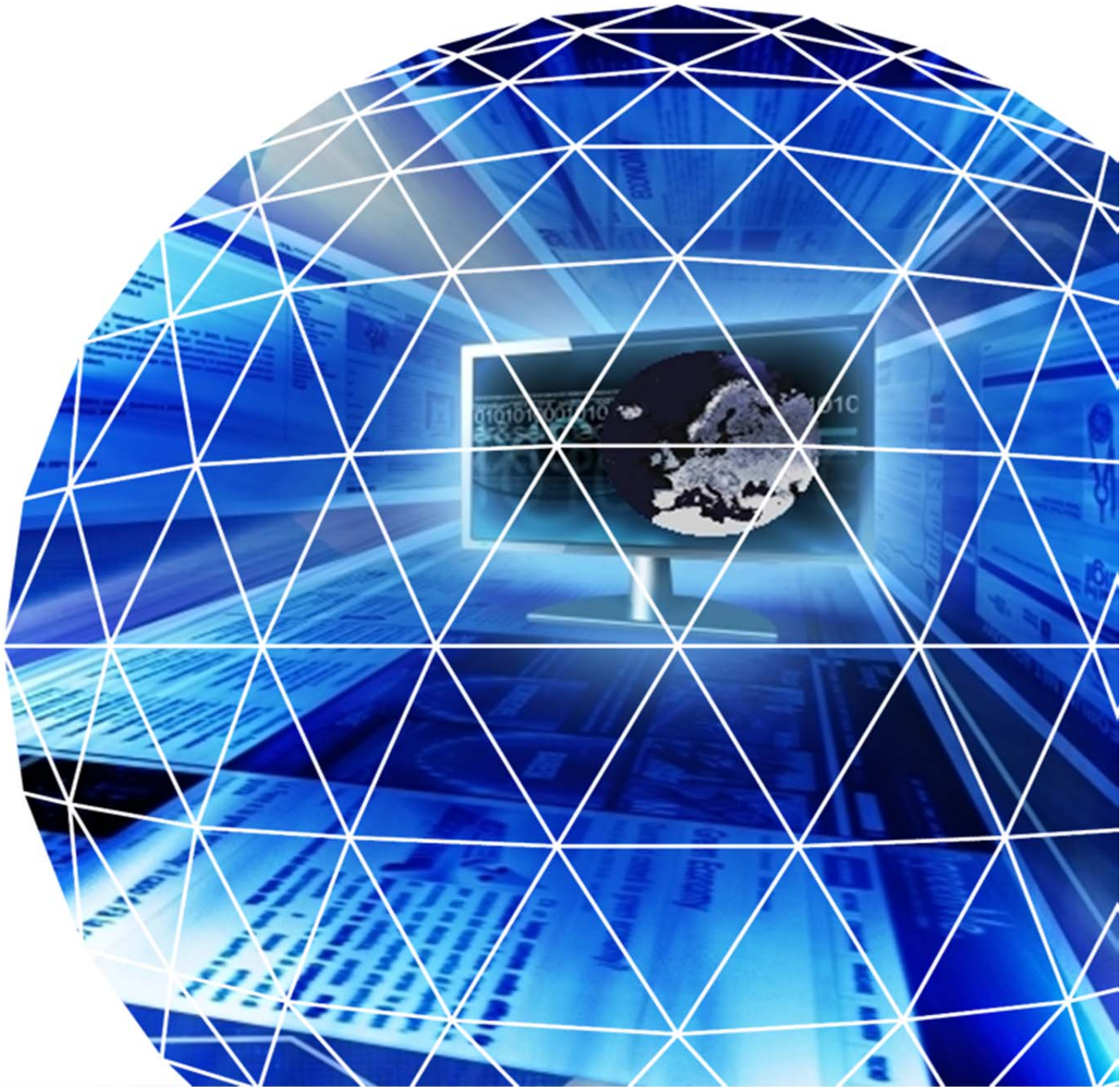
# Steps towards a truly Internal Market for e-communications

## In the run-up to 2020

Client: DG Information Society and Media, European Commission

Rotterdam, 14 November 2011



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Final Report

Client: DG Information Society and Media, European Commission

Nicolai van Gorp, Marcel Canoy, Erik Canton, Lars Meindert, Bjørn Volkerink, Wolter Lemstra, Pieter Nooren, Hans Stokking

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ECORYS Nederland BV
Watermanweg 44
3067 GG Rotterdam

P.O. Box 4175
3006 AD Rotterdam
The Netherlands

T +31 (0)10 453 88 00
F +31 (0)10 453 07 68
E netherlands@ecorys.com
Registration no. 24316726

**W www.ecorys.nl**

Ecorys Macro & Sector Policies
T +31 (0)10 453 87 53
F +31 (0)10 452 36 60

# Table of contents

# Preface

In accordance with the Communication from the Commission on “A Digital Agenda for Europe” COM(2010) 245 final/2 from 26.8.2010 and therein stated actions to “reinforcing the single market for telecommunications services” and to “*assess, on the basis inter alia of practical input from stakeholders, the socio-economic cost of non-Europe in telecoms markets, outline the benefits of a better-integrated market, and propose appropriate steps to reduce this cost*”, the Commission published on 21 August 2010 an invitation to tender for a “Study on steps towards a truly internal market for e-communications networks and services in the run-up to 2020” SMART n° 2010/0016. The study was granted to a consortium comprising Ecorys Netherlands BV, TNO, and the Technical University Delft. The consortium was advised by a team of academic experts; all leading authors in the fields of technological, legal and economic aspects of e-communications.

Contributors to the report are: Nicolai van Gorp, Professor Marcel Canoy, Dr Erik Canton, Lars Meindert and Dr Bjørn Volkerink (Ecorys NL); Dr Wolter Lemstra (TU Delft); Dr Pieter Nooren and Hans Stokking (TNO).

The advisory panel consisted of (in alphabetical order): Dr Paul de Bijl, Professor John Groenewegen, Professor Pierre Larouche, Professor William Melody, and Professor Andrea Renda.

We would like to thank the steering group from the European Commission for its constructive comments and excellent guidance and advice throughout the entire period of this study.

Responsibility for the opinions and views presented in this final report rests exclusively with the authors and should not be attributed to the European Commission.

# Executive summary

The purpose of this study is to assess the state of progress of the EU's Internal Market for electronic communications networks and services and its economic potential. Focusing on the 2020 horizon, the study also formulates policy options to realize that potential.

The study first defines the Internal Market for e-communications, which includes identifying the boundaries of the Internal Market. These boundaries are determined by natural barriers such as language and cultural barriers. In our discussion on the Internal Market we also examine the engine of the Internal Market: which consists of two elements: i) openness or contestability of national markets and ii) interoperability of markets as to allow for the exploitation of economies of scale.

Next, the study estimates the economic potential for the Internal Market in the run up to 2020. This starts with an identification of trends and drivers and an assessment of the likely impact of these trends and drivers on the market - and specifically on the Internal Market. Subsequently, in order to illustrate the economic importance of the issues that this study addresses, we present a 'what if analysis'. What if all the barriers to the Internal Market for e-communications networks and services are gone? What would be the economic gains for society at large?

We complement our previous analysis with an evaluation of barriers perceived by stakeholders today. We examine each barrier that we identified in a structured way:

1. Is it a natural barrier, or does it concern a policy domain that falls within the domain of Member States?
2. What actions are currently in place? Are these sufficient?
3. What are the policy options, if any?

We conclude the final chapter by providing a sketch of a policy agenda to realise the Internal Market by 2020.

## The Internal Market for e-communications in theory

### The progress of the Internal Market cannot be measured in terms of price differences only

The success of the progress of the Internal Market cannot simply be measured in terms of price differences. Such a single indicator does not do justice to the heterogeneity and complexity of different industry structures. Notably with e-communication networks a major barrier for price convergence is the fact that network services are largely non-tradable. Also at the service level, the ability for network operators to become active in other Member States is often hindered by e.g. (semi-) natural barriers such as differences in language and culture. Consequently, price differences often reflect differences in underlying cost structures, differences in preferences by end-users, differences in income, etc.

Measuring the progress of the Internal Market requires a closer look at the drivers of the Internal Market.

### The engine of an Internal Market for e-communications

The engine of the Internal Market consists of two elements: i) the openness (contestability) of national markets and ii) Interoperability as a driver for EU economies of scale.

Open national markets allow companies to become active in other Member States, thereby contributing positively to the local competitive circumstances in that Member State. It also allows companies to become active in multiple Member States, thereby contributing positively to the competitive circumstances in the EU at large. If national markets are characterised by a certain degree of interoperability (or integration) openness creates possibilities to serve multiple Member States from a single country and to realise economies of scale.

In e-communication networks and services we notice that network operators have experienced/realised higher levels of competition in the Member States, but have enjoyed little economies of scale. On the service level we notice that, with the disappearance of physical links between network and service, the ability to serve multiple Member States from a single location increases. The services become over-the-top services (provided without control of infrastructure) that allow for the exploitation of economies of scale.

### The Internal Market for e-communications in terms of performance

As in any market, the Internal Market for e-communications brings more competition and cost savings due to economies of scale. This will translate into high value for money for end-users and more incentives for operators to invest in order to meet demand. In the most far-reaching case, the interoperability of markets makes that every European has access to all content and services, everywhere throughout the EU. In other words, a Fin is able to watch Finnish broadcasting while he is working and living in the Netherlands; a German patient is able to go on holiday to France while being monitored by his own physician; children are playing online games in the back of the car while travelling across borders; a company with multiple offices throughout the EU can use a single provider of cloud computing services for all its branches.

## The economic potential of the Internal Market in the 2020 horizon

### Trends, drivers and market developments

#### *Demand for broadband quality increases*

According to projections by the industry and by industry experts, demand for bandwidth will increase. This increase is driven by future developments at the level of over-the-top services. The quality of these services increases: movies and games will evolve from HD to 3D, developments in e-health allow patients to be monitored in their own homes, developments in e-learning allow students to follow courses and take exams from foreign universities, etc.

Furthermore, we estimate that these future premium over-the-top services will also require more quality from the network connections in terms of less latency and interruptions. Meeting that demand requires new forms of traffic management on networks. This in turn requires new forms of network intelligence and additional technical specifications for telecom infrastructures. In order to keep markets interoperable for the delivery of premium over-the-top services, there is a need for standards with respect to these telecom infrastructures specifications. Without such standards, premium over-the-top service providers will not be able to exploit the full potential of economies of scale. This seriously hinders the development of such services, thereby limiting their contributions to economic growth.

#### *Changing business models*

The development of over-the-top services puts pressure on the traditional business model of operators. Hitherto, they used to deliver an integrated package of network connection and voice or video services.

Current trends indicate a growing importance of over-the-top service providers. Some are even developing into aggregating platforms, becoming a new natural entry point for content providers in order to reach end-users. These over-the-top service providers will increasingly need to interact with operators because the quality of services depends on the quality of the broadband access connection. This transforms the market from a market that is characterised by operators only engaging in contractual relations with end-users (and each other) to a market in which operators also engage in contractual relations with content and service providers.

These developments imply considerable changes in the business models of operators. In a world with pan-European managed IP standards, operators will experience increased competition from over-the-top service providers. This forces them to redefine their business models and/or to innovate in products and processes as to increase the quality of their own (integrated) services.

*New regulatory challenges to the horizon 2020*

The developments above also give rise to new regulatory challenges. First, the current regulatory framework is typically designed to manage the contractual relation between access seekers and access providers and the contractual relation between operators and end-users. Is the regulatory framework endowed to manage the upstream contractual relations between over-the-top service providers and operators as well? In other words, is the framework ready to deal with the transition towards an internal market in which operators can exert market power in the contractual relation with content and over-the-top service providers? Related challenges are how to deal with issues such as net neutrality. Net neutrality is essentially about traffic management. Network operators have the ability to prioritise certain data such that a particular service can be delivered at a higher quality. In extreme cases network operators can block certain data. These developments create lively debates in Member States on universal services and protection of private information, and further policy and regulatory development might be required to deal with these issues.

**The economic potential up to 2020: What if…**

In an attempt to illustrate the economic potential of realising the Internal Market we examined the impact of the two main elements of the engine of the Internal Market: contestable markets and interoperability of markets. Hence we asked what would be the economic effect if…

*…all markets are equally competitive at the level of the current best practice?*

Qualitatively, we expect higher value for money, i.e. lower prices and higher quality; we expect more private investments (notably in next generation networks).

Quantitatively we estimated the annual gains at: 27 billion euros to 55 billion euros (or 0.22% to 0.44% of GDP). These numbers are based on an econometric analysis. We first analysed the regression between indicators for the intensity of competition and prices and investments. On the basis of this regression we analysed how much the EU average prices and investment levels would change if the EU would be as competitive as the current best practice. On the basis of educated assumptions we developed a model to translate these changes into Euros.

*…the necessary level of standardisation has been realised?*

Qualitatively, we have identified the upcoming rise of pan-European premium quality over-the -top services; we expect more specialisation throughout the value chain; economies of scale in the production of medical systems and other smart machines; we expect improvements in e-Health, e-Learning, and B2B services; we expect head offices and production facilities to move back to the EU.

Quantitatively we illustrated this with an example of the past: the case of the 2nd generation mobile phones (better known in Europe as GSM). In Europe all providers adopted the GSM standard, whereas in the United States there were three competing standards in the market. Looking at mobile penetration rates it is clear that that US has been lagging behind the EU since 1995. On the basis of educated assumptions we analysed how much the EU has gained over the US due to having a single standard instead of multiple standards. We estimated the annual gains at: 35 to 55 billion Euros (0.3% to 0.45% of GDP).

## Towards policy options

In order to formulate policy options, we first consulted a variety of stakeholders in order to identify barriers for market players to expand into other markets and/or to benefit from pan-European scale. Starting from this list of barriers we analysed in a structured way the options for improving the Internal Market by taking away/lowering these barriers.

### Barriers perceived by stakeholders

We organised interviews with more than 40 stakeholders: operators (incumbents and challengers, fixed and mobile), vendors, over-the-top service providers, and business end-users. In addition we set up an online questionnaire that we sent out the technical experts working in or with the industry. These consultations resulted in a long list of 77 issues that the respondents perceived as barriers to the Internal Market. Next we applied a first filter in order to reduce this list to a short list. The filter reduced the long list by asking whether it was a natural barrier and whether it involved a policy area that would fall outside the competences of the EU according to the subsidiarity principle. The barriers in the short list are categorised under: barriers stemming from regulatory uncertainty, from government discretion, from the heterogeneity in the implementation of regulation, from the national orientation of sector regulation, and finally, from the lack of standards.

#### *Regulatory uncertainty*

Regulatory uncertainty is caused by: 1) gaps in the regulatory package, notably with respect to net neutrality and NGN transition; 2) governments holding shares of incumbent operators causing them to experience incentive problems; 3) governments pursuing to protect national champion, notably via the allocation of spectrum rights, and 4) a lack of sufficient enforcement by NRAs due to potential regulatory capture, a lack of independence or insufficient resources. Such kinds of uncertainty not only make markets less attractive for entry (affecting the internal market by hindering the contestability of national markets), it also reduces the incentives to invest.

Policy options to radically address these issues are (except for net neutrality and NGN transition) limited within the boundaries set by the Treaty in terms of subsidiarity and proportionality and in terms of fiscal autonomy. First, the Treaty has no provisions for forcing governments to divest from government participations, nor to restrict their ability to sell natural resources (such as spectrum). Second, the ability of NRAs to control governments meddling with the industry are limited. In this respect we like to stress that NRAs do not merely act in the national public interest. They are accountable to multiple principals: the European Commission, national governments and parliaments, and the Courts. Following Hancher and Larouche (2011) we recognise that this model, whilst understandable, may have some distorting effect on the NRA's incentives. Reducing the number of principals and make NRAs more effective and contribute to harmonising the implementation of the regulatory framework. Third, the potential for peer pressure within the Council is limited as the issues at hand are likely to be subject of negotiations in the wider political context. All in all, this leaves us with a set of softer tools: reporting, orange and red cards, public statements

by the Commission, and now peering pressure as part of the newly established Body of European Regulators for Electronic Communications.

On net neutrality and the transition to NGNs we elaborate more in the section below on sketching a policy agenda.

*Government discretion in spectrum policy*

Governments enjoy a certain degree of discretion with respect to spectrum policy. In the absence of coordination this may result in too much heterogeneity in policy making, creating barriers for the Internal Market. More specifically, market players complain about a lack of coordination leading to different speeds of adopting 4G technologies. This may frustrate entry at the level of network operations (openness of national markets) as well as the realisation of EU economies of scale in developing and producing handsets and network equipment.

We already recognised that legally, the ability to sell natural resources falls within the discretionary domain of Member States. But from an economic perspective we recommend more coordination in the allocation of spectrum rights, notably with respect to the timing of re-allocating spectrum currently in use for commercial mobile communication.

*Heterogeneity in the implementation of regulation*

The heterogeneity in the implementation of regulation forces multi-country operators to duplicate costs thereby limiting opportunities to realise economies of scale. More specifically, this relates to different technological standards for number portability and different rules on consumer protection and user's rights.

On the issue of number portability the options for policy measures are limited because the costs of harmonisation may be very high due to path dependency. Concerning consumer protection, notably concerning issues such as contract duration and transparency of bills, we question the need for national discretion. A fairly easy measure to solve this issue is to adapt the directive such that implementation is based on mutual acceptance of NRA's decisions. This provides an EU one-stop-shop model requiring firms to suggest templates for contracts or bills only to one NRA but still have EU coverage. Such option will also create incentives for BEREC to act as a coordinator.

*National orientation of sector regulation*

Interviewees indicated that they perceive sector regulation as being too focussed on national markets. As a result, the existing market for pan-European products and services is unregulated and faces a lot of the same 'problems' which are regulated on a national level (access to essential network facilities, strategic behaviour). More specifically, interviewees mentioned that NRAs structurally failed to recognise pan-European business users as a separate market segment. This has resulted in a lack of standardised wholesale offers fit for multinational corporations. This increases the costs for multi-national operators. Furthermore, when an international pan-European tender has a big footprint in a specific country (e.g. Germany, France) the incumbent supplier can, in the absence of standardised WBA offers, easily fence off other pan-European service providers who depend on bitstream access. We suggest a further evaluation of why the current regulatory arrangements for defining pan-European markets (article 16.5 of the Framework Directive) have never been used.

*Lack of standards*

The lack of standards is a clear barrier for the Internal Market. As indicated above, standardisation of a number of service offerings across Europe improves the working of the market. Answers from technological experts to our survey confirm that the current lack of standardisation of access

products at IT and processes levels is a major barrier for pan-European service provision typically consumed by multinational corporations. With respect to technical specifications of the telecommunication infrastructures there seems to be sufficient standardisation for current broadband use, which is largely based on best effort. In the future, however, when the demand for managed quality of services increases, there is likely to be greater need for more standards as to stimulate in the future the provision of pan-European application areas such as in e-Health, e-Energy, e-Mobility, etc. (see Chapter 2.). This applies to both fixed as well as mobile broadband.

## Sketching a policy agenda

We suggest three main types of policy: first, the need for reducing heterogeneity in the implementation of regulation; second, a call for more European standardisation; and third (in order to facilitate the first and second direction), the need for more 'Europeanisation' in the institutional arrangements, involving a more directing role for the EU and more regulatory oversight at European level. In addition we recognise the importance for the Internal Market of a coordinated investment path towards NGN and 4G networks. Below we elaborate on these issues, but we start by stressing the importance of complementary policies aimed at fostering EU competitiveness.

### *Complementary policies*

While the Internal Market perspective stands at the heart of our analysis, it is known from earlier literature (and confirmed by the case of the US) that accompanying policies are needed to reap the full benefits of the Internal Market. Trade and Internal Market policies are complementary since trade policies allow the Internal Market to lead to improved exports from the EU to the rest of the world. Competition policy helps to remove national barriers. Innovation policy allows the business community as well as society at large to reap the fruits from a well functioning Internal Market. Moreover, in line with the recent Monti report, efforts are needed to harmonise Internal Market policies with other European policies, to reinforce European institutions and to build consensus to achieve the support of European citizens. Finally, the Commission needs to shift from a homogeneous legal approach (harmonisation of existing rules and adoption of directives) to a differentiated economic-based approach where barriers are removed yielding the highest welfare gains. This is in particular important in the light of the heterogeneous nature of the services sector and differences in administrative capacity in Europe.

### *Reducing heterogeneity in the implementation of regulation*

Less heterogeneity of regulation will gain substantial benefits for the Internal Market as it reduces uncertainties for entrepreneurs at various levels in the supply chain. It also contributes to further opening up of national markets, and allows for economies of scale throughout the supply chain.

We identified two priority areas that need to be addressed and require institutional changes. First, there is a discrepancy between the capacities of NRAs to incorporate long term market dynamics in the regulatory market analyses. With respect to the regulation of Next Generation Access networks, this notably may hamper the sustainability of competition (i.e. the contestability of national markets in the long run) and create legal uncertainty for market players. This may also reduce incentives to invest in Next Generation Networks, which is counter productive in realising the Digital Agenda's broadband targets and preventing the materialisation of the full potential of pan-European scale economies in Next Generation services. Second, the regulatory framework needs to be extended in order to cover the new contractual relations between providers of content and over-the-top services and network operators. Failure to do so may leave the regulatory framework incapable of managing potential upstream competition problems with the effect of closing off national markets for over-the-top service providers. This hinders the Internal Market in two ways: first, it thwarts the competition

between over-the-top services and the providers' integrated services; second, it prevents over-the-top services from realising pan-European economies of scale.

The regulatory framework recognises the dynamic character of the industry by requiring NRAs to analyse markets prospectively. In practice this means that the NRA's often do not look beyond the next regulatory period (i.e. 3 years ahead). This typically leads to uncertainty, for example, concerning access to Next Generation Networks. Challengers fear that regulatory choices in the transition to Next Generation Networks can undo much of the work that has been done over the past 15 years, threatening the sustainability of their business case. However, looking further away into the future endangers to increase uncertainty in market analyses, whereas Courts typically place the burden of proof on NRAs. How can this dilemma be solved? We suggest that the EC (in cooperation with BEREC) publishes guidelines for market analysis spelling out potential risks for the sustainability of competition within the context of a general long-term prospective analysis, along with a list of possible remedies to address these risks. This would help NRAs in their forward-looking approach by empowering them to look beyond the 3-year timeline in a holistic way (i.e. accounting for EU and global developments). NRAs can then complement their 3-year prospective analysis with an evaluation of the chances that the long-term risks materialise in the Member State and the remedies that should reduce these risks. An additional benefit of such guidelines is that it will have a harmonising effect on the implementation of regulation.

The increasing importance of the contractual relationship between providers of content and OTT services and network operators is currently reflected in the discussions on net neutrality. We noticed that there is a need to for a timely adoption of a uniform approach towards net neutrality and that the EC and BEREC are running behind as Member States are taking own initiatives. The difficulty in formulating policy quickly is hindered by the formalistic framework creating dividing lines at 1) the institutional level between policy making and implementation and 2) at the legal level between networks and content. These dividing lines prevent the regulatory framework to effectively respond to the new regulatory challenge stemming from increasing importance of the contractual relations between providers of content and OTT services and network operators. The separation of powers makes a system less flexible and thereby makes the second more urgent. We suggest abolishing the dividing lines in the regulatory framework. The regulatory framework should take into consideration the dynamics in the entire value chain and set the conditions for regulating the relation between ISPs versus content/OTT service providers. Putting it differently, content and OTT service providers should be recognised as access seekers.

### *More European standardisation*

The call for more standardisation refers to technical and administrative standards. The interviews identified a current need for standardisation of access products at IT and processes levels (e.g. standards for the exchange of billing information), the lack of which is frustrating pan-European services (notably towards multi-national corporations). Furthermore, the interviews identified a future need for standards at the level of telecom infrastructure services (notably within the managed IP domain). Failing to come to such standards will affect future pan-European roll-out (and thus development) of premium over-the-top services (such as E-learning, E-health, etc.). Additional benefits are that multinational corporations will be better served, making Europe a more attractive location for headquarters and production facilities; and 2) Manufacturers of telecom systems would enjoy economies of scale because there is less need for customisation.

The current market structure seems inapt to result in proprietary standards because of its non-competitive nature. Furthermore, proprietary standards score relatively low in terms of lessening market power, fostering global procurement, fostering economies of scale in components, increasing adoption speeds, increasing outsourcing, etc. Formal standards score much higher in

these respects. How to organise effective standardisation conventions is a matter for further analysis. We suggest ETSI and CEN taking lead in this, under the impulse of the Commission.

But even if European standards have been formulated, network operators may still have an incentive not to comply with these standards. Notably, because applying deviating standards will gain incumbents a competitive edge over foreign operators in international pan-European tenders with a big footprint in a specific country. Indeed, NRAs can enforce the adoption of pan-European standards in national WBA reference offers when SMP has been established in the national WBA markets. But, given that the ultimate objective of regulation is to make itself obsolete (sunset principle), it is unclear how NRAs can enforce uniform WBA reference offers for pan-European service providers once national WBA markets are deemed competitive – as is the case in the Netherlands. The current arrangements for defining pan-European markets (article 16.5 of the Framework Directive) have never been used and it should be evaluated why not. There may be a need for making institutional arrangements to bring a pan-European focus in the regulatory package. Within this context, also the current provisions of the regulatory framework for making the use of a standard compulsory (in order to ensure interoperability of services and to improve the freedom of choice of end users) might also be subject to review (article 17 of the Framework Directive).

Furthermore, enforcing standards for telecom infrastructure services within the managed IP domain may require formulating managed IP reference offers. Such reference offer should cover technical specifications and administrative standards for the contracts between content/OTT service providers and ISPs. This contractual relation is currently not formally covered by the regulatory framework. Extending the regulatory framework so as to include this upstream relation may allow for imposing such reference offers, provided that the NRAs manage to define SMP in the upstream relation. In such case, operators with SMP would be forced to adopt the managed IP standard, the challengers will soon follow in order to be able to deliver similar OTT services to end-users.

*Stimulating investments in NGNs and 4G networks*

Realising the broadband targets in the Digital Agenda will have a significant effect on the Internal Market for e-communications and will require orchestrating actions from the Commission. This follows from the fact that there is a circular relation between investments in bandwidth, the supply of services and the demand for bandwidth. This circular relation gives rise to externalities that affect operators and national governments in a same way: the efforts of operators and/or Member States to promote the roll-out of fibre optic networks within a certain region gives rise to an increased supply of services across regions, thereby pushing the demand for more bandwidth in other Member States/regions. As such, one can argue that a decentralised approach to stimulating NGN roll-out results in a chain reaction. However, this requires a certain minimum scale. If a small country ambitiously promotes NGN roll-out, it may have little effect on the development of OTT services. Governments and operators in smaller countries will have little incentives to follow a more ambitious time schedules. But even the individual large countries may not generate the scale required and they may even experience a hold-up. In other words, both operators as well as Member States have an incentive to wait and to act as market followers rather than market leaders. As such, a European approach (as envisaged in the Digital Agenda) is required to realise this minimum scale and to ‘kick start’ the chain reaction. This allows for an early exploitation of pan-European economies of scale at the OTT level, thereby making NGNs and 4G networks cost effective.

The Digital Agenda aims to realise this objective by specifying broadband targets. Furthermore, the EC is clear about its belief that a pure market-based approach will not realise these objectives and the Digital Agenda also spells out what more it intends to do as to realise these goals. The EC aims

at coordinating/harmonising the regulatory approach towards NGNs thereby making the regulatory environment more consistent across member states. It reduces investment risks stemming from heterogeneity in the implementation of regulation as well as ad hoc policy making. In addition the EC aims to involve the Member States via national strategy plans. Furthermore, the Commission is exploring the options for funding high-speed broadband by: 1) seeking cooperation with the EIB 2) exploring the potential for issuing project bonds, 3) exploring options within the context of the Competitiveness and Innovation Programme (CIP) and the Trans-European Networks (TEN) regulations. This is resulted in a proposal for a new Connecting Europe Facility (CEF) for funding of transport, Energy and broadband infrastructure as part of the new Multiannual Financial Framework for 2014-2020

There are good reasons not to fully rely on a market-based approach and to introduce elements of a centralised approach. From the Korean experience, as well as when considering the European strategy for realising the climate change objectives, we have learned that centralised objectives typically require a strategy towards gaining commitment: commitment from national and local governments, commitment from industries and commitment from the public. The Digital Agenda pays attention to involving Member States via national strategy plans, yet it is unclear to what extent this in itself leads to ownership of the problem by the Member States. In this respect the funding actions of the Commission are more concrete as they are (largely) based on the co-financing principle. The Digital Agenda, and specifically the CEF proposal, is also clear in its intentions to involve the industry by attracting private funding. These intentions materialise in actions: 1) creating a single EU infrastructure fund and financial framework providing a coherent and transparent approach to EU funding offering certainty, amongst others by simplification and reduction of administrative burden and by developing a common approach to NGN regulation; 2) introducing financial instruments aimed at risk diversification; and 3) (in some occasions fully) fund investments in core service platforms or priority networks.

The strategy to realise the Digital Agenda's broad band targets seems rather comprehensive. The final touch may be to formulate a strategy in how to involve the public, for example, by making the Commission's intentions and actions more visible in the day-to-day lives of citizens. This is common practice in projects realised within the context of cohesion, environment and transport, where the Commission places banners mentioning the involvement of the EU in realising these projects. How exactly to formulate such a communication strategy within the virtual world of e-communications falls outside the domain of this study, but it is worth exploring the option. A communication strategy aimed at the general public may contribute to the Digital Agenda gaining a more prominent place in the day-to-day lives, economy, and politics in the European Union.

# 1 Introduction

## 1.1 Background

### Purpose and subject of this study

The purpose of this study is to assess the state of progress of the EU's Internal Market for electronic communications networks and services, as well as its economic potential in the 2020 horizon. The study identifies technical, legal and regulatory obstacles to achieve a higher degree of EU market integration in electronic communications networks and services, and formulates policy options to address these obstacles.

The term 'electronic communications networks and services' includes the roll-out and exploitation of infrastructures for electronic communications. It does not include the development and exploitation of content and applications that are marketed via the Internet. This does not mean that our analysis will not include content and applications. Notably in the analysis we examine whether current barriers for the Internal Market at the level of infrastructure affect the development and roll-out of new products and services at the application level. For example, we examine whether differences in Quality of Service (QoS) levels across Europe at bitstream level may negatively affect the (pan European) roll-out of services such as Video on Demand (VOD) or cloud computing.

### The Internal Market for e-communication in a broader context

In his Mission letter to Professor Mario Monti, the President of the European Commission José Manuel Barroso states:

"The Single Market has been, and remains, the cornerstone of European's integration and sustainable growth. But this major European project requires renewed political determination so that it can fulfil all it potential. As I have indicated in my political guidelines, the Commission intends to lead this process, fully engaging Member States, the European Parliament and all Stakeholders."

This "Study on steps toward a truly Internal Market for e-communications networks and services in the run-up to 2020" commissioned by the Directorate General for Information Society and Media contributes to this process through an investigation into the remaining barriers to a full-fledged Internal Market for e communications networks and services in Europe. This investigation involves identification of the barriers and an assessment of the impact of potential removal of the barriers in terms of contribution to consumer surplus.

The realisation of the benefits of the Internal Market results from the activity of economic actors, primarily by firms providing added value in the provision of e-communications products and services. These activities take place in a setting that is conditioned by institutions, rules and regulations that facilitate or hinder an optimal outcome. Hence, for a full appreciation of the remaining barriers towards a full-fledged market, the experiences and perceptions of economic actors are highly valuable. An understanding of the issues from a micro-economic perspective complements the macro-economic approach to the issue at hand.

### The outcome is an objective, not an end-state

The 'ideal outcome' of the Internal Market is an objective rather than an end-state. The European Project is an ongoing process and, *grosso modo,* will remain so in the future for a number of reasons.

The creation of the full-fledged Internal Market is a process of changing the market from one state to another. The top-down process from EU regulation to Member State enactment and subsequent adjustments in behaviour by economic actors takes time and will introduce diversity. Deviations from the 'ideal' will occur as interests of political and economic actors at the Member State level shape the outcome in the spirit of the subsidiarity principle. The EU implementation reports reflect this diversity and, at the same time, exert peer pressure towards uniformity of implementation. Also the cooperation among NRAs (within BEREC) plays an important role in this respect.

Since its inception the EU has been expanding to include New Member States, a process that is ongoing. This implies that the regulatory framework becomes applicable to Member States at different points in time, leading to a high degree of heterogeneity in the enactment and deployment of EU regulation. As a result, the full-fledged Internal Market for the European Union will only be achieved incrementally, i.e. progressively over time.

The shared EU objective of a full-fledged Internal Market is not a stand-alone objective. It is part and parcel of the broader EU economic and social policy agenda. This implies that next to economic objectives also other public interests need to be accommodated. In many cases a full-fledged Internal Market will support the safeguarding of public interests, such as security of the supply of e-communications services. In other instances the demands may become conflicting, e.g. in areas of public health and the environment. Policy choices will have to be made that may infringe to a certain degree upon the objective of reaching a fully liberalised market.

Critical to the achievement of the objectives of the Telecom Reform process has been the high degree of innovation in the e-communications sector. Over the lifetime of the European Project fundamental technological changes have occurred in the e-communications sector that carry on today. Examples include the transition from analogue to digital, first in the fixed network, later in mobile networks and currently in broadcasting networks. Another example is the transition from circuit-switched to packet-switched connections, supporting the emergence and global diffusion of the Internet. These innovations create opportunities for the creation of pan-European markets, for instance through the harmonised use of the Digital Dividend in radio frequency spectrum. They also create new challenges that again provide opportunities for EU level intervention aimed at securing a full-fledged Internal Market from the outset, for instance related to enabling e-commerce by unifying e-billing, e-payment, improving security and privacy and fighting cybercrime (see e.g. Van Eeten and Bauer, 2008).

This all underlines that the European project is best perceived as an ongoing process with a clear objective that can be realised progressively, but requires constant attention and intervention due to changing circumstances. Recognising these different dimensions, policy packages that are aimed at removing the remaining barriers or preventing new barriers to emerge can be shaped to further the development towards a full-fledged Internal Market.

## 1.2 Reading guide

This study is organised as follows:

In Chapter 2 we define the concept of the Internal Market for e-communications. We start with a general discussion of the Internal Market concept, followed by a description of the value chain and a pragmatic definition of the Internal Market for e-communications including a classification of barriers.

In Chapter 3 we describe technological developments foreseen in the 2020 perspective and their potential impact on the market. On the basis of this and the analysis in Chapter 2 we sketch a picture of what the future Internal Market for e-communications in the EU might look like. Although we claim throughout the report that the Internal Market is not an end state, we do think that (with a view on policy making) a clear 'target point' is very useful. This future picture should also be regarded as such.

Chapter 4 analyses the potential impact of advancing the Internal Market assuming that all barriers that can reasonably be removed are removed. The purpose of this exercise is to illustrate the economic importance of promoting the development of the Internal Market for e-communications. Such an intellectually challenging exercise calls for a creative and transparent research approach. We will adopt a "what if" approach: what are the expected gains for the economy at large, if:

- Telecom markets in the EU become as competitive as our best performing country in this respect?
- The markets in the EU allow for fuller exploitations for EU economies of scale?

Chapter 5 describes the results of a series of interviews that we organised with executives of various market players. The purpose of these interviews was to concretely identify institutions, behaviour, rules and/or regulations that economic actors perceive as a barrier for the Internal Market today. It has helped us gain an understanding of the issues from a micro-economic perspective (i.e. at the firm level) to complement the macro-economic approach to the issue at hand (cf. Chapter 3 and 4). We filtered and structured this large amount of information to end up with a short list of barriers that we think should be at the top of the agenda of policymakers. These insights notably feed the discussion on policy options that follows in Chapter 6.

Finally, policy implications are explored in Chapter 6. Here we first examine existing policy measures embedded in the regulatory package and/or formulated in the Digital Agenda. We determine which actions already address certain barriers that we identified and assess whether they are sufficiently concrete and comprehensive. Next we assess whether there are additional measures needed to remove the barriers that we identified. We also present two mini cases from which we can draw some policy lessons. One case concerns the United States, examining why the development of over-the-top (OTT) services is much more successful in the US compared to Europe. The second case concerns Korea examining the active role of the government in stimulating NGN roll-out.

# 2 The Internal Market for e-communications defined

This chapter clarifies the concept of the Internal Market for e-communications. We start (Section 2.2) with a general discussion on the Internal Market project in the EU and the economic reasoning behind it. The section concludes with a discussion on the limits to which we can push the Internal Market project. In Sections 2.3 and 2.4 we focus on e-communication. Section 2.3 provides us with a concise description of the value chain and elaborates briefly on the vertical power struggle between the various levels in the value chain. Finally, Section 2.4 presents an analytical framework for assessing the barriers towards a full-fledged Internal Market for e-communications networks and services.

## 2.1 The Internal Market project

The Internal Market is one of the foundations on which the European Union is based. The European Economic Community started as a so-called Customs Union. Its goal was to promote economic integration by eliminating the role of internal territorial borders on economic activities, in particular for the trade of goods and services (Pelkmans, 2006a). The Customs Union, which focuses on free trade, has in due course developed into an economic union. An economic union attempts to further promote integration by means of free mobility of labour and capital.

Promoting the four freedoms of movement – for goods, services, people and capital – is not sufficient to achieve the objectives of the Internal Market. In addition appropriate legal structures are necessary to allow businesses to operate effectively across the EU, guaranteeing a level playing field. Also required are policies aimed at combating illegal activities such as piracy, counterfeiting, anti-competitive practices, etc. Therefore, the EU Internal Market policy framework focuses on the four freedoms of movement – free movement of people, goods, services and capital – and on creating a single business environment and protecting rights of consumers and businesses:

- *The free movement of people* relates amongst others to the free movement of workers.[1] Policies are aimed for example, on the recognition of diplomas, integration in social security systems, etc.
- *A Single Market for goods* relates to banning restrictions on imports, exports or goods in transit between Member States (including discriminatory requirements to be met by goods originating from other Member States).[2]
- *A Single Market for services* relates to fostering the freedom of establishment and free movement of services. This includes simplifying procedures and formalities that service providers need to comply with and removing unjustified and disproportionate burdens.
- *A Single Market for capital* includes banning restrictions for foreign direct investments and participations.
- *A single business environment* aims at fostering a favourable climate for business to grow and operate across borders, guaranteeing a level playing field and appropriate legal structures. This

1 This also includes policies in the sphere of justice and home affairs, such as preventing criminals from taking advantage of a European space without frontiers.

2 On the other hand, rules on selling arrangements indistinctly applicable to domestic and imported goods fall, in principle, outside of the scope of the Internal Market policies.

includes measures such as improving the regulatory environment and licensing policies, harmonisation of rules[3] and promoting transparent and non-discriminatory public procurement practices.

- *Protection of rights* aims to preserve the protection of rights of consumers and businesses. These include not only policies such as consumer protection and data protection, but also competition-related issues and the protection of intellectual property rights.

In the extreme case, economic integration leads towards price and factor price equalisation. There are certain boundaries that make it impossible for this ultimate integration to be reached. The boundaries of the Internal Market are diverse: there are natural boundaries (e.g. mountains and rivers), semi-natural boundaries (e.g. language and culture), and policy-related boundaries (e.g. differences in social policy and in tax policy). Policy-related boundaries are largely affected by the subsidiarity principle (Ecorys et al., 2008).

### *2.1.1 Economic theory and the gains from the Internal Market*

There are two theoretical approaches to study the gains from an Internal Market, namely the trade perspective and the competition perspective.

#### A trade perspective

From a trade theory perspective, economic integration contributes to welfare through free trade and better allocation of production factors through the free movement of labour and free movement of capital (Niebuhr and Stiller, 2004). Free trade maximises welfare by creating possibilities for regions to specialise in activities in which they have a comparative advantage. Consequently, free trade will lead to lower prices and greater variety in the quantity and quality of products (Pelkmans, 2006b). Free movement of labour and capital on the one hand promotes an efficient allocation of production factors; on the other hand, it improves the integration of economic activities and structures – which creates possibilities to enjoy economies of scale and scope through agglomeration effects (Krugman et al., 2001). Below we briefly elaborate on these issues.

The comparative advantage model (Heckscher–Ohlin) is based on the trade of goods and services (as opposed to factor mobility). Subject to given factor endowments, this classical general equilibrium model explains the pattern of specialisation where country A produces product *i* and country B produces *j* on the basis of comparative advantages. Krugman (2008) referred to this as 'dissimilar-dissimilar trade', as in trade in dissimilar goods between dissimilar countries. Extensions of this model with insights from industrial organisation theories on imperfect competition (e.g. Dixit-Stiglitz) were inspired by the inability of the classical trade model to explain the observed 'similar-similar' trade flows.[4] This resulted in 'new trade theories' describing identical countries specialising in different products as to exploit economies of scale. Furthermore, by introducing transport costs the size of the home market turns out to be an important factor of the location of industrial clusters and therefore trade flows. Krugman (2008) explains this as follows: "Increasing returns provide an incentive to concentrate production of any one product in a single location; given this incentive to concentrate, transport costs are minimised by choosing a location close to the largest market, and this location then exports to other markets." The mix of products that a country produces subsequently depends on the relative importance of comparative advantage, economies of scale, and transport costs.

3 Notably rules relating to company law and corporate governance, contract law and taxation.

4 As in trade in similar goods between similar countries.

Besides his contributions to the above modifications of trade models, Krugman (1991) also embraced insights from economic geography so as to explain trade flows and specialisation patterns. These insights more or less confirmed the importance of economies of scale and extended these analyses with Marshall's agglomeration economies in the form of knowledge spillovers, labour market pooling, and specialised suppliers. Yet, more importantly, the revival of economic geography made clear that also within national boundaries (and thus within an Internal Market) one can observe a level of specialisation that is typically induced by economies of scale in combination with the free movement of production factors. Krugman (1991) analysed the degree of regional specialisation in the United States and Europe and found that European nations were less specialised than US regions. Illustrative of this is, for example, the automotive industry. Whereas in the United States this industry was (and still is) typically clustered around Detroit, the automotive industry in Europe was typically scattered across Germany, France, the UK, Italy, Spain, Belgium, and Sweden. The lack of specialisation can be explained by the existence of internal barriers to trade and factor mobility and thus by the lack of an Internal Market.[5] These elements prevent successful industrial districts expanding beyond national markets.

The above conclusions stem from the early '90s. We would expect a significant increase in specialisation in the EU since then, as we have experienced a period of Internal Market progress (including the completion of the monetary union). However, today we still observe the level of specialisation in Europe being less than in the USA.[6] Ilzkovich et al. (2007) conclude that considerable cross-border barriers remain. The working of the Internal Market is particularly hampered by "the slow and sometimes incomplete implementation of directives, the inadequacy of some instruments, the persistence of barriers to cross-border trade and investment particularly in services, and the slow development of an Internal Market for knowledge". One could also add the (lack of) political will to this list.[7] However, even if these barriers are levelled, there will remain certain semi-natural barriers such as language and culture and (related to that) the lack of factor mobility. One could say that these semi-natural barriers define the boundaries of the potential for the EU Internal Market.

### A competition perspective

In the stylised world of competition models there are multiple market structures ranging from a monopoly with only one supplier to perfect competition with an indefinite number of (potential) suppliers. Between these extremes, several forms of imperfect competition can be identified that differ in terms of heterogeneity among suppliers and products, in terms of buying power by end-users, in terms of mode of competition (price-based, quantity-based, or based on qualitative aspects), etc. These different models lead to different levels of market performance in terms of static (consumer surplus and profits) and dynamic (investments and innovation) efficiency. Generally speaking, a monopolistic market structure performs badly in terms of consumer surplus and profits, while perfect competition performs optimally in terms of static efficiency. Concerning

5 Krugman and Venables (1994) explain the difference between the US and the EU resulting from barriers to trade (including the de facto barriers created by differences in language and culture), lack of factor mobility, and "the sheer nuisance presented by the existence of a border".

6 An important explanation may be that this is (partly) cosmetic. Sapir (1996) explains: "many of the effects of increased integration may have taken place within, rather than across, industries." Krugman (2008) also refers to a seminal paper by Balassa (1966) on the rise of intra-industry trade in Europe, in which he stated: "each country produced only part of the range of potential products within each industry, importing those goods it did not produce, because "specialisation in narrower ranges of machinery and intermediate products will permit the exploitation of economies of scale through the lengthening of production runs.""

7 For example, with respect to some sectors, national governments typically follow a focused national industrial policy (e.g. promoting 'national champions' in the automotive industry and the electricity markets) maintaining a scattered pattern of production locations. With respect to other industries, national governments follow a more supra-national approach (e.g. aviation, space, and satellites), which has resulted in a more concentrated production pattern.

dynamic efficiency, there seems to be consensus on an inverse U-shaped trade-off between the extent of competition and dynamic efficiency – as argued by Aghion et al. (2005).[8]

Competition models can be applied in order to assess the performance of real world industries. Regulators typically utilize such models in market reviews, assessing the need for and impact of ex-ante regulation. Such market assessments typically start with an identification of the *relevant market*, which is divided into a relevant product market and a relevant geographical market, followed by an assessment of market dominance. As a rule of thumb: the larger the relevant market, the more competitive are the market structures and the less likely one finds market dominance (Gal, 2001). This brings us directly to the benefits of the Internal Market: as the Internal Market breaks down territorial barriers, relevant geographical markets are likely to increase in size. Across the board, this makes market structures more competitive, increasing welfare and reducing the need for (ex-ante) regulation.

What defines the boundaries of the relevant geographical market? In essence it is similar to what defines the boundaries of the product market: demand and supply substitution between regions (instead of products).[9] In the case of non-tradable goods and services, only supply substitution is relevant for determining the relevant geographical market.[10] As a proxy for establishing geographical supply substitution, one can use the extent to which competitive circumstance structurally differ between regions. This does not mean that all sub-regions comprising the relevant market are served by the same suppliers or even by the same number of suppliers. It may suffice for only one supplier to serve two sub-regions in which this one supplier subsequently competes with different parties. In such case, regional suppliers may indirectly compete with each other while competing with the supra-regional supplier. This is known as a "chain of substitution", see Jones and Sufrin (2000). If such indirect competitive forces are strong enough, the relevant geographical market comprises both sub-regions.[11] From this perspective the presence of supra-national suppliers contributes to integrating national markets into a single European market, in particular if the service or product is non-tradable.

Why would suppliers of non-tradable goods be active (and employ production factors) in multiple regions? A reason may be that there are scale and scope economies in supra-regional branding (e.g. through advertising, help desks, a network of physical service providers, etc., cf. Yip, 2002). Another reason may be that regions are complementary, an argument which typically applies to network industries (e.g. in car rental services, postal services and telecommunications) (cf. Shy, 2001).

### 2.1.2 *The boundaries of the Internal Market*

In a recent report to President Barosso, Professor Monti (2010)[12] stated, "In some sectors, such as in the Internal Market for goods, market integration reached a mature stage. […] In others, as in the

8 I.e. an oligopolistic market structure may perform best.

9 Demand substitution refers to the extent to which consumers consider two different products as substitutes. Supply substitution refers to the extent to which suppliers can use their production factors (and processes) to produce different products. From a geographical point of view, the analysis is broadly similar. Demand substitution translates into the extent to which consumers (or entrepreneurial intermediates) are able to arbitrage when regional price differences occur. Supply substitution translates into the extent to which producers are able to shift production factors to supply different regions.

10 By definition arbitrage of non-tradables is not possible in case regional price differences occur.

11 In theory, one can imagine that the chain goes on for yet another sub-region, but the strength of indirect competition decreases with the length of the chain. Compare the Fiat 500 with a Rolls Royce, one can describe a chain of substitutes linking these two cars, but everybody knows intuitively that Rolls Royce will never respond to a decrease in the price of the Fiat and vice versa.

12 Monti Report on the re-launch of the Single Market (May 2010).

case of services, Europe is still in a phase of "market construction" that requires breaking down barriers to cross-border activity […]". As many services are typically non-tradable, the formation of the Internal Market requires particular attention from policy makers with respect to the freedom of establishment and the freedom to provide services in other Member States.

What is the maximum extent to which we can push the Internal Market concept? In the extreme case (but this is purely hypothetical) there are no barriers; price differentials only reflect transport costs and taxes. A first objection to this hypothesis is that we have numerous geographical differences that affect production costs and hence prices. Second, in reality language and cultural differences across the EU make it a prime example of what Paul Samuelson (1949) referred to as the Tower of Babel scenario where factors of production find themselves with national labels and are only able to work with other factors that have the same national label. This severely limits the ability to reap the benefits of full specialisation. Third, the division of labour between Europe and its Member States is based on the subsidiarity and proportionality principles. These principles are not always at par with economic integration: different tax regimes, differences in social security systems, or differences in institutional labour relations, may affect the economic choices of firms and individuals.

The above arguments imply that the situation of full arbitrage of prices of goods and services is unlikely to be achieved. This may hold even stronger in case of non-tradable services for which geographical clustering of production is not possible. As a result, local differences in production costs, tax regimes and social policy preserve international price differences. Consequently, also the full convergence of regional macroeconomic performance is unlikely to be achieved.

## 2.2 E-communications markets and products: Description of the value chain

A strict definition of markets is necessary in order to bring focus to the project. We concentrate on fixed and mobile broadband networks and services. Networks refer to infrastructures and include access networks as well as the backhaul and core networks. Here we can differentiate between fixed and mobile. With respect to services we limit the analysis (as far as possible) to broadband data services. Other types of service are voice services (analogue or digital), TV, SMS (texting), etc. In a prospective analysis (moving towards next generation access networks with net neutrality), broadband data services can be seen as a proxy for all other services as these will all be based on IP and data standards (see Section 3.1). This results from network intelligence moving away from the physical network to the Internet, allowing for over-the-top provision of content and applications.

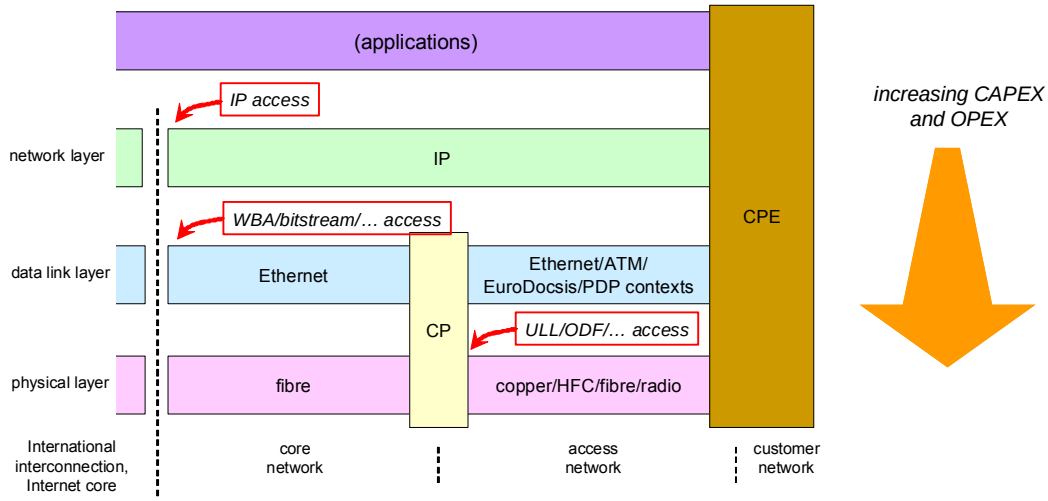
Using 'applications' such as streaming video, web browsing, or VoIP requires a simultaneous consumption of a broadband Internet access service. The increased demand for these applications by consumers, in turn, drives the demand for bandwidth and thus also the investments in Next Generation Networks. Because of this close interaction between broadband services and content and applications, we cannot simply ignore them. Together they produce a certain amount of value added. How this value added is distributed between application providers, network operators and end-users is the result of horizontal and vertical power relations. The effects of progressing the Internal Market for broadband services should also account for the potential impact on the (pan-European) provision of applications and content. We elaborate on this below by first discussing the value chain at the network level and then extending this with a description at the content or application level.

### Network level

A vital input for Internet Service Providers (ISPs) is the connection to the equipment at the users' premises (CPE) via so-called 'access networks'. Many of these access networks (notably fixed) are characterised by very high sunk costs. Consequently they have features of a 'natural monopoly' providing owners/operators of such networks with significant market power. Key measures for fighting this market power and opening up national markets has been the regulation of wholesale access, such as *Unbundled Local Loop (ULL)* or *Wholesale Broadband Access (WBA) on twisted-pair copper networks*. It enables new entrants to use (parts of) the network assets of incumbents to provide their own retail services. Apart from regulated wholesale services, there are also wholesale services that have developed in the market without regulatory intervention. These are typically found in markets where multiple networks compete with each other. For example, in the mobile market, Mobile Virtual Network Operators (MVNO) gain access to mobile networks on a negotiated basis.

Figure 2-1 shows the main wholesale services involved in the supply of broadband services. There are different services at different technical layers, loosely following the standard Operating Systems Interconnection (OSI) layering.

**Figure 2-1 Overview of wholesale services related to fixed and mobile broadband services.**




Source: TNO

Apart from the vertical layering, the hierarchical structure and topology of networks is relevant for the characterisation of wholesale services as well. Broadband networks are generally made up of an access network and a core network. The access network is used to connect individual customers and provides connectivity up to a so-called Concentration Point (CP), e.g., a local exchange. The core network provides national connectivity between concentration points, as well as the link to the international public Internet core. In access networks, a number of different technologies are found, such as DSL over copper, EuroDOCSIS over HFC (Hybrid Fibre Coax), Ethernet over fibre, GSM and UMTS/HSPA over radio.

Figure 2-1 shows the types of wholesale product an ISP can use to enter the market. As one moves closer to the physical layer, an ISP relies more heavily on its own investments, is less dependent on regulatory measures, and is less subjected to anti-competitive threats by the incumbents such as margin squeeze. Closer to the physical layer, both capital expenditures (capex) and operating expenditures (opex) tend to be higher. While climbing the 'ladder of investment' we see four forms of access:

- A service provider can gain access to the end-user without owning and investing in any network facility. For broadband services this is still uncommon but not unthinkable (it is called IP level

wholesale access here).[13] For voice there currently is a wholesale line rental product that allows service provision without owning or investing in network facilities.[14] The business model of these service providers is typically based on 1) gathering a group of consumers and reselling that group (i.e. using collective buying power to negotiate better access conditions); 2) provide additional, better or cheaper services (e.g. better helpdesk); 3) sell advertisement space (e.g. during the phone call or voice communication); and/or 4) bundling with other services, that are provided via own or third-party networks (e.g. mobile and broadcasting).

- Another business case is to invest in a few or more regional nodes in the core network (points of presence or POPs) that have a direct connection with the national concentration point. With additional wholesale broadband access (or bitstream access) service provision can be started. Compared to the previous business case, the basis for this one is extended with possible benefits from more efficient network services and/or skimming of profits from the upper levels of the infrastructure. At this level, entry is still fairly easy as sunk investments are relatively small.
- A third business model is based upon further investments up to the local distribution frame. Service provision depends on regulated wholesale access to physical access network – the so-called unbundled local loop (ULL) access to twisted-pair copper and optical distribution frame (ODF) access to fibre networks.
- A final business case is that of a service provider owning an entire network (including the local loop).

Of course this is a somewhat stylised presentation. These different business models can exist in parallel to each other and one could also invest in the local loop without investing in the entire backhaul (e.g. some local Fibre to the Home or FttH network initiatives). Furthermore, from a policy perspective, the ladder of investments approach as described by Cave (2006)[15] is not undisputed. Renda and Pelkmans (2011) conclude that the ladder of investment "has proven to be of doubtful effectiveness". Also De Bijl and Peitz (2007), Bourreau et al (2010), Bouckaert et al (2010) and De Bijl (2011) raise doubts as the final step from ULL access to full network competition seems unrealistic in the light of natural monopoly characteristics of the access networks. Nevertheless, these critiques do not argue that the concept of an investment ladder is basically wrong.[16] Hence, we can certainly use the concept at this point to describe the value chain. Even if firms do not climb all rungs of the ladder, the ladder of investment concept serves to differentiate between different types of access services and market entry.

### Vertical power relations with the content and application level

At the core, network operators provide access to content, in the broadest sense of the word: web content, television and video, e-mail, voice communications, file downloads, VPN connections, etc. Without content, the value added of 'being connected' reduces to practically zero. On the basis of the IP protocol, interconnectedness has been facilitated and thereby also the development and access to content. Today, and in the near future, the innovations at content and application level are immense: connected TV, cloud computing, machine-to-machine, 'Apps', eHealth, etc. These innovations create a tremendous amount of value added requiring bandwidth to reach consumers, thereby requiring network operators to invest.

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13 It typically takes the form of white labelling: an ISP resells the broadband service of another ISP.

14 Also such services as skype and youtube are respectively voice and media services that are IP based.

15 As summarized by Bourreau et al. (2010) "The approach entails providing entrants, successively, with different levels of access —the ''rungs'' of the investment ladder, while inducing them to climb the ladder by setting an access charge that increases over time or by withdrawing access obligations after some pre-determined date (i.e. by setting sunset clauses). Proponents of the ladder of investment approach claim that such regulatory measures make service-based entry and facility based entry complements – albeit they have been traditionally viewed as substitutes – in promoting competition."

16 De Bijl and Peitz (2007) state, "It should be noted here that (to some extent) it may not be the underlying idea that is flawed, but that the implementation and credible commitment to the policy by regulators are problematic."

