IMPACT ASSESMENT

REVIEW OF THE REGULATORY FRAMEWORK FOR ELECTRONIC COMMUNICATIONS

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INTRODUCTION

When the current framework for regulation of electronic communications in the EU came into force in its original version in 2002[1], liberalisation was recent, former monopolist operators had still very high market shares in traditional telephony services, while the evolution of internet and broadband was still at an early stage and the telecom sector largely relied on copper networks to offer its services. A key objective of the 2002 framework, consisting of (i) sector-specific economic regulation based on the principles of EU competition law and (ii) rules safeguarding end-user interests, was to promote competition via regulated access to incumbents' networks and market entry as a means to make markets contestable, to achieve efficient market outcomes and, in particular, to maximise consumer benefits.

While the general competition objectives were maintained in the 2009 revisions to the EU Framework, more emphasis was placed on fostering efficient investment and innovation and a specific reference was also made to fostering infrastructure-based competition to deploy Next Generation Access networks (NGA). The 2009 review also aimed at furthering the internal market by reinforcing the institutional set-up and strengthened a number of end-user rights. In 2010 the Digital Agenda for Europe introduced non-binding targets of universal access to connectivity at 30 Mbps by 2020 to ensure territorial cohesion in Europe and a penetration target of 100 Mbps (50% of subscriptions in Europe by 2020) to anticipate future competitiveness needs.

Since then, the electronic communications sector has significantly evolved and its role as an enabler of the online economy has grown. Market structures have evolved, with monopolistic market power becoming increasingly limited, and at the same time electronic communications and the telecoms sector in particular have now acquired a vital importance for most sectors of the overall economy[2]. Consumers and businesses are increasingly relying on data and internet access services instead of traditional telephone and other communication services. This evolution has, on the one hand, brought formerly unknown types of market players to compete with traditional telecom operators (e.g. service providers offering a wide variety of applications and services, including communications services, over the internet, so called **over-the-top** -players (OTTs)) and, on the other hand, it has increased the demand for high-quality fixed and wireless connectivity with the rise in the number and popularity of online content services, such as cloud computing, the **Internet of Things** (IoT), **Machine-to-Machine** communication (M2M) etc. Electronic communications networks have evolved as well. The main changes include: (i) the ongoing transition to an all-IP environment,(ii) the possibilities provided by new and enhanced underlying network infrastructures, which can support the practically unlimited transmission capacity offered by fibre optical networks, (iii) the convergence of fixed and mobile networks towards seamless service offers to the end-users regardless of location or device used and (iv)the expected introduction of innovative technical network management approaches, in particular **Software Defined Networks** (SDN) and **Network Function Virtualisation** (NFV). These usage and operational changes have exposed the current rules to new challenges which are likely to increase in importance in the medium and long term, and cannot therefore be excluded from the scope of the present impact assessment.

The review of the regulatory framework for electronic communications needs to be seen in light of the priority of the Juncker Commission to create a connected Digital Single Market (DSM)[3].

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[1] The current Framework consists of a suite of Directives covering the Framework for regulation (and its objectives), rules concerning the authorisation of electronic communications network and service providers, ex ante regulation of access and interconnection, universal service and user rights.

[2] See details in section 2

[3] See: https://ec.europa.eu/priorities/publications/president-junckers-political-guidelines_en

The **DSM strategy**[4] recognised the importance of the paradigm shifts that the digital sector is exposed to and stated that individuals and businesses should be able to seamlessly access and exercise online activities under conditions of fair competition.

According to the Commission Communication, the **DSM Strategy** will be built on three pillars[5]. The second pillar specifically focuses on the review of the telecoms framework and states that "*The Commission will present proposals in 2016 for an ambitious overhaul of the telecoms regulatory framework focusing on (i) a consistent single market approach to spectrum policy and management (ii) delivering the conditions for a true single market by tackling regulatory fragmentation to allow economies of scale for efficient network operators and service providers and effective protection of consumers, (iii) ensuring a level playing field for market players and consistent application of the rules, (iv) incentivising investment in high speed broadband networks (including a review of the Universal Service Directive) and (v) a more effective regulatory institutional framework*".

The prerequisite to achieve this goal is to ensure access to unconstrained connectivity based on ubiquitous, very-high-capacity fixed and mobile broadband infrastructures. The increase in data consumption and the process of aggregation and conversion between increasing (wireless) data usages into fixed networks will require the provision of **Giga-Bit connectivity** ever closer to the end-user. In order to achieve this, the review will **focus on investments in Very High Capacity networks** through direct market incentives, in order to maximise the benefits for the European digital economy and society. Such a necessary prioritisation requires the endorsement of Giga-Bit connectivity needs and ambitions to be achieved by 2025 (i.e. building on existing targets for 2020), as a measurable and achievable focus point within the broader connectivity ambition for the European digital economy and society.

The emphasis on connectivity as a new objective of the framework should not of course downplay the other existing objectives such as competition, internal market and end-user protection which will remain valid and on which the framework has delivered to various extents, as analysed in the REFIT exercise carried out in parallel with this IA report.

1 WHAT IS THE PROBLEM AND WHY IS IT A PROBLEM?

1.1 What was concluded from the evaluation/fitness check of the existing regulatory framework?

In the context of the REFIT programme, the current regulatory framework has been evaluated not only in terms of achievement of the original goals, but also in view of potential simplification and reduction of the regulatory burden. The main findings can be summarised as follows (see specific Staff Working Document on the subject).

Relevance: the analysis showed that the specific objectives of the framework - promoting competition, realising the single market and protecting consumers' interest – remain as valid as before, with an increased relevance for the single market objective. Connectivity has emerged as

[4] A Digital Single Market Strategy for Europe COM(2015) 192 final

[5] According to the Commission Communication, the **Digital Single Market Strategy** will be built on three pillars:

- **Better access for consumers and businesses to online goods and services across Europe** – this requires the rapid removal of key differences between the online and offline worlds to break down barriers to cross-border online activity.
- **Creating the right conditions for digital networks and services to flourish** – this requires high-speed, secure and trustworthy infrastructures and content services, supported by the right regulatory conditions for innovation, investment, fair competition and a level playing field.
- **Maximising the growth potential of our European Digital Economy** – this requires investment in ICT infrastructures and technologies such as Cloud computing and Big Data, and research and innovation to boost industrial competiveness as well as better public services, inclusiveness and skills.

the underlying driving force for the digital society and economy, underpinned by technological changes and evolving consumer and market demands. There is therefore a widely recognised need to consider adjusting the current policy and regulatory tools to further support the deployment of infrastructure and take-up of corresponding services in line with future needs in view of the structural evolution of the sector, its importance within the larger economy, and the political commitment of the Juncker Commission to deliver the DSM.

Most regulatory areas remain as relevant (if not more) than in 2009 – in particular spectrum regulation and access regulation. While the relevance of certain specific components of the universal service regulation is being put into question, the concept of a safety net ensuring that all citizens are included in a fully developed digital society is gaining relevance. Similarly, while the specific provisions under the consumer protection objective might have to be adjusted in view of technological market or legislative changes, the basic needs to which the provisions respond remain unchanged and their specific objectives remain relevant.

Effectiveness: while the specific objectives of the framework (competition, single market and consumer protection) have remained unchanged by the 2009 review, the specific aims of this last reform include aligning spectrum management with market demands to realise its full potential to contribute to innovative and affordable services making access regulation more predictable, while adding some emphasis on network investment and ensuring better consumer rights.

The regulatory framework has had an impact on the **competitiveness** of the sector, which in turn has delivered overall significant consumer benefits, in particular basic broadband, lower prices, and increased choice. The contribution of the framework - mainly through access and spectrum regulation, but also with the support of market entry provisions – to deliver competition is undeniable and widely recognised even if sometimes difficult to measure. As regards the contribution of the framework to the **Single Market objective**, the results are rather modest. Regulatory consistency has been achieved only to a limited extent, affecting the operations of cross-border providers and reducing predictability for all operators and their investors. More importantly, the cooperation and consistency tools available led to a situation where best regulatory solutions have not always been followed, with impact on consumer outcomes. Finally, the achievements of the framework in **promoting consumer interest** are significant, in tackling certain sector-specific consumer protection issues and in ensuring a safety net so that all citizens can benefit from electronic communications services. However it is also clear that not all consumer interest rules are still fit for purpose, in the context of technological, market, and legislative developments, and that simplification can be achieved. At the same time, consumer surveys continue to report a relative dissatisfaction, which requires attention.

In terms of specific regulation areas, **access regulation** delivered competition, though more at service level than at network level. While investments in VHC networks have advanced, they have not taken place across all Member States at the pace envisaged by the public policy agendas and more importantly at the pace to meet the future connectivity needs for a fully-fledged DSM. Access regulation has also become more predictable, thanks to the reinforced EU-level consistency check, which however does not adequately cover remedies, with the effect that significant regulatory inconsistency remains on the single market.

While progress were made in the field of **spectrum** (e.g. the release of a significant amount of spectrum for wireless broadband as well as achievements in the field of technical harmonisation, which were praised in the public consultation by Member States and operators), they were more limited than wished in the last review. In particular the impact of the current spectrum regulation on competition and single market outcomes - with direct consequences for consumers in terms of availability of innovative and affordable services - is put into question by the current evaluation, with the example of the delayed 4G deployment in most parts of the EU. Indeed, the majority of respondents (spanning from telecom and non-telecom associations to virtual mobile operators,

converged operators and vendors) in the public consultation considered that the lack of coordination of selection methods and assignment conditions has impaired the development of electronic communications services. Operators have also criticized the ineffectiveness in addressing interference issues and ensuring usage efficiency.

The **regulation of numbers** proved generally unproblematic at national level. However, the provisions have not been particularly supportive to the single market in particular given that there is emerging demand for using numbers outside the country where they have been assigned (extraterritorial use of numbers) and for which the current framework does not provide clear rules. .

While **universal service** rules were effective, reviewing its specific components appears necessary. Similarly, in order for the **consumer protection rules** to remain effective, they need to be revised to remove redundancies, where identified, with horizontal rules and to safeguard end-user interest in light of market and technology developments (e.g. increasing use of communications services provided over internet access, so called Over-the-Top communications services . As far as network and service security rules are concerned, their adoption has contributed to an improved situation in the EU, but their impact remains unequal across the MS, not least due to the respective scope and definitions of national implementing provisions.

Efficiency: The framework often allows ample flexibility to national regulatory authorities (NRAs) to adapt their decisions to national circumstances, and the actual administrative costs and burdens depend to a large extent on the solutions adopted in each Member States. This flexibility allows for cost optimisation for and by national administrations. At the level of operators, costs and burdens are not evenly spread across the stakeholders. Access regulation is considered burdensome by incumbent operators, yet nothing more than what is necessary to reach the competition objective by alternative operators

Most operators refer to consumer protection rules as being over burdensome especially in view of the differing implementation across Member States and of the overlapping horizontal legislation. While this suggest a need for simplification and reduction of burden in specific areas, consumer organisations recall the value of certain sector-specific rules and of the discretion left to Member States to complement minimum harmonisation in a fast moving sector.

Several areas were identified for reducing administrative burden while preserving the effectiveness of the provisions. The level of complexity of access regulation is considered in most cases necessary to ensure that regulation affecting operators directly is fit for purpose and not unnecessarily burdensome on operators. This is in particular the case of "stable" markets, where simplified procedures can be envisaged without affecting the quality of the regulation (e.g. the case of the termination markets). In a similar vein, it can be questioned, based on the actual implementation experience, whether the very short cycles of market reviews are truly necessary. Achieving more regulatory consistency in areas such as spectrum or authorisation requirements might in addition reduce the administrative burden of businesses operating across several Member States.

EU added value: the framework has played a role in the broader development of national regulatory regimes and market developments that favour a pro-competitive offer of electronic communications services across Europe. It has contributed to major positive outcomes for consumers and businesses, across and within Member States. Moreover, it has levelled up national regulation in the area of electronic communications, including in areas which were previously not even tackled by some Member States, such as consumer protection, where there are, however, too many overlapping or varying provisions and simplification can be achieved.

Coherence: not many coherence issues were identified during the evaluation work. Generally speaking, the various instruments making up the regulatory framework for electronic

communications have reinforced each other in the pursuit of its objectives. As an illustration, provisions on authorisation enable pro-competitive market entry. Access regulation and spectrum management contribute to positive outcomes for consumers, to the point where commercial offers render regulated universal services redundant or obsolete in certain instances. Some issues of internal inconsistencies have been identified.

Two external consistency issues require however attention in the review process namely the coherence between regulations aimed at incentivising competitive network rollout and the EU financing and state aid rules in the field, as well as the potential overlaps between sector specific and horizontal consumer interest legislation. Provided that detailed analysis of the exact scope of the provision in place concludes that sector specific rules have become redundant, those particular provisions can be withdrawn, leaving sector specific rules only to address those areas where such rules are still warranted, in line with the REFIT principles.

The evaluation has identified several areas where simplification is possible and the **administrative burden** could be reduced without compromising – in some cases even improving - the effectiveness of the provisions: e.g. longer ex ante market regulation cycles, universal services adjustments, streamlining certain overlapping consumer protection provisions. This aspects is more widely analysed in Section 1.2.3 and in section 4.9.3 where the preferred policy option is analysed from the perspective of meeting the objective of simplification and administrative burden reduction.

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1.2 What is the problem? What is the size of the problem?

As anticipated by the DSM strategy, the traditional telecom sector is under increasing pressure to (i) serve increasing user demand for data connectivity, (ii) anticipate future demand and socio-economic needs and (iii) react to new internet-based competitors. These aspects are important since investments in networks are becoming instrumental for productivity gains not only in the telecom sector, but especially in several downstream sectors (transport, health etc.) and for the functioning and growth of the entire European economy, as shown by the macro-economic modelling described in Annex 5[6]. In this regard, the Commission has identified **three interrelated problems** that need to be addressed:

- The obstacles to **unconstrained connectivity** based on ubiquitous, **Very High Capacity (VHC)**[7] fixed and mobile broadband infrastructures serving the Digital Single Market, attested by: the low coverage and take up, especially for VHC networks; unsatisfactory connectivity offers across the EU for businesses; and a lack of timely and appropriate spectrum management.

- A regulatory framework not fit for **rapid market and technological changes,** reflected by: discrepancies between rights and obligations for the provision of equivalent services; gaps in consumer protection in some areas; and persisting barriers to switching, in a market increasingly characterised by the bundling of offers.

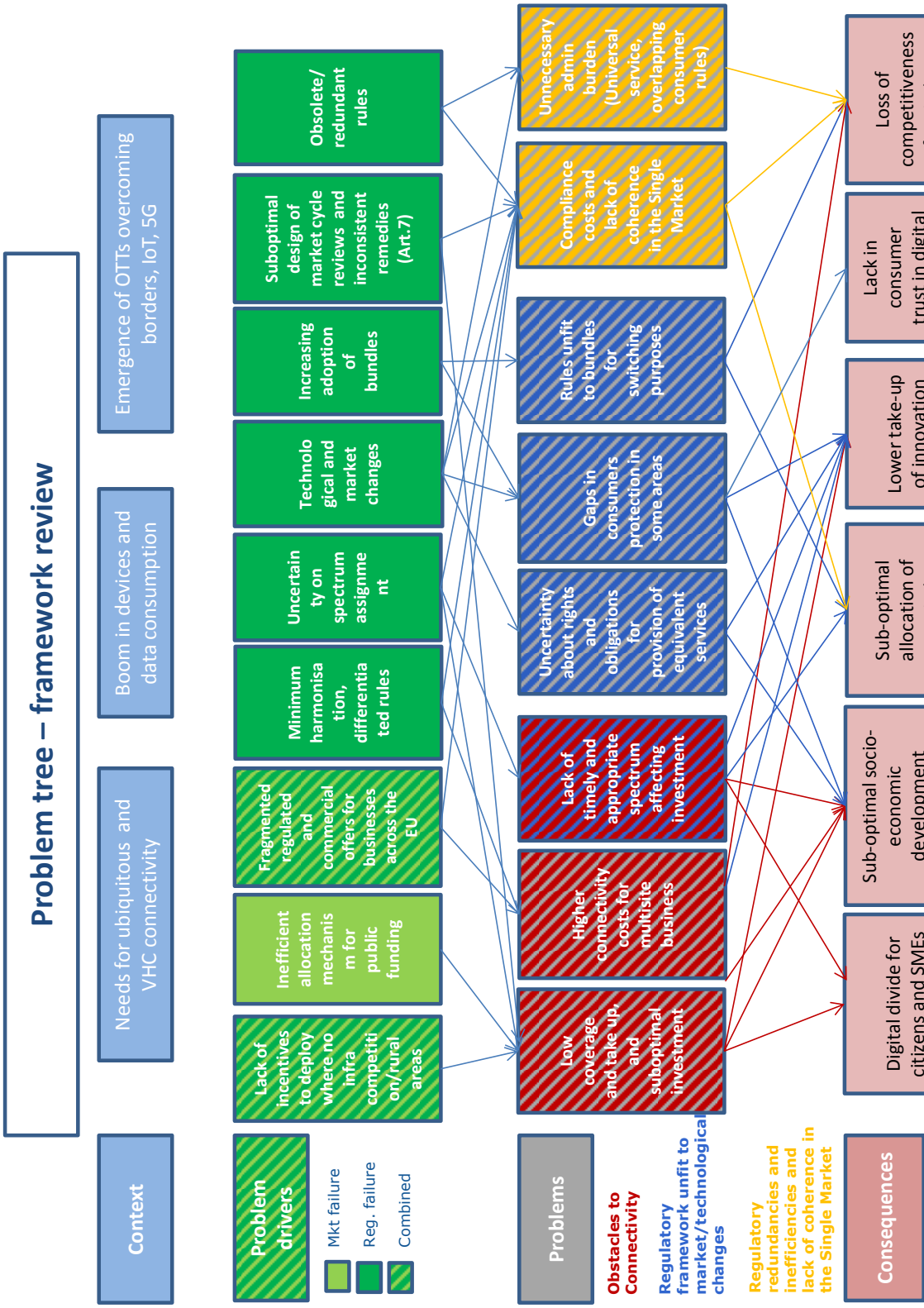
- Regulatory redundancy, inefficiencies and lack of coherence in the Single Market; unnecessary administrative burden and high compliance costs.

[6] Short-term demand uncertainty may (and does) manifest itself, but it does not reduce the needs for ultimate migration to very high capacity networks in the future.

[7] **VHC** should guarantee **best-in-class performance** in terms of speed (that should be significantly above 100 Mbps and able to reach 1 Gbps when considering both upload and download capacity), **latency, package loss and jitter.** This definition is therefore more ambitious that the definition of NGA that includes all technological solutions able to deliver more than 30Mbps download.

Figure 1 illustrates the problems underpinning the review of the electronic communications framework and describes the problem drivers, (with market and regulatory failures further elaborated in section 1.3 and annex 10), the problems themselves (presented below) and the consequences of those problems in a no change scenario (described in section 1.5). As shown by the colours in the picture, problems are interrelated and tend to have similar drivers or consequences.

Figure 1- Problem tree


Problem tree – framework review
Context
Needs for ubiquitous and VHC connectivity
Boom in devices and data consumption
Emergence of OTTs overcoming borders, IoT, 5G
Problem drivers
Mkt failure
Reg. failure
Combined
Lack of incentives to deploy where no infra competition/rural areas
Inefficient allocation mechanism for public funding
Fragmented regulated and commercial offers for businesses across the EU
Minimum harmonisation, differentiated rules
Uncertainty on spectrum assignment
Technological and market changes
Increasing adoption of bundles
Suboptimal design of market cycle reviews and inconsistent remedies (Art.7)
Obsolete/ redundant rules
Problems
Obstacles to Connectivity
Regulatory framework unfit to market/technological changes
Regulatory redundancies and inefficiencies and lack of coherence in the Single Market
Low coverage and take up, and suboptimal investment
Higher connectivity costs for multisite business
Lack of timely and appropriate spectrum affecting investment
Uncertainty about rights and obligations for provision of equivalent services
Gaps in consumers protection in some areas
Rules unfit to bundles for switching purposes
Compliance costs and lack of coherence in the Single Market
Unnecessary admin burden (Universal service, overlapping consumer rules)
Consequences
Digital divide for citizens and SMEs
Sub-optimal socio-economic
Sub-optimal allocation of
Lower take-up of innovation
Lack in consumer trust in digital
Loss of competitiveness

1.2.1 Obstacles to unconstrained connectivity

This section analyses the obstacles to unconstrained connectivity in the EU. These factors prevent the achievement of ubiquitous and performing fixed and mobile broadband infrastructure that is a necessary component for global competitiveness and lies at the heart of the DSM strategy. When considering the problems of suboptimal investment and the need for connectivity it is important to take into account that **albeit networks are often national or local in nature** (and will in some cases get even more local in the future with the proliferation of small fibre operators as it has already happened in Sweden) the problem of **suboptimal investment is a European problem,** as even local networks are financed from international and cross-border capital markets; furthermore, the deployment throughout Europe of networks with similar (high) connectivity characteristics is vital for the development and widespread take-up at European scale of the sorts of consumer and industrial applications and services on which the DSM will thrive. So despite the often local nature of the networks, connectivity and investment have a clear internal market dimension and the review should strive to induce policies which are more favourable to investment without jeopardising the existing objectives.

The causes of suboptimal investment are explored in more detail in section 1.2.1.1, below while the size of the investment gap and the inadequacy of public sector financing to take on even the current deployment challenge and to meet the current DAE target is explored in more detail in a dedicated annex 14. The same annex also includes international comparisons on connectivity and the EU dimension of the connectivity problem.

1.2.1.1 Low coverage and take up and the reasons for suboptimal investment,

As recognised in the evaluation report in section 7.1.1.[8], the level of investment has been suboptimal. As of July 2015, only 71% of Europeans have access to NGA networks (above 30 Mbps), and the figure is as low as 28% in rural areas[9]. The take-up rate of NGA was around 30% of the overall subscriptions in 2015

The **trend of the take-up rate for NGA networks** shows that Europeans are rapidly replacing their basic broadband connections with NGA: while in 2013 the only 15% of European subscribed to NGA above 30Mbps, the same figure was 21% in 2014 and 30% in 2015 (see annex 6 for more detailed statistics). .Figure 13 shows how demand for 100 Mbps turns into take-up in countries where networks are widely available.

The Impact Assessment support study has estimated that the EU is very likely to miss the target of 50% take-up of 100 Mbps networks by 2020[10], according to current trends[11]. The main findings are reported in annex 14 and in **Error! Reference source not found.** included therein. The same study shows that basic NGA at 30 Mbps is not enough to meet the near future connectivity needs (see also annex 9).

Causes of suboptimal investments

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[8] " *investment has been uneven across the EU and clear gaps have begun to emerge between and within different countries in the path to upgrading broadband networks to provide ultrafast speeds and meet increasingly demanding quality parameters*.

[9] Source: Digital Agenda Scoreboard, https://ec.europa.eu/digital-single-market/en/connectivity

[10] The Europe 2020 Strategy has underlined the importance of broadband deployment to promote social inclusion and competitiveness in the EU. It restated the objective to bring basic broadband to all Europeans by 2013 and seeks to ensure that, by 2020, (i) all Europeans have access to much higher internet speeds of above 30 Mbps and (ii) 50% or more of European households subscribe to internet connections above 100 Mbps. See: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245R(01)&from=EN

[11] See SMART 2015/0002, section 3.1.

There are a number of causes for investment in connectivity being suboptimal. These causes can be regrouped in two main sets: (i) causes that are of a macroeconomic or socio-economic nature and therefore **exogenous to the regulatory framework** that is the object of this review (e.g. the financial crisis took a toll on telecom companies' CAPEX as well) and (ii) some are of a regulatory nature (level of uncertainty due to price regulation; deterrent effect to incumbent first movers because non-discriminatory access requirements mean they cannot differentiate on the basis of their investments, whereas competitive pressure on them is often insufficient to force investment, especially in less dense areas; access-based alternative operators often have insufficient scale to invest alone) and therefore can be considered as **endogenous to the framework**. The corollary of the previous statement is that the **proposals that will be presented in the forthcoming sections can only affect to a given extent the level of investment**, although they will be significantly beneficial to investment and will make an important contribution by reducing risk the operators face and increasing their expected return on investment.

Investment is not suboptimal everywhere, as clearly evidenced by the different degrees of coverage in Europe (see **Error! Reference source not found.** below). The evaluation identified in section 6.2. that:

- Telecom network **CAPEX** in Europe was 43 bn EUR in 2013. CAPEX figures have remained relatively stable over the last four years despite the fact that in the same period NGA coverage increased from 29% to 68%. Mobile CAPEX spending represented 59% of total spending[12].
- Capital expenditure/revenue ratio is a better measure of assessment of capital expenditure. In a context of declining revenues in the sector, there has been an increase in this ratio, from 11.7% in 2009 to 14% in 2013. In other words, telecom operators increased the proportion of their investment through the period.

In terms of **endogenous factors**, investment may have been restrained by the fact that average revenue per users went down in Europe for a number of years. According to a study quoted in the evaluation (Section 6.2.), Average Revenue Per User (ARPUs) of the top seven mobile operators in the EU would have gone down 34.8% between 2006 and 2013, with a 5% decrease in investment.[13]

This does not mean that investment and competition are at odds with each other. Under the current regulatory framework, as shown in the evaluation report (see in particular section 7.2.3.1) investment has been uneven across the EU and **divergences have begun to emerge between and within different countries in the path to upgrading broadband networks to provide ultrafast speeds and meet increasingly demanding quality parameters**.

Some of the countries in Eastern Europe which had relatively lower standard broadband coverage have relatively high coverage of FTTH, as do countries that have pushed for infrastructure competition such as Spain, Portugal and Sweden, while certain countries with high NGA coverage overall including Belgium, the UK and Germany, have very limited deployment of FTTH. This reveals a second ‘gap’ amongst EU countries whereby the quality of NGA infrastructures varies depending on whether an ‘upgrade’ of existing networks or FTTH deployment strategy was pursued. Basically in some countries operators are deploying NGA but not VHC networks. The result is that the Digital Agenda Target of 50% of 100 Mbps is at risk of not being met (see **Error! Reference source not found.**).

[12] Digital Agenda Scoreboard 2015
[13] Mazars - Etude Télécom mai 2015

Of course, infrastructure competition will not be possible everywhere, but regulation should promote it when possible. In this respect, the support study SMART 2015/0002 suggests in its analysis of business and regulatory models suggests that the geographical dimension of the deployment problem may be addressed by a combined approach:

1. The problem in dense urban areas is to encourage feasible infrastructure investment and foster competition;
2. The problem in less dense (but economically viable, i.e. that can guarantee return on investment in the long term) zones, is to encourage first movers without losing the effects of competition by ensuring wholesale access on lines favouring future investment;
3. The problem in rural and 'challenge areas' which are not traditionally economically viable is attract new business models that have a different risk/return profile and give support when needed.

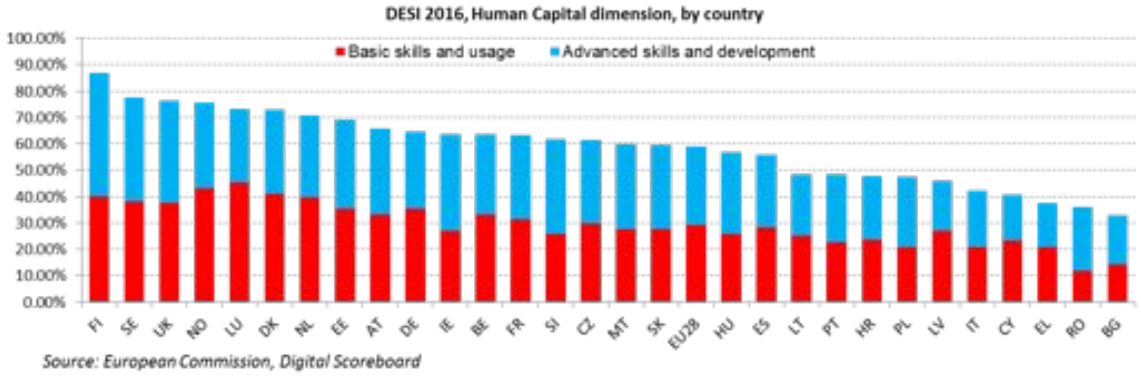
Different requirements are likely to be needed for business access, as the market can involve different scale economies and customer distribution (as well as different operators) than the residential mass-market.

In terms of **exogenous factors**, beyond the macroeconomic (GDP, country risk etc.) investment may in some instances be sub-optimal (or in less performing technologies) due to the expected lower take up.

Demand and low take-up can also certainly condition investment. As explored in the access study, (SMART 2015/002) that states "*Take-up may also be restricted in cases where there is low demand for high speeds. Indeed, low take-up even in the presence of fast infrastructures is cited by several stakeholders (*NB mostly incumbents*) as a key problem in the market today*". However, the forecast run by IDATE in the same study have shown the insufficiency of networks to meet future demand, so in the medium run this may be a problem, as demand keeps booming and infrastructure cannot be upgraded in the short term. This is also part of the reason why a European gigabit Society strategy is needed, since **a policy and non-binding strategy can be better suited than regulation at taking into account demand-side aspects** (e.g. promotion of connectivity for schools, in order to integrate connected learning tools with education). The importance of demand is another reason to maintain the important role of competition in the regulatory mix, as competition on very high capacity networks should not only ensure that prices are attractive to end users, and not too distant from those for traditional copper networks, but also that there is more commercial innovation in building demand.

The level of e-skills is certainly affecting demand for NGA services as illustrated by Figure 2 below.

Figure 2 – eSkills in the EU, DESI 2016



The **public consultation** showed that in relation to different treatment of legacy copper networks (whether pure copper access networks or upgraded FttC networks with copper sub-loops) to incentivise upgrades, operators invoked the principle of technological neutrality and leaving the market to decide how to best meet demand. However, a number of contributors consider that copper-based solutions will not represent a credible alternative in the long term. **Investors** in FTTH solutions and some **access seekers** call for a recognition that the risk involved in rolling out fibre to the premises is higher than upgrading copper, so that regulatory incentives, if any, should not include FttC solutions. **Regulators** also argue that any risks specific to a particular new investment network project should be considered if wholesale tariffs are subject to regulation, in order to allow the operator a reasonable rate of return on adequate capital employed (ROCE) and return on investment (ROI).

On a more critical note, there was some discussion in the Expert Group[14] on 30 May 2016 over what the review of the framework should aim towards as regards objectives for connectivity overall and whether or not there should be an emphasis on very high speeds potentially delivered via fibre connections (See Annex 13 for more details). It was noted by some experts that FTTH may not be necessary to fulfil many of today's needs at household level; even when considering multiscreen 4K TV content (see also the access study, SMART 2015/0002); while the longer-term needs of a significant proportion of the population are likely to be much greater. It follows that, from a short term perspective, **the added value of VHC may not currently be so high in the eyes of consumers, with consequential effects on their willingness to pay for it at least in the short term**.

1.2.1.2 Low coverage and take up in mobile

As regards mobile, **4G coverage** of households is almost universal in some Member States, but it is still substantially below that of 3G (HSPA). Although the user experience for mobile communications is very much determined by territorial coverage, LTE deployments have focused mainly on urban areas, as only 36% of rural homes at EU level are covered against a total coverage of 86% (see annex 6, **Error! Reference source not found.** for Member States information).

14 On 30 May 2016, WIK-Consult GmbH, Ecorys Brussels N.V. and VVA Europe organised a high-level academic expert panel to support the Commission in the preparation of the Impact Assessment for the Review of the electronic communications framework. The purpose of the expert panel was to provide feedback on the provisional conclusions reached by the consultants concerning the impact of planned changes to the e-communications framework. Prior to the meeting, the experts were provided with a programme for discussion, slide presentation and draft 'overview' of the consultant's research findings.

The technical availability of mobile signals (i.e. LTE/4G coverage available in a territory) does not necessary mean that the quality of service (including user experience) is optimal[15]. Truly ubiquitous coverage (i.e. everywhere) and capacity (i.e. peak speed up to 10Gbps) is a necessary condition for the success of 5G. 5G networks will not only provide very high peak downlink speeds in ultra-dense environments but also provide mobile broadband services to a range of vertical industries, notably, for automotive, healthcare, transport and utilities. These vertical industries will require sufficient capacity and reliability and other application-related parameters (e.g. latency) to meet their robust performance requirements.

Although 5G will coexist with other legacy infrastructures (2G and 3G) as well as with upgraded 4G networks, capital-intensive 5G networks architectures will require high capacity connection to base stations and, thus, involve a greater number of base stations as well as denser networks that will increase the backhaul[16] traffic. 5G connectivity will increase mobile data traffic, through 3 main scenarios[17], i) enhanced mobile broadband (eMBB), ii) massive M2M communications and/or iii) ultra-reliable low-latency communications. These will pose challenges for backhaul links[18] due to the fact that, on the one hand, network architectures become much denser by means of, e.g., small cell deployment, and a significantly higher number of backhaul links will be required. On the other, since the capacity of individual cells increases thanks to advances in technology, the corresponding backhaul links also require more capacity to manage data coming from technologically advanced cells. Indeed, with regard to facilitating deployment of denser networks, many respondents in the public consultation pointed to obstacles to the roll-out of small area access points needed for mobile services[19]. A development that is critical to estimating the costs of future connectivity of 5G is the increased prevalence of small cells. Although these are already being deployed for 4G services to increase capacity of networks, the very high data and bandwidth requirements of 5G will require a much larger number of small cells. *The 5G Manifesto for a timely deployment of 5G in Europe*[20], endorsed by key industry and telecom players, underlines the need for improved regulatory conditions of spectrum in terms of local installation of cells to facilitate the construction of denser networks Along these lines, many market actors and public authorities consider that a general

[15] The user quality of experience is affected by many other factors, namely the quality of user device (some smart phones are better than others), user movement (when using phones in a train or car which is moving fast), user contractual data plan, network congestion (it is different at 8am or 3pm) or network configuration (depending on the operator).

[16] In a mobile network, the last link to connect various forms of base stations with either the core network or the backbone network is referred to as backhaul. While optical fibre links are often the default solution, wireless backhaul links also play an important role for cost reasons or due to difficulties to connect the location of some base stations by optical fibre.

[17] The ITU defines 5G as encompassing (i) Enhanced Mobile Broadband: Higher performance targets across the board; relative to 4G including indoor/hotspot and enhanced mobile broadband everywhere; (ii) Massive Machine Type Communications: Massive numbers of connected devices with a huge diversity of connectivity requirements ranging low power/small data to high power/big data; and (iii) Ultra Reliable & Low Latency Communications: Native support for use cases having highly divergent requirements including mission critical applications, tactile internet experiences and self-driving cars.

