-European level. A comprehensive measurement methodology is required and the European Commission could fund research in this area. Otherwise it will be difficult to know what constitutes good practice*
- *the benchmarking undertaken by the European Commission is reviewed with the aim of including the best practice countries outside Europe and collecting more data on the use of rather than the supply of e-policy services*
- *the European Commission develops and disseminates ideas on how to make government budgetary processes and fiscal policies more supportive of capital investment including ICT investment*
- *the European Commission promotes e-policy services that are "joined up" across traditional departmental or agency boundaries by targeting its funding of e-policy initiatives on such projects.*

Glossary

2G	Second generation of mobile telephony systems using digital encoding. 2G networks support voice, low speed data communications, and short messaging services
2.5G	In mobile telephony, 2.5G protocol extends 2G systems to provide additional features such as packet-switched connection (GPRS) and enhanced data rates
3G	Third generation of mobile telephony systems. 3G provides high-speed data transmission and supporting multimedia applications such as full-motion video, video-conferencing and internet access
ADSL	Asymmetric Digital Subscriber Line. A digital technology that allows the use of a copper line to support high bandwidths in one direction and a lesser bandwidth in another direction
ADSL2+	A version of ADSL that allows speeds of up to 24 Mb/s
AltNet(s)	Alternative fixed network operator
ARPU	Average Revenue Per Unity
ATM	Asynchronous Transfer Mode, a standard for high speed data communications
BITKOM	German Association for Information Technology, Telecommunications and New Media
Bluetooth	Wireless standard for short-range radio communications between a variety of devices such as PCs, headsets, printers, mobile phones, and PDAs
BPO	Business Process Outsourcing
BRT	Brussels Round Table
BT	British Telecommunications plc
CATV	Cable television
CD	Compact Disc
CDMA	Code Division Multiple Access
CEPT	European Conference of Postal and Telecommunications Administrations
DECT	Digital European Cordless Telecommunication system. ERC Decision ERC/DEC/(94)03 refers
DG	Directorate General
DGInfoSoc	Directorate General Information Society
DSL	Digital Subscriber Line. A family of technologies generally referred to as DSL, or xDSL, capable of transforming ordinary telephone lines (also known as 'twisted copper pairs') into high-speed digital lines, capable of supporting advanced services such as fast internet access and video-on-demand. ADSL, HDSL (High data rate Digital Subscriber Line) and VDSL (Very high

	data rate Digital Subscriber Line) are all variants of xDSL
DVD	Digital Versatile Disc or Digital Video Disc. A type of optical disc technology
DWDM	Dense Wavelength Division Multiplexing. An optical technology used to increase bandwidth over existing fiber optic backbones
EBITDA	Earnings before Interest, Depreciation and Amortisation
EC	European Commission
ECC	Electronic Communications Committee within the CEPT
ECN	Electronic Communication Network
EDGE	Enhanced Data Rates for GSM Evolution
EITO	European Information Technology Organisation
ERG	European Regulators Group
ERMES	European Radio Messaging System
EU	European Union
EU-14	EU-14 refers to the pre-1st May 2004 fifteen-member EU, less the United Kingdom
EU-15	Refers to the pre-1st May 2004 fifteen-member EU: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom
EV-DO	EVolution, Data-Only. Part of a family of CDMA digital wireless standards; a 3G standard
EV-DV	EVolution, Data and Voice. Part of a family of CDMA digital wireless standards
Ex ante	Before an event takes place
FCC	Federal Communications Commission (US)
FTTC	Fibre-to-the-curb
FTTH	Fibre-to-the-home
G7	Group of 7, refers to the seven leading industrial nations that meet annually to address the major economic and political issues facing their nations and the international community as a whole. Those seven nations are Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation. GFCF consists of resident producers' acquisitions, less disposals of fixed assets during a given period, plus certain additions to the value of non-produced assets stemming from the productive activity of producer or institutional units

GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
HR	Human Resources
ICT	Information and Communications Technology
IETF	internet Engineering Taskforce
IMF	International Monetary Fund
IP	internet Protocol. The packet data protocol used for routing and carriage of messages across the internet and similar networks
iPod	A combination digital audio player and portable hard drive from Apple Computer
ISP	internet Service Provider. A company that provides access to the internet
IT	Information Technology
ITU	International Telecommunications Union. A group of representatives from 161 countries headquartered in Geneva, Switzerland. The ITU publishes recommendations that influence telecom engineers, designers, manufacturers, and service providers around the world. These have the status of an international treaty and are binding on member states
LAN	Local Area Network. A network allowing the interconnection and intercommunication of a group of computers on a single site, primarily for the sharing of resources and exchange of information (e.g. email)
LRIC	Long Run Incremental Cost. The costs caused by the provision of a defined increment of output, taking a long run perspective, assuming that some output is already produced. The 'long run' means the time horizon over which all costs (including capital investment) are variable
MFP	Multi Factor Productivity
MIT	Massachusetts Institute of Technology
MMS	Multimedia Messaging Service. A descendent of SMS, MMS extends text messaging to include longer text, graphics, photos, audio clips, video clips, or any combination of the above, within certain size limits
MPEG	Moving Picture Experts Group. MPEG is the name of family of standards used for coding audio-visual information (e.g. movies, video, music) in a digital compressed format
MVNO	Mobile Virtual Network Operator
Narrowband	A service or connection providing data speeds up to 128 kbit/s, such as an analogue telephone line, or via ISDN
NASDAQ	National Association of Securities Dealers Automated Quotations. A computerized data system to provide brokers with price quotations for securities traded over the counter
NBER	National Bureau of Economic Research

NGN	Next Generation Network
NRA	National Regulatory Authority
NRF	New Regulatory Framework for the EU
OASIS	Organisation for the Advancement of Structured Information Standards. OASIS is a not-for-profit, international consortium that drives the development, convergence, and adoption of e-business standards
OECD	Organisation for Economic Co-operation and Development
OFCOM	Office of Communications. The UK regulator for the communications industries, created by the Communications Act
OFTA	Office of the Telecommunications Authority, Hong Kong
OGSA	Open Grid Services Architecture
ONS	Office for National Statistics
OUN	Open Universiteit Nederland
PBX	Private Branch Exchange. A PBX is a private telephone network used within an organisation
PC	Personal Computer
PDA	Personal Digital Assistant. A PDA is a handheld device that combines computing, telephone/fax, internet and networking features
R&D	Research and Development
RFID	Radio Frequency Identification systems
RSPG	Radio Spectrum Policy Group. The RSPG assists and advises the EC on radio spectrum policy issues, on co-ordination of policy approaches and, where appropriate, on harmonised conditions with regard to the availability and efficient use of radio spectrum necessary for the establishment and functioning of the Internal Market
SMEs	Small-Medium Enterprises
SMP	Significant Market Power. This test is set out in the EU Framework Directive, and is aligned with the competition law definition of 'dominance'
SMS	Short Message Service. A method of sending text messages that are 160 characters in length or shorter over a mobile phone
SoftSwitch	SoftSwitch is the concept of separating the network hardware from network software. In traditional circuit switched networks, hardware and software is not independent
SPAM	Unsolicited bulk email
TELRIC	Total Element Long Run Incremental Cost
TFP	Total Factor Productivity
TV	Television

TVWF	Television Without Frontiers Directive
UEFA	Union of European Football Associations
UMTS	Universal Mobile Telecommunications System (3G mobile standard)
Universal Service Provider	Telecoms operators who are designated by Ofcom as Universal Service Providers. Currently BT and, in the city of Hull, Kingston Communications
Universal Service	A certain minimum set of services that should be provided to all citizens, or those with special needs
USO	Universal Service Obligation. The set of Universal Services that Universal Service Providers are required to supply
VAT	Value Added Tax
VDSL	Very high data rate Digital Subscriber Line
VoIP	Voice over internet Protocol. A technology for transmitting voice, such as ordinary telephone calls, over packet-switched data networks
VPN	Virtual Private Network. A VPN is a network that is constructed by using public wires to connect nodes
W3C	World Wide Web Consortium, the organization that develops standards for the web community
W-CDMA	Wideband Code Division Multiple Access
WiFI	Wi-Fi is a WLAN technology. It primarily provides short-range, high-speed data connections between mobile data devices (such as laptops) and nearby Wi-Fi access points (special hardware connected to a wired network)
WiMax	802.16, a fixed wireless access technology
WLAN	Wireless Local Area Network
WSi	Wireless Strategic Initiative. The WSi is an R&D project sponsored by the European Commission that provides a focus for the conceptual work of future wireless systems and that opens a range of the most advanced research prototypes and testbeds to other successful projects with a wireless component
xDSL	Digital Subscriber Line