In order to provide the right incentives for such investments, network operators need to re-position their pricing models/strategies as to reap a larger share of the additional value added from the new content. Strong upstream players such as Google, Apple and Microsoft are trying to fight the network operators' gatekeeper position (and each other) by moving into the CPE level with competing operating systems and developing specific 'Apps' for these operating systems. They are in effect trying to create an additional layer (in Figure 2-1 we visualised this with the purple coloured top layer 'applications'). The outcome of this 'fight' over value added depends on vertical power relations between these platform and ISPs. These vertical power relations are highly determined by horizontal power relations; i.e. the competition among platform providers and among ISPs.[17] Furthermore, content providers/aggregators play a role. Both ISPs and platforms want to integrate/cooperate with content. E.g. ISPs are active in broadcasting, but also Google, Apple, and Sony are setting up their own over-the-top broadcasting services. Both types of players are depending on the entertainment industries (i.e. movie and music industry) to fill their broadcasting channels with content. Some are even vertically integrated with the content level (e.g. Sony).

## 2.3 The Internal Market for e-communications

Above we described some general notions of the Internal Market, but one has to be aware that at industry level these general notions may not always apply. Following Defraigne and Streel (2011), we take the definition given in the Treaty on the Functioning of the European Union (TFEU) as a starting point to define a truly Internal Market, namely: an area in which goods, services, workers and capital can move freely. In e-communications the non-tradability characteristic is highly important, limiting the potential of trade as a driver for the Internal Market. Hence, for the purpose of this study, what really matter are (i) the free movement of services and (ii) the freedom of establishment of firms.

The freedom to supply services and the freedom of establishment allow companies to expand across national borders, facilitating entry into new (geographical) markets, fostering competition and innovation, yielding economies of scale and scope, and driving economic growth. Although legally well embedded, these freedoms differ *de facto* from one country to another. These freedoms can be hampered by:

- *(Semi-) natural barriers* stemming from different cost structures due to historical developments, different spatial policy regimes, soil structures, population density, etc. and from the extent of market saturation;
- *Strategic barriers* stemming from the combination of market dominance and regulatory failure to address this – see De Bijl and Peitz, 2007; Bouckaert et al., 2010; Bourreau et al., 2010; Ware and Dippon, 2010; Pelkmans and Renda, 2011;
- *Technological and institutional barriers* stemming from heterogeneity in the institutional landscape of standardisation and regulation of e-communication services – see Blind et al., 2010.

The (semi-) natural barriers are barriers that we cannot level. They determine the boundaries for the Internal Market of e-communications in terms of convergence of performance. As regions differ with respect to these structural characteristics, the Internal Market for e-communications (as for other non-tradable goods) is thus not defined by full convergence of prices and investment levels[18] or by full convergence of regulatory approaches – see Defraigne and Streel (2011; 65-67).

17 See the literature on bilateral oligopolies: Steiner (1997), Björnerstedt en Stennek (2001, 2006), Comanor en Rey (2000), Rey en Vergé (2005), Dobson en Waterson (2007).

18 As opposed to the working hypotheses applied by Pelkmans and Renda (2011)

The second group of barriers relates to the main focus of e-communications policy over the past 15 years (opening up national markets). In essence this policy focus is what theory prescribes in order to form an Internal Market. In order to account for country-specific circumstances, Member States have had some discretion in the transposition of EU Directives into national law. This entails the risk of creating a patchwork of different standards, protocols, and regulatory approaches,[19] creating the third barrier mentioned above. It is not so much a barrier when reviewing a national market in isolation. But in conjunction with other markets, a more homogenous and a more standardised landscape facilitates foreign operators in 'copying' their business case from one Member State to the other Member States with limited replication costs. As such, a full-fledged Internal Market is defined by the removal of these two categories of barriers, such that:[20]

- **all national markets are open** and thus characterised by a level playing field, transparency and non-discrimination between all types of players;
- conditions for establishment and supplying services are sufficiently harmonised allowing entry in other EU markets as to **benefit from European economies of scale**.

### *2.3.1 Semi natural barriers*

As mentioned above, natural barriers are barriers that we cannot level and have to accept as 'fact'. Natural barriers relate to natural monopolies that exist, according to the economic theory, when production by a single firm outweighs the costs of production by multiple firms. From a welfare perspective, it is therefore the most efficient situation that this single firm remain the only firm in the sector. Because this monopolist is not subject to the normal competitive forces on a market, regulation of the natural monopoly is an option.

In line with such a natural monopoly, natural barriers are related to the 'economics' of electronic communication services. The most important natural barrier related to e-communication is the costs of duplication of a network. Given the enormous costs of developing a new network (a lot of the costs relate to digging) it is (in most cases) far too expensive for new entrants to roll-out their own network to individual households. As a result, new entrants choose for bit stream access and/or roll-out only a part of their own network (on a more aggregate level) and use the network of the incumbent (telecom or cable).

Related to this 'default' natural barrier there exist a lot of other (semi-) natural barriers that, in fact, are related to (or hinder) the profitable economic exploitation of e-communication services. On the supply side, one can think of economies of scale and scope (often related to historical developments of monopolised networks and policy regimes), network effects, sunk costs of investments, soil and geographical structures (mountains, many islands, etc.), population density, highly localised distribution channels, the type of competition, etc. On the demand side one can think of specific consumer demand for services, cultural demand, language preferences, costs of switching, reputation effects (of incumbents), market saturation, countervailing power of buyers, etc.

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19 Pelkmans and Renda (2011) name a few reasons for the persistence of the fragmented markets amongst which they mention:
- The national markets approach in regulation, leading to regulatory heterogeneity "yielding differences in market definition, in the choice of cost parameters and access price models, in the implementation of remedies and in appeals procedures."
- Insufficient coordination and exchange of best practices among NRAs has contributed to this effect.

20 Defraigne and Streel (2011; 66) mention a third condition "the presence of regulators which are independent of operators […] and national governments". We agree that this is indeed as a prerequisite for the Internal Market, but we do see this as an integral part of a level playing field and thus of opening up national markets.

A lot of the barriers for the Internal Market perceived by the industry are in fact (semi-) natural monopolies that have to be accepted as 'fact'. In Chapter 3 (and annex IV) we identify many of these barriers and filter them out of our analyses.

### 2.3.2 Full opening of national markets

In essence, broadband services are supplied in co-existing national markets (see Renda and Pelkmans, 2010). This does not mean that there is a lack of an Internal Market. It is possible that, due to a range of semi-natural barriers, the potential economies of scale from pan-European networks are limited. In such case, the full-fledged Internal Market for e-communications will look like a patchwork driven by historically determined network configurations, sunk costs, differences in population density, and differences in soil structures. The question is whether the patchwork originates from the absence of freedom to establish a business and/or to provide a service. This freedom can be hampered, for once, by an incumbent's strategic behaviour denying entrants access to his network facilities. Over the last fifteen years, guided by the European regulatory framework for electronic communications, Member States have taken various measures to open up their national markets for competition by regulating access. This policy framework has been largely based on the ladder of investment concept.

The measures to open markets have been implemented with varying success in different Member States. Consequently, there are considerable differences between Member States in the extent to which wholesale products are offered, such that entrants are able to climb the ladder. These differences (partly) explain the differences in performance as observed in the business as usual situation. But how would this picture differ when all countries manage to open their markets to the full extent? What is the full extent? Is that competition between access networks? Recent critiques to the ladder of investment concept are perhaps mainly based on the observation that the final step (towards network competition in the local loop) may not be possible for natural monopoly arguments. But still, if network competition *up to* the local loop is possible and provided access to the local loop is effectively regulated, society is likely to experience efficiency gains compared to fully closed networks.

The benefits from open national markets should not only be seen from a static perspective (lower prices, higher service quality), but also from a dynamic perspective: as competition on copper networks increases, the incentives to invest in fibre increase as to 'escape' competition. Furthermore, from a more long-term perspective, climbing the 'copper' ladder can be a basis to jump to the 'fibre' ladder.[21]

### 2.3.3 Exploitation of EU economies of scale

A crucial observation is that today, all of the wholesale services mentioned in the previous sections are offered at a national scale. This partly results from differences in the openness of national markets and partly due to (semi-) natural barriers. These are barriers for exploitation of EU economies of scale stemming from substantial differences between Members States related to technical implementation, commercial arrangements and the processes around services. Thus, for every additional Member State in which an operator wants to provide his broadband services, an additional implementation effort is required. Standardisation helps to reduce these implementation efforts. In an ultimate situation, expansion into another Member State only requires duplication of

21 The customer base and the back offices are already in place.

equipment and processes without any technical implementation efforts[22]. At this point, it is useful to distinguish two areas where standardisation is required:

- Telecommunication Infrastructure (TI);
- Information Technology (IT) and processes.

The lack of standards with respect to IT and processes may be a barrier for pan-European broadband service provision as it may increase transaction costs. The lack of standardisation at the TI level may hamper the pan-European interconnections of networks.

Entry in other EU markets (and thereby exploiting EU economies of scale) can also be hampered because of differences in the regulatory and legal frameworks. Legal obstacles refer for instance to license conditions (e.g. spectrum licenses of infinitive duration in the UK, obligations with respect to geographical coverage) or difficulties in obtaining licences to provide telecom services in general. Regulatory obstacles include, inter alia, roaming and national spectrum allocation policies. With respect to regulation it is important to note that in decisions regarding foreign direct investment and international trade it is not so much the level of regulation that matters, but regulatory heterogeneity across countries.[23]

Furthermore, European mobile telecommunication networks benefit (in terms of EU network effects) from harmonisation of frequency bands for electronic wireless communication networks. This process is well underway but not yet fully accomplished. Deviations in national frequency allocation tables still exist for certain frequency bands due to legacy conditions. It leads for example to higher costs at the level of peripheral equipment and handsets. In a situation where frequency bands are fully harmonised, producers of such equipment enjoy more economies of scale that may boost adoption rates and thereby economic growth[24]. Refarming is the solution to achieve harmonised bands, but refarming operations occur at different speeds in EU Member States (e.g. the Digital Dividend band).[25] . Licensing is also a national matter with different procedures and timelines, which pan-European operators must take into account. The first multi-annual radio spectrum policy programme (RSPP) intends to improve this situation. The potential impact of this programme needs to be assessed in order to determine if any further spectrum policy measures are required to achieve the 2020 goals.

In the situation that European economies of scale can fully be exploited we assume that, at the level of both IT and TI, the necessary extent of standardisation has taken place as to allow for the full exploitation of EU economies of scale. We foresee three potential modes of pan-European service provision:

- Pan-European Managed IP access wholesale service.
- Pan-European wholesale broadband access service, and
- Pan-European wholesale physical access service.

### Pan-European Managed IP access wholesale service

Pan-European Managed IP access service could be a service that facilitates high-end pan-European e-communication applications such as e-Health. Pan-European e-health service providers may have a similar demand as multinational corporations have today, but with even

22 Obviously, there would still be a need for marketing, sales and other efforts.

23 See H. Kox, A. Lejour and R. Montizaan (2004), "The free movement of services within the EU", CPB Document 69, The Hague, and H. Kox and A. Lejour (2005), "Regulatory heterogeneity as obstacle for international services trade", CPB Discussion Paper 49, The Hague.

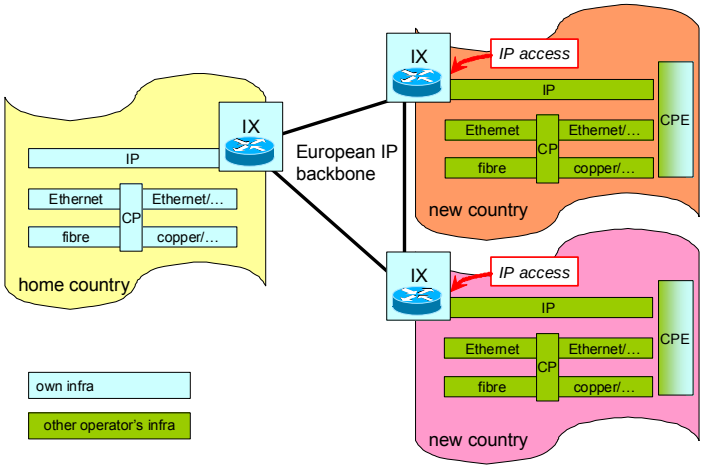
24 See for example the GSM episode (Section 3.1.3 and 4.2.3)

25 Referring to additional spectrum becoming available in the 800Mhz band as a consequence of the shift from analogue to digital terrestrial broadcasting.

higher demands for quality of service. It requires a full standardisation of IT and TI. An operator wishing to provide e-health service providers with pan-European broadband access should be able to rely on a standardised wholesale Managed IP product in case its client is located in a country in which the operator has no points of presence (PoPs).

In the most basic model of this situation, there is no technical link between the networks of the two operators. The operator providing the wholesale service will typically also provide the helpdesk, the CPE and its installation at the customer premises, if needed. In another model of this situation sketched in Figure 2-2 the operator seeking expansion into other Member States picks up the IP traffic in one or a few Internet Exchanges in these States and carries the IP traffic further to the Internet core.

**Figure 2-2 Provider expanding into other Member States using a pan-European Managed IP access wholesale service**

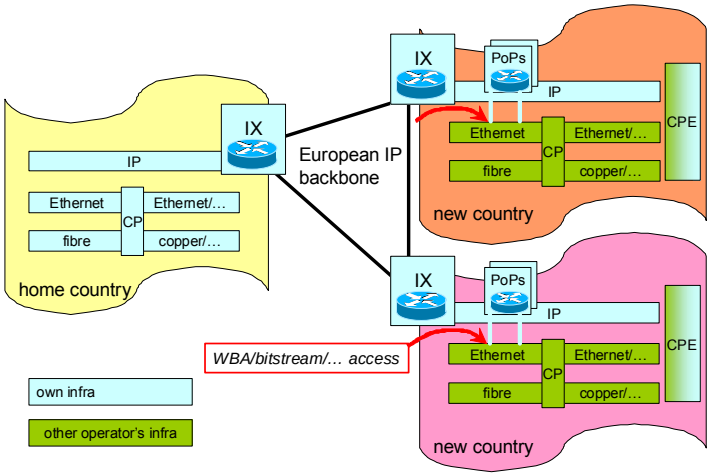



Source: TNO

## Pan-European wholesale broadband access service

In the wholesale broadband access situation, the expanding operator builds an own IP network presence in his target countries, at least in an Internet Exchange and probably also a few additional PoPs. This model can exist today, but we foresee a future in which this model is combined with full standardisation of IT and TI.

**Figure 2-3 Provider expanding into other Member States using a pan-European wholesale broadband access service**

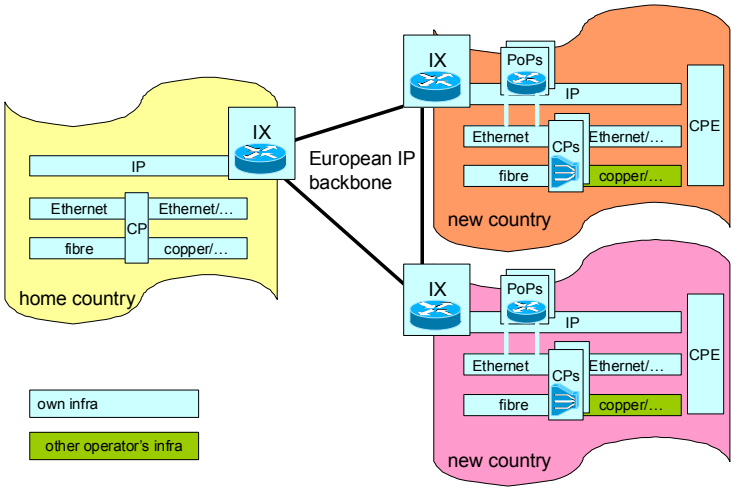



Source: TNO

### Pan-European wholesale physical access service

In the wholesale physical access situation, the new entrant rolls out to the CP and builds his own IP and Ethernet infrastructure. The business case for such a roll-out exists only for CPs that serve a geographic area where the new entrant has or expects a substantial number of customers. Typically, the new entrant builds a customer base, first using WBA before migrating in specific, commercially attractive areas to wholesale physical access. Today this model is non-existent because markets are typically driven by national demand. In the future the demand for standardised managed IP services may act as a catalyser for pan-European physical access by creating EU economies of scale and leading to a market driven standardisation process (see Section 3.1.3).

**Figure 2-4 Provider expanding into other Member States using a pan-European wholesale physical access service**




Source: TNO

# 3 E-communications networks and services in the run-up to 2020

This chapter sketches a picture of the future of the e-communications market. For this we have identified a number of trends that shape the current and future market. Below we present these trends and discuss the driving forces behind them and the (possible) implications for the (internal) market. The chapter concludes with a sketch of the market in 2020 assuming that we have managed to push the Internal Market such that national markets are open and a necessary level of standardisation has been reached.

## 3.1 Technological developments, trends and market implications

There are many technological developments underway. This section provides an overview of the relevant developments. The two main questions that we address are:

- What technological developments can we expect?
- How do they change markets (and in particular the Internal Market)?

Table 3-1 provides an overview of a number of anticipated technological developments up to 2020 and their possible impact on markets.

**Table 3-1 Overview of technological developments and their market impact**

| Development | Possible market impact |
|---|---|
| 1. Very high bandwidth | 1. Applications may demand higher bitrates than can be delivered with xDSL technology or 3G technology. This requires a major change in fixed and mobile infrastructures across Europe.<br>2. Users will not only demand more bandwidth, but also more quality of service (QoS). |
| 2. Special network functions | 3. Network operators may need to change their pricing models as traditional telecommunication services (voice, broadcasting, messaging) experience increased competition from software based over-the-top (OTT) services as a result of physical network functions being substituted by software based network intelligence.<br>4. New services require new forms of physical network functions.<br>5. Differences in wholesale access products across Europe may exist because different operators support different functionality. This heterogeneity prevents pan-European offers for pan-European users. In particular, differences in technical specifications of managed IP interfaces may frustrate the pan-European offering of OTT services.<br>6. In the absence of standardisation of technical specifications, the network operator controls the provision of premium OTT services that depend on higher network efficiency (more QoS). |
| 3. Applications and application platforms | 7. The market becomes more influenced by application platform providers becoming the natural access point to consumers.<br>8. Vertical power relations between network operators and platform providers change (the market for network services becomes a two-sided market), potentially affecting the incentives to invest in NGA networks.<br>9. Standardisation of the managed IP interfaces would increases the |

| Development | Possible market impact |
|---|---|
| | competition at OTT level, leading to more specialisation (i.e. mobile and fixed network operators focussing on their core activities: operating the network). |
| 4. Fixed-wireless convergence | 10. New wireless broadband infrastructures may be considered as a substitute for or a complement to existing fixed infrastructure.<br>11. High-speed wireless infrastructure still requires extensive fixed infrastructure towards base stations. In the long run, fixed and mobile increasingly complement each other. This may lead to higher entry barriers. |
| 5. Technical changes resulting from new regulatory requirements | 12. The regulatory framework may need to change in order to deal with the fact that the market for network services is (becoming) a two-sided market.<br>13. This also relates to the net neutrality discussion. Heterogeneity in net neutrality policies would frustrate the development of OTT services.<br>14. Heterogeneity in the approach towards new requirements (such as deep packet inspection) leads to replication costs for ISPs when entering another Member State. |
| 6. Different network architectures | 15. There is heterogeneity in wholesale access leading to replication of costs for ISPs operating in multiple national markets and preventing pan-European offers for pan-European users.<br>16. Choice for specific network architectures may become a strategic choice instead of efficiency based choices. |

In order to analyse the impact of the developments listed in Table 3-1, these development should be seen in relation to each other. In the following sections we elaborate on this. Each section first briefly describes trends and drivers followed by a discussion of the possible impact on the market.

### *3.1.1 Content and applications requiring very high bandwidths*

#### Drivers

The bandwidth consumption of applications has grown strongly over the years and is expected to grow further (SBS, 2010)[26]. In recent years, video (streaming or on demand) has been the main driver for the growing demand for bandwidth. Future growth can still be expected from this driver, going from Standard Definition (SD) to High Definition (HD) and 3 Dimensional (3D). The same trend can be expected from online gaming. Other drivers are cloud computing (or software as a service), virtual private networks, e-health, e-learning, etc. Not only will there be a greater demand for bandwidth, but also for Quality of Service (QoS). Fulfilling this increased demand for QoS may conflict with interconnectedness as network operators often choose for customised managed IP solutions to deliver increased QoS – we elaborate on this in section 3.1.2. SBS (2010) refers to the combination of demand for more bandwidth at higher quality levels as an increased demand for *broadband quality.* [27]

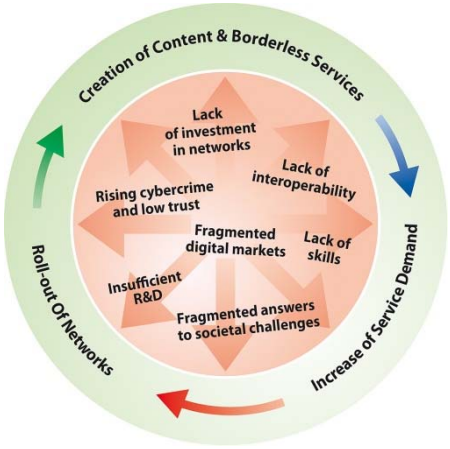
The relation between online services and demand for broadband quality is not a one-way relation. Operators respond to the demand with investments in more bandwidth. The availability of abundant

26 Saïd Business School - Oxford University and Universidad de Oviedo (2010), "third annual broadband study", sponsored by Cisco.

27 More specifically, they define broadband quality as a combination of download throughput, upload throughput, and latency capabilities of a connection, the key criteria for a connection's ability to handle specific Internet applications, from consumer telepresence to online video and social networking.

bandwidth again drives the development of online services. In other words, there is a circular relationship between online services, demand for bandwidth, and investments in bandwidth – see Figure 3-1.

**Figure 3-1 Cycle of the digital economy**




Source: A Digital Agenda for Europe

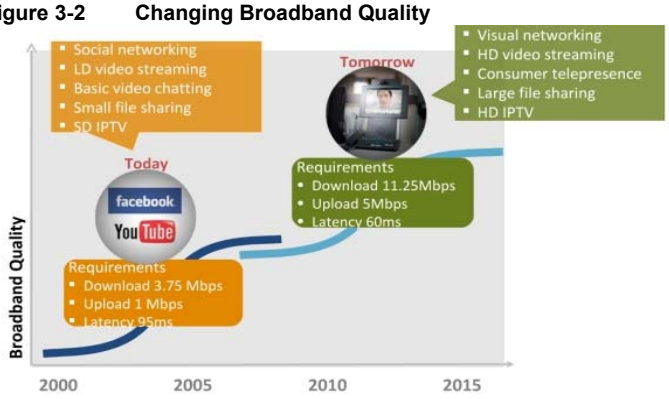
From this circular relation between demand, services and investments it follows that (given a certain minimum scale) the efforts of Member States (or local/regional governments) to promote the roll-out of fibre optic networks (indirectly) pushes the demand for more bandwidth in other Member States (regions).

## Impact on the market

### *Future demand for broadband: market prospective*

SBS (2010) notices an S-shaped development of broadband quality in the period 2000-2010 and foresee a second S-shaped development for the next 10 years (see Figure 3-2).

**Figure 3-2 Changing Broadband Quality**




Source: Saïd Business School (Oxford University) and Universidad de Oviedo (2010) – referring to ComScore, Nielsen; Expert interview: Oxford Team analysis (august 2008)

According to the SBS report, current household download patterns range from 20 GB per month (for a basic household) requiring a capacity of over 2 Mb/s to 500 GB per months (for a smart and connected household) requiring a capacity of over 20 Mb/s. The number of today's connected households is still small. For the Netherlands (one of the European front runners on penetration rates and broadband capacity), TNO (2011a) finds that most users have a connection of 8Mb/s or

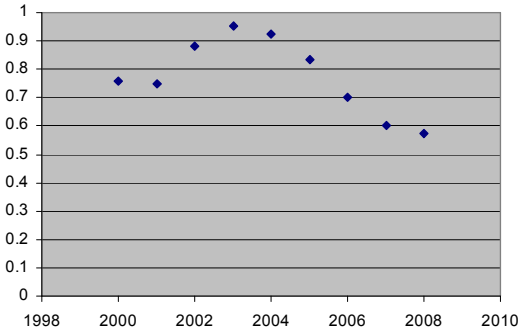
less.[28] Given that around the year 2000 the majority of the users in the OECD were using dial up connections of 56 Kbit/s,[29] bandwidth capacity has grown with a factor 35 (or around 40% per year) for basic households over the past 10 years.[30] The OECD (2009) even presents figures of 50-60% per year.[31]

For the period 2010-2020, SBS foresees another wave of bandwidth (and quality) increase. Also TNO (2011a) expects major bandwidth increases over the next ten years (with another 30% to 40% per year). All in all, we can conclude that the objectives of the digital agenda[32] are consistent with this picture. Furthermore, it is clear that not all (access) technologies will be able to deliver the required bandwidth. Very high bandwidths can only be achieved with additional fibre roll-out to a location close to the customer (FttC – fibre to the curb) or directly to the home (FttH/B – fibre to the home/building).

### *Investments required to meet demand*

The S-shaped growth in broadband quality indicates a parabolic development of yearly investments. If we look at the developments of yearly investments in the EU and (other) large OECD countries[33] between 2000 and 2010, this picture is confirmed (see Figure 3-3).

**Figure 3-3 Yearly investments in networks in Europe and (other) large OECD countries (1995=1)**




Source: Ecorys calculations based on ITU-data

For the next ten years we may expect another wave of investments. The total amount involved is likely to be higher than has been observed so far (Analysys Mason, 2008). The majority of the connections between 2000 and 2010 were DSL based, requiring (only) an upgrade of the existing backbone of the copper based local loop. In order to meet future demand, (additional) investments are required much deeper into the network: up to the street corner (FttC) or into the homes (FttH). Because the local loop has such an intricate structure, the costs of digging and laying ducts may grow exponentially. It is difficult to gauge how much Europe as a whole will have to invest because the costs of vitrifying the local loop differ considerably from one region to another[34]. On the basis of

28 TNO (2011), "New broadband services: the demand for reliable and guaranteed-quality connections", Presentation at the WIK conference on "Fibre Networks: Demand and analyses of costs and benefits" June 6 – 7, 2011, Berlin

29 See data on information society at http://stats.oecd.org.

30 From 56Kbit/s to 2000Kbit/s.

31 Network developments in support of innovation and user needs, OECD, 2009.

32 Almost all users having access to a minimum capacity of 30Mb/s and half of the users having access to a 100Mb/s connection.

33 USA, Japan, South Korea, Canada, Australia, and New Zealand

34 This is due to differences in soil structure, population density, ability to re-use ducts, various forms of regulation (e.g. way of rights and/or spatial planning). For example, in some Member States regulation about spatial planning allows for the cables to be placed above ground. This is one of the reasons that Bulgaria and Romania seem to score high on fibre penetration rates.

several studies[35] the European Commission estimates that total investment needs for meeting the objectives of the digital agenda may run up to 270 billion Euros.[36]

*Transition from copper to fibre*

Currently, DSL technologies play an important role in the provision of fixed broadband in all Member States. Initial investments in copper based networks are largely sunk, while fibre based networks require considerable new investments. Putting it bluntly, copper-based networks are cash cows and fibre-based networks are costs. In a non-competitive setting, copper-based incumbents have an incentive not to run ahead with investments in fibre (Cave, 2011). Alternative investors in fibre entering the markets with competing networks could face severe price competition from the incumbent upon entry. In addition, a potential entrant often lacks the scale and scope economies that incumbent operators enjoy. In sum, large-scale entry by third parties on the basis of fibre optic networks seems unrealistic for the same reasons that the ladder of investments policy notions does not seem to work. We therefore may have to rely on incumbents. In an alternative setting where copper already competes with alternative networks (e.g. cable), the competitive pressure can be an incentive for both competitors to invest in an upgrade to fibre to the node or premises (FttC or FttH/B) (Cave, 2011). This presumes that competition between networks is strong enough. OPTA (2006) brings forth an analysis in which it concludes “two is not enough”. All in all, one may argue that the competitive pressures for incumbents to invest should come from inter-infrastructure competition requiring a strong focus by national regulators on static efficiency while regulating access to copper based networks and a strong focus on dynamic efficiency while regulating fibre optic networks.

Some countries seek alternative options. In the United Kingdom, for example, policies have been formulated aiming at a functional separation of BT so as to force access to the ULL. Also the Commission Recommendation on Next Generation Access Networks specifically foresees a role for functional separation. Furthermore, while parts of the network (typically the local loop) may be characterised as a natural monopoly, recent policy discussion have focused (again) on public investments in network facilities – see Nucciarelli et al (2010), Fredebeul-Krein and Knoben (2010), Falch and Henten (2010), and De Bijl (2011). This mainly concerns local initiatives of public investments in FttH networks in compliance with state aid rules (e.g. in Copenhagen, Amsterdam and rural areas in France).

Above we concluded that there is an externality resulting from the circular relation between demand, services, and investments. This externality on the one hand implies that the efforts of Member States to promote the roll-out of fibre optic networks drive the development of OTT services, pushing the demand for more bandwidth in other Member States. As such, one can argue that the decentralised approach to stimulating NGN roll-out results in a chain reaction. However, this requires a certain minimum scale. If a small country ambitiously promotes NGN roll-out, it may have little effect on the development of OTT services. Governments and operators in smaller countries will have little incentives to follow a more ambitious time schedules. But even the individual large countries may not generate the scale required and they may even experience a hold-up. As such, a European approach (as envisaged in the Digital Agenda) is required to realise this minimum scale, allowing for exploitation of pan-European economies of scale at the OTT level,

35 Analysys Mason (2008) “The costs of deploying fibre-based next-generation broadband infrastructure” Final report for the Broadband Stakeholder Group.
Lewin D., B. Williamson and M. Cave (2009), “Regulating next-generation fixed access to telecommunications services”, The journal of policy, regulation and strategy for telecommunications, 11, 2009 , pp. 3-18.

36 COM(2010) 472 final.

thereby making NGNs cost effective. In chapter 6, we evaluate options for such an European approach.

*Transition from 2/3G to 4G*

The analysis in mobile is partly analogous to the analysis for fixed. 2nd generation and (to a lesser extent) 3rd generation mobile technologies (2G and 3G) are comparable to copper: the investments are sunk and have largely been recouped, so that 2G and 3G networks are now considered cash cows. In a non-competitive setting, mobile operators have few incentives to run ahead with investments in 4th generation (4G) networks. The analogy stops here. Compared to the fixed market, the mobile market is (potentially) more competitive because it has less features of a natural monopoly. The biggest hurdle for (potential) entrants to become active is having access to radio spectrum that is controlled by governments of the Member States. As such, Member States have large discretionary powers in shaping local competitive circumstances by means of setting the specifications of auction designs, setting technical specifications for use of the spectrum, determining the duration of licences, etc. The choices that governments make in this policy area affect the extent of inter-infrastructure competition in the mobile market, such that we can speak of a competitive setting (giving enough incentives to invest in 4G technologies) or of a non-competitive setting (where incentives to invest are largely absent). Because Member States have 'created' different extents of contestability in mobile markets, the roll-out of 4G may takes place at different moments in time in different Member States.

Another reason that 4G roll-out may occur at different speeds is that the expiration dates of the current licences in place (notably the 1800 Mhz and the 900 Mhz) differ between Member States. In the past, the expiration dates of licences determined the initial depreciation period applied to investments. Indeed, given technological developments and competitive pressures from challengers, operators may choose to write off some off the installed base and start with 4G roll-out, prior to licence expiration. However, they will not do that, not knowing whether they will obtain a licence in the next auction round.

The different speeds at which 4G will be rolled out may lead to spillovers in the form of a delay. Developers of handsets and peripheral equipment set their R&D agenda according to the time schedule applied in the largest countries (Germany, UK, France) because that will achieve economies of scale. Similar to the NGN case, governments and operators in smaller countries will be prevented from following more ambitious time schedules and even large countries may lack the scale required. This calls for a (coordinated) European approach (we elaborate on this in chapter 6).

### 3.1.2 Special Network Functions

**Drivers**

There are two forces at work in relation to network functions. First, there is a shift in network intelligence moving away from the physical network to the Internet (see Lewin et al., 2009). Second, new forms of network intelligence are born (see TNO, 2011b).[37]

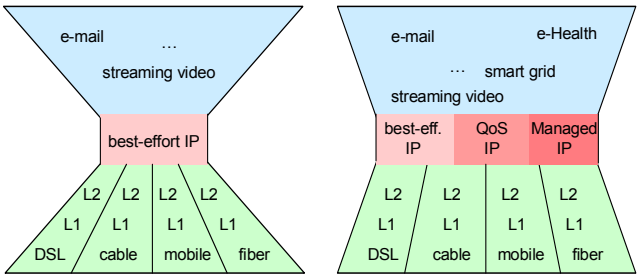
An example of the first effect is that of traditional circuit switched voice services being replaced by soft-switched technologies allowing for IP-based voice communication such as Skype and WhatsApp. Most of these communication services can rely on best effort quality levels. However,

37 TNO (2011b), "Openheid van vaste IP-netwerken Mogelijkheden en belemmeringen voor de ontwikkeling van nieuwe elektronische diensten", study commissioned by the Dutch Ministry of Economic affairs, Agriculture and Innovation.

as mentioned above, certain next generation applications will not only require higher bandwidths, but also higher quality of service levels. This leads to the second effect: the birth of new network functionalities.

A first sub-category of functionalities has to do with connection between service and network layers. Regularly, the different network layers are depicted in the form of an hourglass; see the left panel in Figure 3-4 below. The (best effort) IP layer is the connecting layer between the network and the application layers. This suggests a clean separation between the two parts, with IP being a uniform and simple interface. Over time, other connecting (managed IP) interfaces have been added (right side of Figure 3-4). These connections exist for various reasons, mostly having to do with providing specific QoS benefits and guarantees to specific applications. Currently, such network functionality is only available when a single player operates the various layers of the network. A service provider not operating the entire network (using certain access models described above) will not be able to use such functionality for those specific applications.[38] This has an impact on the openness of networks for application and service providers and, as a result, also on the access of end-users to applications and services (Marcus et al., 2011).[39]

**Figure 3-4 Hourglass shaped layers versus wide IP layer**




A. Hourglass shaped layers B. Wide IP layer

Source: TNO.

It should be mentioned, however, that content providers are developing software-based solutions to increase the quality of their service over the best-effort IP interface. These solutions relate to a second sub-category of specific functionality that is implemented at the edge of the network, either in the edge nodes of the network (e.g. in the DSLAM, CMTS or base station) or in the nodes in the customer premises (e.g. in the modem or Residential Gateway (RG) or in the end-user terminal)[40]. Although much of the functionality in this second sub-category is on the IP layer or above, service providers cannot always guarantee efficiency using IP access (see examples below). This means that a relationship exists between the different wholesale access models described earlier and the possible services that an entrant can provide. As with voice and broadcasting services, software-based solutions may be found to mimic the physical network intelligence (see the example of VNET below).

38 In theory, the network provider could implement interfaces on network elements that the service provider could use, but such interfaces are in many cases simply not defined or specified yet.

39 "Network Neutrality: Challenges and responses in the EU and the U.S., Marcus et al (2011),

40 Functionality, for instance, can be provided in a RG. Because of the specific location in the network of the RG, connecting the private network (Local Area Network or LAN) to the public network (Wide Area Network or WAN), certain functions can only be provided at this location in the network. Functionality can also be provided in an edge node. In many cases this has to do with either network efficiency or application performance. For instance, using multicast to provide a certain video broadcast stream to many users can be much more efficient then using multiple unicast streams.

**Examples of network functions that are asymmetrically available for different types of ISPs**[41]

- On the physical layer:
  - Use of specific noise protection settings
  - Use of line identification for authentication purposes
- On the WBA layer:
  - Use of specific QoS settings, for delivering different QoS for specific applications
  - Use of different vlans, for security purposes or QoS purposes
  - Use of jumbo-frames or super-jumbo-frames for enhanced throughput
- On the IP layer, specific RG functions:
  - Support for Network Address Translation (NAT) settings / virtual server settings
  - Support for firewalling for security
  - Support for LAN monitoring, including bandwidth monitoring
  - Support for roaming
- On the IP layer, specific edge node functions:
  - Support of multicast for network efficiency purposes
  - Support for mobile IP, network mobility
- On the application layer, specific RG functions:
  - Support for LAN protocols like UPnP, DLNA, etc.
  - Support for protocol conversion
- On the application layer, specific edge node functions:
  - Caching of content for high application performance or network efficiency purposes
  - Provide location data
  - Support for Fast Channel Change (FCC) solutions
  - Support for retransmission or error correction
  - Support for SVC bandwidth scaling
  - Support for application-aware handovers
  - Support for Proactive network Provider Participation (P4P) for higher P2P network efficiency
  - Support for sensor data aggregation
  - Support for localised transcoding

### Impact on the market

#### *Changing pricing models*

Due to the shift in network intelligence, network functions are also moving away from the network layer to the application layer – this applies to fixed as well as to mobile communication. It concerns services in which the network operator traditionally had a role as service provider (e.g. voice telephony, text messages and video conferencing) or as content distributor (e.g. broadcasting). These services are now becoming so-called over-the-top services (i.e. can be provided without owning any infrastructure). It leads to value-added by communications services moving away from the transport layer to the application/platform layer and has consequences for the pricing models that network operators apply. Current policy debates on net neutrality should also be seen from this perspective (Marcus et al., 2011). As ISPs (notably mobile) are currently exploring new pricing models, they may consider blocking free access to certain communication applications such as VoIP (e.g. Skype) and IP-based messaging (e.g. What's App). This conflicts with the notion of net neutrality. As net neutrality is seen as the basis for the success of the Internet, policy makers are obviously suspicious.

41 One should keep in mind that it is not any one individual function that warrants this category. It is the entire trend of adding functions in the network for either increased application performance or increased network efficiency. Certain functions (such as multicast support) may likely be more important than others, while certain applications (such as multimedia streaming) may benefit from these network functions more than others.

*Need for standardisation of TI to foster development of OTT services*

The increased demand for network quality and (thus) special network functions may have implications for content providers who wish to provide pan-European products. When priority levels and QoS levels are determined at a national level, we may end up with a patchwork of different standards across Europe. For example, providers of HD/3D TV, e-health, e-learning, or machine-to-machine services may find it increasingly difficult to develop a pan-European standardised service. In the absence of an Internal Market, it requires intense coordination among European operators to come to standardised wholesale products. Failure to do so hampers the Internal Market at the content level. This problem not only applies to the fixed market. OTT services and other services also require wireless access functionalities for which access conditions are either absent or may differ across Member States.

This effect may be limited as providers of (certain) content and services develop software based network intelligence allowing them to deliver their service on a best effort basis. An example is the technique behind the video-on-demand service by Voddler (see text below). Nevertheless, this may be a second best outcome.

**VNET**

"The cornerstone of Voddler is its unique patented software-based network solution, VoddlerNet ("Vnet"), based on 28 filed patent claims. The distribution network is built up of the end-users' storage and bandwidth while centrally controlling the publishing and access to the content, making it virtually impossible to copy or pirate. Each consumer device connected to the network works like a small edge server and is part of a huge virtual distributed hard drive or cloud on which all content is stored. Through Vnet, Voddler reduces data traffic within the network and at the same time delivers large quantities of high-bit-rate linear data with high quality of service. As the number of users increases, the capacity expands exponentially with Vnet, offering significant advantages compared to traditional content delivery networks ("CDNs"). Vnet combines the best technical, legal and commercial aspects of both CDN and peer-to-peer ("P2P")"

Source: Voddler teaser April 2011

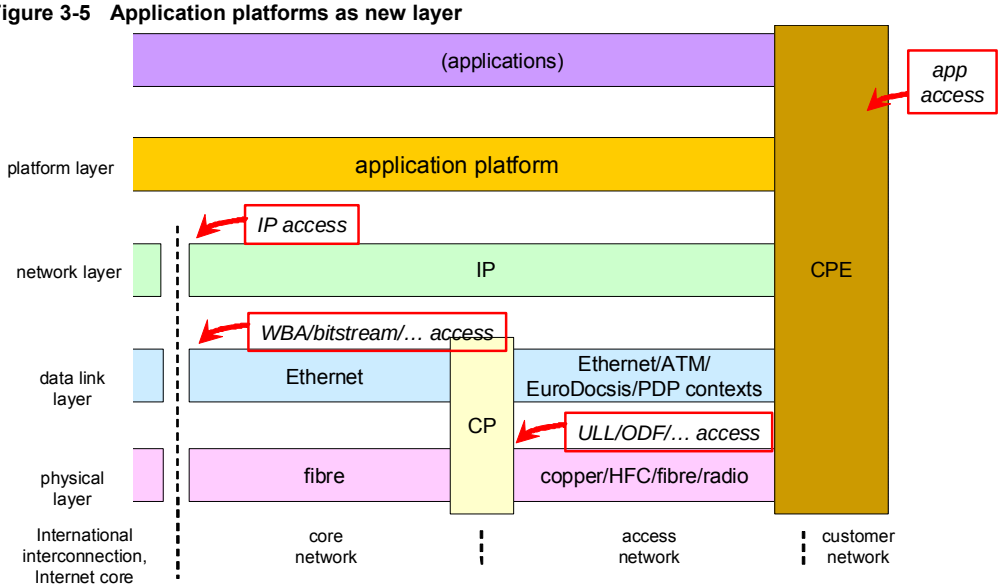
Potential coordination problems between national operators lead to transaction costs that result from forming agreements on standards. We elaborate on this in the next section.

### *3.1.3 Platforms competition*

**Drivers**

A more recent trend that we already introduced above when describing the value chain, is that of platforms, applications and app-shops. Although this is not an infrastructure development as such, there will be implications for the infrastructure market: the introduction of a new layer on top of the traditional OSI layers. This 'platform' layer can significantly change the workings of the industry. Figure 3-5 shows this new layer, sitting between IP and applications. The core of this layer is implemented on CPE and though currently most found on mobile terminals, it can also be found on game consoles (Play Station and Xbox) and (connected) TVs.

**Figure 3-5 Application platforms as new layer**




Source: TNO

Technically, the value added of apps and platforms over traditional html-based solutions is limited. However, these new platforms are not only about technology. They are also concerned with global marketing, content aggregation and integration of functional device and software.[42] As such, these platforms are increasingly becoming a natural point of entry for content providers.

### Impact on the market

#### *Changing competition*

Because new application platforms (Android, iOS, Windows mobile) are implemented on CPE, one could argue that this development threatens the current position of (local) network operators as the natural entry point for service and content providers. As such, there is indeed a change in the competitive landscape as network operators are forced to reconsider their pricing models: the traditional cash flow from voice and text communication is slowly drying up, and the value of other services (broadband connections) are increasing. It is clear that powers shift, but not to what extent and not to whom (to platforms or to consumers?). There are two reasons why it is unclear how vertical power relations are affected. First, the bargaining power of platforms towards content providers and consumers is limited. Second, many applications will still require special network functions (and thus the involvement of network operators).

The first reason arises from the nature of competition between the new platforms (based on an open structure, leading to multi-platform apps - see below) and from the fact that content providers / aggregators have the outside option of an html-based solution that is accessible via every Internet browser. This limits the mark-up that platforms can impose on apps, which increases the consumer surplus derived from these services. Subsequently, a higher consumer surplus from services delivered via a broadband connection increases the willingness to pay for that connection. All in all, the lower returns for network operators from services other than Internet access are partly undone by an increase in the revenues from Internet access services. The remainder will be shared between content providers, platform providers, and consumers.

42 Skype on fixed PCs did not significantly substitute traditional voice services. Only after VoIP Apps were introduced on (or rather integrated with) mobile phones, it became so popular that operators started to experience loss of revenues.

**Nature of platform competition**

The competition between platforms is not new. A prime historic example is the battle between VHS (from JVC) and Betamax (from Sony) during the 1980s.The competitive process typically focussed on scale and content much resembles the discussion of the chicken and the egg: the more users of a system, the more content available for its users, in turn attracting more users and so on.[43] A second example is the competition between Microsoft and Apple over the leadership in operating systems during the early 1990s. Also this battle was based on content and network externalities.[44] A third example is the competition between web browsers that is still going on.[45] Web browser can be seen as the future portal (or platform) to cloud computing, making most of the current platform functionalities obsolete. Today, with mobile broadband on the rise, history repeats itself. Mobile platforms (iOS, Android, Windows Mobile, Symbian, etc.) are competing amongst each other to gain scale. The competitive process is based on an 'open' structure as each platform wants to attract as many apps as possible. This leads to multi-platform apps. In the extreme scenario, it leads to a multi-platform app creating a new overarching platform (e.g. Sony Play Station has an app for Android phones).

The second reason why it is unclear how much powers will shift away from network operators is due to the fact that new services may require higher QoS levels, symmetric up- and download speeds, less latency, etc. In that case, service providers need to deal directly with the infrastructure owners to request specific network functionality. In other words, these new applications require a form of physical network intelligence (Managed IP) that cannot always be replaced by software-based solutions. As such, the network operators still have a 'gatekeeper' position that gives them the power to reap some of the additional value added created by the new service.

All in all, the move from 'best effort' to 'managed quality of service' means that the market is changing from a one-sided market (defined by the relation between ISP and end-user) to a two-sided market in which ISP also engage in economic relations with OTT service providers. This poses the question: is the current regulatory framework able to deal with this transition? After all, the current regulatory framework is typically designed to manage the relationship between ISP and end-user, not the relation between ISP and (global) OTT service providers. Moreover, for OTT service providers it involves a duplication of costs if they distribute via multiple operators applying different technical standards for their managed IP services. As such, there are economies of scale at the network level in attracting high-quality (managed IP based) services.

*Standardisation of managed IP interfaces?*

In Section 3.1.2 it is indicated that there is a potential barrier for pan-European content providers stemming from non-standardisation of managed IP interfaces, resulting from a lack of European-wide coordination between network operators. However, is it possible that the market will resolve this issue? The answer lies in how standardisation may affect the ISPs position vis-à-vis other ISPs and vis-à-vis OTT service providers. As with other platform competition examples, a standard will survive on the basis of scale (network externalities) and content. As such multi-country operators (with significant coverage of LLU access) may have an advantage over single country operators because global content and platform providers (particularly those integrated in CPE) will have an

43 While Betamax was betting on consumers' demand for quality of home recordings, VHS essentially won the race by facilitating video rental distribution chains in combination with VHS technology being licensed to almost every major consumer electronics company.

44 Here Microsoft applied the strategy of JVC by licensing its operating system to almost all major PC producers, while Apple has always sold its operating system tied with its own hardware as to better control the quality of the combination.

45 When at the end of the 1990s Internet became popular, Microsoft had a very strong position on the market for operating systems. Competitors accused Microsoft of abusing this dominant position and blocking certain applications from competing with Microsoft's applications. This gave rise to several court cases during the 2000s, in which Microsoft was forced to open its platform to other applications such as media players and web browsers.

incentive to confine to the technical standards of the operator with the largest scale. Below we present some illustrative (hypothetical) examples.

**Gaming networks**

The value of gaming networks is highly determined by network effects: the more users online, the more an individual will value joining that network. However, the extent of the network effect depends on the level playing field between players.[46] Bandwidth is less important here, because one can always join the game at lower video quality settings. What really matters for gaming is the stability and latency of the connection. The gaming industry may benefit from managed IP interconnectivity throughout Europe (and beyond). This may create incentives to large gaming networks to approach ISPs with LLU access in multiple countries (e.g. Tele2, Deutsche Telecom, France Telecom, Telefonica, TeliaSonera, etc.) and to agree on standardised managed IP services for online gaming. Gamers with Internet Access services from other providers could still connect to the gaming network on a best effort basis, but this would mean that they have a disadvantage compared to gamers with Internet Access from the multi-country operators.

For the gaming networks the benefits lie in that they can better safeguard the level playing field between gamers, which increases the network effects of joining the network (and thereby the value added of the network). For the multi-country operators, the additional functionality can be used as a strong marketing tool (attracting the gaming community) and create a competitive advantage over single country operators such that in the long run these Internal Market operators will confine to the set standard.

**E-learning**

Educational institutes throughout Europe are seeking to grow in scale in order to survive in the increasingly competitive business. In this search for scale, educational institutes are exploring the potential for e-learning, allowing them to attract students in other countries. TNO (2011b) describes the case of the Dutch Open University. From this it is clear that in order to exploit the full potential of e-learning, one also needs the proper conditions for long distance examination. This requires additional functionality from the Internet connections. The current problems faced by educational institutes to develop online examination result from the lack of interconnecting managed IP services (both within countries as well as between countries).

Now consider the top educational institutes of Europe and the USA offering online master courses or even PhD programmes to companies and individual students. A similar analysis applies as with the example of gaming networks above: educational institutes agree with multi-country operators on certain standards for managed IP that (depending on the success of e-learning) will convince single country operators to confine to the set standards.

**Economies of scale in the production of equipment**

Companies such as Philips and Siemens developing medical devices will experience economies of scale in production when they can standardise the communication settings of medical systems on the basis of a standardised Managed IP interface. The same goes for the production of smart machines that will communicate from machine-to-machine.

In the mobile market, scenarios in which the market itself results in standards are more likely than in the fixed market because the market is generally more competitive and there already is a coordination platform (GSMA). However, the latter may just as well prevent a market-based standard because that would weaken the position of ISPs vis-à-vis OTT service providers. In the fixed market, an essential requirement for market driven standardisation is that multi-country

46 For example, if Korean players dominate the online games because they have a much more stable Internet connection, the individual gamer in the Austrian mountains will attain less value by joining the gaming community than if all had connections of similar quality.

operators have sufficient LLU access (which is not always the case at this moment). In the absence of pan-European scale and limited competition from other ISPs, a market driven standard is unlikely. Furthermore, also fixed operators will have little incentives to come to a standard.

In particular when there is a need for interoperability and interconnection (as is the case here), government action/support may be required. For example, comparing the European experience with respect to the roll-out of mobile phone networks to the experience in the United States has learned that competitive standardisation processes are not always optimal (see text below).

**Standardisation in mobile communication technologies**[47]

Lemstra et al (2011) conclude from the diffusion of cellular technologies that standards play an important role in creating business success. Furthermore, they state that "In the USA, the first (analogue) generation that emerged under the 'Bell System' led to the application of one standard: AMPS. In Europe, different standards were deployed, with the Nordic NMT standard being adopted by a large number of countries, but having a relatively small market size. In the second – digital – generation the European actors – operators, manufacturers and regulators – coordinated their efforts and introduced one harmonised standard and operations model: GSM. In the USA, following the breakup of the 'Bell System' in 1984, the operators coordinated the selection of cellular technologies and their technical specification through the industry organisations, TIA, CTIA, and EIA. However, they retain individual freedom in the technology selection, applications, network architectures, and price schedules. This resulted in different – almost reversed – adoption curves for the two generations of cellular systems. The success of cellular development must be attributed largely to the incumbent telecom operators in close coordination with the regulatory bodies. In Europe the issue of incompatible standards being applied during the 1st Generation has been resolved through a coordinated action leading to GSM as the most successful standard within the 2nd Generation globally. This coordination process dovetailed with the objectives of creating a harmonised market in Europe and hence received broad political support."

The benefits from standardisation in mobile telephony largely resulted from economies of scale in the production of peripheral equipment and handsets, and thus lower prices. This allowed for a rapid uptake of mobile communication in Europe: by 2000 the mobile penetration rate in most EU countries was between 60 to 90%, whereas only 40% of Americans had a mobile phone connection.[48] Only in 2008 did the United States have a penetration of around 80%. By that time, the European economy showed mobile penetration rates (far) beyond 100%.

*Increased specialisation throughout the supply chain*

In the event that the EU manages to agree on uniformly applied standards for managed IP interfaces, this will spur the development of (premium) OTT services. For example, it will allow for OTT IP based competitive offers for linear television and/or VoB that are of equal quality as the services that ISPs are currently offering as a package with the broadband connection. However, assuming that the standards will be adopted by all, standardisation alone may not be enough. As explained in section 3.1.2, ISPs may seek strategies as to block OTT services that are directly competing with services that ISPs traditionally provided. This requires additional rules on transparency and non-discrimination within the IP domain. Alternatively, the market may automatically lead to a constellation where ISPs welcome the new OTT services because they are better than the vertically integrated service that the ISP provides. The increased service level makes the broadband connection of that specific ISP more attractive to end-users, thereby giving the ISP an advantage over its competitors.

47 Largely taken from: Lemstra, W., P. Anker and V. Hayes (2011) "Cognitive Radio: Enabling technology in need of coordination", Competition and Regulation in Network Industries, 12 (3): 210-235.

48 ITU data base

Depending on how the intensity of inter- and intra-infrastructure competition develops and/or how the rules on net neutrality are drafted, the future market developments may drive ISPs to divest from OTT services and specialise in operating networks only.

### *3.1.4 Fixed and wireless convergence*

#### Drivers

When we take a look into the area of Broadband Wireless Access, we see that the broadband capacity of 3rd (3G) and 4th (4G) generation networks increases very fast, e.g. through the introduction of new wireless technologies like HSPA+, WiMAX or LTE. The fast growing use of devices with mobile Internet such as laptops, notebooks, smartphones, eReaders etc. leads to an explosive growth of mobile data traffic. Progress in wireless technologies – access, devices and applications – results in wireless being seen as a complement as well as a substitute for fixed access technologies.

Two elements are important in the context of this study in relation to the use of wireless networks as a substitute or a complement for fixed infrastructure. First, wireless broadband may change the level of competition in countries. In certain countries there are already competing infrastructures, based on copper and cable networks. In these countries wireless as substitute may increase competition, as wireless is an additional competing broadband network. This effect is limited as the capacity of wireless is also limited compared to fixed. Recent trends in these countries towards quadruple play bundles seem to indicate that wireless is more a complement for fixed. This may have an opposite effect on competition, as operators will be required to have access to both fixed and mobile networks. In countries where only a copper-based infrastructure is available the impact of wireless as a substitute may be larger (but still limited by the maximum capacity that wireless can offer).

The second element that is important is that higher-speed wireless infrastructure also requires a more extensive fixed infrastructure. Each base station is still connected to the fixed network. To achieve higher bandwidth, smaller cells are used and thus more fixed infrastructure is needed. For example, with femtocell architectures, wireless is typically not a substitute for fixed but a complement because the fixed infrastructure is actually used to deliver the wireless service. Higher speed wireless networks thus increase the demand for fixed infrastructure as well.

#### Impact on the market

Fixed and mobile networks differ in some essential aspects that result in different (semi-) natural barriers to operating in multiple countries. First, mobile communication suffers less from path dependency.[49] Second, users of mobile communication networks move across borders and thus there is an intrinsic need for mobile operators to agree on international standards.[50] Finally, mobile communication networks do not have features of a natural monopoly. This last point led some of the pioneering mobile operators from the 1990s initially believing in the advantages of a 'global scale'. In due course, it became clear that other (semi-) natural barriers to global economies of scale (e.g. the need for local distribution chains, differences in regulation of e-communication, privacy, and security) were too large, even to benefit from European scale.[51]

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49 The structure of fixed mobile communication is heavily affected by the past hundred years in which telecommunication networks were typically provided by national governments, leading to national network architectures.

50 This has led to the establishment of the GSM association (GSMA) as the deliberative body to come to agreed standards.

51 This was raised frequently during interviews with market players.

In the future the benefits from European scale may become more prominent. First, given the developments in content and platforms as described above, the European scale may strengthen vertical power relations of pan-European mobile operators towards global content and platform providers. Furthermore, as Europeans become more mobile across borders the benefits from European scale may become more prominent in the absence of too stringent regulation of roaming because consumers may now start selecting subscription on the basis of roaming rates. These increased benefits from European scale, may be countered by the increased complementarities between fixed and mobile networks. As mobile operators are forced to enter into the fixed market, they are faced with the (semi-) natural barriers for pan-European fixed networks as described above. In addition, these barriers may increase in the future, depending on the transition path from copper to fibre (see Section 3.1.1). Finally, we should mention that the role of mobile virtual network operators (MVNOs) may increase as not all fixed players have access to radio spectrum. For them, the MVNO business model is essential in order to provide quadruple play packages.

### *3.1.5 New regulatory requirements and processes*

With the further evolution of applications and the demand for more quality of service creates new regulatory challenges. As already indicated above, it should be explored whether the current regulatory framework and institutions are able to deal with the development from a one-side market to a two-sided market; in particular since the upstream OTT market has a European/global dimension.

In relation to this, policy makers and regulators are challenged to take position in the net neutrality debate: in some cases higher quality of service requires giving certain applications priority in the traffic flow. How will this be arranged such that we can prevent anticompetitive practices? In the United States the ISPs are allowed to do what they want as long as they keep a neutral 'best effort' interface in place. Could this approach also apply to Europe? Or would transparency and non-discrimination obligations suffice. Subsequently, what is the role of the European Commission in this? Currently the Universal Service Directive gives rather general directions on transparency, but the technical implementation of the new transparency obligation around net neutrality (recently introduced in European directives) is left to the Member States, potentially leading to different arrangements.[52] This heterogeneity may lead to differences in the vertical (power) relations between ISPs versus OTT service providers, thereby hampering the Internal Market at the OTT level.

Another example is the requirement to monitor content via Deep Packet Inspection (DPI) as to detect illegal content distribution. The introduction of such a requirement is controversial. Here, we do not go into the fundamental pros and cons of the DPI approach, but look at the way it may be implemented and the effects for the Internal Market. The introduction of DPI in Europe could become a process that is developed on a per-Member-State basis. This subsequently leads to a divergence of process arrangements between Member States and, consequently, to an additional implementation effort for providers expanding into other Member States.