[18] The RSPG report on (wireless) backhaul predicts by 2020 capacity requirements for the backhaul link of already one to a few Gbit/s per base station in dense urban areas, while only several hundred Mbit/s second are considered necessary for rural areas and small cells. At the same time, the range of wireless backhaul is expected to be short between 200 meters to 1 km in urban areas and even shorter for small cells, while it could be up to 15km in rural areas. However, since peak data rates are expected to increase 10-50 times and user data rates 10-100 times with the introduction of 5G, this will result in significantly higher peak data rates of roughly 10-50 Gbit/s for backhaul links. As a consequence, the need to connect base stations directly with fibre backhaul or to at least bring a fibre connection very close will increase significantly.

[19] Such as lengthy permit process, high administrative fees for back-haul provision, inappropriate fee structure, lack of harmonisation of management of electromagnetic fields' emission..

[20] https://ec.europa.eu/digital-single-market/en/news/commissioner-oettinger-welcomes-5g-manifesto

authorisation regime for small cells would foster innovation and competition both for services and end-devices.

Figure 3 - Summary of future wireless evolution

Source: Analysis Mason, 2016

Despite the fact that the specificities of the future 5G architecture are still unknown today and standards still need to be defined, a Commission study uses a standalone small-cell deployment scenario as a cost proxy and estimates 5G deployment costs in the order of magnitude of **120 billion EUR for 95% of EU28 population coverage**[21]. Hereby the costs for only the wireless infrastructure amounts to 38 billion EUR, while the 81 billion EUR for fibre infrastructure used for front/backhaul in this standalone scenario could be reduced due to synergies with fibre rollout for other purposes[22]. In order to provide full coverage of transport links, their model predicts an additional 104 billion EUR, the wireless infrastructure accounting for 64 billion EUR without any further synergies possible for fibre rollout in the corresponding scenario.

1.2.1.3 Lack of timely and appropriate spectrum affecting investment

The lack of sufficient connectivity to meet future demand and to allow development of services, is especially notable in wireless connectivity networks that rely on access to spectrum[23]. Demand for spectrum is growing significantly driven by both existing and new services and applications.

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[21] According to the study SMART 2015/0068 on 'Costing the New Potential Connectivity Needs', a wide deployment of small cells is commensurate with the aims of 5G in terms of peak mobile speeds and other target parameters and thus serves as a cost proxy. The figure of 120 billion EUR corresponds to 95% of EU28 population coverage. The figure is subject to a large number of assumptions (e.g., the unit cost of a small cell falls to 1000 EUR, only 50% of small cells require fronthaul connections via fiber and the wireless infrastructure is shared) and varies in the model from 75 billion EUR for a smaller proportion of cells using fiber fronthaul connections to 194 billion EUR without a shared wireless infrastructure. A second DG CONNECT study on 'Identification and quantification of key socio-economic data to support strategic planning for 5G in Europe' SMART 2014/008, estimates that in 2020 the total costs of enhanced mobile broadband 5G networks deployment will be approximately 56 billion EUR in EU28 Member States. The estimation is based on a high level linear extrapolation of the costs per subscriber of 2G, 3G and 4G deployment in Europe. These costs do not include key technological components of 5G type networks (i.e. backhaul and small cells) and does not consider the wide set of very challenging 5G requirements. It largely corresponds to a scenario of the above study SMART 2015/0068 in which only macro cells are upgraded at the cost of 63 billion EUR.

[22] In case of fiber rollout to big Socio-Economic Drivers and Professionals (SEDPs) and in combination with the fiber necessary for macro cell coverage, the costs for fiber in this scenario would be reduced to 52 billion EUR.

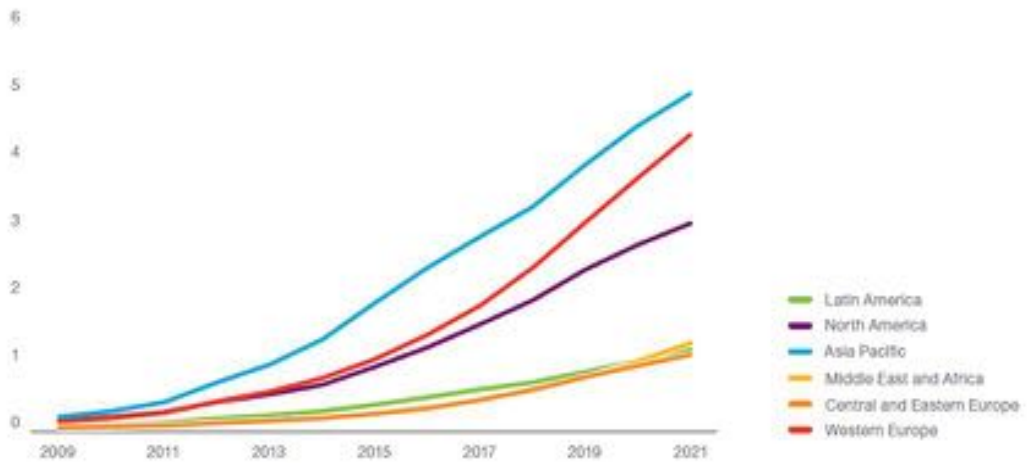
23 The section dedicated to the efficiency of spectrum regulation in the Evaluation SWD further discusses the contribution of spectrum management as currently arranged in the EU to competition and investment on the single market.

It is estimated that up to 56 GHz[24] will be needed to meet the demand of 5G users and applications (e.g. the connected car, health related services, smart cities).

Mobile data traffic in Western Europe (and the US) is expected to grow 6-fold from 2015 until 2020, which represents a higher growth compared to South-Korea (x5) and Japan (x4). Indeed, mobile data traffic will grow twice faster than fixed IP traffic from 2015 to 2020.

In terms of traffic, the average smartphone user in Western Europe will generate **4.6 GB of mobile data traffic per month in 2020, up by 353% from 2015**. In terms of devices, laptop users will generate 4.4 GB and tablet users more than 6 GB (see Annex 6). IoT devices[25] are expected to surpass mobile phones as the largest category of connected devices in 2 years[26]. Between 2015 and 2021[27] **IoT connections will increase at a compounded annual growth rate (CAGR) of 23%**, over that time, Western Europe will add the most connections, led by growth within the connected car 5G vertical.

Figure 4 – IoT connected devices: cellular and non-cellular in billions



Source: Ericsson Mobility Report, June 2016[28]

Timely award of sufficient spectrum (i.e. 5G pioneer bands below 6GHz such as 700MHz, 3.4-3.8 GHz, 4.2GHz and new higher frequency millimetre bands) is critical to the launch of 5G – its architecture will require a radio-frequency bandwidth of at least 100MHz[29] to be accommodated for enhanced broadband 5G services and, in parallel, involve more base stations (including small cells) for radio access and denser connectivity to backhaul 5G increasing traffic.

Forecasted data for mobile broadband traffic confirm this trend of potential increase of wireless traffic, the growing need of wireless connectivity is due not only to wireless broadband but also

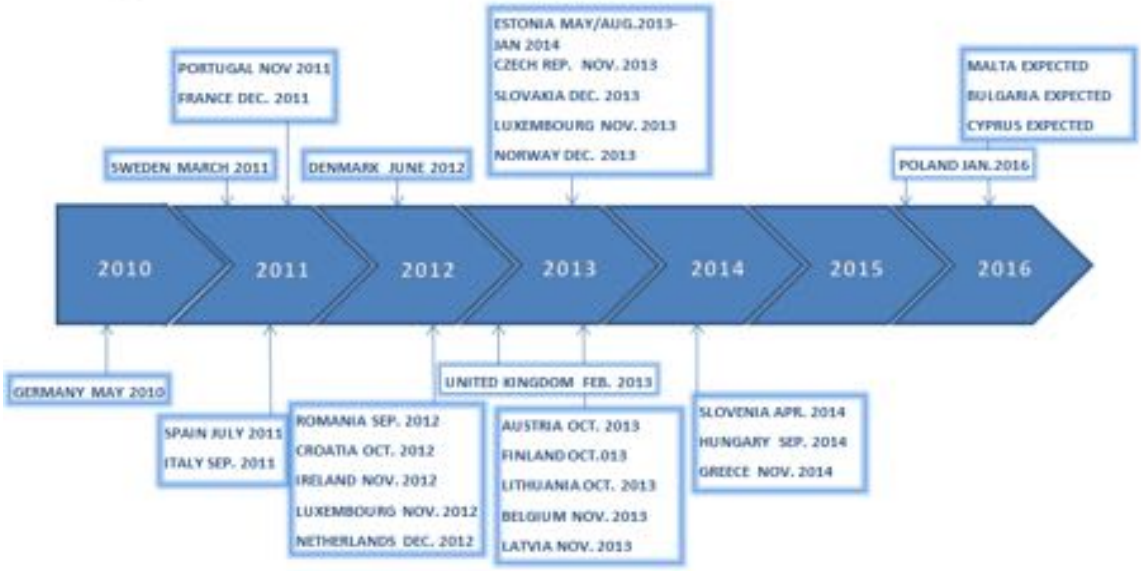
[24] According to the SMART 2014/0018 'Identification and quantification of key socio-economic data to support strategic planning for the introduction of 5G in Europe' this number corresponds only to the extreme scenario of full exclusive spectrum (no-sharing) for automotive cars. In case of 50% sharing this number is 35 GHz.
[25] IoT includes connected cars, machines, utility meters, remote metering and consumer electronics
[26] Ericsson Mobility Report June 2016.
[27] 28 billion connected devices billion are forecast by 2021, of which close to 16 billion will be related to IoT
[28] https://www.ericsson.com/res/docs/2016/ericsson-mobility-report-2016.pdf
[29] Every generation upgrade of mobile technology requires wider radio-frecuency channels. First generation worked in 25kHz channel , second generation GSM in 200kHz, 3G mobiles in 5Mhz channel and 4G mobiles in up to 20MHz.

M2M communications enabled by 5G networks. While M2M modules currently generate 3% of total mobile data traffic in Western Europe, by 2020, this figure will go up to 11.6%, while M2M modules will represent more than half of the total connected mobile devices. The US and Japan will show similar figures, while in South Korea both traffic and number of M2M devices will be significantly higher proportionally[30].

In order to meet these connectivity requirements timely access to spectrum needs to be assured. In some Member States, there have been significant delays in making necessary spectrum resources (i.e. bands technically harmonized at the EU level) available to market operators, the main reason being the lack of consistency in spectrum governance across the EU (see Annex 2). Taking 4G licences in the 800MHz band as an example, the figure below depicts the difference in timing of spectrum availability across the EU countries which stretched over 5 years with some countries still in the process of awarding 800MHz licenses, despite the envisaged deadline in the Radio Spectrum Policy Program already having expired in January 2013.

[30] See annex 6 for detailed data.

Figure 5 - Timing of 800MHz spectrum awards



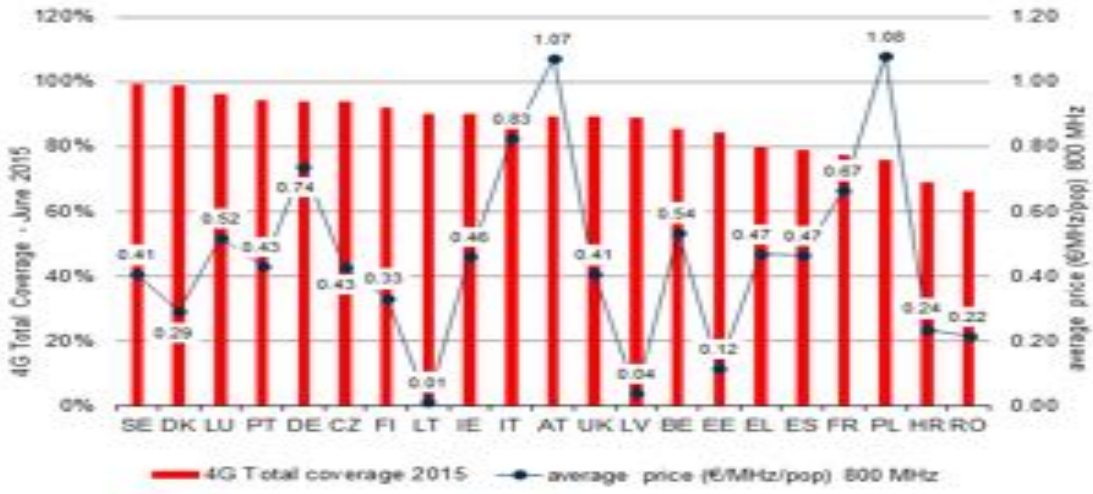
Source: Commission Services

The result of the slow coming into service of spectrum resources is that it affects possibilities and incentives for operators to invest in the development of their networks (see Annex 2 on Public Consultation). The results of the Public Consultation showed that although the current technical harmonisation is seen to be working relatively well, there is criticism on the current institutional system's capability to bring spectrum resources to the market in a coordinated and timely manner.

Similarly, the differences in fees and auction prices paid across MS that, in addition, create discrepancies between markets and operators and contribute to the fragmentation of the European mobile market. In some cases, the auction processes (especially those with high reserve prices) appear to be driven by fiscal considerations rather than the objective of optimal use of the spectrum resource for connectivity. Thus, short term considerations (i.e. delicate national budgetary situations) play against long-term economic investment considerations needed to promote network roll-out. As illustrated in Figure 6, the LTE coverage in some EU Member States (AT or IT) is negatively correlated to the average price paid[31] for the 800MHz in EUR/MHz/pop, whereas in other Member States (SE, DK or FI) the correlation is positive. The more capital is required to acquire a licence the less capital is available for investment in the network, and the lower the coverage.

[31] In an auction, the price paid is driven by the value to mobile operators,.

Figure 6 - Average price paid in the 800MHz (€/MHz/pop) and LTE (4G) Coverage in EU MS.



Source: Commission Services

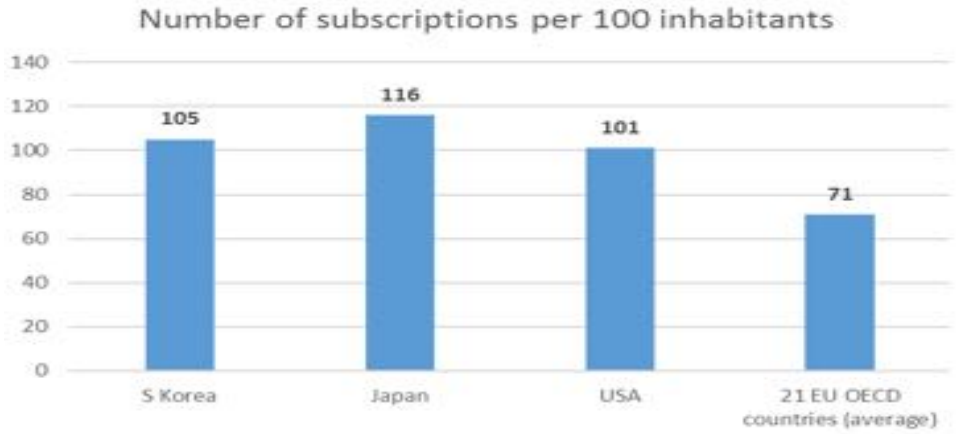
Consequently, the coverage of 4G services in the EU has been slow; it started to develop late and with great differences across national markets. However, it reached 86% in 2015 up from 27% in 2012. While LTE - 4G coverage, which allows users to profit from ubiquitous mobile internet services of up to 30Mbps, is almost universal in some countries (the Netherlands, Sweden, Portugal) reaching only 60% in others (Croatia, Romania). These differences amongst Member States are even more marked when looking at rural LTE coverage which continued to vary from close to 100% in Denmark, the Netherlands and Sweden to no coverage in Bulgaria, Cyprus and Malta in mid-2015; the EU average is 36% (see Annex 6).

Compared with other regions of the word, Europe lags behind in the roll-out (85.6% of households at EU level by 2015) and take-up of 4G/LTE. Leading markets for 4G (Japan, South Korea, Canada and the USA) have substantially higher connection rates than in the EU.[32] Whilst Japan is leading the way with regards to mobile broadband (take-up and coverage). Japan is closely followed by the Nordic countries (Finland, Sweden and Denmark) and Estonia. Australia is the 6th best performer, followed by Korea and the United States[33].

[32] However, the degree and quality of coverage is variable in the US as well. A recent (2016) study by Imperial college concluded that" From a public policy perspective the results reinforce the belief that ,although governments are eager to mitigate the digital divide in terms of access to the Internet, there appears to be a mobile divide between individuals and households in urban or affluent areas and those in rural or lower-income areas. See: http://ac.els-cdn.com/S0308596116000410/1-s2.0-S0308596116000410-main.pdf?_tid=cad0768e-180a-11e6-bb74-00000aab0f01&acdnat=1463034711_b683de50d0e533237591e737924da244

[33] Source: I-DESI: https://ec.europa.eu/digital-single-market/news-redirect/31457

Figure 7 - OECD wireless broadband take-up (subscriptions/100people)



Source: OECD

Operators' incentives to invest in network deployment especially in the more capital-intensive future 5G networks are influenced by factors such as the lack of predictability of spectrum availability or broad synchronisation of spectrum release and licence durations relative to the required investments cycles. Consistently with the above analysis, t*he 5G Manifesto* with European industry endorsement seeks sufficient spectrum bands to be licensed on time if 2020 target launch date for 5G is to be met[34]. It also emphasises *that* the spectrum aspects of the DSM - namely, harmonisation and predictability of spectrum policy across Member States (including spectrum availability, licensing procedures and costs, licence terms, and liberalisation and renewal of existing spectrum) – are essential to encourage more investment into the mobile sector, particularly in 5G networks.

As indicated in the evaluation (section 7.2.3.2.), the harmonisation approach of the current framework has not achieved sufficient convergence of the actual conditions attached to individual licences or of the underlying motivations to impose such conditions, thereby creating regulatory uncertainty and possibly impacting effective access and use of spectrum and market investment incentives.

1.2.1.4 Unsatisfactory connectivity offers across the Union for businesses

The DSM strategy also focusses on business and SMEs. Business customers typically require higher quality of service levels than residential customers, and may also require higher performance levels as regards certain technical characteristics.

A survey conducted for SMART 2014/0023[35] confirmed that business customers value symmetrical speeds, low contention, short latency, and unlimited data volumes that can only be guaranteed by fixed VHC connections. They also require short provisioning and fault repair times, and service level guarantees. Mobile broadband is not considered a substitute as it does not sufficiently meet the higher expectations of business customers with regard to these aspects.

However it has also to be said that interviews conducted for the support study suggest that the technical requirements of business customers may over time converge with the growing ones of residential customers. The widening use of telework practices could boost the need for

[34] European operators are targeting the launch of 5G in at least one city in each of the 28 European Member States by 2020

[35]See:https://ec.europa.eu/digital-single-market/en/news/investigation-access-and-interoperability-standards-promotion-internal-market-electronic

symmetric gigabit connectivity and therefore the need for VHC networks to be made available to ever more end users. This could in theory also enable business users to benefit from any infrastructure-based competition or co-investment in mass-market FTTH networks. Whereas large companies tend to solve the connectivity problem through ad-hoc leased lines, SMEs are often struggling to meet their connectivity requirements. Moreover, the wider diffusion of the collaborative economy and the increasing number of micro enterprises that operate in it also fosters higher connectivity requirements.

Multi-national businesses require not only the availability of connections in dispersed locations, but also uniform conditions for provisioning, repair and quality guarantees. In a 2013 study "Business communications, economic growth and the competitive challenge", WIK estimated the cost of non-creation of a single market enabling the seamless provision of business communications services in Europe at €90bln per annum over time in terms of non-realized efficiency and productivity gains.[36]

The lack of availability of harmonised conditions for business accessing connectivity across borders has its roots in the national focus of the institutional regulatory set up and of the rules intended to address cross-border market failures, such as the lack of availability of a business grade product for which demand exists. Although rules for cross-border harmonisation exist, they require relatively complex and often non-binding procedures to deliver consistent outcomes. This has failed to provide the consistency demanded by multi-national business users operating across the single market.[37]

The evaluation (section 7.2.2.) and the public consultation evidenced how cross-border providers deplore the lack of consistent access products (in particular when it comes to the wholesale inputs needed to serve the high end business market), the multiplicity and great diversity of market entry provisions (e.g. authorisations, rights of ways) and, in solving disputes across borders, etc.

The lack of available business connectivity products on a cross-border basis is one of the reason why the framework contribution to the **Single Market objective**, was rated more critically than the other objectives with most stakeholders[38] considering that this is the least accomplished objective of the framework, referring to the lack of regulatory consistency and to the persisting barriers to operating across borders.

1.2.2 A regulatory framework not fit to rapid market and technological changes

This section deals with the problems brought about by the significant market and technological developments that have taken place since the last review, changing the way citizens and businesses communicate, and bringing the need to adapt current rules to these changes.

1.2.2.1 Uncertainty about rights and obligations for provision of equivalent services

The evaluation report noted that Over-the-Top players (OTTs) are not subject to sector-specific rights and obligations, even when their services are used by the end-users to cover the same or

[36] The gains are associated with a welfare gain from lower prices, efficiency gains from an improvement in ICT processes and productivity gains through a reorganisation of business processes.

[37] 64% of respondents considered that the access-related provisions have made a moderate or significant contribution to the internal market (of which most consider the contribution has been moderate), while 29% consider it has made little or no contribution.

[38] Roughly 46% of the respondents to the public consultation consider the single market objective achieved (of which 39% only "moderately" achieved), while the competition objective is considered achieved by 59% of the respondents (of which 32% consider that it was "significantly achieved") and the citizen interest objective is considered achieved by 54% of the respondents.

similar communications needs as the traditional electronic communications services. Many stakeholders (BEREC, several Member States, most operator associations, most incumbents, some cable players, all user associations and some broadcasters) referred in the public consultation to the need to review the current definition of ECS, owing to the increasing uncertainty on the scope of the definition of ECS related to "conveyance of signals", the inconsistent regulatory obligations for similar services and the convergence of communications services.

New online players -often global- have emerged offering communication services which many users perceive as comparable to traditional electronic communications services such as voice telephony and SMS. These so called Over-The-Top-players (OTTs) provide their services in the form of applications running over the internet access service and are in general not subject to the current EU telecom rules. Some of such OTT communications services make use of telephone numbers and can for this reason be considered to fall under the framework[39], but the point is contested and *de facto* the rules of the framework have not been applied to them. Traditional electronic communications services, however, clearly fall under the scope of the EU Regulatory Framework, since they incontestably fulfil the definition of "Electronic Communication Services" (ECS), a legal term contained in the Framework Directive (Art. 2(c)). Under the interpretation offered by the European Court of Justice, ECS covers communication services of providers that bear the responsibility for the conveyance of signals over the underlying electronic communication network vis-à-vis end-users.[40] Being responsible implies that the service provider must have a certain degree of control over the conveyance of signals. Operators of traditional electronic communications services usually also own and run (parts of) the underlying network, which consequently puts them into a "controlling" position. Conversely, providers of OTT communications services usually do not own or operate any network infrastructure and cannot in principle fully control the signal in the same way, as this is carried over the internet access service on a 'best-effort' basis (unless they negotiate a managed service with network operators). These differences have led national regulatory authorities to adopt diverging interpretations on the consideration of OTT communications services as "Electronic Communication Services" (ECS)[41].The generic OTT label hides different types of communications services which may e.g. offer the option to use the E.164 numbering system (e.g. Skype out) in order to interconnect with traditional telecom service providers. In order to be able to technically make use of numbers, such OTT operators need to e.g. conclude wholesale termination agreements with traditional ECS operators in order to terminate a call. So by being able to offer OTT communications services which - from a user perspective - can "interact" with phone numbers, such OTT operators factually market their services as being equivalent to and cheaper than traditional telecommunication services and end users can come to rely upon them having equivalent functionalities. Other OTT communications services may not give the possibility to use numbers, yet they nevertheless provide communications services that consumers may in certain situations also see as functionally substitutable to traditional services.

Such disruptive innovations, while very convenient and financially beneficial to end users, bring the need to analyse their impact on existing competition conditions and possible distortive effects stemming from differentiated regulatory treatment, as well as the adequacy of existing regulation in a changed environment.

Providers of traditional communication services, which mainly provide both networks and services, including internet access services and some specific services, have to comply with

[39] See ERG Common Position on VoIP adopted in December 2007
[40] Case C-475/12, *UPC v. Nemzeti Média*, judgment of 30 April 2014, par. 43.
[41] BEREC, Report on OTT services, BoR (16) 35, http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/5751-berec-report-on-ott-services. Differences in national case law are also observed, as described in annex 10 (problem drivers).

sector-specific obligations related to e.g. contractual rights, transparency, quality of service, contributions to universal service funds, access to emergency services ("112") and caller location information. Pure OTTs, on their side, are subject to horizontal legislation only and not to these sector-specific obligations, even when their services are used by the end-users to cover the same or similar communications needs. Moreover, traditional providers are often subject to sector-specific administrative charges and taxes. Finally, they have to comply with specific data protection obligations under the ePrivacy Directive, beyond the Data Protection Regulation[42], which applies also to OTTs.

At the same time, the EU regulatory framework offers providers of traditional communication services certain rights which could be considered as an advantage in comparison to OTTs, such as e.g. access to the (international) E.164 numbering plan. Such access to the numbering regime provides a global reach through phone numbers and the interconnection agreements between traditional telecom providers ensure a global network effect for telephony and SMS.

The differentiated regulatory treatment outlined above creates uncertainty about rights and obligations for provision of equivalent services that needs to be addressed by the review. Firstly, the question arises to what type of communications services the framework should extend. Secondly, what sector-specific end-user protection rules are still warranted or have become obsolete. Thirdly, whether underlying public interest such as e.g. security and privacy would require extension of some of the sector-specific rules to OTTs.

1.2.2.2 Gaps in consumer protection in some areas.

Sector-specific end user protection rules complement general consumer protection and aim at a high level of consumer protection in the electronic communications sector. These sector-specific rules cover in particular areas such as contractual information, transparency, quality of service, contract duration, switching, privacy and security, and access to emergency numbers. The functioning of the provisions concerned is discussed in more detail in various sections of the evaluation SWD[43].

Many providers of electronic communications networks and services, a few broadcasters, vendors and OTTs consider however that certain sector-specific end-user rights' provisions are not relevant anymore and should be repealed, mainly in the area of those contract rules which are covered by various other Directives. European and national consumer associations, on their side, have not identified any provision to be repealed, and would prefer to keep current sector-specific end-user in order to supplement the framework and general consumer protection rules which do not address sector-specific issues.

Although the rapid adoption of alternative OTTs communications services that are not subject to these sector specific rules suggests that end-users generally feel confident in using these services without sector-specific protection, there may be areas where the users of these new services are exposed to the same risks that sectorial rules were designed to address, for instance regarding security and confidentiality of communications or transparency and contractual information. This brings the need to assess to what extent the rules on consumer protection which would still seem to be necessary should be extended to all or some new market players. This was confirmed in the public consultation where, despite the fact that most stakeholders (Member States, telecom operators and their associations, broadcasters, vendors and OTT providers) argued that the current framework has contributed to effectively achieving the goal of ensuring a high level of

[42] REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

[43] See in particular sections 7.2.3.3, 7.2.3.9, 7.2.3.11, and 7.2.3.12 of the Evaluation SWD.

consumer protection across the EU, many of them also considered that the current regulatory framework has failed to deliver consumer protection with respect to emerging services based on new technological developments and outside (or not clearly within) the remit of the sector-specific rules. In particular, most responding Member States support specific requirements to be applied to all communications services irrespective of the provider ("traditional" telecom operators or "new" OTTs) in order to avoid risks of (a) insufficient customer protection, (b) a lack of clarity, and (c) confusion among consumers who might mistakenly believe that their communication is protected by sector-specific rules. Consumer representatives supported this view, calling for an extension of existing rights for communications services. The majority of communications service providers, including OTTs, would prefer that end-user rights rely on horizontal regulation (consumer and data protection), together with competition law tools, with a minimum set of rules applying to all players.

Concerns about security of communications have risen in parallel with the adoption of new services in the economy and society as a whole. In 2014 a total of 137 "major incidents" (in terms of either duration or percentage of users affected) were reported, affecting in comparable percentages fixed telephony, mobile telephony, fixed Internet and mobile Internet. Although there are no comparable figures, security incidents have also been reported for alternative OTTs communications services. Over half of respondents to the public consultation considered that current rules have been effective in achieving their objectives and more than a third considered it important to involve the complete Internet value chain under the security rules. This would help to increase consumers' trust in the use of communications services regardless of the underlying technology. End-users of OTT messaging services are currently less protected because there are no security duties applicable to OTT communications that are comparable to those applying to telecoms services. OTT communications services are not considered as digital services under Article 3(11d) and Annex III of the NIS Directive, nor are they covered by the current Articles 13a and 13b Framework Directive. If security is considered as an important value, it is reasonable to consider whether it should apply in a similar way to all comparable communications services.

Another important requirement is confidentiality of communications which currently applies to electronic communications services only. The scope of the services potentially subject to such obligations is a matter for this review while the exact confidentiality obligations, if any, will be subject to further conclusions of the review of the e-privacy Directive.

Current adoption of new communications services has not led to any particular needs thus far in the area of interconnection and interoperability. The variety of available means of communications, ease in switching between various OTT communications services (because of multi homing, for instance) have ensured *de facto* end-to-end connectivity for end users via various communications services (in addition to traditional numbers-based telephony and messaging) and consumer choice. However, in view of the increasing importance of communications platforms which benefit from network effects, it appears opportune to have tools available in case healthy functioning of markets or innovation is threatened, in particular if network effects would impede entry and innovation in the market and limit consumer choice in the use of different services. Alternatively, a significant fragmentation in the services employed, combined with a possible marginalisation of the interconnection/interoperability ecosystem based on public numbering plans, could frustrate the objective of end-to-end connectivity of the entire population. Either such scenario would in turn hamper the creation of a fully functioning single market for communications services. The public consultation showed divergent views on this issue, with mobile operators and certain incumbents calling for a phasing out of the ex-ante regime in place, arguing that the IP-based delivery of voice services is modifying market circumstances. MVNOs have an opposing view on the matter, on the ground that terminating networks will always remain a bottleneck. OTTs consider that interconnection rules are needed

to avoid discrimination.

Rules regarding contracts and switching are complementary to competition: they ensure that consumers derive maximum benefits from a competitive market: from making the right purchase, to ease of switching to other providers when desired. These rules have thus enhanced competition on prices, quality and service innovation and have fostered innovative commercial offers. Regarding contract information, the majority (86%) of the respondents to the public consultation consider that the same level of protection vis-à-vis contracts should apply to all communication services, including those offered by OTT providers.

Good and reliable quality of service is of particular importance for the internet access service, through which many communications services are made available to consumers. This is reflected in the increasing attention that consumers pay to factors other than price when subscribing to an internet access service. In particular, data show that after price, the two factors that consumers consider for their purchase decision are the maximum download and upload speed of the service and the maximum amount of data that can be used.

Similarly, an increasing number of consumers perceive that the possibility to keep their phone number when switching provider is an important facility that they would like to use for other components of the communication services, such as e-mails, contents, photos and content stored online by the communication service provider.

The public consultation indeed supported these findings, with consumer protection bodies and Member States in favour of keeping sector-specific end-user rights applicable to communication services, while alternative telecom operators suggested that full harmonisation is needed for contractual information, transparency measures, contract duration, switching, and bundles.

Telecom operators associations, most incumbents, several alternative players and most cable operators think there is no need for additional sector specific consumer protection rules and that any potential issues should be dealt with horizontally. However, these stakeholders acknowledge that there may be several issues that need attention. Some of these would include bundling of contracts and their impact on switching (see section 1.2.2.3 below). All these changes to the market place raise questions about notably the scope of application of the regulatory framework as well as the type of regulatory intervention prescribed by the latter to ensure consumer protection in some areas.

1.2.2.3 Rules unfit to bundles for switching purposes

Technology developments have fostered the convergence of different technologies and services enabling the delivery of seamless services to end-users in the form of bundles. The rapid adoption of bundles in the EU[44] has brought significant benefits to users in terms of convenience and price; however, it has also affected market structure and market conduct and created new transparency, comparability and switching problems for consumers, which poses longer term risks for competition on prices and quality of service.

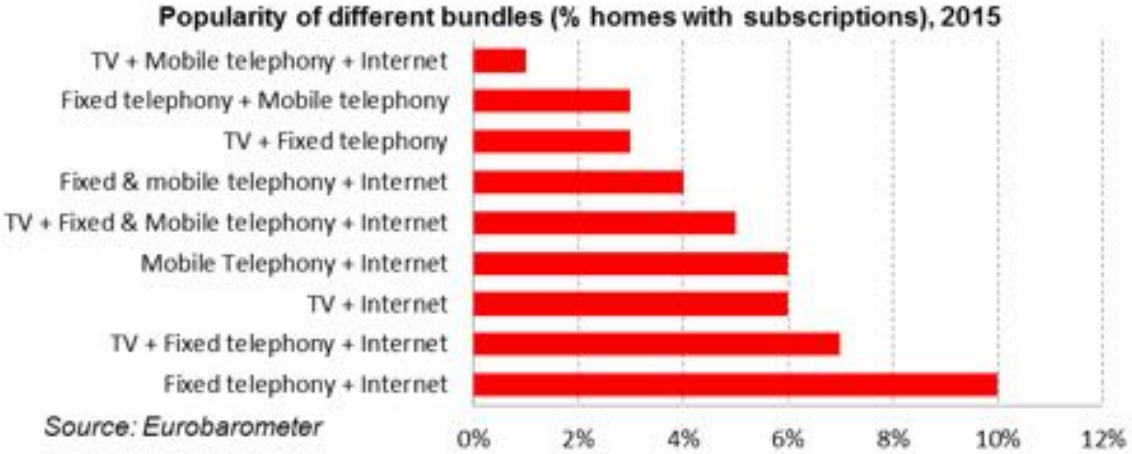
A bundle refers to a package of several different services sold together as a single plan: landline calling, Internet access, mobile services, pay-tv. A bundle can also include products, most frequently a terminal device The aim for vendors is to increase average revenue per user (ARPU) by increasing the number of subscriptions sold to customers, and to secure customer loyalty. Mobile customer churn rates decrease when their mobile plan is bundled with a fixed Internet access and pay-tv plan.