Appendix A: Forecasts for the EU-15, US and Japan

EU-15

Forecast (i) – productivity trend

European Union (15 members)							Forecast				
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Labour input growth	1.9%	1.3%	0.5%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%
Labour productivity growth	1.6%	0.4%	0.5%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
GDP growth	3.4%	1.7%	1.1%	2.2%	2.2%	2.2%	2.1%	2.1%	2.1%	2.1%	2.1%
GDP (real)	8,571,003	8,714,760	8,807,320	8,870,111	9,044,901	9,258,686	9,455,174	9,655,832	9,860,749	10,070,014	10,283,720
Inflation	2.9%	1.7%	2.4%	0.7%	2.0%	1.8%	2.0%	2.0%	2.0%	2.0%	2.0%
GDP (nominal)	8,571,003	8,867,920	9,178,806	9,306,602	9,680,746	10,088,550	10,510,777	10,950,675	11,408,984	11,886,474	12,383,948
ICT value added / GDP	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%
ICT value added (nominal)	493,137	515,790	533,872	541,305	563,066	586,786	611,344	636,930	663,587	691,359	720,294
ICT producing labour productivity growth	7.0%	2.8%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.8%	6.8%	6.8%
Employment in ICT producing sector	6,452	6,672	6,330	5,884	5,610	5,359	5,117	4,885	4,663	4,450	4,245
ICT-using services value added / GDP	21.3%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%
ICT-using services value added (nominal)	1,829,482	1,908,570	1,975,479	2,002,984	2,083,508	2,171,276	2,262,149	2,356,824	2,455,462	2,558,229	2,665,296
ICT using labour productivity growth	8.5%	3.8%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
Employment in ICT using sector	35,049	35,814	35,818	35,060	35,176	35,326	35,468	35,610	35,753	35,896	36,040
ICT investment / GDP	2.7%	2.6%	2.6%	2.6%	2.6%	2.6%	2.7%	2.9%	3.0%	3.1%	3.2%
ICT investment (nominal)	232,725	231,448	239,562	242,897	252,662	263,306	287,584	313,432	340,941	370,204	401,318
GFCF / GDP	15.3%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%
GFCF (nominal)	1,315,648	1,342,702	1,389,773	1,409,123	1,465,772	1,527,519	1,591,448	1,658,054	1,727,447	1,799,744	1,875,067