52 Article 20 of the new Universal Service Directive obliges ISPs to inform end-users of their practices with regard to traffic management and provides end-users the right to switch to another ISP if they are dissatisfied with a change in traffic management practice. However, Member States are in charge for defining the details of transparency (e.g., what information must be made transparent, in what form). See: Transparency about net neutrality ("Transparantie over netneutraliteit"), report in Dutch with English summary for the Dutch Ministry of Economic Affairs, Pieter Nooren, Mark Prins, TNO report 35383, December 2010, publicly available at http://www.rijksoverheid.nl/onderwerpen/telecomwet-en-regelgeving/documenten-en-publicaties/rapporten/2010/12/02/transparantie-over-netneutraliteit.html.

### 3.1.6 *Different Network Architectures*

Current architectures slowly evolve and new architectures emerge and replace old architectures. These new architectures bring various benefits in terms of increased network efficiency, new network functionality, increased security, increased manageability, increased robustness, increased scalability, etc. In this process, the various national operators start from different positions: their market environments differ and their current technological situation also differs. This pushes some operators to adopt a more cutting-edge technology strategy while other are smart followers or focus mainly on operational excellence and network efficiency. Due to these various migration paths and migration speeds one finds a variety of old and new network architectures throughout Europe. Another large difference is caused by the difference in physical media operated upon. Technology and architectures are different for twister pair copper, coaxial cable, fibre optics, power line communication and different radio technologies. Although there is a trend that on higher layers the different underlying physical media are converging to similar architectures, differences will remain in the foreseeable future.

The process to come to standardised IT solutions for all these different architectures and media is not uniform throughout Europe. There are different industry and standardisation groups for the different architectures for the different physical media and different companies participate in these various groups. Consequently, reference offers for wholesale access may differ between national markets. The larger these differences, the more difficult it is for content providers to market a pan-European product. Hence, the uncoordinated change in network architectures may increase the negative effects on the Internal Market at the content level as described above.

Furthermore, in the migration from copper to fibre, the ISPs can opt for different architectures for their optical network. These architectures differ in the possibilities for granting other ISPs access to the network. Consequently, there is a danger that the choice for the type of architecture may be a strategic choice rather than a choice based on efficiency.[53] Broadly speaking, an ISP can choose for point-to-point architecture of for Passive Optical Network architecture.

## 3.2 The market for e-communications up to 2020

We conclude the chapter with a (hypothetical) sketch of the market in 2020. We start with describing the 2020 market when the current Internal Market situation continues ('business as usual'). After that, we assume that we have managed to push the Internal Market in 2020 in such a way that national markets are open and a necessary level of standardisation has been reached.

The purpose of this exercise is to provide direction for policy making. It does not express a vision of the end state of the Internal Market for e-communications (for that does not exist).

### 3.2.1 *Business as usual*

If current barriers to the Internal Market remain, the differences in the openness of national markets still exist in 2020. This results in maintaining differences in prices and in levels of investment. In order to fully exploit the copper's cash cow potential, the investments in NGA networks are postponed as much as possible. This will increase the demand for public investments in NGAs in order to reach the objectives of the digital agenda (by 2020 the majority of people in densely populated areas may have broadband capacity up to 30 Mb/s). Furthermore, the lack of

53 The first allows for LLU ODF access, the latter only allows for bitstream access.

standardisation of IT at WBA level remains and the standardisation of IT fails, leading to a fragmentation of standards for Managed IP interfaces both in fixed as well as in mobile markets.

In terms of content, the pan-European content and application providers need to rely in 2020 on best effort. Depending on how net neutrality rules are formulated and implemented, the quality of best effort Internet may reduce to the benefit of managed IP interfaces. This may limit the growth of certain content services (e.g. gaming, HD/3D TV) and even block the roll-out of certain pan-European services (e.g. e-learning). In this situation, network operators maintain a broadcasting function of premium quality content and 'regular quality' will be provided on best effort. Network operators will lose the revenues from voice, but gain revenues due to an increase in the number of services using the Internet as distribution channel.

### *3.2.2 Full flexed Internal Market*

The full flexed Internal Market has two dimensions: all national markets are open and companies can reap the full benefits from EU economies of scale.

#### Open national markets

We assume that in 2020 the efforts in opening up national markets (making them contestable) have had maximum effect. The differences in the contestability of national markets have been minimised, resulting in smaller differences in prices and levels of investment.

Furthermore, one of the effects of open national markets is that the pace of investments in NGA networks increases, as additional competitors erode copper's cash cow potential. Due to this increased investment, there is less demand for public investment in NGAs (to reach the objectives of the digital agenda). This is strengthened by the fact that the measures taken to support the objectives of the Digital Agenda are reached.

#### European scale

In 2020, the demand for network quality and special network functions has increased, calling for (more rapid) introduction or improvement of services that require high bandwidth capacity of high quality. This demand has been met with reaching the necessary level of IT standardisation at WBA-level in 2020. There is also standardisation of TI such that operators offer certain standardised Managed IP services. Consequently, providers of HD/3D TV, e-Health, e-Learning, cloud computing and Machine-to-Machine services find it increasingly easy to develop a pan-European standardised service and move the knowledge intensive parts of their business to Europe. The latter also is true for multinational companies, which are now better served with standardised WBA based pan-European broadband services. In addition to these developments, net neutrality rules have been formulated and implemented such that there is a level playing field in the market for OTT services. Due to the increased competition from OTT services, network operators will focus more on their core business (broadband).

End-users can access all content everywhere: a Fin is able to watch Finish broadcasting while he is living in Italy; a German who is being monitored by his physician is able to go on holiday to France; a Spaniard can keep on playing his online game while crossing the border with Portugal; etc.

# 4 Potential impact of advancing the Internal Market

This chapter analyses the potential impact of advancing the Internal Market up to 2020. Because forecasting is always weak spot in economic analysis, in particular in fast moving industries, such an exercise is intellectually challenging and calls for a creative and transparent research approach. Analysing historic data may gain some relevant insights in relations between policy and performance on which to base a forecast. However, one should be aware that one or more technological developments could radically change these relations. Furthermore, it is very difficult to calculate welfare effects for single measures, instead we follow a more macro "what if" approach:

- *What could be the expected gains for the economy at large if telecom markets in the EU become as competitive as the best performing country in this respect?* These gains (in terms of more value for money, higher investments and increased contributions to GDP) should be interpreted as the gains to further opening up of national markets.
- *What could be the expected gains for the economy at large if the EU market for e-communications manages to reach the necessary level of standardisation with respect to WBA and Managed-IP interfaces?* These gains (in terms of increased contributions to GDP) should be interpreted as the gains to reducing barriers for the exploitation of economies of scale at the level of network operations as well as content and applications.

Our research plan is as follows. First we present a narrative on the performance of markets in terms of static and dynamic efficiency, and the alleged trade-off between these two efficiency indicators (Section 4.1.1 and Section 4.1.2). Then, in Section 4.1.3, we give a concise literature review on the impact of ICT to economic performance. Section 4.2 describes our calculation of the potential gains of a more advanced Internal Market. We first provide a brief overview of some existing literature (Section 4.2.1). Next, we present the situation where all national markets are fully open (Section 4.2.2). Finally, we describe the situation in which enough standardisation throughout Europe has taken place with respect to WBA and Managed IP access, such that application and content providers can roll-out pan-European operations requiring high QoS levels (Section 4.2.3).

## 4.1 Methodology

### *4.1.1 Performance of markets: a typology*

In this section we describe a general methodology on how to evaluate the performance of markets.

#### Efficiency states

Welfare is an economic concept that can be looked at from various angles.[54] First, it may refer to production factors being used in the most efficient way (productive efficiency). Alternative use of production factors yields lower value added and hence lower levels of welfare. Second, welfare may refer to goods, services and resources being allocated to those users that place the highest value to them (allocative efficiency). Alternative allocations then yield lower utility / value added and hence yield lower levels of welfare. Third, welfare has to take the factor of time into consideration. Welfare in the short-run can be sacrificed (e.g. in the form of higher prices) for longer-term welfare (e.g. through innovation).

54 See, for instance Bennett et al. (2001).

The economic literature distinguishes between static and dynamic efficiency. The functioning of markets can then be expressed in terms of performance with respect to static and dynamic efficiency.[55] Static efficiency captures productive and allocative efficiency and boils down to consumers getting value for money while firms earn a normal profit (or a fair rate of return on capital invested). Dynamic efficiency captures the long run gains from technological progress. CPB/CEP (2010, 98) state "When firms invest in product and process innovations that expand their technological constraints, dynamic efficiency increases. [As such] dynamic efficiency can be interpreted as the additional surplus arising from new technologies."[56]

How to assess static and dynamic efficiency? Above we defined that a "high" level of static efficiency means that the consumer gets good value for money and abnormal profits are absent. "Low" levels of static efficiency are thus characterised by bad value for money and (in case of elastic demand) by high profits. More precisely, high static efficiency means *low prices, high volumes, good quality*, and *efficient (low cost) production*. Not all of these aspects of static efficiency can easily be measured for e-communications due to data limitations. Notably, for quality (e.g. stability of network connections, access, penetration rates, speed) and costs of production there are no proper time series available that allow for cross-country comparison. But the main indicators (prices or average revenues per user and volumes) are well documented for e-communications by institutes such as ITU, OECD, GSMA, and Eurostat.

Similar to static efficiency we need to define what we mean by "low" and "high" levels of dynamic efficiency. Dynamic efficiency is characterised by *innovations of products and processes*;[57] in other words: through time, consumers are offered more choice and cheaper or better products and services. Due to the fact that quality and the costs of production (as well as product variety) are not well documented, one needs to measure dynamic efficiency indirectly with proxies that are available in public databases. Dynamic efficiency can be proxied by the level of investments in networks (documented by ITU and OECD) and the contributions of ICT capital to productivity and GDP growth (documented by EU KLEMS). The latter is also heavily influenced by other factors such as digital literacy and the overall structure of the economy and is therefore a weaker indicator for the performance of the market for e-communications as such.

In sum, one can describe the performance of e-communication networks and services in terms of 4 efficiency states:

1. high value for money and high investments;
2. low value for money and high investments;
3. high value for money and low investments;
4. low value for money and low investments.

On the basis of these 4 efficiency states Bennet et al. (2001) develop a sort of 'dashboard' to monitor or benchmark performance of markets (see Figure 4-1).

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55 Creating a truly integrated market may lead to static and dynamic efficiency but that does not mean that other societal objectives than efficiency (values of privacy, access of specific social groups to services, ...) are fulfilled. In this respect we also like to refer to a somewhat related study commissioned by DG Information Society and Media on the socio-economic impacts of broadband (SMART 2010/0033).

56 In addition we could mention adaptive efficiency. Adaptive efficiency refers to the flexibility and responsiveness of the economic system in adapting to changes in consumer demand and technological capabilities. This is thereby also connected to technology diffusion and technology adoption. We propose to use a broad definition of dynamic efficiency, including the idea of adaptive efficiency.

57 Product innovation refers to the introduction of new products and services; process innovation refers to the improvement of production technologies.

**Figure 4-1 Efficiency states**

| | | Dynamic Efficiency | |
|---|---|---|---|
| | | Low | High |
| Static Efficiency | High | Value for money + Low investments | Value for money + High investments |
| | Low | No value for money + Low investments | No value for money + High investments |

## Drivers

The next question to address is then: which factors determine whether a market achieves high or low efficiency levels? In other words, what are the important efficiency drivers? The literature identifies several mechanisms:

Driver 1: Market structure and entry
Driver 2: Anti-competitive practices
Driver 3: Regulation and competition policy
Driver 4: Uncertainty
Driver 5: Technology

Regarding driver 1, in mobile telecommunications the number of operators is determined by the number and conditionality of licenses. Both the way in which licenses are allocated, and the type of access to networks (roaming or site sharing) that is permitted, will have an impact on efficiency. For fixed networks (copper, cable or fibre) local (geographical) circumstances affect the costs of duplication of networks, which may determine the market structure. This, in general, ranges from monopoly to duopoly (in some rare cases we see three networks at a local level). The latest technological trends in the development of mobile telecommunication and in all-IP communication ensure that mobile networks can increasingly be considered substitutes for fixed connections, leading to radical changes in market definitions and thus market structures.

Firms may have an incentive to (tacitly) collude or to engage in other anti-competitive actions (driver 2). As such, tacit or explicit collusion increases prices and decreases output and static efficiency. For this reason it is vital to ensure that measures are taken to ensure that anti-competitive practices are unattractive.

Driver 3 refers to regulation and competition policy. For instance, access price regulation (facilitating *cheap* third-party access) intensifies competition and may therefore increase static efficiency. On the other hand, it may decrease network operators' incentives to invest in maintaining and upgrading their networks – in particular if access prices are based on a very low allowance for the rate of return, or do not take into account quality. Furthermore, regulatory interventions should account for continuity of service (an indicator of quality), e.g. reallocating spectrum from an incumbent to additional operators should not lead to network interruptions. Regulatory interventions may also indirectly affect efficiency, in particular when regulation (and policy in general) leads to uncertainty. Uncertainty in the direction of regulation or policies in general increases risks and hence the costs of capital, thereby reducing the level of investment.

Uncertainty (driver 4) may be derived from many areas, some within policy control such as regulation (see previous driver), and some determined externally (e.g. uncertainties in demand and

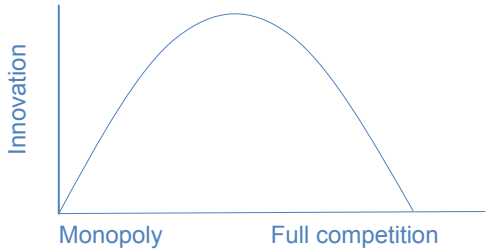
technology). In general, uncertainties reduce the incentives to invest and may therefore be detrimental to dynamic efficiency.

Technology (driver 5) can impact on efficiency, for instance, in relation with compatibility and standardisation. If there are multiple standards that are not compatible, mobile network operators may delay the adoption decision until there is more clarity about the dominant standard rather than potentially committing themselves to a standard that may become obsolete in a few years. Technological lock-ins can reduce static as well as dynamic efficiency. Dynamic efficiency is reduced because lock-in effects may make it simply unattractive to develop new technologies. This simultaneously reduces static efficiency as the threat of entry on the basis of innovation is reduced, thereby increasing the ability of incumbents to earn high profits without inducing entry.

### *4.1.2 Trade-off between static and dynamic efficiency*

It is not straightforward to simultaneously achieve static and dynamic efficiency. Arrow[58] argues that in a competitive industry (i.e. an industry characterised by high static efficiency) firms have much more to gain from innovation, in order to "escape" competition and the incentives for innovation are therefore much larger. However, following Schumpeter, Tirole (1992)[59] states that "monopoly situations are natural breeding grounds for R&D, and if one wants to induce firms to undertake R&D one must accept the creation of monopolies as a necessary evil". Aghion et al. (2005)[60] argue that the relationship between product market competition and innovation is an inverted U-shape and support this idea with empirical analysis.

**Figure 4-2 Inverted U-shaped relation between competition and innovation**




Source: Ecorys

Would this asserted trade-off between competition and innovation also apply to the market for telecommunications? It should be noted that Bennett et al. (op. cit.) point out that mobile telecommunications differs from other research dominated industries (like pharmaceuticals) in the sense that a single firm does not typically undertake both research and delivery of telecommunication services. Most of the research is done by specific research oriented companies, operating globally. This separation between R&D and service delivery renders the emergence of a trade-off less likely for the network operators. Empirical evidence for the inverted U-shaped relationship between innovation and competition does exist, as found by Friesenbichler.[61] Van Gorp, et al. (2010) also find an inverted U-shaped relationship between investments and competition. In Annex II we present new empirical evidence on this issue, suggesting that the

58 Arrow, Kenneth (1962), "Economic Welfare and the Allocation of Resources for Invention," in R. Nelson, ed., The Rate and Direction of Inventive Activity (Princeton, NJ: Princeton University Press, 1962), pp. 609–625.

59 Tirole, J. (1992), The Theory of Industrial Organization, Cambridge, Massachusetts/London, England: MIT Press, fifth printing.

60 Aghion, Philippe, Nick Bloom, Richard Blundell, Rachel Griffith and Peter Howitt. "Competition and Innovation: An Inverted-U Relationship," Quarterly Journal of Economics, 2005, 120(2), May, pp. 701-728.

61 Friesenbichler Klaus S. (2007) "Innovation and Market Concentration in Europe's Mobile Phone Industries Evidence from the Transition from 2G to 3G", WIFO working paper 306/2007.

relationship between competition and (aggregate industry) investments is positive. This does not mean that there is no inverse U-shaped relation; but if so, the European markets would still be in the upward sloping region. Furthermore, for the mobile market, Annex II shows that an inverse U-shaped relationship was found between the level of competition and investments per operator. The investments per operator are a better proxy for innovation (or adoption of innovations) then the industry aggregates.

#### Moving across efficiency states

Policymakers strive to arrive in a state where both static and dynamic efficiency are "high". A central conclusion from Bennett et al. (2001) is that "*The only market driven route towards the state with high static and dynamic efficiency is via dynamic efficiency. If e.g. investments in new technology create a market structure breakthrough, the market can lead itself to the high efficiency state (provided competition law is effective).*" Essential to this argument is that if investments or innovations create a breakthrough in market structure, future high static efficiency is conceivable. If such a breakthrough happens, innovating firms would gain and maintain market power. Although this may be to some extent harmful for current-generation customers, later generations will benefit from it. Alternatively, if policymakers opt for a path through high static efficiency and low dynamic efficiency, market players may lack the incentives to invest in innovation. While this may be beneficial for current-generation customers, later generations could be harmed.

### *4.1.3 From micro to macro*

#### Contribution of ICT to economic growth

Technological developments are incremental and come in long-term waves that are initiated by radical technological changes. Such radical technological changes are basic innovations that have a large potential for widespread innovative spin-offs, boosting economic growth. Realising these spin-offs often requires large societal changes as well; hence one often speaks of 'socio-technological paradigms'. This process has been described by many (e.g. Kondratiev (1935) and Schumpeter (1934)); well known examples of radical innovations that gave birth to such socio-technological paradigms are the inventions of the steam engine, steel, electricity, petrochemicals and the combustion engine.[62] The latest socio-technological paradigm, one we are currently experiencing, is driven by information technologies.

##### *Investments in ICT*

The benefits of better Information and Communication Technology (ICT) can spread through the economy in three ways. First, it can lead to reductions in the relative prices of products for which ICT is an input; second, advances in ICT lead to the creation of new products; and third, new modes of business organisation come into use, translating into an increase in the pace of growth in Total Factor Productivity (TFP). Most of the debate about the "new economy"[63] has centred around the continuous technological advancements in ICT, largely relying on evidence for the United States of America (US).

The rapid productivity growth in the US has been largely attributed to increased investments in ICT (OECD 2001). While some authors (e.g. Jorgenson (2001)) argue that this growth acceleration is primarily due to improved productivity growth in the ICT-producing sector, others (e.g. Bailey (2002)

62 Crafts (2004) shows that the contribution of steam power as an example of GPT (general purpose technology) to productivity growth has been considerable and probably exceeds the productivity and growth effects of public infrastructure investment (Gramlich 1994).

63 In 1983, Time magazine first defined the "New Economy" as the switch from an economy based on traditional production industries (cars, steel, rubber, etc.) to a technology based economy.

and Oliner and Sichel (2002)) believe this is due to increasingly productive use of the ICT goods and services in the rest of the economy. Other studies find that most of the improvement was due to the use of ICT equipment by other industries (capital deepening) rather than to the production of ICT equipment by the ICT industries themselves (see e.g. Oliner and Sichel (2000) and (2002), Jorgenson and Stiroh (2000a) and (2000b), Stiroh (2002), and Jorgenson, Ho and Stiroh (2004a, 2004b and 2007)).

Several studies have also been carried out to assess the relationship between ICT and productivity growth from an international comparative perspective. Van Ark and Inklaar (2005) find the EU-US productivity growth gap to have increased since 2000. The US experienced a sharp acceleration of TFP growth while the authors did not find such improvement in TFP for Europe (in particular 'market services' performed quite badly). Timmer et al. (2003) find that IT investments in the EU lagged behind IT investments in the US since 1980. In 2001 the IT capital stock per hour worked was found to be almost two times higher in the US relative to the EU. Also, the difference in the size of the IT-goods producing sector (e.g. semi-conductors) was seen as another important reason for the EU falling behind.

Timing of the productivity effects of ICT has also been assessed (see e.g. Bresnahan and Trajtenberg (1995), O'Mahony and van Ark (2003) and van Ark and Inklaar (2005)). The main finding is that many European countries were (are) in a transition process towards a next phase of productivity gains from ICT usage, which the US had (have) already realised. However, time lags may seem to be a rather unsatisfactory explanation for the lack of aggregate productivity impacts of ICT in many European countries (Haltiwanger et al., 2003). This is related to the conditions under which ICT is beneficial to firm performance, such as having sufficient scope for organisational change, experimentation or process innovation, are more firmly established in the United States than in many other OECD countries. Also, product market regulations may also play a role as they can limit firms in the ways that they can extract benefits from their use of ICT. The impact of product market regulations on ICT investment is confirmed by recent OECD work (Conway, et al., (2006) and Gust and Marquez (2002)).

*Investments in broadband*

Studies have also been carried out to measure the impact of broadband investment on economic growth. Crandall and Singer (2009) use broadband multipliers to analyse this relationship. The weighted average output multipliers used for FTTH is 3.1293, for cable broadband it is 2.8063, for DSL it is 2.8063, and for wireless broadband it is 2.8739. A wireless broadband multiplier of 2.8739 implies that every € 1 investment in wireless broadband infrastructure results in a € 2.8739 increase in GDP. The authors estimate that US economic output increased by $561.4 billion from 2003 to 2009 as a result of broadband deployment.

Czernich et al. (2009) have also tested the effect of broadband infrastructure on economic growth, using an annual panel of 25 OECD countries for the period 1996-2007. Using a technology diffusion model, the authors find a significant positive effect of broadband introduction and penetration on economic growth. The results suggest that a 10 percentage-point increase in the broadband penetration rate results in a 0.9-1.5 percentage-point increase in annual per-capita growth. For the analysis the authors use the OECD as the main data source, in particular the OECD Broadband Portal for estimates on broadband penetration. Two policy reports (Crandall, Lehr, and Litan, 2007 and Gillett, Lehr, Osorio, and Sirbu, 2006) also examine the association between broadband infrastructure and economic development. Both reports find positive associations between broadband penetration and different economic outcome variables such as employment, wages, and housing prices.

**The multiplier process: an empirical illustration**

Here, we present the results of the empirical analysis carried out to test the relationship between investments in ICT capital services in the post and telecommunication (P&T) sector and investments in total ICT capital services. ICT capital services in P&T serve as a proxy for investments in broadband. The table below presents the findings of the analysis. The first column shows the results of the regression analysis and indicates how much additional investments in ICT capital in the economy as a whole are generated by one Euro invested in broadband (ICT capital in P&T). The third column indicates the importance of ICT capital in the performance of the economy as a whole.

Table 4-1 Relationship between ICT investments in P&T and in the macro-economy[64]

| | Regression results | {Standard errors} (t-values) | | Contribution of ICT capital to GDP growth[65] |
|---|---|---|---|---|
| Australia | 1.761 | {0.096} | (18.23) | 0.85 |
| Austria | 3.318 | {0.327} | (10.13) | 0.42 |
| Belgium | 1.245 | {0.039} | (31.54) | 0.70 |
| Czech Republic | 0.344 | {0.043} | (7.94) | 0.54[1] |
| Denmark | 0.452 | {0.009} | (47.99) | 0.83 |
| Spain | 1.123 | {0.013} | (80.94) | 0.44 |
| Finland | 1.168 | {0.026} | (44.01) | 0.50 |
| France | 1.498 | {0.066} | (22.54) | 0.27 |
| Germany | 2.449 | {0.223} | (10.95) | 0.38 |
| Hungary | 1.672 | {0.051} | (32.40) | 0.31[2] |
| Ireland | 1.103 | {0.072} | (15.32) | 0.41 |
| Italy | 1.827 | {0.097} | (18.74) | 0.24 |
| Japan | 1.101 | {0.024} | (44.96) | 0.31[2] |
| The Netherlands | 2.295 | {0.102} | (22.41) | 0.52 |
| Slovenia | 0.151 | {0.010} | (14.11) | 0.38[3] |
| Sweden | 1.447 | {0.138} | (10.47) | 0.49 |
| UK | 0.734 | {0.015} | (48.85) | 0.68 |
| US | 1.731 | {0.054} | (31.60) | 0.74 |

Source: EU KLEMS and own estimates,
Notes: [1] (1996-2007); [2] (1995-2006); [3] (1996-2006)

The results of the analysis suggest a positive relationship between investments in ICT capital services in P&T (broadband) and investments in total ICT capital services for all 18 countries (15 EU countries, Australia, Japan and the US). These results are statistically significant. The third column suggests that investment in ICT capital services contributes significantly to value added growth. In some cases this impact is large – Australia: 0.85 percentage points and Denmark: 0.83 percentage points. Considering that most advanced economies experience an annual average growth rate of roughly 2 per cent, this contribution is considerable. Finally, given that ICT capital services contributes positively to value added growth and the results suggesting a positive impact of investments in ICT capital services in P&T (including broadband) on total investments in ICT capital services, we may expect investments in broadband infrastructure to have a positive impact on overall value added growth.

64 To assess the relationship between investments in ICT capital services in P&T and investments in total ICT capital services the following equation is tested: $x = \alpha + \beta * y + e$
where x = Total ICT capital services; y = ICT capital services in P&T; e = error term

65 1995-2007 (annual average growth, in %)

Several studies on the correlation between the use of mobile phones and GDP growth have been conducted. Most of these studies indicate that higher mobile phone penetration rate is correlated with higher GDP growth. Higher GDP leads to higher demand for mobile services. Yet, at the same time, a higher penetration rate of mobile phones leads to higher GDP growth. For instance, Deloite (2006-2007 and 2008) estimates the effect on GDP of higher mobile penetration rates. The regression analysis included almost 60 very poor developing countries; it showed a 0.12% increase in GDP as a result of a 1% increase in mobile penetration rate. For a sample of countries consisting of both developing and high-income countries, Deloite (2006-2007) finds a multiplier effect of 0.0069% as a result of a 1% increase in mobile penetration. Sridhar & Sridhar (2007) did a similar analysis for 63 developing countries and they found a 0.01% increase in GDP growth as a result of 1% increase in mobile penetration rate. The most cited reference is Waverman, Meschi and Fuss (2005). They investigated 92 high and low-income countries and estimated the impact of higher mobile phone penetration rates on GDP growth rates. Low-income countries benefit more (0.6%) from a 1% increase in mobile penetration than high-income countries (0.03%). This is because low-income countries experience a leapfrog effect. With their results, they are approximately in the middle of the estimations of other researchers mentioned above. Therefore we continue to work with the effect sizes of Waverman et al. (2005).

## 4.2 Gains from the Internal Market for e-communications

Quantifying the gains from the Internal Market is useful in order to illustrate the economic importance of the policy domain, as long as it is put in perspective and performed in a logically consistent and transparent manner. We have to realise that the choices researchers have to make in such analysis are always prone to criticism. Also, there is no single data source or unique economic model available for such an analysis. Instead, we adopt an eclectic approach based on a variety of data sources and empirical methods.

### *4.2.1 Earlier research: an overview*

To put our analysis in perspective, we can compare our approach and results with related studies by Analysys Mason (2010)[66] and by Copenhagen Economics (2010)[67]. Both studies adopt a somewhat comparable “what if” approach. Below we present an extensive summary of these studies, as we think this should help to interpret our results.

#### *Analysys Mason (2010)*

The gains for consumers in countries with more competition are calculated in Analysys Mason (2010). Analysys Mason estimates the additional consumer surplus that could be generated if all EU countries achieve higher levels of competition. A distinction is made between retail services and business services. For retail services three markets are considered, namely fixed voice calls, fixed broadband, and mobile voice calls. For fixed voice the analysis is based on regression results on the relationship between fixed voice call revenue per minute and the incumbent’s share of fixed call revenue (as a metric for intensity of competition). A positive relationship is found, suggesting that more intensive competition (i.e. a lower market share of the incumbent) is associated with lower price levels. Each price is then adjusted under the assumption that in each country the incumbent’s share is reduced to a point halfway between the current level (in the range of 50-95%) and 40% of

66 Analysys Mason (2010), “Europe’s digital deficit: revitalizing the market in electronic communications”, *Final report for ECTA*, 3 March 2010, Ref: 15784-84

67 Copenhagen Economics (2010), the economic impact of a European digital single market, *Commissioned by the European Policy Centre*.

the market. Note that this implies that also the countries performing best in terms of competition show further reductions in terms of the market share of the incumbent. Decreased market concentration lowers the fixed call price per minute, and thereby result in consumer surplus gains of approximately 5 billion Euros per year in the EU.

A comparable analysis is carried out for mobile voice, but now the HHI is used as an indicator for intensity of competition. Also for this market a positive relationship between price per minute and market concentration is found. Now the likely future price in a more competitive situation is calculated under the assumption that each country could reach the lowest HHI achieved in a country with the same number of mobile operators (varying from 2 to 5). The authors then find a consumer surplus gain of about 5 billion Euros per year in the EU (so in the same order of magnitude as for fixed voice).

Thirdly, the researchers consider the fixed broadband market. Here the average retail revenue per line is used, and this price metric is regressed against HHI. The regression analysis suggests a weak relationship between prices and market concentration, but the regression coefficient has the expected positive sign. In this case the more competitive situation is built upon the assumption that in each country the HHI could reach 80% of its current value. Analysys Mason then finds an annual consumer surplus gain of approximately 1 billion Euros in the EU. The researchers underline that this should be seen as a conservative estimate, as the calculation does not take into account benefits from product improvements (and speed in particular) associated with increased competition.

Finally, the researchers investigate the gains that could be made if multinational corporations (MNCs) had access to ubiquitous connectivity. A report by Independ concludes that MNCs could reduce their annual expenditure on pan-European communications services by 15% if they received services from a single supplier. They then calculate that the gain in consumer surplus is approximately 13.9 billion Euros per year.

Summing up, Analysys Mason concludes that the total potential welfare gain from increased competition (which can be interpreted as the gains from opening up national markets) in the four markets amounts to 24.9 billion Euros per year. Total EU-27 GDP at market prices (2010, data from Eurostat) amounts to 12,266.4 billion euro, so the total potential welfare gain is about 0.20% of EU GDP.

*Copenhagen Economics (2010)*

Copenhagen Economics concludes (p5), “the digital economy can potentially provide a major boost to EU productivity and growth. We estimate that at least 4 percent additional GDP (EU27) can be gained in the longer run [between 2010 and 2020] by stimulating further adoption of ICT and digital services through the creation of a DSM [Digital Single Market]”. This boils down to 0.4% of GDP per year. It is not entirely clear from the report where this 4% comes from. Copenhagen Economics bases its analysis on a model developed by MICUS (2009)[68]. However, in the Annex of the report, Copenhagen Economics elaborates on this model and concludes that the creation of a DSM leads to annual gains of 73.7 billion Euros (or 0.7% of GDP). A review reveals that the Annex contains a calculation error and that consistently applying the methodology in the Annex indeed generates an annual growth of 0.4% per year.

68 MICUS (2009): The Impact of Broadband on Growth and Productivity. Study prepared for DG Infosoc.

The calculation of the impact of the DSM is based on two steps. The first step looks at the impact of improved physical infrastructure and improved e-readiness on the take-up of online services. The combined effect of better infrastructure and increased e-skills is an increase in the use of online services of 3% per year. This generates two effects: structural change in the EU economy and improved productivity in all sectors. Regarding structural change, the improved adoption of online services is assumed to initiate job shifts from the rest of the economy towards business services. As productivity in business services is relatively high, this leads to a net increase in GDP. Copenhagen Economics calculates an increase in GDP of 5.7 billion Euros per year. Secondly, an increase in the use of online services will boost sector productivity. For example, Atrostic and Nguyen (2006) estimate that a 1% increase in the use of online services generates an increase in manufacturing productivity of 0.05%. Copenhagen Economics assumes that the effect on business services is 0.2% (but this is not based on an empirical study).

### *4.2.2 Gains from opening up national markets*

Electronic communication and infrastructures are still highly fragmented along national borders. Monti (2010) claims, “The existing regulatory framework at EU level has been instrumental in market opening but has not yet created a single regulatory space for electronic communications. Market fragmentation leads to numerous negative effects: it facilitates the creation of market power, it prevents operators from achieving economies of scale, it slows down investment in new infrastructures and services, it reduces growth potential and hinders the emergence of European champions to the detriment of Europe's global competitiveness.” These factors lead to Member States typically performing differently in terms of static and dynamic efficiency.

The first step to improve the functioning of the Internal Market is to further open up national markets. Above we stressed that Member States today differ in terms of openness of the national market. It has been a focal point of EU policy making over the past decade, but this policy has been implemented by Member States with different rates of success (De Bijl and Peitz (2007), Renda (2008), Pelkmans and Renda (2011)). The question that we ask ourselves is: *what if* all national markets are (fully) open?

European businesses and citizens experience direct gains in terms of better value for money (higher quality for lower prices). Furthermore, increased competition may lead to higher investments. In the scenario where demand for bandwidth increases we argue that an increase in DSL-based competition (eroding the profitability of the copper network) increases the incentives to invest in fibre, because such investments can escape competitive pressures in the market with copper networks. The objectives of the Digital Agenda (by 2020 the majority of people in densely populated areas will have broadband capacity up to 100 Mb/s; rural areas face speeds of 30 MB/s) will then be reached with less need for the involvement of government budgets. This is a very welcome effect given that national budgets are under pressure to consolidate. This transfer from investment sources (from national budgets to the budgets of telecom operators) does not bring additional gains in terms of GDP growth – we assume that in any case the necessary investments (270 billion euro) will be made as to reach the objectives of the Digital Agenda.

#### Quantification

In order to assess the potential gains of more progression in opening up national markets, we compare the current situation to a situation where national entry has been facilitated to the maximum extent. We define the maximum extent of openness as the current best practice observed in the EU. For practical reasons we use the observed intensity of competition (measured by market shares of new entrants and/or the Herfindahl-Hirschman-Index, HHI) as a proxy. There are certain drawbacks to this approach:

- First, we stress that observed market concentration is not a perfect indicator for the success of regulation. Facilitating entry will not always lead to actual entry. More specifically, stimulating entry through sector specific regulation (e.g. low access prices) may be less effective when legal and artificial entry barriers are present (e.g. trade restrictions). As such, the observed levels of competition may underestimate the intensity of sector specific regulation in a particular country.
- Second, low concentration levels are, by definition, not optimal. Although stimulating entry (by helping entrants through regulating access prices at a low level) temporarily increases welfare, it may be inefficient in the longer run as it reduces returns to investments. Literature on spectrum as a tool for market ordering confirms that welfare is not promoted by actual entry *per se*, but that it is the *threat of entry* that matters.[69]
- Third, the optimal level of concentration is not the same for each country. In densely populated areas the minimum efficient scale for operators is easier to realise than in rural areas. As such, the markets in densely populated areas have more room for competitors.
- Fourth, strictly taken, the analysis does not account for improvements of the best practice. Yet, there are extenuating arguments to this drawback. Given the third drawback above, the situation where all countries have similar concentration rates is not real due to heterogeneous local circumstances. By definition this means that if the future EU average equals the current best practice, the current best practice has improved in the future. But this then reduces the benchmark of the current best practice to an arbitrary choice.
- Fifth, the analysis does not account for potential pan-European economies of scale at the network level. This is particularly relevant for mobile because there is greater potential for pan-European champions (compared to fixed). In other words, we carry out a 'what if analysis' that concentrates on movements *along* the curve and not *of* the curve.[70] This drawback is partially compensated by the same extenuating arguments applying to drawback four. We examine briefly what the impact would be of pan-European mobile operators in section 4.2.4.
- Finally, the Internal Market is likely to develop gradually. Our analysis assumes the Internal Market to be realised overnight, starting in 2012.

Given these drawbacks of our approach, we should interpret the results of the analysis as an ***illustration*** of the potential welfare gains and not as proven facts, since the measure is imperfect.

*Methodology*

On the basis of regression analysis (panel analysis) we analyse the relation between the performance of markets and the openness of markets (and some exogenous parameters such as GDP, population density, etc.). We use indicators of the intensity of competition such as the market share of new entrants (MSNE) and the Herfindahl-Hirschman-Index (HHI) as a proxy for the openness (or contestability) of markets.[71] As a proxy for the performance of markets we use the average revenue per user (ARPU) and the average investments per capita (AIPC).[72] Figure 4-3 shows the results of the regression between HHI and *net* ARPU and *net* AIPC[73] for the mobile markets in the EU.

69 See Gruber and Verboven (2001) and Van Gorp et al. (2010)

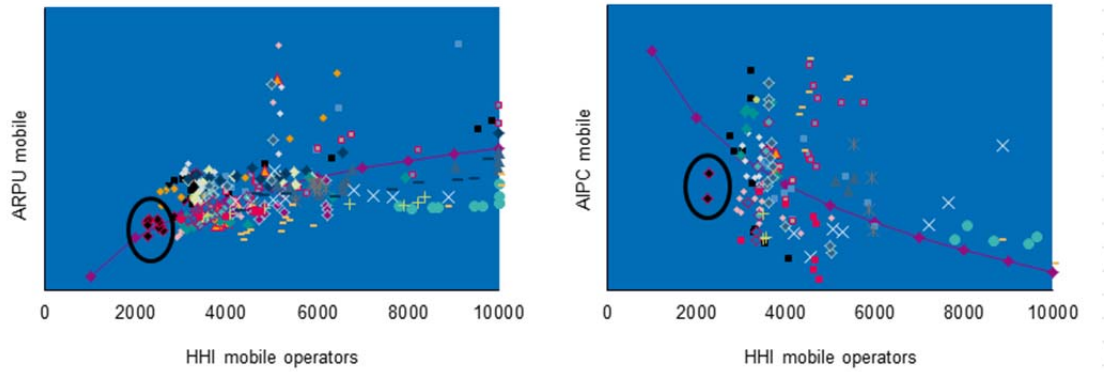
70 The 'curve' being the identified regression lines between market concentration indices and the performance indicators for static and dynamic efficiency (the red line in Figure 4-3).

71 Source MSNE: OECD; source HHI: GSMA (see Annex I

72 Sources for both ARPU and AIPC: ITU and OECD (see Annex I).

73 Net of the effects on ARPU from exogenous factors

**Figure 4-3 Net ARPU and net AIPC as a function of HHI in EU mobile markets**



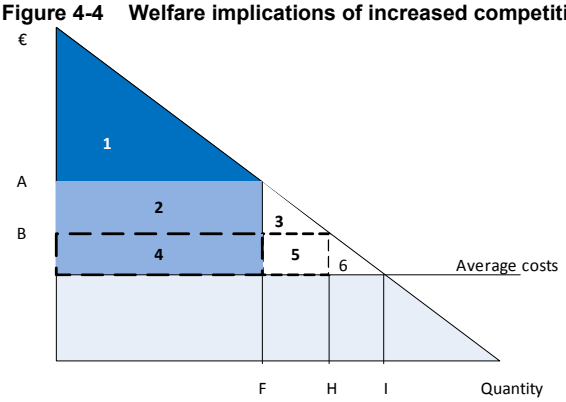

Source: Ecorys analysis on the basis of several databases (see Annex I)

We identify the best performing Member State in terms of HHI / MSNE in 2009 (indicated with a circle in Figure 4-3). We then calculate on the basis of the regression the net ARPU corresponding to this HHI / MSNE. We do the same for the net AIPC. Using the weighted average EU values for the exogenous factors in the regression we calculate the corresponding gross values for the corresponding ARPU and AIPC. This analysis thus assumes a convergence of *net* prices and investments. The observed *gross* prices and investments throughout Europe will not be fully converging because of differences in the underlying cost structures.

Next, we calculate the weighted EU averages for the HHI / MSNE in 2009 (weighted against population). We then calculate on the basis of the regression (and the weighted average of exogenous factors) the corresponding gross EU average ARPU and AIPC.

We then proceed with calculating the welfare effects of a change in ARPU in terms of consumer and producer surplus. From our data sources (see Annex I) we know how much subscriptions were sold in the EU in 2009. On the basis of elasticities found in literature ($\varepsilon = -0.5$)[74] we construct a demand curve and analyse how prices and volumes would change if the EU average HHI would equal the HHI of the best performing Member State. On the basis of these price and volume changes we can calculate the impact in terms of consumer and producer surplus and deadweight loss. Figure 4-4 illustrates this analysis.

**Figure 4-4 Welfare implications of increased competition**




Source: Ecorys

74 See Jerry Hausman (1997), "Valuation and the Effect of Regulation on New Services in Telecommunications," *Brookings Papers on Economic Activity: Microeconomics*.
See also OPTA (2010 marktbesluit MTA/FTA, Annex E)

In the current situation, average EU ARPU equals (A) and the number of subscriptions equals (F). Total welfare equals the sum of consumer surplus (1) and producer surplus or profits (2) and (4). The deadweight loss (or the forgone welfare compared to the case of perfect competition) equals (3) (5) and (6). In the case that the average EU ARPU moves to the benchmark (B), the number of subscriptions increases from F to H; profits reduce with (2) and increase with (5); consumer surplus increases with (2) and (3); the deadweight loss reduces to (6). In sum, total welfare increase with (3) and (5).

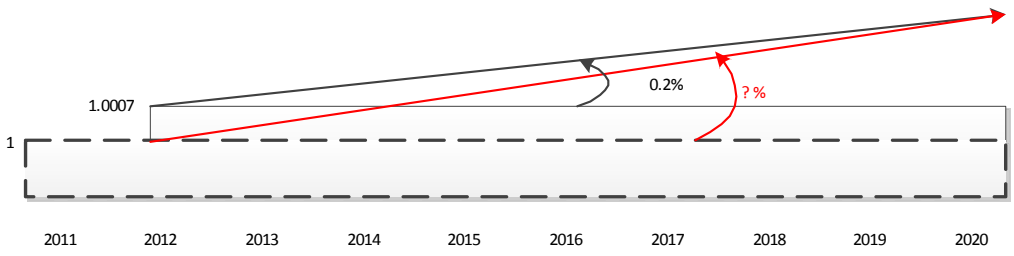
Next, in order to monetise the dynamic welfare effects, we analyse the effects on GDP growth as a consequence of an increase in penetration rates (following from the volume increase from F to H in Figure 4-4) as well as the change in AIPC. From the literature (see section 4.1.3) we have an indication on the size of the multiplier effects from an increase in mobile and fixed broadband investments (both are slightly below 3), as well as an indication on the effect on GDP growth of a 1% increase in mobile and fixed penetration rates (0.03% for mobile and 0.09% to 0.15% for fixed).

Finally, in order to express the total gains in a single value, we cannot simply add the *constant* gains in terms of consumer and producer surplus to the GDP *growth* effect. As such we have to make some intermediate steps in the calculation.

- Assuming that the Internal Market is completed overnight, the additional static efficiency gains are realised in year 2012 and remain constant for the years thereafter. Indeed we can say that this generates x billion euro per year (compared to the counterfactual of not having realised the Internal Market), but in terms of percentage of GDP the gains are decreasing because GDP grows over time.
- Assuming that the static welfare gains are fully reflected in the GDP statistics[75], the following calculation applies:

$$\overline{\Delta GDP\ growth}_{t=2012-2020} = \left(\left(\left((1+\Delta GDP\ growth) + static\ gains\right) \times (1+\Delta GDP growth)^{(2020-2012)}\right)^{1/(2020-2012)}\right) - 1$$

The figure below visualises the equation above. The counterfactual is a zero growth scenario where GDP=1. The static welfare effects are 0.07% lifting GDP to 1.0007 from 2012 onward. The additional gains in GDP growth from 2012 onward are 0.2%. The red line is the average growth path of GDP from 2012 to 2020. The slope of this line (red question mark) is the average yearly gains in GDP over the period 2012-2020 (which equals the equation above).




75 One can argue about this, because consumer surplus is not the same as consumer income. But indeed the gains in consumer surplus of the size (2) in Figure 4-4 do reflect a relief on the budget constraints of consumers that they can spend on other goods and services, thereby adding to GDP. But it also reflects a decrease in value added realized by suppliers which has a decreasing effect on GDP. Also the additional turnover (F to H) x B in Figure 4-4 adds to GDP. In addition to these effects one should account for a multiplier effect to calculate the total effect on GDP. Surely this can be done, but for the purpose of this study we do not need such kind of detailed analysis: at the aggregate it will not make much of a difference.

In a nutshell, our analysis is as follows:

- We distinguish between fixed and mobile.
- We distinguish between static and dynamic efficiency.
- We investigate the empirical relationship between market concentration (the HHI index) and market performance (ARPU for static efficiency and AIPC for dynamic efficiency).
- We inspect the performance across countries and over time.
- We evaluate the EU average performance and also identify the best performing country (in terms of market concentration).
- We carry out a "what if" analysis: What could happen in EU markets if all Member States were able to achieve the best performance in terms of prices, investments, and penetration rates?
- The impact for society at large is then calculated based on consumer surplus, producer surplus, multiplier effects for the economy at large stemming on the one hand from higher investment levels and on the other hand from higher penetration rates.

*Regression results*

Here follows a comprehensive overview of the results of the analysis. A more detailed discussion is presented in Annex II.

For both the fixed and mobile markets we find that lower rates of market concentration lead to lower prices.

$ARPU_{mobile}$ = 118.72** $\ln(HHI_{mobile})$ + 0.006184*** GDP/cap + 5.870e-05*** Number of Households

$ARPU_{fixed}$ = -2.3456** $MSNE_{fixed}$

*** p<0.01, ** p<0.05, * p<0.1

Only for the mobile market we find that lower rates of market concentration lead to higher investment level.

$AIPC_{mobile}$ = 0.003307* $HHI_{mobile}$

*** p<0.01, ** p<0.05, * p<0.1

For fixed we did not find a significant relation with investments which is notably due to data limitations. It may also be the result of the fact that competition in fixed has largely been based on intra-infrastructure competition whereas with mobile competition has been largely based on inter-infrastructure competition. In other words, an increase in the number of mobile network operators goes hand in hand with an increase in the number of networks and thus also with a significant increase in investments at the aggregate level. Therefore, we also tested for the relation between HHI and the level of investments per capita per mobile operators. Now we find an inverse U-shaped relation:

$AICP_{mobile}$ per operator = 0.01566*** $HHI_{mobile}$ -1.196e-06*** $HHI_{mobile}^2$ -3.285e-04*** GDP/cap

*** p<0.01, ** p<0.05, * p<0.1

We also find that most observations are on the upward sloping segment of the curve, implying that also at the micro level increased concentration goes hand in hand with increased investments by mobile operators.

*Welfare effects*

Plugging in the results of the regression analysis into the methodology as explained above gives us the following results:

**Table 4-2 Welfare effects, mobile (max)**

| Variables and factors | Values |
|---|---|
| Elasticity of demand | -0.5 |
| N0: Number of connections t=0 | 620 million |
| N1: Number of connections t=1 | 640 million |
| P0: Average revenue per user t=0 | 739 |
| P1: Average revenue per user t=1 | 693 |
| C0,1: Average costs t=1=0 | 100 |
| A: Change in penetration rates (%) | 3.2% |
| B: Change in investments per capita | 4 |
| C: Weighted average GDP per capita | 36,330 |
| D: GDP effect from 1 Euro invested | 2.8739 |
| E: GDP effect from 1% increase in penetration rate | 0.03% |
| **Welfare components** | **Change** |
| Change in consumer surplus (% of GDP)[76] | 0.17% |
| Change in producer surplus (% of GDP)[77] | -0.10% |
| Sum of GDP effect (% of GDP)[78] | 0.13% |
| **Sum** | **0.14%** |

**Table 4-3 Welfare effects, fixed (max)**

| Variables and factors | Values |
|---|---|
| Elasticity of demand | -0.5 |
| N0: Number of connections t=0 | 200 million |
| N1: Number of connections t=1 | 203 million |
| P0: Average revenue per user t=0 | 997 |
| P1: Average revenue per user t=1 | 964 |
| C0,1: Average costs t=1=0 | 200 |
| A: Change in penetration rates (%) | 2% |
| B: Change in investments per capita | No significant regression found |
| C: Weighted average GDP per capita | 36,330 |
| D: GDP effect from 1 Euro invested | 2.8739 |
| E: GDP effect from 1% increase in penetration rate | 0.09%-0.15% |
| **Welfare components** | **Change** |
| Change in consumer surplus (% of GDP) | 0.04% |
| Change in producer surplus (% of GDP) | -0.02% |
| Sum of GDP effect (% of GDP) | 0.18%-0.3% |
| **Sum** | **0.18%-0.3%** |

Over the period 2011-2020, opening up national markets (i.e. closing the gap) yields the European economy at large a yearly gain of 40 billion euro to 55 billion euro (or 0.32% to 0.44% of GDP).

### *Sensitivity analysis*

The results above should be interpreted with care:

76 $\Delta cs = n_o(p_0 - p_1) + 1/2(n_1 - n_0)(p_0 - p_1)$

77 $\Delta ps = n_0((c_0 - c_1) - (p_0 - p_1)) + (n_1 - n_0)(p_1 - c_1)$

78 $(A \times E) + \frac{B \times D}{C} \times 100$

- A higher level of competition may in the long-run not be optimal as it potentially erodes the incentives to invest. To what extent can we simply apply the multiplier that others found? There exists no analysis that is conclusive on this, nor is ours.
- We did not find a relation between investments and competition for the fixed networks. We did find one for mobile, but this is only logical because a country with 5 competing networks will have a lower HHI and require 5 times the investment capital to install, maintain and upgrade the networks. There is of course a danger that this involves an inefficient duplication of costs. Furthermore, in the prospective setting, the relationship between competition and investments may become much more important. This largely depends, however, on how the transition from copper to fibre is managed by policy makers: public investments, regulatory holidays, copying the services based competition model as applied to copper to fibre, functional separation, etc.
- The marginal GDP effect of an increase in penetration rates is likely to decrease at higher penetration rates; we assume a linear relation.[79]

As such, the results presented in the above tables should not be interpreted as forecasts but as a maximum gain. We conduct a sensitivity analysis to try to account for the above remarks. We apply the following modifications to the welfare parameters:

- an increase in mobile competition leads to a lowering of prices, but not to an increase in penetration rates (i.e. demand is fully inelastic; in that case the increase in consumer surplus equals the decrease in producer surplus).
- the GDP multiplier for investments is only half of what existing studies report.
- the GDP effect of higher penetration rates is only half of what existing studies report.
- increased competition in fixed leads to an increase in investments, the effect is half of that found for mobile.

Under these circumstances the welfare effects are as follows:

**Table 4-4 Welfare effects, mobile (sensitivity)**

| Variables and factors | Values |
|---|---|
| Elasticity of demand | 0 |
| N0: Number of connections t=0 | 620 million |
| N1: Number of connections t=1 | 620 million |
| P0: Average revenue per user t=0 | 739 |
| P1: Average revenue per user t=1 | 693 |
| C0,1: Average costs t=1=0 | 100 |
| A: Change in penetration rates (%) | 0% |
| B: Change in investments per capita | 4 |
| C: Weighted average GDP per capita | 36,330 |
| D: GDP effect from 1 Euro invested | 1.43695 |
| E: GDP effect from 1% increase in penetration rate | 0.015% |
| **Welfare components** | **Change** |
| Change in consumer surplus (% of GDP) | 0.17% |
| Change in producer surplus (% of GDP) | -0.17% |
| Sum of GDP effect (% of GDP) | 0.016% |
| **Sum** | **0.016%** |

79 For mobile this effect is strengthened by the fact that European penetration rates incorporate an unknown number of inactive pre-paid SIMs.

**Table 4-5 Welfare effects, fixed (sensitivity)**

| Variables and factors | Values |
|---|---|
| Elasticity of demand | -0.5 |
| N0: Number of connections t=0 | 200 million |
| N1: Number of connections t=1 | 203 million |
| P0: Average revenue per user t=0 | 997 |
| P1: Average revenue per user t=1 | 964 |
| C0,1: Average costs t=1=0 | 200 |
| A: Change in penetration rates (%) | 2% |
| B: Change in investments per capita | 2 |
| C: Weighted average GDP per capita | 36,330 |
| D: GDP effect from 1 Euro invested | 1.56465 |
| E: GDP effect from 1% increase in penetration rate | 0.045%-0.075% |
| **Welfare components** | **Change** |
| Change in consumer surplus (% of GDP) | 0.04% |
| Change in producer surplus (% of GDP) | -0.02% |
| Sum of GDP effect (% of GDP) | 0.2%-0.32% |
| **Sum** | **0.2% - 0.32%** |

The European economy at large gains 27 billion euro to 42 billion euro annually (or 0.22% to 0.34% of GDP).

*Concluding*

Further opening up national markets (thereby increasing the intensity of competition) results in a potential welfare gain *of* ***27 billion euro to 55 billion euro*** *or* ***0.22% to 0.44% of GDP***.

### 4.2.3 Gains from exploitation of EU economies of scale

The second step to improve the functioning of the Internal Market is to facilitate the exploitation of EU economies of scale. We conclude from Chapter 3 that currently the largest gains can be achieved by promoting a certain degree of standardisation of (technical) specifications of WBA and managed QoS products and offers. The question then is: what if the necessary level of standardisation at the level of WBA and Managed IP interfaces is reached?

We found that today there are not many sources for EU economies of scale from the perspective of the network operator's business case. One exception is the case of pan-European service provision to multinational corporations (MNCs). The business case of pan-European service providers (such as BT Global Services and Orange business services) is hampered by the existing heterogeneity in terms of (technical) specifications of WBA products and offers throughout Europe. A similar problem is experienced by MNCs with respect to mobile offers; the current national orientation of mobile market structures makes that MNCs experience duplications of transaction costs. Standardisation will result in a considerable relief for the actors involved, but the market segment is relatively small for this standardisation to generate significant welfare effects for society at large.[80]

80 To illustrate this point we present here a back of the envelope calculation. Globally, the size of the market for business services is between 20% and 25% of total telecom revenues (BT annual report 2010 states that the world wide global services market is worth $548; this is 22% of the total global revenues from telecommunication as reported by the ITU). However, this figure includes the domestic services to domestic businesses (SME's and large corporations). It is unclear how much of the 20-25% is attributable to MNCs. Assuming it were 5%, the total size of this market equals around 0.04% of GDP. BT annual report 2010 reports a profit margin of around 10%, thus Opex+Capex amounts to 90% (or 0.032% of GDP). If standardisation leads to a 5% decrease in costs this amounts to 0.0016% of GDP.

In the future, the problems related to service provision to MNCs may be experienced by many more business cases: e-health, e-learning, machine-to-machine communication, gaming, cloud computing, etc. These types of services typically require high bandwidth capacity of high quality, along with cross border interconnection as to allow for pan-European service provision. To address this pan-European demand for network quality, and (thus) special network functions, the necessary level of standardisation has to be reached with respect to WBA and managed IP interfaces. The gains of standardisation can be large. Content/application providers can provide premium quality services via standardised managed IP interfaces (potentially next to a best-effort based product). Consequently, providers of HD/3D TV, e-Health, e-Learning, cloud computing and Machine-to-Machine services find it increasingly easy to develop a pan-European standardised service. The welfare gains are not only strictly economic in nature (lower prices, better service levels, higher employment), but also translate into improvements in health (e-health), education (e-learning), and business services (cloud computing and Machine-to-Machine communication). These are vital themes for current policy makers in Europe, as reform is needed to manage future costs or to promote future growth. The Internal Market for broadband can be a tool to ease the pressure.

Productive efficiency throughout the value chain is boosted as each node in the value chain will be able to focus on its core business: network operators will divest themselves from broadcasting and voice services and these (and other) services will now be provided by dedicated over the top service providers. Also the producers of medical systems and other smart machines will experience greater economies of scale in production.

### Quantification

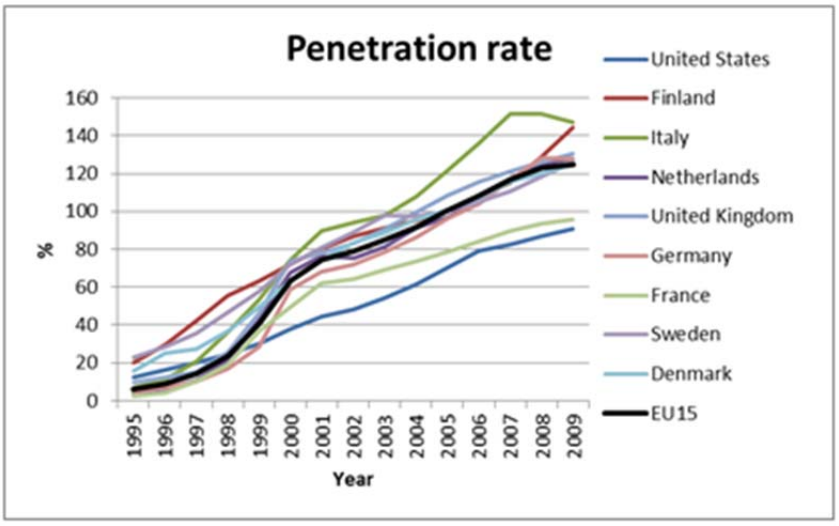
Because the aforementioned benefits accrue in the distant future and depend on a variety of unknown technological developments, any attempt to quantify these gains individually is open to critiques and result in a discussion over details. An alternative approach is to look at the core of what defines this dimension of the Internal Market (i.e. standardisation) and look at similar examples in the past that can illustrate the potential impact. We can remain within the topic of telecommunication. The example of standardisation in mobile telephony (see Section 3.1.3) is illustrative for what happens if standardisation fails. Our calculations indicate that as a consequence of the GSM standard the EU15 has gained an additional growth of around 0.46% of GDP each year between 1995 and 2003 and 0.3% between 1995 and 2009. Translating this to the EU27 this boils down to a gain of 55 billion euro each year. Of course we cannot simply mirror these results to other markets and time dimensions, but it gives us a feeling of the magnitude of the effects of standardisation in e-communications.