50% of all EU households purchase bundled communications services in 2015, up from 38% in 2010. The most popular bundle is Fixed telephony + Internet followed by the triple play Fixed

[44] See section 6.10.7 on the increasing adoption of bundles

telephony + Internet + TV. Internet access (either fixed or mobile) is present in 80% of all service bundles, fixed telephony in 64%, TV in 54% and mobile telephony in 46%.

Figure 8 – Bundles in the EU in 2015



Bundles have both benefits and disadvantages for consumers. By integrating several services in a single offer, with unified billing and customer care service, they can be more convenient and less expensive for consumers. A 2011 Eurobarometer survey on e-communications measured that 68% of households with a bundle considered that bundles are more convenient because there is only one invoice and 52% of them found that bundles are cheaper, while households without a bundle at the time invoked as the main reason for not having a bundle the fact that they provide packaged service they don't really need.

Yet bundles can also make transparency and price comparison more difficult and potentially lead to lock-in effects, since bundles make it more difficult for consumers to switch providers of certain services within the bundle. This problem is clearly identified in the evaluation report, which indicates that this market has the largest proportion of consumers among the surveyed markets who say they tried to switch provider but faced obstacles while attempting (7%); from those customers who wanted to switch their internet service provider (42% of participants), 15.1% found it easy, 7.2% switched but found it difficult, 2.4% tried and gave up, and 3.6% did not even attempt to switch as they thought it might be too difficult [45].

Regarding transparency and price comparison, as shown in the evaluation report (see section 7.23.9.), the latest data available show that although more than two thirds (68%) agree that it is easy to compare the services and prices of bundled offers of other providers, 24% of consumers do not yet think it is easy to do so and also note that there has not been any improvement in this area since the previous survey.

Respondents in Italy (88%), Greece (84%) and Bulgaria (82%) are the most likely to agree that it is easy to compare, while the most critical countries are Denmark, where far fewer (31%) agree this comparison is easy, followed by Luxembourg (57%) and the Netherlands (59%). Easiness of comparison and take-up of bundles are not directly correlated, since adoption rates in the latter group of countries is above the EU average, with 87% of households in the Netherlands subscribing to a bundles of services. Yet data show a relative correlation between easiness of comparison and actual switching of bundle service provider for some countries, with Greece (80%) and Italy (70%) on top, while Luxembourg (40%) has one of the lowest rates in switching.

A majority of respondents to the public consultation, including several Member States, almost half of the NRAs, mobile and certain fixed operators and the European consumer association

[45] Section 7.2.3.9 of the Evaluation SWD.

advocate that the scope of current rules on switching needs to be adjusted due to bundles. Bundles are a cause of concern and the TV service should not hinder switching of broadband services. Consumers' view, shared by many others, is that consumers should be able to terminate any individual service within a bundle (equipment linked to one service should not lock-in consumers to other services), and renewal of one service should not be used to renew the entire bundle.

On the opposite side to this view are a few Member States, operators' associations and a large number of fixed operators, which think that additional rules would represent a disproportionate burden on telecom operators, as OTTs are currently not obliged to offer unbundled services. Moreover, they argue that the market is competitive, there is no evidence of harm (on the contrary, consumers value bundles), and competition rules together with horizontal consumer protection should suffice.

Besides the three major problems described above (different rules for equivalent services, gaps in consumer protection and rules unfitted to bundles for switching purposes), technology and market changes have also prompted the need to consider the advisability of adapting other sets of rules.

For instance, must-carry obligations on providers of electronic communications networks for the transmission of specified radio and television broadcast channels could be examined in view of the increasing use of OTT services for accessing audio-visual content, as well as the prevalence of catch-up or other video-on-demand services accompanying traditional broadcast channels and broadcast distribution platforms. OTT services are not covered by 'must-carry' obligations. While there is a majority view in the public consultation that transmission obligations imposed on electronic network operators ('must-carry' rules) and rules related to electronic programme guides should be adapted to new market and technological realities, there is sharp disagreement how such adaptation should be conceived. Extension of current rules is supported by most broadcasters whereas most telecom operators are in favour of reducing the scope of the rules.

Another area where adjustments may be necessary is numbering. While the evaluation showed no significant problems with the implementation at national level, it made it clear that changes may be needed to cope with future competition issues in the machine-to-machine market, e.g., connected cars, logistics, etc. with particular view to their increasing cross border aspects,. M2M growth rates are expected to be many times higher than those of the pure voice communications, changing the pattern and intensity of demand for numbering resources. The public consultation showed consensus that to cope with the numbering needs of M2M in the future, a clear framework for extra-territorial use of numbers is necessary to ensure sufficient numbering resources. As rules regarding extraterritorial usage are not governed by the regulatory framework, they may differ per Member State, entailing a risk of regulatory fragmentation. In this respect, existing coordination efforts in CEPT to prevent regulatory fragmentation may not prove sufficient to comply with the requirements of the Single Market. More specifically, administrative limitations of extraterritorial use may raise concerns with regard to compliance with EU Law notably with the requirements of Article 56 TFEU concerning the freedom to provide services.

At present, the scope of entities that can be beneficiaries of assignment of numbers vary per Member State and is often limited to specific categories of electronic communication service providers, In this respect, the current beneficiaries, e.g. most mobile network operators, expressed concerns over implementation and security issues, such as fraud, exhaustion of national numbers, and interoperability and end-to-end connectivity aspects. Mainly respondents beyond the telecom sector noted the increasing cross border aspects and the need to adapt to market changes.

Rules on access to emergency services are a very important issue too, as indicated in the evaluation report. In the public consultation, the telecom industry highlighted the importance of reliable access to emergency services that, in view of the technical standards and legal arrangements in place, can be provided only through ECS today. However, they argue that access to 112 obligations should be imposed on OTTs as well, if technically feasible. A large number of stakeholders consider that, although it would not be technically feasible to subject all OTT services to the obligation of providing access to emergency services, all the voice services perceived by the users as substitutive to the current PSTN voice service and which also give access to E.164 numbers should be subject to the same obligations regarding the access to emergency services.

Finally, obligations related to Universal Service may no longer be in line with current levels of availability and use of communications networks and services, as evidenced by the evaluation of the regulatory framework.

1.2.3 Regulatory redundancies and inefficiencies and lack of coherence in the Single Market

This section analyses the regulatory set up and regulation areas where objectives can be achieved in more efficient ways. This problem is clearly identified in the evaluation report [46].

1.2.3.1 Unnecessary administrative burden

The better regulation principle is about regulating only when necessary and in a proportionate manner. **The evaluation has identified several areas** where the administrative burden could be reduced without compromising – in some cases even improving - the effectiveness of the provisions.

Access regulation is an area where a certain level of simplification could take place in terms of process, intervention triggers or the relevance of access products for safeguarding competition, without compromising however the results achieved. The current regulatory framework implies a considerable amount of intervention intensity at both Member States and EU level, given, for example, the need to carry out and consult on **market analyses every 3 years** as well as the complexity of regulating ex ante the terms of provision of a significant number of different access products based on such analyses, in particular as several access products may be required for each regulated market. Moreover, the procedures as such could be simplified for certain very stable markets such as the markets for call termination, without compromising the outcomes.

Evaluation findings indicated that there is room for reducing the regulatory burden on national administrations/institutions and operators, or redirecting efforts to priority tasks, while at the same time increasing the predictability and the stability of the framework. Based on the actual implementation experience, it appears that the current cycles of market reviews are unnecessarily short and that lengthening them would increase the regulatory certainty and reduce the administrative burden for NRAs, the Commission, as well as for market participants. There are is also a potential to avoid duplication of processes for the specification of new wholesale remedies, and simplify the imposition of remedies in the medium term through the introduction of standardised wholesale remedies in cases where such remedies would be appropriate, for example in relation to business access for which there is significant trans-national demand). Compliance burden could be reduced with limiting the interventions only when it is needed to address retail market failures.

Areas where much is to be gained from streamlining include the **universal service** rules that can be revised in view of their effectiveness and of the decreasing relevance of some of the elements.

[46] For a more extensive analysis of administrative burden and potential redundancies, please refer to the Efficiency and Coherence sections of the Evaluation SWD as well as to the REFIT conclusions.

There is a clear simplification and reduction of administrative burden potential highlighted by the evaluation, indicating the possible removal of some redundant universal service obligation components as public payphones, comprehensive directories and directory enquiry services. Those are causing costs on top of the administrative burden for the NRAs from the process leading to the imposition of obligations. For example, as indicated in the evaluation report, the estimated maintenance of **payphones** in the EU costs annually over 1 bn euro – a large amount that needs to be critically considered in the light of rather infrequent use of the facility.[47] Usage and costs of the provision of **comprehensive directory and directory enquiry services** are difficult to estimate. However, the available data suggest that the relation between the cost and demand is such that commercial provision by the market would suffice, in particular for online directories and enquiry services.[48]The evaluation also indicated that directories are satisfactorily provided by the markets and demonstrated the non-use of 88% across the EU28 regarding public payphones[49]. [Evaluation p. 35] and highlighted the potential to narrow the **scope of universal service availability** and possible administrative burden reduction through ending of the current sectorial sharing mechanism possibility for financing.

The table below summarises the current state of play of universal service obligations in the Member States. Orange indicates that a universal service provider (USP) was designated in the past, but that the USO has been withdrawn in the year indicated in the applicable field. Around 42% of obligations related to public payphones, comprehensive directory and directory enquiry services were lifted between 2006 and 2012[50].

Table 1- State of Play on USO providers in the EU 28

[47] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 42-43. Payphones use has been dropping consistently over the last few years. Only 8% of population used payphones in 2014, and according to the data of 2008-2009 only 1% of emergency calls was made from payphones (7% for cross-border emergencies).

[48] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 38-42.

[49] Special Eurobarometer Report 414,2014, p.153. However, it should be noted that unlike public pay phones, mobile telephony is not regulated for accessibility. To tackle such issues and in order to improve the functioning of the internal market for accessible products and services by removing barriers created by divergent legislation, the Commission proposed the European Accessibility Act, which will facilitate the work of companies and will bring benefits for disabled and older people in the EU.

[50] It indicates whether a service provider has been designated to provide a universal service obligation (USO) for each component of the universal service in the Member State. Green indicates that at least one operator is currently designated to provide the component of the universal service. Orange indicates that a universal service provider (USP) was designated in the past, but that the USO has been withdrawn in the year indicated in the applicable field. Red indicates that no universal service operator has ever been designated in the Member State.

Table 1 Current state of play for the designation of a universal service provider for each universal service component in EU28 Member States[20]

	Access to a network at a fixed location, and PATS	Comprehensive directory	Comprehensive directory enquiry service	Public payphone
Austria			2006	
Belgium		2013	2013	2013
Bulgaria				
Croatia				
Cyprus		E-directory only[21]	2011	2011
Czech Rep.		2006	2006	
Denmark				
Estonia	2011	2011	2011	2011
Finland				
France		2014[22]	2012	2014
Germany				
Greece				
Hungary			Underway[23]	Underway
Ireland				
Italy		2012	2012	
Latvia		E-directory only		2014
Lithuania				
Luxembourg				
Malta				
Netherlands		2015[24]	2015	2008
Poland	2011	2011	2011	2011
Portugal				
Romania	2011	2011	2011	
Slovakia	For disabled only [25]	2012	For disabled only [26]	2012
Slovenia				
Spain			2012	
Sweden				
UK				

Source: SMART 2014/0011

Another target area will be the removal of certain **consumer protection measures** which are adequately addressed through horizontal legislation.

The evaluation report indicates that simplification may be achieved among others by analysing the necessity of overlapping provisions, which may lead to reducing the sector specific rules to those areas where they are still warranted, or of provisions which developments may have made redundant or irrelevant, such as for instance certain sector-specific consumer protection rules or some universal service components. In the public consultation providers argued that at present there is a problem of regulatory redundancy in certain areas because of overlapping general consumer protection rules and telecom sector specific rules for consumer protection, as well as duplication of authorities dealing with consumer dispute settlement and sanctions and that this overlap leads to over-regulation, too detailed provisions, and inconsistency of rules.

The latest development of general consumer protection rules such as the Consumer Rights Directive, the Regulation on online dispute resolution or the Directive for alternative dispute resolution has resulted in partly overlapping legal frameworks, which could in some cases lead to duplication of procedures, over-regulation, too detailed provisions or inconsistency of rules. For example some contract provisions in Article 20 Universal Service Directive are overlapping with information requirements in contracts in the Consumer Rights Directive covering aspects such as characteristics of services, identity of trader, tariffs or contract duration; additionally general contract rules are also set out in the Services Directive. In the same vein, out-of-court complaint and redress mechanisms are provided for under Article 34 Universal Service Directive, while a recourse to similar mechanisms is provided by the legislation on Alternative and Online Dispute Resolution (Directive 2013/11/EU on consumer ADR ("ADR Directive") and Regulation (EU) No 524/2013 on consumer ODR ("ODR Regulation"). The ADR Directive enables EU consumers to resolve their disputes concerning contractual obligations stemming from sales contracts or service contracts with EU traders, including electronic communications service providers, through the intervention of ADR entities respecting binding quality requirements. Under the ODR Regulation the EC launched in February 2016 an EU-wide online

platform (ODR platform) that facilitates the online resolution of contractual disputes between EU consumers and traders over purchases made online. Online traders and online marketplaces are required to provide a link to the EU ODR platform on their website.

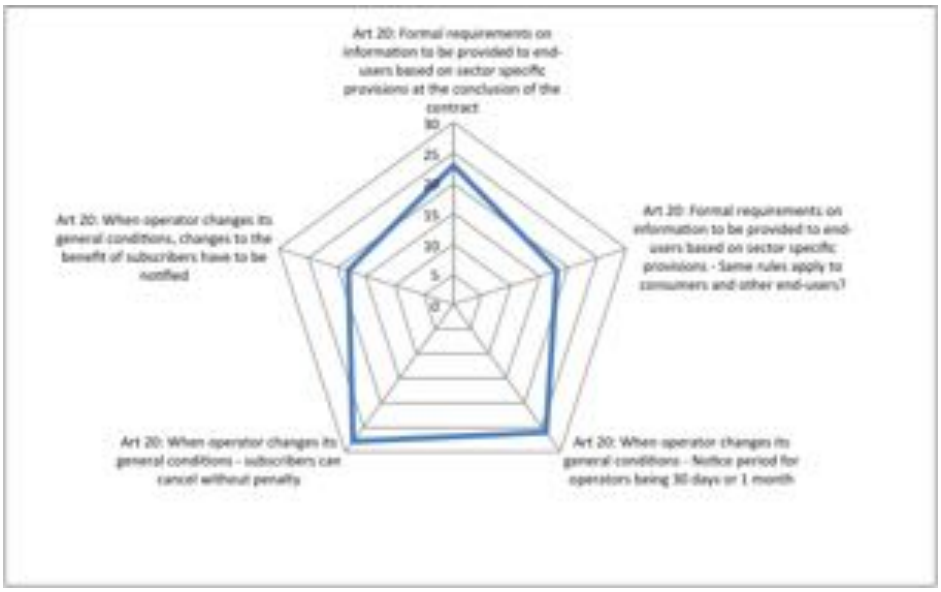
Table 2 - Overlap between key provisions of the USD and horizontal rules

	Applicable to ECS?	Similar protection rules	Other protection rules
Consumer Rights DIR (2011)	v	v	v
Misleading Advertising DIR (2006)	v		v
DIR on Services (2006)	x	v	v
Unfair Commercial Practices DIR (2005)	v	(v)	v
Unfair Contract Terms DIR (1993)	v	(v)	v
ODR Regulation (2013)	v		v
ADR DIR (2013)	v	v	

Source: SMART 2015/003

The evaluation report noted however that the exact scope and protection level of each set of rules must be analysed in detail before any conclusions are drawn – in particular in view of making sure that the level of protection offered to consumers remains adequate and whether sector-specific rules are still warranted. In particular, even in the case of protection rules with similar purposes and similar measures (e.g. transparency or dispute settlement) their exact scope and redress mechanisms might differ. In any case, a clear need appears to address the (small) inconsistencies identified (e.g. penalties, terminology, circular references, etc.).

Figure 9 - Homogenous provisions on contract with specified terms (Art 20 USD)



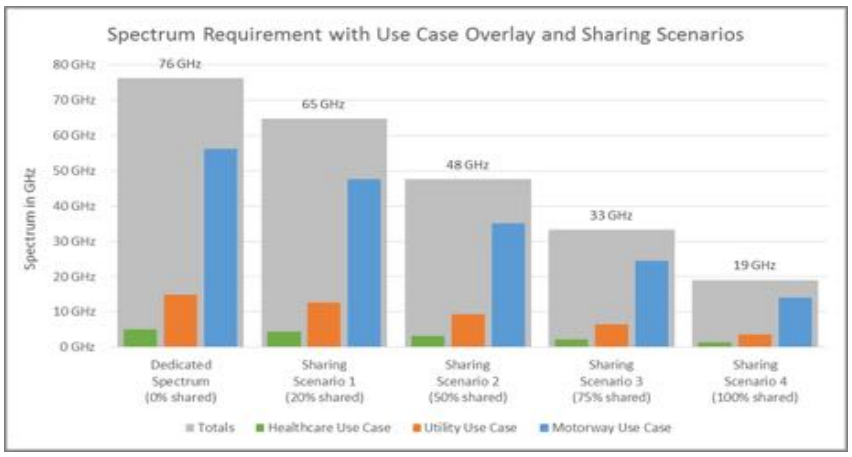
Source: SMART 2015/003

In the field of **wireless communications** a greater use of general authorisations in some instances could also contribute to simplification, especially for new short-range bands (so-called millimetre bands) envisaged for 5G well above 6 Ghz, while enabling users/innovators to gain access to spectrum in a quick, open and non-costly manner. In the public consultation, market actors and public authorities share the view that a general authorisation regime would foster

innovation and competition both for services and end-devices. Shared access to spectrum is likely to play an increasingly important role in meeting this growing demand (see section 1.2.1.3), thus there will be an increased need for flexible access to some spectrum bands (e.g. new Millimetre Wave spectrum) and a consistent approach in Europe which grants users regulatory certainty. Indeed, most public and commercial respondents are calling for flexible or shared access to spectrum to meet future demand, in particular for 5G, preferably on a voluntary basis. Vendors and operators insist on the contrary on exclusive or licensed shared access for quality purposes. Broadcasters raise interference issues and thus urge for careful selection of compatible sharing usages.

Greater and more intense spectrum sharing is becoming possible because of more sophisticated technologies and new authorization approaches. Successful deployment of 5G requires a consistent spectrum sharing model across the EU. The figure below shows the impact that spectrum sharing has on the need for additional spectrum in three 5G use cases, i.e. motorway, healthcare, transport and utilities (see also Annex 11).

Figure 10 - Spectrum sharing per different 5G use case



Source: Real Wireless, SMART 2014/0008

The deployment of 5G networks may raise the need for fewer and simpler rules to create the right conditions for necessary investment in fixed and wireless infrastructure (backhauls to be '5G ready') to enable cross-border services. The increased reliance of mobile technologies on fixed fibre backhaul (see annex 14) to achieve greater speeds and reliability also underlines the importance of strategies which address fibre deployment and spectrum availability in tandem. Along this line, most of public and commercial respondents to the Public Consultation called for a flexible and shared access to spectrum, preferably on a voluntary basis, in order to meet the future demand.

In terms of coherence and lack of effective coordination, the current **governance structure** of access regulation is based on a relatively complex system of Recommendations, ex ante checks and balances. Even in cases where common approaches are agreed between the Commission and BEREC, the system does not achieve full consistency, because of the lack of effective co-ordination mechanisms for regulatory remedies and lack of binding powers[51].

[51] Unlike in the process of defining relevant national markets and identifying SMP by NRAs (Article 7), the Commission is not able to use a veto power with regard to remedies under the article 7a procedure. More general binding decisions on remedies might still be possible under Article 19 of the Framework Directive, but may only be implemented two years after a Recommendation on the same subject and following a lengthy process involving BEREC and COCOM. Cf. case studies smart 2015/0002.

For instance regarding Mobile termination rates, despite a Commission recommendation, backed by BEREC, certain NRAs still do not apply the recommended costing methodology, or have adhered only after very long delays. This leads to an unjustified discriminatory treatment of consumers in different Member States and to a transfer of resources between providers in different Member States.

As regards consistency of market regulation, just over half of the respondents to the Public Consultation answered that the Art.7/7a process had been "significantly" or "moderately" effective in achieving regulatory consistency, while a combined 35% were of the opinion that this process had only little or no effect on consistency. However even if the main arguments brought forward were that the Art.7 procedure has none the less contributed greatly to more consistency and contributes to a steady development of the Single Market many respondents who were generally positive suggested that the Commission's role vis-à-vis remedies (under Art.7a) should be strengthened, either by a veto-power, or by a so-called double-lock veto (where BEREC and the Commission agree).With regard to spectrum, despite the fact that the current framework[52] allows the Commission to issue a Recommendation on the harmonised application of spectrum provisions, the governance mechanism in place is not sufficient to facilitate a consistent approach and common EU policy objectives can't be enforced resulting in the problems identified under section 1.2.1.1 above and the problem drivers analysis in Annex 10. In the public consultation, while several respondents noted delays in the availability of spectrum and fragmentation between conditions of use in different Member States and called for a stronger role of the Commission, others disagreed and stressed the national character of spectrum policy.

The existing spectrum governance structures focus on the harmonisation of technical parameters but do not ensure sufficient consistency of the timing of effective use of spectrum once allocated. Moreover, spectrum is assigned with varying conditions reflecting different (national) priorities and regarding the objectives of the regulatory framework. This leads to disparate conditions where a national border bisects otherwise similar areas. The absence of consistent EU-wide objectives and criteria for spectrum assignment, as well as for the conditions applicable to individual rights of use, creates barriers to entry at national level, hinders competition and reduces predictability for investors across Europe.

In the public consultation the views of the operators and of the regulatory community diverged. While operators were in favour of more harmonisation of spectrum assignment procedures, the regulatory community encompassing both BEREC and RSPG was of the view that the EU already benefits from substantial coordination and harmonisation processes, and no further EU-level coordination procedures are necessary. There was nevertheless openness to a peer-review mechanism as regards spectrum assignment. While Member States reject the need for full harmonisation they are open to a more common approach to spectrum management, and some could accept a peer review of national assignment plans as well as a certain level of harmonisation or approximation of conditions and selection processes.

Access to spectrum could also be simplified by placing greater emphasis on general authorisations wherever possible as opposed to individual licenses. More generally speaking, achieving more regulatory consistency in areas such as spectrum or authorisation requirements might in addition reduce the administrative burden of businesses operating across several Member States, while at the same time supporting the objectives of the framework.

[52] Article 19 of the Framework Directive

1.2.3.2 Compliance costs

Inconsistent regulation across Member States in similar competitive situations and access scenarios makes it burdensome and costly for market players relying on regulated access products to offer services in multiple countries and thus creates artificial barriers to market integration. Similarly, the lack of harmonised wholesale access products makes it difficult for operators to offer services on cross-border basis. This aspect is of particular concern for business end-users, which, despite benefiting from access regimes under the current regulatory framework, encounter - due to uneven regulation across Member States for which no objective justification may exist - difficulties to obtain fit-for-purpose telecom offers covering all services and countries of operation, and for multi-national telecom providers, which seek to replicate business models in multiple markets. Today, most large businesses, be they multinational/multi-site companies or large businesses rely on a sufficient homogeneity of inputs, and may not be able to contract connectivity inputs enabling them to sell on geographically integrated markets themselves. This leads to higher costs, higher concentration in smaller markets and, ultimately, higher prices and lower quality for end-users[53].

As regards the administrative costs of the market analysis process including the costs of three yearly review cycles, stakeholders consider[54] that those are relatively less significant.[55] if compared with the indirect impacts on competition and investment, and the economic costs of fragmentation impeding the single market. However, if review cycles – and indeed remedies – are shorter than needed, an important cost that is created beyond administrative costs, is increased uncertainty concerning the nature and strength of regulation, which can undermine investor confidence in both regulated operators and alternative operators that may be the beneficiaries of regulation.

For service providers that offer services cross border, or the same service in several Member States, the lack of harmonisation of end-user protection rules increases compliance costs and complicates processes, preventing service providers benefitting from economies of scale.

Telecom operators found it difficult to provide robust calculations of all compliance costs and only a few examples are available. For instance, one (large European) operator explained that its annual costs for complying with Quality of Service rules (standards and reporting) are about 14 million EUR per Member State[56]. Other operators indicated that that the annual costs for complying with contractual rights (including rules on contract duration, termination & withdrawal) and transparency obligations add up to about 70 million EUR per Member State. However available evidence is not sufficient to provide a robust estimate on compliance costs at EU level.

1.2.3.3 Lack of coherence in the Single Market

As shown by the evaluation, the framework's contribution to the development of the single market objective is perceived as relatively modest. **Regulatory consistency** has been achieved only to a limited extent, affecting the operations of cross-border providers and reducing predictability for all operators and their investors. More importantly, the cooperation and consistency tools available have led to a situation where best regulatory solutions have not always been followed, with impacts on end-user outcomes. EU-level consistency checks contribute to the predictability of access regulation throughout the EU, however their influence is

[53] For more details see: WIK (2013) Business Communications, Economic Growth and the Competitive Challenge http://www.wik.org/index.php?id=meldungendetails&tx_ttnews%5BbackPid%5D=85&tx_ttnews%5Bpointer%5D=11&tx_ttnews%5Btt_news%5D=1495&cHash=30344c3cd7aecfcd5efef7bec7b60b8b

[54] Interviews conducted in context of SMART 2015/0002

[55] The cost of undertaking market analyses for 7 markets on a 3 yearly basis have been estimated at €1.9m per NRA per year – see Ecorys 2013 Future electronic communications market subject to ex ante regulation

[56] Ibid

significantly restricted as regards draft regulatory remedies. Similarly, the lack of consistency in spectrum management has had negative consequences for end-users such as the delayed 4G deployment in most parts of the EU.

This view is shared by stakeholders. Despite some advances in areas such as interoperability and in the cooperation between NRAs, most stakeholders[57] consider that this is the least accomplished objective of the framework, referring to the lack of regulatory consistency and to the persisting barriers to operating across borders. In particular, cross-border providers deplore the lack of consistent access products (in particular when it comes to the wholesale inputs needed to serve the high end business market), the lack of harmonisation related to the actual access to spectrum by market players, the multiplicity and great diversity of market entry provisions (e.g. authorisations, rights of ways) and the very different implementing rules across the EU designed in view of consumer protection. Furthermore, the experience of implementing the framework has revealed clear difficulties in obtaining consistent access regulation and market entry conditions, in securing end-to-end trans-EU connectivity, in solving cross-border spectrum interference issues in some cases, in solving disputes across borders, etc.

Findings from the evaluation in the area of access, spectrum regulation and consumer protection illustrate how the lack of coherent regulatory approaches is impacting the single market.

While **access regulation**[58] has generally delivered more consistency in areas where the Commission was given greater competences, for example of determining market definition and designating operator with Significant Market Power (SMP), greater discrepancies can be observed with regard to the imposed remedies which cannot all be sufficiently explained by varying national circumstances. This translates into divergent approaches towards the regulation of fibre networks, symmetric regulation (ex ante access regulation which is not based on SMP), pricing methodologies, the imposition of Virtual Unbundled Local Access (VULA) remedies , etc. Those diverging regulatory practices in the individual national markets can have a profound effect on cross-border trade and, thus, on the development of a Single Market in electronic communications and may seriously distort competition across the EU by "levelling" the EU-wide playing-field. Diverging practices also affect predictability and the attractiveness of the telecom sector to institutional investors who are willing to invest in a common European market; even relatively smaller operators and project companies interested in network roll-out tend to rely on a pan-European or even global capital market in order to obtain funding.

BEREC's role in supporting consistent outcomes has received mixed feedback,. BEREC's current institutional set-up results in it often opting for greater flexibility or the lowest common denominator instead of focusing on a more harmonised approach for the single market.

Similarly, as regards the **spectrum regulation** area[59], while technical harmonisation and coordination have worked relatively effectively to ensure the availability of spectrum resources across the EU, in particular in relation for wireless broadband, the provisions concerning spectrum management have not sufficiently or consistently supported the single market objective.

The lack of Member State initiatives supporting spectrum usage opportunities across borders, going beyond technical harmonisation aspects that could bolster new business models in electronic communications may also reflect institutional limitations. The framework currently

[57] Roughly 46% of the respondents to the public consultation consider the single market objective achieved (of which 39% only "moderately" achieved), while the competition objective is considered achieved by 59% of the respondents (of which 32% consider that it was "significantly achieved") and the citizen interest objective is considered achieved by 54% of the respondents.
[58] Section 7.2.3.1 of the evaluation staff working document
[59] Section 7.2.3.2 of the evaluation staff working document

does not foresee any decision-making mechanism at EU level to buttress and provide legal certainty to such initiatives which would foster the internal market. More generally, and despite some positive contributions, the development of mechanisms in favour of the Internal Market has until recently received little attention in the work of the RSPG notwithstanding its competence to support measures 'necessary for the establishment and functioning of the internal market'[60].

By not achieving sufficient convergence of the actual conditions attached to individual licences or of the underlying motivations to impose such conditions, the framework has failed to eliminate regulatory uncertainty and possibly impacted effective access and use of spectrum and market investment incentives. This lack of consistency has had negative consequences for end-users, such as the delayed 4G deployments in most parts of the EU.

Another issue is also the lack of coherence in the single market as regards a high degree of heterogeneity in the **implementation and governance of consumer protection** as a result of different national legislation brought about by the current minimum harmonisation approach. Indeed, as indicated in the evaluation report, a large majority of operators (25 operators and 10 associations of electronic communications providers) which reacted to the public consultation believe that the provisions are administratively or operationally burdensome when providing services in several Member States, because of the minimum harmonisation nature of the consumer protection provisions in the regulatory framework, which lead to a different level of protection across Member States. The various implementation models, often supplemented by additional national consumer protection requirements, also result in varying compliance costs for cross border providers. This tends to result in lower predictability for businesses and higher compliance costs as explained in more detail in SMART 2015/0005. For example, some Member States define specifications of contract terms for all types of users, while in other Member States these provisions do not apply to business users. In about half of the Member States, operators are obliged to publish information on fixed/mobile broadband and mobile voice; also differences exist in terms of requirements on contract duration and termination, and some Member States have adopted detailed rules regarding consumer protection safeguards in case of unilateral changes on contract conditions. There are differences too in the application of out-of-court dispute resolution.

1.3 What are the main drivers?

The present section summarises the main problem drivers identified and illustrated inFigure 1, on the basis of market and regulatory failures highlighted in the evaluation, the public consultation and the support studies to this impact assessment. In line with the Better Regulation Guidelines[61] the drivers are based on our understanding of the underlying factors and behaviours underpinning the problems stated. In addition to that, it should however be clear that several external factors have contributed to the problems described above, such as: the larger economic context in the EU; the evolution of demand patterns of companies and citizens for buying services; comparative cost advantages of producing electronic communications services, competitive dynamics and company strategies unrelated to regulation; and the availability of public and private funding. The problem drivers identified are:

1. <u>The lack of incentives to deploy new networks (NGA and VHC) in the absence of infrastructure competition or in rural areas</u>, explaining the slow pace of the gradual

[60] Art. 2(1) of Commission Decision 2002/622/EC of 26 July 2002 establishing a Radio Spectrum Policy Group, OJ L 198, 27.7.2002, p. 49, as amended by Commission Decision 2009/978/EU, OJ L 336, 18.12.2009, p. 50.

[61] See: http://ec.europa.eu/smart-regulation/guidelines/toc_guide_en.htm

transition from copper-based networks towards fibre-based networks. The driver also investigates how certain elements of the current framework may lead to suboptimal behaviours by operators.

2. Inefficient allocation mechanism for public funding; this driver concerns the way public funds have been allocated (selection of the model of investment, structure/size of procurement calls, mix of grants vs. financial instruments, etc.) and how the lack of detailed and reliable mapping of existing infrastructures, of quality of services and about credible forthcoming investment in the next three years may lead to suboptimal and inconsistent outcomes across Member States.
3. Fragmented regulated and commercial offers for businesses across the EU; this driver covers the reasons for inconsistently regulated access inputs, in particular those serving business customers on a cross-border basis, and with regard to non-harmonised end-user protection requirements.
4. Minimum harmonisation, differentiated rules; this driver covers the lack of consistency of telecoms regulation which could be partially due to the current institutional set-up and the way the institutional players interact.
5. Uncertainty on spectrum assignment due to differentiated rules; this driver concerns the factors that hamper spectrum availability and deployment of mobile networks as a result of weak coordination mechanisms. As noted in the public consultation by the operators, different Member State choices regarding spectrum assignment conditions decrease investment predictability. This concerns in particular different timing of assignments, different conditions for licence duration and renewal, flexibility to trade, lease or share, technology and service neutrality limits, refarming conditions, technical performance, use-it-or-lose-it clauses and interference mitigation obligations.
6. Technological and market changes; this driver is about the reasons why the current definition of electronic communication services brings increasing uncertainty as many OTTs which do not provide conveyance of signals are entering the communications market, due to the latest technological developments;
7. Increasing adoption of bundles ; this driver concerns the policy dilemma posed by bundles that trigger economies of scale and scope, and advantages for consumers, but at the same time make transparency, comparability and switching more difficult for them.
8. Suboptimal design of market review cycles and inconsistent remedies under current rules (art.7) This driver covers the insufficient legal certainty and regulatory predictability regarding access obligations on NGA networks due to short market review cycles, lack of sufficient focus on retail markets and the difficulty of enforcing consistency on the basis of non-binding recommendations, impacting network roll-out.
9. Obsolete and redundant rules; this driver is about the regulatory inefficiencies that could be identified in the current regulatory setting, and which are generating unnecessary compliance costs or administrative burdens.

See Annex 10 for a more detailed analysis of the drivers underpinning the problem definition.

1.4 Who is affected by the problem, in what ways, and to what extent?

As connectivity underpins the DSM, a failure to achieve adequate connectivity is likely to have wide repercussions on jobs and growth in the digital economy and beyond given that industry is

increasingly becoming digitalised[62] Any lack of VHC connectivity is expected to impact negatively on SMEs and micro businesses as well as citizens, by limiting the opportunity to reduce mobility needs (teleworking, teleconferencing) and to reap the full benefits of all the new applications that the collaborative economy is creating. It is worth recalling that micro and small companies will create the bulk of the new jobs under the DSM. The modelling exercise accompanying the support study to this IA (see Section 4.11 and Annex 5) confirms in general terms the positive contribution of connectivity to job creation in an incremental and in an all-fibre scenario. Overall, if all the preferred options are pursued as a result of the review of the electronic communications framework, we expect expanded market-driven investment and consumption and a cumulative effect **on growth of 1.45% and on employment of 0.18% in 2025**, assuming that the reforms are implemented by 2020. A step change of 0.8% in labour productivity is also envisaged during the period 2020-2025.

