Productivity, Growth and Jobs: How Telecoms Regulation Can Support European Businesses

Report for BT plc, the EVUA and INTUG

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Executive summary

I Introduction

In this report, commissioned by BT, the International Telecommunications Users Group (INTUG) and the EVUA,[1] we assess the economic benefits that would arise from better pan-European communications services (PECS). The findings are based on in-depth discussions with five EU-based multinational enterprises (MNEs) whose revenues are worth over 1% of EU GDP, and a survey of the in-country managers of one of Europe's leading PECS providers, BT.

II Background

In the summer of 2007 BT, the EVUA and INTUG published a report setting out the case for developing a more competitive supply of PECS. Produced by a panel of leading consultants and academics in the field of telecommunications economics, it made the following points:

- Connectivity and ICT are significant drivers of productivity, innovation and growth
- In order to fully realise the benefits that ICT can bring, businesses need seamless networking across multiple sites. In the case of MNEs this means seamless networking across borders
- There is substantial demand for PECS from MNEs. However, the PECS which are currently available do not meet MNE requirements. The functionality of the services offered is inadequate and services cannot always be provided to all the locations required by the customer
- Liberalisation of telecommunications markets at a national level has brought substantial benefits to the mass markets of consumers and Small to Medium Enterprises (SMEs). But these end-users access telecommunications from a single site. In contrast the benefit of liberalisation for multi-sited organisations, and especially MNEs with sites in many countries, has been limited by the fact that the wholesale access products that PECS providers need to serve an MNE are not available for all of its sites or are available at widely differing prices, functionality and levels of service
- The lack of choice and quality in the PECS on offer has a significant impact on the cost base, organisation and productivity of MNEs in the EU. In particular, the poor quality of PECS limits the ability of European centric MNEs to use ICT effectively to transform the business models that they use. As a result there are likely to be substantial economic costs for the EU.

This report sets out to understand these effects better and, where possible, to quantify them.

III The role of PECS in business transformation

EU-based MNEs are continually transforming their business processes so as to improve productivity, service delivery and competitiveness. Their current priority is to consolidate and centralise business processes.

This trend reflects a general trend towards globalisation of national economies, and is part of what the OECD refers to as "the great unbundling".[2] The transformations and productivity improvements involved are initiated by the MNEs. But the economic benefits generated by the transformations are felt across the supply chain as a whole, including the many SMEs which act as suppliers and

[1] The EVUA (Enterprise VPN (Virtual Private Network) Users Association) is an independent, non-profit global ICT network user group for multinational enterprises.

[2] In which the production of goods and services is "unbundled" and the processes consolidated in those countries where they are most efficiently performed.

distributors to MNEs. We estimate that MNEs together with their supply chains account for 35% of EU GDP. One recent study suggests that, in combination with broadband connectivity, such changes could improve SME productivity by 10%.[3]

Good PECS are essential to these transformations. An MNE typically wants a single principal supplier who can provide:

- Seamless access at broadband speeds from all of their sites and from the homes of key workers to a global IP virtual private network (IP VPN)[4] with managed quality of service
- Fast and consistent provisioning of access connectivity, so that the communications services offered over this IP VPN can support rapid change in the structure and business processes of MNEs and their supply chains
- Predictable quality of service on a pan European or global basis, backed up with the appropriate service level agreements
- Managed network solutions, including security applications, which run over reliable access links.

It is important that the supplier provides such services across all countries in which the MNE has significant operations. If it is possible to receive such services only in a subset of countries then the value of improved PECS is significantly reduced.

It is also important to consider improved PECS and the transformation of MNEs as complements to one another. As communications services are improved, they enable greater scope for both integration of activities and "unbundling" of elements of the supply chain, which in turn drives demand for improved communications services.

This is analogous to, but so far much less advanced than, the transformation that the reliable supply of electricity brought about from around 1900 through to 1930. During this period industries transformed their production processes and progressively replaced centralised steam and mechanical distribution of energy with grid based electricity and decentralised electric motors. Over time this enabled a fundamental transformation of production processes and major productivity gains.

The economic value of ***demand*** side changes from such transformations ultimately far outweighs the value of ***supply*** side changes. In the case of electricity the demand side transformation from the introduction of the electrification process is substantially complete. While further liberalisation of energy markets may enhance supply side competition and innovation, the impact on the demand side will be more limited given the maturity of electricity as a productive input. The situation in telecommunications is different, with substantial scope for further demand side transformation which is complementary to changes on the supply side.

IV The current problems with PECS

Right now PECS do not meet the needs of MNEs and this shortcoming is one of the biggest barriers which EU-based MNEs face in making the business transformations required to raise their productivity and improve their service offerings. When MNEs try to purchase such services on a pan-European basis they find that:

- They have little, if any, choice of supplier which can meet all the MNEs' requirements

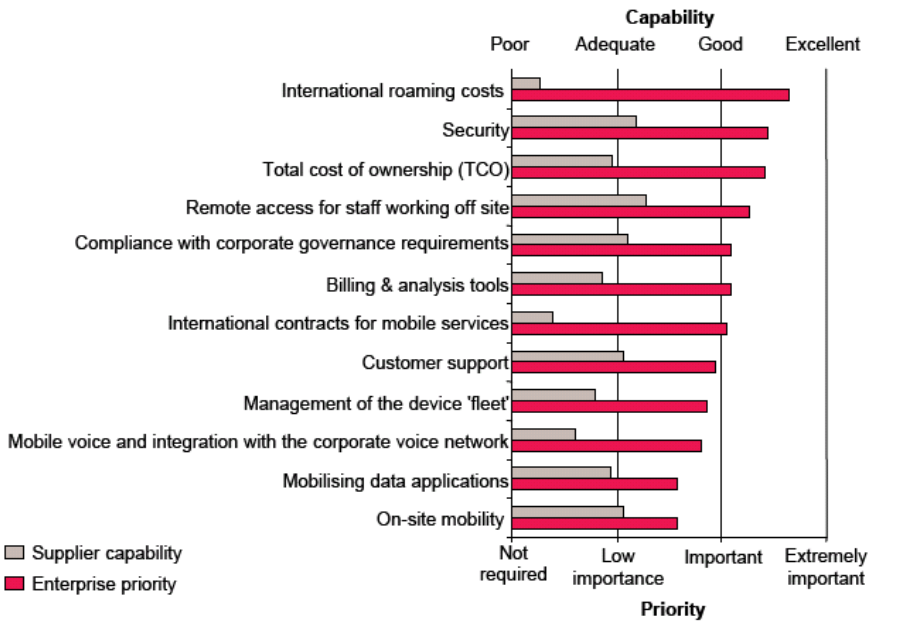
[3] L'impatto della banda larga sulla produttiva delle PMI italiane, Colombo, Grilli and Verga. Thinktel, 2007.

[4] A virtual private network (VPN) is created through the use of software across one or more public networks (a carrier's network or the Internet) to provide connections between multiple offices. IP enabled VPNs are widely used by MNEs to create wide area networks that span large geographic areas. They offer the security of a private network using access control and encryption while benefiting from the economies of scale and management facilities of large networks.

- The supply of PECS is fragmented, often expensive and the service levels and provisioning times vary considerably from country to country
- When compared with services available in the US those in the EU are far from seamless.[5]

As an example of the inadequate nature of PECS, Figure 1 shows the extent to which mobile services fail to meet the requirements of EU based MNEs.

Figure 1 The mobile services needs of European MNEs and the extent to which they are currently met



Source: Ovum/EVUA

Why is the supply of PECS so poor? PECS suppliers must buy-in access network components such as trunk and terminating segments of leased lines, ethernet access circuits, bitstream for business connectivity and mobile network access if they are to serve all of an MNE's employees and sites. For most fixed locations they have little choice when they buy these components – the national incumbent operator is typically the only supplier. And when it comes to mobile services, access for Mobile Virtual Network Operators (MVNOs[6]) is only available in a very small subset of EU markets. As a result of this lack of competitive supply, PECS providers find that:

- The prices of wholesale access components are often substantially above the prices that could be expected in a competitive market. For example BT estimates that regional ethernet access

[5] Services in the US are also not completely seamless. However, services are available in multiple states from single network suppliers, a situation which contrasts with the general EU scenario of separate underlying national networks. In the US, when a supplier (either an incumbent outside its wide geographic area or a non incumbent more generally) does need to buy-in inputs to complete business services provision, they continue to be available on a regulated basis under the "special access" regime. There have, however, been complaints that the access prices are too high and the product coverage not sufficiently wide. For a longer discussion of the US business services regime. See "The economic benefits from providing businesses with competitive electronic communications services. Part 3: The extent of competition in serving business customers from fixed infrastructures" − Annex 2, BT. June 2007.

[6] Various definitions and models of MVNOs exist. Generally speaking, a Mobile Virtual Network Operator (MVNO) is a mobile operator that does not own its own spectrum and does not operate its radio network infrastructure and may or may not have its own core network infrastructure. For this reason an MVNO has commercial arrangements with traditional mobile operators to access their networks in order to provide service to end customers.

prices are five times cost based levels in Country H.[7] Overall, we estimate this premium at 30% or more. This raises the price of PECS to MNEs by 15% or more

- Some access components are simply not available in certain countries to PECS providers, or are only available to access seekers who build out infrastructure towards the customer (which due to customer density issues is often more feasible for serving residential, rather than business, customers). This makes it difficult for PECS providers to meet the coverage and service level requirements of MNEs
- Incumbent operators often supply wholesale access components to PECS providers on terms which are significantly inferior to those offered to their own retail arms. The effect of this discrimination means that PECS providers tend not to bid on contracts where they buy in more than 50% to 60% of the access network inputs to serve the contract from incumbents, or where the overall cost of the wholesale access component exceeds 50% to 60% of the total cost of serving an MNE. As a result MNEs cannot obtain PECS everywhere they wish.

V The benefits of ubiquitous access

Ubiquitous access refers to supply conditions such that PECS providers are able to purchase wholesale access services at competitive supply conditions and offer seamless access to multiple business sites.

What would happen if PECS providers enjoyed ubiquitous access to the wholesale access products they require on similar competitive supply conditions across the EU? Such ubiquitous access would allow PECS providers to offer the seamless networking which MNEs seek. Our analysis suggests that this would have the following ***supply side*** impacts:

- PECS providers would offer MNEs services at significantly lower prices − partly because ubiquitous access lowers the integration costs of building PECS and partly because the PECS provider enjoys lower input costs
- PECS providers would significantly increase both the functionality and speed of provision of services to MNEs
- We would see a significant increase in the choice of PECS available to MNEs. Existing PECS providers would bid for a higher proportion of contracts and new firms would enter the market.

In response to these supply side changes we expect to see the following ***demand side*** changes. EU centric MNEs would:

- Become more flexible and responsive to global changes in market conditions and hence more competitive on world markets. This would have positive impacts on the quality of jobs in the EU and the macro economic stability of the EU.
- Become more productive:
  - The cost to the MNE of running existing ICT applications would fall given that the price of PECS would be reduced and that the cost of dealing with the PECS provider would be significantly lower
  - Improved PECS would help accelerate organisational change and regional consolidation, leading to greater economies of scale in the production of goods and/or the delivery of services

[7] We refer to the eight countries in which BT surveyed staff as Countries A to H. We set out more detailed findings on this survey in Annex B.

    - The lower costs and greater ease of implementation of ICT applications would lead MNEs to re-engineer business processes and supply chains based around new ICT applications more quickly.

- Expand the level of international trade, both within the EU so as to make progress towards completion of the single market, and between the EU and the rest of the world. MNEs could consolidate business processes in specific countries more easily and would look more readily for suppliers, whether SMEs or large enterprises, in other countries.

VI The scale of the economic benefits

We have used three separate methods to provide order-of-magnitude estimates of the scale of the economic benefits which we might expect to be generated through ubiquitous access for PECS providers and seamless networking for MNEs.

In calculating economic benefits we make two common assumptions across all three methods. We assume that:

- Adjustment to deliver the full level of benefits takes a decade
- Overall benefits are calculated as a present value over a 20 year time horizon. Benefits are likely to continue beyond the 20 year cut-off, but uncertainty over future technology and market structure suggests it is prudent to cut-off the calculation at some point.

It is important to note that regulation to enable ubiquitous access is complementary to other measures, such as improved labour and product market flexibility, together with implementation of measures to remove barriers to completion of the single market. In other words the payoff from liberalisation of markets generally, and increased scope for trade in services in particular, will be greater if telecommunications is further liberalised with the needs of MNEs in mind. Likewise, the payoff from telecommunications market liberalisation will be greater if there is greater scope for users of telecommunications inputs to restructure their activities.

The calculations do not take account of the potential for MNEs to replace travel with ICT to reduce their carbon footprint with enhanced connectivity.

Method 1: trade effects

Copenhagen Economics[8] has estimated the economic impact of full market opening across the EU for network industries such as telecommunications, electricity and postal services. Completion of the single market in these industries would lead to lower prices from, and greater efficiency in, the network industries. Copenhagen Economics has estimated that this would lead to a permanent gain to the EU economy as a whole of €130 billion per year in the short run and €276 billion per year in the long run.[9] If we consider just the telecommunications industry and just the impact on MNEs and their supply chains, then the NPV of the long run gain is ***€327 billion.***

This estimate reflects historical relationships between liberalisation and economic gains, but does not capture the full potential for a transformation of the supply of PECS and demand side transformation that a fully developed PECS market could deliver. In considering the current and potential structure of the telecommunications industry and further potential role of improved telecommunications in enabling MNEs to restructure business processes along their supply chains,

[8] Copenhagen Economics is a respected consultancy in economic analysis, whose clients include key European ministries, international organisations such as the European Commission and the World Bank, and a wide range of European businesses.

[9] Net of any costs of restructuring.

it is useful to contrast telecommunications with another of the network industries considered by Copenhagen Economics – electricity.

Electrification of the manufacturing industries enabled major productivity gains in these sectors at the start of the ***20th century***. But these gains have long since been exhausted and Method 1 captures most of the welfare gains from market opening in this sector.

Use of telecommunications at the start of the ***21st century*** is at a very different point in the cycle. It is only recently that networking of ICT began to have a major impact on productivity, in particular with the advent of the Internet. It is clear that there is still a long way to go before the productivity gains associated with the business processes transformations enabled by telecommunications are exhausted. So we might expect substantial dynamic efficiency gains from improved PECS in addition to the gains quantified by Copenhagen Economics.

We quantify the dynamic gains which improved PECS might generate through Methods 2 and 3.

Method 2: bottom-up estimates

We can estimate the economic benefits of improved PECS on a bottom-up basis. There are three main components:

- Lower ICT cost of MNEs. Improving PECS would lower these costs by 15% or more, leading to an economic gain with an NPV of ***€216 billion***
- Lower prices for PECS. The gain here has a modest NPV of ***€6 billion***
- Productive efficiency gains through reorganisation of business processes. This might involve co-ordination across companies to reduce the costs and increase the speed of product design, it might involve the reorganising of supply chains within the retail sector to decrease stock holding and wastage, or it might involve centralisation of processes which were previously distributed across many countries. Our analysis suggests for example that improved PECS might:
  - Cut the costs of car design by 35% and lead to a reduction in the costs of car production of 5%
  - Lead to a more efficient telecommunications industry in which national, or sub-national, network operators run ***access networks*** and ***IP transport networks*** while pan-European and global service providers[10] compete to deliver ***services*** over these networks. Such restructuring would lead, through economies of scale effects, to productive efficiency gains in the delivery of telecommunications services.

  We estimate that these effects would generate economic gains with an NPV of ***€1055 billion.***

In total the bottom up method leads us to estimate that ubiquitous access and complementary measures generate welfare gains with an NPV of ***€1277 billion.***[11]

Method 3: productivity growth gains

Analysis of the productivity growth rates that are associated with the production and use of ICT, show that:

- the difference in ICT contribution to productivity growth between the US and the EU grew over the past 20 years to nearly 1% per year

[10] Players such as BT, Colt, France Telecom, Deutsche Telekom, Google, IBM, and Microsoft.

[11] €(216 + 10 + 1055) billion.

- ICT has contributed to a significantly greater upsurge in productivity growth in the US than in the EU.

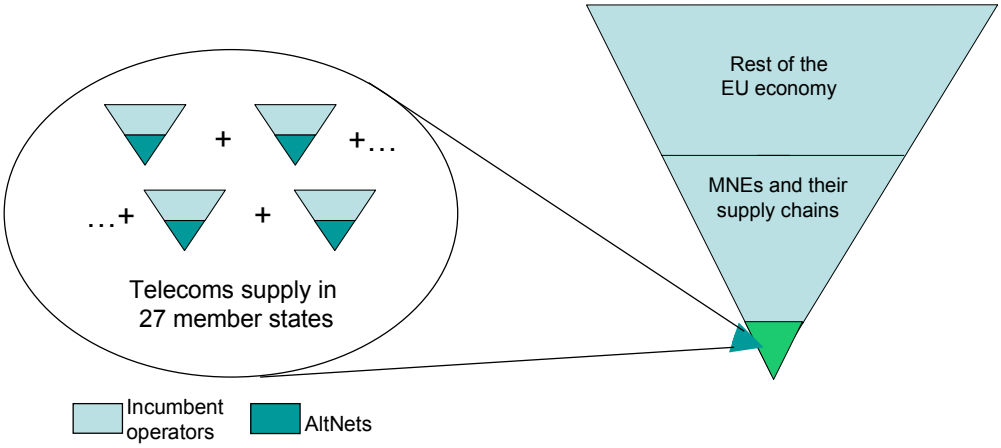
Supplying the PECS which MNEs are seeking, alongside complementary measures, will lead to this gap reducing. It is reasonable to assume that such measures would reduce the gap by one third or more over the next 10 years. If we apply this assumption to the 35% of EU GDP which is generated by MNEs and their supply chains, we estimate that such a change would generate economic gains with an NPV of ***€1196 billion***.[12] This estimate is consistent with the bottom-up estimate of Method 2.