EU-15

Forecast (ii) – productivity catch-up

European Union (15 members)							Forecast				
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Labour input growth	1.9%	1.3%	0.5%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%
Labour productivity growth	1.6%	0.4%	0.5%	1.7%	1.7%	1.7%	1.7%	1.8%	1.8%	1.9%	1.9%
GDP growth	3.4%	1.7%	1.1%	2.2%	2.2%	2.2%	2.1%	2.2%	2.2%	2.3%	2.3%
GDP (real)	8,571,003	8,714,760	8,807,320	8,870,111	9,044,901	9,258,686	9,459,146	9,668,006	9,885,629	10,112,397	10,348,712
Inflation	2.9%	1.7%	2.4%	0.7%	2.0%	1.8%	2.0%	2.0%	2.0%	2.0%	2.0%
GDP (nominal)	8,571,003	8,867,920	9,178,806	9,306,602	9,680,746	10,088,550	10,515,193	10,964,482	11,437,771	11,936,502	12,462,213
ICT value added / GDP	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%
ICT value added (nominal)	493,137	515,790	533,872	541,305	563,066	586,786	611,601	637,733	665,261	694,269	724,846
ICT producing labour productivity growth	7.0%	2.8%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.8%	6.8%	6.8%
Employment in ICT producing sector	6,452	6,672	6,330	5,884	5,610	5,359	5,120	4,892	4,675	4,468	4,272
ICT-using services value added / GDP	21.3%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%
ICT-using services value added (nominal)	1,829,482	1,908,570	1,975,479	2,002,984	2,083,508	2,171,276	2,263,099	2,359,796	2,461,658	2,568,996	2,682,140
ICT using labour productivity growth	8.5%	3.8%	1.7%	1.7%	1.7%	1.7%	1.7%	1.8%	1.8%	1.9%	1.9%
Employment in ICT using sector	35,049	35,814	35,818	35,060	35,176	35,326	35,468	35,610	35,753	35,896	36,040
ICT investment / GDP	2.7%	2.6%	2.6%	2.6%	2.6%	2.6%	2.7%	2.9%	3.0%	3.1%	3.2%
ICT investment (nominal)	232,725	231,448	239,562	242,897	252,662	263,306	287,704	313,828	341,801	371,762	403,854
GFCF / GDP	15.3%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%	15.1%
GFCF (nominal)	1,315,648	1,342,702	1,389,773	1,409,123	1,465,772	1,527,519	1,592,117	1,660,144	1,731,806	1,807,319	1,886,918

United States

Forecast (i) – productivity trend

United States							Forecast				
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Labour input growth	2.5%	0.0%	-0.3%	1.0%	1.0%	1.0%	0.8%	0.8%	0.8%	0.8%	0.8%
Labour productivity growth	1.1%	0.7%	2.2%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
GDP growth	3.6%	0.8%	1.9%	3.3%	3.3%	3.3%	3.1%	3.1%	3.1%	3.1%	3.1%
GDP (real)	9,817,000	9,891,194	10,078,657	10,382,575	10,824,470	11,169,330	11,521,002	11,883,746	12,257,912	12,643,858	13,041,957
Inflation	2.1%	2.4%	1.6%	1.8%	1.0%	0.9%	2.0%	2.0%	2.0%	2.0%	2.0%
GDP (nominal)	9,817,000	10,128,000	10,487,000	11,004,000	11,591,951	12,074,395	12,706,162	13,370,985	14,070,594	14,806,808	15,581,543
ICT value added / GDP	6.6%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%
ICT value added (nominal)	643,117	643,490	666,299	699,147	736,503	767,155	807,295	849,535	893,985	940,761	989,984
ICT producing labour productivity growth	7.6%	8.7%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Employment in ICT producing sector	6,873	6,708	6,285	5,967	5,688	5,361	5,104	4,860	4,628	4,406	4,196
ICT-using services value added / GDP	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%
ICT-using services value added (nominal)	2,513,543	2,594,980	2,686,962	2,819,427	2,970,071	3,093,682	3,255,552	3,425,892	3,605,145	3,793,776	3,992,278
ICT using labour productivity growth	4.2%	6.7%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%
Employment in ICT using sector	37,825	37,042	36,212	35,748	35,306	34,358	33,779	33,209	32,650	32,099	31,558
ICT investment / GDP	4.7%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%
ICT investment (nominal)	464,407	419,321	434,185	455,590	479,932	499,906	526,063	553,588	582,554	613,034	645,110
GFCF / GDP	16.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
GFCF (nominal)	1,568,393	1,514,567	1,568,253	1,645,566	1,733,490	1,805,636	1,900,112	1,999,531	2,104,153	2,214,248	2,330,104