Assuming a baseline with an average annual EU growth of 2% and average annual increase in employment of 0.3%, the cumulative impacts on economic activity and on job creation in nominal terms from implementing the set of preferred options presented in section 4 could amount respectively to EUR 910 bn. and to 1.304 million additional jobs by 2025.

These forecasts are based on a relatively conservative scenario in terms of expected roll-out of fibre networks (the so-called "accelerated fibre scenario"), which is described in more detail in section4.11.2.

Turning to the direct impacts, those most affected by the problems in fostering NGA deployment include **citizens and small businesses in rural areas**, and citizens and small businesses in countries or areas without effective infrastructure-based competition, which receive poorer quality services than those in countries and areas which are well-served with infrastructure-based competition. In areas where infrastructure-based competition is not effective, end-users may also experience delays in upgrades to higher speeds and a lack of competitive high speed offers if wholesale access on NGA and VHC networks is not effectively and efficiently implemented.

Affordable broadband has become of crucial importance to society and to the wider economy. Broadband provides the basis for participation in the digital economy and society through essential online Internet services. There is a risk of social exclusion from not being able to use this type of services because of having no or an insufficient broadband connection. **Universal Service Obligations** (USO) allow today data communications at data rates that are only sufficient to permit functional Internet access[63] at a fixed location, that are nearly universally available and used by citizens across all Member States (MS)[64]. Despite declining hardware costs for computers and tablets, some users are still not able to afford a broadband package. On average in EU28, 24% of households without a broadband access (2014), believed that subscription costs are too high to subscribe[65].

Among those most affected by the lack of consistent application of the framework **are multi-site and multi-nationally-operating businesses** which struggle to obtain coherent connectivity offers across the EU.

Telecoms operators are also significantly impacted by the problems described, notably due to the fact that they are the traditional subjects of sector regulation that now need to compete in a

[62] See the recent Digitising European Industry package launched by the Commission.
[63] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011
[64] According to the DESI index, the standard fixed broadband coverage in the EU stands at 97% of homes in 2015, with an average take-up rate of 72%. This demonstrates a gap between the EU households that have broadband available and those households that actually have a broadband connection. Furthermore, there are still differences between MS when examining availability and affordability of fixed broadband across urban and rural averages.
[65] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011

more complex and fluid market setting against players outside of the sector (namely, internet-based service providers and content distributors). Unclear or overly onerous regulation affects profitability and access to capital and may impede incumbents from investing in upgrading infrastructure. Overly onerous regulation or a lack of effective measures to reduce the cost of deploying fibre could also distort the buy or build decisions of (entrant) telecom operators in areas where infrastructure competition is viable, while a lack of effective access regulation in cases where it is necessary (e.g. where infrastructure duplication is not economically viable, even in the long term) could cause former entrants to exit markets or regions entirely, not justified by underlying economics or welfare considerations. Inconsistent application of the framework may also affect the ability of operators to operate efficiently across borders and build scale across Europe.

Telecoms operators also have to comply with **sector-specific obligations** related to e.g. contractual rights, transparency, quality of service, contributions to universal service funds, access to emergency services ("112") and caller location information that may in some instances have become redundant due to technology and market evolution or to overlaps with horizontal consumer protection rules, which may entail unnecessary administrative and compliance costs. Heterogeneous implementation of consumer rules based on minimum harmonisation may raise the costs of cross-border offerings or of expanding into other markets.

Equipment manufacturers depend on an investment-friendly environment to develop and sell equipment to modernise and upgrade telecom networks. As an example the public consultation showed how vendors seek a common definition of small-area wireless access points and the harmonisation of technical characteristics about their design, deployment and operation. **Content and applications providers**, as well as handset manufacturers, may also be held back from launching and developing advanced services in Europe in the absence of adequate connectivity.

The fact that rules on communications services are ill-adapted to technology and market changes also affects **new players in the current value chain** and in the future of the IoT. These players may experience some uncertainty about whether or not they fall within the scope of the framework and this may hinder future planning and investments.

Consumers are of course sensitive to the level of pricing. The present framework has delivered lower retail prices in Europe compared to the US for mobile data offers, while in the case of bundles of mobile voice and data plans, prices are cheaper for lower usage baskets and more expensive for high-end packages[66] (see Annex 6 for more details). SMART 2015/0002 investigates in more depth the impact that prices have on demand and the impact that different regulatory models can have on retail prices. Consumers are also affected by the problems as the level of protection when using new communications services is different than when using traditional services. This applies in particular to areas such as confidentiality of communications and security, where sector-specific protection seems to be needed regardless of the mode of the provision of the service, but may also in the future cover areas such as interoperability and access to emergency services.

For a detailed analysis of stakeholders views, see Annex 2 on stakeholders' consultation. This information is also complemented further by Annex 4 and Annex 13 analysing which stakeholders are affected by the initiative and the proposed preferred options and in what way.

1.5 Baseline: How would the problem evolve, all things being equal?

This section presents in a succinct way the baseline for this IA exploring how the problem would evolve, other things being equal. Annex 14 explores in more detail and provides more evidence

[66] See: SMART 2014/0049 - Mobile Broadband prices (February 2015) https://ec.europa.eu/digital-single-market/en/news/mobile-broadband-prices-february-2015

on the baseline. A more detailed description of the state of play for each of the policy areas addressed by the review is included under the description of Option 1 (baseline) in Section 4. The evaluation has shown that the existing framework has delivered more competition, better prices and choice for consumers, and spurred operators to invest in upgrading their networks at least in some areas. Today virtually all EU citizens have access to basic broadband networks (97% fixed broadband connections according to the DESI index 2016[67]) and increasing numbers of citizens and businesses have access to networks (Next Generation Access – NGA-connectivity) allowing at least 30 Mbps download speed (70.9% NGA general coverage[68] in EU according to DESI 2016 – see annex 6 for more data). Only some countries, such as Malta, Lithuania, Belgium and the Netherlands, already enjoy nearly comprehensive coverage of NGA networks, in most of those cases probably mainly thanks to the competitive impulse provided by legacy cable networks, which could be upgraded at relatively low cost[69]. NGA coverage in countries which lack extensive cable has been slow to develop in many cases (Italy or Greece being emblematic). Moreover, a large part of the NGA coverage beyond the cable footprint in many countries (UK or Germany, for instance) has been achieved through only partial upgrades of the legacy copper loop (FTTC), rather than full upgrades (FTTH/B). As investigated in study SMART 2015/0002, the former approach may not be sufficient to cope with the data consumptions under the most ambitious scenario forecast.

A key development since the framework was originally conceived is that legacy telephone and cable (coaxial) networks, including the copper 'local loops', are in the process of being upgraded with fibre and other solutions which improve broadband performance.

In terms of demand, these enhancements are needed to enable customers to enjoy better quality in online services including online video and cloud applications, as well as enabling multi-screen viewing, which is becoming increasingly prevalent in European households with the proliferation of devices as illustrated in Figure 11 below.

Figure 11 - Europe IP Traffic and Service Adoption Drivers

[67] The Digital Economy and Society Index (DESI) is a composite index developed by the European Commission (DG CNECT) to assess the development of EU countries towards a digital economy and society. It aggregates a set of relevant indicators structured around 5 dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services. For more information about the DESI please refer to http://ec.europa.eu/digital-agenda/en/digital-agenda-scoreboard

[68] NGA broadband coverage/availability (as a % of households) with Next Generation Access including the following technologies: FTTH, FTTB, Cable Docsis 3.0, VDSL and other superfast broadband (at least 30 Mbps download)

[69] Several studies highlight the role played by cable in stimulating NGA deployments including SMART 2015/0002, WIK-Consult (2015) for Ofcom 'Competition and Investment: analysing the drivers of superfast broadband', and the EP (2013) study 'Entertainment X.0 to boost broadband deployment'

Source: Cisco VNI Global IP Traffic forecast 2014-2019 – Europe includes Western Europe + CEE, excluding Russia

According to CISCO, Global IP traffic will increase threefold over the next 5 years. Overall, IP traffic will grow at a compound annual growth rate (CAGR) of 21 percent from 2013 to 2018[70]. The widespread adoption of cloud services, the number of connected devices (IoT), the booming M2M industry, contribute to further increase the traffic load on communications networks. In particular, as businesses and consumers exchange their data with the cloud, this will also lead to a **modified demand pattern for upload traffic**. Hence, while most of the traffic will still be in download, demand for upload will increase, as well as the need for lower latency for applications such as cloud computing and e-health, parameters included in the VHC concept.

In terms of supply of NGA in commercially viable areas, forecasts from IDATE based on market intelligence (see figure below) suggest that upgrades to NGA and VHC networks will continue, but at a relatively gradual pace. Across the EU, if FTTC/VDSL is excluded (as this technology is less likely than the other technologies considered to be offered at speeds of 100Mbit/s and above), only 42% of households would subscribe to high speed technologies in 2020.

Figure 12 - Projected take-up of NGA by technology (to 2025)

Source: IDATE, SMART 2015/0002

In terms of specific countries, IDATE projections suggest that by 2020 (see annex 14, **Error! Reference source not found. Error! Reference source not found.**), even under very optimistic assumptions (assuming FTTC/vDSL delivers 100Mbit/s in practice), many countries may miss the DAE target of 50% households taking up at least a 100 Mbps connection, and that within the 16 affected countries the target will be missed by around 27m households.

There is evidence suggesting that in the telecom sector **demand responds to supply**,[71] and that restricted download and upload speeds may limit the types of usage and applications that might

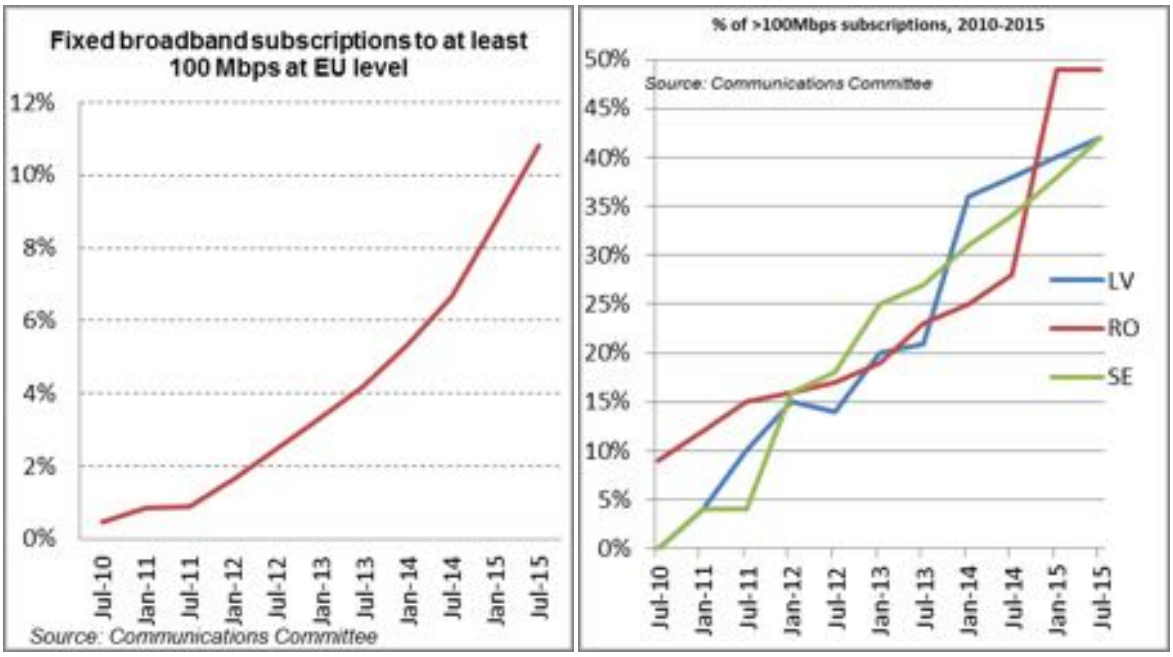
[70] Source: CISCO VNI index, see: http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html

71 Data from the UK regulator Ofcom for example suggests that download bandwidth consumption for NGA (FTTC and FTTP) networks was around two times higher than bandwidth consumption for non-NGA networks, with significantly higher use of upload capacity. This evidence of higher usage being associated with the availability of NGA is supported by the case study of Palaiseau in France, which has been the subject of a pilot trial for the switch-off of Orange copper customers and migration to FTTH networks. In this case it was observed that the average

otherwise emerge. In Sweden, following an early boost by the central government, one out of every two municipalities is involved in fibre to the business and fibre to the home deployments. This has led to very high take-up: as of July 2015, 68% of the broadband connections in Sweden are NGA[72], achieved predominantly through FTTH and FTTB connections. Where FTTH is widespread, the availability of fibre makes extending fibre to base stations far more feasible and efficient. This is well illustrated by the example of 4G in Stockholm where the world's first 4G deployment took place helped by the virtually 100% fibre coverage.[73]

As business and household services and applications depending on high quality connection are becoming more popular, subscriptions to offers of 100 Mbps or more are growing sharply, albeit from a low base; this growth trend is in fact more pronounced in the Member States with the highest 100 Mbps subscription rate, suggesting both important emulation effects on demand and increasing supply of attractive services which exploit such higher capacity connectivity.

Figure 13 - Fixed broadband subscriptions to at least 100 Mbps, EU and selected MS.



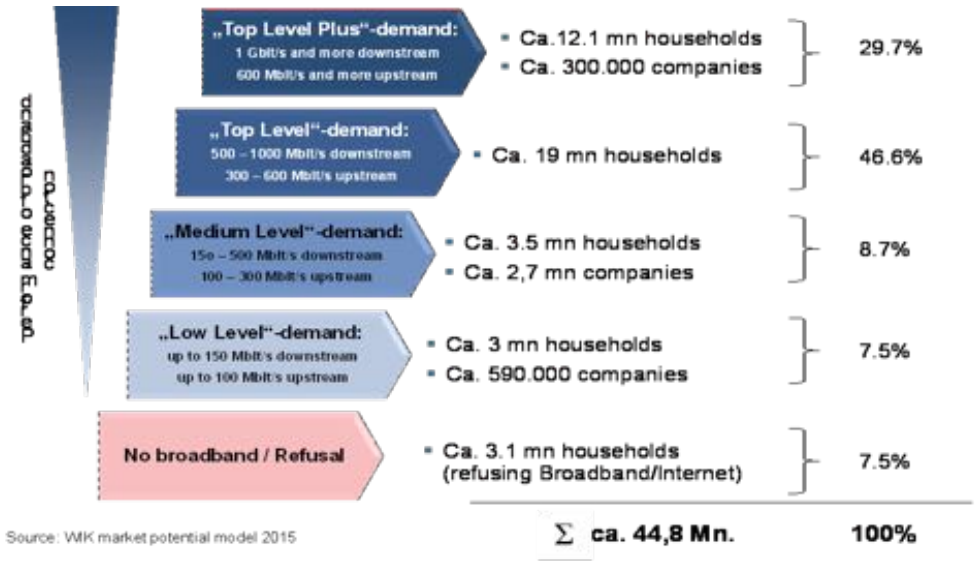
If bandwidth needs are calculated on the basis of what might be required to run certain applications, a case study of the German market providing a forecast for 2025 suggests that an average user might require 150-500Mbit/s downstream with more than 100Mbit/s up, while high-end users including those running small or home offices might require 1Gbit/s in download and more than 600 Mbps in upload (see SMART 2015/0005). This bandwidth would be used not only for multi-screen ultra HD video, but also for applications such as cloud and e-health as well as for home working and small business needs.

Internet traffic of Orange's broadband customers as well as their consumption of video-on-demand was multiplied by a factor of three. Importantly, this trial also resulted in fibre clients' usage of upload bandwidth being increased 8 times, due to changes in Internet usage and an increased usage of cloud-based services.

[72] See annex 6.

[73] Source: Vodafone's call for the Gigabit Society, Dec. 2015

Figure 14 - Model of market potential – Germany 2025



As shown in Figure 14 data rates required by the most demanding users could reach 1 Gbit/s or more on the downstream link by 2025, while a significant proportion of households and offices could demand download speeds of 500-1000Mbit/s and 300-600Mbit/s upstream by 2025. This scenario therefore sets the upper bounds for potential users (including business user) demands in the medium term – though it is worth noting that even a less ambitious scenario will need the fibre rollout to reach far deeper into most of the present networks.

On the subject of inconsistency in the implementation of the framework, there is evidence that without further direction at EU level, this problem is likely to persist and may worsen, in part because when new technologies and services emerge they lack the harmonisation that was historically required through EU legislation, and may not achieve adequate levels of harmonisation through voluntary standardisation alone. Concerns over the impact of fragmentation on business users, in particular multi-national ones, provide an example of the enduring nature of these problems and difficulties in using current tools to address them. Concerning future generations of wholesale access products for residential customers and small business, the experience of a new product designed as a partial replacement for Local Loop Unbundling on NGA networks, such as 'VULA' (Virtual Unbundled Local Access) or a WDM (Wavelength Division Multiplexing) based access product provides a warning that without efforts to apply a European 'standard' any future technological upgrades in fixed access networks are likely to result in duplicate efforts to develop new wholesale access solutions and divergent implementations at national level.

Furthermore, in the absence of more consistent and effective intervention in the area of spectrum, Member States will keep a large discretionary power to organise spectrum assignments and there would still be no possibility to adopt binding measures (other than by distinct co-legislative initiatives) to eliminate fragmentation and introduce more consistency in the selection and spectrum assignment process, or to coordinate some of its main elements. Looking at future challenges of the introduction of capital intense **5G networks** (planned for the early 2020s), there might be a potential risk that they could not be properly addressed at the EU level. The economic benefits of successful, fast and coordinated deployment of 5G across the EU

are very significant and they have been estimated at 146bn EUR per year and the creation of 2.39m jobs[74].

Overall it can be stated that **a no change scenario would lead to a persisting digital divide for citizens and SMEs, sub-optimal economic development outcomes, sub-optimal allocation of capital, lack of consumer trust in digital services, lower take up of innovation and loss of competitiveness of EU industry** (see annex 14 for more details).

Promotion of the **interests of end-users**, including the provision of a safety-net through the universal service obligations, is another principal objective of the regulatory framework, as it ensures that consumers can participate in the digital society and fully reap the benefits of a competitive market. Overall the framework has been successful in safeguarding consumer protection, even when this is not fully translated in increased consumer satisfaction. Given the increasing role of connectivity and electronic communications services in today's European economy, it is important to continue protecting end users' interest.

National rules have ensured transparency of information on services and prices by providers, including in some cases the provision of online tools comparing prices and services; rules on contract duration have been transposed so that the initial commitment period does not exceed 24 months, while also ensuring that providers offer users the possibility to subscribe to a contract with a maximum duration of 12 months (some Member States have opted for considerably shorter periods, such as a 6-month general maximum period); some Member States have adopted detailed rules regarding consumer protection safeguards in case of unilateral changes to contract conditions.

Despite the above, consumers still refer to issues related **to transparency and quality of service**, in particular with regards to the internet access service. This problem is especially acute when access to the internet service is bundled with other communications service, resulting in 24% of consumers not finding easy to compare prices of bundles, while evidence shows that an increasing number of consumers on most Member States opt for this service delivery mode. This trend would not change in a status quo scenario and consumer perceptions of problems of transparency and quality of service are likely to get worse due to the higher take up of bundles, in a baseline scenario

The potential for Member States to mandate **must carry obligations** aim at ensuring that channels of high public interest are broadcast by electronic communications providers, while avoiding unreasonable burden on the latter. While Member States have made wide use of their competences in this domain, the effectiveness of the rules has evolved as viewers increasingly use OTT services on smart TVs and smartphones/tablets and traditional TV channels represent a declining (while still dominant) share of audio-visual consumption patterns. At the same time, the mission of public service broadcasters increasingly extends into the online world and includes non-linear audio-visual services.

As explained in the problem definition, only providers of traditional communication services have to comply with sector specific rules safeguarding end-user's interests. Providers of communications service over the internet (OTTs) are not subject to these sector-specific rights and obligations, even when their services are used by the end-users to cover the same or similar communications needs as the traditional electronic communications services.

Must carry regulations were introduced to give privileges to general interest channels, with the view of fostering media pluralism and freedom, as well as safeguarding fair competition between channel providers. They owe their existence to concerns that privately owned distribution

[74] SMART 2014/0008, Identification and quantification of key socio-economic data to support strategic planning for the introduction of 5G in Europe

networks may prefer to provide commercially successful channels, rather than transmitting sufficient general interest channels, if left unchecked.

Significant changes or further evolution of the problem are not foreseeable with regards to services and end-user protection, absent further intervention at EU level. Uncertainty about the scope of sector specific rights and obligations and gaps in consumer protection would persist, which would in turn lead to a further fragmentation of the internal market and impede adoption of new services.

Rules on **universal service** aim at providing a safety net ensuring that the most vulnerable in society as well as those in more remote areas can receive basic services. In the absence of intervention at EU level, Member States would likely take increasingly different approaches in universal service obligations by unilaterally removing outdated services from the scope. Consistency and coherence of the universal service regime across Member States would reduce without a common approach towards the inclusion of broadband in the universal service scope. The sectorial financing mechanism would continue being a possibility for financing. The costs of financing the universal service obligation in the Member States could significantly diverge, depending on possible national approaches.

In the absence of more consistent and effective intervention, Member States will keep a large discretionary power to organise spectrum assignments and there would still be no possibility to adopt binding measures (other than by distinct co-legislative initiatives) to eliminate fragmentation and introduce more consistency in the selection and spectrum assignment process, or to coordinate some of its main elements. Looking towards future challenges which could not be addressed the most immediate and significant new technological development is **the introduction of 5G** (planned for the early 2020s).

The economic benefits of successful, fast and coordinated deployment of 5G across the EU are very significant and they have been estimated at 146bn EUR per year and the creation of 2.39m jobs[75].

A failure to achieve a single market in electronic communications can in itself impose considerable costs. To give an idea of magnitude (see annex 14 for more details) a 2011 study conducted for the EC – steps towards a truly Internal Market for e-communications[76], concluded that increased standardisation could provide annual gains of 0.3%-0.45% GDP (€35bln-€55bln) and cautioned that failing to reach standardised solutions would affect future pan-European roll-out as well as the development of premium over-the-top-services. The study also examined the impact of harmonised 'best practice' and concluded that a fully-harmonised European approach could provide gains of 0.22% and 0.44% of GDP (€27bln - 55bln) by delivering lower prices, higher quality and greater investments.

1.6 Why should the EU act?

The DSM strategy states that the Digital Single Market must be built on reliable, trustworthy, high-speed, affordable networks and services that safeguard consumers' fundamental rights to privacy and personal data protection while also encouraging innovation. The strategy foresees that the review should strive through common action to deliver benefits for end-users (citizens and businesses) as well as to promote high-performance connectivity fostering the socio-economic development of Europe and its communications industry. The European Council on 28

[75] SMART 2014/0008, Identification and quantification of key socio-economic data to support strategic planning for the introduction of 5G in Europe

[76] Ecorys/TNO/TU Delft (2011) 'Steps towards a truly internal market for electronic communications' https://ec.europa.eu/digital-agenda/en/news/steps-towards-truly-internal-market

June 2016 also endorsed in its conclusions the importance of telecom and connectivity as a backbone for the digital single market, calling for "*swift and determined progress*" to "*ensuring very high-capacity fixed and wireless broadband connectivity across Europe, which is a precondition for future competitiveness*.

In parallel the European Commission launched on 19 April 2016 the "**Digitising European Industry**" initiative under the DSM package that establishes a clear link between connectivity and a the need to ensure that Europe is ready for the emerging challenges of digital products and services in areas such as: **5G[77], cloud computing, Internet of Things (IoT), data technologies and cybersecurity**[78]. All- fibre networks seem to be in a better position to handle these challenges than copper-enhanced networks, although technological evolution such as DOCSIS 3.1 for cable networks may alleviate many of the latters' constraints[79]. Annex 7 on Competitiveness and Innovation further explains how the review of the electronic communications framework could support the development and use of the 'Internet of Things' (IoT) [80] and digitalization of industry. In turn, IoT implies an increased role for communication services in (and increased dependency on connectivity by) various industries, including automotive, agriculture, health, transport, etc. Thus, policies which unlock the full potential of IoT and the digitization of industry trigger a "disruptive growth path".[81]

The review of the telecom framework supporting availability of VHC connectivity networks is therefore complementary to the "**Digitising European Industry**" initiative since it drives the development of value-adding services in the Internal Market that would rely on networks, while the non-availability of VHC connectivity forces providers to adapt services or launch them elsewhere.

Electronic communications is a strategic sector, which directly contributes €168.62bn of European value added and 1.06 million jobs (around 1.3% of GDP and 0.47% of total employment in 2012), with a labour productivity per person of more than 144 thousand euros (the highest rate within the ICT sector), according to a JRC study[82]. The sector supports a wide range of other high-tech manufacturing and digital services (the ICT sector constitutes 4% GDP and 2.76% of EU jobs, with a labour productivity rate 44.45% higher than total labour productivity) as well as the economy as a whole.[83]

The risk, as explained in the support study to this IA (see SMART 2015/0005) is that the current pace of infrastructure deployment may result in the coming years in constrained connectivity negatively affecting EU citizens', businesses' and public authorities' capacity to produce, share and benefit from innovative digital products and services. Moreover, the competitiveness of the wider economy, not least of multinational companies based in the EU, is affected as VHC communications services and networks are not even provided consistently to the business sectors across Europe. As electronic communications networks become increasingly critical infrastructures, market players should be able to expand, cumulating and increasing existing

[77] It is expected that 5G will comprise three elements i) enhanced mobile broadband communications; ii) massive machine-to-machine communications (M2M); and iii) ultra-reliable and low-latency communications.
[78] See: https://ec.europa.eu/digital-single-market/en/digitising-european-industry
[79] See SMART 2015/0002
[80] BEREC (2016) and McKinsey (2015) identify a number of key enablers that contribute to unlocking the full potential of the IoT. Key enablers are optimal fixed and mobile connectivity (realised through policy measures with regards to access, spectrum and numbering), regulatory security for new players in the IoT value chain (which is realised by clarifying the scope of the RF) as well as end-users confidence about security, privacy and confidentiality.
[81] See: "Information Technologies and Labour Market Disruptions - A Cross-Atlantic Dialogue" background document by the "interdisciplinary, cross-sector roundtable organised by the European Commission (DG Enterprise and Industry and DG Communication Networks, Content and Technology) in cooperation with The Conference Board and Cornell University ILR School" 3/11/2014, p. 11
[82] http://is.jrc.ec.europa.eu/pages/ISG/PREDICT/documents/PREDICT2015.pdf
[83] There is a wide range of literature linking broadband diffusion to GDP growth

demand and by way of that unleashing growth potential inherent in a DSM. While wholesale markets for access to networks will, for reasons of lack of substitution and localness of service provision, frequently remain either local, regional or at best national, other communication service providers should not be subject to cross border barriers to further EU market integration. In the absence of either structural or strategic barriers to overcoming market boundaries, it is the legal and artificial barriers which hinder exploiting the growth potential of larger, border-crossing communications markets in the EU. These barriers stem both from access regulation and divergent end-user protection rules across Europe.

2 DOES THE EU HAVE THE RIGHT TO ACT?

The legal basis for the review of the Regulatory Framework remains **Article 114 of the EC Treaty.** This Article confers on the EU legislature discretion, depending on the general context and the specific circumstances of the matter to be harmonised, as regards the harmonisation technique most appropriate for achieving the desired result, in particular in fields which are characterised by complex technical features.

In general, the subsidiarity issues have been addressed as regards the existing framework. Given that this is the review of an existing package, the below analysis concentrates on: the new objective of ubiquitous and unconstrained connectivity, the enhanced role of BEREC as an EU agency and the harmonisation of spectrum-related issues, rules on services.

Ubiquitous and unconstrained connectivity

Lack of ubiquitous, **VHC connectivity** hinders the single market from tapping into a significant part of its human capital, and affects territorial cohesion, and has a negative impact on the ability of businesses to produce efficiently and to provide innovative and competitive services. Connectivity can play an essential socio-economic role to prevent isolation and depopulation, and link peripheral regions with the central regions of the Union[84]. Effective connectivity could reduce the costs of delivery of both goods and services, public and private, and partially compensate for remoteness ensuring the participation of people and businesses in these areas in the DSM. Furthermore connectivity is an enabler not only for EU enterprises to compete with other parts of the globe, but also for public services, including schools, to offer first class services to EU citizens.

Enhanced role of BEREC as an EU agency

The EU has a need to act to address inconsistencies linked with the **institutional set up** under the existing framework. Whilst market fragmentation is not solely to blame on the regulatory set-up in the EU, it has become apparent over the past years, that the lack of consistency of telecoms regulation is – to a degree at least – the result of the institutional set-up and the way the various institutional players (i.e. mainly the NRAs, BEREC and the Commission) interact and can influence the regulatory outcome.
Vesting BEREC with certain normative and decision making powers in the area of ex ante market regulation will enhance legal certainty and contribute to regulatory consistency. Stable and coherent regulation is of outmost importance to create the right incentives for operators to invest in capital intensive efficient and future proof infrastructure. **Regulatory certainty** over a sufficient period of time and reassurance about the consistency of regulatory approaches throughout the single market could unleash the investment potential not only of the large multi-national operators and large investment funds, but also of smaller operators and investors at national or local level, which must often rely on multinational sources of capital which attach a

lot of value to regulatory predictability. Furthermore, absence of EU rules in this area would on the one hand bring fragmentation impeding the development of a DSM and on the other administrative burden jeopardising the efficient development of such services. This is particularly true for services such as M2M, which should be provided in such a way as to be able to seamlessly cross national boundaries. In addition for the **business sector**, there are still national barriers to the provision of **business communications services** on a cross-border basis and this represents a significant missed opportunity for the functioning and the development of the Single Market[85].

Harmonisation of spectrum related issues

Spectrum, as other resources such as numbers and to some extent land, belongs to the Member States or at least fall under their jurisdiction, and their management and assignment needs to take into account national particularities and needs. Nevertheless, there is a need for a more convergent and consistent EU regulation for market entry to eliminate the obstacles that appear due to divergent conditions for the assignment of individual rights of use of spectrum, numbers or land. A consistent EU level regulation is necessary to (i) enable providers to expand their services to other Member States; (ii) create a sufficient market scale effect allowing front running Member States to benefit from it by providing the EU as DSM a sufficient attractively; (iii) give access to state of the art wireless capacities and services for EU citizens and businesses to benefit from the digital environment, innovative services and applications and be able to commercially develop and underpin the benefits of the digital economy that is constantly evolving towards the "mobile" economy, where spectrum policy has an important role[86]; (iv) allow countries which are lagging behind to catch up and participate into the DSM, thereby also allowing more advanced Member States to further increase citizens' and commercial exchanges within such countries; and, (v) treat all spectrum users in a coherent way throughout the Union. Lastly, in order for the EU to lead on new and enhanced services, such as 5G, it needs to offer equipment manufacturers and providers of communication services sufficient scale not only in terms of technical harmonisation, but most importantly of a market developing in a broadly aligned fashion, for services and devices to develop under stable and harmonised rules.

Services

In **services**, competition between local providers of electronic communications services that bundle network access with services and global providers of services over the top of the networks reinforces the right of the EU to act to ensure a level playing field. Action should also be undertaken at EU level to reduce fragmentation of **consumer protection rules,** which on the one hand raises the administrative cost for cross-border providers of services and hinders the development of innovative services and on the other hand result to an uneven and sub-optimal level of consumer protection across the Union.

Under the **subsidiarity principle**, the main purpose of which is to bring decision-making within the Union as close to the citizen as possible, the Union is entitled to act if a problem cannot be adequately settled by the Member States acting on their own. If the action of the Union does not offer prospects for a more effective solution, the national authorities are expected to act individually. Therefore, it is crucial to verify whether action by the Union would provide added value, compared to individual actions by Member States.

2.1 Why could Member States not achieve the objectives of the proposed action sufficiently by themselves?

Ubiquitous and unconstrained connectivity

The situation of Member States with regard to connectivity differs quite significantly. There are very important discrepancies, which may not be explained solely from the different landscape, population, GDP or purchasing power, but are the result of different policy choices made today and in the past. Absence of EU action to pursue ubiquitous and unconstrained connectivity as a separate objective of the framework would only perpetuate this patchwork with negative effects on the single market and consumer interests.

In the public consultation, connectivity was perceived as a necessary condition to achieve the Digital Single Market, with many respondents pointing to the need for policy measures at EU level and adjustments to the current policy and regulatory tools, as these are provided in the current regulatory framework, to support the deployment of infrastructure in line with future needs.

Enhanced role of BEREC as an EU agency

The relative success of BEREC in promoting regulatory consistency and its failure in imposing a single-market oriented solution when NRAs do not adhere to its analysis advocate for the need to enhance its role and competences. The development of common and consistent approaches, the sharing of regulatory knowledge and resources can achieve better regulatory results at lower cost for the whole EU. This is particularly clear for areas of regulation with a cross-border dimension, such as the provision of services to businesses, or spectrum. It is also true for markets which are interconnected, such as the electronic communications markets. Regulatory discrepancies of interconnected markets may lead to a transfer of resources between national markets, as we have seen with the discrepancy in the regulation of termination markets and thus hinder the development of new and innovative products. While a certain degree of flexibility must be maintained to adapt implementation to local circumstances, national regulators performing this task will only be able to achieve their objectives in the most effective way by co-operating between each other and with the EC to devise the best solutions to similar problems. An approach based on the common regulatory wisdom of the EU's regulatory community is therefore more likely to be robust and effective then a range of purely national solutions.

Harmonisation of spectrum related issues

Spectrum issues cannot be addressed by individual Member States on their own, nor by a small number of countries acting together, because they relate directly to cross-border coordination of national spectrum assignment and management activities across the Union. While spectrum is a national resource, it's assignment is necessary for market entry, i.e. of exercising an activity in the digital single market. Absent rules at EU level, it may not be ensured that Member States will take sufficiently into account not only the national specificities of their markets, but also the connectivity needs, and the consistency requirements of the digital single market.

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2.2 What would be the added-value of action at EU-level?