VII Supply versus use

Discussion of telecommunications liberalisation has tended to focus on potential changes within the sector rather than the changes which are induced in the economy more generally. In particular there is considerable debate across the EU about how to establish the right incentives to enable efficient investment in next-generation broadband services. This debate is an important one. But it is also important to place it within the context of the issues raised in this report.

Figure 2 shows this relationship. The left hand side of the figure shows the contribution to GDP of the incumbent operators and alternative network operators in the 27 member states. The right-hand side shows how the aggregate of these contributions sits within the wider context of the EU economy as a whole. It is clear that even modest improvements in the functioning of MNEs and their value chains through more effective ***use of telecoms*** will dominate more effective ***production of telecoms services***. The aim of Methods 2 and 3 above is to capture the dynamic impacts of changes in the provision of communications services on the structure of the economic activity.

Figure 2 The relative contribution of telecoms supply and other sectors to GDP



[12] The stream of economic gains over a 20 year period at a discount rate of 4%.

VIII Conclusions

Providing the PECS which MNEs require, through ubiquitous access to wholesale network components, could deliver significant economic gains as set out in Figure 3.

Figure 3 Possible gains from ubiquitous access and complementary measures

Impact of ubiquitous access	*Economic gain (NPV)*[13]	*Comments*
Method 1: Greater trade from full liberalisation of telecommunications	***€327 billion***	Excludes potential dynamic supply side and demand side industry transformations not captured by historical relationships.
Method 2 – bottom up efficiency gains		
Productive efficiency gains through reduction in ICT costs for MNEs from dealing with one supplier	€216 billion	
Lower prices for PECS	€6 billion	
Dynamic efficiency gains through business process re-engineering in EU by MNEs and their supply chains	€1055 billion	
Total	***€1277 billion***	An estimate which includes all the dynamic effects of ubiquitous access.
Method 3: Productivity growth gap between EU and US is reduced by one third through better PECS and complementary measures	***€1196 billion***	An estimate which includes all the dynamic effects of ubiquitous access.

There are one-off gains to be made through the increased trade which such changes would enable. But the major share of the economic benefits would be generated by EU MNEs and their supply chains when they reorganise business processes for greater productivity. Based on the quantification set out above we estimate that ***ubiquitous access***, together with complementary measures, would generate benefits with a net present value of ***between €1100 billion and €1300 billion*** over the next 20 years.

To put these estimates in context:

- It might take a decade for the EU economy to feel the full effects of ubiquitous access and complementary measures
- The full effect would be to increase EU GDP by 1.6% to 2% each year from then on
- This increase is equivalent to an increase in wealth of €430 to €510 per person per year in the long-term.

In addition to these benefits, we have identified but not quantified potential benefits in terms of the contribution better supply chain integration and management can make to improving macroeconomic stability and reducing the costs associated with swings in economic output. This has been identified as a factor in improving macroeconomic stability over the past few decades, and better integration between SMEs and MNEs in particular might further contribute to economic stability.

These findings highlight the importance of ensuring a regulatory framework that supports ubiquitous access provision. This might largely be achieved by applying the principle of equivalence to eliminate discriminatory treatment of PECS suppliers.

[13] Over a 20 year period discounted at 4% pa.

1 Introduction

1.1 Background to the study

In the summer of 2007 BT published a report in conjunction with the associations representing business users, INTUG and the EVUA.[14] This report set out the case for developing a more competitive supply of pan-European electronic communications services (PECS). Produced by a panel of leading consultants and academics in the field of telecommunications economics, it made the following points:

- Connectivity and ICT are significant drivers of productivity, innovation and growth
- In order to fully realise the benefits that ICT can bring, businesses need seamless networking across multiple sites. In the case of multinational enterprises, this means seamless networking across borders
- There is substantial demand for PECS from multinational enterprises (MNEs). Most MNEs would prefer to source their PECS from one principal provider and almost all EU based MNEs have now moved from self provision of PECS to external supply
- The PECS which are currently available do not meet the requirements of MNEs. The functionality of the services offered is inadequate and cannot always be provided to all the locations required by the customer
- Liberalisation of telecommunications markets at a national level has brought substantial benefits to the mass markets of consumers and SMEs. But these end-users access telecommunications from a single site. In contrast the benefit of liberalisation for multi-sited organisations, and especially MNEs with sites in many countries, has been limited by the fact that the wholesale access products which PECS need to serve an MNE are not available for all of its sites or are available at widely differing prices, functionality and levels of service
- The lack of choice and quality in the PECS on offer has a significant impact on the cost base, organisation and productivity of MNEs in the EU when compared with (say) the US. In particular the poor quality of PECS limits the ability of European centric MNEs to use ICT effectively to transform the business models which they use. As a result there are likely to be substantial economic costs for the EU
- There is a need for EU-wide regulatory measures to improve the functioning of the PECS market so as to ensure the benefits of ICT and connectivity are fully realised by MNEs. In particular there is a requirement for measures which would enable PECS providers to purchase wholesale access components at competitive supply conditions throughout the EU. We refer to such supply conditions as ***ubiquitous access*** from now on.

These ideas are echoed by others. For example the OECD, in its recent economic survey of the European Union noted, in relation to telecommunications services that:[15]

> *"The regulatory framework is sound but some countries have been quicker than others at creating effective competition. Some national regulators may be too soft and competition problems are not always dealt with consistently across the Union. In 2006, the Commission made several proposals, including phasing out regulation in segments where competition was developing well, introducing a more market-based approach to spectrum management, enabling*

[14] *The economic benefits of providing businesses with competitive electronic communications services*, BT, June 2007.

[15] OECD. November 2007. "OECD Economic Surveys – European Union." Page 12.

the pan-European provision of services and beefing up the regulators' enforcement powers. All of these suggestions should be pursued."

The authors of the proposed reforms of the electronic communications framework announced in November 2007 make a similar point. The forward to the proposed reform package captures the key issues:[16]

"Although EU action has brought major benefits, there is still work to be done to create an effective internal market in telecoms, which would bring even greater benefits to consumers and businesses alike. Today there are only a few operators providing pan-European services, and one of the reasons is the different ways in which national regulators have implemented the EU framework. The internal market is fragmented, with the result that operators have to package their services in different ways in different Member States, and satisfy different regulatory requirements each time. That fragmentation is hindering effective cross-border consolidation, and often blocking or delaying the entry of new competitors to the market."

1.2 The scope of the study

The scope of this new study, also sponsored by BT, INTUG and the EVUA, is to understand these effects better and, where possible, to quantify them. So we have:

- Drawn on the results of surveys and interviews with in-country managers of one of the EU's main PECS providers, BT, to understand the difficulties they face in creating the services which MNEs require[17]
- Analysed the variation in the supply conditions which PECS providers face when they purchase wholesale access products. Annex B and C provide key findings
- Had access to in-depth discussions with five MNEs to understand how current weaknesses in the supply of PECS affect their behaviour. A summary of the findings of these interviews is set out in Annex D
- Analysed these interviews to assess how MNEs would behave differently if they had access to PECS which provided MNEs with seamless networking[18]
- Considered, in qualitative terms, the economic benefits which such changes in behaviour might generate for the EU
- Provided order of magnitude estimates of these economic benefits.

[16] European Commission. 13 November 2007. "Reforming the current telecommunications rules."
http://ec.europa.eu/information_society/policy/ecomm/tomorrow/index_en.htm

[17] The survey covered eight EU member states – referred to as Countries A to H in the text. We have chosen not to identify particular countries by name as the purpose of this exercise is to illustrate the difficulties that continue to exist in the EU and not to identify the failings of individual regimes. Only one of the countries surveyed is a country that has recently acceded to the EU.

[18] See Figure 3.1 for a description of seamless networking.

2 The current state of the PECS market

2.1 Demand for PECS

Some observers have questioned whether there is any significant demand for PECS. For example a previous Dutch Minister for Economic Affairs stated in a letter to the European Commission[19]:

> *"The internal market will largely remain a combination of national markets. Cross-border pan-European services will remain limited for the time being. Companies may be active throughout the EU, but they will still offer their services in national markets. For infrastructural services and end user markets, that will probably remain so. Companies are therefore active to a significant extent in national markets and do not offer their services at a cross-border, pan-European level, a fact that must be taken into account with the harmonisation process."*

But this statement is at odds with the evidence available, which suggests that demand for PECS is substantial:

- The IT services market, of which PECS form an important part, is large and growing strongly. Gartner estimates that this market was worth €184 billion to its suppliers in 2006 and predicts growth in revenues to €245 billion in 2011[20]
- There are a number of major telecommunications service suppliers, including AT&T, BT, Cable and Wireless, COLT, Orange Business Systems, T-Systems and Verizon, which supply PECS. See for example a report by the Gartner Group[21] on the "Magic Quadrant for pan European Network Service Providers, 2007" published in December 2007
- This recognition of a PECS industry is supported by surveys of EVUA members. For example Figure 2.1 shows how strategy development, procurement and operations for communication services are now run on a global or regional basis, rather than a national basis, in the great majority of such organisations
- The interviews with the five MNEs for this study show that there is strong demand for such services. All five MNEs report a move away from national and towards regional and global contracts for the supply of ICT and telecommunications services. The hoped-for long term goal of all the MNEs interviewed is to move to a single pan European or global supplier. There are two main reasons for moving to a single supplier:
  - It significantly reduces the transaction costs of network management for the MNE. There is just one interface to a single supplier who has clear responsibilities for providing services to the agreed levels. The financial services company interviewed estimates that such simplification would reduce its ICT costs by 25%
  - It moves the relationship up to more senior levels (within both the MNE and the supplier) and changes it from the traditional supplier/customer relationship to a partnership which has a greater capacity to deal with unexpected events.
- The survey of in-country managers of BT, supports these findings.[22]

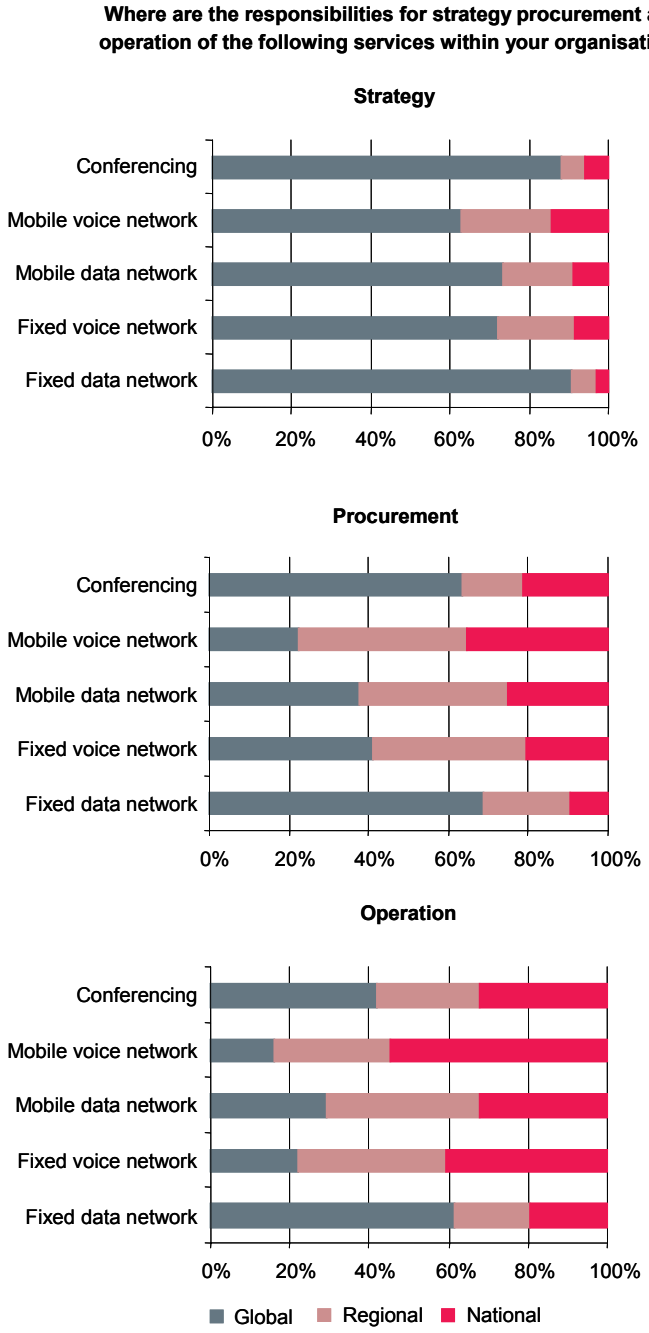
[19] Letter to Vivienne Reding from J G Wijn
http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/review_2/comments/nl_response_review_en.pdf

[20] Gartner: Forecast: IT Services in Europe, the Middle East and Africa, 2006-2011 Update 30 November 2007 Robert De Souza.

[21] www.corp.att.com/awards/docs/pe_nsp_2007.pdf

[22] Consistently, BT in-country managers across all surveyed countries reported that the great majority of MNEs are seeking to consolidate their communications contracts by using one or two PECS providers.

Figure 2.1 How communications services are organised in EVUA member organisations



Source: Ovum/EVUA

Moreover demand for PECS is growing. Our survey of MNEs suggests that PECS enable substantial productivity benefits. For example, a well-functioning PECS market would facilitate MNE productivity by allowing effective cross-border use of ICT solutions which would:

- Reduce process costs
- Improve internal and external communications
- Support the development of new products and services

- Facilitate the reorganisation of internal and external structures (e.g. facilitates outsourcing of other parts of supply chain)
- Improve responsiveness to changes in market conditions.

Figure 2.2 sets out some examples of how a major automotive manufacturer believes that better PECS might help it become more productive.

Figure 2.2 Productivity gains in the automotive sector from better PECS

Better PECS could be expected to:

- Allow more rapid relocation of sales outlets as one market declines and another grows. Typically a three month delay in establishing a new sales outlet costs approximately 100 car sales.
- Reduce the design phase of a car still further. In the past few years this phase has reduced from four years to 18 months for cars and to two years for a truck. Collaboration systems and virtual design could cut new car design from 18 months to 12 months. This would save 5% of the cost of a car, i.e. one third of the design cost which is 15% of the total cost.
- Enable on line training (in place of CD-DVD based training) of garage mechanics for maintenance during the car guarantee period. Better maintenance reduces warranties costs, increases customer satisfaction and speeds return of investments of the dealer-garage network.
- Help deal with component bottlenecks in just-in-time supply chains. Components stand in the way of increased car production. The automotive manufacturer cannot produce more cars until it increases component supply flow and output.
- Increase vehicle productivity, enhance safety, reduce environmental production impacts and improve security qualities for driver and passengers through the use of telematics (the convergence of wireless/mobile communications, locations technologies and in-vehicles electronics).
  - For example mobile convergence with in-vehicle electronics could be tremendously effective for proactive monitoring of truck needs on the road. Truck diagnostics could identify any spare parts required for truck maintenance and using mobile networks and GPS alert the nearest location for these spare parts and identify the appropriate truck route. The automotive manufacturer is unable to effectively boost this initiative at the moment, largely due to the high cost of mobile data transmission in a pan-European scenario and the unpredictable and undefined level of service for mobile business applications − as a result of the need for multiple telecommunications service providers. The automotive manufacturer particularly mentioned the unpredictability of roaming costs for trucks travelling through Europe and the lack of cost transparency.
- Reduce major production line outages (over 5 hours). These lead to losses of up to one day's production. The factory in one key country makes more than 100 cars per day, with each line producing 14 different cars. A nine hour outrage there creates a log jam, not just in the factory, but also in the just-in-time supply chain with many trucks waiting to be unloaded.

Our survey indicates that the productivity benefits from rationalising and consolidating their businesses on a pan-European basis are particularly important to MNEs. This is illustrated in Figure 2.3. This trend is one aspect of what the OECD[23] refers to as the "*great unbundling*" in which the various parts of the production process are distributed to those areas where conditions are optimal, e.g. across borders:

> *"Another novel feature of the ongoing wave of globalisation is that it goes hand-in-hand with the rapid adoption of information and communications technology (ICT). Such technology makes it easier to fragment the production of goods and services, and to outsource certain tasks to other countries. This "great unbundling" has extended the reach of globalisation to domestic activities."*

[23] OECD. June 2007. "Globalisation, jobs and wages." http://www.oecd.org/dataoecd/27/1/38796126.pdf

Figure 2.3 The move by MNEs to rationalise their businesses

MNE	***Planned reorganisation***
Financial services company	"Consolidation of operations in nine global centres" for "extended reach and lower costs"
Automotive manufacturer	"Rationalised processes and achieving higher levels of efficiency"
ICT service provider	"Reducing from 27 to seven or eight businesses" to "achieve greater group consistency"
Consumer products supplier	"Grouping operating companies into multi-country organisations for greater efficiency" − In the EU 30 country units will be reduced to 10 multi-country organisations
Engineering and design consultancy	"Establishing a global design centre with 200 or more staff" using ICT "to enable faster, better and cheaper" service delivery

We might also see this "great unbundling" at work in the EU in the telecommunications industry itself over the next few years. With the roll-out of next generation networks, and the complete separation of service intelligence from access and transport, we could, absent national protectionist measures, see a restructuring of telecommunications in the EU in which:

- National, or sub-national, network operators run ***access networks*** and ***IP transport networks***
- Pan European and global service providers[24] compete to deliver ***services*** over these networks.