Forecast (ii) – productivity acceleration

United States							Forecast				
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Labour input growth	2.5%	0.0%	-0.3%	1.0%	1.0%	1.0%	0.8%	0.8%	0.8%	0.8%	0.8%
Labour productivity growth	1.1%	0.7%	2.2%	2.3%	2.3%	2.3%	2.4%	2.5%	2.6%	2.7%	2.9%
GDP growth	3.6%	0.8%	1.9%	3.3%	3.3%	3.3%	3.2%	3.3%	3.4%	3.5%	3.7%
GDP (real)	9,817,000	9,891,194	10,078,657	10,382,575	10,824,470	11,169,330	11,533,728	11,923,170	12,339,378	12,784,220	13,259,730
Inflation	2.1%	2.4%	1.6%	1.8%	1.0%	0.9%	2.0%	2.0%	2.0%	2.0%	2.0%
GDP (nominal)	9,817,000	10,128,000	10,487,000	11,004,000	11,591,951	12,074,395	12,720,198	13,415,344	14,164,107	14,971,181	15,841,722
ICT value added / GDP	6.6%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%
ICT value added (nominal)	643,117	643,490	666,299	699,147	736,503	767,155	808,187	852,353	899,927	951,205	1,006,515
ICT producing labour productivity growth	7.6%	8.7%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Employment in ICT producing sector	6,873	6,708	6,285	5,967	5,688	5,361	5,110	4,876	4,659	4,455	4,266
ICT-using services value added / GDP	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%
ICT-using services value added (nominal)	2,513,543	2,594,980	2,686,962	2,819,427	2,970,071	3,093,682	3,259,148	3,437,258	3,629,105	3,835,892	4,058,940
ICT using labour productivity growth	4.2%	6.7%	4.8%	4.8%	4.8%	4.8%	5.0%	5.3%	5.5%	5.7%	6.0%
Employment in ICT using sector	37,825	37,042	36,212	35,748	35,306	34,358	33,738	33,090	32,415	31,716	30,995
ICT investment / GDP	4.7%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%
ICT investment (nominal)	464,407	419,321	434,185	455,590	479,932	499,906	526,644	555,425	586,425	619,840	655,882
GFCF / GDP	16.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
GFCF (nominal)	1,568,393	1,514,567	1,568,253	1,645,566	1,733,490	1,805,636	1,902,211	2,006,165	2,118,137	2,238,829	2,369,012

Japan

Japan							Forecast				
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Labour input growth	-0.2%	-0.5%	-1.3%	-0.5%	-0.5%	-0.5%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
Labour productivity growth	3.1%	0.9%	0.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%
GDP growth	2.9%	0.4%	-0.3%	2.4%	2.4%	2.4%	2.7%	2.7%	2.7%	2.7%	2.7%
GDP (real)	511,462,400	513,333,514	511,598,477	524,597,322	542,141,258	554,487,131	569,662,225	585,252,629	601,269,707	617,725,138	634,630,918
Inflation	-2.1%	-1.5%	-1.2%	-2.6%	-1.0%	-0.4%	2.0%	2.0%	2.0%	2.0%	2.0%
GDP (nominal)	511,462,400	505,847,400	498,275,600	497,821,000	509,386,890	518,676,504	543,636,259	569,797,128	597,216,910	625,956,188	656,078,457
ICT value added / GDP	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%
ICT value added (nominal)	29,493,996	29,170,202	28,733,566	28,707,351	29,374,310	29,910,005	31,349,334	32,857,927	34,439,117	36,096,396	37,833,427
ICT producing labour productivity growth	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Employment in ICT producing sector	2,252	2,077	1,907	1,777	1,695	1,609	1,573	1,537	1,502	1,468	1,434
ICT-using services value added / GDP	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%
ICT-using services value added (nominal)	97,090,265	96,024,377	94,587,031	94,500,735	96,696,274	98,459,709	103,197,788	108,163,873	113,368,936	118,824,477	124,542,550
ICT using labour productivity growth	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%
Employment in ICT using sector	14,269	13,438	12,604	11,990	11,682	11,326	11,304	11,281	11,259	11,236	11,214
ICT investment / GDP	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
ICT investment (nominal)	17,654,211	17,460,397	17,199,040	17,183,349	17,582,570	17,903,221	18,764,760	19,667,758	20,614,210	21,606,207	22,645,941
GFCF / GDP	26.9%	26.9%	26.9%	26.9%	26.9%	26.9%	26.9%	26.9%	26.9%	26.9%	26.9%
GFCF (nominal)	137,488,703	135,979,307	133,943,895	133,821,692	136,930,775	139,427,961	146,137,515	153,169,946	160,540,791	168,266,337	176,363,651