The technological developments and the ambitious Digital Single Market strategy have strengthened the case for joint action at EU level. The EU depends on effective and widespread connectivity across all its Member States. Moreover, as essential services such as banking and interactions with local and national Governments move online, connectivity is today vital for social and economic inclusion and the advent of 5G will further foster this role.

Besides bridging current gaps in **end-user protection in certain areas** such as security and achieving effective outcomes for consumers, consistent approaches to the regulation of electronic communications within the single market (including mechanisms to ensure effective competition) are important in ensuring a level playing field amongst operators and avoiding arbitrage whereby 'national champions' could be protected within their home market and leverage such advantages when entering neighbouring markets.

There is also a strong case for action to address inconsistencies in markets which have a clear cross-border aspect. One such case is **business access**, where a standardisation of product characteristics and service levels is important in supporting the delivery of seamless services to corporations across the single market.

With regard to the institutional set-up, while the current set-up may have contributed to more benefits than a system involving Member States acting alone, opportunities to create more added value may have been missed due to the challenges in achieving consistency that are inherent in a regime which relies on soft law. This is particularly true for decisions affecting cross-border services (including call termination and business access), but also applies for services such as very high speed broadband, which have a significant impact on the digital single market as well as on the wider economy and society.

The same rationale is valid for **addressing lack of consistency in spectrum assignments across the EU:** differences in methods and conditions for spectrum use across Member States impede the development of a true single market. Unjustified divergences between Member States should be levelled out and comparable coordinated assignment conditions and awards developed. An EU action drawing on national best practices and experience will ensure that spectrum is put to optimal and efficient use as well as provide the regulatory predictability needed to incentivise network investments to meet the connectivity needs.

In terms of stakeholder perception, there was a quite **clear preference amongst the respondents to the public consultation (see annex 2) for continuing action at EU level** (nearly 89%). The public consultation confirmed that further harmonisation would be welcome on aspects such as spectrum management, market access, consumer protection, authorisations, or privacy and security. The respondents highlighted a risk of fragmentation due to national implementing measures and of incoherence with other regulation and competition law.

In the European Council (June 2016)[87], there was a general recognition of the importance of enhanced connectivity as a regulatory objective, and of the need to create right conditions for stimulating new business opportunities by better coordinating spectrum assignment modalities. The reticence on the part of Member States is mainly focused on spectrum governance – while a significant number of them agree with the need for coordination of spectrum policy objectives and, in particular, acknowledged the potential for greater synergies between national authorities including an enhanced role for the Radio Spectrum Policy Group (RSPG), the vast majority insists in maintaining responsibilities for spectrum policy at national level, notably with regard to spectrum assignment procedures and licence conditions to take account of national circumstances and suggested that the spectrum coordination instruments currently available under the framework were sufficient.

Measures at EU level are also needed to tackle the underlying causes of the problem, by enabling any operator, whatever its size or scope of activities, to benefit from harmonised procedures, stable and consistent regulation allowing for credible assessments about the return on capital invested in enhanced networks. Such measures will ensure regulatory predictability and legal

[87] European Council Conclusions June 2016 http://data.consilium.europa.eu/doc/document/ST-26-2016-INIT/en/pdf

certainty necessary to undertake investments in capital-intensive broadband networks and bridge the digital divide, thereby allowing consumers to enjoy new services.

3 WHAT SHOULD BE ACHIEVED?

The set of objectives and the intervention logic linked to the review of the regulatory framework have to be inscribed in the wider context of the DSM strategy[88] and the **Political Guidelines for the current European Commission – A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change** which set up the policy objectives of the Juncker commission.

The European Council on 28 June 2016 also endorsed in its conclusions the importance of telecom and connectivity as a backbone for the digital single market, calling for "*swift and determined progress*" to "*ensuring very high-capacity fixed and wireless broadband connectivity across Europe, which is a precondition for future competitiveness. The review of the telecoms regulatory framework should aim to incentivise major network investments while promoting effective competition and consumer rights*"; The June 2016 European Council conclusions are also calling for a timely release of the 700 MHz band so as to help ensure Europe's leadership in the roll-out of 5G networks.

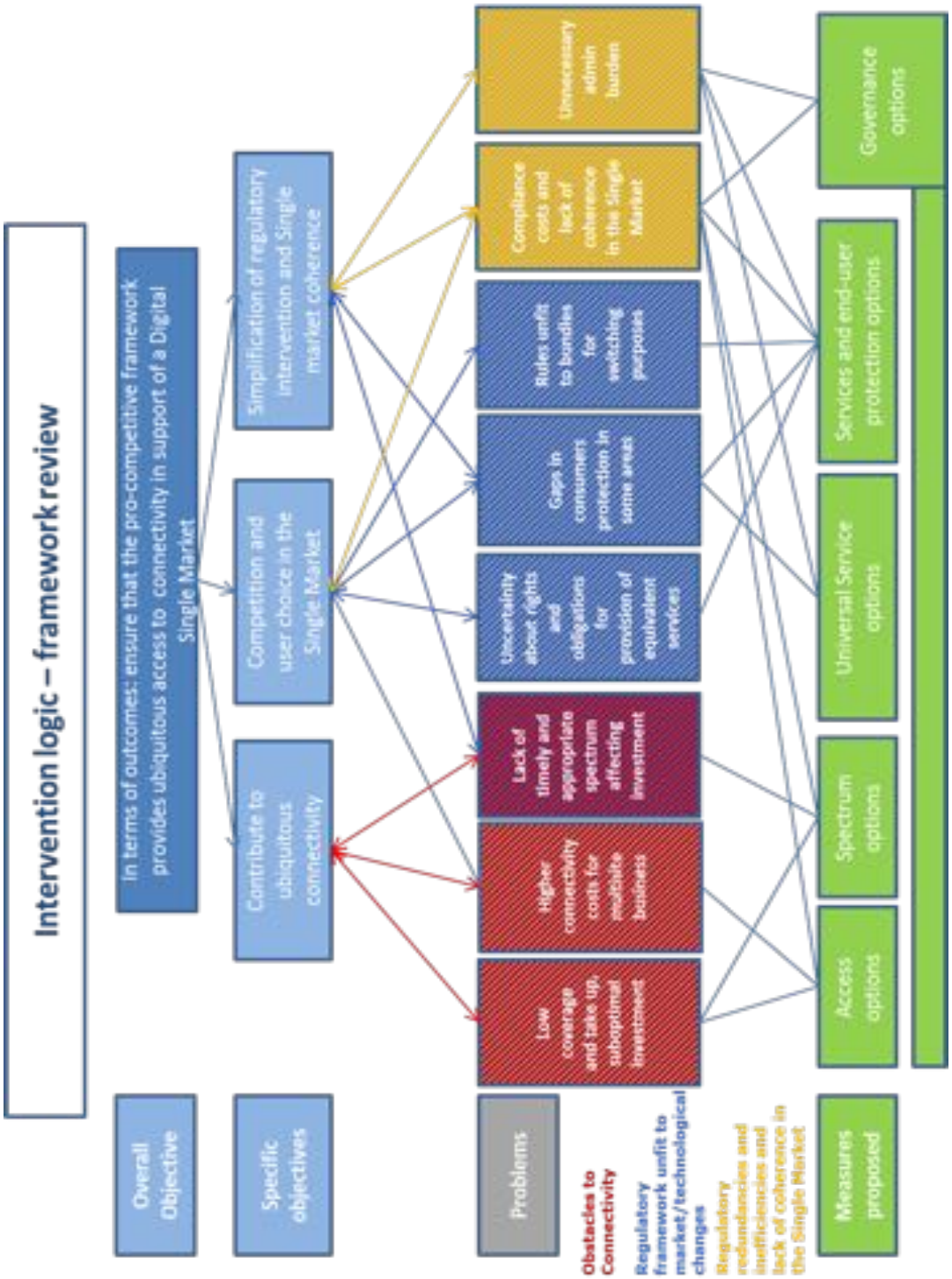
The following diagram illustrates the intervention logic inspiring the review of the framework, providing the necessary links between the drivers and the problems identified in section 1 and the policy options presented in section 4 below.

The diagram below presents the overall objective for the review, the specific objectives that will contribute to the overall objective, including the various policy areas concerned and the link with the problems that are presented in section 1. The eight main problems identified are organised under three categories: (i) Obstacles to unconstrained connectivity, (ii) A regulatory framework not fit to rapid market and technological changes (iii) regulatory redundancies and inefficiencies and lack of coherence in the Single Market.

Additional graphs presenting the link between each specific objective and related problems, problem drivers and solutions are presented in section 3.2.

Figure 15 - Intervention logic diagram

[88] See: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0192&from=EN



3.1 What are the general policy objectives?

The **current regulatory framework** is built on three main objectives as defined in Article 8 of the Framework Directive: **promotion of competition, of the internal market, and of end-users' interests** (understood largely in terms of legal rights: to universal service, privacy, protection of end-users and vulnerable groups). Based on these main objectives, the framework then sets out a number of sub-principles - such as promoting regulatory predictability, promoting

efficient investment and innovation, regulating markets only where there is no effective and sustainable competition - which regulators should take into account when pursuing the primary objectives[89].

The current review is a component of the DSM strategy launched in May 2015[90]. Its objectives will have to be translated into implementable regulatory objectives in the framework. **The current three primary objectives** under art. 8 FWD as well as the regulatory principles relative to investment and innovation **will remain valid and relevant**. However, the telecoms sector is generating more and more spillovers to the rest of the economy, becoming the foundation of modern, innovative economic systems and as well as of certain societal services, such as e-transport, e-government, e-health care, e-learning, etc. This can only be possible if appropriate networks are rolled out at a sufficient scale and if VHC **connectivity** becomes accessible and affordable to all citizens and businesses.

Connectivity was broadly recognised in the public consultation as the underlying driving force for the digital society and economy, underpinned by technological changes and evolving consumer and market demands. It appears necessary that the **current objectives should be flanked by a novel connectivity objective**, spelled out as:

"*Access and take-up by all European citizens and businesses of **very high-capacity connectivity**, both fixed and mobile, and interpersonal communications services, on the basis of affordable price and choice, enabled by effective and fair competition, by efficient investment with adequate returns, by innovation, by common rules and predictable regulatory approaches **in the internal market** and by the necessary sector-specific rules to **safeguard the interests of citizens**.*

This new objective will be **additional** to the objectives already included in art. 8 of FWD **promotion of competition, of the internal market, and of citizen interests**, which should be read **as a whole** in line with the policy strategies and ambitions recalled in section 1, and in section 3.2. on coherence of the objectives, in particular with the connectivity strategy which is articulated around three set of specific ambitions, as assessed in annex 9:

a. Gigabit connectivity for socio-economic drivers
b. Ubiquitous mobile connectivity
c. Improved connectivity in rural areas

However it is important to clarify that unlike the provisions of the regulatory framework, the provisions included in the Gigabit society strategy **will be of a non-binding nature.** The strategy will reinforce the link between the objective of the regulatory framework and the overall political targets of the Commission in terms of connectivity as explicated in the communication accompanying the legal proposal, and can provide guidance for interpreting the regulatory objectives proposed in the revised legislative framework as well as in other areas of public intervention (state aid, structural and investment fund interventions, national broadband plans) and a benchmark for private decision-making on long-term investments.

3.2 What are the more specific objectives?

Three specific objectives for the review of the regulatory framework have been identified by the Commission services, in line with findings of the support study to this IA[91], the public consultation and the workshops and meetings carried out in 2015-2016 and the Fitness Check. The evaluation has showed that among the three existing objectives of the **regulatory**

[89] As confirmed by the Fitness Check, the objectives spelled out above remain valid and are not to be confused with the objectives of the review, presented in the diagram which refers to this review exercise.
[90] See: https://ec.europa.eu/digital-single-market/digital-single-market
[91] See SMART 2015/0005

framework the internal market is the one that has been achieved to a lesser extent as explained in section 1.1. As the **single market objective** is inherently linked with each of the specific objectives identified for this impact assessment it is not included as a separate stand-alone objective but constitutes an integral and essential dimension of each of the specific objectives presented below.

For each specific objective, the link with the problems identified in section 1.2 is provided, as well as the link to the main measures that are included under the options for the policy areas identified in section 4. The methodological link between problems, objectives and measures has to be interpreted in a relative way, as the regulatory measures that fall under the scope of the framework review are certainly not sufficient on their own to guarantee the full achievement of the objectives: as explained in section 1.2.1.1, some significant exogenous factors of non-regulatory nature concur to the problems identified. The measures proposed will contribute to address these problems providing the fittest regulatory framework, but cannot be considered as sufficient to solve them.

3.2.1 Contribute to ubiquitous very high capacity connectivity in the single market

This objective is **addressing the following problems** identified in section 1.2: low coverage and correspondingly limited take up of very high capacity connectivity and the reasons for suboptimal investment in the Single Market, lack of timely and appropriate spectrum affecting investments in the Single Market, unsatisfactory connectivity offers across the Union for businesses, regulatory redundancies and inefficiencies and lack of coherence in the Single Market.

This objective is **linked to the policy options** identified in the access, spectrum, Universal Service Obligations (USO) and governance areas by the **following measures and solutions proposed**:

- Boost VHC network roll-out through increased emphasis on infrastructure competition when possible, co-investment, infrastructure models (wholesale–only), cost reduction measures, on the basis of adequate returns on investment; (see access options)
- Address business needs in terms of cross—border connectivity (see access options)
- Ensure sufficient incentives for operators to deploy VHC infrastructure (where infrastructure competition insufficient), another aspect is to provide greater certainty for those committing to invest in challenge areas; (see access options)
- Ensure faster time to market for spectrum resources, so that spectrum can speedily be made available to the next generation 5G technology on terms which favour investment and predictability; (see spectrum options)
- Modernise USO scope to take account of market and technological developments and bring it into line with current citizen needs;(see universal service options)

The **single market dimension** is specifically addressed by the intent to:

- Promote EU-wide access products for cross-border services to business users in the single market (see access options)
- Promote a consistent EU spectrum management and timely deployment of 5G throughout the EU. (see spectrum options)
- Ensure common means of determining and mapping end user connectivity including also quality of service (see access and spectrum options)

- Ensure a governance structure that can enable and foster connectivity, including new tasks for NRAs, in the area of mapping, spectrum and effective EU coordination mechanisms on spectrum and regulatory remedies (see governance options on access and spectrum).

The following graph links the problems and the drivers related to this specific objective and includes some of the proposed solutions. Section 4.9 provides a more detailed explanation of the link between the measures proposed in the preferred options and the specific objectives, describing how the former concur to achieve the latter.

Annex 10 (section **Error! Reference source not found.**) further details how certain elements of the current regulatory framework could be improved to foster deployment of VHC networks.

1. Intervention logic: measures to contribute to ubiquitous connectivity

Problem	Drivers	Objective	Operational Objectives	Solutions	
Low coverage and take up in very high capacity networks	Insufficient incentives to invest (insufficient infrastructure competition, unviable business case Inefficient allocation mechanism for public funding	Contribute to ubiquitous connectivity	support deployment of dense 5G networks support deployment of VHC networks ensure competition on price ensure competition on quality Inclusion of affordable broadband under USO in MS	Promotion of infrastructure competition in VHC, co-investment and increased investor certainty; strengthened oversight on regulatory remedies Modernise USO rules Focus on broadband affordability	**Access & USO**
Lack of timely and appropriate spectrum affecting investments	Regulatory uncertainty on spectrum assignment Minimum harmonisation, differentiated rules		Faster time to market of spectrum resources increase consistency in some aspects of MS spectrum management	Binding assignment criteria, provisions on small cells and wi-fi, more efficient spectrum usage	**Spectrum**
Lack of coherent connectivity offers for business across the EU	Fragmented regulation of wholesale business access		ensure competition on quality ensure consumer choice	Common specification for wholesale business access	**Access**

3.2.2 Competition and user choice in the single market:

This **objective is addressing the following problems** identified in section 1.2: Low coverage and correspondingly limited take-up, uncertainty about rights and obligations for provision of equivalent services; gaps in consumer protection; rules unfit to bundles for consumer protection; unnecessary administrative burden and lack of coherence in the Single Market.

This objective is **linked to the policy options identified** under all policy areas by the **following measures and solutions proposed**:

- Ensure a European-wide pro-competitive regulatory framework for networks, internet access services and communication services, creating a regulatory level playing field and enabling affordable choice and prices for European citizens in electronic communication services; (see access, universal service and services/end-users, governance options);

- Ensure affordability of connectivity under a modernised set of USO rules in line with current citizen needs;(see universal service options)
- Address new, emerging end-user rights issues based on market developments (e.g. facilitating switching or addressing issues with bundled services) (see services/end-users options);
- Promote trust in the use of new communications services (see services/end-users options);
- Avoid any lack of consistency and ensure that consumer protection measures are coherent and do not present a barrier to the single market (e.g. removing outdated or overlapping legislation) (see USO and services/end-users options);
- Ensure that obligations imposed on ECN operators remain efficient and proportionate when viewers' preferences change with regard to audio-visual content consumption. (see services/end-users options)
- Ensure that the necessary harmonisation procedures are established in order to ensure competition and user choice (see access and governance options)

The **single market dimension** is specifically addressed by the intent to:

- Full harmonisation of end-users rights in the single market (see services/end-users options)
- Harmonise conditions for extra-territorial use of national numbers in all Member States (see numbering and governance options)
- Foster trust in services by ensuring the setting up of an EU-wide protection regime for end-users of all communications services in terms of security and (potentially) confidentiality (see services /end-users options)

The following graph links the problems and the drivers related to this specific objective and include some of the proposed solutions. Section 4.9 provides a more detailed explanation of the link between the measures proposed in the preferred options and the specific objectives, describing how the former concur to achieve the latter.

Problems	Drivers	Objective	Operational Objectives	Solutions
Uncertainty about rights and obligations for provision of equivalent services Gaps in consumer protection in some areas	Technological and market changes	Address barriers to competition and consumer protection in the single market	Ensure a European-wide pro-competitive framework, enabling affordable choice and prices for European citizens	Streamline and apply the same rules to equivalent communications services provided traditionally or OTT that use numbers
Rules unfit to bundles for switching purposes	Increasing adoption of bundles		Address new, emerging end-user rights issues based on market developments	Facilitate switching, avoid automatic roll over of contracts, introduce comparison tools
			Foster trust	Safeguard security and privacy in relation to all communications services
Unnecessary administrative burden and lack of coherence in the Single Market	Obsolete, redundant rules		Avoid lack of coherence and ensure consistency	Apply maximum harmonization
	Rules not fit for numbering based M2M services		Harmonise conditions for extra-territorial use of national numbers in all MS	Enable remote switching and a common basis for extraterritorial use of numbers

Services

3.2.3 Simplification of the regulatory intervention and single market coherence:

This objective is **addressing the following problems identified** in section 1.2: Unnecessary administrative burden & lack of coherence in the Single market; compliance costs.

This objective is **linked to the policy options** in all policy areas by the **following measures and solutions proposed**:

- Reduce administrative burden by shortening current cycles of market reviews, and increasing the regulatory certainty (see access options)
- Modernise the current set of sector specific end-user protection rules aiming at achieving full harmonisation to the extent possible, remove provisions that overlap with horizontal consumer protection legislation and identify those which should appropriately also apply to equivalent communications services regardless of the mode of provision in order to promote end-user interest and consumer welfare. The aim is to review the scope and the scale of the rules, which rules are needed for which actors, as well as which is the competent authority to apply them; (see services/end-user options)
- Reduce the scope for intervention and related administrative burden by allowing NRAs to take action only when retail market failures are detected to address access seekers' problems, and requiring account to be taken of commercial access agreements and co-investment agreements. (see governance access options)
- Focus on general authorizations instead of individual licencing in the single market, ensure minimum duration for individual spectrum licences and greater coordination of spectrum availability and assignment conditions (see spectrum options)
- Modernise USO scope to take account of market and technological developments and bring it into line with current customer needs. (see universal service options)
- Simplification and reduction of universal service-related administrative burden through

ending the current sectorial sharing mechanism possibility for financing. (see universal service options)

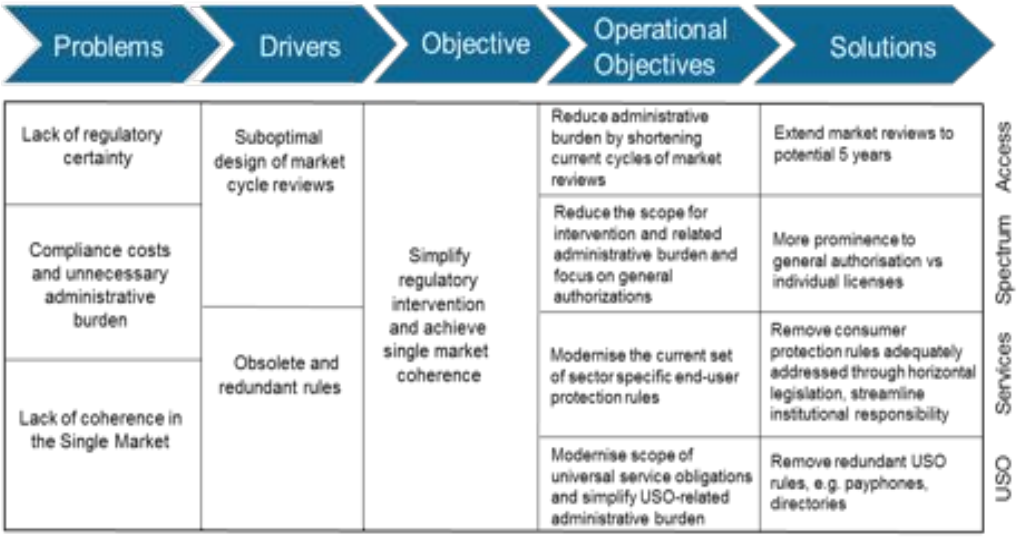
- Ensure that the relevant functions are attributed to the different actors (NRAs, BEREC, RSPG, Commission...) and that the structure of BEREC is simplified in order to have a streamlined and efficient governance set-up (see governance options)

The **single market dimension** is specifically addressed by the intent to:

- Greater consistency in spectrum assignment processes, which at the moment tend to generate complexity for operators wanting to use spectrum in various Member States, and can also cause interference in border areas; (see spectrum options)
- Avoid duplicate processes for the specification of new wholesale remedies by the introduction of standardised wholesale remedies for example in relation to business access; (see access options)
- Enhance the single market dimension of spectrum by fostering the creation of a pan European secondary market for spectrum that will allow a more efficient and dynamic use of spectrum. (see spectrum options)
- Harmonize a minimum set of competences for independent national regulatory authorities essential for market shaping aligned with BEREC tasks focused on the cross-border dimension; (see governance options)

The following graph links the problems and the drivers related to this specific objective and includes some of the proposed solutions. Section 4.9 provides a more detailed explanation of the link between the measures proposed in the preferred options and the specific objectives, describing how the former concur to achieve the latter.

3. Intervention logic: measures to simplify regulatory intervention and ensure single market coherence



In line with the better regulation guidelines of the EC, **operational objectives** will be developed in section 4.9 only for the preferred option in each of the policy areas considered.

3.3 How do they link to the problem? How do the objectives relate to each other, i.e. are there any synergies or trade-offs?

The different specific objectives spelled out above are closely connected.

3.3.1 Synergies between objectives

Main synergies between contributing to ubiquitous VHC connectivity and competition and user choice in the single market. Competition is highly synergetic to connectivity: competition drives investment and therefore contributes to the connectivity objective. The measures proposed under the options in the access and spectrum area are all relying (albeit to a different extent) on the role that competition can play in fostering investment and hence connectivity. Regulation can act as a significant trigger to competition (either focused on access, on infrastructure competition, or on the promotion of co-investment), which has important implications for enhanced connectivity. This is true for basic broadband as well as for NGA and VHC networks. The barriers identified in the sector of business communication services and high costs generated for business users call for a more prominent role for competition to play in the telecom sector. User choice is also highly synergetic to ubiquitous connectivity: measures in the area of access (support for challenge areas), spectrum (the current lack of timely and appropriate spectrum release had repercussions on delayed deployment of networks as well as the 4G handset developed for the European market) and USO[92] make sure that users can choose irrespective of their location. User choice is also ensured by affordability of tariffs that could also be ensured by USO.

Main synergies between contributing to ubiquitous connectivity and simplification of the regulatory intervention and single market coherence. The synergies between those two specific objectives can be observed in the area of access regulation and USO with reference to the compliance and adaptation costs that measures in the current framework have generated. Some measures to reduce compliance cost are proposed in section 4.3. Governance aspects are also important with regard to the spectrum problems and the solutions that will be envisaged in the policy options in this respect. The proposed measures aim at addressing overregulation. This would lead to more streamlined set of rules which in turn contributes to the connectivity objective, and may attract smaller operators in local areas.

Main synergies between competition and user choice in the single market. The synergies between those two specific objectives are evident when assessing the technological and market changes that have affected the telecom sector in the last years. A more competitive market delivers greater choice for consumers; it incentivizes the operators to innovate to satisfy consumers' needs. A good example can be given by the emergence of bundles which are rapidly changing the competitive dynamic in the telecom sector, bringing down costs for consumers, but also making switching more cumbersome for end-users.

3.3.2 Trade-offs between objectives

Potential trade-offs between contributing to ubiquitous VHC connectivity and competition and user choice in the single market. Access-based competition is and has been an effective driver of investment in certain areas, so investment and therefore connectivity should not be seen as opposed to competition. Potential trade-off could emerge between those specific objectives in case connectivity is pursued at the expense of competition. The access regulation proposal that will be developed below will be consistent with the principles laid down in art. 8 FWD, including competition and will not modify the SMP regime currently in force nor will they provide so-called "regulatory holidays" that would benefit in an uneven market certain market

[92] USO regimes are linked to connections at fixed location. However there should be no constraints on the technical means by which the connection is provided.

players. Finally, a too ambitious USO definition in terms of speed, availability or affordability could endanger the competition dynamic between market players and impose excessive or publicly funded benefits on the operators identified as USO provider. This potential trade-off has been taken into account when designing the USO options presented below in section 4.3, in particular by focusing the proposed USO regime on addressing affordability rather than availability of connectivity.

Potential trade-offs between contributing to ubiquitous VHC connectivity and simplification of the regulatory intervention and single market coherence. The main trade-off that can be envisaged between those two objectives could occur in case of wide de-regulation that would remove ex-ante market regulation from those markets that can still be considered as bottlenecks for the provision of telecom services, likely weakening investment pressure as well as service competition, market entry possibilities in the single market and ultimately consumer benefits. In order to avoid such a trade-off a number of options that have been considered in first instance due to their potential effects in terms of simplification, have been discarded such as the full de-regulation of telecom networks in the area of access or the termination of the USO regime. More details on these policy options can be found in section 4.3. On the other hand the pursuit of ubiquitous VHC connectivity may bring too intrusive legislation in terms of technology and business decisions that could potentially reshape the industry. Policy options that were susceptible to determine such an outcome such as mandatory structural separation or mandatory copper switch-off (access regulation) have been discarded. A potential trade-off still remains when changing the market review cycles to 5 years, but it is mitigated by a number of safeguards (see section 4.1.1).

Potential trade-offs between competition and user choice in the single market and simplification of the regulatory intervention and single market coherence. The potential trade–offs that can be foreseen among these objectives mainly relate to the balance to be struck when regulating new services. For instance an extreme interpretation of the level playing field concept may lead to the imposition of the regulatory framework rules to all Over the Top services, irrespective of the degree of substitution existing with the current ECS providers or of the scale of their operations. This would probably hamper innovation and not benefit competition, so that this option has not been considered.

3.4 Are these objectives consistent with other EU policies and with the Charter for fundamental rights?

3.4.1 Coherence with other EU policies

The coherence between the objectives above and the following EU policies has been screened:

1. Digital Single Market: As already mentioned in the introduction section, the set of objectives presented for the review of the telecom sector is consistent with the overall **Juncker Commission's political guidelines** to achieve a connected single market and the **DSM strategy**, whose main points concerning telecom were reported in section 1. Of course, the review of the telecoms framework will be highly synergetic with the other initiative included in the DSM strategy, such as preventing unjustified geo-blocking, modernising the European copyright framework, affordable cross-border parcel delivery services, reducing VAT-related burdens etc..

2. Competition law and state aid regime: The Regulatory Framework is based on the principles of EU Competition Law. It has followed since 2002 a deregulatory trend as markets develop and this is maintained with the current review. As a consequence, wholesale markets which are deregulated because there is no longer SMP or because competition at retail level is fierce, remain subject to general competition law. This principle will be maintained when pursuing the set of objectives for this review. Competition will continue being the driving force fostering investment in VHC networks. **State aid** policy will also continue to be a key aspect of

ensuring access to performing infrastructure in areas with no business case. The new connectivity ambitions to be developed in line with the DSM strategy and the Gigabit society will go well beyond the current Digital Agenda for Europe targets and are likely to require networks of better quality able to grant a superior Quality of Service to users, measured at reference points in the network. The concept of VHC on which 2025 policy ambitions are being developed goes beyond the current State Aid categories; however this tension in terms of coherence appears manageable in the short term, and in the context of the review of telecom framework which deals with market drivers of investment. On the other hand coherence should increase if NRAs have a greater role in State Aid by carrying out mapping and can sanction misinterpretation of operators' involvement and intentions.

3. Cohesion policy and European Structural and Investment Funds (ESIF) are an important tool to fill the connectivity gaps in market failure areas and should be allocated in a way that allows maximising the resources available[93]. The review of the telecom frameworks and its objectives should take this into account by providing appropriate conditions for private investment the review will enable public funds to be focused where they are most needed and by fostering joint investment when structural funds are used and by avoiding strategic overbuilding of the most lucrative portions of networks financed by the structural funds. Also ESIF funds could be used to fund – at least in some countries - part of the measures proposed under a number of options, such as the mapping activities that NRAs may have to carry out. Infrastructure, demand, investment intentions and services mapping by NRAs[94] will also create synergies with mapping activities taking place at the regional level[95] and be complementary with the action by DG AGRI, DG REGIO and DG CONNECT which are already helping Member States to become familiar with the issue through the establishment of Broadband Competence Offices at National or Regional level.

4. General consumer policy. As explained above, one objective of this review is to streamline current sector specific rules on consumer protection so as to avoid any unnecessary overlap with horizontal consumer protections when these ensure an adequate level of protection for end users of ECS.

5. Audio Visual Media services policy: In accordance with art 1(3) of the Framework Directive any objectives and finally provisions (existing and new/revised) are "…without prejudice to measures taken at Community or national level, in accordance with Community law, to pursue general interest objectives, in particular relating to content regulation and audio-visual policy." In accordance with recital (5) of the Framework Directive "the separation between the regulation of transmission and the regulation of content does not prejudice the taking into account of the links existing between them, in particular in order to guarantee media pluralism, cultural diversity and consumer protection." This means that whatever the objectives of the framework are, the promotion of general interest content by Member States would have to be ensured in the areas of must carry and would also be relevant for EPG provisions and in the field of spectrum management. The burden imposed on ECN operators can be relevant for their investment decisions. Also, audio-visual content is a driver of demand for connectivity; therefore the scope

[93] Compared with the previous programming period (2007-2013), the European Structural and Investment Funds (ESI Funds) have stepped up efforts in the areas of ICT and digital networks roll-out. Overall, the ESI Funds are expected to programme around EUR 14.5 billion to "*Enhancing access to and use and quality of ICT*". The allocation of ESI funds for high speed broadband networks experienced a sharp increase from EUR 2.7 billion in 2007-2013 to around EUR 6.4 billion for 2014-2020 (about EUR 5 billion ERDF and an estimated EUR 1.5 billion EAFRD).

[94] NRAs could be appointed as Single Information Points under the Broadband Cost Reduction Directive (2014/61/EU), thus enabling synergies.

[95] See for instance the result of SMART 2012/0022 which gives an overview of the mapping initatives in the EU and finds out that many of the national mapping initiatives are already carried out by the NRAs https://ec.europa.eu/digital-single-market/en/news/mapping-broadband-and-infrastructure-study-smart-20120022

for regulatory intervention in the area of audio visual media services policy can also have an impact on demand for connectivity. Accordingly, the impacts identified in this assessment will inform the Commission, but there are limitations to the legislative choices available to the Commission in the areas of must carry, EPG regulation and spectrum management~~, w~~hich originate in the need to preserve the general interest objectives mentioned above.

3.4.2 Coherence with the Charter for fundamental rights

As regards possible impacts on fundamental rights, as guaranteed by the Charter of Fundamental Rights, the proposed measures aim at achieving higher levels of connectivity with a modernised set of end-user protection rules. This will in turn ensure non-discriminatory access to any contents and services, including public services, and help promote freedom of expression and of business, and enable Member States to comply with the Charter at a much lower cost in the future.

4 OPTIONS, IMPACTS AND COMPARISON OF OPTIONS BY POLICY AREA

The policy options presented for the review are divided into five different sets, covering the following areas (i) access, (ii) spectrum, (iii) universal service obligation, (iv) services and end-user protection, (v) institutional governance.

This section is organised by policy area, due to the wide heterogeneity of the provisions under the scope of the current framework and to make sure that a reasonable level of analysis can be reached:

We first present the policy options. Some aspects falling within more than one policy areas could be considered as horizontal (such as authorization) but are not considered for a stand-alone set of options because no modification to the current framework has been proposed or modifications are embedded in other areas. Given the sometimes technical complexity of the options presented, **Annex 8 includes a graphical description of the main measures associated with the options presented in this section**. Each set of options for the areas mentioned above is endowed with a no change/baseline scenario, which will be used as the benchmark against which the alternative options should be compared, in line with the provisions in the Better Regulation Guidelines while many of the areas have a non-regulatory option. In the following sections the options considered in the various areas are shortly presented. More detail on the options can be found in SMART 2015/0005. **Discarded options** are also mentioned.

We then determine the impacts of the policy options in relation with the objectives stated in the intervention logic included in chapter 3. The novel objective of the review is to facilitate unconstrained connectivity for all in the Digital Single Market. This objective can be operationalized in three specific objectives, presented in section 3.2.

Within each policy area, each specific objective translates into even more specific measures that we have assessed using both qualitative and quantitative elements, including KPIs. Also some options are designed to have a greater impact on one specific objective rather than the other, which will be reflected in the analysis. In addition, each option is evaluated in relation to the potential economic, social and environmental impacts it might have. The criteria against which each option is assessed are:

What impact does the option have on achieving investment connectivity and innovation in the context of the Digital Single Market Strategic objective to be considered in the context of economic, social and environmental analysis for:

To what extent does the option contribute to ensuring a European-wide pro-competitive regulatory framework for networks and communication services, together with affordable choice and protection for end users?