Such restructuring would lead to stronger service-based competition in the supply of electronic communications services across the EU and, through economies of scale effects, to productive efficiency gains in the delivery of telecommunications services through lower unit costs. This point was made by Indepen in a recent study on the application of telecommunications regulation in the microstates of the EU[25].

The MNEs interviewed all identified the current poor quality of pan European telecommunications services as a major barrier to making the organisational changes required to benefit from the "great unbundling". They also complained that the current level of competition in the supply of PECS outside city centres was weak and that there are wide variations in access conditions across countries.

The MNEs interviewed were especially critical of current mobile services when used in a pan European context. They found them fragmented and expensive. This is consistent with the findings of larger recent surveys. For example Figure 2.4 summarises the mobile services requirements of 22 EVUA MNE members and the extent to which current services meet these needs. For example it indicates that the level of international roaming charges remain a major concern for MNEs, which suppliers are a long way from meeting.

[24] For example global players like Google, IBM and Microsoft and major EU operators like BT and France Telecom).

[25] *Applying the EU regulatory framework in microstates*, Indepen, March 2006.

Figure 2.4 The mobile services needs of European MNEs and the extent to which they are currently met

Source: Ovum/EVUA

2.2 What kind of PECS do MNEs want?

The interviews with the MNEs and with the leading PECS provider are consistent in specifying how PECS should be improved in order to enable the "great unbundling". For all the countries in which they operate MNEs want:

- Seamless access at broadband speeds from all of their sites and from the homes of key workers to a global IP Virtual Private Network (VPN) with managed quality of service − for example using MPLS[26]
- Fast and consistent provisioning of access connectivity, so that the communications services offered over this IP VPN can support rapid change in the structure and business processes of MNEs and their supply chains
- Predictable quality of service on a global basis, backed up with the appropriate service level agreements
- Managed network solutions, including security applications, which run over reliable access links.

[26] MPLS stands for Multi-Protocol Label Switching which is a means of carrying packet services more efficiently across networks where there are common specific destinations for the traffic.

And in future MNEs will want:

- Higher bandwidth, with an increasing emphasis on video-based applications
- A growing number of applications available on-the-move as well as at fixed locations. For example the engineering and design consultancy MNE interviewed estimated that e-mail on-the-move is worth €9,000 per year per employee in terms of productivity gains.

In addition we note that it is important to MNEs to receive services with these characteristics across all of the countries in which they have significant operations. If it is possible to receive such services only in a subset of countries then the value of improved PECS is significantly reduced. Often it is the supply situation in the country where the problem is greatest which determines the value of PECS to MNEs.

2.3 Impacts on the MNE supply chain

The benefits of improving PECS are not confined to the MNEs. The MNEs interviewed all believe that improved PECS will enable them to become more productive in dealing with suppliers and distributors as well. For example the automotive manufacturer interviewed sees improved PECS enabling more effective integration with component suppliers and dealers. It is normally the MNEs which initiate changes in the business processes of the supply chain. But the economic benefits are felt across the chain as a whole. In particular better PECS benefit the national SMEs involved in a supply chain as well as the MNE itself.

Strengthening competition in the supply of PECS could also benefit SMEs in other ways. The interviews with the in-country managers of BT indicate that where a PECS provider can buy access network components on more competitive supply terms it is more likely to compete for the business of SMEs as well as that of the MNEs.

The overall impact of MNE initiated changes in supply chains could be quite dramatic for SMEs. One recent study[27] suggests that, in combination with broadband connectivity, such changes could improve SME productivity by 10%.

These supply chain effects are important when it comes to quantifying the benefits from improved PECS. The fact that better PECS benefit national SMEs involved in a supply chain as well as the MNE itself amplifies significantly the scale of the economic benefits from improved PECS. It is difficult to estimate the contribution made by MNEs and their supply chains to EU GDP. We estimate a contribution of ***35%*** based on two sources:

- A recent study[28] estimates that US MNEs currently generate 25% of US GDP. Adding in the value-added from other enterprises in the US-based supply chains of these MNEs might raise this proportion to ***50%***
- The top 500 companies in the EU generate revenues of €5,850 billion. A high proportion of these top 500 companies are MNEs and there are many other, smaller, companies which are also MNEs. So it is reasonable to use this figure as an estimate of the revenue generated by MNEs in the EU. Around 25% of this revenue is value added.[29] So the contribution of MNEs to EU GDP is €1462 billion.[30] Adding in an equal contribution from the rest of the supply chain of the MNEs takes us to €2925 billion or ***25%*** of EU GDP.

[27] L'impatto della banda larga sulla produttiva delle PMI italiane, Colombo, Grilli and Verga. Thinktel, 2007.

[28] *The contribution of MNCs to US productivity growth, 1977 to 2000*, Corrado et al, July 2005.

[29] Value add as a proportion of revenues for the five MNEs of Annex D.

[30] 25% of €5856 billion.

Taking the average of these two sources, we estimate that MNEs and their supply chains account for 35% of EU GDP.

2.4 Current problems in the supply of PECS

A PECS provider must buy wholesale access network products and combine these with its own core network infrastructure and software to create the services it offers to MNEs.[31] The key access products required are:

- Trunk and terminating segments of leased lines
- Business ethernet access circuits
- Bitstream access for business connectivity to virtual private networks and to internet service providers
- Access to mobile networks in order to provide corporate mobility and combined fixed and mobile solutions.

In a very high proportion of cases the PECS provider buys its access products from the national incumbent telecommunications operator in each member state since:

- The national incumbent operator is often the only supplier of access network products for MNE sites outside city business districts.
- In the limited areas outside CBDs where there are alternative providers, these providers do not generally operate wholesale systems and processes which would support PECS provision of services to MNEs.

So the PECS supplier has little choice when they buy access components. As a result of this lack of competitive supply the PECS provider faces five major difficulties in procuring the access network products it requires:

- ***Prices are often substantially above competitive levels.*** For example BT estimates that regional ethernet access prices are five times cost based levels in Country H.[32] Overall we estimate that wholesale access prices are 30% or more above prices that could be expected in a competitive market − based on observations of current prices and the relative importance of each key business access product
- ***Some wholesale access products are simply not available in certain member states***. For example:
  - Wholesale ethernet access is not yet available from the incumbent in Country C. Although mandated, a regulated product is not yet available in Country A, C, F or G. Business ethernet access is not regulated at all in Country B, D or H
  - Terminating segments of leased lines are not available in Country F and, although mandated, regulation (or revised regulation) is awaiting implementation in Country A, C, F and H
  - Business bitstream at the ATM level is not available in Country B, C or F. The product is not regulated at all in Country B
  - MVNO access is not available on a competitive basis in any of the countries surveyed.

[31] See the diagram in Annex A illustrating the different types of access requirements of multi-site businesses.

[32] We refer to the eight countries in which BT surveyed staff as Countries A to H. We set out more detailed findings on this survey in Annex B.

- ***Other access products are only available to access seekers who build out infrastructure towards the customer,*** often as a result of regulation put in place by the national regulator to encourage infrastructure based competition. For example in Country E, BT is only able to gain access to terminating segments of leased lines in regions where it has invested in a point of presence. As a result BT would need to invest in a point of presence in each of nine regions in order to gain national coverage. In Country G in order to gain national coverage using the bitstream product, connection at 100 points is required. Such requirements may create economic benefits in areas within countries where replication is economically feasible. Where replication is not feasible these requirements simply make it difficult for access seekers to compete and to achieve scale when serving multi-site business customers.
- ***Incumbent operators supply wholesale access to PECS providers on price and non-price terms which are significantly inferior to those offered to their own retail arms.*** For example:
  - In Country F it has been estimated that ethernet access has been offered to *retail* customers by the incumbent at prices significantly cheaper than to BT wholesale (in some cases by at least 40%)
  - In Country A and Country B the wholesale bitstream service level agreements are equivalent to the service level agreements available at retail level.[33]

  Effective Key Performance Indicators (KPIs) that compare the treatment of third party suppliers to the treatment of the incumbent's retail arm are published in none of the eight countries surveyed.[34]

  Discrimination on non price grounds[35] is as important to the PECS supplier as discrimination on price. Quality of service and SLAs are particularly important for business customers.
- ***Products are not always fit-for-purpose or with satisfactory Quality of Service***
  - Time to supply and time to repair vary widely across member states. For example, as outlined in Annex B, standard delivery times for 2 Mbps terminating segments of leased lines range from 15 days to 51 days and standard times to repair range from 4 to 10 hours and can be much longer for faults assigned lower priority. In some cases, standard delivery and repair times are not available at all
  - Where service level agreement timeframes are in place these are not always met and sufficient penalties are not always in place
  - Technical specifications,[36] for example contention ratios and packet prioritisation mechanisms, differ across countries meaning that access services may:
    - Be unable to provide for higher specification services such as real-time bi-directional voice and video
  - Be incompatible between access and network service providers and therefore require PECS providers to customise the interface with these third party access providers, significantly raising development time and costs, and raising costs to end-users.

[33] If an incumbent offers a wholesale SLA identical to its retail one, given that the PECS provider will have to address its part of the provision/repair activity, the PECS provider cannot offer a retail SLA that is equal to that of the incumbent.

[34] Refer to Annex B for more detail. KPIs are a fundamental non price condition as they provide an indication as to whether access seekers are receiving services in a non-discriminatory manner. However, in order to be effective KPIs must measure treatment of third party suppliers compared to the treatment of the incumbent's retail arm, and they must do so at a sufficient level of detail.

[35] SLA issues such as provisioning times, ordering processes, migration processes and guaranteed times to repair.

[36] See Annex C, Technical Service Specifications.

There is a common theme here. The typical incumbent operator has the ability to discriminate in terms of the price, the provisioning times, and the service level agreements on which it makes wholesale access network products available to its own retail arm and to rival access seekers. This discrimination, which varies in nature by member state, has three main effects:

- It makes it difficult for a PECS provider to meet an MNE's requirements for provisioning times, service level agreements, coverage and bandwidth
- It raises the prices of PECS in two ways:
  - The PECS provider incurs additional costs in order to provide a uniform offering across the EU to its MNE customers. In Country F for example ethernet access is only available over SDH circuits. So the PECS provider must add both SDH and ethernet interface equipment (rather than just ethernet) to the circuit ends in order to provide an ethernet presentation to the MNE. This adds to the costs and makes the offering uncompetitive against the incumbent's retail offer
  - The input costs of the PECS provider are higher because the wholesale access products used are priced above that which would be expected in a competitive market. Annex B suggests that these prices are 30% or more above estimated competitive levels. Wholesale access products typically make up 50% of the costs of supplying PECS. So, if the prices of wholesale access products were reduced to competitive levels, then PECS prices would reduce by 15%.
- It weakens competition in the supply of PECS. As a result of uncompetitive pricing, PECS providers tend not to bid for MNE supply contracts in countries where the cost of the wholesale access products exceeds 50 to 60% of the total cost of supply or where it would require that they buy in more than 50% to 60% of the access inputs to serve the contract from incumbents. If discrimination could be eliminated then PECS providers would bid on a much wider range of contracts and the market would be much more competitive.

Our interviews suggest that these difficulties affect the productivity of EU-centric MNEs in five main ways:

- It is hard to integrate with business partners. Because of poor coordination with suppliers, the automotive manufacturer interviewed believes that suboptimal service quality leads to outages on its production lines which generate substantial avoidable costs
- Operating costs are higher than they should be. The ICT service provider interviewed believes it could cut its telecommunications costs by 30 to 50% with greater competition in the supply of PECS
- The organisation is less flexible than it could be in terms of its ability to reorganise in response to changing market conditions
- The opportunity to expand in the EU is more limited than it is in the rest of the world
- Business processes take longer than they should. For example, the car manufacturer interviewed in our survey believes that effective video communication could cut the design phase of a car from 18 to 12 months and so cut its overall costs of car production by 5%.

It also reduces the ability for MNEs to replace travel with ICT to reduce their carbon footprint.

3 The benefits of ubiquitous access

3.1 Ubiquitous access and seamless networking

This chapter considers in qualitative terms the economic benefits which would arise if PECS providers enjoyed ***ubiquitous access*** to the wholesale access network products they require on similar competitive supply conditions across the EU. The analysis of Section 2.4 suggests that such ubiquitous access could largely be achieved by applying the principle of ***equivalence***[37] and so eliminating the discriminatory treatment of PECS providers.

Such ubiquitous access would make it substantially easier for PECS providers to offer MNE customers seamless networking as specified in Figure 3.1.

Figure 3.1 The characteristics of seamless networking

One stop contract for all services – both fixed and mobile
Unified but itemised billing for the service
A limited number of standardised interfaces for connectivity
Guaranteed end-to-end quality and provisioning times at all sites
A unified view of network management for the MNE

It is important to note that regulation to enable ubiquitous access is complementary to other measures, such as improved labour and product market flexibility, together with implementation of measures to remove barriers to completion of the single market.[38] In other words the payoff to liberalisation of markets generally, and increased scope for trade in services in particular, will be greater if telecommunications is further liberalised with the needs of MNEs in mind. Likewise, the payoff from telecommunications market liberalisation will be greater if there is greater scope for users of telecommunications inputs to restructure their activities and realise the benefits of the "great unbundling".

3.2 The reaction of the MNEs to seamless networking

The MNEs interviewed were unanimous in agreeing that the seamless networking enabled by ubiquitous access would improve their productivity significantly. As an input to productivity improvements they described seamless networking as:

- "Essential" (ICT service provider)
- "Vital" (financial services company)
- "Very important" (consumer products supplier)
- "Significant" (automotive manufacturer); and
- "Very important in terms of supporting a strategy of faster, better, quicker" (engineering and design consultancy).

[37] This requires a dominant operator to supply wholesale access products on identical supply terms, using the same provisioning and maintenance processes, to all access seekers, including its own downstream business.

[38] As noted by Indepen in its report *Achieving the Lisbon agenda: the contribution of ICT*, for the Brussels Round Table, January 2005.

As part of the discussion with MNEs we asked which regions and countries currently come closest to seamless networking. The results are shown in Figure 3.2. We can see that:

- At the regional level the US is closest to offering seamless service while Asia, Africa, and Latin America are furthest away. The EU is somewhere between these positions
- Within the EU the Nordics and the UK come closest to offering seamless service. Central European and Mediterranean countries are furthest away
- In some EU member states, seamlessness is possible in the central business districts (CBDs) of city centres where access competition is economically feasible but not in other areas, where there is no competition and the availability of access products is much poorer. For these reasons such member states are listed in Figure 3.2 as both closest to and furthest from facilitating seamlessness.

Figure 3.2 Where do MNEs get closest to seamless networking?

How close to seamless networking	Closest	Furthest
Globally		
Automotive manufacturer	US, EU (CBD)	Asia, Latin America
ICT service provider	US , Japan	Asia, Africa, EU
Financial services company	US	Asia, Africa, EU, Latin America
Consumer products supplier	North America	Asia, Africa
Within the EU		
Automotive manufacturer	UK, Italy (CBD)	France, Germany, Poland, Spain
ICT service provider	Nordics(CBD), Germany(CBD)	Spain
Financial services company	Nordics(CBD), Belgium, France	Baltics, Germany
Consumer products supplier	UK, Netherlands	Greece, Italy, Balkans, Russia

The MNEs interviewed identified five main effects of seamless networking:

- It enables consolidation and specialisation of functions within the EU to give greater economies of scale and higher productivity
- It leads to lower ICT costs. MNEs estimated that seamless networking might lower ICT costs by 10% to 20%. Dealing with a single PECS supplier accounts for a significant proportion of this saving. Seamless networking also lowers the cost of introducing new ICT applications
- It enables more flexible organisations that are better able to integrate new business units and dispose of old ones in response to changes in global market conditions
- It facilitates more integrated and efficient supply chains. For example both the financial services company and the consumer products supplier interviewed spoke of the need to move to video-based applications for their supply chain
- It leads to less business process outsourcing outside the EU and more within it, as intra-European communications is improved relative to that in other regions of the world.

3.3 The economic benefits from ubiquitous access

Based on the analysis set out above we suggest that ubiquitous access to wholesale access network products, and the seamless networking which it enables would produce the following effects on the ***supply side***:

- PECS providers would offer MNEs services at significantly lower prices − partly because ubiquitous access lowers the integration costs of building PECS and the costs of bidding for PECS contracts, and partly because the PECS provider enjoys lower input costs (see Section 2.4)
- PECS providers would significantly increase both the functionality and speed of provision of services to MNEs
- We would see a significant increase in the choice of PECS available to MNEs i.e. an increase in competition in PECS supply through:
  - Existing PECS providers bidding for a higher proportion of contracts; and
  - New firms entering the market.

In response to these supply side changes we would see the following ***demand side*** effects. EU-centric MNEs would:

- Become more flexible and responsive to global changes in market conditions and hence more competitive on world markets. This would have positive impacts on the quality of jobs in the EU and the macro economic stability of the EU
- Become more productive through a combination of three main effects:
  - The cost to the MNE of running existing ICT applications would fall given that the price of PECS would be reduced and that the cost of dealing with the PECS provider would be significantly lower. MNEs estimate these cost reductions at 10 to 20%
  - Improved PECS would help accelerate organisational change and regional consolidation. This would lead to greater economies of scale in the production of goods and/or the delivery of services
  - The lower costs and greater ease of implementation of ICT applications would lead MNEs to re-engineer business processes based around new ICT applications more quickly. This would include more effective integration with the rest of the MNEs supply chain. There is now a substantial body of evidence to show that effective use of ICT is a major driver of productivity growth
- Expand the level of international trade, both within the EU and between the EU and the rest of the world. MNEs could consolidate business processes in specific countries more easily and would look more readily for suppliers, whether SMEs or large enterprises, in other countries.