**Welfare gains from standardisation in mobile telephony**

We applied the results of Waverman et al. (2005) to estimate the benefits resulting from setting a GSM standard by comparing US to the EU15 average. To capture these benefits in terms of GDP we calculated the extra GDP growth that the US would have had, had they experienced similar penetration rates as the EU15 as a consequence of adopting the GSM standard.[81]

The graph below shows that most EU countries gained an advantage over the US, as did the EU15 as a whole. In our calculations we assumed that a penetration rate higher than 100% loses its value in contributing to GDP growth, as there are many inactive prepaid mobile phones that account for the higher penetration rates. So in our calculations the EU15 remains at 100% as of 2005.

81 Of course there are also other reasons why the US has experienced lower penetration rates that we do not (can not) account for in this illustrative example.




Source: ITU

The results are shown in the tables below. We find that EU15 on average enjoyed 0.3% additional GDP (compared to the US) over the period 1995-2009. Since 2003 (about the time the first IMT2000 - or UMTS – systems were rolled out) the US started a period of catching up with Europe. For the period 1995-2003 we find that EU15 enjoyed almost 0.5% additional GDP growth (compared to the US) each year.

Table: Extra GDP growth due to higher mobile penetration rate (1995-2009)

| | 1995-2009 | 1995-2003 |
|---|---|---|
| % extra growth over period | 4.62 | 4.20 |
| Annualised difference (as % of GDP) | 0.30 | 0.46 |

Source: Ecorys calculation on the basis of ITU penetration rates and Waverman et al. (2005)

### 4.2.4 *Additional consideration*

As stated the analysis above does not account for potential pan-European operators. How would the analysis change if only 3, 4 or 5 pan-European operators were active in the EU? Concerning the intensity of competition (and thus the movement along the curve) we see no changes compared to the approach where we evaluate the intensity of competition at Member State level. After all, we still use the benchmark of the current best performing Member State. However, a large difference is that the pan-European scale of operators may bring them economies of scale such that there is not only a movement along the curve, but also a movement *of* the curve. Economies of scale could be realised for example by concentrating back office operations (help desks, billing, and administration) as well as technical operations (operating sms and voice traffic) in a single location. From interviews with market players we have learned that this might save around 10% of operating expenses or around 5% of total expenses. If we plug these values in the analysis (i.e. reduce $C_0$=100 to $C_1$=95) and assume that the cost advantage is entirely passed on to end-users, total volume increase with an additional 0.27 percentage point and total welfare (as percentage of GDP) increases further with 0.025 percentage points. In addition, MNCs experience lower transaction and roaming costs if they could be offered pan-European contracts.

How does the possible convergence between fixed and wireless infrastructures affect our calculations above? In such case the relatively high entry barriers in the fixed markets will be transposed into the mobile market. In the extreme case, this leads to an increase in concentration indices for the mobile market up to the level of the current HHIs in fixed. The best performing

country in the EU for fixed has a HHI of around 5000,[82] whereas the best performing country in the EU for mobile has a HHI of around 2248. If we apply the best performing HHI for fixed in the welfare analysis for the mobile market, this would reduce static welfare by around 0.08% (as opposed to an increase of 0.07% in the base analysis above) and reduce GDP by 0.14% (as opposed to an increase of 0.13% in the analysis above). In sum, this will lead to an average decrease of GDP of 0.15% per year (Table 4-6 presents an overview of the results).

**Table 4-6 Welfare effects, mobile (fixed wireless convergence)**

| Variables and factors | Values |
|---|---|
| Elasticity of demand | -0.5 |
| N0: Number of connections t=0 | 620 million |
| N1: Number of connections t=1 | 599 million |
| P0: Average revenue per user t=0 | 739 |
| P1: Average revenue per user t=1 | 787 |
| C0,1: Average costs t=1=0 | 100 |
| A: Change in penetration rates (%) | -3.3% |
| B: Change in investments per capita | -5.5 |
| C: Weighted average GDP per capita | 36,330 |
| D: GDP effect from 1 Euro invested | 2.8739 |
| E: GDP effect from 1% increase in penetration rate | 0.03% |
| **Welfare components** | **Change** |
| Change in consumer surplus (% of GDP)[83] | -0.17% |
| Change in producer surplus (% of GDP)[84] | 0.09% |
| Sum of GDP effect (% of GDP)[85] | -0.14% |
| **Sum** | **-0.15%** |

We also elaborate on the situation where international roaming rates equal national rates in the country of presence. What would be the consequences for competition levels? If roaming rates equal national rates, an Austrian mobile operator could start selling subscriptions in the Netherlands. In this case, subscriptions to the Austrian mobile network are still less attractive for Dutch end-users because their colleagues, friends and family will always be faced with (higher) rates for international calls. This problem will likely disappear in the future when voice communication will become just another OTT service. But in such a case, the Austrian operator still needs to set up a customised marketing campaign, a customised (Dutch-speaking) helpdesk, and a customised retail channel in order to reach Dutch consumers. If the Austrian operator manages all this, his business case is more or less comparable to the business case of a mobile virtual operator (MVNO). Because the room for efficiency improvement by MVNOs is limited to marketing, helpdesk and retail (other elements of the mobile communication service are bought at wholesale level from the MNOs) the additional competitive pressure from MVNOs is limited. All in all, it seems that the case of roaming rates being equal to national tariffs in the country of presence does not have considerable consequences for the intensity of competition. MNCs experience lower transaction and roaming costs if they could be offered pan-European contracts.

82 Since we do not have robust data on the HHI in fixed we estimated this on the basis of OECD data on the market share of new entrants. The best performing country in the EU has a market share for new entrants of 49%. A rough estimate of the HHI is as follows 49^2+51^2=5002.

83 $\Delta cs = n_o(p_0 - p_1) + 1/2(n_1 - n_0)(p_0 - p_1)$

84 $\Delta ps = n_0((c_0 - c_1) - (p_0 - p_1)) + (n_1 - n_0)(p_1 - c_1)$

85 $(A \times E) + \frac{B \times D}{C} \times 100$

Alternatively, we evaluate the situation of bill and keep in international roaming and where prices for calling and being called abroad equal prices for calling and being called in the home country. In this case, it is likely that European end-users would massively subscribe to operators in the Member State with the lowest ARPU, forcing operators in other Member States to drop prices to this level. This will have a much more radical effect than our calculations above indicate because this will not lead to a convergence of *net* ARPU, but a convergence of *gross* ARPU. Or, expressed differently, local prices will no longer reflect underlying cost structures and may therefore disrupt incentives to invest.

### *4.2.5 Conclusion*

Combing the results from further opening of national markets and the insights that we gained from the GSM case allows us make an educated guess of the potential welfare gains of the Internal Market for e-communications – being somewhere in the area of ***0.5% to 1% of GDP***.

# 5 Obstacles to the Internal Market perceived by the firms

In this chapter we describe the results of a survey among technological sector experts and a series of interviews that we organised with executives of various market players: telecommunications operators (fixed/mobile/ISPs), providers of over-the-top services, consumer and industry organisations. The purpose of these consultations was to concretely identify technological aspects that could, in effect, form a barrier for the Internal Market as well as institutions, behaviour, rules and/or regulations that economic actors perceive as a barrier for the functioning of the Internal Market. Both the interviews and the survey have helped us to gain an understanding of the issues from a micro-economic perspective (i.e., at the firm level) to complement the macro-economic approach to the issue at hand (cf. Chapter 3 and 4).

These insights notably feed the discussion on policy options that follows in Chapter 6. We stress that the translation of the findings into conclusions and recommendations will have to be handled in a balanced way. First, firms' interests may not be aligned with the interests of consumers or with welfare for society at large. Also, the dynamic nature of the industry makes forecasting a challenging task, even for the main stakeholders. Furthermore, the idea of completing the Internal Market could suggest that the Internal Market is a kind of end-state. Our impression is that the further integration of markets is an ongoing process, where new obstacles arise while existing ones may become less important (cf. Canoy et al., 2007).

Below we first present a long list of barriers that resulted from the survey of technical experts (Section 5.1). Next, we present the results from the interviews with executives (Section 5.2). The survey supports the earlier findings that the lack of standards is a significant barrier for pan-European provision of network services. Today it typically concerns the arrangements for the IT and processes required for the use of wholesale services and the delivery of retail services. The interviews with executives have resulted in a much larger set of barriers. Not all of these barriers can be levelled. In Section 5.4 we work towards a short list of barriers that can be levelled in order to progress towards the Internal Market.

## 5.1 Survey among technological experts

The survey has been sent out to a large number of European operators and vendors. Through its activities in various conferences, TNO has a large network consisting of people working for these organisations at the appropriate technical level. Several hundred people were invited to fill out the survey.[86] A total of 82 people responded to the invitation to participate in the survey. Of these, 27 respondents answered the survey completely. Of the 27 respondents:

- Eight fall within the category 'Telco', meaning they are a Fixed-line operator, Incumbent / former PTT, Mobile operator and/or a Mobile Virtual Network Operator (MVNO) (multiple options may apply);
- Nine are of the category 'Vendor';

86 The survey has been sent to mailing lists and individual members from 3GPP, ETSI TISPAN, ETSI MCD, DVB, Ecma, ETNO, NGMN, ANGA, VATM, ERO SE42, BTG, ICIN conference, ETIS conference and TNO partners in several research projects like 4GBB, Rubens, HBB-NEXT.

- Ten belong to the category 'Other', meaning they are a Consultancy Firms or Integrator, Research Institute, User or User Group or Regulator.

The survey contained questions on re-use and standardisation as an indicator for entry barrier on each of the four main categories: Fixed Telecommunication Infrastructure, Mobile Telecommunication Infrastructure, Supporting IT and Processes and Regulatory Obligations. The goal of the online survey was twofold: to validate the list of technical barriers that we ourselves identified on the basis of our own expertise and to complement and refine this list. Specifically, the following hypotheses are investigated via the survey:

- Technical barriers in the area of mobile infrastructure are lower than barriers in the area of fixed infrastructure.
- Technical barriers in the area of infrastructure (TI) are lower than barriers in the area of IT.
- Technical barriers are to a large extent related to the level of standardisation.

We present the main conclusions below (a more elaborate presentation of the results follows in Annex V).

### Heterogeneity in IT and process management

There are several national specific IT and process arrangements that new entrants will need to adapt to; these are related to the offering of retail services. In many cases, they are the result of regulatory obligations. Examples are: lawful interception, data retention, number portability, and transparency about net neutrality. Typically, the arrangements and implementations for these processes have been developed nationally. As a result, their implementation requires a substantial new development effort for each additional Member State that a provider wants to enter. As these obligations are related to retail services, also a new entrant that builds a complete network without relying on wholesale access services will need to implement those procedures. According to the respondents, there is a certain level of standardisation for the interfaces and procedures involved in the regulatory obligations mentioned above (see annex V) and some reuse of efforts in new countries is possible.

### (Lack of) standards for Telecommunication Infrastructure

Within the e-communications industry, there is a long tradition of technical standardisation of equipment, network architectures and protocols. The standardisation occurs in organisations like ITU-T, ETSI, 3GPP, IETF, Broadband Forum, IEEE and more. It has led to economies of scale for equipment vendors and, more importantly in this context, to interoperability and interconnection between networks of different providers. As has been explained earlier, the technologies used to provide broadband services are, for the most part, similar throughout Europe. As a result, the technical basis for national wholesale services is similar as well. This is reflected in the Reference Offers (RO) that SMP operators need to publish for the regulated wholesale services they provide: these are based on international standards created by the organisations mentioned above. In itself, this opens up good opportunities for the definition of pan-European wholesale services. However, some complications remain, including:

- Options in international standards. In many standards, there is a choice between different technical options at various levels. These options have been introduced to allow users of the standard to tailor their implementation to the specific needs they have. As a result, the national implementations of, for example, the WBA service show a number of technical differences that complicate the development of a single, pan-European WBA service.
- Variation in preferred technologies. Certain broadband technologies, like DSL over copper and UMTS/HSPA are found in all Member States, but this is not true for all technologies. For example, the Point to Point fibre topology is popular in e.g. the Netherlands, opening up the opportunity for ODF access there, while in France and a number of other countries the Passive

Optical Network (PON) technology is preferred, which does not allow for ODF access. This obviously limits the geographical scope that a pan-European ODF access service can have.

An important observation here is that the variation in technical standards in mobile broadband is much smaller than in fixed broadband. One cause for this is that mobile providers and their customers highly value international roaming, which introduces extensive and strict requirements for technical interoperability. The respondents to our questionnaire on technical barriers for the Internal Market confirm this observation (see Annex V). According to the respondents, the degree of standardisation of technical interfaces in mobile networks is larger than that in fixed networks (see also annex V). This is consistent with another questionnaire result: when expanding the provision of broadband services from a given European country into a new country, the degree to which resources, knowledge, and other efforts from implementation in the first country can be reused in the new country is larger for mobile networks than for fixed networks.

### (Lack of) standards for Information Technology and processes

A wholesale service agreement leads to a close interaction between two providers: one providing the wholesale service and one using it for its own retail service. The seamless delivery of the retail service, built from components of (at least) two providers, requires a close integration of IT and business processes. This calls for a detailed agreement on the inter-provider IT interfaces. The Reference Offers for wholesale services typically contain more pages on the IT and business process aspects of the wholesale service than on the technical specification of the equipment and interfaces involved. This shows that the arrangements for IT and processes are a large and crucial part of the overall agreement between the two parties involved in the wholesale service.[87] These types of processes have to be implemented for (pan-European) wholesale access services in which one provider builds his network using network components from another provider. They also need to be implemented for the interconnection required for establishing communication between end-users on networks of different providers.

The level of standardisation for IT and processes for wholesale services is much lower than for the TI component of wholesale. This translates in differences between the Reference Offers from different countries and is confirmed by the questionnaire results. According to the respondents, the degree of standardisation of the inter-provider IT interfaces is substantially lower than that of the inter-provider TI interfaces in fixed and mobile networks. A related result is that the potential for reuse of IT resources is smaller than that for fixed and mobile TI.

In fixed broadband, the arrangements for IT and business processes are essentially purely national with little reference to international standards, primarily because such standards do not exist. In mobile broadband, the situation is better: the GSM Association has developed standards for the exchange of billing information that mobile operators use globally to support roaming. Especially in fixed broadband, the lack of European standardisation for IT and processes represents a major obstacle for companies that consider expanding into other Member States. In every new country they plan to expand to, they will need to implement the required IT and processes applying in that country. This prevents the reuse of processes from countries where they are already operating. Typically, they need to carefully study the reference offer and join one or more national industry fora to gain access to the information, facilities and background knowledge required to implement the IT

87 Examples of processes that have to be agreed in detail between the providers are:
1. Ordering;
2. Trouble tickets;
3. Billing;
4. Porting of retail customers between providers.

and process arrangements. At present, this leads to increased costs for pan-European broadband service provision towards multinational corporations (MNCs) that wish to contract out their broadband requirements to a single provider.

**Summarising**

- The arrangements for the IT and processes required for the use of wholesale services and for the delivery of retail services vary from Member State to Member State.
- The level of standardisation for IT is substantially lower than for the TI components.
- The lack of standardisation means that providers wishing to expand into other Member States face substantial implementation costs.

## 5.2 Interviews with industry executives: a long list of barriers

We conducted 29 interviews that have resulted in a so-called 'long list' of 77 issues covering a broad range of topics (see Annex IV). The interviews have been semi-structured such that interviewees were able to share what they perceive as barriers. Interviewees were also asked to fill out a web-based questionnaire to collect information on the barriers in a structured manner.

The interviews have not only provided a list of barriers but, even more importantly, also insights into how the barriers relate to strategy and operations of the firm. As such, the interviews have provided insights into the opportunities that the Internal Market provides and we gained important clues as to the potential effect of removing the barriers that have been identified.[88] In Annex IV we present these insights in short narratives linking the barriers to firm strategies and market outcomes, including a high level impact statement reflecting the directional effects of removal of the barrier on static and dynamic efficiency, on capital expenditure (capex) and operating expenditure (opex), and on investment.

We stress that the barriers below represent the views and opinions of the interviewees. These do not necessarily comply with the views and opinions of the authors of this report. In Chapter 6 we make our own assessment of these barriers.

**The long list**

As this study has an emphasis on the role of governments in the proper functioning of e-communications markets at the EU and Member State level, we have applied a break-down of the interview findings in: (1) barriers as a result of the 'creation of the market and its maintenance' – primarily the result of government and regulatory action; and (2) barriers resulting from the 'operation of the market' – primarily the result of demand and supply side factors, including strategic behaviour of the entrepreneurs. There may be some interaction between these barriers as the barriers from (2) are (in some cases) resulting from insufficient policy/regulatory measures (1). We will make this link explicit when relevant in the analysis below.

Within the category of policy related barriers (1) we distinguish between barriers that cause differences in the extent to which national markets are contestable, or differ in the 'openness of markets', and between barriers that obstruct the 'exploitation of EU economies of scale'. Within the first subset ('openness of markets') we distinguish between barriers stemming from heterogeneity of regulation of e-communication services, barriers stemming from uncertainty regarding regulation and barriers related to government discretion. The second subset (EU economies of scale) covers

88 Interviewees have also been requested to identify the impact of removal, e.g. the savings that can be achieved and the effects on firm strategy. However, the responses provide a very fragmented and incomplete picture.

barriers stemming from heterogeneity of regulation in e-communications and in other/parallel policy domains (in which national governments typically have discretionary powers), as well as deficiencies in the regulatory e-communications framework.

Within the category of barriers stemming from the operation of the market (2) we also distinguish between barriers for 'openness of national markets' and barriers that prevent exploiting 'EU economies of scale'. Within the first subset we further distinguish (broadly) along the lines of the Structure-Conduct-Performance paradigm[89] classifying barriers into those stemming from 'market maturity'[90], from 'economies of scale' and access to 'essential up/downstream nodes in the value chain'[91], from 'strategic behaviour' by actors[92], and from 'performance of the market'[93]. Within the second subset we distinguish between barriers stemming from 'market arrangements', from the 'lack of standards', and from the 'lack of market synergies'.

The resulting classification is outlined in Figure 5-1.

89 For an elaborate presentation of the SCP paradigm see Scherer and Ross (1990) or Ecorys (2007, appendix 1).

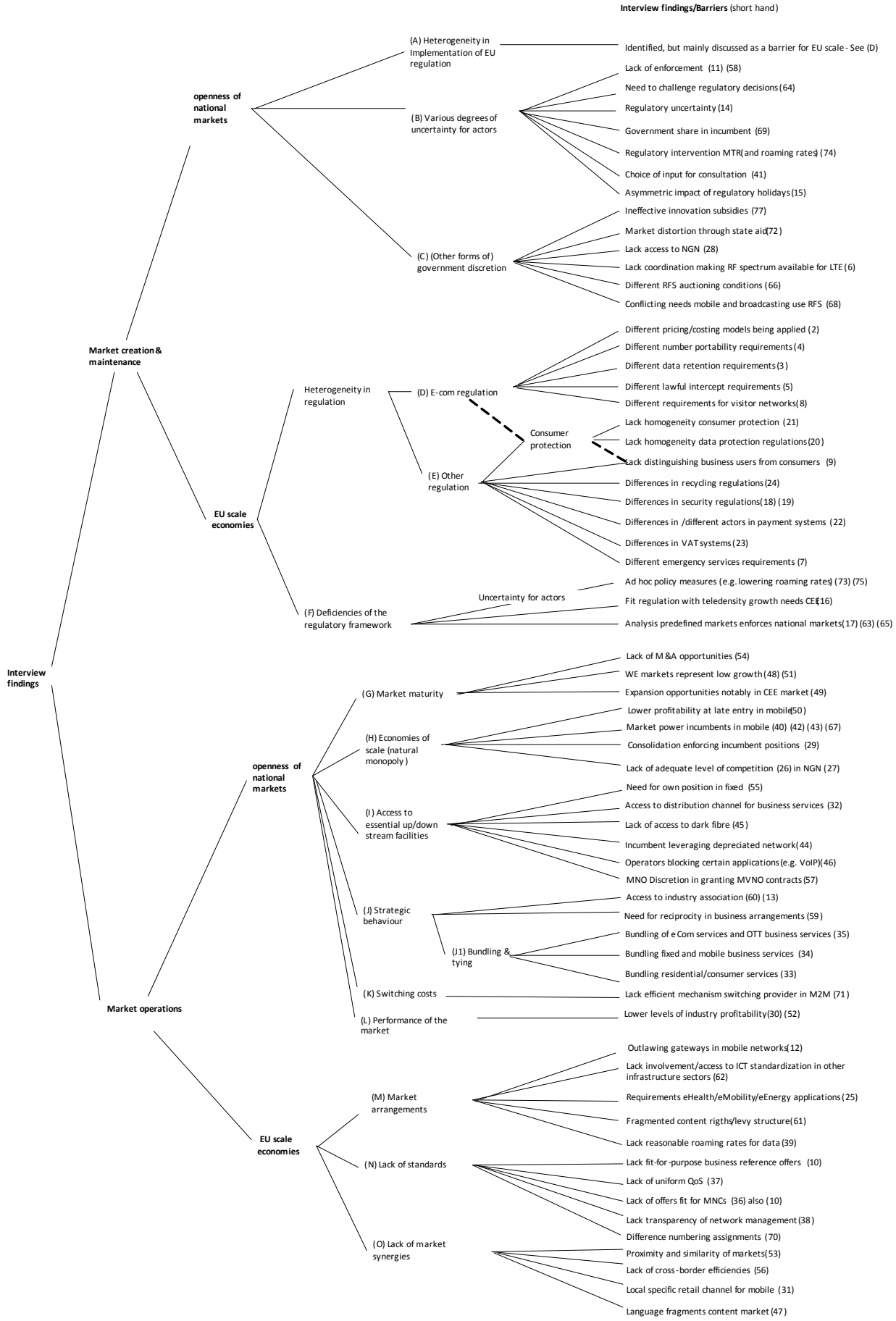
90 We consider this loosely related to the notion of 'basic conditions' within the SCP paradigm.

91 **S**tructural features of the market.

92 **C**onduct.

93 **P**erformance of the market can be experienced as a barrier: when profits are zero, the business case for entry is difficult (and must be highly innovative).

**Figure 5-1 Long list of barriers**




Note: the (numbers) behind each barrier refer to the numbers of the barriers in Annex IV

## 5.3 Towards a short list of barriers

Based on the information obtained through the interviews, this section works towards a 'short list' of barriers based on a categorisation and assessment of the 'long list'. This 'short list' contains those barriers that can be levelled or reduced by policy actions at the EU level (accounting for subsidiarity) and realise a potential welfare gain for the European citizens. As such, a first step towards the short list is to identify those barriers that cannot be levelled a priori because they are more or less natural barriers or because they are caused by related policy in which Member States typically have discretionary powers.

### *5.3.1 Identifying barriers that cannot be tackled a priori*

We exclude from the short list those barriers that we cannot level because they are more or less natural barriers or because they are caused by related policy in which Member States typically have discretionary powers. As a result, these barriers fall outside the scope of policy influence.

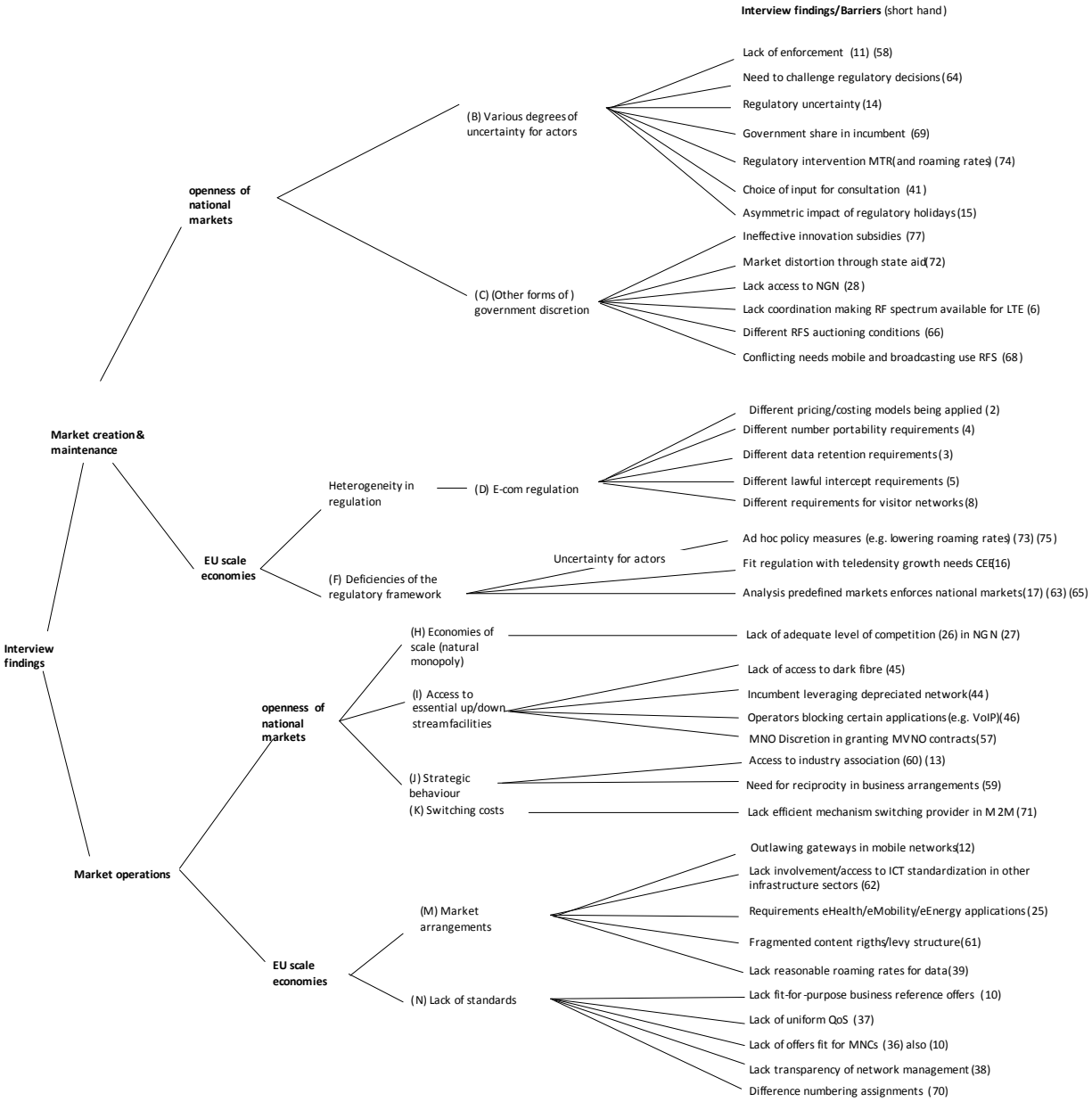
(Semi-) natural barriers may stem from e.g. different cost structures, historical developments, different spatial policy regimes, soil structures, population density, or from different extents of market saturation. From Figure 5-1 we consider the following groups to be a barrier that we cannot level a priori: (O) 'lack of market synergies'; (G) 'market maturity'; (H) 'economies of scale' – with the exception of the 'lack of adequate levels of competition (26 and 27) as this is typically something that regulation should foster; (J1) 'bundling' (as long as it is not anti-competitive); and (L) 'performance of the market'. These groups can be considered (semi-) natural barriers stemming from local cost structures and/or a healthy working local market. Also the barriers 'Need for own position in fixed' (55) and 'Access to distribution channel for business services' (32) are market developments/characteristics that we should not consider as an artificial barrier for market entry.

Barriers caused by parallel policy fields in which Member States (normally) have discretionary powers are typically captured under group (E) in Figure 5-1 'other regulation'. Also we suggest categorising the barriers related to access to industry associations (13 and 60)[94] as parallel policy, namely competition policy under article 101 and 102 of the Treaty.

Taking the above groups out of the long list gives us the following 'medium list'.

94 In order to obtain access to functionality/tools essential for interoperability of operations systems, it is required to be a member of the GSMA. This membership requires a MNO status.

**Figure 5-2 Medium list of barriers (excluding barriers that cannot be levelled a priori)**




### 5.3.2 *Assessing remaining barriers: methodology*

Next we assess the remaining barriers more in depth on whether they can be levelled, subject to the subsidiarity principle. The *subsidiarity principle* (embedded in the Treaty) requires taking action at the most decentralised level that does justice to the nature of the problem.[95] In line with Oates' *decentralisation theorem* (1972), assessing subsidiarity involves weighing the costs and benefits of centralisation. The literature on fiscal federalism classifies these costs and benefits respectively as: heterogeneity and proximity to beneficiary versus externalities and economies of scale (see Ecorys et al. 2008). For example, regulatory heterogeneity is often mentioned as an obstacle for the Internal Market arguing in favour of a stronger role for the EU as to harmonise national regulation. While we recognise that some types of regulatory heterogeneity can indeed limit the exploitation of

95 The principle of subsidiarity as such is neutral regarding the optimal degree of centralisation. However, in conjunction with proportionality, the principle implicitly assumes that lower-level governments are in a better position to efficiently (in accordance with local preferences) provide public goods. After all, the proportionality principle argues that no more than what is necessary to achieve the goals of the actions should be done at the central level. Where it is possible and efficient, states should play the primary role in policy implementation (see Ecorys et al. 2008).

EU economies of scale and/or the freedom of establishment, we also recognise that a more homogeneous regulatory approach is not always welfare enhancing because it cannot account for specific local circumstances. Furthermore, additional criteria can be used for assessing subsidiarity (see Ecorys et al. 2008). For example, in some cases the risk to policy failure may be high (with inefficient outcomes), e.g. due to a lack of information. In such cases it may be better to allow for decentralised 'experimentation' along with a certain extent of systems competition, such that in due course a best practice may become a model for all. This means that initially a decentralised approach is warranted, which may (via competition between policy systems) lead to a uniform adoption of the best practice. Alternatively, the decentralised 'experimentation approach' is followed by either a bottom-up process of exchange of best practices or a top-down imposed directive based on the best practice. In fact, it may sound a bit paradoxical, but in order to reap the fruits of the Internal Market, differentiation between Member States may be needed. All in all, in this second step we analyse the extent to which levelling barriers entails avoidable costs and generates welfare gains.

We first look at barriers related to the openness of national markets (Section 5.3.3). Then we look at barriers preventing the exploitation of EU economies of scale (Section 5.3.4).

### *5.3.3 Barriers related to the opening of national markets*

Figure 5-3 presents the barriers related to the opening of national markets. Most of these barriers already exist (in different form and scope) since the liberalisation of the telecommunication market and largely relate to the heterogeneity of country specific characteristics of markets and to government discretion in designing regulation that reflect this heterogeneity. Reducing these barriers involves striking a delicate balance between the costs and benefits of a homogenous approach versus differentiation between Member States.

**Figure 5-3 Barriers related to the opening of national markets**


#### Regulatory uncertainty and uncertainty regarding governmental intervention

The level of discretion enjoyed by national governments has resulted in a differentiated pattern of regulatory approaches across Europe. It also leads to differentiation with respect to the intensity of government intervention and participation. This may lead to uncertainty, resulting from (i) the fact

that (under certain circumstances) decentralised decision making makes policy more subject to lobbying forces, (ii) a greater risk of regulatory capture[96], and (iii) governments working with (relatively) short term policy agendas (typically coinciding with the terms of presidency). In some countries these risks are larger than in others, depending on the market structure (and the strength of the lobbying apparatus), technical and institutional capacity of NRAs, direct financial involvement of governments via shares, and the intensity to which voters hold politicians accountable for the choices made in the respective policy area (see Ecorys et al. 2008).

Such kinds of uncertainty not only makes markets less attractive for entry, it also reduces the incentives to invest. Important investments in new technologies have a 'horizon' of at least ten years and the incentive to invest in (often unclear) business cases is severely hampered by regulatory uncertainty. The industry has a clear need for a 'stable and trustworthy' investment climate and a fair period to earn back investments. Stakeholders indicate that, due to political intervention, the rules-of-the-game sometimes change and, as a result, the viability of a business case disappears. Further, some stakeholders stated that it is to some extent not really important what the regulatory framework determines, as long as this framework remains a 'constant factor' (no fundamental changes) for their investment decisions. This need is also identified in academic literature (see, e.g., Newberry 1999, p. 28-29).

*Avoidable barriers*

The problem strongly relates to the institutional setting determining the extent to which lobbying forces can affect regulatory and policy choices. These forces are a given fact, but they can be constrained – potentially – by more stringent directives. We consider the following barriers to be avoidable:

1. **Gaps in the EU regulatory package;** one of the main purposes of the EU regulatory package is to create a long-term policy framework as to increase certainty for market players. However, according to the interviewees, some essential matters are not dealt with in the framework, leading to different (sometimes politically driven) approaches by Member States. A specific example mentioned by interviewees is the intervention to lower mobile terminating rates (MTRs) and international roaming rates (74) reducing the incentives for entry as an MNO. This answer by interviewees is striking because for the past years the EC has communicated and formulated a clear policy on these matters. In chapter 6 we examine whether we can validate the view of interviewees. Another example is the lack of clear (up to date) rules with respect to net neutrality (46). We also noticed in section 3.1.3 that are open issues with respect to net neutrality that need to be addressed while progressing the Internal Market. A clear vision for the future regulation of the industry (in the EU regulatory package) may reduce the 'gap'.

2. **Uncertainty due to the existence of a government share** (69); on a national level, the role of the government in the market is sometimes unclear, also due to the government retaining a share in the incumbent operator. According to interviewees, partial ownership by the government may result in certain advantages for the incumbent operator or may provide incentives for opportunistic political-driven intervention.

3. **A lack of sufficient enforcement of regulations by NRAs**; the lack of sufficient enforcement of regulations by NRAs (11) is seen as an important obstacle for the opening of national markets. Challengers complain that in some Member States, incumbent operators are (still) allowed to behave strategically with respect to 'non price discrimination' (e.g. access to

96 Regulatory capture may arise when the position of the regulator is relatively weak compared to the regulated industry and/or a specific company (like the incumbent).

essential facilities (45, 46, 57, 58 and 60) and the ability to leverage the full depreciation of the network (44). Furthermore, challengers feel disadvantaged in the way interests of market actors are consulted and the long and cumbersome process of bringing violations by incumbents to the attention of NRAs (41).

### Other forms of governmental discretion

Other forms of governmental discretion and freedom, which lead to a variety of barriers are, for example, found in areas regarding taxation, policies to promote innovation and investments (including the role out of Next Generation Networks), and spectrum management.

*Unavoidable barriers*

Again, the level of discretion the EC regulatory package offers is very important to consider and should delicately balance a homogenous approach versus differentiation between Member States. For example, the (potentially) market distorting state aid grants (e.g., in fibre/NGN) are an issue of national discretion, as long as it does not interfere with general EC rules on state aid.

*Avoidable barriers*

From a European perspective the following barriers may be avoidable:

4. **A lack of coordination with respect to spectrum allocation may lead to different speeds of adopting 4G technologies**. Spectrum management has traditionally been a policy domain of Member States; inter alia, because of the vital role spectrum plays in national security (army, police, ambulances, etc.). As commercial applications of mobile communications evolved, the increased importance of network effects (interoperability) and economies of scale (lower costs of handsets and peripheral equipment) have resulted in more and more supra-national coordination of spectrum managements at the level of ITU, EU and sector institutions such as the GSMA. In the future, the arguments for centralisation (economies of scale and spill over) will only become more important. Also stakeholders stress that there is a need for coordination in radio spectrum allocations (6, 66 and 68) in order to accommodate growth of LTE in a timely manner. The costs of different speeds (resulting from different allocation policy frameworks) are not only incurred by the operators and users in less mature markets (in terms of missed profits and consumer surplus), but are also felt EU wide as there is a delay in realising the minimum efficient scale in the production of handsets and peripheral equipment (see section 3.1.1).

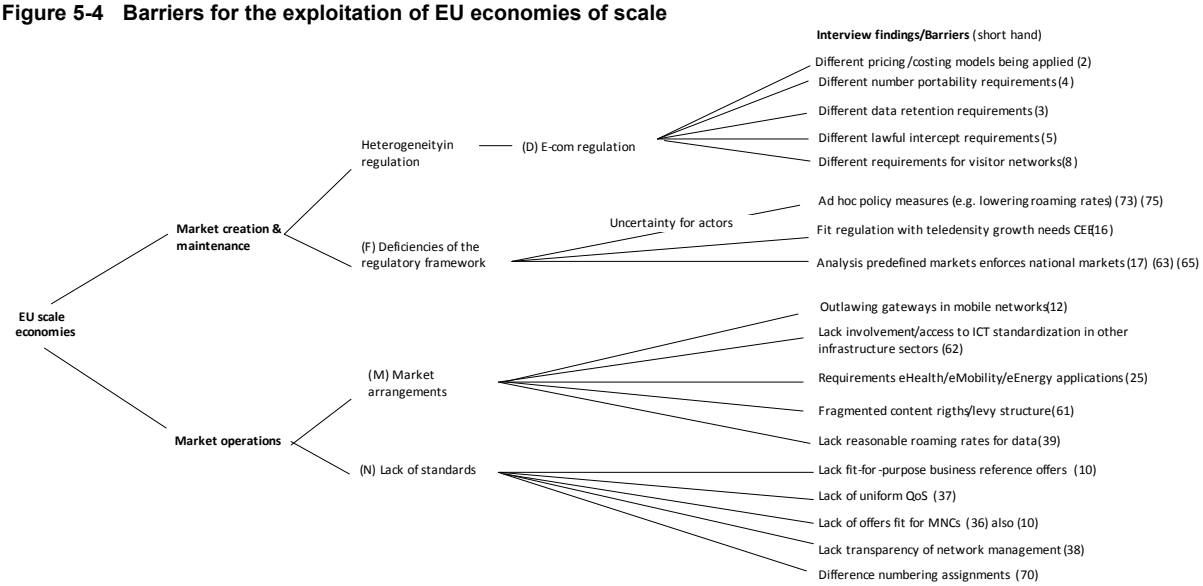
5. **Lack coordination in regulation of NGN transition**; the freedom of Member States in the transition to next generation networks raises important concerns. Recognising the (limited) degree of success achieved in opening-up the copper infrastructure of the incumbent, creating a level playing field through regulation, and considering the efforts this required, challengers are questioning whether the promise of market opening in a fibre world can be realised. Interviewees notably mention the granting of a regulatory holiday (15) as threatening the sustainability of the challengers' business case. Challengers fear that after expiration of the regulatory holiday, their business case has been set back such that access regulation will not be effective in a timely manner. We notice that recent German case law makes regulatory holidays less likely in the EU because the market is in principle subject to a Market analysis and an analysis of significant market power. Still, challengers fear the lack of access to NGNs (28), as this may result from the type of network architecture used. Challengers fear that the type of network architecture may be determined strategically such that access can only be realised on the basis of bitstream access (i.e. PoN). This may block fibre access in case NRAs conclude that fibre and copper access belong to the same relevant market and that the market for WBA is competitive. Alternatively, NRAs apply the 'cable model' to PoNs (the cable architecture also does not allow for physical LLU access). Cable has traditionally enjoyed a status as 'challenger

of copper' and has as such not been regulated. In recent years, several NRAs have been adopting different views on this and have tried to open up the cable infrastructures. So far, only Belgium has succeeded. Challengers stress that bitstream access is essential in order to preserve adequate levels of competition in NGA networks, including fit-for-purpose IP-TV multicasting capability (27).

### 5.3.4 *Barriers related to the exploitation of EU economies of scale*

We now turn to barriers for the expansion of services into other Member States in order to exploit the potential EU economies of scale. Figure 5-4 provides an overview.

**Figure 5-4 Barriers for the exploitation of EU economies of scale**




#### Heterogeneity in the implementation of regulation

Lack of homogeneity has multiple dimensions and relates for example to different implementation of data retention requirements (3) (including differences in response time) and the different implementation of lawful intercept requirements (5). These differences lead to replication costs (up to 27 times) for pan-European operators. Harmonisation could lead to some economies of scale, but these differences are more or less inherent to the level of discretion enjoyed by the individual Member States regarding security and privacy. The same applies for a large part to consumer protection (see above). There are also replication costs as a consequence of differences across Member States with respect to numbering assignment (70) and portability requirements (4). Harmonising these barriers does not generate great losses in national autonomy, but it could involve substantial transition costs because in the past these processes have been institutionalised at the level of Member States.

Whether there is room for further harmonisation with respect to the above issues typically depends on whether policy measures available can account for government discretion and / or path dependency. We elaborate on this in Chapter 6.

#### Deficiencies in the Regulatory Framework

There is a group of barriers that we classified as a deficiency of the regulatory framework and that can only be removed at the EU level.

*Avoidable barriers*

6. **National orientation in pre-defined markets** (17, 63, 65); sector regulation is too focussed on national markets. This finding was also supported by Pelkmans and Renda.[97] This barrier is inherent to the request to NRAs to analyse a predefined set of markets, which enforces the markets to be perceived as 'national' and not as (potentially) EU regional.[98] As a result, the existing market for pan-European products and services is unregulated and faces a lot of the same 'problems' which are regulated on a national level (access to essential network facilities, strategic behaviour). For instance, there is a lack of reasonable roaming rates for data (39). Of course, the general EU competition law framework is applicable here, but a more pan-European focus in the (ex-ante) regulation (at least for a certain type of pan-European business services) is seen as an important step for the future of the EU-market. For example, an often heard problem mentioned by interviewees was that the current regulatory approach typically focuses on national market segments for consumers and much less on market segmentation and (WBA) reference offers for businesses users (high and guaranteed end-to-end Quality of Service, fast Time to Repair), let alone for pan-European business users. This has resulted in a lack of standardised wholesale offers fit for, for instance, multinational corporations (10, 36 and 37), which not only applies to fixed but also to mobile offers. A related problem (following from the national orientation of regulation) is that when an international pan-European tender has a big footprint in a specific country (e.g. Germany, France) the incumbent supplier can, in the absence of standardised WBA offers, easily fence off other pan-European service providers who depend on bitstream access. From Chapter 3 we know that the incumbent (with physical access) can offer much more functionality.

7. **Uncertainty due to ad hoc policy making** (73 and 75). Interviewees indicate that the EC regulatory framework has not been able to cover (and/or has not been clear enough about) all (potential) competition problems. In the eyes of market players this has led to ad hoc policy measures. For example, they argue that the regulatory package has been too vague on how to regulate mobile terminating rates and international roaming is not addressed in the regulatory package, causing various (ad hoc) approaches in different Member States. Now that arbitrage is (in the eyes of the Commission) not evolving fast enough, ad hoc regulatory measures are imposed outside the scope of the regulatory package. As stated earlier, we find the barriers mentioned due to ad hoc policy making in relation to MTR and roaming strange and will evaluate the validity of the arguments in chapter 6.

### Lack of standards

Although we discussed the lack of standards as a consequence of the national focus of the regulatory package, we wish to explicate the lack of standards being a barrier for the Internal Market. Standardisation of a number of service offerings across Europe (10, 36 and 37) improves the working of the market. We learn from the online survey (see Section 5.1) that the lack of standardisation at IT and processes level is currently a major barrier for pan-European service provision that is typically consumed by multinational corporations. Related to this is the need for transparent network management (including traffic blocking) by network operators (38), especially for business users that run critical applications over the network.

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97 See Pelkmans and Renda ('Single eComms Market? No such thing',2011, p. 5-6): "NRAs tended to turn inward whilst paying scant attention to soft cooperative processes at EU level. The exchange of good practices and guidance in the European Regulators Group (…) appeared far too soft. (…) The straightforward notion that a single market requires a single and authoritative regulator has been rejected in reports and studies commissioned by the European Commission between 1995 and 2006".

98 Pelkmans and Renda, 'Single eComms Market? No such thing', 2011, p. 10.

With respect to TI (telecommunication infrastructures) there seems to be sufficient standardisation for current broadband use, which is largely based on best effort (see Section 5.1). In the future there is likely to be greater demand for more standardisations as to prevent barriers in the future pan-European application area such as in e-Health, e-Energy, e-Mobility, etc. (see Chapter 2.). This applies to both fixed as well as mobile broadband.

### Need for investments

Above we discussed the lack of EU coordination in the transition towards NGNs from the regulatory perspective. The interviews did not report the lack of investments in NGN networks (both fibre networks as well as 4G mobile networks) or the different speeds at which this occurs as being a barrier to the Internal Market. However, in section 3.1.1 we identified it as a potential barrier for (or a brake on the development of) the Internal Market at OTT level. The barrier results from a combination of externalities and economies of scale: the externality is that investments in NGNs by country A will (given a minimum scale) spur the supply of next generation OTT services in country B and thereby also demand for investments; however, investments in NGN by a single Member State will not be enough to stimulate the development of next generation OTT services. This combination of market failures gives Member States an incentive to postpone investments in fibre and 4G until other Member States have taken the initiative. Needless to say this asks for an exogenous 'kick start' to set the investment cycle in motion (e.g. initiated by the European Commission).

### Geographically fragmented arrangements for intellectual property rights

Although our study specifically does not focus on barriers unrelated to the network level in the provision of e-communication services, we cannot ignore the problems identified by interviewees that relate to the fragmentation of arrangements for intellectual property rights.

*Avoidable barrier*

Content plays a very important role in providing electronic communication services to consumers at the moment, like, for example, the mobile platforms with music, movies, and Apps (the iTunes, the Apple App store, Nokia Ovi Suite, etc.) as well as services like Video on Demand. Despite some harmonisation on intellectual property rights (IPR, like copy- and related rights) on EU level,[99] the market situation pertaining to these rights is geographically still very fragmented, which results in repeated costs when one wants to exploit EU economies of scale.

8. **Fragmented arrangements for content rights** (61); issues focus especially on the fragmented arrangements for distribution rights, multiplicity of rights collecting agencies and differences in levy systems. When a company wants to offer a pan-European content service they often have to negotiate multiple times about the distribution rights with the content-provider (e.g. music labels, film studios) for various countries (of course transaction costs will reduce per negotiation). Furthermore, every Member State has its own system and agency for collecting the payments for using the rights (e.g. levies on empty CD's, levies on copy machines, levies on podcasts, levies on using radio signals in public areas, etc.).

   The benefits from harmonising IPR frameworks in the EU are limited. The European content market is fragmented along natural barriers relating to language and cultural differences (e.g. preferences for movies with subtitles or dubbing; preference for national or English music, etc.). This is also a major driver for content aggregators (e.g. RTL and EuroVoD) to have a national focus when composing content packages and marketing their services. The differences across

99 See for example: http://ec.europa.eu/internal_market/copyright/index_en.htm.

countries in price and conditions for IPR licences is a form of price differentiation reflecting this heterogeneity of preferences and is as such not welfare degrading (on the contrary). There are also examples of content services (VoD services) that do follow a pan-European strategy. These services mainly offer blockbuster movies (e.g. Voddler) or music (e.g. Spotify) typically serving a more homogeneous preference among consumers. For these services the fragmented IPR arrangements can lead to duplication of transaction costs. During our interviews we have identified several different experiences with respect to this. For example, an ISP also providing VoD services indicated that a pan-European strategy is not something that he considers because he already experienced large transaction costs related to copyright payments and conditions in one country. The ISP indicated that rolling out to another Member State simply duplicates these costs. Yet, another (over-the-top) VoD provider indicated that in IPR negotiations the biggest concern for content providers (e.g. film studios) relates to the technical protection of their content against piracy and copying. Once the studios are convinced about the level of protection a certain technology provides, the negotiations about the rights are relatively easy, because in films the studios are typically a one stop shop.

## 5.4 Conclusion

In the table below we have summarised the assessed barriers which are avoidable and in line with the subsidiarity principle.

**Figure 5-5 Overview of avoidable barriers**

| Barriers related to…. | Category | Avoidable barriers |
|---|---|---|
| … the opening of national markets | Uncertainty regarding governmental intervention | • Gaps in the EU regulatory package, notably with respect to net neutrality.<br>• Uncertainty due to the existence of a government share.<br>• A lack of sufficient enforcement of regulations by NRAs. |
| | Others forms of governmental discretion | • A lack of coordination with respect to spectrum allocation may lead to different speeds of adopting 4G (3G) technologies.<br>• Lack of coordination in regulation of NGN transition. |
| … exploitation of EU economies of scale | Heterogeneity in the implementation of regulation | • Harmonising the implementation of regulation aimed at switching between operators;<br>• Harmonising the implementation of regulation aimed at security and consumer protection. |
| | Deficiencies in the regulatory framework | • Uncertainty due to ad hoc policy making (examples mentioned by interviewees are questionable).<br>• National orientation in pre-defined markets. |
| | Lack of standards | • Standardisation of a number of service offerings (including IT related).<br>• Transparency in network management.<br>• (Future) standardisation of TI |

| Barriers related to…. | Category | Avoidable barriers |
|---|---|---|
| | | specifications. |
| | Need for investments | • A combination of externalities and economies of scale induces Member States to postpone investments and wait for other Member States to take the initiative. |
| | Geographically fragmented arrangements for intellectual property rights | • Fragmented arrangements for content rights. |

This short list of barriers forms the basis for the discussion on policy options in Chapter 6. With exception of the issues on intellectual property rights, this issue falls outside the scope of our research.

# 6 Policy options

Chapter 5 produced a short list of barriers. Building on this, Chapter 6 examines for each barrier in this short list the measures that (could be) required for reducing these barriers. The barriers in Chapter 5 are those perceived by market players. Here we make our own assessment of these barriers. In some cases we will conclude that the problem identified by market players indeed endangers individual business cases, but is not distorting the functioning of the Internal Market.

In order to structure the discussion, section 6.1 first spells out the legal framework for EU policy making. Section 6.2 elaborates on the development of the institutional framework over time. Next, section 6.3 examines to what extent current policy is addressing the problem, whether more measures are needed, at which policy level should it be implemented/executed, and whether the measure is proportional.

Section 6.4 presents two country cases (the US and Korea) in search of lessons that we can learn from following different policy approaches. The US is typically interesting because of the noticeable dynamics in the development of OTT applications and platforms. Korea is interesting for its fast development from ICT laggard to ICT leader.

Section 6.5 concludes with a sketch of the policy agenda for 2020.

## 6.1 Legal framework for EU policy making

Below we first discuss the concept of proportionality (6.1.1). Next we consider the legal instruments that the EU has at its disposal for implementing policy (6.1.2), as well as the measures in place for promoting the Internal Market for e-communication (6.1.3).

### *6.1.1 Proportionality*

In legal terms, proportionality means that a measure may not impose obligations beyond the extent to which they are strictly necessary to attain the purpose of the measure. As such, it has to fulfil three criteria:

1. The measure is adequate to reach the objective;
2. The measure is the most limited intervention possible; and
3. There is a positive balance between benefits and the (costs of) intervention.

In economic terms, proportionality entails whether the costs of the measure stand in relation to the size of the problem. The three legal criteria above translate into the economic concepts of *effectiveness* (1) and *efficiency* (2 and 3).

Efficiency (or at least the second criterion of proportionality) is closely linked to subsidiarity because the costs of the measure also comprise the costs of losing autonomy when preferences or local circumstances are diverging. In the academic literature on the lack of an Internal Market for e-communication, a discussion seems to develop on whether promoting the Internal Market requires *more harmonisation through centralisation* (Pelkmans and Renda, 2010, 2011; and Cave and Corkery, 2009) versus *NRAs should be granted more discretionary powers* as to experiment with

policy measures (Defrain and v.d. Streel, 2011) and/or *to be able to (even) better anticipate local circumstances* (Houpis et al., 2011). In our view, one should look at it at a case-by-case basis.

Efficiency also relates to the costs of policy measures interfering with market operations. For example, with respect to standardisation one has to weigh the benefits of imposing formal (or informal) standards against the costs of impeding (yet) unknown innovations that would have evolved if the market had been able to run its course.

### *6.1.2 Legal instruments*

#### A typology

To exercise the Commission's competences it adopts regulations, directives, decisions, recommendations, and opinions.

- A regulation has general application. It is binding in its entirety and directly applicable in all Member States.
- A decision is binding in its entirety. A decision specifies those to whom it is addressed and is binding only on them.
- A directive is binding, as to the result to be achieved, upon each Member State to which it is addressed, but leaves to the national authorities the choice of form and methods.
- Recommendations and opinions have no binding force. However, they do have a political (and sometimes also legal) weight. The Recommendation is an instrument of indirect action aiming at preparation of legislation in Member States.

A regulation becomes immediately enforceable as law in all Member States simultaneously. A regulation overrides all national laws. A directive is different from regulations in that regulations are directly applicable and do not require transposition (i.e. making changes in national laws). A directive requires member states to achieve a particular result but does not dictate the measures for realising that result. Directives leave member states with a certain amount of flexibility as to the exact rules for adopting the measure. However, directives offer Member States a timetable for transposition and for the reaching the intended outcome. Failing to pass the required national legislation (or enforcing the requirements of the directive) may lead to legal actions. A recommendation has no legal power, but may lead to considerable political pressure.

The EU may also adopt so-called *framework directives.* Framework directives are generally less detailed leaving more discretion to the Member States. They can be complemented with recommendations, specific directives, or regulations to offer more directions in certain areas within the specific policy domain.

#### Prioritisation of instruments

Through the years, the text of the Protocols annexed to the Treaty on the application of the principles of subsidiarity and proportionality has been changed. In the version of 2006,[100] there was a comprehensive description of how the Community should prioritise certain different legal instruments it has at its disposal:

> "6. The form of Community action shall be as simple as possible, consistent with satisfactory achievement of the objective of the measure and the need for effective enforcement. The Community shall legislate only

100 Treaty establishing the European Community (consolidated version) - D. Protocols annexed to the Treaty establishing the European Community - Protocol (No 30) on the application of the principles of subsidiarity and proportionality (1997), *Official Journal* C 321 E , 29/12/2006 P. 0308 - 0311

to the extent necessary. Other things being equal, *directives should be preferred to regulations* and *framework directives to detailed measures* […]."

Although this text is no longer in force, its description of the order in which legal instruments should be used still applies in practice. In the spirit of this section of the Treaty on how to apply the subsidiarity and proportionality principles, *recommendations should be preferred to directives.*

### 6.1.3 *Current policy (plans)*

**Regulatory framework for electronic communications**[101]

The EU legal framework for regulating telecoms services aims at progressing the Internal Market for e-communications networks and services. The current framework has been in force since 2002. Major developments since then include the growth in voice-over-internet (VOIP) telephony and the uptake of television services through broadband lines. The framework was revised in 2009 to reflect these and other (future) developments. The rules should have been transposed into national legislation of all Member States since 25 May 2011.

The EU regulatory framework covers all forms of fixed and wireless telecoms, data transmission and broadcasting.[102] The main engine of the regulatory framework driving the Internal Market is its aim to promote free and fair competition between network operators and service providers. Operators and service providers have the right to set up and offer their services throughout the EU. As to encourage and enable them to do so, the national regulatory agency (NRA) has regulation in place to protect them from anticompetitive behaviour by dominant incumbents. BEREC (Body of European Regulators of Electronic Communications) supports NRAs in ensuring fair competition and promotes more consistency of regulation across Member States.

**The framework is made of a package of five Directives and a Regulation:**

- Directive (2002/21/EC) on a common regulatory framework as amended by Directive 2009/140/EC ("Better Regulation Directive")
- Directive (2002/19/EC) on access and interconnection as amended by Directive 2009/140/EC ("Better Regulation Directive")
- Directive (2002/20/EC) on the authorisation of electronic communications networks and services as amended by Directive 2009/140/EC ("Better Regulation Directive")
- Directive (2002/22/EC) on universal service and users' rights relating to electronic communications networks and services as amended by Directive 2009/136/EC ("Citizens' Rights Directive")
- Directive (2002/58/EC) on privacy and electronic communications as amended by Directive 2009/136/EC ("Citizens' Rights Directive")
- Regulation (EC) No 1211/2009 of the European Parliament and of the Council of 25 November 2009 establishing the Body of European Regulators for Electronic Communications (BEREC) and the Office.

*BEREC*[103]

The Body of European Regulators for Electronic Communications (BEREC) was created to improve consistency of the EU regulatory framework. BEREC replaces the European Regulators Group (ERG), but continues its role as platform for the exchange of expertise and best practice between NRAs and its role in giving opinions on the functioning of the telecoms market in the EU. BEREC assists the Commission and the national regulatory authorities (NRAs) in implementing the EU

101 http://ec.europa.eu/information_society/policy/ecomm/eu-rules/index_en.htm
102 The regulation of the content carried by such services is, however, dealt with under separate rules.
103 Taken from http://ec.europa.eu/information_society/policy/ecomm/implementation_enforcement/berec/index_en.htm

regulatory framework. It gives advice on request and on its own initiative to the European institutions and complements the NRAs.