Appendix B: Indicators of market flexibility

Country	Country code	Cost of starting up a business (% of income per capita)[1]	Hiring and firing indicators[1]					New economy indicator[2]	ICT expenditure[3]
			Flexibility-of-firing index	Conditions-of-employment index	Flexibility-of-firing index	Employment-laws index	Employment law rigidity		
Austria	AT	6.6	14	41	14	30	29.5	5.021	6.42
Belgium	BE	11.3	22	90	22	48	48.25	5.624	6.48
Denmark	DK	0	17	25	17	25	25	7.331	6.62
Finland	FI	3.1	52	43	52	55	55.25	5.162	6.93
France	FR	3	26	61	26	50	50	1.34	5.95
Germany	DE	5.9	45	46	45	51	51.25	3.105	6.06
Greece	GR	69.6	43	81	43	67	67.25	-5.399	5.29
Ireland	IE	10.4	30	68	30	49	48.75	6.343	5.29
Italy	IT	24.1	40	62	40	59	59.25	-3.102	5.29
Netherlands	NL	13.7	33	79	33	54	54.25	8.001	7.3
Norway	NO	3.9	25	39	25	41	40.75	N/a	6
Portugal	PT	12.5	73	88	73	79	79	2.076	6.96
Spain	ES	16.4	45	88	45	70	69.75	-3.141	5.43
Sweden	SE	0.8	31	39	31	42	42	9.882	8.84
Switzerland	CH	8.5	23	53	23	36	36.25	N/a	7.85
United Kingdom	UK	1	9	42	9	28	28	6.21	8.07
United States	US	0.6	5	29	5	22	22.25	4.857	7.9
Japan	JP	10.5	9	64	9	37	37.25	N/a	7.8

Source: (1) "Doing Business 2004, Understanding Regulation", The World Bank Group, 2004. (2) "Productivity, Innovation and ICT in Old and New Europe", Bart van Ark and Marcin Piatkowski, Research Memorandum GD-69 Groningen Growth and Development Centre, March 2004. (3) "European Information Technology Observatory 2004", EITO, 2004.

Appendix C: e-policy examples

Liverpool Direct: An example of ICT deployment in a Local Authority

What it is

A few years ago Liverpool City Council was ranked near the bottom of most league tables of British Local Authority service performance. A new Chief Executive of the City, David Henshawe, was recruited to deliver a leap forward in performance.

Rather than outsourcing his problems to someone else, Henshawe decided to in-source the solutions. He partnered with BT to create Liverpool Direct, a company in which the City Council owns 19.9% and BT owns 80.1%. The employees are seconded from both parent organisations, so there is no change to their pay and conditions. BT gains when Liverpool Direct exceeds its performance targets. Liverpool Direct has introduced the latest ICT technologies to improve: the ICT infrastructure itself, the combined revenues and benefits system, customer contact centres, and HR and payroll.

Key results

- 70% of Liverpool City Council's performance indicators improved from the bottom quartile in 2000-01 to the top quartile of local authorities in 12 months;
- Citizens were being summonsed for non-payment of council tax while waiting to receive benefits payments; the paper-based system was overloaded, creating a warren of office space infested by paper fleas; in this unpleasant working environment finding a citizen's file could take council officers ten minutes, and the backlog had risen to 40,000 queries. Installation of the electronic system removed the paper, the fleas, and the unpleasant working conditions, and reduced the backlog to 11,500 items; the time taken to record a change in a citizen's circumstances has fallen from 9 to 6 days, and the early or on-time processing rate reached 75% and is rising; overdue rent owed to the City has been reduced by £1m;
- By combining more than 500 separate databases into one, 90% of public enquiries are now solved in a single contact – i.e. a 90% Right First Time rate; abandoned calls have halved from 25% to 12% at the same time as the volume of calls from the public has quadrupled from 40,000 a month to 160,000;
- Internally, the new Human Resources Intranet handles 2,500 hits a day, saving thousands of phone calls, and enabling the Council to reduce HR staff by 42% from 206 to 120. All staff released have been productively redeployed;
- Through better management intelligence, absenteeism has been reduced from16 days a year to the national average of 11 days a year;
- Total efficiencies enabled the Council to reduce taxes by 3% in 2002 – the only Council to achieve this that year.