Our analysis so far provides a good qualitative understanding of the impact of improved PECS. But what is the scale of the economic benefits which improved PECS might generate? We consider this issue in the next chapter.

4 Quantification of potential benefits

4.1 Introduction

We adopt three approaches to the quantification of benefits from ubiquitous access:

- First, by estimating the potential benefits from increased market opening in telecommunications services and the corresponding gains from trade
- Second, by estimating potential allocative, productive and dynamic benefits directly based on economic reasoning and survey evidence
- Third, by estimating the potential benefits from an increase in the rate of productivity growth attributable to ICT due to improved connectivity.

These three approaches provide complementary approaches to estimating overall benefits and should not be thought of as generating separate estimates that can be summed.

The first approach relies on published estimates of potential gains from trade for liberalisation of services generally, and communications services in particular, for Europe.

The second approach draws on the results of survey evidence we have obtained to quantify the benefits of ubiquitous access directly in a bottom up manner.

The third approach is based on the differences in ICT related productivity growth in Europe and the US, and relies on judgement over how much of this gap might be closed via further reform of telecommunications (potentially in combination with other complementary measures to improve ICT use and trade in services generally).

4.2 Method 1: estimate based on potential gains from trade

Copenhagen Economics (2007) estimated the short-run gains from further market opening for network industries including telecommunications for the UK Department of Trade and Industry (now BERR). [39] It also estimated the benefits from liberalisation of the internal market for services in 2005 for the European Commission.[40] Ubiquitous access is a necessary condition for enabling such gains. The network industries concerned and their share of EU GDP are shown in Figure 4.1.

The approach adopted by Copenhagen Economics is to:

- Assess and score barriers-to-trade subjectively and apply weights to produce indices of the extent to which the seven industries studied are already open. Figure 4.2 shows this market opening index. We can see that, of the seven industries, telecommunications is rated about average
- Use data on firms in Europe to estimate econometrically the impact of barriers-to-trade on prices and costs. These are referred to respectively as rent-creating and cost-creating impacts of barriers-to-trade in services[41]
- Translate the barriers into hypothetical taxes (tariff equivalents) that would produce the same economic effects as the actual barriers

[39] Copenhagen Economics. January 2007. *The potential economic gains from full market opening in network industries*. http://www.berr.gov.uk/files/file37074.pdf

[40] Copenhagen Economics. January 2005. *Economic assessment of the barriers to the internal market for services*. http://www.copenhageneconomics.com/Admin/Public/DWSDownload.aspx?File=%2fFiles%2fFiler%2fPublikationer%2ftrade4.pdf

[41] The latter is more economically costly for a given change in final prices since higher costs involve an overall loss, whilst higher non-cost reflective prices involve some loss, but also a transfer from consumers to producers.

- Enter these tariff equivalents into a model of the economy to estimate the economy-wide impact.

Figure 4.1 The network industries and their share of GDP

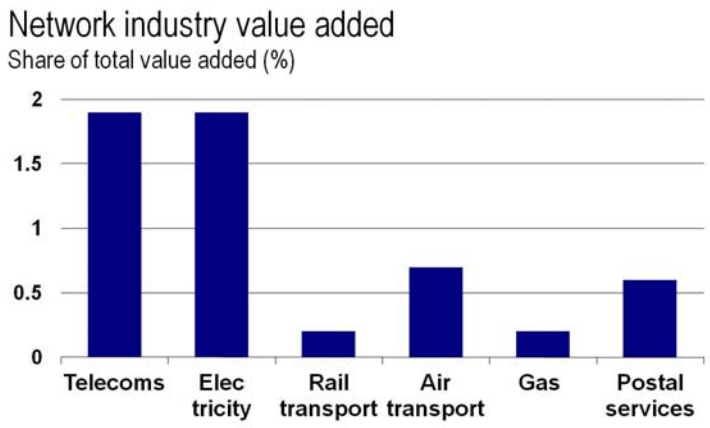
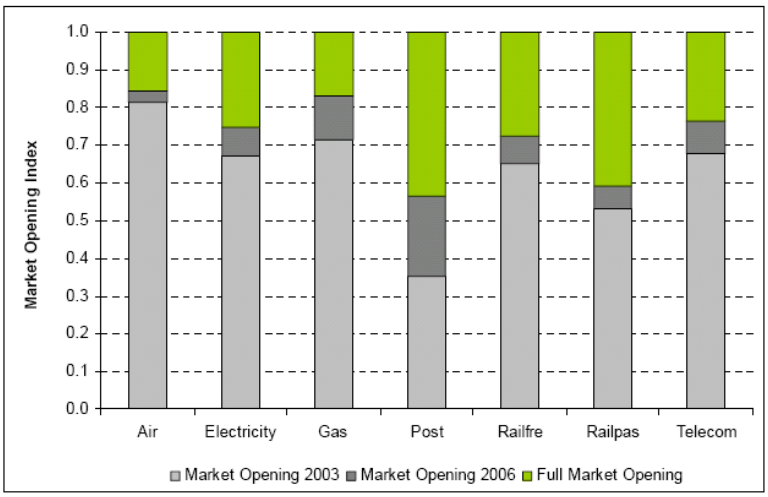


Figure 4.2 The market opening of the network industries in the EU



Using this method Copenhagen Economics estimates the short-run economic gains from full market opening of the network industries as a permanent increase in annual economic welfare of €130 billion per annum and a long-run gain of 3.4% of GDP or €276 billion. Given that these industries provide important inputs for production in all other sectors of the economy, these gains accrue across the EU economy as a whole.

The reason the study focused on the short-run estimates was to ensure consistency with the previous 2005 report for the Commission, and because of the greater uncertainty involved in long-run estimation. The long-run estimate of the gains from market opening was based on past relationships between market opening and gains. The approach would not capture possible dynamic effects from further market opening such as new products or organisational innovations that go beyond past experience. This is a particularly important caveat when we consider evidence that ubiquitous access and the provision of PECS is likely to lead to such changes.

To estimate the economic benefits from full market opening for telecommunications alone based on the long-run Copenhagen Economics estimates we assume that:

- The benefits from full liberalisation are proportional to the contribution which telecommunications makes to GDP relative to the other network industries. This is a relatively conservative estimate and the study authors believe the gains from telecommunications might be somewhat greater than this. But, given the position of the telecommunications sector, in terms of its market opening index shown in Figure 4.2, this is a reasonable assumption
- Telecommunications contributes 1.9% of the EU GDP while network industries as a whole contribute 5.5%.

This means that full market opening for telecommunications generates benefits of €95 billion per year.[42] But market opening and its effects take time. So we have assumed that:

- The welfare gain increases from zero to its full value over a ten-year period
- The EU enjoys this full welfare gain for a further ten years
- The benefits of market opening then disappear. This assumption reflects the high levels of uncertainty associated with benefits 20 years in the future
- Benefits are discounted at 4% pa.

With these assumptions the NPV of the net benefits which flow from the full opening of the telecommunications market is €935 billion. But these benefits apply across all industry sectors. The impact on MNEs and their supply chains, which constitute 35% of EU GDP,[43] is a welfare gain with an NPV of ***€327 billion***. See Annex E for details

4.3 The importance of dynamic effects

The findings of Chapters 2 and 3 suggest that the development of a competitive PECS market through ubiquitous access would generate significant additional dynamic benefits. So the Copenhagen Economics estimate represents only a part of the benefits which ubiquitous access (and complementary measures) would generate.

It is useful to draw parallels between telecommunications and electricity here. Manufacturing industries electrified their production processes in the first three decades of the 20th century. This allowed them to reorganise business processes to take advantage of local electric motors that replaced a centralised power source with energy distributed by belts and pulleys. This in turn allowed changes such as the production lines introduced by Henry Ford and, as a result, generated major increases in productivity. For example during the central decade of the electrification process, total factor productivity (TFP) increased by around 1.25% per annum in the UK, led by manufacturing TFP which grew from 0.6% to 1.9% per year.[44]

The gains in productivity from the transformations which electrification enabled have long since been exhausted.[45] But use of telecommunications is at a very different point in the cycle. It is only 12 years ago that networking of ICT began to have a major impact on productivity, with the advent of the internet. It is clear from many studies,[46] including this one, that there is still a long way to go before the productivity gains associated with business processes transformation enabled by

[42] €276 billion x 1.9%/5.5%

[43] See Section 2.3 for a discussion of this estimate.

[44] David and Wright. 1999. *General Purpose Technologies and Surges in Productivity: Historical Reflections on the Future of the ICT Revolution*. http://www-econ.stanford.edu/faculty/workp/swp99026.pdf and Jovanovic and Rousseau. January 2003. *General purpose technologies*. http://www.econ.nyu.edu/user/jovanovi/GPT.pdf

[45] Whilst further liberalisation of energy markets may enhance supply side competition and innovation, the impact on the demand side will be more limited given the maturity of electricity as a productive input.

[46] See for example *Achieving the Lisbon Agenda: the contribution of ICT*, Indepen for Brussels Round Table, January 2005. *The UK economy − analysis of long term performance and strategic challenges* UK Treasury, March 2008.

telecommunications are exhausted. Further, we have identified opportunities for supply-and-demand side transformations from improved PECS that may exceed those reflected in historical relationships. These gains are likely to be particularly substantial, given that they affect both MNEs and their supply chains, which together account for around 35% of EU GDP.[47] We consider the likely scale of the changes in the next two sections.

4.4 Method 2: bottom-up estimates of efficiency gains

Introduction

There are a number of ways in which improved PECS might generate economic benefits:

- Through reorganisation of business processes within MNEs and their supply chain
- Through reductions in the prices charged for PECS
- Through reductions in ICT costs of MNEs by dealing with a single supplier.

We consider the scale of each of these effects below.

The gain from reorganising business processes

Ubiquitous access would allow entry and growth in the pan-European services market, thereby increasing competition and innovation. Improved provision of services would, in turn, facilitate improvements in the use of communications services and restructuring of organisations, business processes and extended value chains. We provide below two quantified examples of the impact of such changes:

- On the automobile manufacturing industry
- On the telecommunications services industry itself.

Dynamic changes in the automobile manufacturing industry

One of the MNEs interviewed estimated that availability of collaboration systems and virtual design across all relevant sites[48] could cut new car design from 18 months to 12 months. This would save 5% of the cost of a car, i.e. one third of the design cost which is 15% of the total cost.[49] Motor vehicle manufacturing revenues in Europe were €476 billion in 2001. So a 5% reduction in costs represents a gain of €24 billion per annum.[50]

Dynamic changes in the telecommunications services industry

In a recent paper[51] on barriers-to-trade in telecommunications services Martin Cave describes how ubiquitous access might lead to a more efficient telecommunications industry in the EU.

[47] See Section 2.3 for a discussion of this estimate.

[48] Enabled through ubiquitous access to ethernet extension circuits.

[49] There are also costs in implementing the systems which enable faster car design. We have assumed that these are offset by other savings from improved PECS in other parts of the car production process.

[50] Assuming that the industry is competitive and that the price is equal to the cost plus ROCE.

[51] Analysing regulatory barriers-to-trade in telecoms services, Martin Cave and Matthew Corkery, October 2007, Thinktel.

If ubiquitous access reached a sufficient threshold and operators were confident that they would have genuine non-discriminatory access to local access infrastructure, we anticipate that the service element of the communications sector would rationalise – with perhaps five or so service providers emerging from the current vertically integrated national operators. With the roll-out of next generation networks, and the complete separation of service intelligence from access and transport, we are likely to see a restructuring of telecommunications in the EU in which:

- National, or sub-national, network operators run ***access networks*** and ***IP transport networks***
- Pan-European and global service providers[52] compete to deliver ***services*** over these networks.

Such restructuring would lead to stronger service-based competition in the supply of electronic communications services across the EU and, through economies of scale effects, to productive efficiency gains in the delivery of telecommunications services through lower unit costs. This transformation, which has so far been impeded by discriminatory local access, parallels those in other sectors such as retailing.

The end user spend on communications services is around €290 billion per annum.[53] Based on consideration of the split of costs between local access and potentially tradable service components of the telecoms cost stack, we estimate that roughly 50% of this spend is tradable. Assuming modest cost savings of 10% from consolidation on the tradable component of service provision gives ***annual*** estimated benefits of €15 billion.[54]

Grossing up for all industry sectors

To gross up from these two examples to take account of similar effects in other industries we assume that:

- The productivity gains from ubiquitous access and complementary measures in the telecommunications services and automobile manufacturing industries is 5% as set out above[55]
- The equivalent productivity gains in other industries is 2%
- The EU GDP, currently at €12,200 billion per annum, grows at 2% per year
- The productivity gains from ubiquitous access and complementary measures are phased in over ten years
- MNEs and their supply chains account for 35% of EU GDP.

Using these assumptions we estimate that the NPV of the dynamic gains from ubiquitous access is ***€1055 billion.***[56]

Lower prices for PECS

Our research suggests that ubiquitous access would lead to at least a 15% reduction in the prices charged by PECS. This in turn would lead to an allocative efficiency gain of €0.7 billion per year or an NPV of ***€6 billion*** at a discount rate of 4%. This is illustrated in Figure 4.3, where we have assumed:

- A price elasticity of -0.7 based on observed price elasticities for comparable services[57]

[52] For example global players like Google and Microsoft and major EU operators like BT and France Telecom.

[53] *Achieving the Lisbon Agenda: the contribution of ICT*, Indepen and Ovum, January 2005.

[54] €290 billion x 50% x 10%.

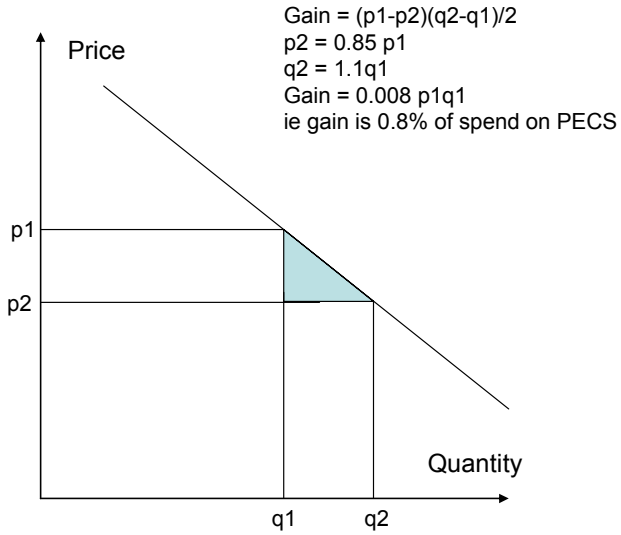
[55] This estimate is net of any implementation costs.

[56] Assuming a 20-year period of benefits and 4% discount rate. See Annex E for details.

- That MNEs in the EU generate revenues of €5850 billion pa[58]
- 1.5% of this revenue is spent on PECS
- Price effects are phased in over a ten-year period.

This gives us a welfare gain of €0.7 billion per year (= €5850 billion x 1.5% x 0.8%).

Figure 4.3 The economic gain from lower PECS prices



Compared with other economic gains from improved PECS this gain is modest. It is important to note the main effect of lowering the prices of PECS is a transfer of economic surplus from the suppliers of the wholesale access products that form inputs to PECS to the users of PECS, rather than any gain in economic surplus.

Lower ICT costs

Our survey indicates that MNEs can reduce their ICT costs by 10% to 20% if they deal with a single supplier. Ubiquitous access, leading to improved PECS should enable this. Using the more conservative 10% figure, this cost reduction generates an economic gain with an NPV of ***€216 billion*** if we assume that:

- MNEs in the EU generate revenues of €5850 billion
- MNEs in the EU spend 4% of revenues on ICT[59]
- The cost reduction is phased in over ten years.

This implies a cost reduction of €23 billion per annum[60] and a NPV for the gain of €216 billion.[61]

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[57] See for example Annex 9 of the *Review of the Regulatory Framework for fixed mobile convergence in Hong Kong*, Ovum for OFTA, April 2006.

[58] As measured by the top 500 companies in the EU from the *Financial Times'* "Europe 500" for 2007.

[59] This is the average for the five MNEs surveyed

[60] = €5850 billion x 4% x 10%.

[61] At a discount rate of 4% over 20 years.

4.5 Method 3: estimate based on gains in productivity growth

Another way to quantify the potential benefits from improved PECS is to approach dynamic effects directly by considering impacts on ***growth rates***, rather than starting with a static analysis of the impact on GDP ***levels***. A study for Cable and Wireless in 2004 adopted this approach to estimate the benefits of moving to equivalence of inputs and greater competition in the UK telecommunications market.[62] It assumed that:

- Equivalence of inputs would produce "leverage" of between 5 and 10 per cent on the contribution of telecoms to growth
- The share of ICT growth attributable to telecommunications is between 15 and 30 per cent; and
- ICT contributes growth of 1% per annum.

It estimated that the net present value of the benefits of equivalence for the UK was in the range £22 billion to £86 billion. This is equivalent to €220 billion to €860 billion when scaled to the European economy.

The study for Cable and Wireless sought to answer a different question. So the results should be compared with care. However, given that equivalence of inputs is one of the prerequisites for a fully developed pan-European services market, there are parallels and a similar methodology can be usefully applied.