BEREC's main tasks include:

- to participate in consultations under the Single market consultation (Article 7) procedure;
- to give opinions on cross-border disputes;
- to disseminate best practice, assist NRAs, advise the Commission, the European Parliament and the Council, and assist the institutions and the NRAs in their relations with third parties;
- to deliver opinions on draft recommendations and/or guidelines on the form, content, and level of detail to be given in notifications, in accordance with Article 7b of Directive 2002/21/EC (Framework Directive);
- to be consulted on draft recommendations on relevant product and service markets, in accordance with Article 15 of the Framework Directive;
- to deliver opinions on draft decisions on the identification of transnational markets, in accordance with Article 15 of the Framework Directive;
- to be consulted on draft measures relating to effective access to the emergency call number 112;
- to be consulted on draft measures relating to the effective implementation of the 116 numbering range;
- to deliver opinions on draft decisions and recommendations on harmonisation, in accordance with Article 19 of the Framework Directive;
- to deliver opinions aiming to ensure the development of common rules and requirements for providers of cross-border business services;
- to publish an annual report on the state of play in the e-communications markets.

### Current topics

#### *Open Internet and Neutrality*

The revised telecoms framework recognises the importance for EU citizens of preserving the openness of the Internet and provides a number of regulatory tools to help ensure this outcome. In particular, these provisions are concerned with transparency, enabling consumers to switch to other operators if they are unsatisfied with the offered conditions for QoS and traffic management. Furthermore, national regulators have the power to intervene by setting minimum QoS requirements (Article 22(3) of the Universal Service Directive).

In April 2011, the Commission published a Communication on the open Internet and net neutrality, outlining the way forward in this area (see COM(2011) 222). The Commission intends to decide on taking measures after having examined how the rules on transparency, switching and quality of service are implemented in the Member States. The Commission works closely with BEREC on this.

#### *Roaming*

The EU Roaming regulation was adopted in 2007 and introduced caps on roaming prices ("Eurotariff"). In July 2009, revised rules were adopted that cut roaming prices further and introduced new caps on SMS tariffs ("Euro SMS tariff"). In addition, as of 1 July 2010, an automatic safeguard protects consumers against data roaming bill shocks.

The amended roaming regulation will apply until summer 2012. Following a review of the regulation, the Commission finds that the roaming market is not yet competitive enough and indicated that it aims for extending the Roaming Regulation until 30 June 2022.

The Digital Agenda for Europe defines roaming as one of the 'Key Performance Targets' for attaining the Digital Single Market. More precisely, the target is that 'the difference between roaming and national tariffs would approach zero by 2015'.

*First Radio Spectrum Policy Programme*

On its website[104] the Commission states "The revised regulatory framework invites the Commission to submit a multi-annual Radio Spectrum Policy Programme (RSPP) to be adopted by the European Parliament and the Council of Ministers. The general objective to be achieved by the RSPP is stated in Article 8a(3) of the Framework Directive: The Commission […] may submit legislative proposals […] for establishing multi-annual radio spectrum policy programmes. Such programmes shall set out the policy orientations and objectives for the strategic planning and harmonisation of the use of radio spectrum in accordance with the provisions of this Directive and the Specific Directives."

The Commission has already issued a proposal for the first radio Spectrum Policy Programme that has recently gained approval from the European Parliament and Council. The new programme seeks to achieve in particular the following policy objectives:

- to encourage efficient management and use of spectrum;
- to allocate sufficient and appropriate spectrum in a timely manner to support EU policy objectives and, for that purpose, make every effort to identify, based on an inventory of spectrum, at least 1200 MHz of spectrum by 2015 at the latest;
- to bridge the digital divide and contribute to the objectives of the Digital Agenda for Europe by fostering access to broadband at a speed of not less than 30 Mbps by 2020 for all EU citizens;
- to enable the EU to take the lead in wireless electronic communication broadband services by freeing up sufficient spectrum in cost-efficient bands for these services to be widely available;
- to promote innovation and investment;
- to maintain and develop effective competition, in particular in electronic communication services;
- to reduce the fragmentation and fully exploit the potential of the internal market in order to foster economic growth and economies of scale in the EU.

## 6.2 The institutional framework for EU policy making

**The evolution of the basic principles of policy making**

The basic principles of policy making in the EU have moved away from a 'central approach' towards a 'market-based approach'. The central approach is characterised by an EU policy maker that tries to do what it thinks is best for the public and implements policies to realise this (e.g. liberalisation). The market-based approach is characterised by a policy maker that has some ideas of what is 'bad' for the public, but recognises that it does not know what is 'best'. Subsequently, it formulates general guidelines/frameworks that prevent the 'bad' and stimulate the market to identify and realise the 'best'.

The central approach is still being pursued in other parts of the world that perform quite well (e.g. Rep. of South Korea) and also in the EU, elements of such an approach are still visible (e.g. the firm objective formulated in the Digital agenda to get full EU coverage of high speed broadband or the objectives set for reducing CO2 emissions). The approaches are not by definition mutually exclusive, as a market-based solution can surely help to efficiently realise top-down formulated

104 http://ec.europa.eu/information_society/policy/ecomm/current-topics/index_en.htm

objectives (e.g. the trading of emission rights). As opposed to the pure market-based approach, the central approach requires commitment by all stakeholders and the public. This is clearly visible in the way that Korea has realised its development towards global ICT leader (close cooperation with industries at the strategic level and intense communication towards to public). It is also a clear element in the overall EU strategy to realise the objectives for reducing CO2 emissions (gaining commitment from Member States and Industry and communication towards the public for gaining support).

### The evolution of EU regulation of network industries

Hancher and Larouche (2011) explain that the EU regulation of network industries and services is moving away from a traditional formalistic paradigm to a more integrative paradigm. The first is based on legal definitions and concepts, forming classifications in which phenomena are placed by ways of pigeonholing or labelling, and upon which consequences are based. This traditional paradigm creates clear dividing lines in market ordering (e.g. universal services versus non-universal services, networks versus content) and institutions (EU versus Member States). The second paradigm to which the EU is slowly evolving is based on a multi-disciplinary, more holistic approach. Hancher and Larouche explain, "[the second paradigm is based on] general guidelines and principles based on economic insight to assess specific situations in a wider sectoral setting, with progressive refinement, until the point where a conclusion can be reached and consequences attached. In other words, this paradigm is characterised not by separation, but rather by integration (in substance as well as institutionally)".

The authors go on by stating that the current regulation is in some cases still based on inherent separations such as network industries and services versus content and competition law versus sector regulation. They conclude that separation does not work in today's dynamic Internet ecosystem[105] and that the 2002 regulatory framework is a step in the right direction: "it is based on a more integrative approach in the form of a light regulatory framework applicable to all market players, plus a heavier regime for firms holding significant market power (SMP). The SMP regime does not work with labels, but includes a series of guiding principles, an analytical framework, and a choice of possible remedies." Still, the regulatory package contains a clear dividing line between networks and content. We have indicated throughout the report that this separation is not sustainable in the context of managed QoS and net neutrality.

From an institutional perspective, Hancher and Larouche (2011) explain that the EU is evolving away from traditional paradigm, but the potential for an integrated institutional framework are limited. The move towards an integrated framework is due to the fact that the separation between EU and Member State institutions has largely disappeared. Today, national agents (NRAs) are typically responsible for implementation and execution of EU policy. However, there remain lines of separation along national borders leading to a patchwork of implementation. Although this may distort the functioning of markets (e.g. NGN and 4G investment decisions and standardisation in IT and processes) it also has benefits in that it recognises heterogeneity as well as the potential for experimentation in the presence of risks to policy failure. In other words, whether a separation along national barriers is a good or bad thing should be evaluated from a holistic approach.
The separation between the NRA and the (national and EU) legislative and executive power demonstrates this point. NRAs do not merely act in the national public interest. They are accountable to multiple principals: the European Commission, national governments and parliaments, and the Courts. Following Hancher and Larouche (2011) we recognise that this model, whilst understandable, may have some distorting effect on the NRA's incentives. Reducing the

105 "Separation is no longer the solution, but the root of the problem".

number of principals and make NRAs more effective and contribute to harmonising the implementation of the regulatory framework.

## 6.3 Assessing policy measures

This section identifies policy measures to support the development of the Internal Market for e-communications. Our point of departure is the short list of identified barriers as developed in Chapter 5. We first determine whether current policy measures already address the identified barriers. We notably focus on the Regulatory Framework and the Digital Agenda. We assess 1) the extent to which these measures capture the identified problem, 2) the level of implementation (EU or Member State), and 3) whether the policy is on track. Next, we examine 4) what additional measures can be taken and 5) whether these policy options are proportional.

### *6.3.1 Openness of national markets*

**Uncertainty regarding government Intervention**

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| *Barrier* | *Interviewees indicate that regulation of (mobile) terminating rates differs across Member States and that the rules of the game change from one regulation period to the other. Interviewees indicated that this creates uncertainty for market players, reducing incentives to invest (and enter).* |
| Measures in place: | The market for terminating calls has been included in the Commission Recommendation of 17 December 2007 on relevant product and service markets […] as a market susceptible to ex ante regulation in accordance with Directive 2002/21/EC (on a common regulatory framework). In the Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU[106], the Commission recommends an equal treatment of fixed and mobile terminating rates and recommends that national regulators regulate terminating rates on the basis of the *long run incremental cost* (LRIC) model. |
| Level | Member States (NRAs) implement the directives and regulation with a certain degree of discretion. The experiences in the Member States is (should be) monitored and evaluated by BEREC. BEREC also has a coordinating responsibility to promote homogeneity across Member States in implementation. |
| Match with the barrier | The perceived barrier knows two elements: 1) heterogeneity of implementation by Member States, and 2) changes in the rules of the game.<br><br>1. If all Member States follow the Commission's recommendations, the differences between Member States cease to exist. However, Member States don't necessarily follow suit because:<br>• a regulation has no legal binding force. National regulators can opt for deviating remedies in their market analyses decisions, although they potentially face political pressure from their peers. Moreover, the extent of implementation also depends on how successful NRAs are in defending their case in front of the national Courts. It is one thing to follow the recommendation of the Commission; it is another to |

106 Official Journal L 124 , 20/05/2009 P. 0067 - 0074

successfully pass the national Courts.

- in market analyses decisions, the framework directive foresees veto powers for the Commission with respect to the analysis of the 'relevant market' and of 'significant market power', but not with respect to 'remedies'.

In practice we observe that all EU member states have adopted the LRIC model, except for the Netherlands where the Court decided that the argumentation for imposing LRIC was not well founded. Still, There may be differences in the specifics of the LRIC models applied by NRAs leading to different outcomes.

2. There are two reasons why this argument is not valid. First, market players active in this intensely regulated industry are fully aware of the basic principles on which the regulation is based: market efficiency. When certain practices result in (obvious) inefficient market outcomes that will/can not be corrected by the market itself, any stakeholder should be prepared for top down policy interventions one day or another. In the MTR case the obvious inefficiency was the large transfer of rents from fixed to mobile networks and the absence of market forces correcting this. Second, it is common that prior to adopting a recommendation there is a consultation process. During this period, stakeholders can inform themselves of the upcoming changes.

Concluding, the measures in place may leave room for heterogeneity in implementation. The rules of the game change from time to time, but this does not create extra uncertainty: the end state is (and has been) clear to all.

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| On track? | Is BEREC fulfilling its role? |
| More measures needed? | BEREC could review the models used by NRAs in an attempt to explore the potential benefits of having a more uniform LRIC costing model (or at least harmonise the models). |
| Impact / proportionality of additional measure(s) | There are additional costs to more harmonisation of costing models because there is less room for reflecting country specific circumstances. The benefits are (in this particular case) unclear because in practically all Member States the basic principles of the costing models have already been standardised.<br><br>Beforehand, it is hard to claim that harmonisation of costing model is a proportional measure. Efforts of BEREC (through agenda setting, exchange of experiences, monitoring and recommending) to explore potential for harmonisation are proportional. |
| *Barrier* | *Interviewees indicated that in their view the regulatory package has no proper rules on preserving net neutrality (of best effort Internet). This leads to Member States taking their own initiatives on an ad hoc basis (often politically driven), creating unnecessary heterogeneity of regulation. It frustrates the home market advantage (i.e. EU economies of scale) for the development of OTT applications in Europe.*[107] |
| Measures in place: | The discussion on net neutrality is about blocking applications and strategically squeezing bandwidth for certain applications (to the benefit of Managed IP), and |

107 Note that this critique does not relate to the managed QoS services. The net neutrality discussion of managed QoS services is discussed below under 'lack of standards'.

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| | (therefore) also about transparency on traffic management. Furthermore, it relates to e-communication network industries moving from a one-sided market to a two-sided market. Content and OTT service providers are engaging in contractual relationships with the ISPs in order to get a higher priority in the traffic management systems.<br><br>The current regulatory framework is not covering the full dimension of the net neutrality debate because it does not include the upper levels in the supply chain (content and OTT services). The regulatory package has some provisions concerning transparency, enabling consumers to switch to other operators if they are unsatisfied with the offered conditions for QoS and traffic management. Furthermore, national regulators have the power to intervene by setting minimum QoS requirements (Article 22(3) of the Universal Service Directive).<br><br>In many countries the consumers' ability to switch are limited and the practices of blocking or squeezing applications that are competing with managed IP services are becoming more common - see COM(2011) 222.<br><br>Currently the European Commission is examining whether measures are appropriate. By the end of 2011 (early 2012) the Commission expects to decide on the issue of additional guidance on net neutrality - see COM(2011) 222. |
| Level | In the meantime, Member States take own initiatives. |
| Match with the barrier | Indeed it is important that the EC carefully examines the need for intervention and what this measure should be. This process is currently going on parallel to this research, and hence we do not address the specifics of such intervention here. But in any case, the approach should be uniform for all Member States. Once heterogeneity in policy exists, the costs for transition towards a uniform standard may be much larger due to path dependency.<br><br>The main cause of the inability of the regulatory framework to deal effectively with net neutrality is that it only deals with networks and integrated services and not with content and OTT services. As indicated by Hancher and Larouche (2011), this dividing line prevents an integrated approach. |
| On track? | There a danger to time lags between market needs and EC regulatory response, leading to Member State initiatives. Member State initiatives may also be politically driven, which increases the need for a fast adoption of a uniform policy. |
| More measures needed? | A fast adoption of a regulation repairing the dividing line between networks and content. The regulation should spell out the rules on net neutrality as specifically as possible to prevent heterogeneity. Alternatives are a directive or recommendation spelling out the rules, but there are some drawbacks to this, as we explain below. |
| Impact / proportionality of additional measure(s) | • For uniform adopting rules on net neutrality there is no heterogeneity in terms of path dependency or geographical / technical circumstances. The costs of central decision making are relatively small. The benefits of central decision making are clear: economies of scale at OTT level.<br>• For extending the regulatory framework as to cover OTT services and content, there may be a problem with heterogeneity in other areas, e.g. the area of cultural policy. For example, how to deal with local preferences for multiformity in media? Extending the regulatory framework also has consequences for the national institutional landscapes. In the Netherlands for example, enforcing media policy falls within the competence the ministry of |

Education, Culture and Science and the Commission for the Media (*Commissariaat van de Media*).

- Timing is an issue. As Member States are currently taking initiatives on their own (in response to market needs), postponing uniform EC rules leads to future costs of transposition.
- A recommendation does not address the root of the problem (divide between networks and content in the regulatory framework) and leaves too much room for interpretation with the risk that heterogeneity may remain for an unnecessary long time, frustrating the development of OTT services.
- Adapting the Common Regulatory Framework on the basis of a direction increases the homogeneity of implementation, and it provides room to Member States for accounting for local preferences while transposing the direction into national laws. A problem is that it generally involves a period of 2 years for transposition (in addition to the time required to prepare the adoption of a directive). The industry wants solutions today.
- A regulation is uniform and (once adopted) immediately effective. In order to speed up the formulation of the specifics of this directive, the EC could increase the resources spent on examining the issue and formulating appropriate policy principles. A regulation leaves little room for customising to local circumstances.

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| *Barrier* | *In some Member States the incumbents are still (partly) owned by the government. According to interviewees, this creates an incentive problem for governments to the disadvantage of challengers.* |
| Measures in place: | Although in common economic terminology privatisation is intimately related to liberalisation, there remains no requirement for privatisation in the regulatory packages. The Treaty does not have provision for making Member States divest.<br><br>NRAs are required to make no distinction between fully privatised and (partly) government owned operators. In specific areas NRAs may not have discretionary power (e.g. auctions of spectrum).<br><br>The Commission has the ability to veto market analyses and analyses of establishing dominant positions. This might be a safeguard against politically influenced decisions by NRAs. However, the Commission has not veto power over the remedies imposed.<br><br>The Commission can take decisions authorising or preventing an NRA from taking exceptional measures (Directive 2002/19/EC article 8). BEREC has the task to deliver opinions draft decisions (Regulation 1211/2009 article 3.1).<br><br>BEREC is required (under Regulation 1211/2009 article 3.1) to monitor and report on the electronic communications sector and to publish an annual report on the developments in that sector. The regulation does not specify which kind of developments. Hence, in theory, these could also include events of 'abuse of governmental powers' taking place in the sector. |
| Level | MS |
| Match with the barrier | There is a fundamental weakness in the system of control in that NRAs are formally independent but are accountable to governments and parliament, if not only because they are dependent in terms of resources. Furthermore, the hands of BEREC are to a certain degree tied as there is a clear dividing line between politics (policy making) and policy implementation. All this increases the |

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| | importance of the roles that the EC can play. But also the roles of the EC are limited, as they have no power to veto a remedy. They can block a remedy by vetoing the market analysis or SMP analysis, but this is a rather drastic approach.<br><br>Obviously governments with shares in e-communication companies have a conflict of interest. But also if they have no shares, there may be a delusional ambition to protect national champions and to wait for other Member States to open their markets first (something which is also seen in the regulation and liberalisation of the postal sector). The regulatory framework is specific and compelling to prevent such beggar thy neighbour policy and the EC can monitor this via reports, and might even start infringement procedures. However, in some areas where Member States have exclusive competences (e.g. spectrum management), also the hands of the Commission are tied. A Member State can fence off foreign entry in the national mobile market via specific details in the spectrum allocation mechanisms (both in auction design as well as in the design of beauty contests). |
| On track? | No |
| More measures needed? | Preserving independence of NRAs should be high on the agenda of the EC and BEREC. We note, however, that the issue is political in nature and thus that the powers of BEREC are limited to informal signalling mechanisms. Subsequently, it is up to the NRAs to make no exceptions between government-owned companies and privately owned companies. The Commission can to a certain extent use its powers (under Directive 2002/19/EC article 8) to safeguard this.<br><br>In specific areas in which NRAs may not have power (e.g. auctions of spectrum) the NRAs could signal misbehaviour by governments to BEREC and the EC. Individuals reporting misbehaviour should be protected via a whistle-blower protection programme. Subsequently, naming and Shaming is a method available to the EC. This could be in the form of a sequence tool with increasing pressure effects: e.g. mentioning in annual reports, orange and red cards, and public statements. In addition, the reports could be a matter of discussion in the Council as to increase pressure from peers among governments.<br><br>Alternatively, the independence of NRAs can be improved to make them accountable to the EC only. While maintaining the decentralised approach to implementation, this can be done by transforming NRAs into local agencies of the Commission, paid from the EU budget. |
| Impact / proportionality | The independence of the NRA is something that should have been transposed into national law. But is that enough (*effective*) to safeguard the market from the mixed incentives that governments with shares in telecom companies may experience? An NRA may be legally independent, but still under considerable political pressure.<br><br>Pressure peer review among governments within the Council might be effective. However, in order to work, there should be clear measureable objectives, progression reports from national governments spelling out medium term objectives, reviews from the Commission, and a punishment mechanism. With respect to the specific problem at hand the formulation of specific objectives seems rather difficult. Even if specific objectives can be formulated, it is not said that the peering pressure mechanism will work (see for example the problems with enforcing the Stability and Growth Pact). This largely depends on the basis for adopting Council decisions: unanimity, majority or reversed majority. It also depends on the extent to which national governments are guilty of the same |

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| | crime, and the extent to which the issues are subject of negotiations in the wider political context.<br><br>Local Commission agencies can account for local heterogeneity and make regulatory agencies more effective against governments with conflicting interests. At large it is neutral in terms of costs, but (all else equal) it requires a transfer of funds from the national budgets to the EU budget. Because today NRAs should be fully independent, it does reduce national autonomy for as far it concerns the implementation of EC law (which is about 90% of the work of NRAs). There is a problem with the implementation of additional national laws. It is possible to leave this up to Commission agencies. This problem increases when the regulatory package is extended to content and OTT services.<br><br>Both of the previous measures are neither effective nor proportional. This leaves us with a set of softer tools: reporting, orange and red cards, public statements by the EC. |
| *Barrier* | *Challengers complain that in some Member States there is a lack of enforcement that may be caused by regulatory capture.* |
| Measures in place: | There is always a risk to regulatory capture for several reasons: at national level the interaction between regulators and market players is intense; over time, there may be mobility of human resources as individuals seek new career challenges; in some Member States the government owns part of the incumbent.<br><br>In order to minimise the risk to regulatory capture there need to be (institutional) provisions for *monitoring*, *learning* and for *peer pressure*. BEREC could pay practical attention to this by adopting a review of NRAs practices in its annual report.<br><br>Also the Commission's veto powers might be a safeguard against regulatory capture. |
| Level | Cooperation between Member States and EC monitoring. |
| Match with the barrier | Potentially, depending on how the EC and BEREC interpret their powers. |
| On track? | Not clear yet. According to Regulation (EC) No 1211/2009 establishing BEREC, BEREC will be evaluated in 2013 (3 years after its founding). |
| More measures needed? | The upcoming evaluation could have eye for BEREC's functioning with respect to *monitoring*, *learning* and *peer pressure*. |
| Impact / proportionality | Spelling out clearly the elements on which BEREC will be evaluated in 2013 will have an immediate effect on current practices. There are no additional costs involved. |
| *Barrier* | *Challengers complain that in some Member States there is a lack of enforcement that may be caused by resource problems for the NRA* |
| Measures in place: | On the resources of NRAs the Directive only says that NRAs should have enough resources to participate in BEREC (2002/21 art. 3a). |
| Level | Member States |
| Match with the barrier | No |
| On track? | Not relevant |

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| More measures needed? | 1. Regional cooperation and mutual (HR) support between NRAs.<br>2. Supporting role of BEREC in 1) providing technical assistance, and 2) in reporting (in the annual report) on governments that do not spend enough resources. |
| Impact / proportionality | 1. It's effective and efficient<br>a. no consequences for national autonomy;<br>b. no complicated institutionalisation required to reap the associated economies of scale (it can be informal cooperation),<br>c. no additional resources required (maybe even less).<br>2. It's effective and efficient<br>a. no consequences for national autonomy;<br>b. it may require more resources for BEREC (provided by the NRAs), but only to a limited extent. There is also some overlap between the extra costs. |

## Government Discretion

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| *Barrier* | *The allocation (auctioning) of spectrum falls within the competence of the Member States. Market players complain about a lack of coordination leading to different speeds of adopting 4G technologies. This may frustrate both entry (openness of national markets) as well as EU economies of scale in developing and producing handsets and peripheral equipment.* |
| Background | In the short run, there are two frequency bands of particular importance in relation to 4G roll-out: 800 MHz and the 2.6 GHz bands. Technically, also the other frequency bands (currently in use for 2G and 3G technologies) will be suited for 4G. However, given the installed base, it is not likely that 4G roll-out will initiate in these bands. Most Member States have already allocated the 2.6 GHz bands. 4G roll-out on the basis of 2.6 GHz alone does not allow for national coverage. Operators optimally require a mix of 800 MHz frequencies and 2.6 GHz frequencies. The 800 MHz band becomes available in all EU countries by 2013.<br><br>In the long run, the adoption of 4G in the other bands may take place at different moments because the expiration dates of the current licences in place differ between Member States. The expiration dates of licences also largely determine the ambitions of operators to switch from 2/3G to 4G because in the past the licence period determined the initial depreciation period applied to investments. Indeed, given technological developments, operators may choose to right off some off the installed base and start with 4G roll-out prior to licence expiration. They will not do that, not knowing whether they will obtain a licence in the next auction round.<br><br>This may lead to spillovers in the form of a delay. Developers of handsets and peripheral equipment set their R&D agenda towards the time schedule applied in the largest countries (Germany, UK, France) because that will gain economies of scale. Governments and operators in smaller countries will be prevented from following more ambitious time schedules. But even the individual large countries may not generate the scale required and also they will experience a hold up because of the heterogeneity across the EU in expiration dates of licences.<br><br>Other problems that may hinder the transition from 2/3G to 4G relate to national specifics on the conditions for spectrum use: different duration of licences, |

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| | different licence conditions (e.g. technology neutrality and roll-out requirements). Furthermore, Member States may experience incentives to promote national champions by designing auctions such that foreign entry is limited. Alternatively, there is political opportunistic influence by national parliaments. This limits the intensity of competition and thereby the incentives to adopt new technologies. |
| Measures in place: | The RSPP seeks to address heterogeneity in spectrum use: the Commission has a radio spectrum policy in place that has three main objectives:<br>• Harmonising the use of radio spectrum<br>• Working towards more efficient use of the spectrum, and<br>• Improving the availability of information about the current use of spectrum, future plans for use and availability of spectrum.<br><br>On the issue of timing, the EU leaves this largely to the Member States. But in practice has some coordination powers via its influence on spectrum assignment. E.g. with respect to the 800MHz band (Digital Dividend), the first radio spectrum policy programme (Article 6) sets 2013 as the date for clearing the band for use of mobile telecommunication. Adopting this proposal will make all 800 MHz bands available by 2013. Subsequently it is very likely that Member States will auction the frequencies as soon as possible. Concerning the roll-out of 4G in the other spectrum bands, there are no specific actions aimed at harmonising licence duration/expiration, nor to coordinate timing of re-auctioning of the licences for use after expiration. |
| Level | 800 MHz/2.6GHz: EU directs and MS implement<br>Other bands: EU coordinates and MS direct |
| Match with the barrier | Yes, in relation to the 800 MHz/2.6GHz bands.<br><br>Yes, in relation to harmonising the efficiency and flexibility in using spectrum in other bands.<br><br>No, in terms of timing licence duration and timing of auctions (particularly relevant for the bands currently in use for2G and 3G).<br><br>No, on the issue of promoting national champions as there is a gap between the NRAs capacity to regulate markets independently and the exclusive powers enjoyed by national government to control the entry conditions in the mobile market via allocation mechanisms. |
| On track? | Yes/No |
| More measures needed? | No, concerning the 800 MHz/2.6GHz bands<br><br>Concerning 2G and 3G bands, move towards harmonisation of (re)auction moments such that regions of large enough scale exists to escape the hold up (preferably as soon as possible) Options are:<br>1. A single pan-European auctions of spectrum licenses.<br>2. Stick to national auctions, but coordinate more. This involves developing an allocation framework (perhaps through a framework directive) that leaves sufficient discretion to Member States (in terms of the objectives of the auction, institutional competences with respect to spectrum management, etc.) but grants the EC powers to orchestrate harmonisation in timing of auctions. We specifically note the option to re-auction spectrum bands a few years before the current licences expire.<br><br>Empowering NRAs to better control the entry conditions in the mobile markets. |

This can be done by extend the regulatory framework to cover those spectrum bands that are assigned to commercial mobile communication services within the context the EU, CEPT and ITU.

Proportionality

**Economies of scale**

Pan-European auctions reduce duplication of transaction costs for market players and in effect gain economies of scale. These economies of scale are relatively small compared to the economies of scale from harmonising spectrum management and technological standardisation of spectrum use, which has already been arranged through the RSPP and various supra-national coordination bodies.[108]

Pan-European auctions could indeed make sure that all licences are auctioned at the same time, creating economies of scale for producers of handsets and peripheral equipment. The same could potentially be reached with option 2 (this is a matter for further research). Pan-European auctions may thus go beyond what is necessarily required in order to obtain the objective.

**Heterogeneity**

A single auction for the entire EU space most likely leads to suboptimal market order. From the interviews we have learned that geographical markets are largely defined by (semi) natural barriers (notably language and culture) that require mobile operators to customise marketing and distribution efforts, and require 'closeness' to the markets (both respect to consumers and to politics). Furthermore, these geographical markets differ in size, population density and income, which may result in differences in the optimal number of competitors. A single EU auction could not account for that.

There is heterogeneity in institutional governance structure (NRA, CA, TA, Ministries) and national governments may have different objectives with auctions: auctions can have the objective of gaining financial resources that can feed into the general budget, on the other hand, auctions can be used as a market ordering tool. Both objectives are not always at par with each other. Extending the regulatory framework as to cover those frequencies that are assigned for commercial communication services solves this problem. From a subsidiarity and proportionality point of view there is little reason to keep these frequencies within the sphere of influence of national governments. There are also examples in the EU where national governments have delegated the responsibility for spectrum management to NRAs.

*Barrier*

*Interviewees indicated that there is a lack of coordination in the transition to Next Generation Networks (NGNs). There is a danger that regulatory choices in the transition to NGN can undo much of the work that has been done over the past 15 years with respect to opening up national markets. Notably regulatory holidays are seen as destroying the business case of challengers. The basis for regulatory holidays is the principle of non-regulation of new markets (that would otherwise not exist because of the trade off between regulation and investments).*

*Challengers also fear for other reasons that they will not have access to NGNs,*

108 Radio Spectrum Committee (RSC), Radio Spectrum Policy Group (RSPG), Conference of Postal and Telecommunications Administrations (CEPT), the European Telecommunications Standardisation Institute (ETSI), and the International Telecommunication Union (ITU).

*threatening the sustainability of their business case. Notably with passive NGN architectures (PONs), as opposed to point-to-point architectures (P2P),[109] optical LLU (ODF) access is not possible and one has to rely on bitstream. In case NRAs conclude that (within the time frame of the next regulatory period) the market for bitstream access is competitive and therefore does not require regulation, there is a danger that (in the longer run) the absence of access regulation of fibre bitstream sets back the business case of the challenger, such that he misses the momentum for making its business case sustainable for the future. Alternatively, the regulatory model currently applying to cable networks is applicable to PONs, which does not foresee regulated reference offers for bitstream access in most Member States (except, recently, in Belgium).*

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| Measures in place: | German case law says that the principle of non-regulation of new markets (i.e. regulatory holidays) is not compatible with the regulatory package. NGN access networks fall within the definition of market 4 and 5 within the context of Recommendation 2007/879 (i.e. markets that NRAs are required to subject to a market analysis). If a dominant position has been identified the NRAs are required to regulate.<br><br>Recommendation 92/9/2010 stresses the possibility to define sub-national markets, increasing the chances that an SMP will be identified at bitstream level. |
| Level | MS |
| Match with the barrier | • The provision in the regulatory framework and the recommendation seem to address the right issues. In principle, the regulatory framework gives the right tools for market analysis and remedies, it even requires NRAs to analyse the markets in a prospective setting. However, the Commission guidelines on market analysis are formulated such that in practice NRAs typically apply a prospective analysis of the markets for the coming regulatory period.[110] Given the fact that NGN transition paths cover a much longer period, this timeline is too short. A problem with applying longer timelines in the prospective market analyses is that this inherently leads to more uncertainties and speculation making the analyses weaker in court.<br>• If access to PONs is not guaranteed, the choice between network architecture (PON versus P2P) may become a strategic choice (aimed at keeping challengers out) instead of an efficiency choice (aimed at serving the needs of end users).<br>• Because of the dynamic nature of the market and the potential of NGNs for being a 'game changer', the traditional approaches by the NRAs may require some modifications. In particular, the time horizon that NRAs apply in their prospective analysis could be more flexible. In a highly dynamic setting, the NRAs should look at the consequences of their decisions (to impose remedies or not) beyond the next regulatory period. |
| On track? | No, but there are still lots of uncertainties about how to deal with the NGN issue from a regulatory perspective. |
| More measures needed? | • In addition to the existing recommendations and directives, we suggest that BEREC maintains and (potentially increases) the resources spend on monitoring and supporting the approach to NGNs by NRAs and to advice the EC on policy |

109 For an explanation see http://www.fibreevolution.com/2007/04/the_point_of_po.html

110 Or even less, because it is often based on historic data describing a regulated market, whereas the counterfactual in the market analysis is always an unregulated world for which no historic data is available. The limits to data availability limit the timelines that NRAs can apply in their prospective analyses.

choices.

- EC could formulate guidelines on market analysis including a genial long-term prospective analysis identifying potential risks for the sustainability of competition and a list of possible remedies. Subsequently, NRAs can complement their 3-year prospective analysis with an assessment of the chance that a specific risk will materialise in the national context and the remedies that reduce these risks.
- The EC and BEREC should regularly organise research as to monitor future developments and risks for the sustainability of competition.
- Some of the interviewees suggested that the EC should follow a radically different approach: not focussing on transition towards NGNs, but focussing on a switch off of copper and jump to NGNs.

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| Impact / proportionality | Within the current regulatory framework it is not necessary to specify a custom regulatory approach to NGNs. The current framework offers the tools for NRAs to manage. As such the regulatory framework recognises the importance of decentralised implementation as to account for heterogeneity. Notably, different local circumstances (soils, urban planning, density, extent of inter-network competition, etc.) require different approaches to stimulate / participate in NGN roll-out. A centrally imposed directive or regulation may frustrate the participation of national and lower level governments.<br><br>With respect to a using longer time horizons in market analyses, changing the directive or regulation is not required. Extending the guidelines for market analysis with a general prospective analysis on risks and remedies may be sufficient to give NRAs the appropriate tools for incorporating long-term risks for the sustainability of competition in their market analysis. In addition, more frequent research (financed from the EC and/or executed by BEREC) will strengthen the position of NRAs in national Courts.<br><br>A radical different approach towards NGNs in terms of an orchestrated switch off of copper might not fit well within the current traditions of EU policy making. That having said, the EU has orchestrated a similar kind of switch off for analogue terrestrial television. We suggest that the idea deserves some more examination in order to spell out the costs and benefits of such approach. After all, the benefits from a fast and uniform roll-out of NGNs throughout Europe will foster the development of new OTT applications and may contribute to Europe's competitiveness in the global OTT application market. |

### *6.3.2 EU economies of scale*

#### Heterogeneity in implementation of EU regulation

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| *Barrier* | Interviewees claimed that different technological standards for number portability determined at Member State level lead to duplication of costs. |
| Measures in place: | Article 20 of the Directive (2002/21/EC) on a common regulatory framework deals with number portability, but is rather general leaving much room for interpretation. |
| Level | MS |
| Match with the barrier | No |
| On track? | N.r. |

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| More measures needed? | Path dependency limits policy options. A recommendation specifying a set of preferred standards is the only tool that can account for the fact that harmonisation involves large transition costs for all countries. Hence, a recommendation may primarily be useful for (future) new Member States that are less burdened by historic events. |
| Proportionality | It's questionable whether the transition costs outweigh the benefits (in the form of reduced transaction costs). |
| *Barrier* | Interviewees claimed that rules on consumer protection (including contract duration and transparency of bills) determined at Member state level, lead to duplication of costs. |
| Measures in place: | Article 20, 21, and 22 of the universal service directive |
| Level | MS |
| Match with the barrier | General but not specific enough |
| On track? | N.r. |
| More measures needed? | Adapt the directive such that implementation is based on mutual acceptance of NRA's decisions. This work as follows: firms suggest their templates for contracts or bills to one NRA in the EU, which evaluates whether this is in line with the directive. If so, the templates can be used throughout the EU. Such option will also create incentives for BEREC to act as a coordinator.<br><br>The alternative is to send the consumer protection dossier back to the general consumer protection policy domain. |
| Proportionality | Some loss of Member State discretion, but how large is this cost? In the past Member States have not objected to give away similar discretion in relation to other sectors. Do we really need a different regime for e-communications? |

### Deficiencies in the regulatory framework

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| *Barrier* | Interviewees claimed that there is a biased national orientation in the market analyses by NRAs, which in itself frustrates the development of pan-European market (self fulfilling prophecy). |
| Measures in place: | Article 15.4 of the framework directive 2002/21 provides the opportunity for NRAs to define trans-national markets. Article 16.5 says that in such case, the respective NRAs involved should jointly conduct the market analysis. It has not been done so far. |
| Level | MS |
| Match with the barrier | Partly. The directive does not anticipate a potential externality creating too little incentives for NRAs to act. E.g. in the case of roaming, NRAs could decide to launch a show case, however, the benefits of this effort go to foreign mobile phone users and gain little applause in the home country.<br><br>The problem should also be seen in conjunction with the potential gains from having a pan-European market for managed IP access (see section 2.3.3). Currently such market does not exist and it is not clear how the selection of remedies and their implementation by NRAs, pursuant to Art. 16(5) of the Regulatory Framework Directive would work in practice. |

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| On track? | With an eye on future pan-European markets, we conclude 'no'. |
| More measures needed? | BEREC could monitor and report the developments in the EU market with a focus on the need for defining pan-European markets.<br><br>The EC might make institutional arrangements similar to the ones creating LLU and WBA wholesale markets, i.e. require pan-European reference offers. However, such arrangement would differ in the sense that all operators with LLU and WBA access (including those that do not have a dominant position) are required to publish a reference offer. Hence, such arrangement would not fall within the regulatory framework, but within the framework of the Digital Agenda. |
| Proportionality | The creation of pan-European markets (either through article 16.5 or by means of more drastic measures) may be necessary in order to promote the adoption of TI and IT standards throughout the Union (see analysis on 'Lack of standards' below). |
| *Barrier* | Interviewees indicated that there was ad hoc policy making related to MTR and roaming, and that this created uncertainties.<br><br>NOTE: We have addressed MTR in Section 6.3.1. Here we focus on roaming. |
| Background | Initially roaming at wholesale level was arranged via a memorandum of understanding (MoU) between MNOs obliging all mobile operators to grant access to foreign operators. One can see the MoU as a form of self-regulation addressing the problem of very large transaction costs involved when every operator on its own has to shop around in 27 countries to offer its clients EU wide coverage. However, as with every form of self-regulation, there is a danger to rent seeking. In effect the MoU eliminated competition among national MNOs and thus led to monopolistic wholesale prices.<br><br>As such, the MoU functioned *de facto* as an institutional arrangement for (tacit) collusion. Consider two cases: 1) all operators shop around to strike the best wholesale deal 2) MoU leading to monopolistic wholesale prices.<br><br>In situation 1) the roaming operators can still charge monopolistic retail prices to its customers that a) select a subscription primarily on the basis of national calling rates and b) become a captive market once they have crossed the border. In this situation there is a threat that NRAs will be able to argue that calling abroad is a separate national relevant market (only national residents are involved) and that every MNO has a monopoly position towards this captive market.<br><br>In situation 2) the monopoly rents at wholesale level are automatically divided between MNOs according to traveller flows. This benefits operators in southern European countries more than in Northern European countries (depending on tourist flows). However, there is an additional benefit for all operators in situation 2) in that NRAs are put off-side because the wholesale roaming market is not a national market and thus falls outside their jurisdiction. |
| Measures in place: | The EU Roaming regulation was adopted in 2007 and introduced caps on roaming prices ("Eurotariff"). In July 2009, revised rules were adopted that cut roaming prices further and introduced new caps on SMS tariffs ("Euro SMS tariff"). In addition, as of 1 July 2010, an automatic safeguard protects consumers against data roaming bill shocks.<br><br>The amended roaming regulation will apply until summer 2012. Following a review of the regulation, the Commission finds that the roaming market is not yet competitive enough and indicated that it aims for extending the Roaming Regulation until 30 June |

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| | 2022.<br><br>The Digital Agenda for Europe defines roaming as one of the 'Key Performance Targets' for attaining the Digital Single Market. More precisely, the target is that 'the difference between roaming and national tariffs would approach zero by 2015'. |
| Level | EU |
| Match with the barrier | In the past the roaming regulation may have come as a surprise for market players (although the Commission had announced measures if the industry could not resolve the problem itself). Also the intermediate revisions may have come as a surprise. However, in the Digital Agenda (2010) the Commission communicates clearly (and in advance) its ultimate target. The Commission is clear about its intentions and market players should anticipate the fact that excess profits from roaming services will disappear.<br><br>Furthermore, as mentioned earlier, market players should anticipate that persistent excess profits would be dealt with by policy measures; particularly if they are the result of rent seeking agreements. |
| On track? | Yes |
| More measures needed? | No |
| Proportionality | N.r. |

### Lack of standards

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| *Barrier* | Interviewees indicated that there was lack of standards with respect to IT and processes frustrating pan-European services (notably towards multi-national corporations).Furthermore, we identified that a lack of standards at TI level (notably within the managed IP domain) will affect future pan-European roll-out (and thus development) of premium OTT services (such as e-learning, e-health, etc.). |
| Measures in place: | The framework directive requires the public offering of reference offers. But many specifications in these reference offers with respect to IT and processes are set at Member State level.<br><br>The framework directive (Article 17) does provide provisions for setting non-compulsory standards that can be made compulsory in case interoperability of services in one or more Member States cannot be ensured. The article does not specify whether it concerns technical or procedural standards. |
| Level | EU/MS |
| Match with the barrier | The necessary measure is in place, but has not been enforced (enough). It is clear that there is latent demand for pan-European reference offers, but this has remained a blind spot for EC policy makers. With an eye for future developments in OTT services the focus has to extend to TI standards within the Managed IP domain. |
| On track? | No |
| More measures needed? | The analysis in Chapter 4 indicates that there are considerable welfare gains from the adoption of pan-European standards, both with respect to IT and administrative processes, as well as in TI specifications within the managed IP domain.<br><br>A first step is to develop pan-European standards. Primarily for TI, preferably also for IT and processes. The question then is, what kind of standard is most appropriate: formal standards (imposed by public bodies), informal standards (agreed upon |

between market players), or propriety standards (resulting from market forces)?

Second, notably in the case of formal standards, institutional arrangements are needed to make sure that the standards are adopted EU wide. This asks for a strategy towards market creating (as opposed to market maintenance). Similar strategies were applied in the past with respect to LLU and WBA wholesale markets. These reference offers spell out technical and administrative standards, yet only at national level. In order to push for the adoption of pan-European standards the EC should make arrangements for pan-European reference offers.

Proportionality

To harmonise the current fragmented landscape of standards will involve transition costs, but the benefits in terms of economies of scale are large: 1) Multinational corporations will be better served, making Europe a more attractive location for headquarters and production facilities; 2) Manufacturers of telecom systems and suppliers of back office services will enjoy economies of scale because there is less need for customisation; and 3) it will nurture the development of premium OTT services.

How to agree on standards? Propriety standards might come about if there are multinational operators (such as Tele2, Deutsche telecom, Orange, etc.) with sufficient physical access points in the Member States. The possibility to facilitate the provision of premium OTT services to subscribers might give them a competitive edge towards competitors. However, LLU penetration by challengers is too low in most countries and is unlikely to increase due to population densities being too low. Relying on the market to come to standards seems futile. Furthermore, Blind et al (2010) spell out that formal and informal standardisation have better results (as opposed to propriety standards) in lessening market power, fostering global procurement, fostering economies of scale in components, increase adoption speeds, increase outsourcing, etc. Currently, the specifications for national reference offers are determined by national industry forums (consisting of incumbents, challengers, technical experts, large end-users, governments, and regulators) that are specifically set up for this purpose.[111] Whether this approach will also be successful at EU level is not straightforward. If all parties involved in the 27 national forums will be represented in the EU forum, the chances for agreeing on standards might diminish due to the increased heterogeneity of the actors involved. The success story of the GSMA (in which only MNOs are represented) might be a better blue print for agreeing on standards, however, this entails the risk of creating rent seeking arrangements and of creating standards that do not meet demand specifications. How the standardisation process is organised is a matter for further analysis. We suggest the EU standardisation institutes (ETSI and CEN) take lead in this.

How to make sure that standards are adopted? We suggest enforcing the adoption op standards via Managed IP reference offers. These reference offers describe for a large part the contractual arrangement between OTT service providers and ISPs. As such, the suggestions above to extent the regulatory framework as to include this contractual relation may provide the basis for enforcing Managed IP standards, provided that NRAs manage to identify SMP. In case the incumbent is holding SMP, it can be forced to make a reference offer that includes the standards for Managed IP. Competing ISPs will have an incentive to adopt the same standards as to deliver similar OTT services to end-users.

111 We leave in the middle whether this falls under the category of formal or informal standards.

### Need for investments in NGN networks

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| *Barrier* | We identified a potential incentive problem for national governments to invest/stimulate the roll-out of NGNs and 4G networks. The problem is caused by a combination of externalities and economies of scale making governments wait for other Member States to take initiative. More specifically, the problem is caused by the circular relation between investments, innovations by providers of OTT services and vendors, and demand for bandwidth and the scale that is required to set this wheel in motion. The problem applies to NGN networks as well as 4G networks. |
| Measures in place: | The Digital agenda formulates the objectives that by 2020 the majority of people in densely populated areas will have broadband capacity up to 100 Mb/s and in rural areas speeds of 30 Mb/s.<br><br>The Digital Agenda formulates the following actions to reach that objective:<br>• In September 2010 the Commission adopted a Communication outlining common rules within which EU and national policies should be developed to meet the broadband targets. In this regard, the development of operational national broadband plans is foreseen.<br>• The Communication adopted a Recommendation on Next Generation Access Networks to encourage investment through clear and effective regulatory measures and a proposal for a Radio Spectrum Policy Programme.<br>• The Commission is exploring the options for funding high-speed broadband by: 1) seeking cooperation with the EIB 2) exploring the potential for issuing project bonds, 3) exploring options within the context of the Competitiveness and Innovation Programme (CIP) and the Trans-European Networks (TEN) regulations. This is communicated via proposing a new Connecting Europe Facility (CEF) for funding of transport, Energy and broadband infrastructure as part of the new Multiannual Financial Framework for 2014-2020. |
| Level | EU/MS |
| Match with the barrier | The Digital Agenda expresses doubts about the market's potential for realising the stated objective. We recognise that there are market failures hampering the market as well as decentralised policy leading to too low levels of investment. As such, there are good reasons not to fully trust on a market-based approach and to introduce elements of a planned approach.<br><br>The move towards more homogeneity (or coordination) of regulation will surely help to mobilize private investments, but will likely not be enough to set the wheel of investments, content, and demand in motion. If the EU would manage to find funding within the boundaries of the Multiannual Financial Framework and the mandate of the EIB, this could surely help, but how much can we expect from this?<br>• The CIP can support the 'wheel' via the Information and Communication Technologies Policy Support Programme (ICT-PSP) which aims at stimulating a wider uptake of innovative ICT based services and the exploitation of digital content. This could trigger a demand for bandwidth.<br>• The "Connecting Europe Facility" has a total budget of 50 billion Euros and foresees almost 9.2 billion Euros to support investment in fast and very fast broadband networks and pan-European digital services<br>• The cooperation with the EIB in combination with the project bond initiative could mobilise another 4.2 billion Euros.<br><br>These efforts may be enough to set the 'wheel' in motion, provided that Member |

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| | States and private investors will follow up on it. The Digital Agenda pays considerable attention to involving Member States requiring them to formulate national strategies with medium term objectives serving as a basis for a reporting mechanism to monitor progression. It is not clear whether this will really lead to ownership and commitment and whether there are enforcement mechanisms that can stimulate Member States (e.g. peer review mechanisms or punish mechanisms).<br><br>In addition the EC aims to reduce risks for private investments by creating a more consistent regulatory approach. |
| On track? | Unclear at this point in time |
| More measures needed? | The Commission has implemented a comparable strategy while dealing with the challenge of climate change. On that policy issue the Commission put more effort on gaining commitment from industry and the public. This will create additional motives for national governments as well to become more committed. |
| Proportionality | Yes |

## 6.4 Case studies: what can we learn from other countries

On average, the EU is not leading in terms of value for money and pace of innovation in fixed and mobile broadband infrastructures. Yet, some of the individual Member States are among the top 10 countries. in terms of penetration rates. Also in terms of value added (or OTT) services provided over the Internet, the EU is not leading. Two cases in particular (the US and South Korea) have been looked at in more detail in order to see whether Europe can learn from experiences abroad. Obviously these case studies look back rather than forward. A more elaborate description of these cases is presented in Annex VI.

### OTT services – the US dominates, mostly

The US is the country in the world where most OTT services originate from. The US is particularly dominant in innovations at the application, platform and device layers and social media platforms. This dominant position cannot be explained by the quality and penetration of broadband – current QoS and speeds of Internet services, both fixed and mobile as well as penetration of both, are no more than average relative to Europe. Lack of standards in the past has been one of the reasons for a relatively slow development of mobile penetration. This relatively low mobile penetration has in the meantime caught up. The roll-out of fixed broadband has been hampered by, inter alia, regulatory uncertainty. Without additional incentives, innovation to improve quality-price ratios will be limited.

Notwithstanding this, OTT services are used extensively, if possible, also by people outside the US. That said, some similar services have also been developed and are in use elsewhere (e.g. Hyves, Cyworld, Skype, Voddler). In most cases, services originating from the US, if not the first in the field, tend to be the first after some time. The sheer speed of deployment – to a large extent driven by the *real* number of potential users – is typically much larger for services originating from the US.

Other factors than the quality of infrastructure should thus explain the predominance of US firms in these areas. The most relevant factors seem to be:

1. The presence of a large and rather homogeneous home market, including populous large cities, with a single language that facilitates international roll-out. States differently, there are numbers, which enable firms to benefit from network externalities. If network externalities are present the first to have substantial number often prevails;

2. Agglomeration effects related to the presence of Silicon Valley;
3. A well educated and mobile labour force;
4. A favourable business climate, including potential access to venture capital;
5. Consumers attaching great weight to present consumption.

Obviously, more factors are present, see Annex VI for a more elaborate discussion.

### Korea – leadership in equipment and deployment of national services

South Korea has achieved a remarkable turnaround from being in shambles and by most accounts a developing country in the 1950s to being a highly digitalised economy with a select number of firms exporting substantial amounts of ICT and telecommunications equipment and a high penetration of high-speed Internet. A number of factors have contributed to the country to be this successful.

1. Very dense urban areas concentrating a large majority of the national population which has reduced the cost of deployment of fibre access networks.
2. Initiatives for focussing limited resources in particular sectors have been taken at the centre of political power – the "Blue House." It should be added that in the past, Korea was often seen as being rather autocratic. Ownership for the execution of the total 'project' was firmly embedded in the government bureaucracy;
3. Execution of the plans typically took place by chaebols (industrial conglomerates consisting of a large number of firms ranging from banks to heavy industry), which compete and cooperate. The government often retained some form control over strategic decisions;
4. Government R&D centres and government funding played a large role in initial development of technology. This resulted in a focus on early standardisation (with competition in developing standards first);
5. Given the relatively small population, a combination of national demand and exports was seen as necessary to achieve enough scale to innovate and produce profitably; National demand was effectively created, but easy to ensure given the single language, and a dedicated, tech-savvy culture.

### Can Europe learn from these experiences and respond?

Many factors that have made the US (or Silicon Valley) the world leader in particular value added services and Korea prime examples of a countries which have achieved fast roll-out of high speed internet and of an industry that is export oriented produces world-class equipment.

It is questionable whether the EU can learn much from these experiences. Some of the factors contributing to the success of the two countries presented above are country specific (culture, size of the population speaking the same language) and cannot be influenced in the short or medium run. Other factors refer to policy areas not directly under control by DG INFSO (e.g. competition policy, state aid), or the Commission at large (industrial policy). Finally, some factors do not fit the EU framework. Economic dominance by a select number of industrial conglomerates, with a strong directive role of the government, does not fit with EU rules and regulation.

All in all, some lessons can be learned:

- Within limits, a more goal oriented and directing role for the EU in realising the Internal Market could be more effective than relying on the market within the current institutional arrangements. With reference to Section 6.3 we notably mention directing the process towards realising and adopting standards and directing the transition towards NGNs.
- Quick roll-out of high speed Internet throughout the Union will most likely creates economies of scale enabling the development in the EU of value added services that require such speeds.

- Supplementary policies are important. This ranges from good education to a good business environment.

## 6.5 Synthesis of our findings: Sketching a policy agenda

From the regulatory perspective, we suggest three main types of policy directions: first, the need for more regulatory harmonisation in the implementation of regulation; second, a call for more European standardisation; and third (in order to facilitate the first and second direction), the need for more 'Europeanisation' in the institutional arrangements, involving a more directing role for the EU and more regulatory oversight at European level. In addition we recognise the importance for the Internal Market of a coordinated investment path towards NGN and 4G networks. Below we elaborate on these issues, but we start by stressing the importance of complementary policies aimed at fostering EU competitiveness.

### Complementary policies

While the Internal Market perspective stands at the heart of our analysis, it is known from earlier literature[112] (and confirmed by the case of the US) that accompanying policies are needed to reap the full benefits of the Internal Market. Trade and Internal Market policies are complementary since trade policies allow the Internal Market to lead to improved exports from the EU to the rest of the world. Competition policy helps to remove national barriers. Innovation policy allows the business community as well as society at large to reap the fruits from a well functioning Internal Market. Moreover, in line with the recent Monti report, efforts are needed to harmonise Internal Market policies with other European policies, to reinforce European institutions and to build consensus to achieve the support of European citizens. Finally, the Commission needs to shift from a homogeneous legal approach (harmonisation of existing rules and adoption of directives) to a differentiated economic based approach where barriers are removed yielding the highest welfare gains. This is in particular important in the light of the heterogeneous nature of the services sector and differences in administrative capacity in Europe.

### Reducing heterogeneity in the implementation of regulation

Less heterogeneity of regulation will gain substantial benefits for the Internal Market as it reduces uncertainties for entrepreneurs at various levels in the supply chain. It also contributes to further opening up of national markets, and allows for economies of scale. This involves reducing the role that governments play as (co)owners of incumbents, more coordination in spectrum management, more consistency with respect to the regulation of Next Generation Access networks, and an EU driven and homogeneous approach to net neutrality.

#### *Actions required*

Except for spectrum management and public ownership of the incumbent, above issues typically fall within the domain of the regulatory framework. But is the current regulatory framework ready for these challenges? The regulatory framework may need a review, but this has to be placed within the wider context of the entire institutional framework (see section 6.2).

The regulation of NGN access should be analysed against the background of another (more fundamental) issue: the prospective nature of regulation. The regulatory framework recognises the dynamic character of the industry by requiring NRAs to analyse markets prospectively. The

112 See e.g. Steps towards a deeper economic integration: the Internal Market in the 21st century A contribution to the Single Market Review Ilzkovitz, Dierx, Kovacs, Sousa (DG Ecfin European Commission, 2007), Canoy, Liddle and Smith (2007) BEPA "The single market yesterday and tomorrow", M Monti (2010): A new strategy for the single market.

Commission guidelines[113] specify: "the actual period used should reflect the specific characteristics of the market and the expected timing for the next review of the relevant market by the NRA". In practice this means that the NRA's often do not look beyond the next regulatory period (i.e. 3 years ahead). Concerning NGN access and fixed-wireless convergence a more forward-looking approach is required. Looking further away into the future endangers to increase uncertainty, whereas Courts typically place the burden of proof on NRAs. How can this dilemma be solved? Striving for an integrated approach, but staying within the formalistic context of separated powers, the right level of dealing with this is the central executive power (i.e. the Commission). The EC (in cooperation with BEREC) could publish guidelines for market analysis spelling out potential risks for the sustainability of competition within the context of a general long-term prospective analysis, along with a list of possible remedies to address these risks. This would help the NRAs with their forward-looking approach by empowering them to look beyond the 3-year timeline in a holistic way (i.e. accounting for EU and global developments). NRAs can then complement their 3-year prospective analysis with an evaluation of the chances that the long-term risks materialise in the Member State and the remedies that should reduce these risks. An additional benefit of such guidelines is that it will have a harmonising effect on the implementation of regulation.

Concerning net neutrality, we identified the need to for a timely adoption of a uniform approach and that the EC and BEREC are running behind as Member States are taking own initiatives. The difficulty in formulating policy quickly is hindered by the formalistic framework creating dividing lines at 1) the institutional level between policy making and implementation and 2) at the legal level between networks and content. These dividing lines also prevent the regulatory framework to effectively respond to the new regulatory challenges, notably those stemming from increasing importance of the contractual relations between providers of content and OTT services and network operators. The separation of powers makes a system less flexible and thereby makes the second more urgent. We suggest abolishing the dividing lines in the regulatory framework. The regulatory framework should cover the dynamics in the entire value chain and set the conditions for regulating the relation between ISPs versus content/OTT service providers. Putting it differently, content and OTT service providers should be recognised as access seekers. In that case, the NRAs' exclusive competence to implement regulation may become problematic because the upper parts of the value chain (i.e. content and OTT services) have EU and global coverage. The regulatory heterogeneity that may arise due to decentralised implementation may hinder the economies of scale at the OTT level, but this problem of heterogeneity will surely reduce compared to the current regulatory setting in which the relation between ISPs and content are not regulated. Furthermore, the move towards an integrated approach will also have consequences for the local institutional landscape. NRAs do not have the competences in all Member States. For example in the Netherlands, the ministry of Education, Culture and Science and the Commission for the Media (*Commissariaat van de Media)* are responsible for formulating and enforcing policy in media affairs. One example of their tasks is the enforcement of a universal service kind of obligation imposed on broadcasters to include the public networks in the content package offered. Can the Netherlands maintain such universal service obligation within the new regulatory package or not? Should the NRA enforce it or can this remain within the sphere of influence of the Ministry?

The conflict of interests that governments experience as shareholder of incumbents was initially addressed by creating independent regulators and EU requirements that Member States endow NRAs with enough resources and with powers to gather information and the right to appeal NRA decisions. The requirement to national governments to provide enough resources turns out to be

113 Commission Guidelines of 9 July 2002 on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services, *Official Journal of the European Communities* [2002] C 165/6, henceforth the *Commission Guidelines*.

difficult to enforce. Similarly, the issue of governments using their competences (e.g. in spectrum management) to promote national champions is difficult to monitor and control by NRAs. A possible solution that we explored is to maintain the decentralised structure of implementation, but making NRAs only accountable to the European Commission: i.e. transforming the NRA's into local agencies of the Commission and finance them from the EU budget. This would also facilitate a general reduction of heterogeneity in the implementation of regulation. This idea runs into several practical difficulties and we concluded in section 6.3 that it is not proportional. The current tools available to the Commission (monitoring, signalling, public statements) are most appropriate.