How does the option contribute to reduced regulatory redundancies, inefficiencies impinging the development of the electronic communications sector? What is the option impact on administrative costs? Can it be effectively implemented? Are the impacts likely to change over time? Does it reduce the barriers for scaling up in Europe?

Finally, we present the comparison of the options identified in the light of the impacts determined. The options are assessed against the three core criteria:

1. Effectiveness: we consider the extent to which the options will address the identified problems and deliver the desired objectives
2. Efficiency: we consider the likely time taken to achieve outcomes and the associated cost of policy options for regulators and stakeholders
3. Coherence: we consider the degree to which the policy options provide stability in relation to current mechanisms as well as internal coherence with approaches taken to other topics. We also consider whether the measures are coherent in relation to external measures such as competition law, the TSM Regulation and the Cost Reduction Directive

We also discuss the degree to which different strategies at EU level provide additional value added in comparison with Member States acting individually. For the sake of brevity, we present only the main findings of the comparison exercise, while a more detailed analysis can be found in chapters 1 to 5 of the support study to this IA, SMART 2015/0005. A **preferred option** for each policy area is clearly stated at the end of each section.

4.1 Access regulation

4.1.1 Options

This section presents the access regulation policy options. All access options below, apart from option 4, build on the current regulatory approach applying competition law principles for market definition, designation of operators with Significant Market Power and for the imposition of regulatory remedies. Therefore the soft law instruments which the Framework has mandated the Commission to adopt and which constitute an integral part of the current regulatory framework, including the Recommendation on Relevant Product and Service Markets and Guideline for Market Analysis and the Assessment of Significant Market Power, remain relevant and will need to be updated, as appropriate, under these three options.

Option 1 – Baseline scenario (status quo)

This option is based on the EU policies in place and reflects possible developments of these in the absence of new EU-level action.

Under the baseline scenario the main tool by which NRAs promote competition under the framework will continue to be the system of ex ante regulation, under which NRAs conduct market analyses at regular intervals and apply appropriate remedies (such as access obligations and charge controls) on operators found to have significant market power (SMP). Following the 2009 review of the framework, some adaptations were made to NRA's tools and objectives to reflect the need to foster 'next generation' fast broadband access. Emphasis was placed on the need for NRAs to 'promote efficient investment and innovation in new and enhanced

infrastructures',[96] and NRAs were given the additional option of mandating facility sharing in the final (terminating) segment of the network.[97] The 2009 review also introduced the potential for NRAs to mandate 'functional separation' of SMP operators in cases where other remedies had failed, although this remedy has not yet been used.

The flexibility given to NRAs in the 2002 Framework required the introduction of co-ordination mechanisms. The main features were:

- The requirement for the Commission to issue a Recommendation on Relevant Markets susceptible to ex ante regulation – which has become an important harmonising and deregulatory tool
- The introduction of a system of ex post checks on market analysis and SMP designation by the Commission through the article 7 process.
- The potential for the Commission to issue Recommendations on the application of the Framework subject to consultation with the Communications Committee (a committee composed of member state representatives)

In the 2009 revisions, these co-ordination mechanisms were further strengthened through the extension of the article 7 process to remedies (which however fell short of enabling a Commission veto) and the (thus far unused) potential for the Commission to issue Decisions (subject to comitology) if Recommendations were not followed. The important role played by NRAs collectively in these mechanisms also drove the creation of BEREC as a formal EU body, replacing the ERG.

Under this option the framework would continue to have a strong emphasis on market entry through wholesale access and competing infrastructures.

This option implies a continued focus on market analysis and the regulation of operators with Significant Market Power (SMP) to foster competition and investment. Regulation would be applied through a three-yearly cycle of ex ante market reviews, and with appropriate remedies selected from amongst those listed in the Access Directive. Price-controlled regulated access to the wholly owned networks of vertically integrated incumbents, largely based on physical access to copper assets and increasingly on virtual access to upgraded fibre-copper FttC/vectored assets, would remain the main paradigm but with many local variations. The option of applying symmetric obligations under article 12 of the Framework (and if relevant article 5 of the Access Directive) would also remain.

NRAs would maintain significant flexibility in applying the framework to reflect national circumstances. Consistency would continue to be supported through the use of non-binding Recommendations (for the most part), monitored by means of the article 7 process. There would in this context be no binding Commission decisions possible for remedies. BEREC's governance and remit would remain as present.

Option 2 - Continuity and simplification

This option foresees only relatively limited adjustments to the current rules on the basis of the experience of the implementation of the framework in recent years and of the REFIT exercise, with the important aim of increasing stability and simplifying the overall regulatory approach.

This option includes measures to provide more regulatory stability through **longer market review periods up to five years**, with the possibility to interrupt it earlier in case of significant market developments as is already possible. Further this option entails that NRAs would focus

[96] Article 8(5)d Framework Directive
[97] Article 12 Framework Directive

more on the **competitive situation at retail level** when conducting their market analysis and identifying the need for regulatory intervention at wholesale level, as is already indicated in the Recommendation on Relevant Markets (i.e. an apparent SMP position at one wholesale level need not result in regulation if in fact such wholesale input does not appear necessary to resolve a competition / end-user problem at retail level). It also includes **the codification of the "three criteria test"[98],** which is currently in the Recommendation on Relevant Markets, to ensure proportionate market intervention.

This option could also include a clarification of the relationship between the SMP market analysis process and **symmetric obligations for access to civil infrastructure**. Such clarification could ensure that any symmetric duct and pole access obligations stemming from implementation of the 2014 Cost Reduction Directive[99], as well as facility sharing obligations mandated under article 12 of the Framework Directive are considered by NRAs when conducting market reviews. It could also be clarified that access to civil engineering can in principle be imposed through SMP regulation as a stand-alone remedy and not just as an ancillary remedy to local access.

The requirement for transition periods after regulation is withdrawn could be clarified. Finally, since **voluntary functional or structural separation** have not been used since their introduction in the framework in 2009, a revised framework could simplify the procedure foreseen in the Framework for the *ad-hoc* market analysis to be carried out in case of separation, as well as a mechanism for market testing the terms of any such voluntary separation projects.

As option 2 builds on the status quo, but does not impact the current balance between flexibility and harmonisation, the **governance structure** as regards BEREC and the article 7 process would also remain largely unchanged under option 2. Nevertheless, there could be some minimum harmonisation of NRA powers and the independence & regulatory capacity requirements could be enhanced to address certain shortcomings of the current system.

The responses to the public consultation overwhelmingly affirm the important role that civil engineering plays in the roll-out of NGA. Some **Member States** and a number of **infrastructure owners** don't see the need to further intervene to ensure access to civil engineering falling within the scope of the Cost Reduction Directive (2014/61/EU). However, **alternative operators** highlight the importance of detailed SMP obligations, beyond the general obligations in that directive. Furthermore, **incumbent operators** call for effective symmetrical access to in-house wiring.

There was broad alignment between **regulators, Member States** and many others that longer review periods (compared to the current mandatory three years) would be beneficial, particularly in stable markets such as for example termination rates. On the one hand, **access seekers** reject the idea that retail market considerations should be the focus of wholesale regulation, an idea that is strongly supported, on the other hand, by **network owners**, who consider that continued wholesale regulation is not justified if retail markets are competitive.

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[98] The three criteria are cumulative and, therefore, must be applied in conjunction. According to the Recommendation, "*The **first criterion** is the presence of high and non-transitory barriers to entry. These may be of a structural, legal or regulatory nature. However, given the dynamic character and functioning of electronic communications markets, possibilities to overcome barriers to entry within the relevant time horizon should also be taken into consideration when carrying out a prospective analysis to identify the relevant markets for possible ex ante regulation. Therefore **the second criterion** admits only those markets whose structure does not tend towards effective competition within the relevant time horizon. The application of this criterion involves examining the state of competition behind the barriers to entry. **The third criterion** is that application of competition law alone would not adequately address the market failure(s) concerned*.".

[99] Subject to the rule that obligations imposed in application of the Framework prevail over those imposed in application of the Cost Reduction Directive.

Option 3 – NGA+ Focusing regulation on high-quality connectivity

This option considers that while the key principles of the framework remain valid, significant adjustments are necessary to provide necessary incentives for both incumbents and competitors to make economically viable investments or co-investments in future networks that are in principle capable of providing VHC connectivity to every citizen and business in Europe. These measures would help addressing the endogenous regulatory factors exposed in section 1.2.1.1, but do not automatically guarantee any level of investment which is influenced by other socio-economic factors mentioned in that section. These measures aspire towards providing VHC connectivity, corresponding to Europeans' future connectivity needs and thus bridging the digital divide, taking into account that risks for operators are generally higher when CAPEX increases. The measures will therefore aim at extending the reach of commercially viable areas. As the demand side cannot be predicted it is not possible to calculate by how much commercially viable areas will be extended, while their extension will in turn shrink the need for public support. As discussed in annex 14, the public funds currently available are not sufficient to reach even the current Digital Agenda targets. This is proposed to be done by focusing on promoting the transition to VHC networks and promoting greater territorial coverage through the measures mentioned below.

(i) First, NRAs would have the **obligation to conduct a geographical survey of network deployments** on their national territory, on a forward looking basis and taking into account investment plans of operators. The survey would cover existing infrastructure, investment forecast and quality of service aspects from existing networks. This would improve the geographical granularity of market analyses, and make it easier to conduct sub-national market analysis. The results of the investment planning survey would constitute a basis for establishing misrepresentations by operators that depart from their plans with the intention of crowding out other investment initiatives in "challenge areas", unless a reasonable explanation is provided, or which finally do not invest as announced (thereby distorting both market analysis and planning of possible State Aid). NRAs will be empowered to take **action/sanction** against such misrepresentations, in particular by SMP operators. NRAs will be requested to publish the main outcomes of the survey by locality, to share the results with public authorities responsible for allocation of public funding or for drawing up national broadband plans, for determining the extent of universal service obligations or for defining coverage obligations attached to rights of use of spectrum.

In the public consultation, a clear majority of respondents considered that NRAs should have a role in mapping areas of investment deficit or infrastructure presence because they are vested with the necessary powers to access relevant information and have the necessary expertise, as well as independence. Some respondents (among which incumbents) are opposed to such a role and contested as a matter of principle any public interference with investment. There is strong support to a revision of the framework to better accommodate the role of NRAs regarding public funded broadband projects, notably i) identification of target areas, ii) setting access price and access obligations, iii) ensuring better consistency between obligations imposed under state aid intervention and ex-ante regulation and iv) resolution of disputes. A few respondents propose that the role of NRAs regarding mapping of infrastructures or setting target areas must be limited to provide technical assistance to the relevant competent authorities or to being consulted.

On the same subject the **Expert Group** (see annex **Error! Reference source not found.** for more details) considered that mapping provisions are important to clearly describe the size of these problems: the magnitude of white, grey and black areas is generally not known and changes continuously due to ongoing deployments of infrastructure. A clear and reliable survey would show what the options to improve existing infrastructure are, reducing one important

market failure which is the presence of sunk costs, giving rise to economies of scale and market power. Regions differ in the scalability of investments and this problem may be more pressing in white areas than in black areas.

(ii) **reinforcing and adjusting the existing SMP rules** for supporting deployment of VHC networks where competitive safeguards are provided including **co-investment** to reward those who invest first in very-high capacity networks, without compromising competition and therefore provided competitive safeguards are present, as well as creating new alternative regulatory incentives. This would be done by:

1. Codifying in legislation the principles of the 2013 non-discrimination and costing recommendation[100], namely non-discriminatory access, flexible NGA pricing in presence of certain competitive constraints and copper-price stability, application of an Economic Replicability Test in lieu of direct price controls to ensure sustainable competition.
2. The power for NRAs to impose symmetrical obligations, as already foreseen in Article 12 of the Framework Directive and Article 5 of the Access Directive would be clarified and strengthened, while still being limited to non-replicable assets, and subject to the Article 7 process.
3. The market review process would formally encompass consideration of symmetrical obligations alongside asymmetric obligations (Articles 12, 14 and 16 FWD and Article 5 AD as modified) as well as measures that may result from the application of the 2014 Cost Reduction Directive. Hence, NRAs would start with the consideration of symmetric obligations (limited strictly to non-replicable assets). If SMP is no longer found, these measures could also contribute to safeguarding competitive markets together with appropriate transitional measures.
4. The market analysis would also take account of the impact of such obligations alongside all competitive pressures observed in the market, including the market effects of existing co-investment projects, commercial access agreements and wholesale only networks.
5. If there are significant changes in the market situation, NRAs could conduct mid-market reviews in order to take account of any significant market developments in this regard.
6. NRAs would be required to choose the most proportionate and effective SMP remedy or combination of remedies where necessary, with initial priority to a stand-alone access remedy to civil engineering (e.g. duct access).
7. NRAs will also be encouraged not to impose access obligations on network upgrades by the SMP operator which are open to reasonable and sustainable co-investment offers, if the upgrade represents a significant improvement compared to available networks in terms of their performance, speed, quality and reach as well as a significant investment effort . NRAs would maintain regulated access on the SMP network to a product which offers comparable performance to that offered before the network was upgraded.
8. NRAs would be empowered to monitor incumbents' voluntary copper switch-off processes to ensure appropriate and smooth transition for access seekers while promoting migration to NGA and VHC networks.
9. Wholesale-only models of historic and new SMP operators will be further promoted by clarifying their potential right to a lighter touch regulatory regime, based on the concept of reasonable access pricing as opposed to cost orientation.
10. Further reduction of regulatory burden could be achieved in termination markets by way of setting a Euro-model which can be calibrated to national circumstances but which could also produce a Euro-rate to be used as default. This model could be developed by BEREC. A single Euro-rate has the advantage of great simplicity and transparency and very low maintenance cost for the individual NRA.

[100]See:https://ec.europa.eu/digital-single-market/en/news/commission-recommendation-consistent-non-discrimination-obligations-and-costing-methodologies

For this set of measures, the **public consultation** showed that regarding measures aimed at facilitating the roll-out of high-speed networks in the most challenging areas, responses were cautious with regards to first mover specific protections (to operators that are willing to roll out next generation networks in challenge areas). **Access seekers** and **consumer associations** warned about the risk of re-monopolisation, whereas **network owners** challenged the proposition that a risk of strategic overbuild can be defined and distinguished from competition. Some **Member States** highlighted the need for local responses to sub-national competitive and investment challenges, indicating openness to consider approaches to incentivise first movers on a geographical basis, subject to suitable safeguards being built in. In supporting first mover incentives, most stakeholders agreed that any first mover advantage should be subject to safeguards against re-monopolisation.

Network owners call for their discretion to decide whether and how to continue to use copper assets (full copper loop or sub-loop), whereas **access seekers** request guarantees that physical access to copper networks will continue to be guaranteed. While a majority of respondents, including **regulators**, would not agree to mandating the switch-off of copper networks where fibre is present, they still see a role for regulators to manage the transition where switching off copper makes economic sense, with **copper networks owners** advocating minimal intervention, and others rather invoking public intervention to preserve competition (e.g. transitional migration regime).

With regard to **co-investment models**, many stakeholders can see the advantages of co-investment for increasing the reach of NGA networks, for example, in less densely populated areas. Their views however differ on the related regulatory regime. While **incumbents** favour co-investments on commercially negotiated terms, **access seekers** call for strict conditionality to ensure fairness and openness of the co-investment.

(iii) Allowing for the conclusion of **longer contracts for provision of infrastructure** for the payment by instalments of the higher connection costs required to connect remote households and to support 'demand aggregation' models for consumers in those areas. The user would pay by instalment the infrastructure, but consumer rights on services will not be affected: **the maximum contract duration for provision of the service would remain unchanged** thereby preserving the possibility for customers to switch service provider. If consumers want to switch service provider before the cost of the infrastructure has been fully repaid, they can, and the remainder of the infrastructure cost can either be paid off at switching or they can continue paying to the infrastructure provider.

(iv) defining common criteria for a **standardised EU-wide access product** to facilitate the provision of cross-border services to business users[101]. This would address concerns about fragmentation impeding the provision of business services cross-border and delaying the specification of wholesale products required to address problems which are common to several Member States. There would be a provision in the framework which enables common product and service specifications to be set in cases where the lack of such specifications impedes the single market.

In the public consultation, in relation to the simplification of access products and focussing on key access points, **network owners** responded in favour of a drastic simplification to a single access product (if at all necessary), whereas **access seekers** insist on the importance of different access products to compete at the retail level.

Option 4 – Significant reduction of sector-specific regulation

[101] While imposition of such an access product would be subject to SMP analysis, it could also serve as a benchmark product for commercial wholesale provision in deregulated markets.

This option envisages a significant reduction of the reach of sector-specific access regulation, via a **sunset clause for ex ante regulation** at least in areas where two or more infrastructures are present, thereby a transition from ex-ante telecoms-specific regulation to a setting where NRAs would only supervise the market as necessary, and the telecoms sector would otherwise be subject to *ex-post* competition law control.

A certain role for NRAs would remain. Preference would be given for commercially negotiated agreements between access providers and access seekers, without the need to conduct regular market analyses and pre-approve reference offers as is the case under the current framework. However, there would remain the possibility for NRAs to intervene in a **dispute resolution setting**, potentially across market segments and geographical areas, but particularly where only one broadband infrastructure is present. The powers of the NRAs would include the possibility of ordering the supply of wholesale services, but this would be in the form of a single access product, aimed to remedy the specific access problem identified in the dispute. The phased withdrawal of the market analysis process under this option would also imply a **reduced remit for BEREC.** The article 7 process would no longer be needed and could be withdrawn.

4.1.2 Discarded options

This section outlines the options which have been discarded. A more detailed analysis can be found in Annex 3 on discarded options as well as the IA support studies.

- Full deregulation of telecoms networks
- Regulation of non-collusive oligopolies on the basis of a unilateral effects test similar to the one used under the European Merger control regulation[102]
- Mandatory structural separation of former monopolies
- Mandatory copper switch off
- Rely fully on the mechanisms established for general ICT standardisation and remove special competences for the Commission to recommend and ultimately mandate ECNS standards

4.1.3 Impacts

This section presents the likely impacts from the options identified in section 4.1.1. It should be noted that a significant proportion of stakeholders – and nearly all respondents from amongst alternative telecom operators and regional fibre investors (although not incumbent operators) – consider that the existing access provisions remain relevant.[103]. A longer description of the impacts from each option area can be found in SMART 2015/0005, while impacts on specific categories of stakeholders are included in annex 13 and Annex 4 for the preferred option.

4.1.3.1 Option 1: Baseline scenario (status quo)

Option 1 involves a continuation of the existing regime.

<u>Economic impacts</u>

The economic impacts of the baseline include notably gaps in the capabilities of networks impacting the delivery to affected households and businesses of applications such as cloud computing and other services which require high and/or symmetric bandwidth (such as next generation TV, video conferencing, e-Education, e-Health and remote monitoring applications). In turn, weak links in connectivity within the EU may have broader impacts on Europe's

[102] See more detail on oligopolies in annex 3
[103] Question 8 of the Commission's online consultation

attractiveness as a centre for innovation and business development in ICT. In this context, it is notable that Japan and South Korea have well-developed ICT industries, which may have been supported by the early drive for very high speed connectivity in these countries[104].

As 4G and 5G mobile networks are increasingly **reliant on fibre backhaul** in order to meet requirements for 'low latency' needed for applications such as connected cars, a failure to upgrade fixed infrastructure could have implications for mobile applications as well as fixed. The economic impact of this option can be associated with the **opportunity cost of failing to ensure that Europe keeps pace with the infrastructure deployments** needed to make use of advanced services, including 5G.[105] Based on econometric analysis and macro-economic modelling prepared for this study, achieving average speeds expected in an all-fibre scenario by 2025 could raise EU GDP by 2% compared with the status quo and by 0.7% in an incremental high speed scenario. See section 4.11 presenting the results of the macroeconomic modelling for more details

The total costs of the institutional set-up applying to access including estimated impacts on stakeholders are shown in the table below[106]. A standard hourly rate is assumed for professionals[107] and a 40% mark-up is applied to account for overhead.[108]

The estimated costs for the BEREC Office are similar to those available in its published annual accounts, which show that the costs of operating BEREC were €4,04m in 2014, and were estimated at €4,02m in 2015 and €4.25m in 2016. The Agency operated with around 15 temporary agents, 8 contract agents and 5 seconded national experts over this period – a total of 28 staff. However, it should be noted that not all of BEREC's work is related to access regulation (an estimate of 60% has been made based on data from BEREC concerning the split of activities), and the substantive work of BEREC is undertaken by representatives from the NRAs themselves and is therefore included within NRAs budget.

The estimate of the cost to operators is based on data collected on the costs of the market analysis process in the context of Ecorys' 2013 study for the EC concerning future electronic communications markets subject to ex ante regulation.

[104] For example, in Japan, where very fast broadband coverage had reached 90% by 2012, the ICT market accounted for around 8.9% of all industries and for 7.1% of total employment. In contrast, EU coverage in the EU was around 53%, ICT employment in the EU represented just 4% of GDP and 2.7% of total EU employment in 2011.

[105] An estimate of user bandwidth requirements based on specific application needs illustrated in SMART 2015/0005.

[106] The costs for the Commission and BEREC Office are based on staff and overhead cost data supplied by the Commission, with an additional overhead mark-up for BEREC of €30,000 per person to reflect its small scale. The costs for NRAs are estimated on the basis of a standard cost model which draws on responses to questionnaires submitted by the Commission, BEREC and 21 individual NRAs.

[107] ISCO2

[108] This mark-up is used by the Dutch authorities in the context of standard cost models and was used in the Ecorys 2013 study for the EC against which we cross-check our results

Table 3 - Estimated costs of the current institutional set-up for access

Body	Annual cost	Assumptions
Commission	€2.4m	20FTEs (art 7 unit)
BEREC Office	€2.4m	60% of BEREC activity associated with access regulation
NRAs	€65.4m	25FTE on average per NRA to handle market analysis and dispute resolution
Operators	€190m	Drawn from Ecorys (2013) costs of market analysis system

Source: WIK calculations, Ecorys (2013)

On the basis of these estimations, **the total cost for the institutional set-up for access regulation is approximately €70m**. This estimate is higher than the cost estimate of €50m for 27 NRAs reflected in the study by Ecorys et al for the European Commission in support of the 2014 Recommendation on Relevant Markets,[109] but this may be explained by the fact that the costs of dispute resolution and BEREC contributions from NRAs are incorporated within our calculations.

Concerning the direct costs to regulated operators of complying with the existing framework, these can also according to interview reports run into several millions of euros for larger operators and especially those subject to regulation. The Ecorys study for the European Commission on Relevant Markets estimated the total regulatory burden on all operators at approximately €216m per year, which they suggested might fall to around €190m following the reduction in the numbers of markets in the list (which was the outcome of the procedure).

Combined with the institutional cost, this would lead to **a total cost of the access regulation regime of around €260m per year.**

Social and environmental impacts

Social impacts include the continued digital divide and its impact in terms of employment and social cohesion, an effect which may be magnified by the more demanding technological landscape. In addition, a lack of connectivity may drive migration away from rural areas, and contribute to the disenfranchisement of communities which do not have sufficient bandwidth to access public services, healthcare and education, for which being online is increasingly important or even essential.

A number of studies suggest that increased high bandwidth connectivity has a positive effect on employment and migration – and thereby a lack of connectivity could also be seen as holding back rural and other populations which lack these benefits[110]. When considering Green House Gas emissions per subscriber and per Gigabit, the research concluded that an all-FTTH scenario would result in 88% less greenhouse gas emissions from fixed networks in Europe than the status quo. The emissions estimates were based on electricity consumption associated with the different technologies and therefore would also have operational cost implications for operators

[109] Ecorys (2013) Chapter 13
[110] See more details in SMART 2015/0005

and implications on price for consumers. Emissions per Gigabit associated with VDSL2 and – particularly HFC were substantially higher than those associated with all-FTTH networks.

4.1.3.2 Option 2: continuity and simplification

Since the existing framework has support from a number of stakeholder groups,[111] another option may be to retain it largely unchanged, but with certain amendments required to update it and address any inconsistencies or lack of clarity.

Economic impacts

This option includes certain measures which are likely to reduce administrative costs. The requirement for regulation only to address retail market failures and the extension of market review timeframes are likely to reduce the compliance burden on NRAs (and the EC article 7 team) as well as for market participants. Estimates from Ecorys (2013) suggested that removing 2 markets from the original 7 markets listed in the 2007 Relevant Market Recommendation might result in savings on the market analysis process of 10-15% (a saving of up to €7.5m). This could be viewed as an equivalent change to extending the frequency of reviews from every 3 to every 5 years, bearing in mind that NRAs would also need to place further resources on more precise mapping within each market analysis. The consolidation of existing Member States mapping activities into NRAs will avoid duplication of effort, increase reliability of the data and, in certain cases, even reduce the overall mapping cost in Member States where multiple mapping activities are currently carried out. Moreover, the introduction of retail analysis may prove burdensome for some NRAs and add to the existing administrative burden.

It is also possible that limiting regulation to areas of true market failure and providing a longer term horizon for regulatory solutions may increase certainty for investors in VHC networks as well as permitting greater freedom to innovate (such as increased flexibility over pricing). This may have some positive impacts on deployment and usage of VHC networks thereby improving economic outcomes compared with the status quo. However, the scale of these effects is difficult to estimate precisely, and it is unlikely that these conditions alone (in the absence of more specific measures aimed at supporting deployment) would substantially increase VHC networks' investment compared with the status quo.

As regards **indirect effects**, there is a risk that provisions concerning wholesale-only models may foster separation and therefore increase reliance on regulated wholesale access to the detriment of potential developments in infrastructure-based competition[112] thereby impeding incentives in fast infrastructure investment.[113] On the other hand, it would reassure investors regarding the regulatory approach to local fibre networks whose market power at the local level may be found to be significant. If a single wholesale-only fibre network is deployed, infrastructure competition is also likely to be of lesser relevance in attaining the various objectives of the Framework. Separation or wholesale only models may result in increased service competition, which may boost broadband take-up through reduced retail prices and

[111] Stakeholder groups supporting the access-related provisions of the existing framework in its current form (subject only to incremental improvements) include BEREC (co-ordinating the collective views of NRAs, alternative telecom operators and cable providers)

[112] It is notable for example that there is limited infrastructure-based competition in the UK beyond the pre-existing copper and cable infrastructure. BT introduced functional separation (under pressure from the UK regulatory authority Ofcom), in 2005. It is possible that this approach reduced incentives for infrastructure-based competition..

[113] Case studies from SMART 2015/0002 suggest that structural separation/wholesale only models can support the business case for fibre by aggregating demand from several service providers. This strategy has been adopted in particular by regional and municipal investors such as Stokab and Reggefiber to support a fibre business case. However, the study also finds that separation may not itself drive technological upgrades..

service innovation.[114] Moreover the risk of impacting infrastructure competition could be mitigated if separation is incentivised in areas or circumstances where infrastructure-based competition is unlikely to arise.[115]

This option does not specifically tackle *through legislative means*, the central issues of: (i) Gaps in the availability of VHC infrastructure; and (ii) fragmentation impeding consistent service and competition for business users

Instead, it leaves these issues to be addressed – if at all – through soft law instruments such as Recommendations, at least in the first instance.[116] As an example, 7 years following the adoption of the 2009 Recommendation on termination rates, there are still instances of non-implementation of its core recommendations,[117] despite the Commission's active intervention through the article 7 process[118] and BEREC's support for the Commission's position. More examples can be found in SMART 2015/0005.

Social and environmental impacts

Social and environmental impacts under this option would be similar than those under option 1.

4.1.3.3 Option 3: NGA+: Focusing regulation on VHC connectivity

Option 3 builds on option 2 by seeking to further elaborate principles and procedures for the promotion of fast broadband and cross-border business access within the legislation itself. In the sub-section below we present the main economic, social and environmental impacts linked to this option. More detail and supporting evidence can be found in SMART 2015/0005.

Economic Impacts

The economic impacts of this option stem mainly from the expansion of VHC broadband and knock-on effects of improved broadband infrastructure and services on the wider economy. The econometric analysis run in the study supporting this IA Report has found a link between increased average broadband speeds and total factor productivity across a number of sectors[119]. The analysis suggests that the estimated speed and quality increase associated with achievement of all-FTTH across the EU by 2025 would result in GDP levels 2% higher than the status quo by 2025, or an increase of 0.76% over the status quo in a more realistic scenario in which 62% of broadband connections are based on FTTH/B by 2025.

The findings confirm what literature suggests: over and beyond the economic benefits deriving from standard broadband,[120] VHC networks may bring benefits in terms of increased employment and productivity,[121] contributing to GDP growth. For example, Forzati and

[114] Econometric assessments conducted in the context of SMART 2015/0002 and annexed to this report found that NGA take-up was linked to lower NGA prices which were in turn associated with increased access-based competition

[115] Costs for the deployment of NGA increase in less densely populated areas, reducing the prospects for network replicability. See discussion in SMART 2015/0002 as well as WIK (2008) economics of NGA

[116] Article 19 FWD permits Decisions to be adopted in specific circumstances – if Recommendations on the same subject have been adopted, but proved ineffective in achieving consistent outcomes after a 2 year period

[117] Most notably in MS like Germany, which have to date pursued a different cost methodology than that advocated in the Recommendation and have maintained this position despite the agreement of BEREC to the EC position

[118] Termination rates have been the subject of a majority of 'serious doubts' cases (at least 24 since 2011).

[119] See SMART 2015 0002

[120] Waverman (2009) finds that a 1% increase in broadband penetration in high and medium income countries leads to 0.13% growth in productivity

121 Canada, Singer et.al (2015) investigate the effect of FTTP rollout on employment on the basis of the deployment experiences in 39 regions between 2009 - 2014. They estimate that fibre deployment to 100% of a region is associated with an increase in employment of about 2.9% - even if the region had already before a broadband infrastructure. See also Katz et al (2010) and Liebenauer et al (2009)

Mattsson (2013)[122] examine the impact of fibre investment by Stokab in Stockholm during 20 years up to 2012 and estimate the benefit of Stokab to amount to 16 billion SEK (around €1.7bln). Meanwhile, in a 2015 study,[123] The Analysis Group estimated that gigabit broadband communities in the US exhibited a per-capita GDP approximately 1.1% higher than the 41 similar communities with little to no availability of gigabit services.

Greater fibre availability alongside provisions to ensure consistency in wholesale product and service offerings designed for business, could also support the expansion and productivity gains by multi-national corporations in Europe. A 2013 study by WIK[124] estimated that the economic benefits of e-enabling multi-site and multi-national corporations inter alia through consistent best practice regulatory practices could add €90bln to European GDP after a 10 year build up.[125]

The experience from the implementation of the regulatory framework in Portugal, Spain and France suggests that pursuing a regulatory strategy which does not impose "standard" access obligations on newly deployed VHC networks under the conditions that they are accompanied by strong measures to enable alternative operators to 'climb the ladder of investment' towards infrastructure-based competition in FTTH/B, (such as a reasonable possibility to co-invest in such networks, duct access, and the maintenance of access obligations to the networks at the performance level prior to upgrade), may trigger wider availability of FTTH/B across the national territory.

The measures described above will foster infrastructure competition and to bring it to areas where in the absence of effective provisions on duct/pole access it would have not worked, generating a more even competitive field between incumbents and competitors as can be seen from Figure 16. The analysis of the underlying causes of suboptimal investment in section 1.2.1.1 has however shown that regulatory solutions do not automatically solve the investment problem as some of the factors affecting investment are of a macroeconomic or socio-economic nature..

The Swedish experience is quite telling in this respect, as wholesale-only models have helped expanding the NGA footprint by focusing on infrastructure investment models with longer returns on capital, attracting investors that need lower but constant returns over longer asset duration. This is also coherent with other EU initiatives, such as CEF/EFSI de-risking of investment projects via financial instruments, which can be easily applied to financing of infrastructure projects such as VHC networks. In the Swedish experience, demand aggregation is also fostered by the possibility of "up-front payment", which is mimicked by the proposed measure on instalment payments, suitable for rural areas where many residents own their properties.

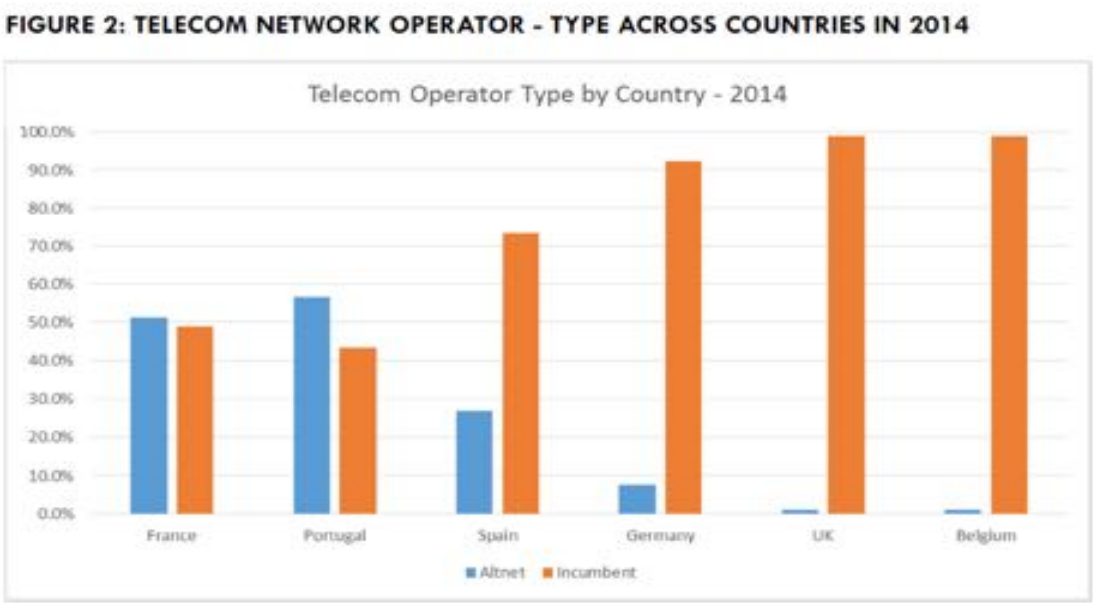
It should be also noted that coverage of very high bandwidth connectivity in Portugal and Spain has also extended beyond very dense urban areas and is projected by IDATE on the basis of operator announcements to reach 95% or above in these countries by 2020.[126] Indeed, reports suggest that Portugal Telecom could achieve copper switch-off by 2020,[127] while Telefonica was

[122] Forzati, M., and Mattson, C. (2013), STOKAB, A Socio-economic analysis, report acr055698, Stockholm.
[123] Analysis Group (2015), Early Evidence Suggests Gigabit Broadband Drives GDP, available at http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/gigabit_broadband_sosa.pdf.
[124] WIK (2013) Business communications, economic growth and the competitive challenge
[125] The study estimated that 65% of the benefits could derive from productivity gains through reorganisation of business processes, while another 34% would be caused by efficiency gains through improved ICT processes. The remaining 1% comes from welfare gains through lower prices for business communications services.
[126] SMART 2015/0002
[127] Total Telecom: Portugal Telecom selling off its copper http://www.totaltele.com/view.aspx?ID=493077

predicted to achieve coverage of 16.2m households by end 2016 amounting to coverage of more than 80% of the households in Spain.[128]

According to a recent paper by Shortall and Cave,[129] the regulatory strategy employed in France, Portugal and Spain, which could be described as a strong version of the conventional 'ladder of investment' theory, combined with symmetric regulation of in-building wiring, is also associated with an appreciably more even **split of homes supplied** between the incumbent, on one hand, and alternative telecom operators, on the other, than is the case in Germany UK, or Belgium, where entrants have been more reliant on mainly active access to incumbent infrastructure. In this sense this approach may lead to a more sustainable form of competition over time than approaches which place greater reliance on access to existing infrastructure of the incumbent.