A good starting point is to consider the contribution of ICT to productivity growth in Europe and to contrast it with the US, where the contribution of ICT has increased significantly over the past decade or so. A previous study by BT considered this issue.[63]

Figure 4.4 and Figure 4.5 show overall labour productivity growth per hour and ICT component contributions for the EU-15 and US.[64] The comparisons are based on data from the Groningen Growth and Development Centre, who have normalised national data into a reasonably comparable database.[65]

In the US, overall productivity growth (the red line) has risen dramatically, whilst the contribution of ICT-producing manufacturing (the middle bar in dark blue) has declined slightly since the mid-1990s, and the contributions of communications and computer services and particularly intensive ICT-using private services have increased (the bottom and top bars respectively in light and mid blue).

In the EU-15, overall productivity growth has declined, whilst the contribution of ICT-producing manufacturing (the middle bar), communications and computer services and intensive ICT-using private services have increased only modestly over the past 25 years. The share of productivity growth that is accounted for by ICT has risen. But the primary reason for this increase is that overall productivity growth has fallen.

In summary, ICT, and ICT use in particular, has contributed to an upsurge in productivity growth in the US but not in Europe.[66] Focusing on the contribution of ICT-communications and computer

[62] Williamson and Heaney. January 2004. *Reaping the telecoms dividend*. http://www.cw.com/docs/newsletters/agenda/ReapingtheTelecomsDividend.pdf

[63] BT. June 2007. *The Economic Benefits from Providing Businesses with Competitive Electronic Communications Services*. Part 2. http://www.btplc.com/Thegroup/Regulatoryinformation/Consultativeresponses/BTdiscussionpapers/Electronic/index.htm

[64] These graphs use smoothed data, the raw data also indicates a similar pattern, though with much more annual variation.

[65] Source data from *Groningen Growth and Development Centre, 60-Industry Database*, September 2006, http://www.ggdc.net

[66] The decline in overall productivity growth in Europe, which is not obviously ICT related, is discussed in Robert J. Gordon and Ian Dew-Becker. November 2005. *Why Did Europe's Productivity Catch-up Sputter Out? A Tale of Tigers and Tortoises*. http://www.frbsf.org/economics/conferences/0511/1_ProductivityCatchup.pdf

services, ICT-producing manufacturing and intensive ICT-using private services, Figure 4.6 shows the difference in the productivity contribution between the EU-15 and US over time[67].

Figure 4.4

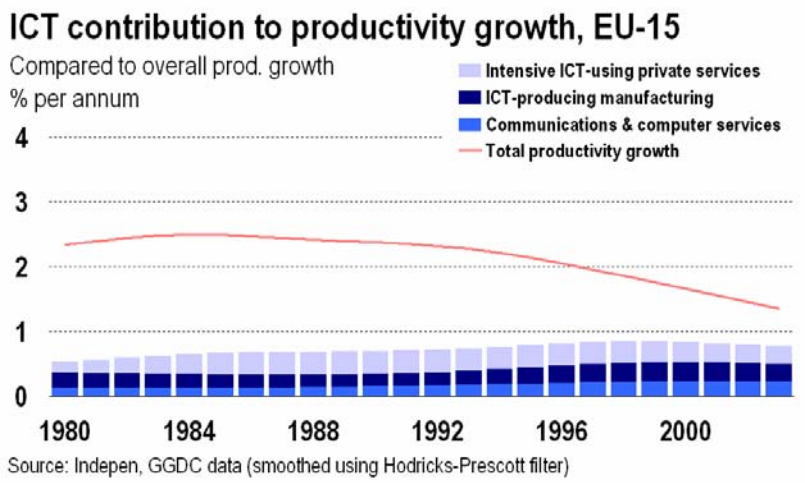
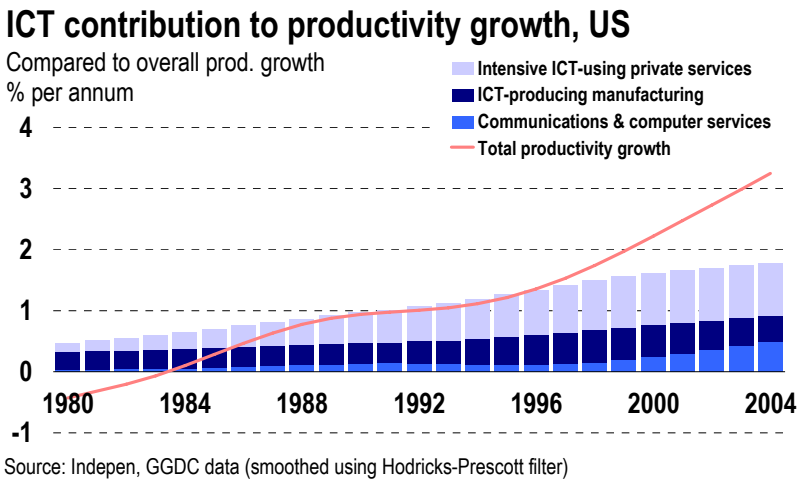


Figure 4.5



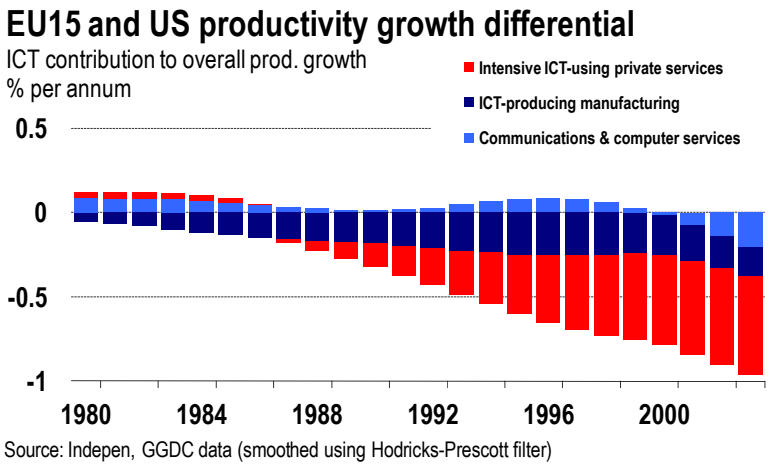
The overall ICT productivity contribution deficit for the EU-15 grew to almost 1% per annum. More recent analysis of relative productivity performance by the European Commission also supports this estimate.[68]

Assuming the causes of this gap are distributed across both ICT production and use, and the policy and commercial environment relevant to both, further liberalisation and development of the pan-European services market could be expected to contribute to higher productivity growth.

[67] The most recent data suggest that this gap in productivity growth has reduced in the past year. But this reflects the slowdown in US productivity, after a decade of strong growth, rather than any improvement in EU productivity. See European Commission. 31 October 2007. Commission Staff working document accompanying *Raising productivity growth: key messages from the European Competitiveness Report 2007*. http://ec.europa.eu/enterprise/enterprise_policy/competitiveness/doc/compet_report_2007/comprep_2007_sec_1444.pdf

[68] European Commission. October 2007. *An overview of the EU KLEMS growth and productivity accounts*. European Economy Economic Papers – Number 290. http://ec.europa.eu/economy_finance/publications/publication9467_en.pdf

Figure 4.6



Source: Indepen, GGDC data (smoothed using Hodricks-Prescott filter)

Indeed, liberalisation of intensive ICT-using sectors and the supply of telecommunications services are likely to be strategic complements, in other words each contributes to the payoff from doing the other.[69] Milgrom and Roberts (1995) discuss complementary activities and, in particular, the emergence of "modern manufacturing" which involves the following specific complementarity:[70]

> *"Factors that increase the attractiveness of a broader product line (such as shifting tastes or a reduction in the costs of more flexible manufacturing equipment) or that reduce the costs of communication (such as improved telecommunications) tend to favour a shift to a make-to-order regime, lower inventories, and more communication with customers."*

It is also clear from Figure 3.2 that the MNEs interviewed for the study see the US as offering telecommunications services which are closer to seamless networking than those offered by the EU. So it is reasonable to assume that a move to ubiquitous access and seamless networking in the EU would lead to a closing of the productivity gap of Figure 4.6.

In addition we can expect MNEs to act as a catalyst for change, initiating changes that spill-over into the rest of the economy and create demand for more, and more sophisticated, inputs from SME suppliers.[71] Pan-European service providers also supply SMEs directly with services at present, but only where access conditions are favourable and/or they have sufficient infrastructure to allow them to compete effectively. This segment of their market could be expected to expand with ubiquitous access, bringing enterprise communications services to the SME market.

Given these assumptions we believe it is reasonable to assume that the impact of improved PECS, enabled by ubiquitous access and complemented with other measures, would be to close at least one-third of the gap of Figure 4.6 over the next ten years.[72] Such a change would generate economic gains with an NPV of €3417 billion over a 20-year period.[73] If we then assume that 35% of these gains are generated by MNEs and their supply chains[74] then the welfare gain associated

[69] Roberts. 2004. "The modern firm." Oxford.

[70] Milgrom and Roberts. 1995. "Complementarities and fit Strategy, structure, and organizational change in manufacturing." *Journal of Accounting and Economics*, 19.

[71] This finding is consistent with the idea that SMEs are an important source of innovation and change.

[72] Here we assume that MNEs and their supply chains can attract the good management needed to take advantage of improved PECS.

[73] Assuming a discount rate of 4% pa and an EU GDP of €12,200 billion which is growing at 2% pa.

[74] As discussed in Section 2.3.

with ubiquitous access and complementary regulation has an NPV of ***€1196 billion***. This estimate is consistent with that of Method 2. See Annex E for details.

4.6 Macro economic benefits − "The Great Moderation"

Economic volatility – fluctuations in income growth, employment and inflation - has fallen by around half in many developed countries (including all G7 countries) over the past two decades. This has resulted in significant gains in terms of reduced disruption of individuals lives and reduced episodes of elevated unemployment.

In part "the Great Moderation" is attributed to improved supply chain management via better use of ICT and connectivity. Inventories act as a buffer between production and sales, and when demand falls production orders may fall more if inventories are able to meet demand, producing large swings in output in the economy. The use of ICT in extended supply chains also allows information to flow more freely, and combined with flexibility in manufacturing this results in less volatility of output. Cecchetti *et al* (2005) comment that:[75]

> *"…the decline in the standard deviation of the contribution of inventory changes to GDP growth is large. Furthermore, it is usually a substantial fraction of the overall decline in volatility growth, accounting, on average, for nearly 60 per cent of the decline in output growth volatility across countries."*

Further, commenting on the ICT and connectivity contribution, Summers (2005) notes:[76]

> *"…the volatility of durable goods sales has remained essentially constant, while the volatility of production has declined by an amount similar to that of GDP…Such changes might have occurred in at least two ways. First, by making production or sales less sensitive to inventories, improved sales forecasting or inventory management could have reduced the volatility of inventory investment within a particular industry. Second, similar improvements in supply, distribution, and transportation networks might have helped streamline connections among industries (such as auto manufacturing and retailing)."*

The extent to which further gains in terms of economic stability can be made via better supply chain management and inventory control, and their linkage to better connectivity, is unclear. However, we note that some of the potential gains identified by MNEs from improved connectivity do involve improvements in information flow along supply chains, and scope to shorten product design cycles via improved availability of video collaboration etc. It is therefore entirely plausible that further gains in economic stability would flow from improved provision of pan-European communications services.

Whilst we do not attempt to quantify the potential benefits of further gains in economic stability, we note that they could be significant and that they are additional to the categories of benefit estimated previously, which related solely to levels of income and rates of income growth.

4.7 Supply versus use

Discussion of telecommunications liberalisation has tended to focus on potential changes within the sector rather than the changes which are induced in the economy more generally. In particular there is considerable debate across the EU about how to establish the right incentives to enable efficient investment in next-generation broadband services. This debate is an important one. But it is also important to place it within the context of the issues raised in this report.

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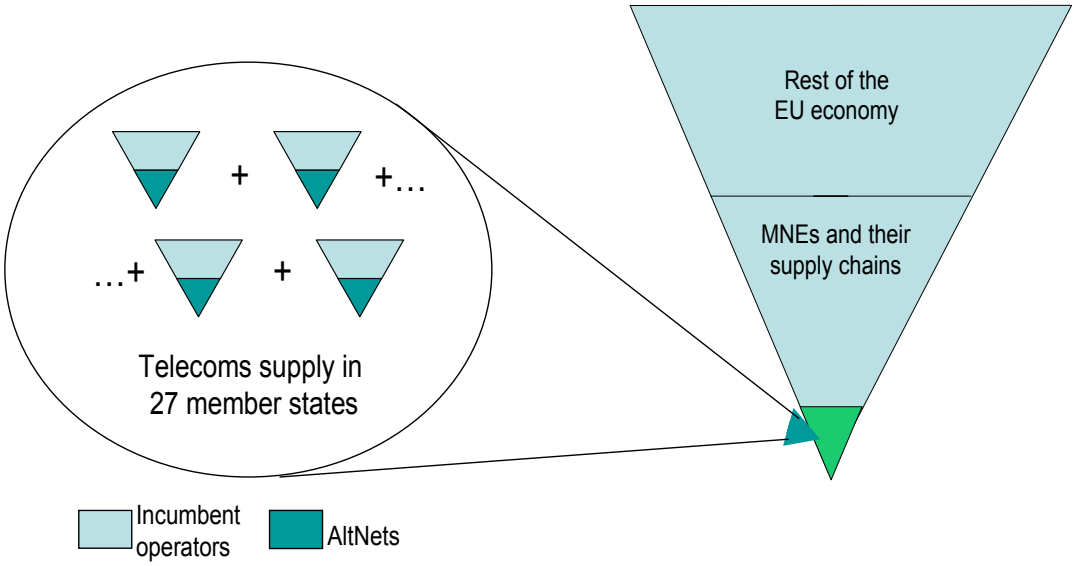
[75] Cechetti, Flores-Lagunes and Krause. August 2005. *Assessing the sources of changes in the volatility of real growth*. http://www.rba.gov.au/PublicationsAndResearch/Conferences/2005/Cecchetti_FloresL_Krause.pdf

[76] Summers. 2005. *What caused the great moderation? – Some cross-country evidence*. Federal Reserve Bank of Kansas *City: Economic Review, Third Quarter. http://www.kansascityfed.org/Publicat/econrev/PDF/3q05summ.pdf

Figure 4.7 shows this relationship. The left hand side of the figure shows the contribution to GDP of the incumbent operators and alternative network operators in the 27 member states. The right-hand side shows how the aggregate of these contributions sits within the wider context of the EU economy as a whole. It is clear that even modest improvements in the functioning of MNEs and their value chains through more effective ***use of telecoms*** will dominate more effective ***production of telecoms services***. The aim of Methods 2 and 3 above is to capture the dynamic impacts of changes in the provision of communications services on the structure of the economic activity.

Figure 4.7 The relative contribution of telecoms supply and other sectors to GDP



4.7 Conclusions

In conclusion, we find that improved pan-European communications services based on ubiquitous access could deliver significant gains, both in the communications sector itself in terms of productivity gains, competition and innovation and for the users of pan-European communications services. Most significantly MNEs and their supply chains would be able to change the way they do things so as to make substantial gains in terms of productivity and product and service innovation, if a more developed and competitive market in such services existed.

Achievement of these gains would be accompanied by a reduction in prices and expansion of output and trade in communications services, thereby contributing to development of the internal market. Improved connectivity may also bring benefits in terms of improved economic stability.

Figure 4.8 below summarises our estimates of the scale of economic gains which might result if PECS providers could offer seamless networking through ubiquitous access to wholesale network access products. It is important to note that regulation to enable ubiquitous access requires complementary measures, such as improved labour and product market flexibility, together with implementation of measures to remove barriers to completion of the single market.

Figure 4.8 Possible gains from ubiquitous access and complementary measures

Impact of ubiquitous access	*Economic gain (NPV)*[77]	*Comments*
Method 1: Greater trade from full liberalisation of telecommunications	***€327 billion***	Excludes potential supply side and demand side industry transformations not captured by historical relationships
Method 2 – bottom up efficiency gains		
Productive efficiency gains through reduction in ICT costs for MNEs from dealing with one supplier	€216 billion	
Lower prices for PECS	€6 billion	
Dynamic efficiency gains through business process re-engineering in EU by MNEs and their supply chains	€1055 billion	
Total	***€1277 billion***	An estimate which includes all the dynamic effects of ubiquitous access
Method 3: Productivity growth gap between EU and US is reduced by one-third through better PECS and complementary measures	***€1196 billion***	An estimate which includes all the dynamic effects of ubiquitous access

Figure 4.8 indicates that:

- On its own the full opening of the telecommunications services market in the EU produces gains of €327 billion. This estimate does not account for possible restructuring value chains and re-engineering business processes which go beyond those associated with past liberalisation.
- When these effects are taken into account the NPV of the benefits of ubiquitous access grows to between €1277 billion (Method 2) and €1196 billion (Method 3).

Based on the quantification tabulated in Figure 4.8, we estimate that ***ubiquitous access***, together with complementary measures, would generate benefits with a net present value of between ***€1100 billion and €1300 billion*** over the next 20 years.

To put these estimates in context:

- It might take a decade for the EU economy to feel the full effects of ubiquitous access and complementary measures
- The full effect would be to increase EU GDP by 1.6% to 2% each year from then on
- This increase is equivalent to an increase in wealth of €430 to €510 per person per year in the long term.