### More European standardisation

The call for more standardisation refers to technical and administrative standards. The interviews identified a clear need for standardisation of IT and processes, the lack of which is frustrating pan-European services (notably towards multi-national corporations). Furthermore, the report identifies a future need for standards at TI level (notably within the managed IP domain). Failing to come to such standards will affect future pan-European roll-out (and thus development) of premium OTT services (such as E-learning, E-health, etc.). Additional benefits are that multinational corporations will be better served, making Europe a more attractive location for headquarters and production facilities; and 2) Manufacturers of telecom systems and suppliers of back office services would enjoy economies of scale because there is less need for customisation.

#### *Actions*

The Internal Market benefits from adopting a more active stand towards the adoption of pan-European standards, both with respect to IT and administrative processes, as well as TI specifications within the managed IP domain. The current market structure seems inapt to result in propriety standards because of the non-competitive nature. Furthermore, propriety standards score relatively low in terms of lessening market power, fostering global procurement, fostering economies of scale in components, increasing adoption speeds, increasing outsourcing, etc. Formal standards score much higher in these respects. How to organise effective standardisation conventions is a matter for further analysis. We suggest ETSI and CEN taking lead in this.

But even if European standards have been formulated, network operators may still have an incentive not to comply with these standards. Notably, because applying deviating standards will gain incumbents a competitive edge over foreign operators in international pan-European tenders with a big footprint in a specific country. Indeed, NRAs can enforce the adoption of pan-European standards in national WBA reference offers when SMP has been established in the national WBA markets. But, given that the ultimate objective of regulation is to make itself obsolete (sunset principle), it is unclear how NRAs can enforce uniform WBA reference offers for pan-European service providers once national WBA markets are deemed competitive – as is the case in the Netherlands. An elaborate evaluation of why the current arrangements for defining pan-European markets (article 16.5 of the Framework Directive) have never been used is required to make further recommendations.

Furthermore, to enforce TI standards within the managed IP domain we may need to formulate managed IP reference offers. Such reference offer should cover TI specifications and administrative standards for the contracts between content/OTT service providers and ISPs. This contractual relation is currently not covered by the regulatory framework. Extending the regulatory framework as to include this upstream relation may allow for imposing such reference offers, provided that the NRAs manage to define SMP in the upstream relation. In case only the incumbents were holding SMP and they can be forced to adopt the managed IP standard. In that case, the challengers will soon follow in order to be able to deliver similar OTT services to end-users. Alternatively, all ISPs are found to have an SMP on their terminating network, which also gives a basis for imposing a

standardised reference offer. However, this latter route may be problematic as it (re-)opens the discussion on data termination charges, extending the coverage of the net-neutrality debate to include traffic pricing. Furthermore, it would require making a case, subject to the three criteria test, for data termination to be included in the Commission Recommendation on markets subject to *ex ante* regulation. Even if this attempt succeeds, the type of remedy that could be imposed is not straight forward. Cost based access pricing would be very complex, the basis for bill-and-keep is thin as traffic flows are far from balanced, and a price cap of zero may lack a legal basis within the current regulatory framework as this would not be cost-based.

### Stimulating investments in NGNs and 4G networks

There is a potential incentive problem for national governments to invest/stimulate the roll-out of NGNs and 4G networks. Governments have an incentive to wait for other Member States to take initiative because they can benefit from spillovers resulting from the circular relation between investments, innovations by providers of OTT services and vendors, and demand for bandwidth and the scale that is required to set this wheel in motion. The problem applies to NGN networks as well as 4G networks. We concluded that there might be a need for a top down (i.e. orchestrated by the EC) 'kick start' of the process.

The Digital Agenda aims to realise this objective by specifying broadband targets. Furthermore, the EC is clear about its belief that a pure market-based approach will not realise these objectives and the Digital Agenda also spells out what more it intends to do as to realise these goals. The EC aims at coordinating/harmonising the regulatory approach towards NGNs thereby making the regulatory environment more consistent across member states. It reduces investment risks stemming from heterogeneity in the implementation of regulation as well as ad hoc policy making. In addition the EC aims to involve the Member States via national strategy plans. Furthermore, the Commission is exploring the options for funding high-speed broadband by: 1) seeking cooperation with the EIB 2) exploring the potential for issuing project bonds, 3) exploring options within the context of the Competitiveness and Innovation Programme (CIP) and the Trans-European Networks (TEN) regulations. This is resulted in a proposal for a new Connecting Europe Facility (CEF) for funding of transport, Energy and broadband infrastructure as part of the new Multiannual Financial Framework for 2014-2020

There are good reasons not to fully rely on a market-based approach and to introduce elements of a centralised approach. From the Korean experience, as well as when considering the European strategy for realising the climate change objectives, we have learned that centralised objectives typically require a strategy towards gaining commitment: commitment from national and local governments, commitment from industries and commitment from the public. The Digital Agenda pays attention to involving Member States via national strategy plans, yet it is unclear to what extent this in itself leads to ownership of the problem by the Member States. In this respect the funding actions of the Commission are more concrete as they are (largely) based on the co-financing principle. The Digital Agenda, and specifically the CEF proposal, is also clear in its intentions to involve the industry by attracting private funding. These intentions materialise in actions: 1) creating a single EU infrastructure fund and financial framework providing a coherent and transparent approach to EU funding offering certainty, amongst others by simplification and reduction of administrative burden and by developing a common approach to NGN regulation; 2) introducing financial instruments aimed at risk diversification; and 3) (in some occasions fully) fund investments in core service platforms or priority networks.

The strategy to realise the Digital Agenda's broadband targets seems rather comprehensive. The final touch may be to formulate a strategy in how to involve the public, for example, by making the Commission's intentions and actions more visible in the day-to-day lives of citizens. This is common

practice in projects realised within the context of cohesion, environment and transport, where the Commission places banners mentioning the involvement of the EU in realising these projects. How exactly to formulate such a communication strategy within the virtual world of e-communications falls outside the domain of this study, but it is worth exploring the option. A communication strategy aimed at the general public may contribute to the Digital Agenda gaining a more prominent place in the day-to-day lives, economy, and politics in the European Union.

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# Epilogue: A hypothetical e-world in the Europe of 2020

On the basis of the report, we sketch a hypothetical world in 2020 where all barriers than can be removed are removed. By doing so, we get a good feel, both in qualitative and in quantitative sense, for the potential gains of a well functioning Internal Market for e-communications. Hence this story sketches the global, dynamic context within which the sector is situated. Eliminating all barriers implies by its very nature a maximum claim. The associated gains and a number of the chosen developments may therefore not sketch a realistic forecast and can even be considered controversial.

### Complementary policies

While the Internal Market perspective stands at the heart of our analysis, it is known from earlier literature[114] that accompanying policies are needed to reap the full benefits of the Internal Market. Trade and Internal Market policies are complementary since trade policies allow the Internal Market to lead to improved exports from the EU to the rest of the world. Competition policy helps to remove national barriers. Innovation policy allows the business community as well as society at large to reap the fruits from a well functioning Internal Market. Moreover, in line with the recent Monti report, efforts are needed to harmonise Internal Market policies with other European policies, to reinforce European institutions and to build consensus to achieve the support of European citizens. Finally, the Commission needs to shift from a homogeneous legal approach (harmonisation of existing rules and adoption of directives) to a differentiated economic based approach, where barriers are removed that will yield the highest welfare gains. This is particularly important in the light of the heterogeneous nature of the service sector and differences in administrative capacity in Europe. Since we sketch a world where all potentials are realised we assume that all such policies are in place.

The gains in such a world have two inherently different dimensions. We describe these dimensions in an e-world of the Europe of 2020 below.

### National barriers

The first dimension has a national flavour with consequences for both static and dynamic efficiency of markets. In 2020 we assume in this hypothetical world that many countries have accomplished the level of the best performer. Efforts in opening up national markets have resulted in closing gaps, yielding gains in the form of lower prices and better service for customers in traditional services for the laggard countries (which we estimate at roughly 11 billion euro annually in terms of consumer and producer surplus).[115] Furthermore, this catching-up process has resulted in higher investment levels and innovation. Since national markets have been opened up further, the pace of investments in NGA networks has increased as additional competitors erode copper's cash cow potential. Additional measures at the European and national level support the achievement of the objectives of the Digital Agenda – in 2020 the majority of people in densely populated areas have broadband capacity up to 100 Mb/s. Rural areas are reached at speeds of 30 MB/s. This has stimulated economic growth at various levels. First, growth is generated in terms of additional

114 See e.g. Steps towards a deeper economic integration: the Internal Market in the 21st century A contribution to the Single Market Review Ilzkovitz, Dierx, Kovacs, Sousa (DG Ecfin European Commission, 2007), Canoy, Liddle and Smith (2007) BEPA "The single market yesterday and tomorrow", M Monti (2010): A new strategy for the single market.

115 This number is a maximum based on an optimistic estimate of the effect of a price decrease on mobile penetration rates.

added value of broadband connections. Second, it has yielded additional value added at the content level as a result of more intense use of broadband as a distribution channel instead of traditional distribution channels. Third, it has stimulated the creation of value added by new services using broadband as a distribution channel. Finally, the economy as a whole operates more efficiently. These effects are captured by the multiplier effect from investments in broadband driving economic growth. This effect has been estimated in various studies. We combine these estimates with the results of our own regression analysis of the effects of competition on investments. We estimate that the dynamic welfare gains from opening up national markets add up to 0.31% to 0.43% additional GPD growth.[116] In sum we estimate the annual gains from opening up national markets at a maximum of 0.44% of GDP, which is around **55 billion Euros** in terms of the current GDP level.

In order to realise these gains, the following policy measures need to be taken:

- Current efforts by NRAs within the regulatory framework need to be maintained. NRAs have to remain targeted at fostering competition. The Commission can support NRAs specifically in addressing issues that are of a political nature (e.g. resulting from governments owning shares in e-communication companies);
- Given the dynamic nature of the industry, there is a need for more prospective analyses in the NRAs' market analysis decisions. The Commission can support this via market analysis guidelines that include a long term prospective analysis spelling out the risks to sustainable competition and a list of potential remedies to mitigate these risks;
- The regulatory framework is in need of reform as to manage the contractual relations between providers of content and over-the-top services and network providers. These contractual are becoming increasingly important in the future vertical relations throughout the supply chain. The current regulatory framework cannot deal with potential competition issues that might occur here because providers of content or over-the-top services are not recognised as access seekers.

### Costs of non-Europe

The second dimension is genuinely European in flavour. It involves the (more rapid) introduction or improvement of services that require high bandwidth capacity of high quality. This increased demand for network quality and (thus) special network functions has been met with the necessary level of standardisation at WBA level, either through market-based coordination, via self-regulation or via top-down policy measures. Operators offer standardised Managed IP services allowing pan-European content/application providers not only to rely on best effort, but they also provide premium quality content via managed IP interfaces. Consequently, providers of HD/3D TV, e-Health, e-Learning, cloud computing and Machine-to-Machine services find it increasingly easy to develop a pan-European standardised service and move the knowledge intensive parts of their business to Europe. The latter also goes for multinational companies that are now better served with standardised WBA based pan-European broadband services. All this exists parallel to the open best effort IP platform.

Moreover, global developments with potentially substantial knock on effects for the European economy will land on a more fertile soil in this hypothetical world. Content is a driving force in next generation networks. Entry by new intermediaries such as content providers occurs in the value chain and the distinction between supply and demand becomes increasingly blurred. Technological convergence progresses further and new business models spur. This study has not been geared

116 This number is the maximum gain for the economy at large. It is the result of the multiplier effect on GDP growth as a result of an increase in investments (due to an increase in competition). We assumed optimistic values for the elasticity of mobile communications.

towards assessing the gains of these global developments, so that can be the subject of another study.

Productive efficiency throughout the value chain is boosted as each node in the value chain is able to focus on its core business: some network operators have divested themselves from broadcasting and voice services and where this has happened; these (and other) services are now provided by dedicated over the top service providers. Furthermore, welfare gains are not only strictly economic in nature (lower prices, better service levels, higher employment), but also translate into improvements in health (e-health), education (e-learning), and business services (cloud computing and Machine-to-Machine communication) and cultural gains (games). These are vital themes for policy makers in Europe, as reform is needed to manage future costs or to promote future growth. The Internal Market for broadband has been a tool to ease the pressure.

Because the aforementioned benefits accrue in the distant future and depend on a variety of unknown technological developments, attempts to quantify the gains can be criticised. It is also extremely difficult to assess the gains in a direct sense in a reliable way, given the combination of various uncertainties. An alternative approach is to look at the core of what defines this dimension of the Internal Market (i.e. standardisation) and look at similar examples in the past that can illustrate the potential impact. For that we remain within the topic of telecommunication. The example of standardisation in mobile telephony is illustrative of what happens if standardisation fails. Our calculations indicate that as a consequence of the GSM standard the EU15 has gained an additional growth of 0.46% of GDP each year between 1995 and 2009. Translating this to the EU27 boils down to a maximum gain of **55 billion** Euros each year. Of course we cannot simply mirror these results to other markets and time dimensions, but it gives us a feeling of the magnitude of the effects of standardisation in e-communications.

In order to realise these gains, the following policy measures need to be taken:

- Currently, there seems to be a national orientation of sector regulation; we see a clear need for institutional arrangements to bring a pan-European focus in the regulatory package.
- The Commission has to take lead in the development of standards and to foster the adoption of standards. The first can be orchestrated via ETSI and CEN. The second can be arranged via a reform of the regulatory framework to capture the contractual relations between providers of content and over-the-top services and network providers. If operators are found to have SMP they can be forced to adopt the standards in reference offers.
- Initiating investments in NGNs and 4G networks and fostering the development and adoption of next generation OTT services. This will set the ‘wheel of investments in NGNs, the innovations of services and equipment, and the demand for broadband quality’ in motion.

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# Annex I: Data sources for Chapter 4

## Country abbreviations

| | Country Code | Country Name | | Country Code | Country Name |
|---|---|---|---|---|---|
| 1 | AUS | Australia | 19 | ITA | Italy |
| 2 | AUT | Austria | 20 | JPN | Japan |
| 3 | BEL | Belgium | 21 | KOR | Korea (Rep. of) |
| 4 | CAN | Canada | 22 | LTU | Lithuania |
| 5 | CHE | Switzerland | 23 | LUX | Luxembourg |
| 6 | CYP | Cyprus | 24 | LVA | Latvia |
| 7 | CZE | Czech Republic | 25 | MLT | Malta |
| 8 | DEU | Germany | 26 | NLD | Netherlands |
| 9 | DNK | Denmark | 27 | NOR | Norway |
| 10 | ESP | Spain | 28 | NZL | New Zealand |
| 11 | EST | Estonia | 29 | POL | Poland |
| 12 | FIN | Finland | 30 | PRT | Portugal |
| 13 | FRA | France | 31 | ROM | Romania |
| 14 | GBR | United Kingdom | 32 | SVK | Slovak Republic |
| 15 | GRC | Greece | 33 | SVN | Slovenia |
| 16 | HUN | Hungary | 34 | SWE | Sweden |
| 17 | IRL | Ireland | 35 | TUR | Turkey |
| 18 | ISL | Iceland | 36 | USA | United States |

## Description of the data

| | | Source | | Coverage | | | |
|---|---|---|---|---|---|---|---|
| | | main | second | years | non-EU countries | EU countries | Observations |
| GDP | GDP | ITU | OECD | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 (AUT, BEL, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HUN, IRL, ITA, LTU, LUX, LVA, MLT, NLD, POL, PRT, ROM, SVK, SVN, SWE) | 540 |
| rev_t | Total revenues of telecom sector | ITU | OECD | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 539 |
| inv_t | Total investments of telecom sector | ITU | OECD | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 528 |

| | | Source | | Coverage | | | |
|---|---|---|---|---|---|---|---|
| rev_m | Revenues of mobile operators | ITU | OECD | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 375 |
| rev_f | Revenues of fixed operators | ITU | OECD | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 384 |
| inv_m | Investments of mobile operators | ITU | OECD | 1995-2009 | CAN, CHE, ISL, KOR, TUR, USA | AUT, BEL, CYP, CZE, DEU, DNK, ESP, EST, FRA, GBR, GRC, HUN, ITA, LTU, LUX, LVA, MLT, POL, PRT, ROM, SVK, SVN, SWE | 201 |
| inv_f | Investments of fixed operators | ITU | OECD | 1995-2009 | CAN, CHE, ISL, KOR, TUR | AUT, BEL, CYP, CZE, DNK, ESP, EST, FRA, GRC, HUN, ITA, LTU, LUX, LVA, MLT, PRT, ROM, SVK, SVN, SWE | 219 |
| FTE | Total FTE working in telecom sector | ITU | | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 528 |
| LAB[1] | total wage bill of telecom sector | own calculations | OECD | 1995-2007 | AUS, CAN, JPN, KOR, USA | AUT, BEL, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HUN, IRL, ITA, LTU, LUX, LVA, MLT, NLD, POL, PRT, SVK, SVN, SWE | 382 |
| Households | Number of households | ITU | OECD | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 540 |
| Population<br><br>Or<br><br>CAP | Total population | ITU | OECD | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 540 |
| Urbanisation | % of population living in urban areas | ITU | OECD | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 540 |
| BBpen | % of population with mobile broadband access | ITU | OECD | 1998-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 359 |

| | | Source | | Coverage | | | |
|---|---|---|---|---|---|---|---|
| Mob BB | % of population with broadband access | ITU | OECD | 2001-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 199 |
| hhi_f[2] | HHI fixed broadband (connections) | ECTA broadband score card | | 2001-2009 | | AUT, BEL, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HUN, IRL, ITA, LTU, LUX, LVA, MLT, NLD, POL, PRT, SVN, SWE | 183 |
| hhi_m[3] | HHI mobile (connections) | GSMA (wireless intelligence) | | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 466 |
| ms_ne_f[4] | Market share of new entrants in fixed trunk telephony | OECD | | 1995-2007 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | AUT, BEL, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HUN, IRL, ITA, LUX, NLD, POL, PRT, SVK, SVN, SWE | 379 |
| No_op_m | Number of mobile operators | GSMA (wireless intelligence) | | 1996-2009 | CHE, ISL, NOR | AUT, BEL, CYP, DEU, DNK, ESP, FIN, FRA, GBR, GRC, IRL, ITA, LUX, MLT, NLD, PRT, SWE | 276 |
| i91fixedte~a | Fixed telephone lines per 100 | ITU | | 1995-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 540 |
| i911mobile~p | Mobile cellular subscriptions per 100 | ITU | | 2000-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 277 |
| Fixed broadband access | Total fixed broadband subscription | ITU | | 1997-2009 | AUS, CAN, CHE, ISL, JPN, KOR, NOR, NZL, TUR, USA | EU 26 | 403 |

Notes:

1 On the basis of EU KLEMS data on labour compensation in post and telecom, combined with total FTE reported by ITU.
2 On the basis of number of connections reported by ECTA, differentiating between incumbents, DSL competitors and cable.
3 On the basis of penetration rates of individual operators as reported by GSMA.
4 http://www.oecd.org/dataoecd/47/47/42480303.xl
s

# Annex II: Regression analysis Chapter 4

## Regressions

### Mobile networks

*Static efficiency gains*

First we analyse the relationship between market concentration and ARPU for mobile. Table A-1 shows the results. We employ fixed effects regression techniques, in order to take account of unobserved heterogeneity across countries and to exploit the panel data character. Regression (1) shows a basic regression where only the HHI for mobile is included as control variable. The results imply an upward sloping relationship between HHI and ARPU. This is in line with expectations: telecom operators in markets that are more concentrated (higher HHI) can charge higher prices for their services to customers. The coefficient for HHI is highly statistically significant. Per capita income is likely to influence ARPU, as mobile services may be a luxury good. This is confirmed in the second regression. Also, the coefficient for HHI increases. Year dummies are added in regression (3). This greatly improves the fit ($R^2$). However, the HHI coefficient turns insignificant, possibly because of multicollinearity problems. In model (4) we have included the natural logarithm of the HHI and now the coefficient is (marginally) significant (p = 0,048), and the fit improves somewhat. Finally, we added population and number of households to the model. This resulted in a more significant coefficient for market concentration and a slightly higher $R^2$. To see if this model is better, we calculated the CHI squared statistic via the log likelihood values of the two models. This shows that the latter model is significantly better than the first ($X^2_{df=1}$ = 5.52, *p* = 0,0188). **Regression (5) is thus the preferred model.**

**Table A-1 Relationship between market concentration and ARPU for mobile (Fixed Effects estimation technique)**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| VARIABLES | arpu_m | arpu_m | arpu_m | arpu_m | arpu_m |
| hhi_m | 0.05537*** | 0.07050*** | 0.005954 | | |
| | (0.006226) | (0.006826) | (0.007187) | | |
| ln(hhi_m) | | | | 91.095** | *118.72*** |
| | | | | (45.779) | (45.935) |
| gdp_cap | | 0.004772*** | 0.006664*** | 0.006578*** | 0.006184*** |
| | | (0.001018) | (0.001293) | (0.001286) | (0.001272) |
| Households | | | | | 5.870e-05*** |
| | | | | | (1.879e-05) |
| Year dummies | No | No | Yes | Yes | Yes |
| Observations | 320 | 320 | 320 | 320 | 320 |
| R-squared (within) | 0.213 | 0.268 | 0.602 | 0.606 | 0.619 |
| Number of countries | 26 | 26 | 26 | 26 | 26 |
| Log likelihood | -2040.5 | -2028.9 | -1931.5 | -1929.6 | -1924.1 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Dynamic efficiency gains – macro*

Next we evaluate the EU mobile market in terms of dynamic efficiency. That is, we look at the econometric relationship between market concentration and investments. In this context it is

important to distinguish between investment data at macro-level (i.e. investment per capita by mobile operators) and at firm-level. We first look at macro-data. Results are presented in Table A-2.

**Table A-2 Relationship between market concentration and per capita investment for mobile (Fixed Effects estimation technique)**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | invmcap | invmcap | invmcap | invmcap |
| | | | | |
| hhi_m | -0.006896*** | -5.915e-04 | 0.01917** | 0.01985*** |
| | (0.001546) | (0.001774) | (0.007475) | (0.007510) |
| hhi_m2 | | | -1.438e-06*** | -1.539e-06*** |
| | | | (5.290e-07) | (5.395e-07) |
| gdp_cap | | | | -2.270e-04 |
| | | | | (2.355e-04) |
| Year dummies | No | Yes | Yes | Yes |
| Observations | 143 | 143 | 143 | 143 |
| R-squared (within) | 0.142 | 0.454 | 0.489 | 0.493 |
| Number of countries | 22 | 22 | 22 | 22 |
| Log likelihood | -578.48 | -546.23 | -541.45 | -540.83 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Model (1) is again our basic regression, with HHI as the sole explanatory variable. A significantly negative coefficient is found: increases in market concentration are according to this result associated with a reduction in per capita investments. Investments may be influenced by year effects. To account for time we have included year dummies in model (2). This improves the model's fit, but it renders the HHI coefficient insignificant. This may be due to the parabolic effect which is present in the data, but not in the estimated model. Therefore, in model (3) we have added a squared HHI term to the model, and this greatly improves the significance of the HHI terms. This confirms the presence of a non-linear relationship between market concentration and investments. Also the $R^2$ is higher. In model (4) GDP per capita is included in the model, and a slightly higher $R^2$ is obtained. This does not result in a better model ($X^2_{df=1} = 0.624$, $p = 0.430$). Similar sensitivity checks are performed by including population, households or revenue as percentage of GDP as explanatory variables. However, this also did not result in better models. The preferred model is thus model (3). In this context we make reference to the earlier mentioned literature on the relationship between investments and intensity of competition, where a commonly heard claim is that there exists an inverted U relationship.

A further inspection of the data reveals that the results may be affected by Luxembourg, which is a kind of outlier in the data set. In order to check the sensitivity of our regression results presented in Table A-2, we have redone the four regressions excluding Luxembourg. The results are presented in Table A-3. Indeed, the results change drastically. The earlier presented evidence for the emergence of an inverted U-relationship between market concentration and per capita investments completely vanishes: the HHI terms (linear and squared) in regression (3) and (4) turn insignificant. The results from the basic regression (reported in model (1)) are similar to those in Table A-2, though the coefficient is now only marginally significant (i.e. at the 10%-level). Significance is lost when time dummies are included, see model (2). We then come to the following conclusion. When investigating the relationship between market concentration and per capita investments we find no robust evidence for an inverted U-relationship. If we can conclude anything from our regressions, it is that there may be a negative relationship between market concentration and investments: per

capita investments tend to be lower in more concentrated markets. However, also this conclusion cannot be written in stone and the result is not very robust. **All in all, our preferred regression model is (1) without Luxembourg.**

**Table A-3 Relationship between market concentration and per capita investment for mobile (Fixed Effects estimation technique), excluding Luxembourg**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | invmcap | invmcap | invmcap | invmcap |
| | | | | |
| hhi_m | *-0.003307** | 0.001958 | 0.009020 | 0.006703 |
| | (0.001913) | (0.001876) | (0.008086) | (0.008243) |
| hhi_m2 | | | -5.479e-07 | -3.833e-07 |
| | | | (6.101e-07) | (6.204e-07) |
| gdp_cap | | | | -8.034e-04 |
| | | | | (6.066e-04) |
| Year dummies | No | Yes | Yes | Yes |
| Observations | 134 | 134 | 134 | 134 |
| R-squared (within) | 0.026 | 0.433 | 0.437 | 0.447 |
| Number of countries | 21 | 21 | 21 | 21 |
| Log likelihood | -537.27 | -501.06 | -500.52 | -499.33 |

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

### Dynamic efficiency gains – firm-level

The third and final step for mobile is to investigate the relationship between market concentration and investments by firms. Table A-4 reports our findings.

**Table A-4 Relationship between market concentration and investment per mobile operator (Fixed Effects estimation technique)**

| | (1) | (2) | (3) | (4) | (4) |
|---|---|---|---|---|---|
| VARIABLES | inv_mop_cap | inv_mop_cap | inv_mop_cap | inv_mop_cap | inv_mop_cap |
| hhi_m | -0.002463*** | -5.948e-04 | 0.01818*** | 0.01566*** | 0.008364* |
| | (6.563e-04) | (0.001085) | (0.004562) | (0.004466) | (0.004827) |
| hhi_m2 | | | -1.237e-06*** | -1.196e-06*** | -5.733e-07* |
| | | | (2.936e-07) | (2.882e-07) | (3.331e-07) |
| gdp_cap | | | | -3.285e-04*** | -4.245e-04 |
| | | | | (1.068e-04) | (3.205e-04) |
| households | | | | -2.395e-06 | -2.418e-06 |
| | | | | (1.750e-06) | (1.568e-06) |
| Year dummies | No | Yes | Yes | Yes | Yes |
| Observations | 100 | 100 | 100 | 100 | 91 |
| R-squared (within) | 0.142 | 0.292 | 0.432 | 0.503 | 0.419 |
| Number of countries | 14 | 14 | 14 | 14 | 13 |
| Log likelihood | -303.49 | -293.90 | -282.88 | -276.18 | -239.62 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Model (1) is the basic regression model with only HHI as regressor. As in Table A-2, the coefficient of HHI is negative. Year dummies are included in model (2). This increases the $R^2$ statistic, but turns the coefficient of HHI insignificant. This may again be due to the parabolic effect that is present in the data, but not in the estimated model. Inclusion of a quadratic HHI term in the model greatly improves the significance of the HHI terms, confirming the presence of non-linearity in the

data. Also the $R^2$ is higher (cf. model (3)). Investments may be influenced by GDP per capita, and by the number of households. Indeed in model (4) a higher $R^2$ is obtained. This does also result in a better model ($X^2_{df=2} = 6.701$, $p = 0.0096$). Inclusion of population or revenue as percentage of GDP as explanatory variable did not result in better models. **The preferred regression is model (4).** However, when the outlier Luxembourg is excluded from the model, the HHI terms become only marginally significant (cf. model (5)). These results thus indicate that there might be a trade-off between static and dynamic efficiency. *Also, most observations are on the upward sloping segment of the curve, implying that increased concentration goes hand in hand with increased investments by mobile operators.*

### Fixed networks

For fixed we may need to distinguish between high and low urbanised countries. This will be taken up in the draft final report.

#### *Static efficiency gains*

Now we turn to fixed. It should be noticed that for fixed no data is available on the HHI, so that we have to resort to another indicator for market concentration.[117] We use the market share of new entrants, which can be interpreted as a proxy for contestability: a high market share of new entrants indicates contestability, and implies fiercer competition. Table A-5 presents the regression results.

**Table A-5 Relationship between market concentration and ARPU for fixed (Fixed Effects estimation technique)**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| VARIABLES | arpu_f | arpu_f | arpu_f | arpu_f | arpu_f | arpu_f |
| ms_ne_f | -3.0897*** | -2.3456** | -2.3542** | -2.2410*** | -3.6505** | |
| | (0.5600) | (0.9357) | (0.9414) | (0.7278) | (1.5337) | |
| lnms_ne_f | | | | | | -10.292 |
| | | | | | | (36.120) |
| gdp_cap | | | -1.744e-04 | | | |
| | | | (0.001660) | | | |
| rev_fperc | | | | 28,555*** | | |
| | | | | (2,400.9) | | |
| inv_fperc | | | | | -2,919.7 | 4,039.7 |
| | | | | | (4,528.2) | (14,762) |
| Year dummies | No | Yes | Yes | Yes | Yes | Yes |
| Observations | 249 | 249 | 249 | 249 | 108 | 77 |
| R-squared (within) | 0.118 | 0.282 | 0.282 | 0.568 | 0.303 | 0.158 |
| Number of countries | 21 | 21 | 21 | 21 | 14 | 13 |
| Log likelihood | -1511.4 | -1485.7 | -1485.7 | -1422.5 | -620.37 | -449.70 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Model (1) is the basic regression model. From this model we learn that a higher market share of new entrants is associated with lower ARPU. This is in line with intuition. Year dummies are included in model (2). The fit of the model improves importantly. Again we find a negative effect of the market share of new entrants, though the coefficient is slightly lower. Per capita income levels may impact ARPU, though such a relationship is not confirmed in model (3). In fact, this model

117 We did find data with ECTA. Problem is that it concerns the broadband segment where ARPU and investments relate to the total industry. The reported MS of new entrants by the OECD as an explanatory variable corresponds better to ARPU and investments for the total industry.

appears not to be better than the model without GDP per capita ($X^2_{df=1}$ = 0.00647, $p$ = 0.9358). The same conclusion holds true for including population or households. Including revenue as percentage of GDP does make a huge difference, although the explanatory power of this model might not be very strong (explaining revenue/user by revenue/GDP). Model (5) includes investments. The idea here is that higher investment levels may cause operators to increase the prices to earn back the investments, or because the operator can differentiate itself from its competitors. Higher investments might also negatively correlate with ARPU, to the extent that these higher investments reflect more competition. The market share of new entrants is now marginally significant. Finally, to investigate the linearity assumption, we have included in model (6) a logarithmic transformation of the market concentration indicator, but this variable shows up with an insignificant regression coefficient. **Our preferred regression specification is model (2).**

*Dynamic efficiency gains*

Table A-6 reports the econometric results regarding the impact of the market share of new entrants on per capita investments in fixed broadband.

**Table A-6 Relationship between market concentration and per capita investment for fixed (Fixed Effects estimation technique)**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| VARIABLES | invf_cap | invf_cap | invf_cap | invf_cap | invf_cap | invf_cap |
| ms_ne_f | 0.1014 | -0.2242 | -0.2651 | -0.2138 | 0.03959 | |
| | (0.2254) | (0.3940) | (0.3776) | (0.3482) | (0.3495) | |
| Ln(ms_ne_f) | | | | | | -8.5657 |
| | | | | | | (5.6618) |
| gdp_cap | | | 0.001288*** | 0.001547*** | 0.001832*** | 0.001898*** |
| | | | (4.472e-04) | (4.174e-04) | (4.567e-04) | (5.051$^e$-04) |
| households | | | | 2.685e-05*** | 3.072e-05*** | -1.375$^e$-05 |
| | | | | (6.878e-06) | (7.070e-06) | (1.111$^e$-05) |
| LAB | | | | | -8,623.2** | 3,111.5 |
| | | | | | (4,060.2) | (4,954.7) |
| Year dummies | No | Yes | Yes | Yes | Yes | Yes |
| Observations | 109 | 109 | 109 | 109 | 107 | 76 |
| R-squared (within) | 0.002 | 0.144 | 0.224 | 0.350 | 0.387 | 0.459 |
| Number of countries | 15 | 15 | 15 | 15 | 15 | 14 |
| Log likelihood | -486.58 | -478.25 | -472.88 | -463.26 | -450.04 | -303.33 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Model (1) is again the basic regression model. The market concentration variable shows up with an insignificant coefficient. The introduction of time dummies in model (2) does not change this result. Inclusion of GDP per capita (model 3), households (model 4), and labour costs in the telecom sector as percentage of GDP (model 5) all add explanatory power to the regressions, but the coefficient for the market share of new entrants remains insignificant. High labour costs result in lower investment levels. It may be that in countries with low labour costs (lower income countries) a catching up effect is present. Finally, in model (6) the market concentration index is included in logarithmic form. To conclude: **the market share of new entrants does not influence the total investment levels.**

## Calculation of welfare gains

This section presents the calculation of the potential welfare gains that can be reached if a truly Internal Market for e-communications is achieved. Again we make the distinction between mobile and fixed. To determine the starting positions, we use the observed values of each explanatory variable for the years 2007 and 2009 (for fixed and mobile respectively). We calculate the weighted average HHI or market shares in the EU in the respective base year (weighted against population). Next we determine the weighted average values of the other variables in the regression functions. Using the regression functions we subsequently calculate the average level of performance in the EU (in terms of ARPU and investments). We then assume that all Member States (and thus the EU average) move towards the best performing country in terms of HHI or market share of new entrants. We carry out a 'what if analysis', thereby concentrating on movements *along* the curve.[118] In particular, we construct the situation with increased competition using the assumption that all countries can achieve the lowest market concentration as observed in the data.

### Mobile networks

The base year for mobile is 2009. The regression results that have been used in the calculation of the welfare effects are in italic in the tables.

#### *Part A: Static welfare effects*

Prices in period 0 (2009 situation) and 1 (increased competition) are determined using the regression function:

**Arpu_m= ln(HHI_m)* 118.72 + …**

and plugging in the values from the table above - for HHI_m: 3335 (for period 0) and 2248 (for period 1).

The number of subscriptions in period 0 is calculated using the function:

**NoS0 = Mobile penetration rate/100 * population * 26**

Assuming an elasticity of -0.5[119] the number of subscriptions in period 1 is determined by:

**NoS1=(1+( ε *-(arpu_m0-arpu_m1)/ arpu_m0))*NoS0**

Welfare in terms of consumer surplus and producer surplus is subsequently calculated by using the functions:

$$\Delta cs = n_o(p_0 - p_1) + 1/2(n_1 - n_0)(p_0 - p_1)$$

$$\Delta ps = n_0\big((c_0 - c_1) - (p_0 - p_1)\big) + (n_1 - n_0)(p_1 - c_1)$$

$$\Delta \omega = n_0(c_0 - c_1) + 1/2(n_1 - n_0)(p_0 - p_1) + (n_1 - n_0)(p_1 - c_1)$$

in which we assume that $c_0 = c_1 = 100$[120]. Table A-7 shows the results.

118 The 'curve' being the identified regression lines between market concentration indices and the performance indicators for static and dynamic efficiency.

119 See Jerry Hausman (1997), "Valuation and the Effect of Regulation on New Services in Telecommunications," *Brookings Papers on Economic Activity: Microeconomics*.

120 This value is assumed on the basis of a model developed by OPTA for calculating the effects of regulating mobile terminating rates (OPTA, 2010 marktbesluit MTA/FTA, Annex E)

**Table A-7 Static welfare effects, mobile**

| Variables and factors | Values |
|---|---|
| hhi_m0 | 3335 |
| hhi_m1 | 2248 |
| Elasticity of demand | -0.5 |
| N0: Number of connections t=0 | 620 million |
| N1: Number of connections t=1 | 640 million |
| P0: Average revenue per user t=0 | 739 |
| P1: Average revenue per user t=1 | 693 |
| C0,1: Average costs t=1=0 | 100 |
| **Welfare components** | **Change** |
| Change in consumer surplus (% of GDP) | 0.17% |
| Change in producer surplus (% of GDP) | -0.10% |
| **Sum** | **0.07%** |

*Part B: Dynamic welfare effects*

Investment levels in period 0 and 1 are determined using the regression function:
*Investments/cap = ln(HHI_m)* (-40.17808) +3.78E+02*
and plugging in the values from the table above - for HHI_m: 3335 (for period 0) and 2248 (for period 1).

Please notice that we have imputed here a negative impact of HHI on investments while the regression results in Table A-4 also indicated the possibility of an inverted U-relationship. As we have argued we indeed believe that this should be the conclusion from our regression analysis. We also concluded that this result is not very robust. We will come back to this issue below.

Crandall and Singer (2009) find a wireless broadband multiplier of 2.8739, implying that every additional Euro invested in wireless broadband infrastructure results in a € 2.8739 increase in GDP. Furthermore, Waverman, Meschi and Fuss (2005) find that a 1% increase in mobile penetration leads to a 0.03% of additional GDP in high-income countries.

Table A-8 shows the impact on welfare (in terms of GDP).

**Table A-8 Dynamic welfare effects, mobile**

| Variables and factors | Values |
|---|---|
| A: Change in penetration rates (%) | 3.2% |
| B: Change in investments per capita | 4 |
| C: Weighted average GDP per capita | 36,330 |
| D: GDP effect from 1 Euro invested | 2.8739 |
| E: GDP effect from 1% increase in penetration rate | 0.03% |
| **Welfare effects** | |
| **Sum of GDP effect (% of GDP)**[121] | **0.13%** |

Table A-9 presents the total welfare change.

121 $(A \times E) + \frac{B \times D}{C} \times 100$

**Table A-9 Total welfare change, mobile**

| Welfare | % of GDP |
|---|---|
| Static | 0.07% |
| Dynamic | 0.13% |
| **Sum** | **0.20%** |

As mentioned above the empirical relationship between market concentration and per capita investments is not very robust. To be on the conservative side, one may conclude that the total welfare gain is equal to the static welfare gain, and that the total welfare gain can be higher if the increase in competition also spurs per capita investments.

### Fixed networks

The text for fixed still has to be completed but here are the results. Please notice that we have not included any dynamic welfare effects for fixed resulting from an increase in investments, because we failed to find a relationship between market concentration and per capita investments for fixed. We do account for a GDP growth effect resulting from an increase in broadband penetration. Czernich et al. (2009) suggest that a 10 percentage-point increase in the broadband penetration rate results in a 0.9-1.5 percentage-point increase in annual per-capita growth.

**Table A-10 Static welfare effects, fixed**

| Variables and factors | Values |
|---|---|
| ms_ne_f0 | 35 |
| ms_ne_f1 | 49 |
| Elasticity of demand | -0.5 |
| N0: Number of connections t=0 | 200 million |
| N1: Number of connections t=1 | 203 million |
| P0: Average revenue per user t=0 | 997 |
| P1: Average revenue per user t=1 | 964 |
| C0,1: Average costs t=1=0 | 200 |
| A: Change in penetration rates (%) | 2 |
| B: Change in investments per capita | No significant regression found |
| C: Weighted average GDP per capita | 36,330 |
| D: GDP effect from 1 Euro invested | 2.8739 |
| E: GDP effect from 1% increase in penetration rate | 0.09%-0.15% |
| **Welfare components** | **Change** |
| Change in consumer surplus (% of GDP) | 0.04% |
| Change in producer surplus (% of GDP) | -0.02% |
| Sum of GDP effect (% of GDP) | 0,2%-0,32% |
| **Sum** | **0.22% - 0.34%** |

# Annex III: Interviews

This Annex provides background information on the interviews we have conducted. Table A-11 presents the list of interviewees.

**Table A-11 List of organisations interviewed, functions of interviewees and scope of the operation**

| | Date of the interview | Organisation | Function interviewee(s) | Scope of operation in 2011 |
|---|---|---|---|---|
| 1. | 2011-02-23 | Venus & Mercury | Founder | NL based. Mobile entrant |
| 2. | 2011-04-04 | OECD | Head of telecommunications section and staff | Organisation for Economic Cooperation and Development |
| 3. | 2011-04-05 | KPN | VP Strategy and business development and Head Regulatory Affairs | Fixed and mobile incumbent in The Netherlands, MNO in Germany and Belgium, MVNO in France and Spain. ISP |
| 4. | 2011-04-06 | Mobile Unify | Founder and CEO | NL based. MNO entrant in Switzerland. MVNO in Germany, Netherlands, UK |
| 5. | 2011-04-12 | INTUG | Former Executive Vice President | International Telecommunications User Group |
| 6. | 2011-04-13 | WIND | Head corporate strategy and Head regulatory affairs | Local mobile and fixed broadband entrant in Italy. ISP |
| 7. | 2011-04-13 | SURFnet | Founder Director | NL based. Operator national part of worldwide scientific e-coms network |
| 8. | 2011-04-14 | TDC | Senior advisor, Regulatory Affairs | Fixed (including CATV) and mobile incumbent in Denmark, alternative operator in the Nordic/business markets |
| 9. | 2011-04-14 | Telecom Austria | Head Regulatory Affairs | Fixed and mobile incumbent Austria, Central and Eastern Europe fixed and mobile, Data-Mobile across EU. ISP |
| 10. | 2011-04-18 | TeliaSonera | Regulatory Affairs expert on fixed and expert on mobile | Fixed and mobile incumbent in Sweden and Finland, concentrating on Nordic/Baltic Region for mobile and some fixed. Spain mobile. International carrier. ISP |
| 11. | 2011-04-19 | IT services provider | Business development manager Benelux | IT services provider to MNC |
| 12. | 2011-04-20 | BT Global Services | Corp. Head Regulatory Affairs and Benelux Head Regulatory affairs | UK based incumbent fixed. International carrier, MANs. Service to MNCs |
| 13. | 2011-04-21 | Swisscom | Director strategy | Fixed and mobile incumbent in Switzerland. Hospitality services EU wide. Fastweb BB entrant Italy. Hungary entrant broadcasting. ISP |
| 14. | 2011-04-26 | INTUG | Executive Vice President | International Telecommunications User Group |
| 15. | 2011-04-27 | Nokia | Head Regulatory Affairs | Finland based. Applications and content platform provider. EU wide |

| | | | | |
|---|---|---|---|---|
| 16. | 2011-05-03 | Vodafone | Head Regulatory Affairs | UK based. Early entrant mobile. Mobile service provider, plus limited fixed. World-wide operations. ISP |
| 17. | 2011-05-03 | Liberty Global (UPC) | Head Regulatory Affairs | USA based. Cable operator, USA and Europe. ISP |
| 18. | 2011-05-03 | OTE | Head Regulatory Affairs | Fixed and mobile incumbent in Greece. Entrant fixed and mobile in Balkan. ISP |
| 19. | 2011-05-04 | Verizon Business | Head Regulatory Affairs Europe | USA based. International carrier. Backbones and MANs. Service to MNCs |
| 20. | 2011-05-05 | Tele2 | Head Regulatory Affairs | Early entrant Sweden. Fixed and mobile entrant in Europe. ISP |
| 21. | 2011-05-10 | BEREC | Working Group on EU-IM project | Body of European Regulators for Electronic Communications |
| 22. | 2011-05-10 | ECTA | Membership Meeting | European Competitive Telecommunications Association |
| 23. | 2011-05-16 | DT | VP Regulatory affairs | Fixed and mobile incumbent in Germany. MNO in Austria, Bulgaria, Hungary, Czech Rep., Slovak Rep., Romania, The Netherlands, Poland and USA (until recent). Share in incumbent OTE. ISP/ICT-provider T-Online operating in Germany, The Netherlands. Hungary, Austria, Switzerland and formerly France and Spain. T-Systems for ICT solutions |
| 24. | 2011-05-23 | NPO | Manager R&D | National broadcasting provider, Internet content provider |
| 25. | 2011-05-30 | Telefonica | Head Regulatory Affairs, and representative Strategy Department Telefonica Corporate | Fixed and mobile incumbent in Spain. Fixed operator in Czech Rep. MNO in Germany, Czech Rep., Slovak Rep., Ireland, Mexico, Caribbean, and Latin America. ISP TerraLycos operating in Spain. TIWS international wholesale |
| 26. | 2011-06-07 | FT | Head Regulatory Affairs and representative. Strategy Department Orange | Fixed and mobile incumbent in France. MNO operator in UK, Spain, Poland, Switzerland, Africa, Latin America, Asia. ISP operating in France. Former cable in the Netherlands |
| 27. | 2011-06-08 | Bouygues Telecom | Legal Director | MNO entrant in France, including fixed broadband and ISP. Former MNO in (French) Caribbean |
| 28. | 2011-06-14 | Beltug | Director | Belgian Telecommunications User Group |
| 29. | 2011-06-17 | BEUC | Director | European Consumers' Organisation |
| 30. | 2011-08-18 | Voddler | Director | Multi country OTT Video on Demand service provider |
| 31. | 2011-09-02 | EuroVoD | Director | Multi country OTT Video on Demand service provider |
| 32. | 2011-09-16 | IP TV | Member of the Board | Association of Italian ISP/IPTV providers |
| 33. | 2011-09-20 | Pathe NL | Deputy Managing Director | Cinema corporation with VoD aspirations |
| 34. | 2011-10-12 | Florence School of regulation | Communications & Media Area Director | Academic research institute |

| | | | | |
|---|---|---|---|---|
| 35. | 2011-10-12 | Disney | VP Global Policy | Global entertainment company |

# Annex IV: Overview of interview results

<table>
<tr><th>Item</th><th>Description of the barrier</th><th>#</th></tr>
<tr><td>A</td><td colspan="2">Barrier related to e-communications regulation</td></tr>
<tr><td>1.</td><td colspan="2">Lack of homogeneity in the implementation of EC regulatory package.<br>Interpretation of the barrier<br>This barrier leads to replicate costs at each entry (up to 27x). The costs are largely invariable to volume. These are upfront costs. This is a disproportionate barrier, affecting entrants most. The barrier tends to increase with introduction of each new rule.<br>Heterogeneity is incompatible with fast product upgrade cycle of applications. Introduction of products with relatively small margins is not viable.<br>The barrier also leads to differences in introduction dates for new regulations, affecting pan-European role out of services.<br>Removal of the barrier lowers systems adaptation costs and operational costs, improves market entry conditions, and improves innovation conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effic.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>++</td><td>+</td><td>-</td><td>-</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by a broad category of operators. For larger, financially stronger players (in their home country) this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>13</td></tr>
<tr><td>2.</td><td colspan="2">Lack of homogeneity in the implementation of EC regulatory package in Member States, in relation to different costing/pricing models being applied.<br>Interpretation of the barrier<br>This barrier leads to different outcome of NRA assessments under the same market conditions.[122] For effective interaction with NRA, operators need to understand the models in detail. Leads to replicate learning costs at each entry. Costs are largely invariable to volume. Upfront costs. Is a disproportionate barrier, affecting entrants most?<br>Removal lowers systems adaptation costs and operational costs, improves market entry conditions, and improves innovation conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>□</td><td>□</td><td>-</td><td>□</td></tr>
</table>
Qualitative impact of removing the barrier<br>In NRA practice only a few different models are in use. This barrier is mostly identified by the smaller operators. For larger, financially stronger players this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>2</td></tr>
</table>

122 This assessment does not cover any difference in the model being applied, their outcomes, and how this may affect market entry.

<table>
<tr><td>3.</td><td>Lack of homogeneity in the implementation of EC regulatory package in Member States, in relation to different implementation requirements for data retention, incl. differences in response times.<br>Interpretation of the barrier<br>This barrier leads to replicate adaptation costs at each entry (up to 27x). Prevents consolidation of function across Member States. The costs are largely invariable to volume. These are upfront costs. This is a disproportionate barrier, affecting entrants most.<br>Removal lowers systems adaptation costs and operational costs and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>□</td><td>-</td><td>-</td><td>□</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the smaller operators. For larger, financially stronger players this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>4</td></tr>
<tr><td>4.</td><td>Lack of homogeneity in the implementation of EC regulatory package in Member States, in relation to different implementation requirements for number portability.<br>Interpretation of the barrier<br>This barrier leads to replicate adaptation costs at each entry (up to 27x). The costs are largely invariable to volume. These are upfront costs. This is a disproportionate barrier, affecting entrants most.<br>Removal lowers systems adaptation costs and operational costs and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>□</td><td>-</td><td>-</td><td>□</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the smaller mobile operator. For larger, financially stronger players this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>1</td></tr>
<tr><td>5.</td><td>Lack of homogeneity in the implementation of EC regulatory package in Member States, in relation to different implementation requirements for lawful intercept.<br>Interpretation of the barrier<br>This barrier leads to replicate adaptation costs at each entry (up to 27x). Prevents consolidation of function across Member States. The costs are largely invariable to volume. These are upfront costs. This is a disproportionate barrier, affecting entrants most.<br>Removal lowers systems adaptation costs and operational costs and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>□</td><td>-</td><td>-</td><td>□</td></tr>
</table>
Qualitative impact of removing the barrier</td><td>2</td></tr>
</table>

<table>
<tr><td></td><td>This barrier is identified by the smaller operators. For larger, financially stronger players this is a barrier of less significance and could be considered as a deterrent to entry.</td><td></td></tr>
<tr><td>6.</td><td>Lack of sufficient coordination in radio spectrum allocations to accommodate growth under LTE in a timely manner.<br>Interpretation of the barrier<br>This barrier will hinder full deployment of broadband mobile services. It will lead to underinvestment. The lack of sufficient coordination will lead to heterogeneity in auction conditions across Member States.<br>Removal of the barrier will facilitate competition, improve innovation conditions and may improve market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>+</td><td>-</td><td>-</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the large mobile operator.</td><td>1</td></tr>
<tr><td>7.</td><td>Different requirements across Member States on handling and/or providing location information related to emergency service calls (112), including in VoIP environment.<br>Interpretation of the barrier<br>This barrier leads to replicate costs at each entry (up to 27x). This barrier hinders consolidation of call handling across Member States. The barrier is upfront capex and on-going opex related. This is a disproportionate barrier, affecting entrants most.<br>Removal of the barrier lowers systems adaptation costs and operational costs, and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>□</td><td>-</td><td>-</td><td>□</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the operator targeting the multinational business users. For large incumbent operators this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>2</td></tr>
<tr><td>8.</td><td>Different requirements across Member States on handling guest/visitor use of (private) networks with respect to separation of traffic streams and liability.<br>Interpretation of the barrier<br>This barrier relates to e.g. Basel-III agreements on consultant access to private networks of banks and to hotspots. This barrier leads to replicate costs at each entry (up to 27x). The barrier is upfront capex and on-going opex related.<br>Removal of the barrier lowers systems adaptation costs and operational costs.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>□</td><td>□</td><td>-</td><td>-</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified on behalf of business users.</td><td>1</td></tr>
</table>

<table>
<tr><td>9.</td><td>Lack of making distinction between consumer and business users in regulatory requirements (e.g. consumer protection, blocking of websites).<br>Interpretation of the barrier<br>This barrier leads to undue costs. The barrier hinders the roll-out of Pan-European business services. The barrier is upfront capex and on-going opex related. This is a disproportionate barrier, affecting entrants most.<br>Removal of the barrier lowers systems adaptation costs and operational costs, and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>□</td><td>-</td><td>-</td><td>□</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the operator targeting the multinational business users. For large incumbent operators this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>1</td></tr>
<tr><td>10.</td><td>Regulation does typically focus on market segmentation and reference offers for consumers, not on fit-for-purpose (high and guaranteed end-to-end QoS, fast TtoR) offers for business users.<br>Interpretation of the barrier<br>The barrier hinders the roll-out of Pan-European business services. The barrier increases the costs of Pan-European services for multinational businesses. This is a disproportionate barrier, affecting non-incumbents most.<br>Removal of the barrier improves services, lowers provisioning costs and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>++</td><td>□</td><td>--</td><td>--</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the operators targeting the multinational business users. For large incumbent operators this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>3</td></tr>
<tr><td>11.</td><td>Lack of enforcement of requirements on incumbents to provide timely and fair reference offers for bitstream access.<br>Interpretation of the barrier<br>The barrier hinders the roll-out of Pan-European business services. The barrier increases the costs of Pan-European services for multinational businesses. This is a disproportionate barrier, affecting non-incumbents most. This includes FTTx-based access and IPTV-capable bitstream product.<br>Removal of the barrier, aiming for a universal bitstream offering across the Member states, improves services, lowers provisioning costs and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>++</td><td>□</td><td>--</td><td>--</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier</td><td>3</td></tr>
</table>

<table>
<tr><td></td><td>This barrier is identified by the operators targeting the multinational business users. For incumbent operators this is a barrier of less significance and could be considered as a deterrent to entry</td><td></td></tr>
<tr><td>12.</td><td>Outlawing of gateways in mobile networks denies MNC cost savings opportunity.<br>Interpretation of the barrier<br>The barrier hinders cost reduction for multinational companies exploiting an internal network.<br>Removal of the barrier improves lowers operating costs of MNCs<br>Quantitative impact of removing the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>++</td><td>□</td><td>+</td><td>--</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified on behalf of the multinational business users. Removal of the barrier lowers opex of MNCs and reduces revenue of mobile operators.</td><td>1</td></tr>
<tr><td>13.</td><td>Conditions for obtaining MNO status differ across Member States.<br>Interpretation of the barrier<br>This barrier leads to different entry conditions across Member States.<br>Removing the barrier, i.e., unifying towards the least restrictive version improves the market entry conditions and improves the innovation conditions.<br>Quantitative impact of removing the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the smaller mobile operators. For incumbent mobile operators this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>1</td></tr>
<tr><td>14.</td><td>Regulatory uncertainty and uncertainty regarding governmental intervention.<br>Interpretation of the barrier<br>This barrier delays or hinders market entry and deters investments. The occurrence and degree of uncertainty differs per Member State. This leads to different entry conditions and investment climates across Member States.<br>Removal of the barrier market entry conditions and improves the investment conditions.<br>Quantitative impact of removing the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>++</td><td>+</td><td>□</td><td>□</td><td>++</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the smaller/entrant operators. For incumbent operators the information asymmetry may be less or of less significance and could be considered as a deterrent to entry.</td><td>4</td></tr>
<tr><td>15.</td><td>Granting of a regulatory holiday affects players in an asymmetric manner, favourable for one and unfavourable for the other.<br>Interpretation of the barrier</td><td>3</td></tr>
</table>

| | | |
|---|---|---|
| | This barrier typically favours the incumbent operator and it's typically granted to achieve a specific policy objective, e.g. investments in NGN, Fibre to the Home.<br>This barrier leads to skewed competitive conditions in a Member State. This barrier leads to different entry conditions across Member States.<br>Removal of the barrier levels the competitive playing field, improves market entry conditions, improve conditions for innovation, but may adversely affect the desired policy outcome. | |
| | Quantitative impact of removing the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / --/++[123] | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by the entrants. The barrier typically favours the incumbent operators as it is intended to provide an incentive for incumbents to invest. | |
| 16. | **Lack of fit of the current Regulatory Package for Eastern European countries facing a teledensity problem rather than a Telecom Reform problem.** | 1 |
| | Interpretation of the barrier | |
| | This barrier typically hinders the incumbent operator and entrants in the new Member States and the Accession States.<br>Removal of the barrier improves market entry conditions and investment conditions for incumbents and entrants. | |
| | Quantitative impact of removing the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by the operator targeting Eastern European countries. | |
| 17. | **The request to NRAs to analyse a predefined set of markets enforces the markets to be perceived as 'national' not as (potentially) regional.** | |
| | Interpretation of the barrier | |
| | This barrier hinders the development of Pan-European markets.<br>Removal of the barrier improves development of Pan-European markets, thereby increasing competition, innovation and investments. | |
| | Quantitative impact of removing the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by an industry observer. | |
| **B** | **Barrier related to other regulation** | |
| 18. | **Lack of homogeneity in the implementation of EC security regulations in Member States (e.g. related to free movement of data across EU).** | 3 |
| | Interpretation of the barrier | |

123 In theory a regulatory holiday is expected to stimulate investment by the incumbent by applying a forbearance on competitive access. The desired outcome is being questioned as regulatory uncertainty after the holiday may still deter investments, which appears to be confirmed by empirical data.