Figure 16 - Incumbent and entrant network access infrastructure 2014



Source: Shortall and Cave 2015

Responses to the public consultation by stakeholders also support the need for action on NGA by policy-makers. Specifically a high proportion of respondents of all kinds believe that duct access will play an important role in enabling the deployment of new infrastructure,[130] while there is also widespread agreement from respondents within the telecom sector that current rules in the Framework and Access Directives and in the Cost Reduction Directive are insufficient to ensure that operators have access to buildings and in-building wiring for the deployment of fibre,[131] although it should be noted that to date only one Member State (Italy) has transposed the Cost Reduction Directive, and therefore it is possible that this perception may change following wider transposition by mid-2016.

There are however some potential challenges and costs associated with this model. Pursuing approaches such as those taken in France, Spain and Portugal may involve more effort at least in the initial stages by NRAs in mapping the availability of ducts and the overlap of network

[128] http://advanced-television.com/2016/02/24/telefonicas-20-cut-in-ftth-investments/
[129] Shortall and Cave, Communications & Strategies No 98 Q2 2015. Please note that the graph refers to infrastructure and does not represent market shares at retail level.
[130] Q38 Public consultation
[131] Q41 Public consultation

infrastructure, as well as in operationalizing the duct access remedy. In the context of interviews conducted for this study, ARCEP observed that the effort required to establish its regime for mapping, duct access and the implementation of regulated co-investment involved was as shown in the following table. Further cost would have been incurred by the regulated SMP operator (Orange) and by all telecom providers engaged in the co-investment process. These administrative costs however are significantly less than the benefits and are expected to reduce over time as the regime (which involves long-term IRUs of 20 years+) stabilizes.

Table 4 – Mapping efforts at ARCEP (indicative)

Process	Time	FTE
Modelling to distinguish dense vs less dense areas (infrastructure viability mapping)	6 months-1 year	2-3
Operationalization of duct access	4 years	1-2
Establishment and operation of symmetric regime (for in-building wiring and terminating segments including decisions, dispute resolution)	Ongoing	3-4 (initial) 2 ongoing

Another challenge is that a model which favours infrastructure-based competition for VHC networks may not be easy to export in the short term in all countries, especially where there are fewer competitors with a sufficient scale to ensure critical mass. In cases such as these, traditional access-based regulation may continue to play a greater role. Where this is the case, proposals within option 3 to allow lighter regulatory scrutiny under certain conditions such as reasonable co-investment offers for the VHC infrastructures may nevertheless provide a regulatory stimulus for investment by the regulated SMP operator and alternative operators, and may assist the latter in accessing capital. This medium to long term incentive may provide a stimulus for investment in VHC infrastructure, although the effects may not be always significant.[132]

This option would permit deployment projects supported by public funds (including ESIF funds) on the basis of a prior mapping of investment intentions to be temporarily protected from overbuild, in particular by SMP operators[133] (which sometimes deploy inferior technologies to the ones funded under ESIF). This can be bolstered by measures concerning co investment and wholesale only models which should be encouraged, especially in rural/underserved areas. If public funding such as ESIF is used for the local loop, wholesale only models could ensure a positive pro-competitive outcome.

On **mapping of infrastructure**, networks and quality of services, the current cost of collecting data from operators varies across Member States as it is linked to the depth of datasets required, and to other factors – such as the operating method (e.g. one-off/case-by-case surveys, automated data transfer, etc.). The proposals included under this option will therefore entail a rationalisation of the broadband data collection in Europe concentrating this capacity within the NRAs. In some cases, when some other bodies carry out such data collection, they will have to

[132] Econometric analysis in the context of SMART 2015/0002 suggests that infrastructure competition for example as embodied by cable coverage is a core driver of NGA coverage. However, as seen in countries such as the UK, Germany and Belgium (which lack additional infrastructure-based competitive stimulus beyond cable) it may not be sufficient to incentivise the deployment of VHC infrastructure.

[133] See for instance:
https://www.landkreis-karlsruhe.de/index.phtml?object=tx|1863.33.1&ModID=7&FID=1863.14496.1&sNavID=1863.13&La=1

transfer this competence to the NRA. In other words, the main cost will be an *organisational* cost borne in the short term – it may involve adjustment costs for the teams working on some of the mapping initiatives – but in the long run, it will be compensated by the fact by having only one national interlocutor as data recipient (i.e. the NRA), which is a major simplification for the data providers (i.e. Telecom operators).

An inventory of mapping initiatives (including Quality of Service and Quality of Experience inferred from infrastructure mapping) by *TÜV Rheinland* gives evidence of this widespread practice with more than 80 mapping initiatives carried out at national level without counting the multiple initiatives often carried out at regional and sometime at lower level to support specific projects [134]. As depicted in the figure below, all Member States are mapping Quality of Service in some fashion.

Figure 17 - Mapping initiatives in EU28.

	Service Mapping*		Infrastructure Mapping	Demand Mapping	Investment Mapping
Country	Focus on Quality of Service	Focus on Quality of Experience			
Austria	Ministry	NRA			
Belgium	NRA				
Bulgaria	Ministry	NRA	Ministry and NRA		
Cyprus	NRA	NRA	NRA		
Croatia	NRA	NRA	NRA		NRA
Czech Republic	NRA	NRA			
Denmark	NRA	NRA			
Estonia	NRA		NRA		
Finland	NRA	NRA			
France	Ministry	NRA	NRA		
Germany	Ministry	NRA	NRA		Ministry
Greece	NRA	NRA			
Hungary	Ministry and NRA		NRA		
Ireland	Ministry				
Italy	Ministry	NRA			
Latvia	NRA	NRA	Ministry		
Lithuania	NRA	NRA	NRA		
Luxembourg	Ministry				

[134] Ongoing study SMART 2015

	Service Mapping*		Infrastructure Mapping	Demand Mapping	Investment Mapping
Country	**Focus on Quality of Service**	**Focus on Quality of Experience**			
Malta	NRA	NRA			
Netherlands	Ministry		NRA		
Poland	NRA	NRA	NRA		NRA
Portugal	NRA	NRA	NRA		
Romania	NRA	NRA			
Slovakia	NRA	NRA	NRA		NRA
Slovenia	NRA	NRA	NRA		
Spain	NRA	NRA			
Sweden	NRA				
UK	NRA	NRA			

Colour code

Existing mapping initiatives

Planned mapping initiatives

*Note: The table depicts if there is at least one initiative in the respective country; there is no count of initiatives. Service mapping refers to initiatives collecting data on the quality of service (i.e. theoretical network performance and marketed speeds) and on the quality of experience (i.e. the line qualification and the connectivity experienced by the user).

Source: TÜV Rheinland, 2016.

On simplifying the setting of termination rates, several stakeholders who agree that termination rates should be regulated up to and beyond 2020 still prefer a simplification of the rate setting[135]. The setting of a **Euro-termination rate** could eventually replace the setting of termination rates at national level currently based on the modelling of the cost of an efficient operator in the Member State concerned. Such Euro-rate could be linked to the finding of SMP in the respective Member State or the status of a 'terminating operator' under a symmetric regime.

A single Euro-rate has the advantage of great simplicity and transparency and very low maintenance cost for the individual NRA. The Euro-rate has the disadvantage that it will in only very few instances correspond perfectly to the cost of a hypothetically efficient operator in any specific Member State. In those instances where the actual cost level is lower operators will be over-compensated, also at the expense of operators in other Member States, and in those

[135] The respondents to the public consultation of the framework review which *strongly agree* or *agree* that termination rates should be subject to *ex ante* rules include the Maltese and Lithuanian ministries, the French and Bulgarian NRAs, ECTA and ETNO, and certain cable, mobile and fixed operators (mainly alternative). They indicated that even in transition to all IP, the current regime will remain relevant, however could be simplified by avoiding the burdensome Article 7 procedure. Simplification could be done through automatically imposing either symmetric interconnection prices (ETNO), or harmonized rates set at a genuine cost-level (MVNO Europe)/common EU price cap (Telecom Italia), or by introducing a harmonized cost model (BG NRA).

instances where the actual cost is higher, termination services could be offered at a loss, to the detriment of operators but also ultimately of consumers.

This makes the proposition of an EU cost model more attractive which can be modified in line with national requirements. Such model could be developed by BEREC and updated regularly, but would still require the national regulator to gather relevant data and feed these into the model. NRAs would no longer have to litigate its parameters in national courts, although they would probably still have to defend the calculations that they make to feed into the model.

Alternatively such Euro-model could regularly produce a single Euro-rate for a 'typical' Member State and be used as default unless an NRA considers (presumably at operators' request) that the calculation of a 'national' rate is appropriate, with the downside risk borne by the operator in case the resulting rate is lower [136].

Social and environmental impacts

Option 3 also includes measures which may foster sharing of ducts and co-investment in cables – thereby limiting environmental impacts and the cost of digging. There are also measures which could facilitate the deployment of VHC broadband to areas which may be poorly served today – so-called 'challenge' areas, which could bring social as well as economic benefits to these areas. The potentially longer duration of instalment contracts for the provision of infrastructure is a possibility foreseen for the economic convenience of end users, and will not modify consumers' rights to switch service providers, thus no social impact could be quantified.

On a more general point on social impact on consumers, it has to be noted that under option 3 competition is safeguarded by way of maintaining the current SMP regime; alternative operators would have more realistic chances of obtaining strategic autonomy via co-investment, while access to dominant operators' network at the performance level prior the network upgrade will be in all circumstances safeguarded. Consumers should be better off under this scenario since they have the choice they previously had, while having the possibility to benefit from higher quality connections if the measures proposed to enhance connectivity are put in place.

A study by Forzati and Mattson (2012) [137] suggests that high-speed broadband may stem the flow of populations away from rural areas and support employment in these areas. Specifically a 10% increase in the proportion of the population living within 353 metres from a fibre connected premise corresponds to a positive change in the population after three years of 0.25% in terms of increased inflow or decreased outflow. They also found that the migration effect as well as (to a lesser degree) the availability of fibre, contributed to increased employment in rural areas.

A 2013 study by Xing[138] based on the experience in Sweden also highlights the environmental benefits of FTTH. Specifically, he observes that FTTH uses around 20% less electricity compared with a VDSL2 network serving the same number of subscribers and suggests that 1m users connected to an FTTH network could save 1m tons of carbon-dioxide emissions through reduced car usage per household.

In a model developed by PWC and Motorola,[139] the relative environmental impact of different FTTH deployment phases was assessed. The study's authors concluded that the environmental

[136] Such an approach should in any case ensure that symmetric termination rates are charged by operators in any specific Member State

[137] Forzati, M., Mattson, C., and Aal-E-Raza, S. (2012), Early effects of FTTH/FTTx on employment and population evolution, Proceedings of the 11th Conference of Telecommunication, Media and Internet Techno-Economics (CTTE), Athens.

[138] Xiong (2013) Socio-economic impact of Fiber to the Home in Sweden http://people.kth.se/~maguire/DEGREE-PROJECT-REPORTS/130226-Ziyi_Xiong-with-cover.pdf

[139] http://www.bbcmag.com/2008issues/april08/BBP_Apr08_ParisEuroStudy.pdf

impact of a typical FTTH network would be positive within less than 15 years on average.[140] Moreover they noted that the main contributor to environmental impacts is associated with the laying of fibre in ducts. Accordingly they conclude that facility sharing could reduce these impacts significantly.

4.1.3.4 Option 4: Significant reduction of sector-specific regulation

Economic Impacts

The New Zealand example of using dispute resolution-led processes under ex ante sectorial legislation suggests that this is an inefficient means of enabling competition. It is notable that this approach may have contributed to high prices and low take-up for broadband in New Zealand in the early deployment phase compared with countries such as those in Europe, Japan and initially the US, which pursued unbundling policies. See SMART 2015/0002 for more details. In policy terms, adopting a New Zealand strategy in Europe might reduce competition with detrimental impacts on consumer welfare and broadband take-up – especially in areas which lack pre-existing cable competition which would in turn harm Europe's wider competitiveness.

Commercial agreements have been concluded between the incumbent and one or more access-seekers for NGA wholesale access in countries such as Portugal (co-investment with Vodafone), Germany and the Netherlands (long-term wholesale access to FTTC/VDSL network).[141] However, the fact that agreement was reached in the context of the ex-ante market process may have provided explicit or tacit incentives for the incumbent to reach agreement. In Portugal, the potential for the NRA to mandate wholesale access to PT's network under the SMP regime (alongside competitive pressure from the extensive cable network) is likely to have incentivised the incumbent to make an arrangement with Vodafone. In the Netherlands, the NRA explicitly stated that in the absence of agreement, it would prohibit the deployment of vectoring and set charge controls for FTTC/VDSL access based on cost.[142] Therefore the ex-ante regulatory regime and associated powers for NRAs seem to have played a crucial role in fostering commercial agreements in these cases.

Social and environmental impacts

This option relies on 'light touch' regulation to provide incentives for infrastructure-based providers to extend the reach of their VHC networks to **rural areas**, thereby providing social as well as economic benefits to customers that today are typically less well served and helping to extend rural coverage. For example, the US, which operates one of the most light touch approaches within the OECD for broadband regulation, has rural coverage at 25Mbit/s or above at 47% according to a 2015 FCC report.[143] This compares well with Europe's coverage rate for speed of above 30Mbit/s in 2014 of 25%[144] However, under the US regime, the degree of choice in high speed offers is limited, retail prices for high-speed broadband have been high and take-up

[140] On the basis of assumptions that telemedicine could be used to certain consultations, that FTTH would enable 10% of the working population to telework 3 days per week, while 20% of the elderly population could benefit from home assistance

[141] See case studies in WIK (2016) Regulatory approaches to risky bottleneck assets http://stakeholders.ofcom.org.uk/binaries/telecoms/policy/digital-comms-review/WIK_regulatory_approaches_to_risky_bottleneck_assets.pdf

[142] See Case study on NL WIK (2016) Risky assets: an international comparison and interview conducted with ACM in that context http://stakeholders.ofcom.org.uk/binaries/telecoms/policy/digital-comms-review/WIK_regulatory_approaches_to_risky_bottleneck_assets.pdf

[143] FCC 2015 Broadband Progress Report. Cable coverage at 25Mbit/s reaches more than 80% households in the US

[144] https://www.broadbandmapping.eu/wp-content/uploads/2015/07/Broadband-Coverage-in-Europe_final-report_2014.pdf

of high speed offers has been low[145]. This raises doubts as regards whether a light touch approach would address rural needs in a socially optimal way.

Alternative investors such as municipalities which may not have a purely commercial motivation might be more incentivised to **consider social welfare** and to offer open networks enabling competition in rural areas.[146] However, this option will not address the threat of overbuild of (typically fibre regional investors') networks in areas where only one network is viable, and therefore may not serve to expand the reach of these types of deployment.

Concerning **environmental impacts**, this option is more likely (than option 3) to lead to incremental upgrades of the incumbent copper network through FTTC/VDSL, vectoring and G.fast alongside incremental upgrades of cable, than the installation of FTTH, which is often deployed as a result of disruptive influences from alternative operators and investors.[147] There may be environmental advantages in the short term to avoiding the replacement of all parts of the copper and cable network with fibre. However, in the medium term these are likely to be outweighed by the greater per Gbit/s energy requirements of xDSL and HFC technologies compared with those associated with FTTH, and the initial environmental disadvantages associated with FTTH can also be mitigated through re-use of existing ducts, where these are available.

4.1.4 Comparison of options

4.1.4.1 Effectiveness

The status quo and continuity and simplification options (options 1 and 2)

The main problems identified relate to gaps in NGA and VHC broadband and fragmentation in the supply of wholesale services impacting cross-border business users as well as cross-border suppliers.

Taking into account the identified problems and the gap between European and other countries´ broadband performance, such as Japan which adopted a straightforward high speed broadband strategy– maintaining the status quo is unlikely to redress the situation. Projections for future developments to 2025, (see **Error! Reference source not found.**) based on operator announcements and expectations concerning state aid, suggest the gap will persist. Moreover, business users consider[148] that it is unlikely that fragmentation affecting cross-border use and supply will be resolved under a continuation of the status quo. Option 2 provides some improvements on the status quo, but does not address these concerns directly. It therefore achieves some benefits in terms of increased certainty, clarity and streamlining, but is unlikely to be significantly more effective than the status quo as regards the main problems affecting the market.

NGA+: Focusing regulation on VHC connectivity

In contrast with the options which largely maintain the existing system, option 3 attempts to address the core ubiquitous connectivity challenge through a set of measures improving

[145] The US enjoy however a large Universal Service Fund. As of mid 2015, 12.2 million Americans are supported by the Low-Income window of the Fund and 1.6 million Americans are covered by the High Cost window for rural areas. The provision is for services up to 3 Mbps.
https://apps.fcc.gov/edocs_public/attachmatch/DOC-337019A1.pdf
[146] See Case studies in SMART 2015/0002
[147] SMART 2015/0002 identified through a number of case studies that FTTH deployment is common triggered by disruptive investors such as iliad in France, Reggefiber in NL, municipalities in Sweden. Countries lacking significant disruptive operators such as the UK, Germany and Belgium have typically tended to pursue an upgrade of existing infrastructure as opposed to FTTH deployment
[148] Interview INTUG SMART 2015/0002

infrastructure mapping,[149] targeting regulation to foster infrastructure competition and co-investment models and providing a harmonised approach towards wholesale products used for business access. The measure would address mapping of existing networks, future investment and quality of service with a view to make data accessible to relevant authorities planning deployment of networks and make it public in a GIS format at the appropriate level of resolution to the wider public. The effectiveness on the provisions on mapping is enhanced by the fact that all Member States have by now established broadband mapping initiatives in different forms. In a number of cases, similar initiatives also take place at regional or at municipal and project level with a high risk of inconsistent and sometimes unreliable results. An inventory of QoS mapping initiatives (including QoS inferred from infrastructure mapping) by *TÜV Rheinland* gives evidence of this widespread practice with more than 80 mapping initiatives carried out at national level without counting the multiple initiatives often carried out at regional and sometime at lower level to support specific projects [150].

It builds on successful regulatory approaches mentioned in section 4.1.3. The approach proposed towards fast broadband deployment draws on successful regulatory strategies pursued in France, Spain and Portugal. Outcomes in these countries[151] suggest that this approach may be effective in triggering the deployment of FTTH/B, as well as supporting sustainable infrastructure competition (or co-investment) in certain areas that may permit SMP regulation to be rolled back. It is notable that overall coverage of very high speed broadband in Spain and Portugal (through FTTH/B or Docsis 3.0 and successors) is also projected on the basis of operator announcements to be high,[152] despite relatively modest broadband state aid financing in these countries.[153] The strategies in the preferred option to deter overbuild also aim to respond to the concerns expressed by regional fibre investors and alternative operators[154] and draw on good practices in managing local and municipal deployments in countries such as France.[155] Meanwhile the proposed standardisation of core wholesale remedies for business access takes lessons from previous successful harmonisation strategies which were applied to legacy technologies (traditional leased lines and local loop unbundling), but now require updating in the light of technological developments. [156]

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[149] Respondents to the public consultation Q26 mostly considered that there are adequate tools in the current framework to enable NRAs to conduct mapping exercises. However, they are not obliged to do so, and this practice is not yet widespread

[150] Ongoing study SMART 2015

[151] See Shortall and Cave Communications & Strategies (2015), SMART 2015/0002 – see interim slide presentation at http://www.wik.org/fileadmin/Konferenzbeitraege/2016/Public_Workshop_April/Public_Workshop_slide_presentation.pdf, and WIK (2015) Competition and Investment: an analysis of the drivers of superfast broadband

[152] IDATE projects coverage of 94% in Portugal and 91% in Spain by 2025.

[153] State aid per household (2003-2013) was recorded at €49 in Spain and €26 in Portugal based on data from DG Competition see figure 19 WIK (2015) Competition and Investment http://www.wik.org/fileadmin/Studien/2015/Competition_and_investment_superfast_broadband.pdf

[154] Regional fibre investors and alternative operators strongly favour measures to avoid 'strategic overbuild' – Q59 public consultation, although incumbents are strongly opposed

[155] Case studies are included in SMART 2015/0002 – see interim slide presentation at http://www.wik.org/fileadmin/Konferenzbeitraege/2016/Public_Workshop_April/Public_Workshop_slide_presentation.pdf

[156] There is extensive analysis on this subject in SMART 2014/0023. There was also support for this approach in the context of the EP 2013 study How to Build a Ubiquitous EU Digital Society. Although in a fully functioning market, there is a risk of standardisation impeding product innovation, this risk is considered less in the context of wholesale products which are not generally defined on a commercial basis but rather on the basis of regulatory requirements from the NRA. The participation of all NRAs as well as operators in the definition of a common product specification should also serve to foster an exchange of best practice leading to improved EU specification in comparison with what might be expected from specifications occurring at a national level in isolation. Moreover, consistency of itself could be considered to present advantages in comparison with fragmented national solutions in the context of offers used for provision to multi-national businesses.

Moreover, the focus on civil engineering and the improved network infrastructure mapping are likely to support further deployments from regional and municipal investors, and contribute to achieving the objective of wider coverage of VHC technologies.[157]

As to commercial agreements, the terms negotiated by SMP operators are likely to depend on the access terms which would otherwise be mandated by the regulator. The prospect of regulation in the event of failure of commercial negotiations, or of ineffective implementation of such agreements, should be maintained in order to ensure that such arrangements are sustainable in the medium term.

Greater coverage of VHC networks should lead to take-up of these networks as shown in the support studies to this IA report (SMART 2015/0005 and SMART 2015/0002). However, this solution might not fully address issues with a lack of demand. The merger proceedings that followed the adoption of NRA policies to foster FTTH investment in France, Spain and Portugal (resulting in three significant players in each market)[158] suggest that infrastructure-based competition may lead to more concentrated markets than today, which might have a countervailing effect on take-up where and if prices would be appreciably higher (although an analysis of fast broadband pricing[159] suggests that this risk has not materialised to date in Spain, France and Portugal). Moreover, fostering co-investment in smaller size deployments could help alleviate the risk of unnecessary consolidation.

This option will help addressing business access through a mechanism to harmonise specifications and service levels, thereby applying standards to new business access technologies in a similar way as was applied to traditional technologies to positive effect.[160] Similar best practice harmonisation measures on wholesale access products could also be used to support competition and cross-border supply in residential services.

It should also be recalled that the conditions for leased line access as well as their specifications were also originally closely harmonised at EU level through the 1992 Leased Line Directive[161] and EU-wide standards. This harmonisation supported the expansion of the Internet during that period.[162] Common definitions also simplified the analysis of leased line markets and imposition, in cases where SMP was found, of leased line remedies in the EU. Further discussion on the impact of common standards as well as service levels for business access is included in the 2015 study "Access and Interoperability standards for the promotion of the internal market for electronic communications."

Reducing the scope of regulation

Option 4 aims to address the identified problems by limiting the scope of access regulation on the basis that access regulation may undermine VHC networks' deployment and may not lead entrants to 'climb the ladder of investment'. A strategy of mandating the easing of ex ante regulation before moving to competition law, would be consistent with this aim. However, case studies as well as quantitative analysis conducted for SMART 2015/0002 cast some doubt on whether this approach would in practice address the identified problems.

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[157] Such strategies appear to have had positive effect for example in the case of France – see case studies in SMART 2015/0002

[158] For example, in Spain ONO/Vodafone and Orange/Jazztel mergers, in Portugal Optimus/ZON and in France Numericable/SFR

[159] Elaborated in SMART 2015/0002

[160] See discussion in SMART 2014/0023. There was also support for this approach in the context of the EP 2013 study How to Build a Ubiquitous EU Digital Society

[161] ONP Directive on leased lines (Council Directive 92/44/EEC)

[162] FCC data shows an expansion in the number of leased lines (64kbit/s equivalents) between the US and other OECD countries (mainly in Europe) from 28,080 in 1995 to 185,972 in 1997 – a compound annual growth rate of 157% - see table 2 OECD report "Building Infrastructure Capacity for electronic commerce" DSTI/ICCP/TISP(99)4/FINAL

- Under this strategy, there is a high risk that infrastructure competition may not emerge, while service-based competition may diminish. Tom Wheeler, Chairman of the US telecom authority, the FCC, noted in a 2014 speech that most Americans did not have a competitive choice of offers above 25Mbit/s.[163] Minimum horizontal measures for duct access under the Cost Reduction Directive would still apply, but these too rely on dispute resolution and access obligations could not be as tightly regulated as those introduced on SMP operators under the EU framework for electronic communications.
- As noted above in section 4.1.3 a strategy of dispute-resolution under ex ante telecom legislation was pursued in New Zealand in the period from 2000, but was discontinued on the basis that it led to low take-up and high prices for broadband.
- It is possible that a light touch approach resulting in consolidation might enable operators to raise prices and revenues, and indeed broadband tariffs in the US, which pursues a light touch approach to access regulation, are generally high in comparison with those in Europe[164]. This should increase operators' *ability* to invest. However, as previously discussed, they may lack the *incentive* to invest if this strategy fails to further boost disruptive infrastructure-based competition, which has been clearly identified in many studies as a key driver of investment.[165]
- While higher prices and ARPUs may generate incentives for new players to enter the market, market scale at entry may be difficult.

Overall therefore, we conclude that this strategy is unlikely to be effective in meeting the stated objectives of ensuring affordable ubiquitous connectivity to all citizens in Europe and the provision of cross-border business services. An approach based on dispute resolution rather than ex ante market regulation is likely to be particularly disadvantageous to operators which may not have large scale in any single market, but seek to serve customers across multiple regions and countries across the EU. It may result in a prioritisation of mass-market remedies to the detriment of wholesale services designed for the business market.

4.1.4.2 Efficiency

Status quo and 'continuity' options

The **direct costs** associated with maintaining the status quo include the cost to NRAs of operating the market analysis process, and the cost to stakeholders (and especially regulated operators) of compliance. The mechanisms currently used to ensure consistency, including the article 7 consultation process, also incur costs to the European Commission, NRAs and in relation to the operation of the BEREC Office. However, it should be noted that telecom operators and their trade associations observed in the course of interviews for this study and SMART 2015/0002 that they consider the indirect costs (in the case of SMP operators) or benefits (in the case of operators making use of regulated access) significantly exceed the direct costs, given the overall scale of the sector and its impact on the European economy. In this context, the direct costs per se are not considered to present the main 'problem' as regards regulation of the electronic communications sector.

Indirect costs of 'overregulation' cited by operators[166] subject to SMP regulation include the opportunity cost of reduced investment in high speed broadband infrastructure and the consequent impacts **on the quality of service to consumers**. However, there are different views amongst the industry and analysts as regards the existence and scale of these costs as reported in

[163] http://arstechnica.com/business/2014/09/most-of-the-us-has-no-broadband-competition-at-25mbps-fcc-chair-says/
[164] More generally, cconometric analysis for SMART 2015/0002 finds that more concentrated markets may be associated with higher ARPUs
[165] SMART 2015/0002, WIK (2015) competition and investment, EP (2013) 'How to build a Ubiquitous digital society' – and literature reviewed in the context of SMART 2015/0002
[166] In the context of interviews and consultation responses

the public consultation. This cost may be mitigated by the proposal in the 'continuity and simplification option' to require NRAs to first identify a market failure at retail level before intervening. Another cost which stakeholders and some NRAs have identified with the current set-up is the uncertainty created by short review cycles and remedies which are reviewed (and prices revised) on a frequent basis. This problem will be addressed under the 'simplification' option, and should reduce procedural costs as well as increasing regulatory certainty.

Looking at the timeframes to reach decisions, the typical time taken to conduct a market review ranges from 9 months to 3 years, while this can in some cases last as much as 5 years (as reported in Portugal). NRAs handle the process differently, but in some countries the market analysis process can involve several rounds of consultation, and lengthy documentation, and delays can occur if there are significant changes in market circumstances (such as mergers or commercial agreements) during the course of the review. A further brief period is added for EU consultation under the article 7 process, but this is short (amounting to only one month in the absence of serious doubts) compared with the market analysis process as a whole. In markets which are subject to change, it may be necessary to conduct this kind of in-depth analysis in order to properly take into account national circumstances. However, for market definitions, SMP designations or remedies which are not subject to significant change, the market analysis process may be a source of inefficiency. It is also clear – especially for more complex markets requiring lengthy reviews – that a requirement for a three-yearly review may give little time to reflect on the consequences of previous market regulation.

Figure 18 - Duration of market review procedure Source: Deloitte based on NRA survey

Another core aspect of the existing framework which has been identified as complex and inefficient in the context of EP (2013) 'How to build a ubiquitous EU Digital Society' and SMART 2014/0024 is the process of ensuring consistency. Although the Commission can take binding negative decisions as regards market definition and SMP (under the article 7 process), the main tools through which consistency on remedies is achieved under the framework today are non-binding Recommendations.

Such Recommendations can take 2-3 years to conclude, and as discussed in SMART 2015/0002, as well as in the implementation reports published annually by the Commission, may require an extensive period of enforcement via the article 7 process and still not achieve full consistency. The clearest example of this is mobile termination rates which are not yet consistently calculated in all Member States seven years following the adoption of the EC Recommendation and despite

the support for the Recommendation from BEREC within the article 7 process[167]. Product specifications[168] and terms for business access, which is not subject to a recent Recommendation, vary even more widely, as can be seen in the following charts comparing pricing and provisioning times[169].

Figure 19 - Ethernet leased line 5km local access pricing benchmarks (Source: WIK based on Reference Offers as of October 2014)

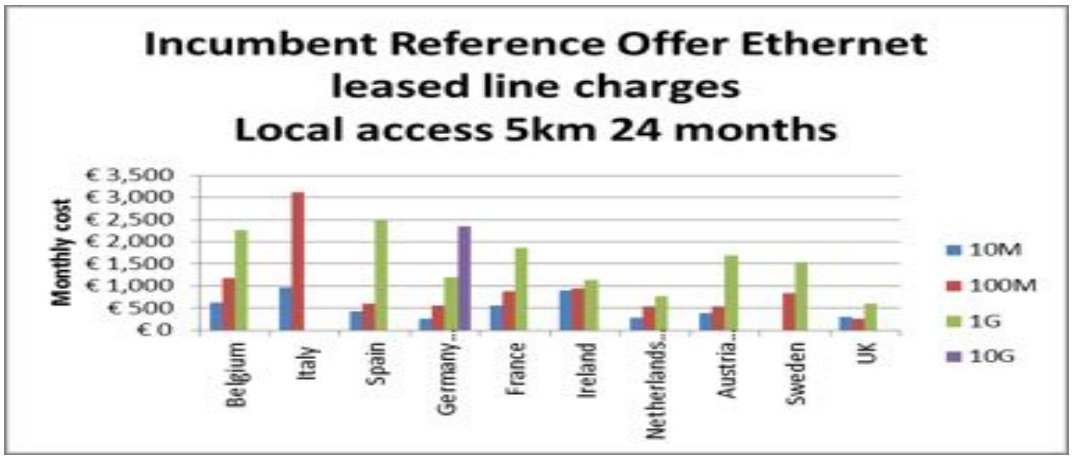
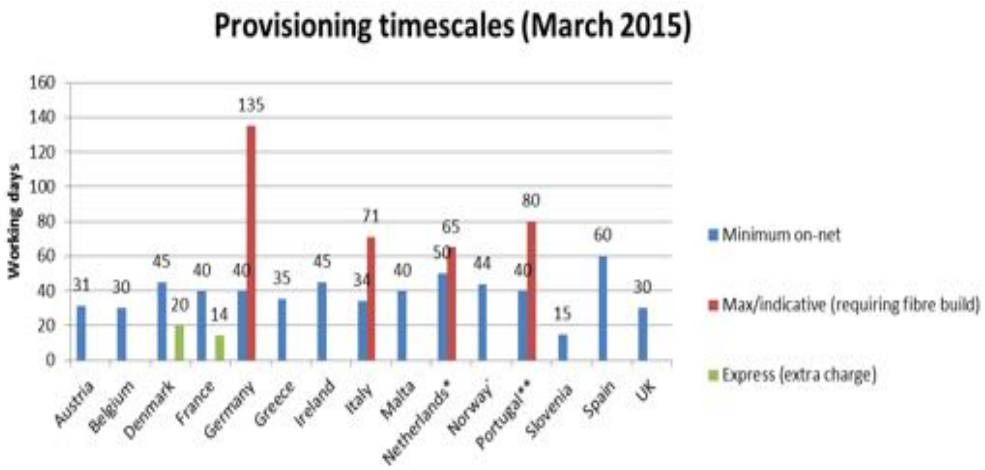


Figure 20 - Ethernet leased lines: on-net provisioning timescales within the SLA



In cases where consistency is merely desirable but not essential, the advantages of flexibility offered through non-binding guidance may outweigh the imperfectly consistent outcomes. However, where consistency would clearly serve to improve Europe's position in relation to economically important objectives such as fast broadband and/or would have a significant impact on competition, consumer welfare and the single market, the existing set-up appears inefficient, especially when compared with specific legislation such as that on LLU (in 2000)

[167] Article 19 FWD permits Decisions to be adopted in specific circumstances – if Recommendations on the same subject have been adopted, but proved ineffective in achieving consistent outcomes after a 2 year period

[168] Ethernet leased line product specifications have been relatively fully harmonised. However, SMART 2014/0023 revealed variations in the availability and specification of business-grade Ethernet bitstream which is increasingly being use to serve the needs of smaller sites and businesses.