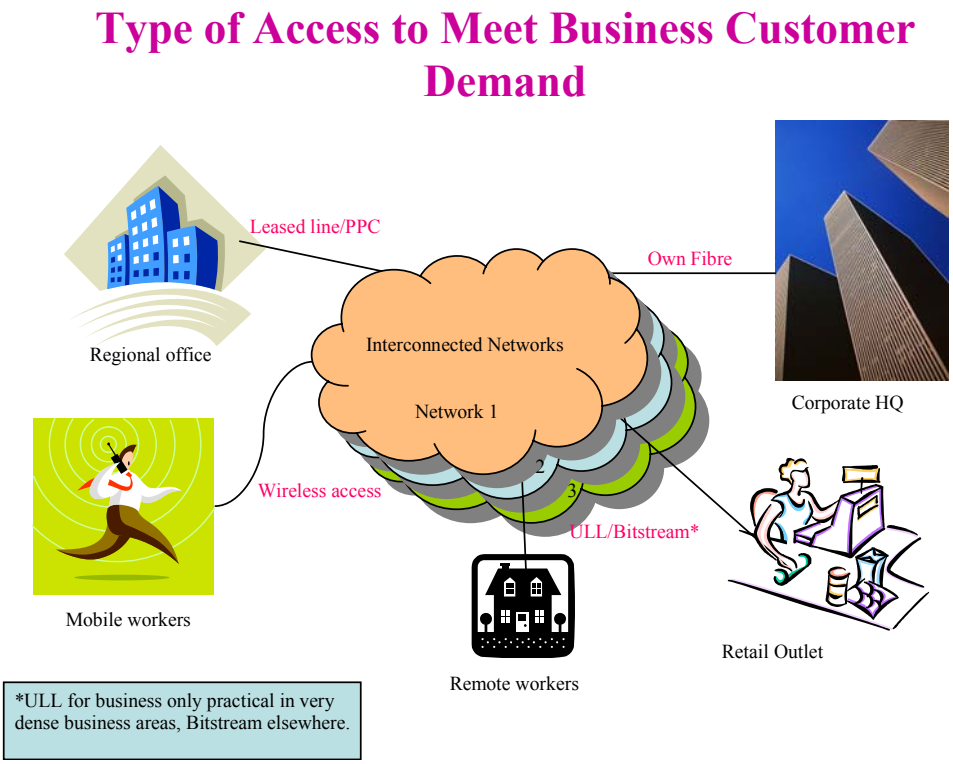
It is important to note that any regulation which enables ubiquitous access would benefit SMEs and consumers as well as MNEs and their supply chains:

- MNEs would be able to deepen their relationship with SME suppliers, and PECS providers would, if ubiquitous access were available, expand the provision of their network services to SMEs, so increasing choice and competition
- Household consumers would also benefit to the extent that reforms aimed at facilitating development of the PECS market would also facilitate greater competition and innovation in the domestic market.

These findings highlight the importance of ensuring a regulatory framework that supports ubiquitous access provision. This might largely be achieved by applying the principle of equivalence to eliminate discriminatory treatment of PECS suppliers.

[77] Over a 20 year period discounted at 4% pa

Annex A Access requirements of multi-site businesses



Source: BT

This diagram shows how businesses connect their sites and workers with each other and with other businesses through a variety of fixed and wireless telecommunications networks and services.

Annex B Variation in EU access conditions

B1 Purpose

This annex illustrates the variation in the supply conditions that PECS providers face when they purchase wholesale access products in different countries within the EU, despite the common regulatory framework. It shows that variation in the terms of supply between countries is substantial, indicating that many regulators have failed to take in the needs of business users − particularly cross-border business users − and that for the purpose of delivering a single European market, PECS providers face a systematic problem.

Information is primarily drawn from a survey of BT in eight EU member states (referred to as Countries A to H) undertaken in October and November 2007. The intention of this annex is not to identify the failings of individual regimes but to point out that the harmonised EU regime is currently failing to deliver anything approaching harmonisation. Moreover, it should be noted that only one of the countries surveyed is a country that has recently acceded to the EU.

B2 Overview

Information collected on key access products for business services in eight EU countries reveals significant differences in terms of:

- The availability of specific regulated products. In many countries particular products are not yet available despite regulators having found Significant Market Power in the relevant market.
- The pricing of relevant products. Overall wholesale access prices are estimated to be marked up 30% or more above prices that could be expected in a competitive market − based on observations of current prices and the relative importance of each key business access product. In many cases the mark-up for specific products is much higher − several times estimated costs.[78]
- The Quality of Service standards available to the PECS supplier. Differences in standard product delivery times and time taken to repair faults are compared across countries as an illustration of the differences that currently exist.

The materiality of these differences indicate that the current access conditions PECS face are not competitive across the EU and are likely to be a significant barrier-to-entry and expansion in the PECS market. Country-specific factors, such as input cost differences, are unlikely to account for the significant differences observed.

B3 Specific Product Conditions

B3.1 Traditional leased lines, including trunk and terminating segments

Leased lines are regulated in most countries surveyed at both the retail level (Market 7 of the previous list of relevant markets under the EU Regulatory Framework) and at the wholesale level (Market 13 – wholesale terminating segments of leased lines, under the nomenclature of the previous list of relevant markets)[79].

[78] In some cases, such as for mobile access, there is no cost-oriented regulation and it is not possible to say what the cost-oriented price would be, however prices generally prevent the purchaser from competing on a price basis for national contracts.

[79] The market for wholesale trunk segments of leased lines has been removed from the Relevant Market Recommendation (previously Market 14). It is the case that this market tends to be more competitive However, this is likely to have been an effect of regulation. In order to remain in the wholesale market on competitive routes (and not to overprice self-supply)

Wholesale access to leased line segments, especially terminating segments, is important for a PECS supplier. This is because leased lines make up a significant portion of customer access demand and because wholesale terminating segments rather than retail end-to-end leased lines allow the PECS supplier to keep costs lower by utilising own trunk network and only purchasing network coverage that is needed.

Availability

Figure B3.1 indicates that although the terminating segments of leased lines are regulated in all countries surveyed − in some cases only up to 2Mbps − in many cases regulations or revised regulations are still awaiting implementation (4 of 8 countries).[80]

Figure B3.1: Regulation of Terminating Segments of Traditional Leased Lines

Country	A	B	C	D	E	F	G	H
Product Regulated	✓	✓	✓	✓	✓	✓	✓	✓
Regulation Implemented	✓ Further national remedies have been proposed but not implemented	✓	✗	✓	✓	✗ NRA has not concluded implementing investigation	✓	✓ Further national remedies have been proposed but not implemented

Further, where regulation does exist, in some cases the use of the regulated product may be uneconomic for the servicing of business customers due to requirements to invest in regional infrastructure that are better justified for the higher density residential market. For example in Country E, BT is only able to gain access to leased line terminating segments in regions where it has invested in a point of presence. As a result BT would need to invest in a point of presence in each of nine regions in order to gain national coverage.

Pricing

Leased line regulation is typically cost-oriented using a retail minus methodology. Despite this, BT responses to the survey considered prices to be well above cost. These observations were based on knowledge of own-network costs, industry knowledge and observations of prices of alternative operators operating alongside the incumbent operators.

For example, in Country H the wholesale prices of alternative operators in metropolitan areas are around 40% cheaper than those of the incumbent.

The different pricing methodologies across countries make it difficult to compare prices directly. For example, in some countries prices are calculated using distances and in others they are determined by the region in which the connection is required. Figures B3.2 and B3.3 approximate the variation in pricing for standard 2M, 5km and 34M, 5km terminating segments of leased lines for a one-year contract provided by the incumbent. These figures factor in the one-off installation charge and monthly rental fees.[81]

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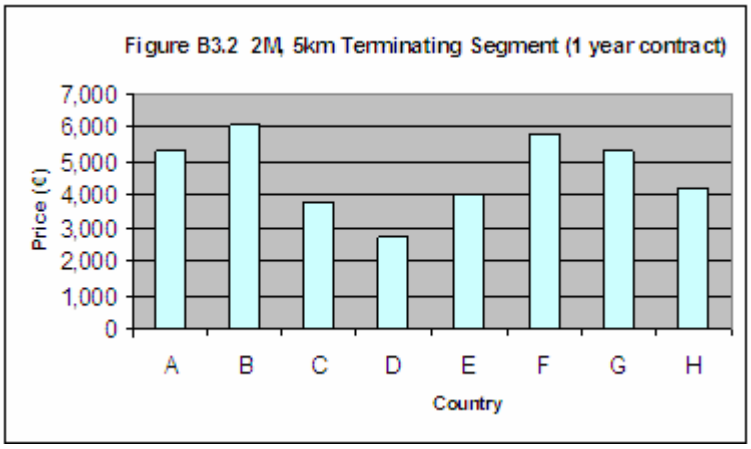
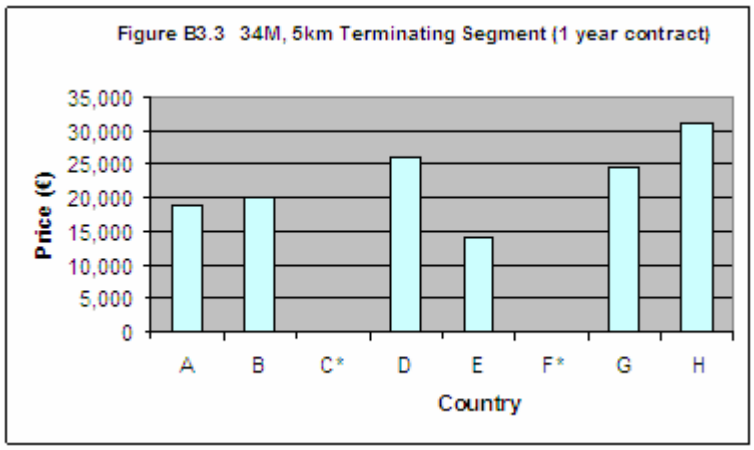
incumbents had to reduce the national regulated price. If this market is now deregulated without regard to different levels of competition by geography, then it is likely that the incumbents will raise price on those trunk routes where they do not face competition.

[80] Inferior commercial products (both in terms of pricing and technical elements) may be available in those countries where regulation is awaiting implementation.

[81] Prices are provided as at November 2007. Gaps in the graphs (*) exist where no standard data is available. Prices have not been adjusted to take into account country specific factors, however adjustments for differences in country costs, for example





Using the lowest three prices in the EU as a proxy for the best-practice price, the average price for the 2 Mbps product is subject to a mark-up of approximately 30%, and for the 34 Mbps product 50%.[82]

While this analysis is a 'rough and ready' measure, it does indicate that there are considerable differences in price across countries. Notably, if a similar analysis is conducted using the 2 Mbps and 34 Mbps data of the European Commission 12th Implementation Report, which includes a wider range of EU members, it results in an average mark-up of approximately 100%.[83]

Quality of service variations

Standard SLA terms and conditions, where available, also vary widely across countries. Figure B3.4 indicates the standard time to supply a 2 Mbps terminating segment. It indicates that this may range from 15 business days to 51 business days (a difference of 36 business days or seven weeks).

For a 34Mbps segment the standard range is from 30 business days to 100 days (A range of 70 days or 14 weeks).[84]

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by adjusting for purchasing power parity, could be expected to exaggerate the mark-up given the countries with the lower prices tend to have a higher cost index.

[82] In the past the European Commission has adopted this approach to establish 'best practice' interconnection rates using benchmark data across member states. These prices are still likely to be above cost.

[83] Commission Staff Working Document, Annex to the European Electronic Communications Regulation and Markets 2006 (12th report), 29 March 2007. The analysis was only applied to those countries where both an installation and monthly rental fee were provided.

[84] It should be noted that data provided is for standard supply times and may only apply to a specific percentage of requests. In some cases premium products may be purchased at additional cost with reduced delivery times.

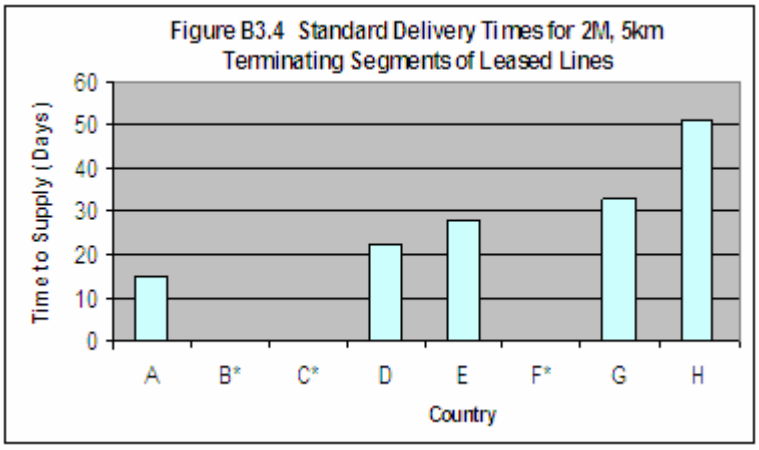
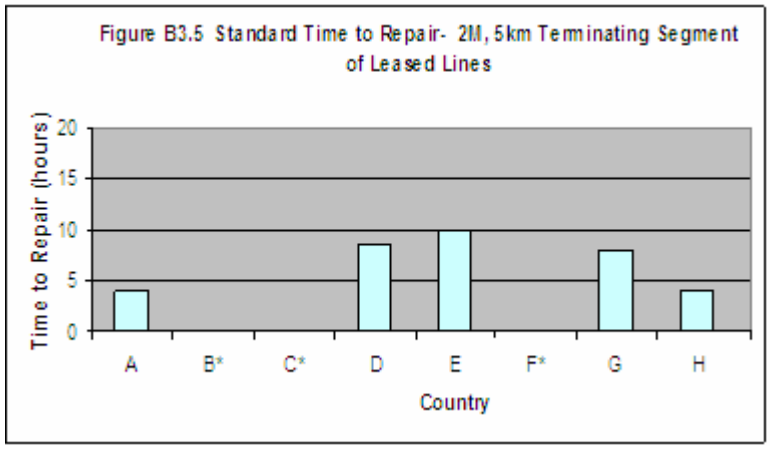


Figure B3.5 indicates the variation in the standard fault repair time for a 2 Mbps terminating segment. Time-to-repair depends on the type of fault and priority, however standard times vary from four hours to 10 hours but can be much longer for faults assigned lower priority. In some cases, standard repair times are not available at all.[85]



B3.2 Access conditions for business ethernet

Ethernet access, although currently purchased in smaller volumes, is anticipated to be a key area of growth as demands for higher bandwidth services grow. Ethernet access was reported as a consistent difficulty across the countries surveyed, with issues in terms of the lack of availability of a fit-for-purpose product and very high pricing.

Availability

Figure B3.6 indicates that business ethernet access is not regulated at all in three of the eight countries. Of the five countries where it is regulated, regulation is yet to be implemented in three countries. Business ethernet access is available on a commercial basis in some countries where regulation is not yet in place.

[85] It should be noted that often shorter repair times are available, but these are usually at a substantial premium.

Figure B3.6 Regulation of business ethernet

COUNTRY	A	B	C	D	E	F	G	H
Product regulated	✓	✗	✓	✗	✓	✓	✓	✗
Regulation implemented	✗	✗	✗	✗	✓	✗	✓ Six month implementation period	✗

Where business ethernet is regulated, this is generally only up to 100 Mbps, making it difficult or impossible to compete on tenders with very high bandwidth requirements. This is despite very little additional cost in order to increase ethernet speeds.

Access may also be limited by infrastructure build requirements and distance restrictions, which make economic access particularly difficult for the servicing of business customers. For example, Country E requires a point of presence in nine regions in order to have national coverage.

There are also issues with the technical nature of the product available. For example, in some cases the incumbent does not provide a true wholesale variant to its retail ethernet offers. In Country F and Country H the incumbent commercially offers only wholesale ethernet access over SDH leased lines and not 'pure' ethernet. In practice, this means that BT is unable to take advantage of the significant cost savings ethernet offers for high-speed bandwidth because it needs to provide and charge for the SDH equipment additionally required.

Pricing

Ethernet regulation, where imposed, is not necessarily cost-oriented and may be based on price squeeze or 'non-excessive' pricing tests (Country A, Country E). In most countries excessive pricing was identified as an issue and a key reason ethernet is not used or used more (eg Country A, H, F).

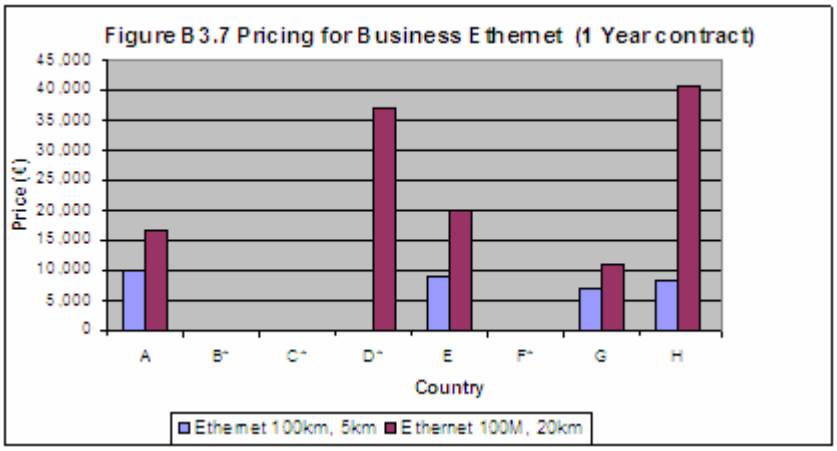
Due to lack of standardised pricing it is difficult to compare prices across countries (Standardised prices and Service Level Agreements are not currently available in six of the eight countries). Pricing tends to be determined on a case-to-case basis and commercially negotiated.