<table>
<tr><td></td><td>This barrier leads to replicate adaptation costs at each entry (up to 27x). Prevents consolidation of functions across Member States. The costs are largely invariable to volume. These are upfront costs. This is a disproportionate barrier, affecting entrants most.<br>Removal lowers systems adaptation costs and operational costs and improves market entry conditions.<br>Quantitative impact of removing the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>□</td><td>-</td><td>-</td><td>□</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the large mobile operators.</td><td></td></tr>
<tr><td>19.</td><td>National security regulations hindering free movement of data due to concerns regarding territorial integrity in relation to integrity of national e-communications infrastructure.<br>Interpretation of the barrier<br>This barrier prevents consolidation of management and back office operations across Member States.<br>Removal lowers operational costs and improves market entry conditions.<br>Quantitative impact of removing the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>□</td><td>-</td><td>-</td><td>□</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the large mobile operator.</td><td>1</td></tr>
<tr><td>20.</td><td>Lack of homogeneity in the implementation of EC regulation in Member States, in relation to definition and treatment of personal data, protection of consumer data.<br>Interpretation of the barrier<br>This barrier leads to replicate adaptation costs at each entry (up to 27x). This barrier prevents consolidation of functions across Member States The costs are largely invariable to volume. These are upfront costs. This is a disproportionate barrier, affecting entrants most.<br>Includes inequality in treatment of content providers vis-à-vis telecom operators as content providers.<br>Removal lowers systems adaptation costs and operational costs and improves market entry conditions.<br>Quantitative impact of removing the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>□</td><td>-</td><td>-</td><td>□</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by a range of mobile operators.</td><td>6</td></tr>
<tr><td>21.</td><td>Lack of homogeneity in the implementation of EC regulation in Member States, in relation to consumer protection<br>Interpretation of the barrier<br>This barrier leads to replicate adaptation costs at each entry (up to 27x).<br>Exacerbated by frequently changing rules in Member States.<br>Removal lowers systems adaptation costs and operational costs and improves market entry conditions.</td><td>1</td></tr>
</table>

| | | |
|---|---|---|
| | Quantitative impact of removing the barrier<br>**Static efficiency** \| **Dynamic effect.** \| **Capex** \| **Opex** \| **Investment**<br>+ \| □ \| - \| - \| □<br>Qualitative impact of removing the barrier<br>This barrier is identified by the entrant. | |
| 22. | **Different rulings, scope of application and requirements regarding payment systems across Member States. No distinction being made between banks and e-coms operators.**<br>Interpretation of the barrier<br>This barrier leads to replicate adaptation costs at each entry (up to 27x). The costs are largely invariable to volume. These are upfront costs. This is a disproportionate barrier, telecom operators in relation to banks. This is a disproportionate barrier, affecting entrants most.<br>Removal lowers systems adaptation costs and operational costs, improves market entry conditions and innovation conditions.<br>Quantitative impact of removing the barrier<br>**Static efficiency** \| **Dynamic effect.** \| **Capex** \| **Opex** \| **Investment**<br>+ \| + \| - \| - \| +<br>Qualitative impact of removing the barrier<br>This barrier is identified by mobile operators and mobile content providers. | 3 |
| 23. | **Different rulings regarding VAT systems and accounting rules across Member States.**<br>Interpretation of the barrier<br>VAT is based on country of consumption and different accounting rules apply. This barrier leads to replicate adaptation costs at each entry (up to 27x). The costs are largely invariable to volume. These are upfront costs. This is a disproportionate barrier, affecting entrants most.<br>Removal lowers systems adaptation costs and operational costs, improves market entry conditions and innovation conditions.<br>Quantitative impact of removing the barrier<br>**Static efficiency** \| **Dynamic effect.** \| **Capex** \| **Opex** \| **Investment**<br>+ \| + \| - \| - \| +<br>Qualitative impact of removing the barrier<br>This barrier is identified by mobile content providers. | 2 |
| 24. | **Different national rulings and funding arrangements for recycling hardware across Member States.**<br>Interpretation of the barrier<br>This barrier leads to replicate adaptation costs at each entry (up to 27x). This is a disproportionate barrier, affecting entrants most.<br>Removal lowers operational costs.<br>Quantitative impact of removing the barrier<br>**Static efficiency** \| **Dynamic effect.** \| **Capex** \| **Opex** \| **Investment**<br>+ \| □ \| □ \| - \| □<br>Qualitative impact of removing the barrier<br>This barrier is identified by the mobile device provider. | 1 |

<table>
<tr><td>25.</td><td>Moving-up in the value-chain to provide combined e-communications and applications services expose providers to barriers specific to the application area (e.g. in eHealth, eEnergy, eMobility).<br>Interpretation of the barrier<br>This barrier hinders the wider deployment of ICTs. This barrier leads to underinvestment and under utilisation of knowledge and capabilities of telecommunications operators.<br>Removal of the barrier improves expansion opportunities, will stimulate investment and will allow economies of scale to develop.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by medium size and large operators.</td><td>3</td></tr>
<tr><td>C</td><td colspan="2">Barrier related to market structure and market dynamics</td></tr>
<tr><td>26.</td><td>Lack of adequate level of competition in Member States makes Pan-European providers of services to multinational corporations dependent on a single source of supply, i.e. the incumbent. Bitstream is essential as LLU is not a viable option due to the dispersed demand.<br>Interpretation of the barrier<br>This barrier leads to competitive advantages for the incumbent and disadvantage for the entrant. The barrier results in lower levels of competition in Pan-European service offerings. This is a disproportionate barrier, affecting non-incumbents most. Removal of the barrier improves services, lowers provisioning costs and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>++</td><td>□</td><td>--</td><td>--</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the operators targeting the multinational business users. For incumbent operators this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>4</td></tr>
<tr><td>27.</td><td>Lack of adequate level of competition in NGA is major concern. Bitstream is essential, including fit-for-purpose IP-TV multicasting capability.<br>Interpretation of the barrier<br>This barrier leads to competitive advantages for the incumbent and disadvantage for the entrant. The barrier affects the entrant to continue to provide bundled offers. The barrier results in lower levels of competition in Pan-European service offerings. This is a disproportionate barrier, affecting non-incumbents most. Removal of the barrier improves services, lowers provisioning costs and improves market entry conditions.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>+</td><td>--</td><td>--</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier</td><td>4</td></tr>
</table>

<table>
<tr><td></td><td>This barrier is identified on behalf of the entrants, multinational business users and by content providers. For incumbent operators this is a barrier of less significance and could be considered as a deterrent to entry.</td><td></td></tr>
<tr><td>28.</td><td>Lack of access to NGNs is major concern for entrants.<br>Interpretation of the barrier<br>This barrier leads to competitive disadvantages for the operators challenging the position of the incumbent providing the NGN (FttH). This barrier may exclude challengers in providing the service bundles that consumers require. This barrier deters entry and may force exits.<br>Removal of the barrier improves competition in services, improves market entry conditions and conditions for innovation<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the entrant.</td><td>1</td></tr>
<tr><td>29.</td><td>Market entry opportunities have diminished since the Telecom Reform took hold and in particular through the consolidation following the collapse of the Internet/telecom bubble. This led to market concentration and enforcing position of remaining players.<br>Interpretation of the barrier<br>This is an outcome of firms adjusting to market realities, leading to lower number of players. Market entry is hence subject to ‘windows of opportunity’.<br>Major technological change or regulatory change may create a new ‘window of opportunity’ for entry, with lower entry barriers.<br>Quantitative impact of a new ‘window of opportunity’
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>++</td><td>++</td><td>□</td><td>□</td><td>++</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the small and large operators.</td><td>2</td></tr>
<tr><td>30.</td><td>Positions of entry achieved following the Telecom Reform are subject to portfolio revaluation, in particular after the crash. Where margins do not meet expectations market exist strategies are pursued. Typically minority positions are divested. An on-going process. Minimum efficient scale levels are being explored.<br>Interpretation of the barrier<br>This is an outcome of firms adjusting to market realities, leading to consolidation of operations led by business economic considerations. The perceived necessity of worldwide operations is challenged and even the need for regional operations is revisited.<br>An overall better economic outlook, improving demand conditions, technological change or regulatory change may create a new ‘window of opportunity’ for expansion.<br>Quantitative impact of a new ‘window of opportunity’
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>++</td><td>++</td><td>□</td><td>□</td><td>++</td></tr>
</table>
Qualitative impact of removing the barrier</td><td>8</td></tr>
</table>

<table>
<tr><td></td><td>This barrier is identified by a broad range of operators.</td><td></td></tr>
<tr><td>31.</td><td>The retail distribution channel for mobile services is highly localised.<br>Interpretation of the barrier<br>In the retail market for mobile services the (access to the) distribution channel influences business success, as a large proportion of users wish to test the ‘look and feel’ of mobile devices, prior to selecting a service offering. Marketing in the retail market is highly targeted.<br>This is a natural business barrier; increasing Internet sales may mitigate this barrier.<br>Quantitative impact of mitigation of this barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>□</td><td>□</td><td>□</td><td>□</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by mobile entrants.</td><td>2</td></tr>
<tr><td>32.</td><td>Access to the distribution channel for business services.<br>Interpretation of the barrier<br>In certain member States the access to the business market runs via a distribution channel. The degree of lock-in of the channel partners with existing suppliers will determine the success of failure of the entrant. This market structure hinders the development of competition. Margin levels may hinder the establishment of a competing distribution channel.<br>Quantitative impact of mitigation of this barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>□</td><td>□</td><td>□</td><td>□</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the entrant.</td><td>2</td></tr>
<tr><td>33.</td><td>In residential markets bundling of service (triple-play and quadruple-play) drives competition.<br>Interpretation of the barrier<br>This is an outcome of market dynamics in a game to achieve sustainable competitive advantage by making bundled offers attractive to consumers. This forces development of the required service components through partnerships, investments or acquisitions. This leads to higher market entry barriers and may lead to exits.<br>Further evolution towards All-IP may reduce the significance of bundling. Subject to customer preferences, speciality players may emerge breaking the bundling trend.<br>Quantitative impact of a ‘breaking the trend towards bundling’<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>++</td><td>+</td><td>□</td><td>□</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by a broad range of operators.</td><td>9</td></tr>
<tr><td>34.</td><td>In the business market competition is based on bundles of fixed and mobile services.<br>Interpretation of the barrier</td><td>9</td></tr>
</table>

<table>
<tr><td></td><td>This is an outcome of market dynamics in responding to the needs of business customers. This forces development of the required service components through partnerships, acquisitions or investments. This leads to higher market entry barriers and may lead to exits.<br>Further evolution towards All-IP may reduce the significance of bundling. Subject to customer preferences, speciality players may emerge breaking the bundling trend.<br>Quantitative impact of a ‘breaking the trend towards bundling’<table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by a range of operators.</td><td></td></tr>
<tr><td>35.</td><td>In business market competition is based on bundles of communications and value-added services.<br>Interpretation of the barrier<br>This is an outcome of market dynamics in exploiting new market opportunities in a quest to develop new value-adding sources of revenue. This forces development of the required service components through partnerships, acquisitions or investments. This leads to higher market entry barriers and may lead to exits. Subject to customer preferences, speciality players may emerge breaking the bundling trend.<br>Quantitative impact of a ‘breaking the trend towards bundling’<table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the operators targeting the (multinational) business users.</td><td>8</td></tr>
<tr><td>36.</td><td>Incumbent supplier power appears to be such that buyer demand for uniform service offering across Europe (e.g. on QoS/SLAs) is not provided to Pan-European service providers or large MNCs.<br>Interpretation of the barrier<br>This is an outcome of insufficient buyer power. The barrier hinders the roll-out of Pan-European business services. The barrier increases the costs of Pan-European services for multinational businesses. This is a disproportionate barrier, affecting non-incumbents most.<br>Mitigation of the barrier improves services, lowers provisioning costs and improves market entry conditions.<br>Quantitative impact of a mitigating the barrier<table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>++</td><td>□</td><td>--</td><td>--</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the operators targeting the multinational business users and on behalf of the MNCs. For large incumbent operators this is a barrier of less significance and could be considered as a deterrent to entry.</td><td>2</td></tr>
<tr><td>37.</td><td>Lack of uniform QoS across the Internet.<br>Interpretation of the barrier</td><td>2</td></tr>
</table>

<table>
<tr><td></td><td>This barrier hinders the roll-out of quality sensitive business services (across Europe and globally). This barrier affects e.g. cloud services and M2M services. Mitigation of the barrier improves services, lowers provisioning costs and improves innovation conditions.<br>Quantitative impact of a mitigating the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>-</td><td>-</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the operator targeting business services and the organisation representing business users.</td><td></td></tr>
<tr><td>38.</td><td>Network management, including load shedding (traffic blocking) regimes by network operators need to be transparent for business users that run business critical applications over the network.<br>Interpretation of the barrier<br>This is an outcome of congestion in networks. But could also be a consequence of business incentives for operators leading to the blocking of services of third parties. The barrier hinders the roll-out of national and Pan-European business services. The barrier increases the costs of national services for local business and Pan-European services for multinational businesses. This is a disproportionate barrier, affecting the non-incumbents most.<br>Mitigation of the barrier improves services, lowers provisioning costs and improves market entry conditions.<br>Quantitative impact of a mitigating the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>-</td><td>-</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified on behalf of the MNCs and by the content provider.</td><td>3</td></tr>
<tr><td>39.</td><td>For end-user the need to switch off mobile data functions when crossing the home country border to avoid ‘bill shock’ reduces the value of e-communications services.<br>Interpretation of the barrier<br>This barrier hinders the use of e-communication services across Europe. This barrier hinders the wider deployment of ICTs. The barrier hinders the roll-out of Pan-European (business) services. The barrier increases the costs of Pan-European services for consumers and business users. This barrier hinders application investment.<br>Mitigation of the barrier improves services, lowers prices, but makes market entry less attractive.<br>Quantitative impact of removing the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the mobile business user.</td><td>1</td></tr>
<tr><td>40.</td><td>Mobile entrants are subject to the market power of a few incumbents, often with ‘collective SMP’.<br>Interpretation of the barrier</td><td>2</td></tr>
</table>

| | | |
|---|---|---|
| | Entry is typically not in the interest of incumbent operators. With a few large mobile operators remaining in most Member States, the playing field is far from level. Tacit collusion may lead to exit of smaller operators and discourage entry. Mitigation of the barrier improves entry, rivalry and the conditions for innovation. | |
| | Quantitative impact of mitigating the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by small mobile operators. | |
| 41. | **In consultations by NRAs the incumbents dominate the input, challengers are few and would-be-entrants are hard to identify and rarely consulted.** | 2 |
| | Interpretation of the barrier | |
| | Information asymmetry re-enforces the position of the incumbents and disadvantages the entrant. Mitigation of the barrier improves entry, rivalry and the conditions for innovation. | |
| | Quantitative impact of mitigating the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by entrants. | |
| 42. | **In an oligopolistic market structure, market entry is deterred by rules-of-the-game largely set and controlled by the large incumbents.** | 2 |
| | Interpretation of the barrier | |
| | Collective interests of incumbents are reflected in various forms of collaboration, e.g. industry Europe such as the GSMA. Entry is typically not in the interest of incumbent operators. With a few large mobile operators remaining in most Member States, the playing field is far from level. Tacit collusion may lead to exit of smaller operators and discourage entry. Mitigation of the barrier improves entry, rivalry and the conditions for innovation. | |
| | Quantitative impact of mitigating the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by mobile entrants. | |
| 43. | **In a market dominated by large players their sheer financial power is a deterrent for entry and contributes to exit.** | 4 |
| | Interpretation of the barrier | |
| | Entrants typically have to fight an uphill battle, e.g. challenging actions and decisions by operators (or NRAs) that are considered unfavourable in court. The costs involved and the time lapse until a court decision is reached (often in appeal) may be unsustainable by entrants, forcing early exits or discouraging entry. Mitigation of the barrier improves entry, rivalry and the conditions for innovation. | |
| | Quantitative impact of mitigating the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |

<table>
<tr><td></td><td>This barrier is identified by mobile entrants.</td><td></td></tr>
<tr><td>44.</td><td>Fixed incumbents have the benefit of leveraging the full depreciation of the network, including ownership of passive infrastructure elements such as duct systems.<br>Interpretation of the barrier<br>Incumbent operators have the intrinsic cost advantage of a largely or fully depreciated asset base adding to their financial power. As a result the playing field is far from level.<br>Mitigation of the barrier improves entry, rivalry and the conditions for innovation.<br>Quantitative impact of mitigating the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by smaller entrants.</td><td>2</td></tr>
<tr><td>45.</td><td>Lack of access to dark fibre.<br>Interpretation of the barrier<br>Access to dark fibre is uneven across Member States. Vertical business models hinder services competition based on access to lower layers of the network.<br>Mitigation of the barrier improves entry and services competition.<br>Quantitative impact of mitigating the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>□</td><td>□</td><td>□</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified by the large user.</td><td>1</td></tr>
<tr><td>46.</td><td>Discretionary power of operators to block certain applications (e.g. VoIP).<br>Interpretation of the barrier<br>This discretionary power hinders the development of uniform service provision across Member States and thereby hinders the consolidation of front and back office services by MNCs.<br>Mitigation of the barrier lowers capex and opex for MNCs, facilitates diffusion of innovation.<br>Quantitative impact of mitigating the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>-</td><td>-</td><td>□</td></tr></table>Qualitative impact of removing the barrier<br>This barrier is identified on behalf of the large business user.</td><td>1</td></tr>
<tr><td>47.</td><td>For broadcast content language drives market segmentation.<br>Interpretation of the barrier<br>Language represents a natural borderline between markets, leading to natural segmentation of markets.<br>Diffusion of the barrier improves competition at the content level and may stimulate competition on the services and potentially network level.<br>Quantitative impact of mitigating the barrier<br><table><tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr><tr><td>+</td><td>+</td><td>□</td><td>□</td><td>□</td></tr></table>Qualitative impact of removing the barrier</td><td>1</td></tr>
</table>

| | | |
|---|---|---|
| | This barrier is identified by the content provider. | |
| **D** | **Barrier related to market attractiveness** | |
| 48. | **Mature/low growth/well served markets are less attractive for entry. Applies to most West European markets.** | 5 |
| | Interpretation of the barrier | |
| | This barrier influences the degree of entry and thereby the competitiveness of markets. This barrier may hinder the development of Pan-European service offerings.<br>Mitigation of the barrier improves entry, services competition and conditions for innovation. | |
| | Quantitative impact of mitigating the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by the small and large (potential) entrants. | |
| 49. | **New Member States, and other countries in Central and Eastern Europe (and developing countries elsewhere), provide for markets with higher growth opportunities, as a result of lower starting points with respect to teledensity and GDP.** | 6 |
| | Interpretation of the barrier | |
| | This relatively lower barrier for Central and Eastern European countries improves investment levels in these countries and thereby closes the teledensity gap with Western European countries. To the extent it applies to investments outside the EU Member States it deflects investments away from the EU.<br>Mitigation of the barrier, i.e. making Western European Member States more attractive for investments, will improves entry, services competition, and conditions for innovation. | |
| | Quantitative impact of mitigating the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by a range of regionally focussed operators. | |
| 50. | **Late entry in mobile (3rd/4th position).** | 5 |
| | Interpretation of the barrier | |
| | Late entry, after the first wave, typically leads to lower market shares, to lower margins and over time to unsustainable positions and ultimately divestment/exits. Entry attractiveness is not evenly spread in time. Mature markets reflect higher barriers to entry.<br>Mitigation of the barrier, i.e. creating favourable conditions, will improve competition, the conditions for innovation and for investment. | |
| | Quantitative impact of mitigating the barrier | |
| | **Static efficiency** / **Dynamic effect.** / **Capex** / **Opex** / **Investment**<br>+ / + / □ / □ / + | |
| | Qualitative impact of removing the barrier | |
| | This barrier is identified by a range of mobile operators. | |
| 51. | **Actual demand falling below expectations** | 3 |
| | Interpretation of the barrier | |

| | | |
|---|---|---|
| | Actual demand being lower than expected in the business plan has led to scaling down of investments and using alternative means of access (e.g. from fibre to LLU), leading to walking down rather than up the 'ladder of investment'. Or to a strategic shift from fixed to mobile service provisioning.<br>Mitigation of the barrier, i.e. stimulating demand conditions, will improve competition, the conditions for innovation and for investment. | |

| Quantitative impact of mitigating the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | □ | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the smaller operators. |

| | | |
|---|---|---|
| 52. | **Continued price pressure.** | 1 |

| Interpretation of the barrier |
|---|
| Price pressure leads to margin pressure and challenges the sustainability of the position of the firm and will (ultimately) results in scaling down of market involvement (e.g. from MNO to roaming), leading to walking down rather than up the 'ladder of investment'.<br>Mitigation of the barrier, if a result of intervention in the market, may retain the current number of market players, but will reduce the intensity of rivalry. It may improve the conditions for innovation and for investment. |

| Quantitative impact of mitigating the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| - | + | □ | □ | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the mobile operator. |

| | | |
|---|---|---|
| 53. | **Proximity and similarity of markets.** | 8 |

| Interpretation of the barrier |
|---|
| Proximity and similarity of markets, e.g. the same or similar language and/or cultural background, a common historical background, make markets more attractive for entry. It lowers risks and thereby lowers the barriers to entry. This explains (in part) the focus of operators on certain Member States and not others, and explains (in part) the lack of EU-wide operating firms emerging.<br>Mitigation of the barrier, i.e. further integration of EU Member States e.g. through the free movement of people, may mitigate this barrier. |

| Quantitative impact of mitigating the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | □ | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by a range of operators. |

| | | |
|---|---|---|
| 54. | **Entry of fixed (PSTN, RTV-cable) markets is subject to (attractive) M&A opportunities.** | 6 |

| Interpretation of the barrier |
|---|

| | | |
|---|---|---|
| | Firm owners (public or private) seeking investors through a share offering or private sale create a market entry opportunity. The conditions of sale reflect the attractiveness of the opportunity.<br>Mitigation of the barrier, i.e. creating a liquid M&A market, e.g. through divesting state holdings and/or relaxing conditions for trade (such as foreign ownership limitations) will mitigate this barrier. | |

| Quantitative impact of mitigating the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | □ | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by a range of operators. |

| | | |
|---|---|---|
| 55. | **Sustainability of positions in fixed without having own infrastructure is becoming increasingly more difficult.** | 2 |

| Interpretation of the barrier |
|---|
| Competitive pressures are reducing margins in the resale business, price-squeeze is increasing. Depending on the circumstances this will either drive firms to acquire a position in existing infrastructure, as building a parallel infrastructure is not economically viable, or divest and exit the market. The latter being more likely.<br>Mitigation of the barrier, if a result of intervention in the market, may retain the current number of market players, but will reduce the intensity of rivalry. It may improve the conditions for innovation and for investment. |

| Quantitative impact of mitigating the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | □ | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by entrants. |

| | | |
|---|---|---|
| 56. | **Opportunities to realise cross-border synergies for fixed operations.** | 1 |

| Interpretation of the barrier |
|---|
| The perceived lack of opportunities to realise economies of scale deters entry.<br>Mitigation of the barrier, e.g. by other operators showing how these economies of scale can be realised. |

| Quantitative impact of mitigating the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | □ | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the smaller entrant. |

| | |
|---|---|
| **E** | **Barrier related to strategic behaviour** |

| | | |
|---|---|---|
| 57. | **Where there is no SMP, market access as MVNO is to be granted in commercial negotiation with the incumbent MNO(s).** | 4 |

| Interpretation of the barrier |
|---|
| These private negotiations do not always lead to successful conclusion and hence deter entry and lead to lock-out.<br>Mitigation of the barrier, will improve competition, the conditions for innovation and for investment. |

| Quantitative impact of mitigating the barrier |
|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** | |
| | + | + | □ | □ | + | |
| | Qualitative impact of removing the barrier | | | | | |
| | This barrier is identified by mobile entrants. | | | | | |
| 58. | **Non-price discrimination** | | | | | 1 |
| | Interpretation of the barrier | | | | | |
| | This barrier relates to e.g. refusal to supply fit for purpose access to essential bottleneck facilities and services; it includes delay, inferior product quality and information asymmetries.<br>Removal of the barrier will improve competition, the conditions for innovation and for investment. | | | | | |
| | Quantitative impact of mitigating the barrier | | | | | |
| | **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** | |
| | + | + | □ | □ | + | |
| | Qualitative impact of removing the barrier | | | | | |
| | This barrier is identified on behalf of the entrants and operators serving the MNCs. | | | | | |
| 59. | **Needs for reciprocity in business arrangements.** | | | | | 1 |
| | Interpretation of the barrier | | | | | |
| | Interdependencies will moderate the intensity of rivalry.<br>Mitigation of the barrier will improve competition, the conditions for innovation and for investment. | | | | | |
| | Quantitative impact of mitigating the barrier | | | | | |
| | **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** | |
| | + | + | □ | □ | + | |
| | Qualitative impact of removing the barrier | | | | | |
| | This barrier is identified by an industry observer. | | | | | |
| **F** | **Barrier related to private institutional arrangements** | | | | | |
| 60. | **Membership of GSMA is required to obtain access to functionality/tools essential for interoperability of operations systems. Membership requires MNO status. MNO status requires spectrum license. MVNO does not quality** | | | | | 2 |
| | Interpretation of the barrier | | | | | |
| | For a proper functioning of an industry coordination among operators is essential. This coordination naturally reflects the interest of the 'insiders'. Collective interests are reflected in various forms of collaboration, e.g. industry forums such as the GSMA. Entry is typically not in the interest of incumbent operators. With a few large mobile operators remaining in most Member States, the playing field is far from level. Coordination and collaboration may lead to tacit collusion, which may discourage entry.<br>Mitigation of the barrier will improve competition, the conditions for innovation and for investment. | | | | | |
| | Quantitative impact of mitigating the barrier | | | | | |
| | **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** | |
| | + | + | □ | □ | + | |
| | Qualitative impact of removing the barrier | | | | | |

<table>
<tr><td></td><td>This barrier is identified by the mobile entrants.</td><td></td></tr>
<tr><td>61.</td><td>Geographically fragmented arrangements for distribution rights, multiplicity of rights collecting agencies and differences in levy systems.<br>Interpretation of the barrier<br>Provision of content services is hindered or even blocked (by lack of minimum volume) by the legacy structure of distribution rights and collecting agencies largely determined by geographical and language borders. Distribution is increasingly facilitated by the ‘borderless Internet’, requiring a new arrangement. Blocks economies of scale in content provision.<br>Mitigation of the barrier will improve competition, the conditions for innovation and for investment, as well as conditions for Pan-European services<br>Quantitative impact of mitigating the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the content and service providers.</td><td>7</td></tr>
<tr><td>62.</td><td>The lack of involvement of e-communications providers c.q. the standards being set by electricity companies makes it difficult for e-communications providers to enter the market for smart meters and smart grids.[124]<br>Interpretation of the barrier<br>This barrier is a result of two industries historically having developed along different trajectories. The reform and technological changes in the electricity sector lead to needs for which, in a number of cases, the e-communications sector has already solutions available.<br>Mitigation of the barrier will improve the wider deployment of ICTs in an efficient manner. Mitigation of the barrier will improve competition, the conditions for innovation and for investment.<br>Quantitative impact of mitigating the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the service providers.</td><td>2</td></tr>
<tr><td>G</td><td colspan="2">Barrier related to governmental institutional arrangements</td></tr>
<tr><td>63.</td><td>The scope of competition policy being applied at Member State level rather than at EU-level.<br>Interpretation of the barrier<br>This barrier refers to the Vodafone-Mannesmann case as an example, whereby the decisions were based on competition policy considerations at Member State level only and, as a consequence, may have hindered or has hindered the forming of Pan-European mobile providers.<br>Mitigation of the barrier will improve the development of Pan-European service providers. Mitigation of the barrier will improve competition, the conditions for innovation and for investment.<br>Quantitative impact of mitigating the barrier</td><td>3</td></tr>
</table>

124 Depending on the ownership structure and the governance structure of the electricity sector this may in some countries be a barrier in the category of government institutional arrangements.

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** | |
| | + | + | □ | □ | + | |
| | Qualitative impact of removing the barrier | | | | | |
| | This barrier is identified by organisations representing the large users. Users. | | | | | |
| 64. | **The need to frequently challenge regulatory decisions in court.** | | | | | 3 |
| | Interpretation of the barrier | | | | | |
| | Entrants typically have to fight an uphill battle, e.g. challenging actions and decisions by operators (or NRAs) that are considered unfavourable in court. The resources required, the costs involved and the time lapse until a court decision is reached (often in appeal) may be unsustainable by entrants, forcing early exits or discouraging entry.<br>Mitigation of the barrier improves entry, rivalry and the conditions for innovation. | | | | | |
| | Quantitative impact of mitigating the barrier | | | | | |
| | **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** | |
| | + | + | □ | □ | + | |
| | Qualitative impact of removing the barrier | | | | | |
| | This barrier is identified by the smaller entrants. | | | | | |
| 65. | **The principle of subsidiarity enforces markets to be perceived as 'national'.** | | | | | |
| | Interpretation of the barrier | | | | | |
| | This barrier hinders the development of Pan-European markets.<br>Removal of the barrier improves development of Pan-European markets, thereby increasing competition, innovation and investments. | | | | | |
| | Quantitative impact of mitigating the barrier | | | | | |
| | **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** | |
| | + | + | □ | □ | + | |
| | Qualitative impact of removing the barrier | | | | | |
| | This barrier is identified by an industry observer. | | | | | |
| **H** | **Barrier related to governmental discretion** | | | | | |
| 66. | **Entry as MNO is subject to conditions set in the auctioning arrangement.** | | | | | 3 |
| | Interpretation of the barrier | | | | | |
| | This barrier relates the degrees of freedom available to Member States in setting the conditions for access to the radio frequency spectrum. It determines the barrier to entry: the cost of entry and the timing of entry. It leads to heterogeneity in costs structures between Member States. It hinders the development of Pan-European markets.<br>Removal of the barrier improves development of Pan-European markets, thereby increasing competition, innovation and investments. | | | | | |
| | Quantitative impact of mitigating the barrier | | | | | |
| | **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** | |
| | + | + | □ | □ | + | |
| | Qualitative impact of removing the barrier | | | | | |
| | This barrier is identified by the mobile entrants. | | | | | |
| 67. | **Entry as MNO requires entrant to be able to compete effectively against financial strength of incumbent.** | | | | | 2 |
| | Interpretation of the barrier | | | | | |

| | | |
|---|---|---|
| | This barrier relates to the situation of an auction for radio spectrum access, e.g. in the case of re-issuance of spectrum usage rights. Small-scale entry is effectively prevented by the financial bidding power of incumbent players, having a strong interest to protect the installed base for future exploitation.<br>Removal of the barrier improves competition, the conditions for innovation and for investments. | |

| Quantitative impact of removing the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | □ | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the mobile entrants. |

| | | |
|---|---|---|
| 68. | **The radio spectrum space is shared between e-communications users and broadcasters.** | 1 |

| Interpretation of the barrier |
|---|
| As broadcasting is subject to a different political oversight regime this impacts policy implementation for the e-communications part of the spectrum.<br>Removal of the barrier improves competition, the conditions for innovation and for investments. |

| Quantitative impact of removing the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | □ | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the mobile entrant. |

| | | |
|---|---|---|
| 69. | **Governments retaining share in incumbent operator** | 2 |

| Interpretation of the barrier |
|---|
| This barrier hinders or even blocks mergers and acquisitions.<br>Removal of the barrier improves the conditions for creating economies of scale and improves conditions for Pan-European service offerings. |

| Quantitative impact of mitigating the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | □ | □ | □ | □ |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the mobile operator and the organisation representing the users. |

| | | |
|---|---|---|
| 70. | **Different implementation across Member States of numbering assignments** | 1 |

| Interpretation of the barrier |
|---|
| This barrier hinders innovation in service provisioning.<br>Removal of the barrier improves the conditions for innovation. |

| Quantitative impact of mitigating the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| □ | + | □ | □ | □ |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the mobile entrant. |

| | | |
|---|---|---|
| 71. | **Lack of (practical/cost effective/without human intervention) mechanism for switching of mobile provider in case of Machine-to-Machine communication.** | 2 |

| Interpretation of the barrier |
|---|

| | | |
|---|---|---|
| | This barrier hinders switching between providers, creating a lock-in. It hinders innovation in service provisioning.<br>Removal of the barrier improves competition and the conditions for innovation. | |

| Quantitative impact of removing the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | + | □ |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by an industry observer. |

| | | |
|---|---|---|
| **I** | **Barrier related to governmental intervention** | |
| 72. | **State aid.**<br>Interpretation of the barrier<br>State aid negatively affects the valuation of previous investments and the market structure, but pre-empts (natural) network evolution.<br>Removal of the barrier improves the business climate, competition and the conditions for investment. | 3 |

| Quantitative impact of removing the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | □ | □ | + | + |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the larger operators. |

| | | |
|---|---|---|
| 73. | **Changing the rules-of-the-game or regulation can be detrimental for the viability of a business from one day on the other.**<br>Interpretation of the barrier<br>This barrier relates to, for example, the intervention in international roaming rates that killed the business of a provider 'solving' the differences between national and international rates through arbitration.<br>Removal of the barrier improves the business climate, competition and the conditions for innovation. | 1 |

| Quantitative impact of removing the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | + | □ |

| Qualitative impact of removing the barrier |
|---|
| This barrier is identified by the entrant. |

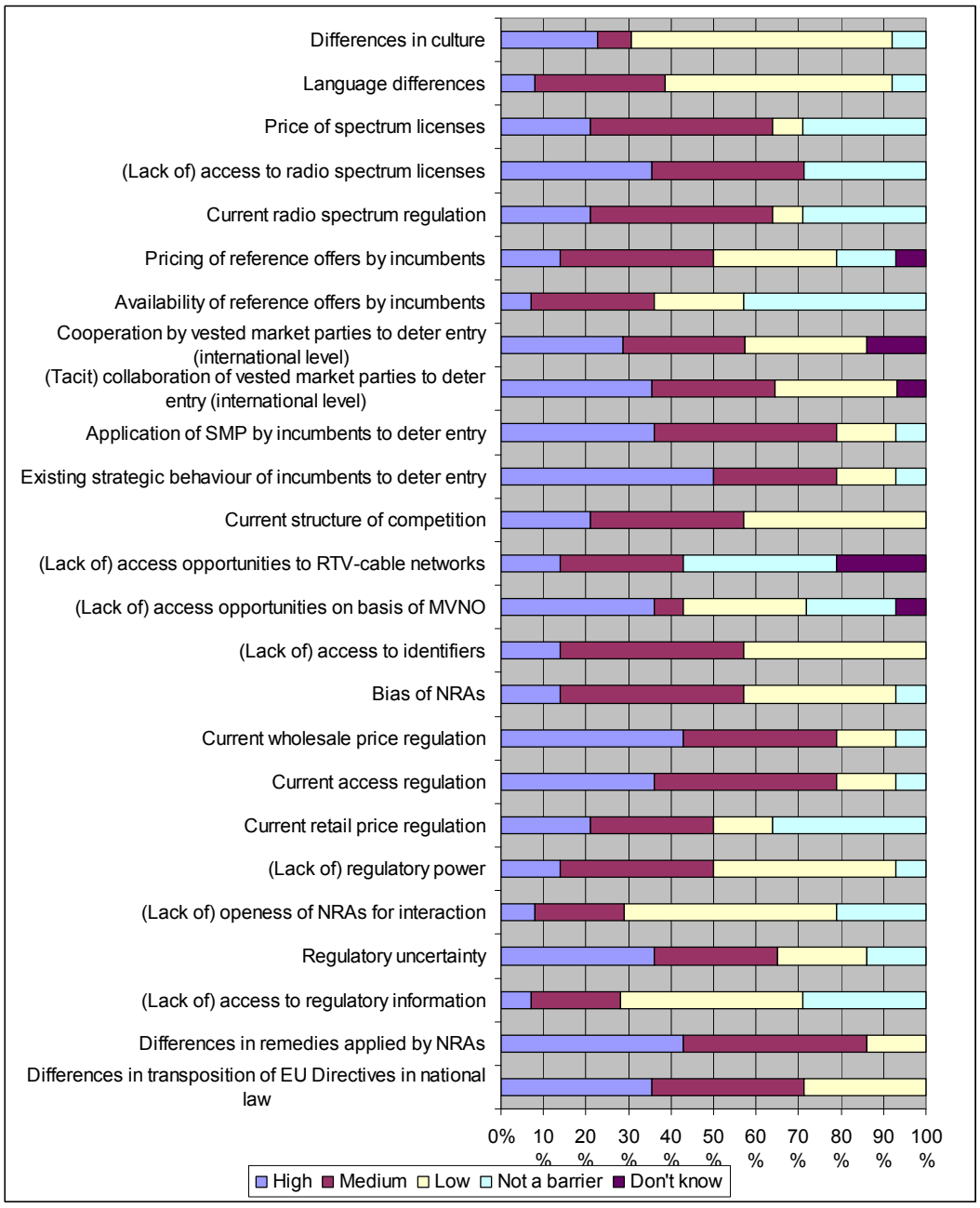
| | | |
|---|---|---|
| 74. | **Political-regulatory intervention to lower of mobile terminating rates (MTRs) and international roaming rates**<br>Interpretation of the barrier<br>The intervention to reduce MTRs and international roaming rates has reduced the attractiveness of the MNO and MVNO business case. This intervention improved consumer surplus and reduced firm rents. It also reduced the risk of 'bill shock'. The lowering of industry profitability deters entry and may force exits of recent entrants. The intervention affects the (normal) development of the Internal Market and deters incentives to invest.<br>Removal of the barrier improves conditions for entry and investments. | 7 |

| Quantitative impact of removing the barrier | | | | |
|---|---|---|---|---|
| **Static efficiency** | **Dynamic effect.** | **Capex** | **Opex** | **Investment** |
| + | + | □ | + | + |

<table>
<tr><td></td><td>Qualitative impact of removing the barrier<br>This barrier is identified by the mobile operators.</td><td></td></tr>
<tr><td>75.</td><td>Lowering international roaming rates to the cost level in country of roaming removes incentives for entry as an MNO.<br>Interpretation of the barrier<br>Considering that cost levels are expected to be based on the most efficient incumbent operator and given that incumbents have the advantage of economies of scale, ceteris paribus, the business case for entry will not be viable anymore. Removal of the barrier improves conditions for entry and for investment.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>+</td><td>□</td><td>□</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the mobile operators.</td><td>2</td></tr>
<tr><td>76.</td><td>Markets in Central and Eastern Europe, outside the EU, represent a lower risk of regulatory intervention.<br>Interpretation of the barrier<br>This relatively lower barrier for Central and Eastern European countries improves market entry conditions and hence investment levels in these countries. To the extent that it applies to investments outside the EU Member States it deflects investments away from the EU.<br>Mitigation of the barrier, i.e. making Western European Member States more attractive for investments, will improves entry, services competition and conditions for innovation.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>+</td><td>+</td><td>□</td><td>+</td><td>+</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the regional operator.</td><td>1</td></tr>
<tr><td>J</td><td colspan="2">Barrier related to governmental support of innovation</td></tr>
<tr><td>77.</td><td>Tax reductions to stimulate innovation do not necessarily benefit start-ups.<br>Interpretation of the barrier<br>This incentive is largely ineffective for start-ups typically having many years of financial losses.<br>Mitigation of the barrier will improve the conditions for innovation.<br>Quantitative impact of removing the barrier
<table>
<tr><th>Static efficiency</th><th>Dynamic effect.</th><th>Capex</th><th>Opex</th><th>Investment</th></tr>
<tr><td>□</td><td>+</td><td>□</td><td>+</td><td>□</td></tr>
</table>
Qualitative impact of removing the barrier<br>This barrier is identified by the mobile entrant.</td><td>1</td></tr>
</table>

In addition, a web-based questionnaire was issued to the interviewees to complement the interview findings with a structured set of questions. The number of respondents is 14; 50% of the respondents are incumbents (fixed, mobile, cable) with operations in multiple countries; 20% challengers/entrants; and the remainder is anonymous. Figure A-1 presents the results of this exercise.

**Figure A-1 Importance of barriers in the eyes of the interviewees**



# Annex V: Survey results on technical and operational barriers

### Survey approach

Our own expertise has allowed us to identify various technical barriers. These barriers can be sorted into the following categories: fixed infrastructure barriers, mobile (including wireless) infrastructure barriers, IT-related barriers and regulatory barriers requiring technical implementation. The goal of the online survey was twofold: to validate the list of identified technical barriers to the Internal Market and (if necessary) to complement and refine this list. Specifically, the following hypotheses are investigated in an online survey:

- Technical barriers in the area of mobile infrastructure are lower than barriers in the area of fixed infrastructure.
- Technical barriers in the area of infrastructure are lower than barriers in the area of IT.
- Technical barriers are to a large extent related to the level of standardisation.

With regards to regulatory obligations, we did not formulate hypotheses as such. Given that the implementation of such obligations differs across Member States, the question remains whether or not respondents see this as a barrier towards the Internal Market and, if so, to what extent.

Technical barriers for the Internal Market exist when the benefits of effort spent in one country are not carried over when entering another country. The indicator we use here is the amount of re-use of effort when entering the market in multiple countries. If much of what has been done in one country can be re-used, the barriers for starting in other countries are low. If little of what has been done in one country can be re-used, the barriers are high. This indicator of re-use is used throughout the survey.

For example, when delivering a broadband connection to a new customer, you will have to provide a broadband modem. The question is whether you can re-use your effort in modems in one country for other countries?

- **Mostly re-use**: We call it 'mostly re-use' if you can use exactly the same modem in all countries. There is still effort spent in supplying a customer with a modem, but the amount of effort (notably for development) has decreased significantly when starting in a new country.
- **Hardly any re-use**: We call it 'hardly any re-use' if you have to completely redesign the modem for each country in which you offer your services. For every new country, a completely new (development) effort is involved.

The survey uses a five-point scale for measuring re-use, using ‘mostly re-use’ and ‘hardly any re-use’ as the two extremes and ‘much re-use’, ‘some re-use’ and ‘little re-use’ in between. The approach in the survey is to ask similar questions in each of the four categories. In that way, the different categories become comparable.

The survey has been sent out to a large number of European operators and vendors. TNO has a large network of people active in these organisations, at the suitable technical level to ask these

questions on technical barriers (through its activities in various standardisation bodies and conferences). Several hundred people were invited to fill out the survey.[125]

The survey was released in the third week of May (week 20), a reminder was sent in the first week of June (week 23), and the survey was closed in the third week of June (week 25). A total of 82 people responded to the invitation to participate in the survey. Of these, 27 respondents answered the part containing the questions on re-use and standardisation as an indicator for entry barrier on each of the four main categories: Fixed Telecommunication Infrastructure, Mobile Telecommunication Infrastructure, Supporting IT and Processes, and Regulatory Obligations. We did receive a response by e-mail from some of the respondents that did not fill out the core of the survey. They indicated that they did not feel they could answer the questions legitimately. One person did not feel able to answer the questions on barriers, but did express his opinion unsolicited in an e-mail, explaining his vision on this topic.

Of the 27 respondents:

- Eight are of the category 'Telco', meaning they are a Fixed-line operator, Incumbent / former PTT, Mobile operator and/or a Mobile Virtual Network Operator (MVNO) (multiple options may apply);
- Nine are of the category 'Vendor';
- Ten are of the category 'Other', meaning they are a Consultancy Firms or Integrator, Research Institute, User or User Group, or Regulator.

### Main results

We present the main results of the survey in a number of graphs. Results are presented using percentage as a scale. The value of each of the five answers possible per category ads up to 100%. Not every respondent answered all questions or gave an answer to every sub-category in some questions. By using percentage as a scale, the answers across the various categories become comparable.

The questions on re-use and on standardisation are used to validate the earlier mentioned hypotheses. Figure A-2, Figure A-3, and Figure A-4 show the results of these questions.

Figure A-2 shows the amount of re-use for each of the main categories: fixed, mobile, IT, and regulatory. Ignoring regulatory for now, it is clearly seen that mobile has the most re-use, followed by fixed and IT. Mobile scores 75% on much and mostly re-use, fixed scores 52% on this and IT scores 15% on this. Also, mobile only scores 8% on hardly any and little re-use, while fixed scores 24% on this and IT scores 53% on this.

These results are very much in line with the hypotheses. Mobile requires more standardisation than does fixed because of roaming and the handset market. Fixed infrastructure is still primarily based on standards, e.g. DSL or DOCSIS specifications, but in many cases tailoring of equipment by operators does occur. IT, on the other hand, is often a national matter and is more often an implementation of individual agreements and thus less standards-based. Re-use and standardisation go hand-in-hand. This becomes clear when looking at the results from the questions on standardisation.

125 The survey has been sent to mailing lists and individual members from 3GPP, ETSI TISPAN, ETSI MCD, DVB, Ecma, ETNO, NGMN, ANGA, VATM, ERO SE42, BTG, ICIN conference, ETIS conference and TNO partners in several research projects like 4GBB, Rubens, HBB-NEXT.

In each category there are two questions on standardisation that complement each other. The first question is concerning the amount of standardisation. The second question covers the impact of a lack of standardisation on the barriers to an Internal Market. Figure A-3 shows the amount of standardisation in each of the main categories fixed, mobile, IT and regulatory, and Figure A-4 illustrates the impact of a lack of standardisation.

Figure A-3 is interesting for the overview it offers and for the differences between the various categories. A total of 62% of respondents disagrees or strongly disagrees with the statement that all interfaces are standardised, while only 19% agrees or strongly agrees with this. For mobile, 32% disagrees or strongly disagrees; for fixed this is 62% and for IT this is 89%. The portion of respondents that agrees or strongly agrees with this statement for mobile is 42%, for fixed is 19%, and for IT is 0%. This clearly indicates that respondents find mobile more standardised than fixed, and fixed more standardised than IT. However, overall, standardisation is still to be further developed.

Figure A-4 is also interesting for the overall view it offers, and somewhat interesting for the differences observed between the categories. A total of 66% agrees or strongly agrees that a lack of standardisation is a barrier for expansion into multiple countries, while only 15% disagrees or strongly disagrees with this statement. The portion of respondents that agree or strongly agree are for mobile 53%, for fixed 62%, and for IT 89%. Respondents to disagree or strongly disagree comprise for mobile 26%, for fixed 24%, and for IT again 0%.

The results shown in these first three figures are very consistent. Still ignoring regulatory aspects, mobile telecommunication infrastructure has the most re-use, the most standardisation, and the least impact on the barriers to the Internal Market; it is followed by fixed telecommunication infrastructure and finally IT. Also, respondents overall indicate very clearly that a lack of standardisation poses a barrier to the Internal Market. This is completely in line with the proposed hypotheses; we thus consider these validated.

The answers on re-use in the regulatory category were less pronounced. Still, in all three areas shown in Figure A-2, Figure A-3, and Figure A-4 the category ’regulatory’ scores less than mobile and better than IT. It has less re-use than mobile, but more than IT; it is less standardised than mobile, but more than IT; and, this poses more of a barrier than mobile, yet less than IT.

**Figure A-2 Averaged amount of re-use for each of the categories fixed, mobile, IT, and regulatory**

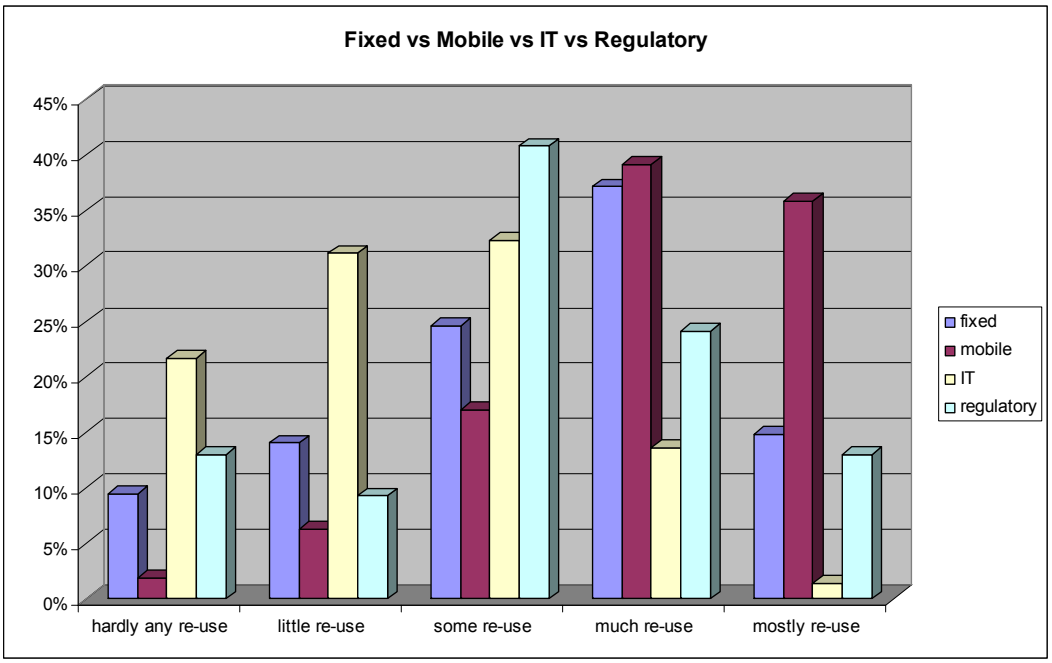
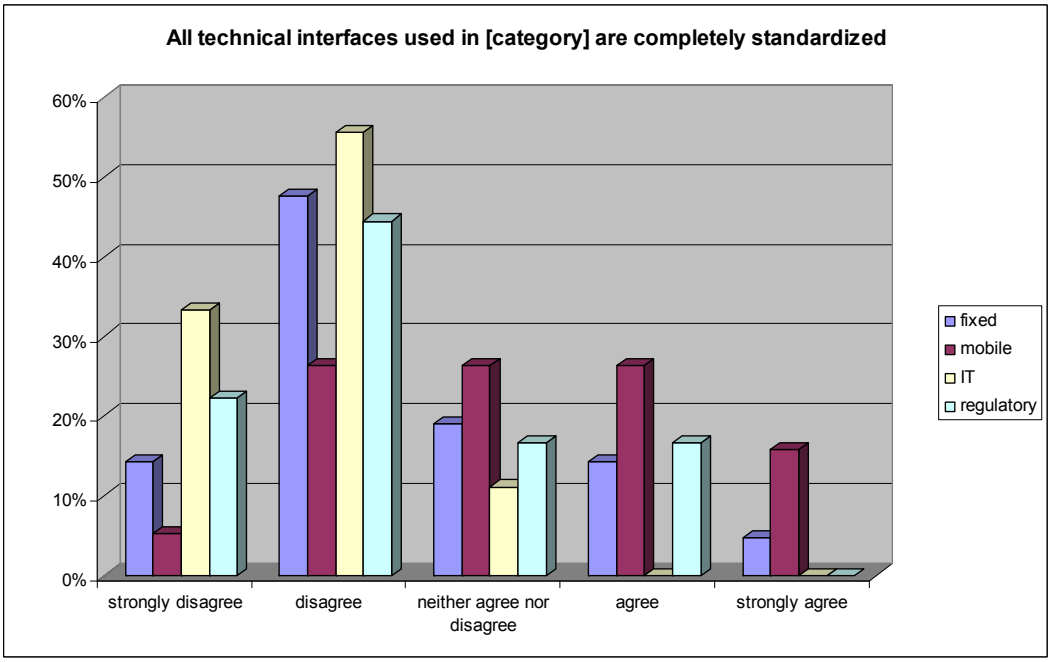



**Figure A-3 Amount of perceived standardisation for each of the categories fixed, mobile, IT, and regulatory**




In addition to confirming the hypotheses, the survey results offer several other insights that are relevant for e-communications in the Internal Market. Figure A-5 shows the overall differences between the three identified subgroups of respondents: Telcos, Vendors, and Other. The interesting insight revealed in this figure is that vendors score 62% on much and mostly re-use, while telcos score 50% and others score 43%. At the other end of the scale, vendors score 15% on hardly any and little re-use, while telcos score 22% and others score 31% here. The differences between the two outer categories are larger still: the scores of vendors are more than double those of telcos and others in mostly re-used, and only about half of those of telcos and others in the hardly any re-use category. Thus, the results indicate that vendors have a more positive view on the potential for re-use than other types of respondents.

**Figure A-4 Perceived impact of a lack of standardisation on the barriers for the Internal Market**

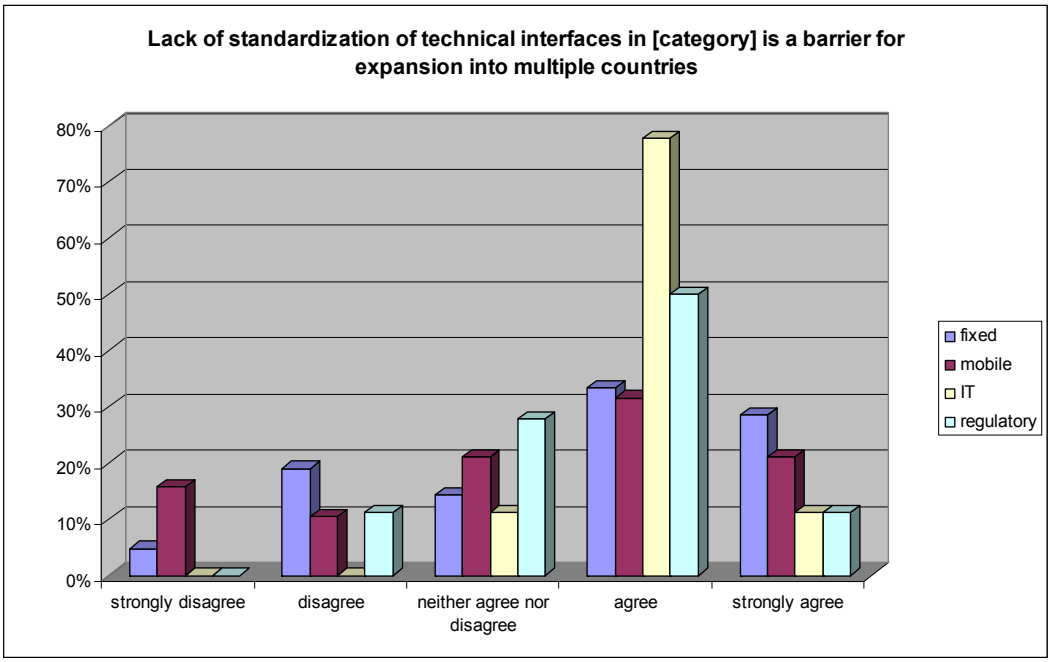
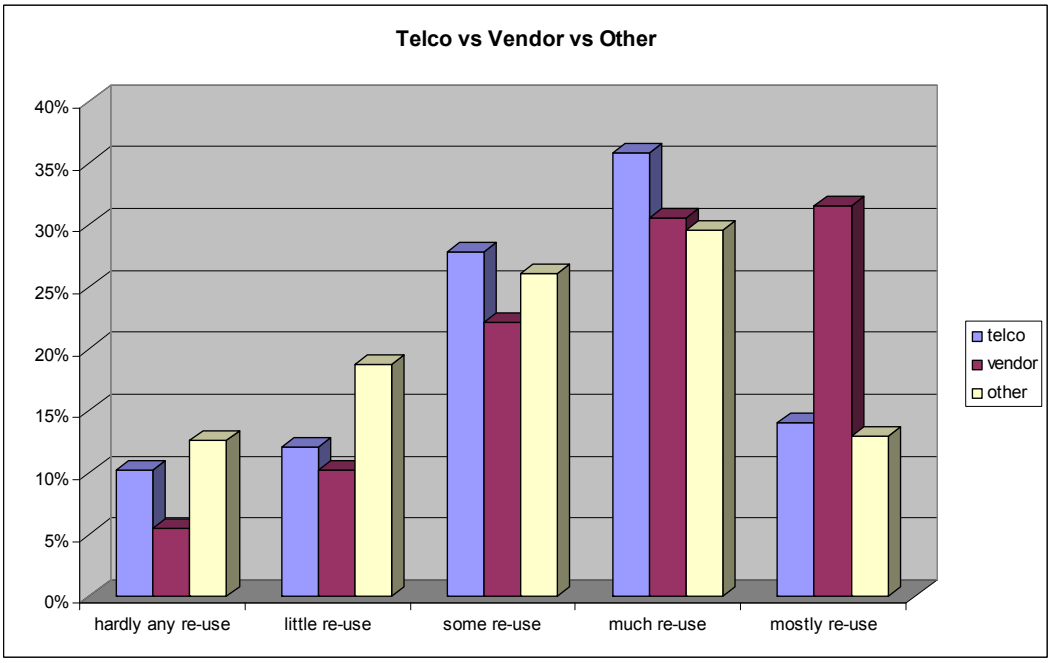



**Figure A-5 Differences in answers between the group of Telco respondents, Vendor respondents and other respondents**




Another valuable insight is revealed by zooming into the sub-categories of fixed and mobile re-use, as shown in Figure A-6 and Figure A-7. Figure A-6 shows the eight sub-categories for fixed infrastructure re-use. When looking at the sum of much and mostly re-use, the co-location services score lowest by far with 11%, followed by backhaul services with 33% and core network with 50%. These are clearly the aspects that require national implementation in each country, whereas the other parts are more easily re-used when expanding into new countries.

Figure A-7 shows a similar picture for mobile. This chart is less clear, however, and mobile scores regarding re-use are much higher on average than those for fixed. Site development is clearly

lowest with 53% on much and mostly re-use, while the other sub-categories score above 70% and as high as 89% for mobile handsets.