Source: BT

Shrivelling the red tape: on-line business registration

The hassle of registering a business and obtaining all the mandatory forms, registrations and licences for your type of business is one of those classic pieces of red tape that slows up business efficiency, but should benefit society if properly done. eGovernment has a major role to play here in shrivelling the red tape, and making government efficient, transparent, accountable and open.

In Singapore entrepreneurs log onto a single site, select the type of business they wish to found, and then register all the obligatory and selective forms their particular kind of business needs using a single shopping cart principle called “My Licence Cart”. At checkout the entrepreneur makes a single credit card payment and checks the status of all their applications online. This speeds up the process of founding a business, as entrepreneurs waste no time researching what they need to do, are automatically registered for all the right kinds of permits without traipsing between different offices across the city, and get an online assessment of the status of their application. In addition the city will save many bureaucratic posts and there is virtually no scope for corruption.

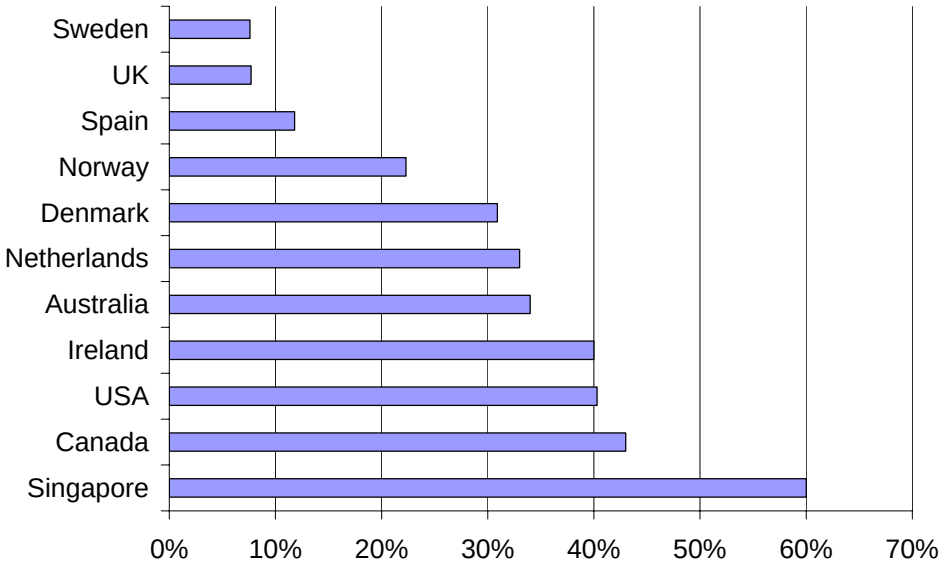
Japan offers a similar one-stop shop: the Sogyo Navi portal allows entrepreneurs to obtain all the information they need on-line, but instead of processing their applications on line, allows businesses to download forms for paper-based application. Online application is planned.

In Denmark “government” is multi-tiered and often very local. The sixty authorities that regulate business in Denmark have joined to create a single portal called Vir.dk which offers half of the forms that government requires businesses to submit. The other half of forms will be added in the next few years. In its first two months of operation Vir.dk had 15-20,000 hits a week.

Better Tax Collection

Citizens perceive that the benefits of online governmental services can sometimes be enormous, and one place where they strongly believe this is in filing personal tax returns. In 2003, five years after the first online filing of personal tax returns was enabled in some countries, the results collaborated across the world look like:

The take up of online filing of personal tax returns in 2003



Business taxes are most obviously extremely well suited to online collection. In France 50% of VAT is collected online, while in Ireland 17% of business tax revenue is collected online. In Australia a full service tax website for business enables businesses or tax agents to file and pay business returns online, transfer balances between accounts, request refunds, view tax accounts in detail, and pay obligations. One large company reported that its tax account reconciliation process has fallen *from two weeks to three hours* as a result of the integrated tax website.