However, comments on the extent of excessive pricing included the following:

- In Country F the incumbent **retail** ethernet offers can be significantly cheaper than the wholesale offer to BT (by at least 40% in some cases)
- In Country H the incumbents wholesale commercial ethernet offering for non-urban areas is estimated to be about five times the cost price, based on the observed price of similar offerings from other operators and the incumbent's urban wholesale commercial offerings. Further, alternative urban ethernet suppliers are at least 70% cheaper than the incumbent.

Figure B3.7 illustrates the standard wholesale prices for 100 Mbps 5km and 20km ethernet lines, where available.[86] The mark-up between the lowest and highest price for the 5km product is approximately 40%. The price variation increases significantly for the 20km product. The mark-up between the lowest and highest 20km product is over 260%.

[86] These represent regulated prices, or standard commercial prices where the regulated price is not available. Prices may vary depending on parameters other than speed and distance, for example area/region and volume discounts. Prices for Country G reflect a regulated offer awaiting implementation.



Quality of Service Variations

Figure B3.8 illustrates that the standard time-for-supply for business ethernet ranges from 35 to 60 days.[87] However, in the majority of cases a standard time-to-supply is not available, and delivery times are worked out on a case-by-case basis. Further, often a feasibility study must be conducted prior to ordering the product, which adds additional time to delivery.

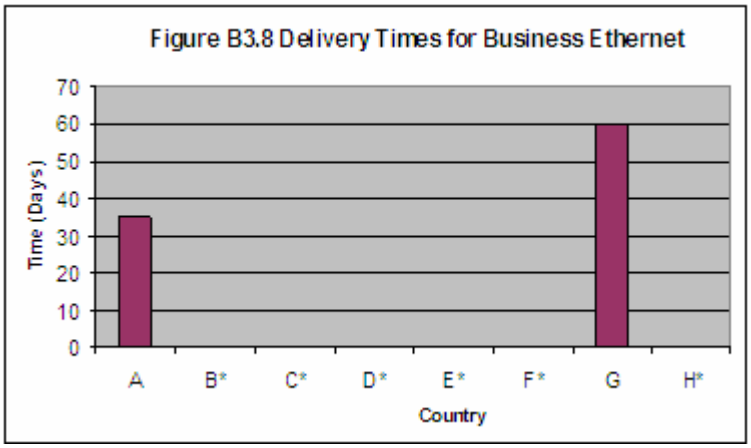
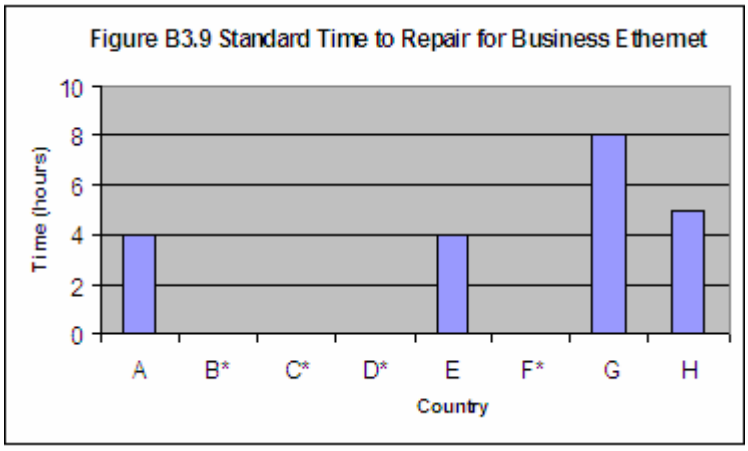


Figure B3.9 indicates that the variation in the standard time-to-repair for business ethernet, where available, is reduced when compared to other products, ranging from four to six hours.



[87] As for leased line terminating segments, it should be noted that data provided is for standard supply and repair times and may apply to a specific percentage of requests. In some cases premium products may also be purchased at additional cost, with reduced delivery and repair times. Repair times may also vary by priority.

B3.3 Bitstream access for business connectivity

Business bitstream access is available in two forms:

- Bitstream DSL access for business connectivity to virtual private networks
- Bitstream DSL access for business connectivity to internet service providers

Such bitstream access services are particularly important for business customers with lower bandwidth and technical requirements. Bitstream access was identified as an area of growth in several countries. BT uses both bitstream access at the ATM and IP levels. ATM bitstream access typically offers higher-quality DSL connections with better quality of service parameters.

Availability

Figure B3.10 indicates that ATM bitstream access is regulated in all but one country surveyed. Regulation is still awaiting implementation in two countries, and revised regulation is awaiting implementation in a further country. IP bitstream is also regulated in all but one country surveyed (a different country to that for ATM bitstream) and is still awaiting implementation in four countries.

Availability of bitstream access is a key issue in countries C and F, where the incumbent operators currently only offer resale DSL products and no regulation has been implemented.

Obtaining national coverage can also be an issue in some countries. For example in country E there are 35 DSL regions and in country G connection to 100 points is required.

Figure B3.10: Regulation of bitstream access

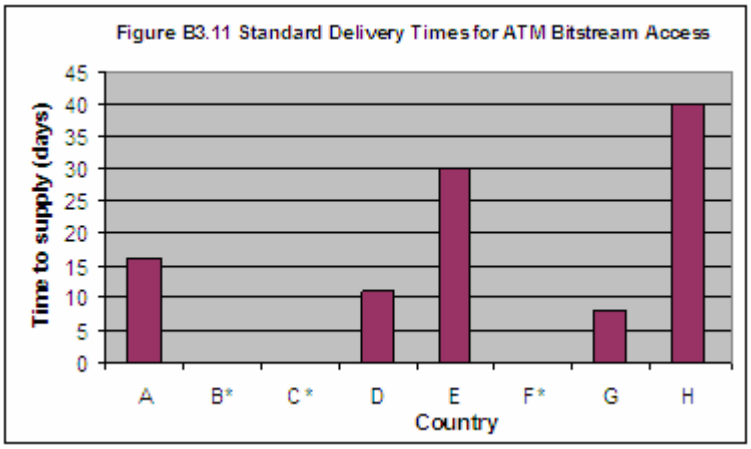
COUNTRY	A	B	C	D	E	F	G	H
ATM bitstream regulated	✓	✗	✓	✓	✓	✓	✓	✓
ATM regulation implemented	✓	✗	✗	✓	✓	✗	✓ Further national remedies have been proposed but not implemented	✓
IP bitstream regulated	✗	✓	✓	✓	✓	✓	✓	✓
IP bitstream regulation implemented	✗	✓	✗	✗	✓	✗	✓ Further national remedies have been proposed but not implemented	✓

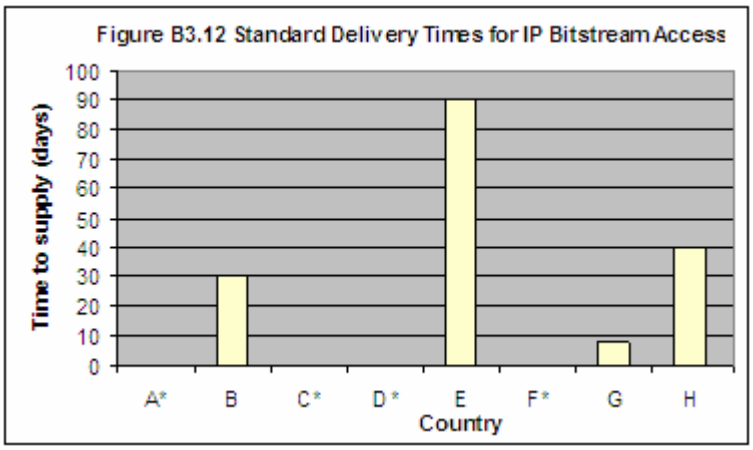
Pricing

Regulation of bitstream is generally on a cost-oriented basis, although in some cases a price squeeze test is applied. Standardised prices and SLAs are often not available (over half of the survey countries in both cases). However, survey responses suggested that on average, prices are at least 20−25% over estimated cost. Notably, in country H where cost-orientation has recently been introduced, the new price is 25% lower than the previous regulated retail minus based charge.

Quality of service variations

Figures B3.11 and B3.12 illustrate the standard time for supply for 2 Mbps ADSL ATM and IP bitstream products respectively. The range in standard delivery times varies widely – from eight working days to 36 days for the ATM product and eight working days to three months (90 days) for the IP product[88].



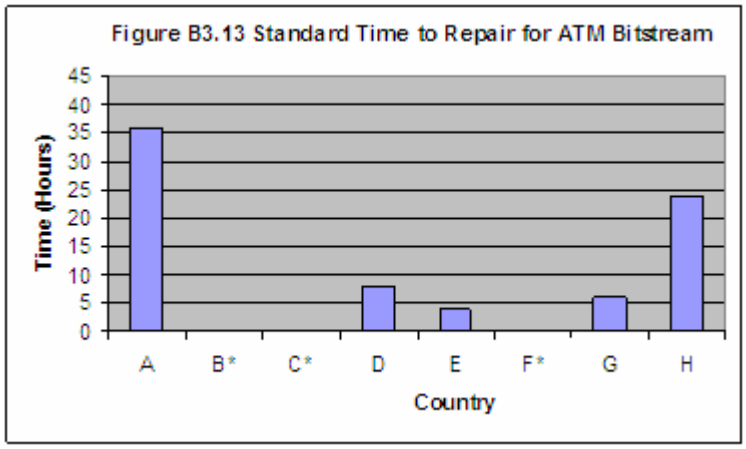


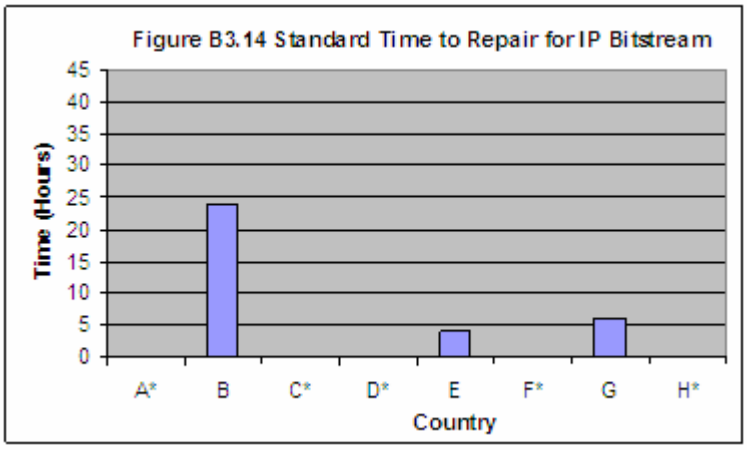
Figures B3.13 and B3.14 illustrate the standard time to repair faults for ATM and IP ADSL bitstream products. While time-to-repair varies depending on priority and specific product (e.g. symmetric bitstream products generally have faster standard repair times) the standard ranges vary between four hours and 36 hours for the ATM product, and between four hours and 24 hours for the IP product (although this can increase to 72 hours for low-priority repairs).

Where negotiable, SLAs are available at additional cost that reduces repair times to between three to eight hours.

Notably, survey responses consistently noted long lead and repair times, including failures to meet times set out in service level agreements.

[88] Time-to-supply varies depending on the specific product (e.g. ADSL versus SDSL, speeds, line type). Data provided is for standard supply times and in some cases premium products may be purchased at additional cost with reduced delivery times.





B3.6 Mobile including MVNO access

Mobile access including MVNO access is particularly important to meet the converging fixed mobile needs of MNEs. These can only be met if MVNOs are available in each member state such that it is feasible to construct a single pan-European offering.

Availability

MVNO access is not yet regulated or available on a commercial basis in most EU countries. Of the specific countries surveyed, many do have commercial offers available but the conditions often make these unusable for the servicing of pan-European business customers. A single-voice pan-European offering cannot feasibly be offered today by any one single mobile operator and no operator at all is capable of offering a single fixed mobile converged solution.

Figure B3.16 indicates that access to mobile is not regulated in five of the eight countries surveyed. Notably, in some countries MVNO access was recommended by the regulator following a finding of joint SMP in the relevant market, however these recommendations have been withdrawn (country E) or are being appealed (country G). In country A, B and F the regulator approached the market review from the perspective of national consumers and not pan-European business customers. As a result, no competition issue was found by the regulator in the relevant retail market.

Figure B3.15: Access conditions for mobile, including MVNO access

COUNTRY	A	B	C	D	E	F	G	H
Mobile access regulated	✘	✘	✓ Not for full MVNO	✓ Must meet reasonable access requests	✘	✘	✓ Must meet reasonable access requests	✘ Some voluntary undertakings to supply access.
Regulated price rule	✘	✘	✘	✘	✘	✘	'Reasonable' prices	✘
Terms and conditions regulated	✘	✘	✘	✘	✘	✘	✘	✘

Pricing and quality of service

Where regulations do apply, these are in limited form, generally imposing an obligation to provide access in response to reasonable requests (country C, D, G). These do not, however, mandate any form of pricing principles or terms and conditions of access. These terms are therefore negotiated on a commercial basis, where the PECS supplier has significantly less negotiating power than the incumbent mobile operators.

Pricing and availability of a fit-for-purpose product are a key issue for PECS providers looking to extend their service to include pan-European mobile services.

A cross-country comparison of terms and conditions is not possible at this stage, due to lack of available information, however BT's EU experience thus far includes:

- Difficulties gaining access to potential mobile operator networks through refusals to deal
- Pricing such that BT is excluded from competing in a large segment of the market
- Operating models that fall short of a full MVNO service − meaning that there are serious limitations in deployment of service to customers as well as limitations in internal operations; and
- Anti-competitive contractual arrangements including incentives to pursue off-net customers and limitations on the number of customers that can be ported per day (including guaranteed portability times less than under the existing regulated rules).

B3.7 Key performance indicators

Key performance indicators (KPIs)are important in order to verify whether non-discriminatory practices are in place. In order to be effective, these KPIs should:

- Record the conditions of supply which the vertically integrated incumbent provides to itself compared to the conditions of supply which it provides to other third-party suppliers
- Record these conditions at a sufficient level of detail in order to be meaningful
- Be made publicly available.

The following tables illustrate that effective KPIs are not currently in place in most of the countries surveyed for either leased line terminating segments or business bitstream services. None of the regulators surveyed publishes KPIs that measure conditions of internal supply against those of third parties.

Figure B3.16 Key performance indicators for terminating segments of leased lines

Country	KPIs	KPIs published	KPIs measure conditions of internal supply against those to third parties
A	×	×	×
B	✓	✓	×
C	×	×	×
D	✓	✓	×
E	✓	✓	×
F	×	×	×
G	✓	×	×
H	✓	×	✓

Figure B3.17 Key performance indicators for bitstream access for business connectivity

Country	KPIs	KPIs published	KPIs measure conditions of internal supply against those to third parties
A	✓	×	×
B	✓	✓	×
C	×	×	×
D	✓	✓	×
E	✓	✓	×
F	×	×	×
G	✓	✓	✓
H	✓	×	✓

Annex C Technical service specifications

C1 Summary

Variation in the technical specifications of access products across EU countries and between access providers can make it difficult and more costly for PECS providers to serve the needs of MNEs. It can mean access services may be:

- Unsuitable for higher-specification applications required by business. As a result of contention and/or prioritisation of packets[89] by third party access providers PECS may be unable to deliver higher-quality 'class of service' applications (for example, high-quality real-time bi-directional voice or video). In such cases it can be necessary to lower the specification of the end-to-end service to match the restrictions introduced by the most constrained access connection
- Incompatible between access and network service providers. As a result of differences in technical specifications communications providers need to customise the interface with these third-party access providers, significantly raising development time and costs, and raising costs to end-users.

C2 Background

Packet-based bitstream and ethernet access allows service providers to simultaneously support a number of applications for several client platforms on a single-access pipe (for example voice, MPLS[90]). This offers significant advantages for both service providers and customers compared to the traditional requirement for a single dedicated leased line access circuit to support each client platform:

- It enables sale of additional services to customers already served without requiring an extra access connection and reduces access costs for customers
- Customers can be given an increasing level of control over their own network services, given suitable information systems.

Service providers achieve this by using 'class of service' to prioritise traffic over the network and access connection. Higher classes of service are assigned to applications that have more stringent tolerance on delay and packet loss, such as real-time services (as opposed to internet browsing). This offers customers predictable, measurable quality of service.

C3 Technical specifications unable to support all business applications

If technical specifications adopted by third party access suppliers prevent service providers from implementing a 'class of service' system over the access connection, the potential advantages outlined above are not as achievable and PECS providers may not be able to offer the full range of business applications.

This may occur if an access provider network is optimised for the servicing of residential users (with much lower usage rates and specification requirements than business customers). For example, broadband networks for data services are typically built around the assumption that not all customers will be using the service at the same time, so while an exchange can support many

[89] "Contention" refers the principle of overbooking, for example networks are typically built around the assumption that not all customers will be using the service at the same time. A *packet* is a unit of data that is routed on any packet-switched network.

[90] MPLS stands for Multi-Protocol Label Switching which is a means of carrying packet services more efficiently across networks where there are common specific destinations for the traffic. MPLS is common for servicing of business customers.

hundreds of customers, the capacity linking the exchange to the network is only sufficient to support a fraction of these customers concurrently. This principle of overbooking is known as 'contention' and allows companies to reduce the cost of broadband service provision. For consumer broadband, contention ratios of 1:50 are typical.

This "contention" prevents the delivery of higher specification classes of service required for business service applications, which can require much lower contention ratios of, say, 1:10 or 1:1. In turn this constrains the set of services/applications that PECS can sell to customers connected using such access.[91] The PECS provider may not be able to offer the higher-specification service or may need to purchase a "traditional" leased circuit in order to deliver the service, at increased cost to the customer.