**Figure A-6 Possible re-use in fixed infrastructure sub-categories**

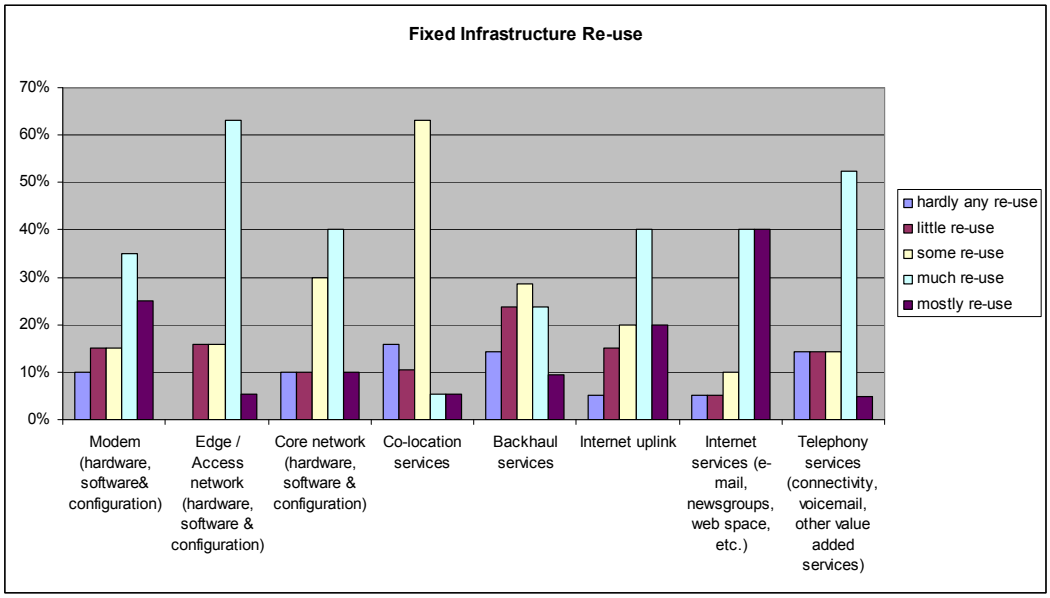
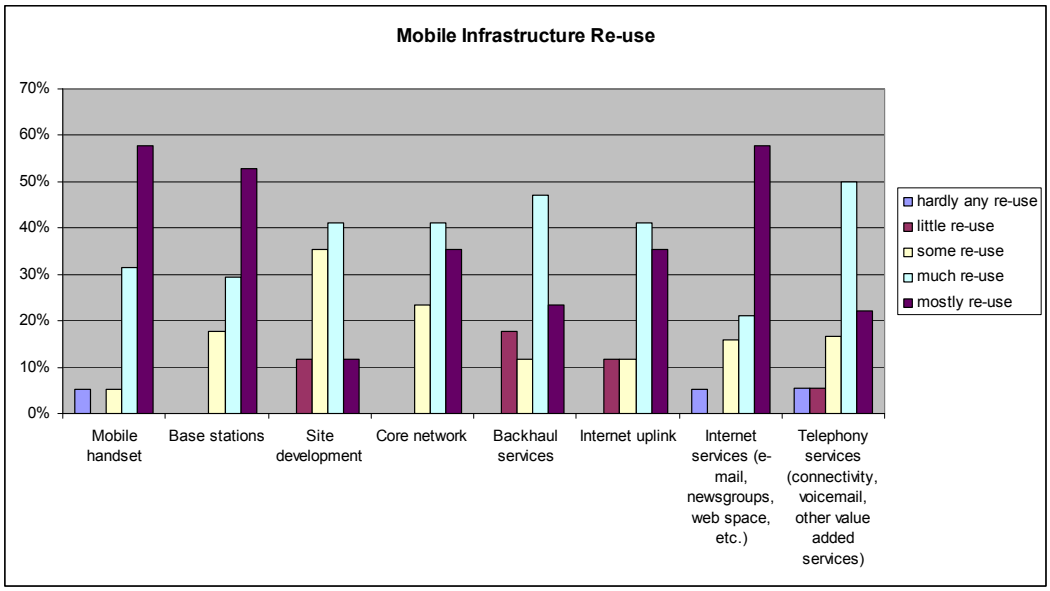



**Figure A-7 Possible re-use in mobile infrastructure sub-categories**




The survey also contains a number of open questions. For the most part, respondents were asked to add additional subcategories if they found any missing or if they found the current categories unclear, too broad, etc. Only one respondent made use of this option, by adding the category 'Interference on citizen equipment' in the mobile category. This single response is insufficient to complement or refine the current list of technical obstacles to the Internal Market.

# Annex VI Case studies

## Introduction

The case study on the United States is included here to support the discussion on the performance of e-communications markets in Europe, often making a comparison with the US as a country of similar size and population, but with a much more homogeneous market. In fact, the US market is considered by some to be the benchmark. The case study on Korea is also included, as this is seen as a leading country in broadband development.

## Case 1: Telecommunication markets in the US

In this case study we provide a quick overview of the situation in the United States regarding the regulatory and policy framework, the market structure and some of the market outcomes. The outcome of this case study will provide some more detail for comparisons with the situation in the European Union.[126] The next table presents some general indicators for both the US and the EU.

**Table A-12 General indicators of the US and the EU**

| General indicators: | US | EU-27 |
|---|---|---|
| Total population (x mln; 2009) * | 310 | 489 |
| GDP (x € bn; 2009) * | 15,000 | 17,801 |
| GDP per capita (€) * | 48,387 | 36,415 |
| Landmass (excl. water)** | 9,237,075 $km^2$ | 4,195,039 $km^2$ |
| Population density (inhabitants/$km^2$) | 33.6 | 116.5 |

* Dataset Ecorys (excl. Bulgaria); ** CIA World Factbook (retrieved June 2011; for the US this includes 50 states).

The table shows that in terms of GDP, the US and the EU do not differ much. Given the total population, the US realises a 32% higher GDP per capita than the EU. This is related to convergence in per capita income levels between EU Member States, which is stronger than between the states in the US. Another important aspect to take note of is the much higher population density in Europe.

### Regulatory and policy framework

In the US model there is a Federal Communications Commission (FCC) that has jurisdiction regarding the interstate and international telecommunication.[127] In addition, every state has a state regulatory agency ('Public Service Commission') that is, amongst other policy fields, responsible for the intrastate telecommunication.[128] The FCC is governed by five commissioners, appointed by the US president and confirmed by the US senate (the chairman is selected by the president). From these five commissioners only three may belong to the same political party.[129] As a result, regulation policy in the US has stronger 'political' elements than in the EU.

126 For the European Union, the United States are the best 'international example' to compare with in terms of size (population, landmass, etc.) but especially in terms of welfare (GDP).
127 The FCC was established by the Communication Act of 1934.
128 FCC, http://transition.fcc.gov/connectglobe/sec2.html.
129 FCC, http://www.fcc.gov/what-we-do.

*Development of regulation*

Regulation of the electronic communication sector dates back to the 1930s and has been amended several times since. The most fundamental change was made in 1996 with increased deregulation and the introduction of competition on the local monopolised markets.

> With the Communication Act of 1996[130] a fundamental change was realised in the regulatory approach. Brock and Katz (1997) summarise this as 'a fundamental shift from a telecommunication policy which protects monopolies to a policy which promotes competition'. The objective of the act was to create a local exchange market that could be entered by new competitors. In order to open these markets, the act introduced interconnection, network unbundling, collocation, and wholesale tariffs.[131] The starting point for market entry was the negotiation between the local incumbent and the entrant, but the Act also included regulations for non-binding mediation and binding arbitration. Brock and Katz point out that the introduction of this act was the result of a 'political deal' that introduced local competition in exchange for eliminating the restrictions (including the prohibition of providing long distance service) imposed on the Bell Operating Companies by the antitrust settlement and divestiture agreement of 1982.[132] [133]

With the Communication Act of 1996 there came an end to the FCC approach of 'breaking up' the traditional incumbent. After 1996 the 'Baby Bells' were allowed to act more freely in the market again; currently (summer 2011) there are again three major (regional operating) companies (AT&T Inc, Verizon, CenturyLink) that include all of the former Baby Bells.[134]

The Communication Act of 1996 was focussed on the (fixed) telephone market, which at that moment also included dial-up Internet. The fast introduction of ISDN and (V)DSL in the end of the 1990s and in the 2000s experienced some regulatory problems. Three different regulatory approaches can be identified since 1996, as the FCC changed their approach from active regulation to one of forbearance.[135]

> From 1996 to 2002/2003 the DSL services were regulated, which included the unbundling of the local loop and line sharing ("open access", so competition within each wire). The prices for this line sharing were quite low compared to the price for an unbundled local loop as a whole.[136] Both the obligation of unbundling and the line sharing obligations created much litigation against the FCC decisions.
>
> In 2003 the FCC changed their approach into a partly deregulated regime. They abolished the line share requirements and focussed on the unbundling of the network. Telecom operators had to invest in their own network (climbing the ladder of investment) in order to reach customers against a profitable margin.[137] In 2005 the DSL services were further deregulated when the FCC changed the juridical definition for broadband services. DSL services and cable services (which were never regulated) were now put on the same unregulated parity (access holiday). Again the rationale was that less network sharing obligations

130 The Telecommunications Act of 1996, Public Law No. 104-104, 110 Statutes 56.

131 Brock, G.W., Katz, M.L., 'Regulation to promote competition: A first look at the FCC's implementation of the local competition provisions of the telecommunications act of 1996', Information Economics and Policy 9 (1997) 103-117, p. 104-105; see also: Berman Centre, 'Next Generation Connectivity', October 2009 (draft), p. 82.

132 Brock, G.W., Katz, M.L., 'Regulation to promote competition: A first look at the FCC's implementation of the local competition provisions of the telecommunications act of 1996', Information Economics and Policy 9 (1997) 103-117, p. 104-105.

133 In 1982 incumbent AT&T Corp. was forced by the FCC (as result of an antitrust suit) to divest and split into seven regional operating companies (the 'Baby Bells'). Beside these seven companies, there were two other companies AT&T had invested in and became then independent (Cincinnati Bell and SNET).

134 AT&T Inc. includes now four of the original Bell companies, namely Southwestern Bell, BellSouth, Ameritec and Pacific Telesis. Verizon includes Bell Atlantic and NYNEX. CenturyLink includes US West/Qwest.

135 Hazlett, T.W., Caliskan, A., 'Natural experiments in the US Broadband regulation', Review of Network Economics, vol. 7, issue 4, December 2008, p. 463-465.

136 Berkman Centre, 'Next Generation Connectivity', October 2009 (draft), p. 82-83; see also footnote 135.

137 See footnote 135and 136.

would increase market initiatives (and investments), [138] especially in the field of the next generation network.[139]

*Current policy*

In 2009 the US Congress required the FCC to develop a national broadband plan in order to increase the level of broadband access.[140] It was assessed that the US was (far) behind other advanced countries in terms of broadband penetration and that severe welfare potentials were left unfulfilled. In the National Broadband Plan (March 2010) the FCC formulates it as "critical problems that slow the progress of availability, adoption and utilisation of broadband".[141]

These 'critical gaps' in the US policy are, for example, (i) the Federal Universal Service Fund (USF) includes telecommunication (€ 7 billion), but does not subsidise broadband deployment; (ii) existence of a broadband adoption gap (low broadband adoption in certain social/demographic groups); (iii) existence of a consumers information gap (consumers lack essential market information, e.g. regarding performance, comparisons, etc.); and (iv) existence of a spectrum gap (lack of spectrum, reallocation problems, etc.).[142] With the National Broadband Plan the FCC wants to close these 'critical gaps' and achieve a number of goals of national importance (access to high-speed Internet for 100 million US citizens, world leadership in mobile networks, etc.)

**Market structure telecommunications**

*DSL and cable market*

As mentioned above, the US has a long history of divesture (in 1982) and consolidation (since 1996) of the Baby Bells. At the moment, there are again three major regional operating companies: AT&T Inc, Verizon and CenturyLink. The merger between Qwest and CenturyLink was approved by the FCC in March 2011.[143]

The FCC investigated the announced merger and concluded that "the potential competitive harms arising from this transaction are limited; in a transaction spanning 37 states, CenturyLink and Qwest compete against each other in only four markets". In addition it was concluded that "with certain conditions (…), the likely public interest benefits of the transaction outweigh the potential public interest harms, and the transaction therefore will serve the public interest".

In the cable market there are three major players: Comcast, Time Warner cable and Cablevision.[144] More and more, DSL and the cable are each other's main competitors. Picot indicated already in 2007 that the market data pointed to a 'strong duopoly tendency' between the telecom and cable operators.[145]

An important remark in this sense is that despite the fact that the majority of the US citizens have access to broadband Internet, the number of available providers is sometimes very limited.

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138 See footnote 135.

139 Renda, A., 'Competition-regulation interface in telecommunications: What's left of the essential facility doctrine', in: Telecommunications Policy, volume 34 (2010), p. 23-35, p. 23.

140 In the American Recovery and Reinvestment Act of 2009 the FCC is required 'to submit in 2010 (…) a report containing a national broadband plan'.

141 FCC, National Broadband Plan, March 2010, p. 3.

142 FCC, 'FCC identifies critical gaps in path to future Universal broadband', FCC news, November 2009.

143 FCC, see: http://transition.fcc.gov/transaction/centurylink-qwest.html.

144 Hazlett, T.W., Weisman, D.L., 'Market power in US broadband services' in: Review of industrial organisation, volume 38 (2011), number 2, p. 151-171.

145 Picot, A., Wernick, C., 'The role of government in broadband access', in: Telecommunications Policy, volume 31 (2007), p. 660-674, p. 670.

Especially in metropolitan areas the number of providers that offer broadband Internet can be substantial, which also results in fierce competition.[146] Grubesic states that the presence of several providers also benefits the suburbs and exurbs around those metropolitan areas. However, in rural areas (e.g. in the Mid-West), the presence of broadband providers can be very limited (often one provider, low broadband speeds).[147]

The low level of access to broadband Internet in rural areas is also one of the main identified problems in the National Broadband Plan. The FCC observed that in 2009 approximately 14 million US citizens did not have access to a decent level of broadband infrastructure, often in areas with low population density where there is no business case for private players.[148] In their 7th Broadband report the FCC even mentioned a number of 26.2 million customers (9.2 million households) that are 'unserved' by broadband Internet.[149] One of the most important FCC initiatives in this sense is to redefine the requirements for the Federal Universal Service Fund (USF), offering more room for federal investments in broadband deploy.[150]

*Mobile market*

In the mobile market, one can observe a consolidation trend. At the moment there are four mobile operators left with a national coverage: AT&T, Sprint, T-Mobile, and Verizon.[151] In 2009, large mergers were realised between Verzion and Alltel, as well as between Sprint and Clearwire. In March 2011, AT&T and T-Mobile announced that, pending FCC approval, AT&T would acquire T-Mobile USA.[152]

There is a strong debate in the US at the moment whether telecom operators are allowed to block the services of certain applications or 'net neutrality' should be respected.[153] Providers of content and applications (like Google, Yahoo, Amazon, eBay, etc.) have an interest in free data transmission over the networks of the telecom operators, without any premium pricing for data streams or blocking certain services (including services that bypass the original services of the telecom operators). Telecom operators, in contrast, aim to control this, also in the interest of defending their business case. These developments will evolve the coming years in a new balance of power in the market.

Net neutrality is an important item in the National Broadband Plan. Nevertheless, the US Court of Appeals stated in April 2010 that the FCC exceeded its 'ancillary authority' under the Communication Act when they proceeded against a cable operator that was blocking certain applications. [154] In December 2010 the FCC made an important decision regarding the net neutrality (the Open Internet Order), which included basic rules regarding transparency (services, networks), no blocking (content, applications, services), and unreasonable discrimination (of network traffic).[155] The decision was taken, with three against two Commissioners votes.

146 Grubesic, T.H., 'The spatial distribution of broadband providers in the United States: 1999-2004', in: TelecommunicationsPolicy, volume 32 (2008), p. 212-233, p. 213.
147 See footnote 145 p. 213-214.
148 See footnote141, p. 136-137.
149 FCC, 7th Broadband progress report, May 2011, p. 15.
150 FCC, 7th Broadband progress report, May 2011, p. 10, 15.
151 Conolly, M. Prieger, J., 'Economics at the FCC, 2008-2009: Broadband and merger review, Review of industrial organisation, volume 35 (October 2009), p. 387-417.
152 FCC, see: http://transition.fcc.gov/transaction/att-tmobile.html
153 Here defined as: no premium pricing and no discriminatory access upon content and services.
154 It was seen as an important 'victory' for telecom providers like AT&T and Verizon against the advocates of net neutrality like Google and Amazon. See: Kurtin, O.D., 'FCC seeks to reclassify broadband as regulated', The National Law Journal, April 2010.
155 FCC, In the Matter of Preserving the Open Internet Broadband Industry Practices, December 21 2010.

## Performance

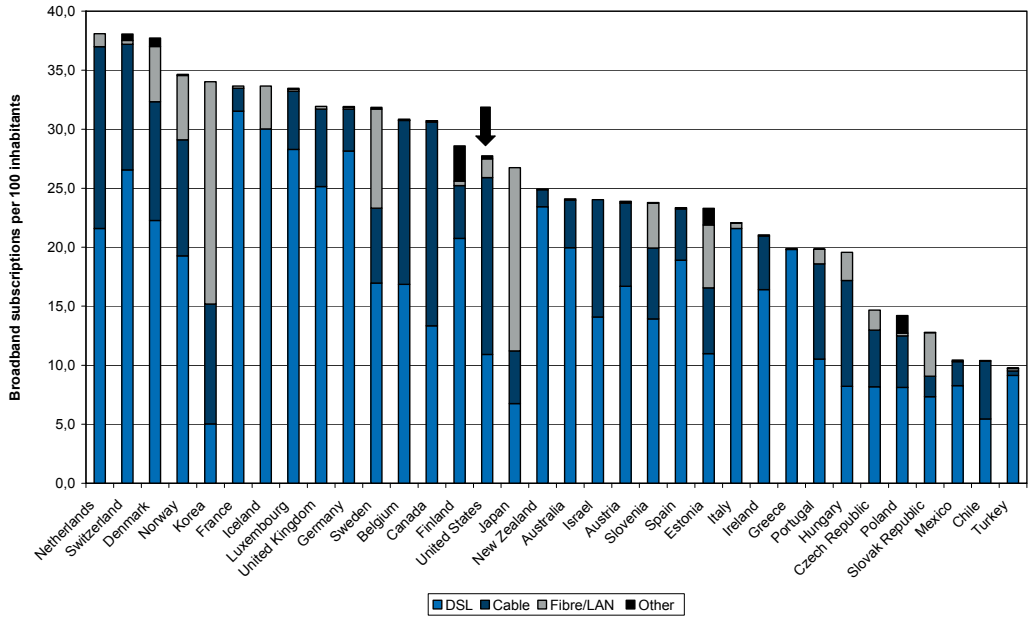
### *Current performance of the US*

The US government indicated in several recent reports that the US is lagging behind compared to other advanced countries.[156]

Compared to 57 advanced countries, the US ranked 23rd in 2010 in the Broadband Composite Index (BCI), a ranking that includes five indicators (household penetration, speed, affordability, value for money, and urbanicity). The list is headed by South Korea, Hong Kong, and the Netherlands.[157] The position of the US in this ranking is confirmed by the Berkman Center, whose findings suggest the United States to be a a middle-of-the-pack performer.[158]

Also compared to other OECD countries, the US indeed does not score among the top for most of the regular performance indicators. When we look for example at the number of broadband subscriptions per 100 inhabitants, the US ranks fifteenth (see graph below, black arrow).

**Figure A-8 OECD Fixed (wired) broadband subscriptions per 100 inhabitants, by technology, Dec. 2010**




Source: OECD Broadband portal

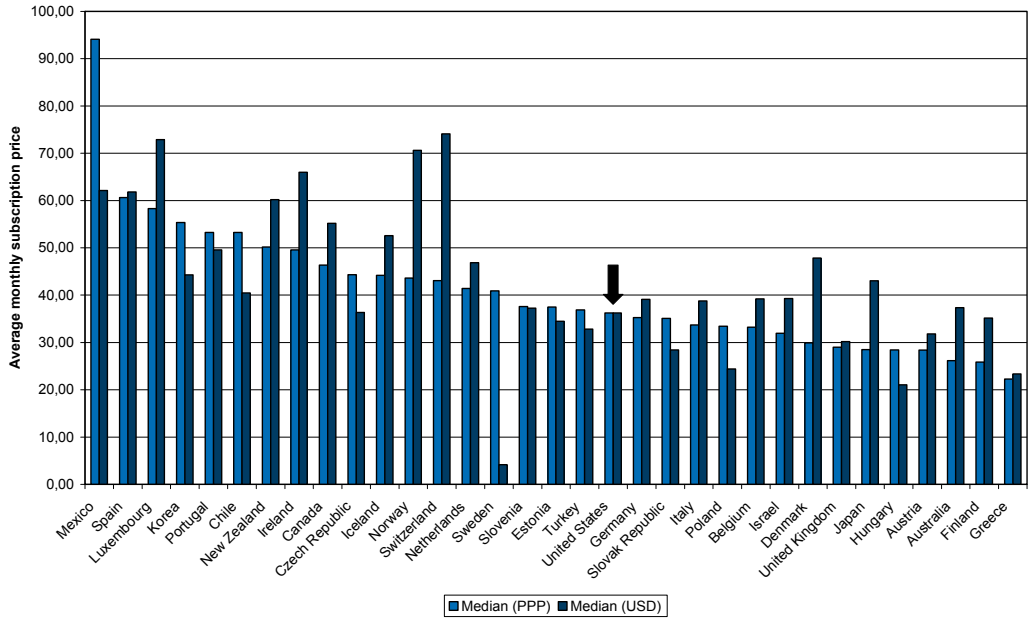
For broadband connections between 2.5 and 15 Mb/s the average monthly subscription price in the US was $36.25 (same in PPP), which placed the US in a 15th position (in PPP terms in $, 11th position). This means that, compared to other OECD countries, this speed category is quite expensive. See the next graph. For other speed categories this view is not fundamentally different (sometimes better positioned, sometimes worse).

156 See for example: FCC, 'Second International Broadband Data Report', May 2011 (and also the first edition). Previously we already refered to the National Broadband Plan (2010), the (6th and) 7th broadband progress reports (2010/2011).

157 Strategy Analytics, Je=une 2010, see for example: http://www.strategyanalytics.com/default.aspx?mod=reportabstractviewer&a0=5646.

158 See footnote136, p. 10.

**Figure A-9 Average monthly subscription price for connections between 2.5 and 15 Mb/s, with line charge (Sept. 2010)**




Source: OECD Broadband portal

### *Effects of FCC regulation on performance*

An important question in the economic literature is what the effect of the US regulatory approach (from regulation to forbearance) has been on the development of the broadband market. It is apparent from current research that there is no uniform answer for that question.

For example, Hazlett concludes that over the past decade in the US, the broadband subscribers growth was significantly and negatively correlated with regulation. To put it differently, the deregulation after 2003 had a positive effect on the broadband penetration rate. The robust deployment response is inconsistent with the view that broadband regulation promotes innovation that spurs infrastructure investment or deployment.[159]

The Berkman Centre concluded the opposite. They observe that the original US model of open access (unbundling, bitstream access, collocation, etc.) has played a very important role in the first generation transition to broadband and will play a key role in the development of the next generation network. They point out that, while open access has been a 'closed issue' since 2001/2002 in the US, countries like Japan and South Korea have become the world leaders with this model. Unbundling, so the approach the US abolished, had a positive contribution on the penetration per 100 inhabitants, according to the Berkman Centre.[160]

Renda points to the disagreement among economists with regards to this view and that The Berkman Centre report contrasts with a number of other findings in literature, like Wallsten (2007), Waverman, Meschi, Reillier and Dasgupta (2007), Wallsten and Hausladen (2009), Grajek and Röller (2009), and Pietrunti (2010), who conclude that access policy has a negative effect on the incentives to invest in (future) infrastructure, so a limitation of dynamic efficiency.[161] Renda observes limited empirical evidence in support of the investment ladder approach in Europe:

159 Hazlett, T.W., Caliskan, A., 'Natural experiments in US broadband regulation', in: Review of network economics, volume 7 (december 2008), p. 460- 480, p. 460 en 477.

160 See footnote 136, p. 11-12.

161 See footnote 139, p. 27.

"available data so far suggests that aggressive access policy resulted in excessive service-based competition in many countries, with low prices emerging together with low investment and speed. At the same time, countries that deviated from this track to protect investment exhibit higher prices, but also better infrastructure".[162]

## Case 2: Telecommunication markets in South Korea

In this case study we look at the development of the Republic of South-Korea and how this country became a leading nation in terms of ICT developments in general and broadband deployment and use in particular. We can distinguish two phases for this development. The first phase, starting in the early 1970s, is a typical example of what economists call a 'catch-up economy', whereby the gap with other countries is reduced. It reflects an ongoing emphasis on education – a catch-up process started in the 1950s, industrialisation and informatisation. The latter becomes the basis for the start of phase 2, when leadership positions are developed in selected parts of the ICT industry.

We identified a number of key factors for the Korea success: (1) initiative from the centre of political power, the "Blue House"; (2) ownership for the execution of the total 'project' firmly embedded in the government bureaucracy; (3) orchestrated participation by the *chaebol* (industrial conglomerates), such that the government retained management control; (4) a combination of responding to, or creating of, national demand with the prospects of export; and (5) engagement of government R&D centres and government funding. As a result, with the strong 'visible hand' of the government, the role of markets remained limited, until the introduction of ADSL (end of the 1990s) with fierce infrastructure-based competition between the three major players: Thrunet, Hanaro, and Korea Telecom. These will be discussed below in more detail.

### Korea's jump to ICT leadership

The current Korean leadership has achieved remarkable economic progress in Korea. Until the late 1960s, the country was considered on most accounts to be a developing nation, following the occupation by Japan from 1910 to 1945, the subsequent North-South division, and the devastating Korean War from 1950 to 1953. The economy was largely dependent on agriculture and the country had no previous track record in technological development. Industrialisation followed the typical path from agriculture to heavy industry, including shipbuilding and cars, as well as chemicals. In 1980 the focus turned to the electronics industry as a result of an initiative from the "Blue House".

The transformation to an innovative and knowledge-based economy in this case is considered to be largely due to education as a prerequisite and to tapping into the power of the ICT-revolution (see below).

> As a result of Japanese colonial rule, access to education beyond the elementary level had been restricted. Consequently, directly after World War II only 64% of children of the age to attend elementary school were enrolled, 3.2% for secondary education and only 0.18% for higher education. It was estimated that of the population aged 13 and above, 53% was illiterate. Education thus became one of the nation's main priorities after the Korean War (1950s). Furthermore, immediately after the Asian financial crisis (end of the 1990s), the government embarked on a comprehensive informatisation programme aimed at improving digital literacy of the entire Korean population. By 2002, almost 11 million people, including housewives

162 See footnote 139, p. 34-35.

and farmers, had received ICT education; by 2006, Korea was leading the world in the proportion of tertiary science graduates aged 25 to 34. As a further illustration, the number of expatriate English teachers increased from 1,000 in 1988 to 43,000 in 2009. Moreover, by December 2008, more than 110,000 Korean students were studying in the USA at all levels, ahead of China, India, and Japan. (Oh and Larson, 2011; Wikipedia, 2011b; 2011d).

In 1997, the ICT industry accounted for only 5.9% of GDP, which increased to 8.3% by 2009 as a result of growing production and export of semiconductor memory chips, flat panel displays and television sets, mobile handsets, and components for digital electronic devices. In terms of GDP growth, ICT contributed 12% in 1997 and 40% in 2009.

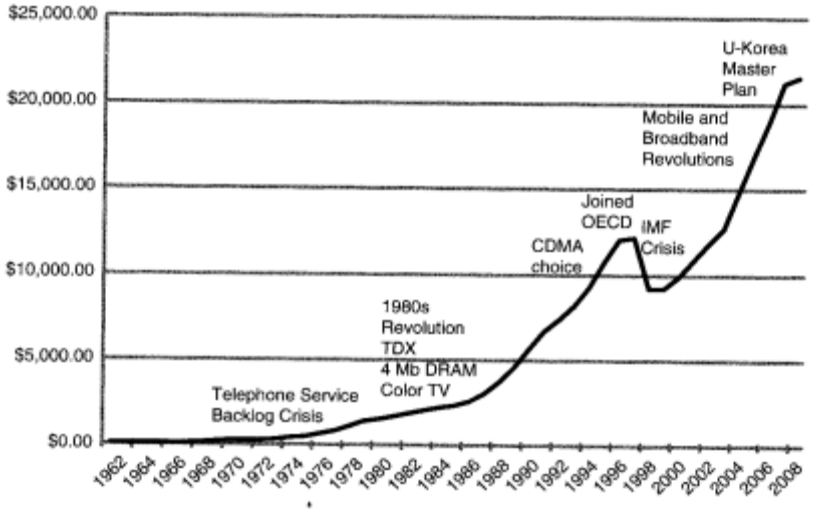
The changes in the economic structure and the growth of the Gross National Income per capita are summarised in the next table and figure.

**Table A-13 Economic structure of South Korea, 1962-2005**

| | *1962* | *1972* | *1982* | *1992* | *2005* |
|---|---|---|---|---|---|
| Population (millions) | 26.5 | 33.5 | 39.3 | 43.7 | 48.1 |
| Economically active population (%) | 56.4 | 57.7 | 58.6 | 60.9 | 62.0 |
| Unemployment rate (%) | 8.2 | 4.5 | 4.4 | 2.5 | 3.7 |
| Absolute poverty (%) | 48.3[a] | 23.4[b] | 9.8[c] | 7.6[d] | 6.4[e] |
| **Macroeconomic indicators** | | | | | |
| GNP (US$ billions) | 2.3 | 10.7 | 74.4 | 329.3 | 790.1 |
| GNP per capita (US$) | 87 | 320 | 1,893 | 7,527 | 16,413 |
| **Industrial structure (% of value added)** | | | | | |
| Agriculture, forestry, fishing, mining | 63.4 | 50.5 | 32.1 | 14.0 | 7.9 |
| Manufacturing | 7.5 | 14.1 | 21.9 | 26.5 | 18.6 |
| Services | 29.1 | 35.4 | 46.1 | 59.5 | 73.5 |
| **Trade structure** | | | | | |
| Export (US$ millions) | 55 | 1,624 | 21,853 | 76,632 | 284,429 |
| Share of capital goods exports (%) | 4.9 | 9.8 | 25.2 | 37.5 | 43.9 |
| Import (US$ millions) | 422 | 2,522 | 24,251 | 81,775 | 261,238 |
| Share of capital goods imports (%) | 16.5 | 29.9 | 25.7 | 37.7 | 34.7 |
| **Human resources** | | | | | |
| Illiteracy rate (%) | 29.4 | 12.4 | 7.2 | 4.1 | 2.2 |
| University enrollment after HS (%) | 29.2 | 29.0 | 37.7 | 34.3 | 82.1 |
| Number of university graduates | 20,452 | 29,544 | 62,688 | 178,631 | 268,833 |
| Proportion of science & engineering graduates | 34.6 | 45.7 | 46.4 | 40.9 | 39.4 |
| **Technology indicators** | | | | | |
| GERD as share of GDP (%) | 0.25 | 0.29 | 0.96 | 2.03 | 2.99 |
| Private enterprise share of GERD (%) | 22.2 | 31.9 | 50.4 | 82.4 | 75.0 |

Source: Oh and Larson, 2011.

**Figure A-10 South Korea GNI per Capita, 1962-2008**




Source: Oh and Larson, 2011.

### *Major government initiatives*

In 1980 a long-term strategy to foster Korea's electronics industry was developed, focused on the development of two strategic industries: (1) semiconductors and (2) electronic switching systems. In a series of government initiated and led projects, the ICT leadership position was built: the 4 Mb DRAM memory chip project (1974-1987); the TDX electronic switching project (1976-1995); the Korea Information Infrastructure (KII) project (1995-2005); the ADSL project (1997-2000); the CDMA project (1991-2002); the WiBro wireless broad band project (2003-2009); and the U-Korea Plan (2006-current). The first two are discussed below; the other initiatives are discussed later.

#### The 4 Mb DRAM project[163]

By the late 1970s four private firms were involved in semiconductor manufacturing: Samsung, Goldstar, Daewoo and Taihan. They were using LSI technology, while the firms in Japan and the USA had moved to VLSI technology. By 1982 the Korean government was eager to move the industry into VLSI. By December 1983 Samsung demonstrated a working version of a 64k DRAM, the state-of-the-art product at the time. However, when full-scale production was available, the American and Japanese firms were already producing 256k DRAM chips. To reach the next stage of development–4 Mb DRAM–the government advised Samsung to work together with other companies (Goldstar and Hyundai). This effort narrowed the gap with the market leaders to only six months. At the end of the 1980s, Korean producers benefited from a trade agreement between Japan and the US (limited Japanese access to the US and a floor price for semiconductor products), as well as the boom in personal computers.

#### The TDX project[164]

The telecommunications part of the Long-term Plan implied a target of "one telephone per household", whether rural or urban, whereby rich and poor would receive the same level of telecommunications service.[165] Implementation of the plan involved the construction of the nation's digital network, with a fibre optic backbone and digital switches (TDX). ETRI, an important Korean institute, contributed to the project with a high-level of design and system integration, assisted in this effort by research groups at universities

163 Oh and Larson, 2011.

164 Oh and Larson, 2011, p. 27-30.

165 The wealthy and privileged had found ways to get around the telephone service backlog paying $3,000 or more on the black market for a white telephone, which came with automatic registration for the immediate start of service.

and other government institutes. The basic technology was transferred to Samsung, Goldstar, Daewoo and OPC, the manufacturing of equipment being equally divided among these companies. Korea Telecom was the main TDX customer, providing the funds for the project and the programme management, as well as providing user requirements, conducting qualification tests, and commercialisation of the technology. The TDX project allowed Korea to build a modern telecommunications network, thereby coping with increased demand and developing an indigenous digital exchange technology.

## Regulatory and policy framework

### *The telecommunications reform*

After having provided basic telephone service to the general public in the 1980s, the Korean government began more actively do deregulate and restructure the telecommunications market in the 1990s. The next table summarises the other major steps in the privatisation and liberalisation of the telecommunications sector.

**Table A-14 Telecom privatisation and liberalisation in South Korea**

| Privatization | | Liberalization | |
|---|---|---|---|
| 1982 | Korea Telecommunications Authority (KTA) established | | Gradual introduction of competition in basic telecom services: |
| | Separation of specialized service operations from KTA: | 1991 | International: Onse Telecom |
| 1982 | International: Data Communications Corporation of Korea (DACOM) | 1994 | Mobile: Shinsegi telecom given second mobile license (CDMA) |
| 1983 | Mobile: Korea Mobile Telecom (KMT); divestiture 1988 | 1995 | Long-distance |
| 1995 | Korea Port Telephone | 1997 | Local service: Hanaro Telecom |
| 1994 | Privatization KMT | 1990 | Full liberalization value added services |
| 1997 | Privatization Act passed | 1996 | Three PCS operators allowed to enter: Korea Telecom Freetel, LG Telecom, Hansol PCS |
| 2002 | Full privatization KT | 1997 | Resale |
| | | 2001 | Foreign ownership limit increased to 49% including KT |

Source: Oh and Larson, 2011; Wikipedia, 2010b

### Privatisation

Already in 1982, the Korean Telecommunications Authority (KTA) and the Telecommunications Policy Office were established. This allowed the separation of services from telecommunications policy-making by the MoC. KTA became responsible for the management of telecommunications services, with the government as sole investor, contributing 2.5 trillion Won (approx. US$ 3 bln). Some 35,000 employees from 153 divisions moved from the MoC to KTA. Later KTA was renamed Korea Telecom. After that, other privatisations followed (e.g. Korea Mobile Telecommunications – KMT).

Domestic policies drove the full privatisation of KT, as Kim Dae Jung had promoted privatisation of state-owned enterprises as part of his presidential election campaign in 1997, with the aim to raise governmental revenues and to avoid criticism from several parts of society regarding corrupt relationships of the government with public enterprises (Jin 2006). The full privatisation appeared to be a difficult (political) negotiation process between the telecom operators, *chaebol,* and the government.

### Liberalisation

A major factor in the restructuring of the telecommunications industry was the pressure from bilateral trade talks with the US and subsequently the multilateral talks in the GATT and WTO. Local pressure was generated by the *chaebol,* which were very large users of KT's services. On the

one hand they wished to reduce operating costs and on the other hand they wished to participate in the lucrative services market (Jin, 2006).

In response to the pressures, in 1990 the Korean government restructured the telecommunications market, applying three categories of service providers: general, specific, and value-added (registration-only). This allowed the opening of the value-added services market and part of the mobile market. Value-added services were opened to full competition, under the expectation that this has no major impact on the domestic industry, because of poor local demand. The principle of 'facilities-based' competition was followed, i.e. no unbundling requirements or wholesale was enforced upon the incumbent operator Korea Telecom (Kushida and Oh, 2006; Oh and Larson, 2011).

In 1996, Thrunet was founded, as the government intended to licence one firm to lease out cable infrastructure[166], with computer manufacturer TriGem and state power company KEPCO as major partners among the 100 that joined the consortium. Thrunet leased the coax cable network and fibre-optic backbone from KEPCO.[167] In this way the government initiated a 'three-way' telecommunications competition policy, aimed at preventing one or two *chaebol* or public enterprises dominating the telecommunications services market. Typically a 5% limit was set for individual *chaebol* ownership (Jin, 2006; Oh and Larson, 2011).[168]

Consolidation occurs in the mobile telecommunications market as Hansol PCS merged with Korea Telecom Freetel in 2001 and Shinsegi Telecom merged with SK Telecom in 2002. This leaves three mobile operators to serve the Korean market: SK Telecom (17.2 million users at the end of 2002; 53% market share), Korea Telecom Freetel (10.3 million, 32%) and LG Telecom (4.8 million, 15%) (Wikipedia, 2010b).

### The emergence of Internet

#### *The start of commercial Internet services*

The 'commercial' Internet services only started with the launch of KORNET by Korea Telecom, DACOM Internet and nuri.net by Inet Technologies together with Nowcom in 1994.[169] The Korean government conclude already in the early 1990s that the construction of a nation-wide fibre-based ATM backbone network was essential for economic development. A pilot project on a national scale was started with the government as the first customer, supported with $1 billion in grants (in US Dollars). Private companies constructed the network to connect all government offices. In this way, the government eliminated the start-up risk of such a large project. The initiative was formally announced in the Korea Information Infrastructure (KII) plan in 1995.

166 Cable television was available as a simple cable-relay to improve reception since 1960. Provision of additional programming not available on terrestrial-based stations started in 1995. The market was fragmented, with exclusive licenses awarded on a regional basis to 77 system operators (Kelly et al., 2003).

167 For the cable services, the government required structural separation of conduit and content, the two state-owned cable infrastructure owners Powercomm and KT were not permitted to offer services, but were expected to lease capacity to programmers at regulated prices. This rule was relaxed as KT sold its cable infrastructure to cable service providers in 2000 (Chung, 2006; Kushida and Oh, 2006). KEPCO had installed fibre in its network from 1980 onward, anticipating that once it had the infrastructure, the government would be forced to allow KEPCO to use it more productively.

168 On the fixed side, LG, one of the three PCS operators, successfully requested the government to lift a 5 percent limit on its ownership of DACOM, the data communications subsidiary of Korea Telecom. This allowed LG to acquire DACOM and change its management of DACOM to full ownership and control. When Thrunet tried to merge with Hanaro Telecom in 2004, this attempt failed. However, following bankruptcy proceedings in 2005, Thrunet was acquired by Hanaro (Bloomberg News, 1999; Wikipedia, 2010a).

169 Korea's first TCP/IP based network SDN (System Development Network) – essentially an intranet – connected computers at Seoul National University, the Korea Institute of Electronics Technology and the Korea Advanced Institute of Science and Technology and started operation in 1982.

**The Korea Information Infrastructure (KII) plan**

The Korea Information Infrastructure (KII) plan had the purpose of building an information superhighway providing advanced IT services to the public and promote informatisation in every sector of society and more ambitiously: "…provide various multimedia communications anywhere, anytime, and to anyone, and also to turn South Korea into one of the top ten advanced countries in the IT industry by the year 2002" (Oh and Larson, 2011 p78). The government part of the KII project connected government and public facilities, including educational and research institutes. Korea Telecom and DACOM were the companies chosen to provide the networks. In 1996, very ambitious goals were set for the desired future information society.[170]

The legal foundation for the KII project was provided through a new law: "Basic Act on Informatisation Promotion", passed in 1995 and informatisation was declared a top national priority. The KII project involved a massive government-industry partnership, with the private sector taking the lead role. It included R&D facilitation programs and the government granted preferential tax treatments and provided loans to service providers. The project was very timely as the Internet and the World Wide Web became available globally. The project provided a state-of-the-art infrastructure for broadband Internet, some 4-5 years before most of the other advanced economies of the world. While the original goal was to complete the network by 2015, it achieved all its goals by 2005[171] - a result of continued technological improvements and the private sector engaging in a competition to expand the public portion of the information superhighway.

### Choice for ADSL

Around 1997 the government recognised the importance of constructing a broadband local access network. From the three principal alternatives (ISDN, cable modem and ADSL) ADSL was seen as the best alternative in terms of export opportunities, the bandwidth that could be provided, and the investment costs. As in the wake of the 1997 financial crisis, government budgets were limited; the government initiated a dialogue with the private sector to induce a commitment to ADSL. Nonetheless, the government did provide R&D matching funds to the equipment providers, which Samsung used for the development of an ADSL chip set. To strengthen demands for ADSL, the government created a building certification system for broadband Internet. This allowed construction firms to use access to state-of-the-art broadband Internet in their marketing efforts. The government also applied demand-side policies, by making computer education in schools mandatory and introducing the testing of computer skills for college entrance exams.

### Development of fixed broadband competition

With the roll-out of ADSL, also the fierce infrastructure-based competition between the three major players (Thrunet, Hanaro and Korea Telecom) began.

In the aftermath of the crisis, forecasting demand and setting the appropriate service fee proved to be contentious between the government and the ISPs. Based on estimated GDP per capita and a market size of 2 million by 2002, the ADSL fee was set to $27. In the confrontation with the ISPs the government did not compromise, but instead offered a series of very attractive, low-interest loans ($65 million at 6.5% in 1999 and $100 at 6% in 2001). While Korea Telecom could afford to

170 The "Informatization White Paper 1996" issued by the agency stated the following goals for the information society: (i) to make an efficient government with improved services for the public through electronic data interchange and joint use of information; (ii) to use Internet and remote learning as new educational tool, and enable all Koreans to access academic and research information from within the country and from the world at large; (iii) to promote electronic commerce and increase the provision of start-up and corporate information for stronger industrial competitiveness; (iv) to spread access to information services across the nation so that people in regional areas benefit from it equally, and (v) to create pleasant living conditions by improving medical services, the environment, and safety management

171 By 2000, 80% of the central government documents were computerized and 55% of national and local documents were handled electronically. Targets set in 2001, to be completed by 2002, covered: single point of access for resident registration, real estate, vehicles, and corporate and individual tax; linking four major social insurance systems, home tax services via the Internet; integrated e-procurement system; e-signature; and e-seal system (Kelly et al., 2003).

build the business without the loans, Hanaro used these loans to install optical cables in 4,700 high-rise apartment complexes. As the fee controversy was ongoing, Thrunet[172]-recognising the threat of massive ADSL deployment-volunteered to deploy broadband services at US$25 per month using cable modems that provided a data rate of 1 Mbit/s. As a result, Hanaro Telecom could no longer delay entering the market.[173] This chain of events is considered the start of South Korea's broadband explosion (Chon et al., 2005; Oh and Larson, 2011).

In 1999 Hanaro offered DSL and cable the leasing cable capacity from Powercomm, a subsidiary of KEPCO and KT.[174] Hanaro matched Thrunet's price of $25 per month. Hanaro also bundled broadband with basic telephone service for only $40 per month, including free installation. With this offer, 1 million subscribers were acquired in 18 months.

**The role of gaming**

Around this time, Starcraft[175] became immensely popular among elementary school and high school students who played the game at PC *bangs*[176] (Internet cafés) that rapidly expanded to reach 15,150 by the end of 1999. Hanaro Telecom focused on this phenomenon in its advertising, claiming that with ADSL one could play the game at home. This resulted in a waiting list of 5,000,000 for ADSL that lasted a long time (Chon et al., 2005; Oh and Larson, 2011). Also launched in 1999 was Cyworld, a Korean version of today's Facebook, but released 4 years earlier. Cyworld was intended to facilitate trust-oriented information sharing among university students and young workers, based on the idea of a personal resource program that would accumulate as the user ages and be exchanged through social networks. By late 2008, nearly half the population, including 90% of Koreans in their twenties used Cyworld. Cyworld has cute avatars and personalized 'mini-rooms' (*mini-homes*) that are interconnected with other friends' and family pages. Cyworld is owned by SK Telecom, Korea's largest mobile operator (Choi, 2008; Oh and Larson, 2011).

Later in 1999, Korea Telecom entered the ADSL market on a limited scale, full-scale entry occurred a year later, recognising that ADSL rather than ISDN was the future for broadband Internet. KT's competitive pricing and rising demand for broadband allowed the company to catch up and take the market lead in 2000. By 2001, 8% of KT's revenues were derived from ADSL, surpassing long distance revenues (Kelly et al., 2003). See also the next table.

**Table A-15 Total subscribers of broadband carriers South Korea, 1999-2004**

| Year | 1999 | | 2000 | | 2001 | | 2002 | | 2003 | | 2004 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thrunet | 142168 | 56% | 760999 | 19% | 1317624 | 17% | 1301620 | 13% | 1293364 | 12% | 1289057 | 11% |
| Hanaro | 84249 | 33% | 1056724 | 27% | 2070552 | 26% | 2872351 | 28% | 2725563 | 24% | 2775638 | 24% |
| KT | 12903 | 5% | 1730977 | 44% | 3874442 | 49% | 4922395 | 47% | 5589058 | 50% | 5900038 | 51% |
| Cable TV | | 0% | | 0% | | 0% | 367135 | 4% | 619103 | 6% | 758603 | 7% |
| Others | 13662 | 5% | 394300 | 10% | 580382 | 7% | 941985 | 9% | 951411 | 9% | 894489 | 8% |
| **Total** | **252982** | | **3943000** | | **7843000** | | **10405486** | | **11178499** | | **11617825** | |

Source: Chung, 2006; Kushida and Oh, 2006

In terms of the technologies being applied, DSL covers 58% (KT and Hanaro), cable modem 34% (Thrunet, Cable TV and Hanaro), and LAN 8% (other). Since 2002, VDSL has been rapidly

172 By 2001 8.3 million homes (57%) were passed by cable television networks (Kelly et al., 2003).

173 These aggressive pricing strategies brought both Hanaro and Thrunet into serious financial difficulties.

174 Note that KEPCOs fibre optic network reached most of the nation's high-rise apartments. KT was not subject to unbundling requirements or the provision of wholesale broadband services.

175 Starcraft is an online war simulation game. Online gaming has become a growing and important part of culture, with 54% of the population playing online games (2008) and for instance three cable television channels being dedicated to internet games. It has become a professional sport with national heroes.

176 Koreans consider a bang as a multifunctional social space, which purpose changes according the occupant's will (Choi, 2008).

replacing ADSL as part of KT's strategy to win back customers in urban areas, pricing VDSL only slightly higher than ADSL. The declining growth rate suggests that the point of saturation is approaching (Chung, 2006).

> From 1995 to 2003, the government made seed money investments of KRW 750 billion (approx. US$ 693 million) to induce a total investment of KRW 20.5 trillion (approx. US$ 19 billion), of which 97% from the private sector. By 2000, 144 localities were connected and 1,400 rural areas had access to broadband networks, serving 30,000 public agencies, 10,000 schools and 11.18 million households. By 2004, the Internet penetration had grown to 11.6 million connections and 77.9% of households (Chon et al., 2005; Chung, 2006; Oh and Larson, 2011).

> The demographic and geographical characteristics of Korea were favourable to these broadband developments, as more than 50% of households are, in fact, apartment complexes. Moreover, more than 93% of households are within 4 km of a central office; more than 60% of commercial and public buildings with more than six floors are connected to the public network by optical fibre (FttO); and many apartment complexes have access to fibre optic networks, or at least the communications cabinets inside those complexes (FttC) (Chung, 2006).

Recognising KT's dominance as a barrier to competition, the government stepped in to strengthen regulations in the broadband market, by shifting the categorisation of broadband service providers from a less regulated segment ('value-added') to a more regulated segment ('facilities-based') with a stricter regulation in terms of services and pricing.

By November 2003, the government announced the Broadband convergent Network (BcN) initiative, with the goal of creating one integrated broadband network on which all forms of service can be provided by 2010. The implementation involved a pilot network to be constructed by 2005. In 2007, commercial services were to be introduced, with the ultimate goal of providing services to 20 million subscribers at 50-100 Mbit/s. KT, SK Telecom and DACOM were selected to participate in the pilot and the testing (Chung, 2006).

### Development of mobile broadband

Mobile telephone service was introduced by Korea Mobile Telecommunications Corp. (KMT), a subsidiary of Korea Telecom (KT) in 1984. The service provided was based on AMPS, a first generation analogue mobile standard developed by Bell Labs. Until 1994, KMT held a monopoly position and the adoption reached 1.1 subscribers per 100 inhabitants. This sluggish performance changed with the introduction of digital mobile technology and the introduction of a second mobile operator.

#### *CDMA as digital mobile standard*

In 1993 the government announced that the CDMA standard (invented by the US-based Qualcomm) became Korea's digital mobile standard. The further development of this standard in Korea was (amongst others) promoted by the Korean government.[177] The manufacturing companies recognised the attractiveness of CDMA over GSM, as it provided them preferred access

177 The government decided to give the lead role in the development of CDMA technology to ETRI, which had proven its capabilities in the DRAM and TDX projects. The main difference was CDMA being a proprietary technology invented and developed by Qualcomm. Hence, a joint development project was started. For Qualcomm the project provided an opportunity to demonstrate its claim to a superior technology, not yet accepted by the US Telecommunications Industry Association (Meurling and Jeans, 1994; Mock, 2005). In 1991, Hyundai Electronics Industries, LG Information and Communications, Samsung Electronics, and Mason electronics joined the project to develop a commercial CDMA system with an in-service target date of 1996. Initially Qualcomm supplied key ASIC chips, over time ETRI and the manufacturers developed their own versions.

to a growing domestic market and the opportunity to develop a high level of competence in support of entering global markets (Mock, 2005; Oh and Larson, 2011). The commercialisation of CDMA was conducted in partnership with Qualcomm in a taskforce led by KMT. The government supported the effort with US$6.7 million from the Information Promotion Fund. CDMA equipment, including handsets, rapidly became South Korea's second most important strategic export market after memory chips.[178]

*Two mobile operators*

The two licenses were granted in 1995 to KTM and Shinsegi and, at the same time, three PCS licenses in the 1800 MHz band were awarded to: Korea Telecom Freetel (KTF), LG Telecom and Hansol. Having one national standard and 4 providers resulted in a rapid growth of the service. This was stimulated by the use of handset subsidies starting at around $160 on a handset of $440 in 1997, to handsets-for-free in exchange for 3-year contracts in 1999. At the same time the government kept the maximum per-minute charge high, allowing mobile carriers to earn sufficient revenues. The handset subsidies led to a high-profile issue between the Ministry and the Korea Communications Commission. It ended in the decision by the Ministry of Information and Communication (MIC) to ban handset subsidies. This led to a dramatic drop in demand for handsets.

### The 3rd and 4th generation mobile

*The 3G broadband licences*

As the government was concerned that excessive competition combined with limited available capital might negatively affect the build out of next generation mobile networks, it decided to issue only three 3G licenses. This triggered a consolidation wave, whereby SK Telecom acquired Shinsegi Telecom and KTF acquired Hansol in 2001. With LG, this left three parties for three licences. SKT had to reduce its combined market share to below 50%, this was effectuated for one month by a process of 'demarketing', i.e. getting rid of the least profitable subscribers and not advertising for new ones. Subsequently, SKT's market share has started to grow again (Kelly et al., 2003; Oh and Larson, 2011).[179]

*WiBro or mobile WiMAX*

In 2003, as a follow-up to the CDMA 2nd generation mobile project, the Ministry for Information and Communication requested ETRI to develop and commercialise with a group of companies a 4th generation mobile technology and standard, which became known as WiBro (Wireless Broadband). Samsung assumed the lead in a consortium including SK Telecom, KT and ETRI. In 2004, Intel, Samsung, and LG agreed to modify the current IEEE 80216e standard to harmonise it with WiBro, and adopt its physical layer. This standard was named 'mobile WiMAX'. In 2007, WiMAX was adopted by the ITU as part of the IMT 2000 family of standards, where it will compete with LTE. As a result, WiBro has become the first technology developed in South Korea to become a global standard. Korean companies and research institutes owned a major share of WiBro related patents, including 51% of those related to OFDM. By 2009, Samsung had supplied WiBro equipment to 20 carriers, mainly operating in developing countries – with the exception of Clearwire in the USA, installing mobile WiMAX in 56 cities across 16 states.

KT, SK Telecom, and Hanaro obtained a WiBRo license. KT and SK Telecom launched the service in Seoul in 2006. By 2011, the KT service coverage was national, covering 85% of the population (Wikipedia, 2011e).

178 Oh and Larson, 2011, p. 101).

179 As SKT is considered a dominant player its prices are regulated (Kelly et al., 2003).

*Digital mobile broadcasting*

In 2005, another innovation was introduced: digital mobile broadcasting (DMB), providing mobile TV on handhelds with a claim to be the first worldwide. Koreans have become the world leaders in viewing television on mobile devices: 27 million people, approx. 55% of the population, watch mobile TV regularly; often in relation to commuting to/from work. The major issue in DMB is to find a reliable revenue stream to keep the service 'in the air', for which neither the advertising nor the subscription-based business models appear to be fully successful at the moment.

### Korea's step to the future: the ubiquitous society

In 2006, the Ministry of Information and Communications jointly with the Prime Minister's Office announced the U-Korea Master Plan, with the goal of making the nation the world's first ubiquitous society: "the characteristic of ubiquitous IT – convergence, artificial intelligence and real-time – are the most effective means to upgrade the operating system of the country and to resolve the full range of social, economic, and administrative issues" (Oh and Larson, 2011 p108).[180] The challenges that the government wished to address were creating a unified Korea, closing the technology gap with China (its major export market), and preparing for an era when Asia would be the centre of the world economy.

#### The U-Korea Master Plan

The goals included in the Plan are (Oh and Larson, 2011 p119):

- *Friendly government*. This goal is to actively answer the administrative needs of the public and to simplify civil service processes;
- *Intelligent land*. The main element is to bring intelligence into all national infrastructure facilities;
- *A regenerative economy*. South Korea wants to achieve a per capita income of US$30,000 by developing the new market for ubiquitous IT and strengthening the competitiveness of existing industries through ubiquitous informatisation;
- *A secure and safe social environment*. This goal is to be accomplished through security and environmental systems based on ubiquitous IT;
- *Tailored u-Life services*. This refers to providing more convenient and affluent living conditions by delivering customised and autonomous services based on advanced intelligence systems.

The U-Korea Plan evolved from the IT 839 initiative, setting the goals for eight services, three infrastructure technologies, and nine product growth areas.

- The eight services included: portable Internet (WiBro), mobile television (DMB), home networking, vehicle-based information systems, radio-frequency-based identification (RFID) technology, W-CDMA mobile telephony, digital television broadcasting, and voice-over the Internet protocol (VoIP).
- The three network infrastructures included: the broadband convergence network, sensor-based computing networks, and the next generation Internet platform IPv6.
- The nine product categories included: mobile handsets, digital television and broadcasting device, home network equipment, system-on-chip products, next-generation PCs, embedded software, digital content and solutions, vehicle-based information equipment, and intelligent robots.

In 2006, the MIC and Ministry of Construction and Transportation signed an MoU on the u-city project aimed at building industry-wide partnerships between the high-tech construction sectors to

180 In a parallel effort, the new government under President Lee Myung Bak made legal and regulatory changes. For instance, media conglomerates to be allowed to own both televisions stations and newspapers, the size limit to owning news outlets was increased from $2.6 to $8.77 billion; IPTV service providers were allowed to include the analogue television offerings of existing broadcasters; and private media representatives were allowed to sell advertising – there abolishing the monopoly of the state-run Korea Broadcasting Advertising Company.

integrate advanced IT infrastructure in the construction of sustainable cities. A law on u-cities followed in 2007.

New Songdo City in Incheon aims to become the world's first entirely ubiquitous city, being built from scratch. It is part of the Incheon free economic zone and related to the overall goal to make Incheon a global hub for communication, as well as sea, land, and air transportation. New Songdo City includes ambitious plans for new educational facilities, with investments from universities abroad. The project attracted investments from for instance IBM, Watson Almaden Research Centre, and from Cisco. The project draws heavily on Korean expectations of less privacy than in Western countries and on the willingness of people to quickly embrace new technologies. Similar to the concept of 'information culture' the concept of a ubiquitous society became a promotional theme for the private sector, the government, the education sector, and the media.

### Lessons to be learned

This mini case study on Korea's ICT development in general and broadband in particular is relevant to the EU Internal Market project as it describes how the country has succeeded in becoming a leading nation in ICT in a very short time span. The case describes the interplay between the major actors – the government and the *chaebol* – against the demand factors embedded in the Korean culture.

ICT leadership in the individual EU Member States forms the foundation for a full-fledged Internal Market for e-communications networks and services. In the proverbial sense, it is the weakest link that determines the strength of the chain. In the alignment towards the full-fledged Internal Market it is the individual strength and the interlinking that shape the 'single' market.

While in Europe we have chosen to rely first and foremost on market forces to shape our future, the Korean case shows that society at large can benefit from well-informed and targeted policies if it intends to close a gap with other nations. At a certain point in time not only the process but also the outcome of the market may be of interest. As emeritus professor of applied economics Daniel W. Bromley observed, at certain instances there may be 'sufficient reason' to change our policies as this may lead to particular outcomes that we wish to accomplish (2006).

P.O. Box 4175
3006 AD Rotterdam
The Netherlands

Watermanweg 44
3067 GG Rotterdam
The Netherlands

T +31 (0)10 453 88 00
F +31 (0)10 453 07 68
E netherlands@ecorys.com

**W www.ecorys.nl**

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