Source: Accenture eGovernment Annual Report 2004

Mobile monitoring helps asthma sufferers

More than 10 million people in Europe are estimated to suffer from asthma. During an asthma attack, the normal flow of air to and from the lungs is impeded, making breathing difficult. To control their condition, sufferers need to record readings from a “peak flow” meter twice a day in a written diary, and take the diary to their doctor or asthma clinic once every three months for review. This can be repetitive and time consuming; many asthma sufferers fail to record the information for several days at a time.

A new mobile technology trial, run by an offshoot company of Oxford University, is making monitoring easier for mild to moderate asthma sufferers. The trial uses an electronic meter connected to a mobile pocket PC device. Sufferers blow into the meter twice a day, and grade their symptoms on the PDA, a process which takes 30 seconds. The meter readings and symptom information is transmitted to a central server in real time using O2’s GPRS (2.5G) network. The server records all the readings, and notifies a doctor if the readings indicate a problem. It also sends a text message reminder to the patient if a reading is overdue.

A survey of participants in the trial found that those using the new system were six times more likely to comply with their treatment regime than those who record their breathing in the traditional way. 7 out of 10 participants found that the system improved their ability to manage their own condition, and 60% found the system contributed to an improvement in their asthma symptoms. Other trials are already in place to monitor diabetes and cystic fibrosis sufferers, and other conditions such as high blood pressure could be monitored in the future.

It has been estimated that 60% of the UK Health Service budget (of around £100bn p.a.), for example, is spent on chronic conditions like asthma, diabetes and high blood pressure. Even small savings in this expenditure from the application of this and other e-health technologies could be large in absolute terms.

Source: O2 press release, Mobile technology can dramatically improve care management for asthma sufferers, July 2004

Classroom-on-a-cart

A small experiment in south west France in March 2004 may well herald the future for schools across the world in the twenty first century.

On 2 March 2004 the pupils of the Paul Lapie school in Talence, Aquitaine, found that their long-awaited IT Room had finally arrived. But instead of a classroom with screens, keyboards, and mice on desks, their computer lab was wheeled in on a trolley. Connected to the internet wirelessly, the trolley of a dozen computers enabled the pupils to undertake all their ICT studies at their desks in their normal classroom, rather than the pupils having to move to a purpose-built IT room.

Due to high local construction costs and a general shortage of adjacent land on which to build in Aquitaine, the innovative 'classroom' was created because Aquitaine schools found building classroom extensions prohibitively expensive. The mobile classroom meets the school's needs without any physical expansion.

As hardware costs decrease over the twenty first century, downloading educational content to mobile computer classrooms may become the default low-cost way to teach standard curricula material for all education authorities in the world. And, given that external bodies could donate the hardware, while education authorities track the hardware remotely, control the software content, and distribute it at zero incremental cost, this may revolutionise the learning of standard curricula in countries where conventional teaching materials are scarce, or in cities where space is a tight constraint.

Better studying

In the Netherlands the Open Universiteit Nederland is an independent distance learning university with its own extranet, Studienet. The OUN website offers students full course information, and the chance to obtain reviews from students who have already taken each course. Students then register and obtain their course materials online, undertake course work and test themselves online, and easily communicate with their teachers and other students using Studienet. 15,000 Dutch students currently use Studienet.

A better quality of student life

In the United States the Free Application for Federal Student Aid website offers a simple, straightforward process for applying for student aid wherever you are in the country. A logical timeline provides all the information a student needs, online application forms that skip unnecessary questions, and application-checking to reduce failures due to missing or conflicting information. Application status is available a week after online submission.

Sweden has a similar online Student Aid programme called Webbsvar, but current legislation prevents online applications. Students aged under 20 are automatically granted aid, while older students below third-level education can print off application forms and check application status online. Graduates with state loans can check their payments history, balances and forthcoming payments, but cannot make online payments.

Indepen
Diespeker Wharf
38 Graham Street
London N1 8JX
T +44 (0)20 7324 1800
www.indepen.co.uk

Ovum
Cardinal Tower
12 Farringdon Road
London EC1M 3HS
T +44 (0)20 7551 9138
www.ovum.com