Similarly, technical specifications may also limit the usefulness of ethernet access. To offer an unrestricted range of business products a PECS provider requires services to be delivered to the customer/network with no additional packet loss/jitter[92] so that the PECS provider (where required) can implement class of service.

The nature of the network used by an access provider to transport Ethernet frames can also impact on the class of service. For example ethernet access may be provided on a switched or non-switched basis. Although in both cases the ethernet transmission bandwidth is uncontended, in the switched case the ethernet frames pass through an ethernet switch in the access provider's domain. As a result of this transition, the switched ethernet service may suffer increased delay/jitter or packet loss which can impact on the overall performance and mean the PECS provider cannot guarantee service quality.

C4 Variation in technical specifications

Access products have typically been defined to suit needs and cost/operational constraints arising from national circumstances. As such, there is little intentional commonality between products from different access providers and where this appears to exist it is often at a superficial level − perhaps arising as a result of using similar equipment. Where technical specifications vary across countries and across access providers, the service provider has to customise the interface with the third-party access provider, significantly raising development time and costs.

For example, within the EU access providers have applied a range of contention ratios and types of packet prioritisation to bitstream access products. As a consequence, BT must customise the interface design for each third-party bitstream service provider that is introduced. This involves issuing a detailed specification to each access provider to capture the technical product specification, reviewing this against BT requirements and developing an appropriate low-level design. To mask differences between access products from the service platforms, BT maps business bitstream offers into one of three service categories (in order of increasing cost): Standard (with a typical contention ratio of 1:50, Plus (1:4-1:10) and Premium (1:1). Such customisation for each new interconnection significantly adds to costs as well as to development time. This customisation is essential to ensure that the end-to-end service specified by BT can be delivered to all the customer locations with consistent quality of service, irrespective of the country or the access provider used.

[91] Prioritisation of packets by third party access providers has the same effect.

[92] "Packet loss" is the failure of packets to arrive at their destination. This can cause noticeable effects such as jitter, gaps in receiving information and errors. "Jitter" refers to the variation in the time between packets arriving. As the name suggests, jitter can be thought of as shaky pulses.

Annex D Findings of a survey of five MNEs

D1 Introduction

This annex provides a summary of the main conclusions from five interviews with multinational enterprises on the impact of providing seamless telecommunications networking.

D2 The five MNEs

The companies interviewed included:

- A financial services company
- An automotive manufacturer
- An engineering and design consultancy
- An ICT service provider; and
- A consumer products supplier.

The annual revenues of these five MNEs together represent just over 1% of EU GDP (€130 billion per annum compared with €12,200 billion per annum for the EU27's GDP). 50% of these revenues were generated from EU sales and 50% from sales in the rest of the world.

Spend on ICT ranges from 2% of revenues in manufacturing (automotive manufacturer, consumer products supplier) to 6% (ICT service provider) to 8% in services (financial services company).

D3 Productivity

Those parts of the supply chain which are outsourced depend on the activities of each MNE. But all five MNEs outsource the bulk of their ICT and telecommunications processes to others.

The MNEs measure productivity improvements in terms of revenue and profit growth rather than by looking at the value added per employee. This value added ranges from 17% of revenues at the automotive manufacturer to around 30% at the consumer products supplier and the financial services company.

Over the next three years all five MNEs will rationalise and consolidate business processes at fewer centres for productivity growth:

- "Consolidation of operations in nine global centres" for "extended reach and lower costs" (financial services company)
- "Rationalised processes and achieving higher levels of efficiency" (automotive manufacturer)
- "Reducing from 27 to seven or eight businesses" to "achieve greater group consistency" (ICT service provider)
- "Grouping operating companies into multi-country organisations for greater efficiency" (consumer products supplier). In the EU 30 country units will be reduced to 10 multi-country organisations
- "Establishing a global design centre with 200 or more staff" using ICT "to enable faster, better and cheaper" service delivery (engineering and design consultancy).

These changes in business processes will mean a need for more and better telecommunications, both within the EU and globally.

The automotive manufacturer provides some quantified examples of how better telecommunications might improve productivity. Better telecoms might:

- Allow more rapid relocation of sales outlets as one market declines and another grows. Typically a three-month delay in establishing a new sales outlet costs approximately 100 car sales
- Reduce the design phase of a car still further. In the past few years this phase has reduced from four years to 18 months for cars and to two years for a truck. Collaboration systems and virtual design could cut new car design from 18 months to 12 months. This would save 5% of the cost of a car, i.e. one third of the design cost which is 15% of the total cost
- Enable on line training (in place of CD-DVD-based training) of garage mechanics for maintenance during the car guarantee period. Better maintenance reduces warranties costs, increases customer satisfaction and speeds return of investments of the dealer-garage network that is based on independent entrepreneurs
- Help deal with component bottlenecks in just-in-time supply chains. Components stand in the way of increased car production. The automotive manufacturer cannot produce more cars until it increases component supply flow and output
- Increase vehicle productivity, enhance safety , reduce environmental production impacts and improve security qualities for driver and passengers through the use of telematics (the convergence of wireless/mobile communications, locations technologies and in-vehicles electronics)
    - For example mobile convergence with in-vehicle electronics could be tremendously effective for proactive monitoring of truck needs on the road. Truck diagnostics could identify any spare parts required for truck maintenance and using mobile networks and GPS alert the nearest location for these spare parts and identify the appropriate truck route. The automotive manufacturer is unable to effectively boost this initiative at the moment, largely due to the high cost of mobile data transmission in a pan-European scenario and the unpredictable and undefined level of service for mobile business applications − as a result of the need for multiple telecommunications service providers. The automotive manufacturer particularly mentioned the unpredictability of roaming costs for trucks travelling through Europe and the lack of cost transparency.
- Reduce major production line outages (over five hours). These lead to losses of up to one day's production. The factory in one key country makes more than 100 cars per day, with each line producing 14 different cars. A nine-hour outrage there creates a log jam, not just in the factory, but also in the just-in-time supply chain with many trucks waiting to be unloaded.

The automotive manufacturer also believes that:

- Voice-over IP could improve employee productivity and reduce costs but the business case remains incomplete due to absence of adequate class of service access[93]
- PABXs which route mobile calls could also improve employee productivity and reduce costs, but are illegal in some countries.

The consumer products supplier spoke about ICT enabling it to change its organisational structure, moving it from an hierarchical to a networked organisation with higher levels of productivity.

[93] Higher classes of service are assigned to those applications that have more stringent tolerance on delay and packet loss, for example VoIP as opposed to internet browsing which is assigned lower priority.

Lack of suitable telecommunications, together with the cost of migrating between networks or between products in a network is a major barrier to re-organising for greater productivity within the EU. Faster provisioning times for telecommunications are especially important. For example:

- The automotive manufacturer mentioned the need to open and close sales outlets quickly to respond to market demand
- The ICT service provider mentioned the need for faster telecommunications provision to support client site working by its staff. In the EU it needs to create 12,000 such temporary connections each year.

D4 ICT requirements

The management of ICT, mostly outsourced already, is moving from national to regional or global organisation. This reflects a trend in the way the underlying businesses are organised.

Better communications connectivity to customers and staff would allow MNEs to deliver better services to more customers. The financial services company mentioned the need for better customer connectivity outside urban centres as a key driver for growing its business while, according to the engineering and design consultancy, staff are 10% more productive at home.

Over the next three to five years MNEs will:

- Move to single IP networks worldwide
- Require higher-speed communications e.g. for collaborative design and real-time video training
- Require more applications to be available on-the-move through better wireless services.

There is a general trend away from national and towards regional and global contracts for the support of ICT and telecommunications services. Global suppliers offer best practice. The goal of all the MNEs interviewed is to move to a single global supplier so as to reduce costs.

There are two main reasons for moving to a single global supplier:

- It significantly reduces the costs of network services management. There is just one interface to a single supplier who has clear responsibilities for providing services to the agreed levels. The financial services company estimates that such simplification would reduce its ICT costs by 25%
- It moves the relationship up to more senior levels (within both the MNE and the supplier) and changes it from the traditional supplier/customer relationship to a business partnership which has the mutual aim of increased growth and productivity and has greater resilience to unplanned changes in requirements.

Fixed mobile convergence is of central importance to all five MNEs and the costs and benefits of mobile communications was singled out for mention. For example:

- 3G services cost €2000 per annum per person (engineering and design consultancy)
- Mobile devices cost €1000 per annum per person (consumer products supplier) and 3G services are considerably more expensive
- E-mail on the move is worth up to €9000 per annum per person (engineering and design consultancy).

But the provision of mobile services on a pan-European or global basis is a major problem. There are currently no suppliers of seamless pan-European mobile services (automotive manufacturer), only aggregate discounts from the five or six biggest operators, with a few, limited, multicountry

offers. For example Vodafone, which has the largest footprint of national mobile networks in the EU now offers a multi-country service for seven EU countries plus the US for voice only.

D5 The role of seamless networks

Three of the five MNEs (automotive manufacturer, ICT service provider and financial services company) believe that suppliers in the US offer MNEs better telecommunications services than suppliers in the EU. Lead times are shorter, quality of service is better, provisioning is simpler and prices are lower.

When MNEs try to purchase such services on a pan-European basis they find that they have little, if any, choice of supply that can meet all the MNEs' requirements.

The businesses of MNEs suffers as a result in a number of ways:

- It is hard to integrate with business partners and production outages are unnecessarily high (automotive manufacturer). The automotive manufacturer believes that suboptimal service quality leads to outages for production lines which generate 10 to 15% of its total costs
- Business costs are higher than they should be. The ICT service provider believes it could cut its telecommunications costs by 30 to 50% with greater competition
- The organisation is less flexible in terms of its ability to reorganise than it could be (consumer products supplier)
- The opportunity to expand in the EU compared with the rest of the world is limited (engineering and design consultancy).

MNEs were asked how their activities would change if they enjoyed seamless networking, which we defined as follows:

- One-stop contract for all services – both fixed and mobile
- Unified but itemised billing for the service
- A limited number of standardised interfaces for connectivity
- Guaranteed end-to-end quality and provisioning times at all sites
- A unified view of network management for the MNE

Seamless network services across the EU would lead to:

- Greater consolidation of activities in single business units combined with a greater geographical dispersion of workers and a consequentially higher level of productivity
- Lower ICT costs through lowered duplication for resilience and less fragmented running of ICT applications. The ICT service provider believes this could reduce its overall ICT spend by around 20%, partly through lower migration costs and partly through lower staff costs in making disparate access products work together. The financial services company and the consumer products supplier both spoke of a 10% reduction in telecommunications costs.
- More flexible organisations that are better able to integrate and dispose of business units in response to market changes
- More integrated and efficient supply chains. Both the financial services company and the consumer products supplier spoke of the need to move to video-based applications for their supply chain.

- More outsourcing within the EU (ICT service provider) and less outsourcing outside the EU (financial services company)
- Information service companies like the financial services company selling more services (with correspondingly more sales for the pan-European communications service providers).

The functionality of a seamless networking offering will be determined by the product functionality and service levels offered in the weakest country included in the offering.

Figure D1 shows how close the different regions of the world and countries of the EU are to offering seamless networking, according to four of the five MNEs (the engineering and design consultancy did not answer these questions).

Figure D1 How close are different regions and countries to seamless networking?

How close to seamless networking	Closest	Furthest
Globally		
Automotive manufacturer	US, EU (CBD)	Asia, Latin America
ICT service provider	US , Japan	Asia, Africa, EU
Financial services company	US	Asia, Africa, EU, Latin America
Consumer products supplier	North America	Asia, Africa
Within the EU		
Automotive manufacturer	UK, Italy (CBD)	France, Germany, Poland, Spain
ICT service provider	Nordics(CBD), Germany (CBD)	Spain
Financial services company	Nordics(CBD), Belgium, France	Baltics, Germany
Consumer products supplier	UK, Netherlands	Greece, Italy, Balkans, Russia

Overall we conclude that:

- On a regional basis the US is closest to offering seamless service while Asia, Africa, and Latin America are furthest away. The EU is somewhere between these positions
- Within the EU the Nordics and the UK come closest to offering seamless service. Central European and Mediterranean countries are furthest away
- In some EU Member States, seamlessness is possible in the central business districts (CBDs) of city centres where access competition is economically feasible but not in other areas, where there is no competition and the availability of access products is much poorer. For these reasons such member states are listed in Figure 3.2 as both closest to and furthest from facilitating seamlessness.

As a factor in improving an MNE's productivity, seamless pan-European communication services are seen as:

- "Essential" (ICT service provider)
- "Vital" (financial services company)
- "Very important" (consumer products supplier)
- "Significant" (automotive manufacturer); and
- "Very important in terms of supporting the strategy of faster, better, quicker" (engineering and design consultancy).

Annex E The NPV of the net benefit streams

This annex sets out the detailed calculation of the NPVs of the net benefit streams estimated for Methods 1, 2 and 3

Figure E1 NPV for Method 1

Method 1 assumptions

GDP gain from full opening of markets for network industries (€bn pa)	276
Telecoms GDP as % of network industries GDP	35%
Long term GDP gain from full opening of telecoms industry (€bn)	95.0
Period before benefits from full market opening are fully realised (years)	10
Discount rate on benefits pa	4%
MNE and their supply chains as % of total EU GDP	35%

NPV benefit calculation

Year	Discount factor	Benefit (€bn)	Discounted benefit (€bn)
1	0.962	9.7	9
2	0.925	19.3	18
3	0.889	29.0	26
4	0.855	38.6	33
5	0.822	48.3	40
6	0.790	58.0	46
7	0.760	67.6	51
8	0.731	77.3	56
9	0.703	86.9	61
10	0.676	96.6	65
11	0.650	96.6	63
12	0.625	96.6	60
13	0.601	96.6	58
14	0.577	96.6	56
15	0.555	96.6	54
16	0.534	96.6	52
17	0.513	96.6	50
18	0.494	96.6	48
19	0.475	96.6	46
20	0.456	96.6	44
			935

NPV of GDP gain from telecoms opening (€bn)	935
NPV of GDP gain from telecoms opening for MNEs and their supply chains (€bn)	327

Figure E2 NPV for Method 2

Method 2 assumptions

EU GDP in 2007(€bn pa)	12200
Baseline GDP growth rate pa	2%
Long term auto manufacturing gain from UA and complementary measures (€bn pa)	24
Long term telecom services gain from UA and complementary measures (€bn pa)	15
Auto manufacturing revenues in EU (€bn pa)	476
Telecoms services revenues in EU (€bn pa)	290
% productivity gain from UA for industry and its supply chain	
auto manufacturing	5%
telecoms services	5%
other sectors	2.0%
overall	2.1941%
Long term productivity gain (€bn pa)	268
Time taken to realise the productivity gain (years)	10
Discount rate on benefits pa	4%
MNE and their value chains as % of total EU GDP	35%

NPV benefit calculation

Year	Discount factor	Baseline GDP (€bn)	Prod gain (€bn)	Discounted gain (€bn)
1	0.96	12200	27	26
2	0.92	12444	55	50
3	0.89	12693	84	74
4	0.85	12947	114	97
5	0.82	13206	145	119
6	0.79	13470	177	140
7	0.76	13739	211	160
8	0.73	14014	246	180
9	0.70	14294	282	198
10	0.68	14580	320	216
11	0.65	14872	320	208
12	0.62	15169	320	200
13	0.60	15473	320	192
14	0.58	15782	320	185
15	0.56	16098	320	178
16	0.53	16420	320	171
17	0.51	16748	320	164
18	0.49	17083	320	158
19	0.47	17425	320	152
20	0.46	17773	320	146
				3014

NPV of additional GDP from UA and complementary measures (€bn)	3014
NPV of additional GDP for MNEs and their supply chains (€bn)	1055

Figure E3 NPV for Method 3

Method 3 assumptions

EU GDP in 2007(€bn pa)	12200
Baseline GDP growth rate pa	2%
Productivity growth rate US less EU	1%
% of productivity gap closed from ubiquitous access (UA) and complementary measures	33%
Time taken to close the productivity gap (years)	10
Discount rate on benefits pa	4%
MNE and their value chains as % of total EU GDP	35%

NPV benefit calculation

Year	Discount factor	GDP - no UA (€bn)	GDP growth with UA	GDP with UA (€bn)	Extra GDP (€bn)	Extra GDP (€bn) discounted
1	0.962	12200	2.03%	12200	0	0
2	0.925	12444	2.07%	12448	4	4
3	0.889	12693	2.10%	12705	12	11
4	0.855	12947	2.13%	12972	25	21
5	0.822	13206	2.17%	13248	43	35
6	0.790	13470	2.20%	13535	65	52
7	0.760	13739	2.23%	13833	94	71
8	0.731	14014	2.26%	14141	127	93
9	0.703	14294	2.30%	14462	167	118
10	0.676	14580	2.33%	14794	214	144
11	0.650	14872	2.33%	15138	267	173
12	0.625	15169	2.33%	15491	322	201
13	0.601	15473	2.33%	15852	380	228
14	0.577	15782	2.33%	16221	439	254
15	0.555	16098	2.33%	16599	502	279
16	0.534	16420	2.33%	16986	567	303
17	0.513	16748	2.33%	17382	634	325
18	0.494	17083	2.33%	17787	704	348
19	0.475	17425	2.33%	18201	777	369
20	0.456	17773	2.33%	18625	852	389
						3417
NPV of additonal GDP from closing productivity gap (€bn)					3417	
NPV of additional GDP for MNEs and their supply chains (€bn)					1196	