[169] See further discussion in SMART 2014/0023

and Roaming, which were concluded within short periods[170] and achieved more consistent outcomes which were beneficial to end-users in a relatively short space of time.

NGA+: Focusing regulation on VHC connectivity

Because this option adapts the market analysis process to foster VHC broadband deployment rather than relying on existing rules complemented with non-binding guidelines, it should be more efficient at achieving results than the status quo or 'continuity and simplification', other things being equal.

There are likely to be increased costs involved for NRAs which have not yet put in place procedures to map the availability of standard and NGA infrastructure and assess viability of replication, as well as for operationalising duct access[171].

However, setting core principles in legislation as well as the preference to incentivise commercial arrangements including co-investment and long-term agreements could potentially reduce the need for detailed SMP obligations and associated enforcement. As such it should help to simplify both the market analysis process and review through the article 7 process. On the other hand more pressure may be put on processes of general application such as infringement proceedings at the EU level where necessary, dispute resolution and litigation. Further guidance either in the form of soft law or delegated instruments may also be needed on certain aspects of the revised legislation, such as more detailed guidance on implementation of retail focus, infrastructure mapping, and definition of co-investment regimes. These tasks could either be handled by the EC, with BEREC continuing to act in a mainly advisory role, or by BEREC. The relative merits and costs associated with these approaches are further considered in chapter 5 of SMART 2015/0005.

A further area in which this option is likely to increase efficiency is the proposal to support standardised specifications and service levels for wholesale products used for business access, and potentially provide for the standardisation of other wholesale products widely used across the EU. SMART 2014/0024 suggests that such an approach could reduce time to market and limit the burden on NRAs and operators seeking agreement at national level, compared with the current approach in which similar wholesale products addressing technological adaptations are developed in parallel in different countries. This approach should contribute to regaining the efficiencies of previous standardised wholesale products such as LLU. Again however, this approach may have implications for the remit and resourcing of BEREC.

Reduction in sector-specific regulation

Because it involves significantly less regulatory intervention, this option is likely to reduce costs for NRAs which are currently associated with market analysis process. It may also render unnecessary many of the core tasks currently undertaken through the article 7 review process and BEREC.

However, this option places further emphasis on dispute resolution, which from the experience of New Zealand may require additional resources and time than a general market review. In this context, BEREC estimated during an interview conducted for this study that this scenario might raise costs for NRAs compared with the status quo, and increase court proceedings.

There may also be significant indirect costs associated with a likely reduction in competition, including increased retail prices and consequent reduced demand. It should be noted in this

[170] The LLU Regulation was agreed within 6 months following its proposal by the Commission.

[171] For example, as shown in SMART 2015/0005, the cost of assessing the viability of infrastructure deployment and competition in the case of France was around €280,000 while operationalising duct access cost around €1.4m over an 8 year period. Establishing the regime for symmetric regulation and associated dispute resolution cost a further €2.6m.

context that econometric analysis conducted in the context of SMART 2015/0002 found that NGA take-up (as a proportion of households) is linked to NGA prices, which in turn are associated with the degree of access-based competition. Charges for high speed broadband in the US, which has operated a policy of regulatory forbearance, are high in comparison with EU charges.[172]

There may be increased costs to other related sectors such as applications and services and greater need for enforcement action elsewhere, if a reduction in competition results in discriminatory behaviour by telecommunications firms to the advantage of their tied service and content providers. Finally, spill over effects from the telecom sector on other sectors (see macro-economic analysis) may result in a negative impact on jobs and growth.

4.1.4.3 Coherence

Internal coherence

The status quo maintains coherence with past strategies in EU regulation of the electronic communications sector. As such it may provide some stability and predictability for investors.

However, the current Directives include some points which may not be internally coherent. In particular, the linkage between symmetric and asymmetric obligations is not specified, and the Commission is not formally involved under Art. 7 in reviewing symmetric obligations under article 12 of the Framework Directive, even though these might become more significant in a fibre environment. The current framework also contains a number of provisions that have remained unused, including the possibility for cross-border dispute resolution and joint consideration by NRAs of a trans-national market.

The continuity and simplification option may clarify the association between symmetric and asymmetric obligations, but does not address the remit of the article 7 review. It also does not provide a workable mechanism to ensure consistency for markets with a retail cross-border aspect.

The NGA+ option provides coherence in the consideration of symmetric and asymmetric obligations within a single market analysis process. In turn, this enlarged market review could also be subject to the article 7 consultation process thereby ensuring consistent treatment. It also includes provision for standardised remedies for business access. However, it is likely to result in some disruption in markets where entrants have previously relied on wholesale access, but might now be incentivised to invest or co-invest in their own access infrastructure. New provisions, including the need to take account of commercial arrangements and co-investment, may also require interpretation and involve disputes before appeal bodies.

The deregulatory option is consistent with the overall aim of reducing sector-specific regulation, but would create significant market disruption and uncertainty, as the market analysis process would be replaced with dispute resolution.

External coherence

The status quo may be incoherent in some respects with external legislation. Specifically, the role of NRAs as regards broadband state aid is unclear and can vary amongst Member States. This may lead to inconsistencies in the analyses concerning the potential for VHC deployment and infrastructure-based competition. The allocation of structural funds to broadband, in focusing on cost, may also fail to appropriately target funds towards performant technologies.

Although the Regulatory Framework prevails if provisions exist concerning facility sharing under the Framework, there may also be some uncertainty as regards how potential or actual

[172] See SMART 2015/0002 as well as WIK (2015) Competition and Investment

facility sharing under the Cost Reduction Directive should be considered in the context of the market review process and in what circumstances it would be appropriate to apply additional sector specific SMP or symmetric regulatory obligations to foster facility sharing.

The continuity and simplification option may address some lack of clarity around how symmetric measures including those under the Cost Reduction Directive might be considered within the market review process. However, it does not specifically address the roles of NRAs concerning broadband state aid.

In requiring NRAs to undertake a current and prospective mapping exercise, the NGA+ option provides linkages between the role of NRAs in fostering competition (in contestable areas) and their potential role in identifying 'challenge' areas and gathering expressions of interest in this regard. In turn, this should provide a natural connection between the regulatory remit of NRAs and their engagement in the process of allocating state aid. The deregulatory option is externally coherent in that, in rolling back sector specific legislation to a significant degree, it leaves more scope to horizontal antitrust law and state aid.

4.1.4.4 Impact on stakeholders

The impact on stakeholders from the preferred option is assessed in more details in annex 4. The impact on stakeholders, consumers and SMEs would benefit most from the increased availability and quality of high speed broadband under the 'fibre-ready' NGA+ option (option 3). They would also enjoy similar levels of competition in standard broadband and a greater degree of choice in high speed broadband. Multi-national corporations would benefit from a greater degree of consistency and competition in cross-border business offerings. On the other hand both residential and business end-users would be least well served under the deregulatory option (option 4), as they would likely face reduced competition, higher prices and greater fragmentation in offerings. As regards the status quo and 'continuity and simplification' scenarios, consumers and SMEs would continue to have differing levels of choice and quality depending on their location, while multinational corporations would continue to be negatively impacted by fragmentation impeding coherent offers across the single market. OTT providers which rely on the widespread availability of high-quality retail internet access over which to offer services would be impacted in a similar manner to end-users.

Electronic communications operators would be differently impacted depending on whether they are currently subject to SMP regulation or are beneficiaries of such. Incumbent operators would benefit most from a significant deregulation of wholesale access (option 4), while entrants would be negatively impacted by this scenario. Conversely in the status quo or 'continuity' scenario, incumbents would continue to be subject to sometimes intrusive access regulation, while entrants would benefit from continued access, although they would be vulnerable to disruption in access due to technological upgrades by the incumbent, changes in regulation or regulated pricing. The fibre-ready NGA+ scenario (option 3) presents challenges and opportunities for both incumbents and entrants. The regulatory approach advocated would be likely to require more up-front investment on the part of entrants, triggering the need for incumbents also to invest in response. However, it should also result in more sustainable forms of competition (i.e. less dependent on periodic regulatory decisions), control over retail offerings and long-term certainty. This option, with its greater focus on deployment and infrastructure competition, is also likely to be favourable to regional fibre investors. Cable operators may also benefit indirectly from reduced regulation on incumbents in dense areas (enabling greater flexibility) and the potential to expand their network reach.

Equipment manufacturers have been negatively impacted by the patchy network investment arising from the status quo. Options 3 and 4 might result in greater investment, but by different actors within the electronic communications sector – with option 4 benefiting existing

infrastructure providers looking to upgrade their networks (incumbent and cable) while option 3 would tend to foster investment by a wider range of operators in FTTH/B networks. The impact of these options on equipment manufacturers may depend on their technological solutions and customer base.

NRAs would benefit most from the option for continuity and simplification (option 2), under which they would retain the existing degree of flexibility in regulatory decision-making, but benefit from reduced burdens in relation to market reviews. NRAs would lose a degree of flexibility under option 3, but some may at the same time benefit from greater empowerment (for example as regards data gathering) and an expansion in their remit to support the identification of areas requiring state aid.

The effects are synthesized by Table 5 below

Table 5 – Effects on stakeholders from access options

	Option 1: Status quo	Option 2: Continuity and simplification	Option 3: Fibre-ready	Option 4: Reduction in scope of regulation
Consumers	Mixed – some may be well-served but existing gaps may remain	As option 1	Substantial benefits arising from higher broadband quality of service due to increased deployment and competition in very high speed broadband. Some market consolidation also possible, which may have positive as well as negative impacts on innovation and price	Negative – significant reductions in competition could be expected impacting pricing and service quality, although some further investment might be made
SMEs	Mixed – some may be well-served but existing gaps may remain	As option 1	Substantial benefits arising from higher broadband quality of service due to increased deployment and competition in very high speed broadband.	Negative – significant reductions in competition could be expected impacting pricing and service quality, although some further investment might be made
Larger and multi-national businesses	Negative – fragmentation would continue to impact cross-border connectivity	As option 1	Benefits from greater fibre availability (also reaching smaller sites, homeworkers) and consistent wholesale specifications, if SMP approach maintained for business access	Highly negative – significant reductions in competition and further cross-border fragmentation
Incumbents	Negative – existing regulatory burden and constraints	Some benefits compared with status quo – more	Mixed. Some benefits – potential lifting of sectorial regulation,	Highly positive – significant reduction in regulatory burden

	would remain	certainty, higher burden of proof for intervention, but may also facilitate functional separation	but also tighter regulation of ducts, pressure to invest	and constraints and lessening of competition
Entrants	Mixed – continuation of access regulation positive, but no emphasis on supporting more sustainable competition. Therefore, practical application varies by country. Entrants vulnerable to technological and regulatory change.	Some benefits compared with status quo – more certainty, greater potential for functional separation, but also higher burden of proof for intervention – may reduce regulation	Benefits for larger scale players able to invest and co-invest. Negative for smaller entrants relying on wholesale access	Highly negative – may undermine business viability
Alternative fibre investors	Neutral for existing players, but no additional support for further investment	As option 1	Positive – greater access to civil infrastructure, support for rural investments	Neutral if not reliant on incumbent SLU/duct access. Otherwise negative
Cable operators	Stability considered highly positive, although continued wholesale price regulation could undermine revenues	Benefits compared with status quo – more stability, higher burden of proof for intervention	Mixed - Some benefits from potential lifting of wholesale price regulation, but also greater infrastructure competition and pressure to invest	Positive – reduced competition
Content and application providers	Mixed – existing bandwidth gaps would remain, but competition would continue to support take-up and protect vs discriminatory conduct	As option 1	Positive – greater bandwidth availability, but risk in some markets of consolidation impacting competitive safeguards	Negative – likely to impede take-up of higher speed offers, and concentrate the market, raising risk of discriminatory conduct
Equipment manufacturers	Neutral to negative – no specific stimulus for investment by industry	Neutral to negative – no specific stimulus for investment by industry	Mixed – depending on business model/customer-base	Mixed – depending on business model/customer-base
NRAs	Mostly positive – retain existing flexibility. But several NRAs have raised concern over burden of 3 yearly review requirement	Positive – NRAs would benefit from continued flexibility, but with reduced market analysis administrative	Mixed – NRAs would have more prescriptive requirements. Those not already pursuing mapping analysis and the operationalization of duct access may	Negative – NRAs would lose an important tool for the promotion of competition, while potentially facing an increased burden in

	+ some NRAs raise concerns over independence and resourcing)	requirements and increased potential to implement functional separation. Under this option their resources and remit would also be strengthened	require additional resources to do so in the short term – although the admin burden may reduce longer term	dispute resolution
BEREC	Neutral	Positive – remit would be expanded and NRAs' competences would be aligned with BEREC's	This option would entail the strengthening of BEREC Governance as well as additional responsibilities. Although BEREC's competence and influence would be expanded, NRAs would have less direct control over its Governance.	Highly negative. BEREC would lose a significant portion of its current remit (concerning market analysis).

4.1.4.5 EU value added

The status quo and continuity and simplification options (Options 1 and 2) do not change the balance of responsibilities between the EU and Member States. Equally, because there is no further transfer of responsibility compared with the status quo, option 2 does not increase the benefits achievable through EU-level action compared with the status quo. Option 4 would significantly limit the available options for ex ante intervention in the electronic communication sector at a national level. As such, it imposes a significant degree of centralised control, even if the decisions (through dispute resolution) would be taken at national level. By applying a common approach that is likely to under-estimate the regulatory requirement, it is likely to result in less effective outcomes than Member States acting alone. Option 3 (NGA+) adds specific requirements to the existing market analysis process in order to make it suitable for VHC networks. As such it reduces somewhat the current degree of flexibility. However, as it supports a level of harmonisation based on established best practice cases and in line with many aspects raised in the public consultation, it is likely to result in greater positive effects than Member States acting alone.

4.1.4.6 Summary table comparing access options

Table 6 – A comparison of options - access

	Effectiveness (wrt ubiquitous connectivity)	Efficiency and cost reduction	Coherence	EU value add

	Ultra-fast coverage	Ultrafast take-up	Universal availability	Competition (infra/ service)	Business access	Cost/ complexity/ enforceability	Disruption from status quo (stability)	Internal coherence	External coherence	Subsidiarity	Proportionality (impact compared with MS acting alone)
Option 1: status quo	0	0	0	0	0	0	0	0	0	0	0
Option 2: streamlining	+	+	0	+/+	0	(+)	++	+	+	0	0
Option 3: NGA focus	++	++	+	++/-	++	+	-	++	+	-	++
Option 4: Dispute resolution	+	-	(+)	+/--	--	-	--	++	+	--	--

4.1.5 The preferred option

The Commission considers that option 3 best fulfils the overall and specific policy objectives of the review of the telecom framework as presented in section 3. In particular, the set of measures under this option would *inter alia*: (i) help meeting the ubiquitous VHC connectivity objective through the facilitation of co-investment and commercial agreements, and wholesale only models, which are expected to help increasing the footprint of VHC networks; (ii) it would safeguard competition through the maintaining of SMP rules on the basis of more granular mapping, flanked by the strengthening of symmetric rules; (iii) improve the efficiency and predictability of regulation by lengthening the market review cycle and focussing regulation where it is really needed by prioritising retail level problems. The single market coherence would also be boosted by the development of EU-wide access products for business end-users.

Due to its effect in boosting connectivity, we estimate that **option 3 would result in a 0.54% increase in GDP compared with the status quo by 2025**. These estimations are further elaborated in section 4.11 and in annex 5 (section **Error! Reference source not found.**). By supporting deployment in rural areas, this option would also contribute social benefits. Various studies have shown that greater connectivity is associated with **reduced migration in rural areas as well as increased employment more widely**.[173] Finally, there is evidence that the

[173] Forzati, M., Mattson, C., and Aal-E-Raza, S. (2012), Early effects of FTTH/FTTx on employment and population evolution, Proceedings of the 11th Conference of Telecommunication, Media and Internet Techno-Economics (CTTE), Athens. Singer, H., Caves K. and Koyfman A. (2015) Economists Incorporated: The Empirical Link Between Fibre-to-the-Premises Deployment and Employment: A case study in Canada, Annex to the Petition to

deployment of all FTTH/B infrastructure, which would be fostered through this option, could lead to environmental benefits resulting in **88% less greenhouse gas per Gigabit (due to reduced electricity consumption) compared with the status quo**.[174]

4.2 Spectrum

4.2.1 Options

Option 1 No change Baseline scenario

This option is based on the EU policies in place and reflects possible developments of these in the absence of new EU-level action.

The 2002 framework, developed at a time when mobile telephony was still in the growth phase (and mobile data virtually unknown) gave significant flexibility to Member States in the management of radio frequencies and procedures for the transfer of rights, subject to general principles set out in the legislation. Two bodies were established at the same time to support the co-ordination of spectrum policy: (1) the Radio Spectrum Decision of 2002 established the Radio Spectrum Committee (RSC)[175]. which has responsibility for technical measures required to implement the broader Radio Spectrum Policy, and (2) the Radio Spectrum Policy Group (RSPG) established under Commission Decision 2002/622/EC consisting of Member State and Commission representatives was established as an advisory group to the Commission. The RSPG issues opinions and reports on Radio Spectrum Policy at the request of the Commission and more recently under an expanded remit also the European Parliament or the Council.

The 2009 revision to the electronic communications framework provided significant new guidance on spectrum management, as mobile communications were gaining prominence and spectrum was more and more seen as essential input to compete on the electronic communications market. Most importantly, it also paved the way for the 2012 Radio Spectrum Policy Programme (RSPP), which now serves as a roadmap for the development of the internal market for a wide range of wireless technologies and services (i.e. not just for electronic communications), taking into account both Europe 2020 and the Digital Agenda for Europe. However, contrary to what happens to access regulation and its 'Article 7', the new provisions on spectrum management did not include measures for the EU-level assessment of draft national measures in particular the assignment of rights of use of spectrum.

This option would keep in place the current possibility of technical harmonisation of spectrum at allocation level based on the Radio Spectrum Decision, as well as the very general provisions regarding policy objectives and regulatory principles, on strategic planning and coordination of spectrum policy, on management of spectrum including technology and service neutrality. Member States will keep a large discretionary power to organise spectrum assignment in general.

There would still be no possibility to adopt binding measures (other than by distinct co-legislative initiatives) to eliminate fragmentation and introduce more consistency in the selection and spectrum assignment process, or to coordinate some of its main elements as envisaged in options 2, 3, and 4. Greater harmonisation would be potentially possible based on Commission non-binding recommendations pursuant to Article 19 of the Framework Directive

Option 2 - Non-binding rules for enhancing consistency of spectrum management in the EU

Vary TRP 2015-326, Bell Canada. Katz, R., Vaterlaus,S., Zenhäusern, P. and Suter, S. (2010), The Impact of Broadband on Jobs and the German Economy, *Review of European Economic P*olicy, 45 (1).

[174] Aleksix and Lovric 2014 Energy Consumption and Environment Implications of Wired Access Networks

[175] See https://ec.europa.eu/digital-agenda/radio-spectrum-committee-rsc

This option will incrementally adapt the framework to the on-going and expected developments in terms of ubiquitous connectivity and 5G deployment and therefore to gradually introduce more consistency in some aspects of Member States' spectrum management by (i) defining spectrum-related objectives and principles in the framework, (ii) proposing a Commission Article 19 Recommendation on some aspects of spectrum assignment, (iii) including a voluntary pluri-national auction procedure and clarifying the possible related common conditions and (iv) proposing measures to support deployment of very dense networks of small cells and access to Wi-Fi networks. This option consists of the following specific measures:

(i) Introducing more **specific spectrum-related objectives and principles** in the framework, including bringing together those in RSPP and in the current directives, to guide Member States when managing spectrum at national level, this would include general principles of transparency, defining criteria to determine the amount and type of spectrum to be assigned; general principles regarding timing for accessing spectrum across the EU and linking assignment deadlines to allocation deadlines as well as regarding license duration; general principles applicable to licence fees to ensure optimal use of spectrum and avoid resulting prices which may stifle investment and service development; objectives and principles on the levels of territorial coverage to be achieved, such as full territorial coverage as a component of spectrum efficiency; principles fostering sharing of spectrum and infrastructure and spectrum trading and leasing in EU secondary spectrum markets; strengthening the objective of promoting an efficient use of spectrum through the revocation of existing rights in case of non-use or non-compliance with license conditions and by setting minimum technology performance levels; creating appropriate incentives to free spectrum by existing users; and improving the protection of unlicensed band users. Half of the respondents to the Public Consultation agreed that the current regulatory regime has moderately achieved the aims of providing a single market for operators with sufficient transparency and regulatory predictability as well as ensuring effective and efficient use of spectrum. While public authorities could envisage limited coordination through common deadlines for making a band available or the common definition of certain general principles, many economic actors seek greater harmonisation of award methods and procedures (need and timing of spectrum release and selections, general principles and objectives, transparency, ex-ante competition assessment, refarming conditions, timing of advanced information to market participants, measures to promote use efficiency, spectrum packaging) so as to enhance legal certainty, support investments, promote competition, provide more clarity to manufacturers and support economies of scale. Equipment vendors supported harmonisation for predictability, but warned that timetables alignment should not delay early movers.

(ii) Accompanying these objectives with a separate non-binding **Commission Recommendation** based on Article 19 Framework Directive which would set out criteria for defining the timing of awards and renewals, common criteria for awards process and design, award fees and payment conditions and defining the most relevant assignment conditions for investment decisions and fostering the single market, such as licence duration, means to define and achieve coverage obligations, auction fees, trading, leasing and sharing conditions, refarming, spectrum efficiency-related technical requirements, market-shaping measures such as spectrum caps, spectrum reservation or wholesale obligations based on Article 5 RSPP. This Recommendation would be initiated immediately after the adoption of the review proposal, building on the RSPG Report on efficient awards adopted in February 2016 or even adopted at the same time.

(iii) Including a **voluntary pan-EU or multi-countries assignment** procedure in the framework which provides Member States[176] with the possibility to jointly organise a spectrum auction where national or pluri-national licences are granted in line with a common timetable and conditions.

[176] For example, neighbouring countries or regions with similar market structures.

(iv) **Introducing provisions on deployment of small cells** to reduce costs of deployment of very dense networks and access to Wi-Fi to meet the exponential demand for ubiquitous connectivity while providing the IoT industry with low cost spectrum[177]. Many public authorities and private respondents to the Public Consultation supported the deployment of commercial/municipal Wi-Fi networks in public premises.

(v) Introducing **a coordination mechanism** to ensure consistent spectrum cross-border coordination outcomes, to enhance the current RSPG good offices work.

Option 3 –Binding and enforceable rules for enhancing coordination of spectrum management in the EU with greater focus to adapt spectrum rules to the future 5G challenges

This option would include all proposed measures in option 2, items (i), (iii) and (iv). However, the spectrum-related objectives and principles in the framework are in this option accompanied by (i) legally enforceable instruments (in lieu of a Recommendation) and (ii) a peer review mechanism, allowing BEREC, Commission and Member States to review individual Member States' planned national assignment procedures. Moreover, this option will set out greater emphasis on the investment environment for dense 5G networks as well as on ensuring greater consistency with regard to Member States´ measures affecting the competitive market conditions and economic regulation.

This option also proposes to enhance the advisory status of RSPG. This option envisages the following specific measures:

(i) Give more prominence to general authorisations vs. individual licenses to ensure that national authorities deliver the most appropriate future licensing models (notably in 5G context). This will allow more flexibility in accessing spectrum and to facilitate a hybrid combination of license-exempt (through general authorisations) and licensed spectrum (individual licenses). To do so, increased protection of unlicensed use of spectrum vs. individual exclusive licenses in the band and in respect of out-of-band interference is needed.

(ii) Introducing, on top of the general objectives and principles in the framework legislation, some substantive provisions and the possibility for the Commission to complement these via binding guidance criteria set out in implementing decisions regarding the most relevant elements of spectrum assignment processes. Such set of measures would aim at enhancing consistency in spectrum management in the EU in areas such as the coordination of assignment timing (deadlines) and regarding the most relevant assignment conditions for investment decisions and fostering the single market such as a) methods for determining coverage obligations, including major transport infrastructures in the EU, as well as powers to impose mobile network sharing where needed to contribute to cover the most challenging areas where replication is impracticable and end-users risk being deprived of connectivity; b) more prominently promote sharing (including licensed shared access) as well as creating the right conditions for spectrum trading and leasing in secondary spectrum markets through the introduction of licences duration of at least 25 years, and; and c) injecting greater consistency with regard to market-shaping measures such as e.g. spectrum blocks, spectrum caps, spectrum reservation or wholesale obligations based on Article 5 RSPP. Conversely, it could also include some flexibility for Member States to allow alternative uses of harmonised spectrum subject to certain conditions where there is no market demand for the harmonised use of the spectrum and provided that the foreseen harmonised use is generally not pre-empted if market demand

[177] These provisions were originally proposed in the proposal for a regulation laying down measures concerning the European single market for electronic communications and to achieve a Connected Continent, and amending Directives 2002/20/EC, 2002/21/EC and 2002/22/EC and Regulations (EC) No 1211/2009 and (EU) No 531/2012

appears. Most operators agree on the need for more consistent binding assignment conditions to increase investment predictability, and, in particular, to support and ensure objective, transparent and non-discriminatory treatment of operators. These binding conditions would also enable transparency and alignment of timing and conditions of licence renewals (including longer licence duration and use-it-or-lose-it clauses), flexibility to trade, lease or share, technology and service neutrality limits, refarming conditions, technical performance and interference mitigation before assignment decisions are taken. On greater harmonisation of coverage obligations , while there are some reserved views in the Council, the Parliament supports the harmonisation of methods for defining coverage obligations in the Union.

(iii) Establishing a peer-review mechanism within the EU body of competent national regulators on NRAs´ draft national measures concerning the economic and regulatory market shaping measures of spectrum assignments. This mechanism would foster common interpretation and implementation across the EU of those elements of spectrum assignment which most impact business decisions and network deployment. Such mechanism would require NRAs to notify to BEREC -in parallel to the national consultation- such measures for review and issuance of a non-binding opinion.

(iv) This option entails reviewing the current institutional set-up for BEREC (and the competences of its component NRAs), while reflecting RSPG's enhanced advisory role in the framework by systematically seeking RSPG advice prior to the adoption of Commission implementing measures in the spectrum area (excluding technical harmonisation measures), so that the relevant bodies provide better support and follow a more strategic and EU-oriented approach when advising the Commission and Member States on spectrum management (see section 4.5.1).

Option 4- EU harmonisation of spectrum management and establishment of an EU regulator

This option builds on option 3 but establishes more far reaching measures essentially in the mechanisms to enforce EU spectrum policy. This option envisages:

(i) Establishing an EU regulator in charge of EU-level spectrum issues amongst other competences;

(ii) Creating an implementing and enforcement mechanism which would give powers to the EU regulator to review (possibly via a system of notifications) and veto any national assignment plan that deviates from internal market rules and common EU assignment criteria without valid justification related to specific national circumstances. Alternatively, the power to veto national measures could be entrusted to the Commission, with the assistance of the analysis and recommendation by the EU regulator (close to the solution of the quasi-binding powers of the EU financial services authorities).

(iii) Giving the Commission and the EU regulator implementing powers to create a pan-EU or pluri-national assignment procedure for specific bands and to establish its conditions of use. (see option 4 on Institutional governance).

(iv) Giving the Commission implementing powers to set out criteria for the classification of regions throughout the EU by similar characteristics (in terms of density, geography, network deployment, etc.) and for determining the most appropriate obligations or assignment conditions per class of regions.

4.2.2 Discarded options

This section outlines the options which have been discarded. A more detailed analysis can be found in Annex 3 on discarded options as well as the IA support studies.

- Full harmonisation
- Creation of a single EU spectrum license that sets out pan-European rights of use of spectrum
- Grant delegated powers to the Commission to further define harmonised conditions for assignment of spectrum

Member States reject full harmonisation but are open to a more common approach to spectrum management and at least some could accept a peer review of national assignment plans as well as a certain level of coordination of conditions and selection processes, in particular as regards timing.

4.2.3 Impacts

4.2.3.1 Option 1 – Baseline

In option 1 no regulatory intervention to address the problem defined above will be taken.

Economic Impact

This option is by its very nature varied and unpredictable, the lack of coordinated EU action means it is not possible to pre-determine which Member States will take which decision within which deadline, thus making the variables of the cost and benefit analysis too wide to determine an estimate per country. However, it is clear that under this scenario, some EU countries will miss their DAE targets, and that insufficient provisions will be made to enable the EU to overcome difficulties faced in the introduction of 5G that is expected to take place from 2020 with commercial availability between 2020-2025. Although under the current framework there is certain scope for ad-hoc technical harmonisation that is relevant for 5G deployment, the existing spectrum management tools at the EU level neither provide sufficient regulatory certainty (i.e. timely spectrum availability and relevant authorisation conditions) nor create the necessary conditions for investment and innovation.

The largest part of the opportunity cost would fall on those countries that are least advanced in terms of LTE coverage and market penetration. Taking the population coverage figures reported in the DESI this includes for instance Bulgaria, Slovakia, Romania, Poland and France, all of which have coverage figures below 80%. In comparison, impacts of this option on Member States such as Denmark, Sweden, the Netherlands and Slovenia would be much less pronounced given their current situation. A DG ECFIN study estimates the impact of spectrum reform in attaining the DAE targets at 0.3-0.4% of EU GDP[178]. In the absence of such reform under Option 1, this translates to an opportunity cost of between **EUR 41 and EUR 55bm per year**.

In terms of future 5G deployment, this option will not create the right conditions for an innovative and competitive ecosystem that would underpin full benefits of 5G technologies in the EU.

Social and environmental impacts

There are four main social impacts that need to be taken into account in all the options:

[178] Dimitri Lorenzani, Janos Varga, The Economic Impact of Digital Structural Reforms. See: http://ec.europa.eu/economy_finance/publications/economic_paper/2014/ecp529_en.htm

- Failure to release the potential for employment associated with reaching the DAE targets in all EU Member States and with successful (i.e. fast and coordinated) deployment of 5G services (see also Option 3 and 4)
- Increasing divergences in terms of mobile ubiquitous connectivity in those areas that lag behind in the deployment of 4G and the introduction of 5G services. As a consequence, we would be likely to see a worsening of the digital divide, with some areas (e.g. large cities in some Member States) benefiting from at least a limited deployment of 5G services while the majority of European would not.
- Reduction in road accidents and increase in online shopping as a result of 5G. Collectively, these are estimated as a potential €12bn per annum from 2025 in a scenario where 5G is fully deployed (i.e. Option 4)
- Loss of potential in the vertical industries that would benefit most from deployment of 5G with repercussions for users of those industries (e.g. in e-health, transport, utilities and automotive sectors). For instance, this could mean lower social inclusion and greater health inequalities.

The environmental impacts that need to be considered include the potential loss of efficiencies associated with the introduction of 5G e.g. in terms of smart cities, efficiencies in transport and automotive and in energy usage (e.g. smart meters). A Commission study on the costs and benefits of 5G[179] has estimated total environmental benefits in the four verticals most likely to benefit from 5G deployment at 50bn per annum across the EU These environmental benefits would need to be set against potential environmental costs caused by the need for a greater number of masts, small cells, etc. Nevertheless, according to the same study, 5G deployment is estimated to lead to a significant environmental net benefit.

Under option 1, do nothing, these net social and environmental benefits would not materialise or they would not materialise as quickly as under the other options. Each year of delay in full deployment of 5G would carry a potential environmental and social opportunity cost of at least EUR 60bn with it (based only on the quantified estimates in study SMART 2014/0008).

Under this option Member States would retain a large margin of discretion in spectrum management. This will consequently lead to:

i) a continued divergence in the timing of assignments between early movers and late movers which will lead to continued issues regarding deployment of new services across the Single market, especially in border regions. Given this disincentive to act quickly, delays in spectrum assignments are likely to persist;

ii) the current spectrum rules of the framework including assignment mechanisms and license conditions (refarming) would not gain in clarity and predictability. Spectrum conditions for assignment will continue to vary significantly across countries (e.g. license duration, fees, usage conditions, etc.). Licence durations differ greatly among the Member States, ranging from 15 year license (DE) to indefinite (UK) depriving EU secondary spectrum markets to flourish.

iii) There would still be no real attempts to avoid revenue maximisation being the main objective of national treasuries when setting spectrum fees.

iv) a continued fragmentation of the Single Market which in turn will mean that equipment manufacturers and network operators will not benefit from greater regulatory certainty that a coordinated approach to spectrum conditions would bring. There is, thus, a risk that the 4G scenario (Europe to lag behind the US and other regions on network and equipment investment) would be repeated with further significant opportunity costs. Estimates of 5G deployment show

[179] Commission Study on the 'Identification and quantification of key socio-economic data to support strategic planning for the introduction of 5G in Europe' SMART 2014/008

that these costs could be even more substantial given the potential benefits of a coordinated approach to 5G at European level.

4.2.3.2 Option 2 – Non-binding EU guidance for enhancing consistency of spectrum management in the EU

This option is unlikely to lead to very significant short-term changes in the way spectrum is managed, it has the potential to "step-by-step" encourage consistency. It does not grant any new powers to the Commission and the proposed general principles can be implemented by Member States with a great margin of discretion.

Economic Impacts

The introduction of more specific spectrum-related objectives and principles will create Member States peer pressure to allow a timely access to spectrum of innovative 5G services across the EU – in particular, if a minimum territorial coverage (including major transport infrastructure) is achieved, it will facilitate the deployment of 5G verticals like connected cars. Furthermore, when general principles applicable to licence fees are set in place, revenue maximization in auctions will no longer be at the core of auction design. Thus, operators will have more capital available for investing in high-performance networks to meet the ubiquitous connectivity needs.

Although option 2 creates a frame that promotes best practices, its non-binding nature will not ensure consistency of radio spectrum management in the Union, such a cautious approach will not have positive impact on the market (including the promotion of EU secondary spectrum markets) and, as it is the case of baseline scenario, fails to achieve a single market approach to spectrum policy and management as spelled out as an objective in the DSM.

There is broad consensus among policymakers, industry and scholars that greater coordination of spectrum assignments and management is necessary. A recent European Parliament report states: "Stronger coordination of spectrum management is likely to foster innovation, allowing the creation of economies of scale at the European level when harmonised spectrum is assigned and the simultaneous use and reduction of uncertainties to speed up the investments in 4G networks."[180]. Greater coordination on spectrum is also endorsed in the European Council Conclusions (June 2016)[181] that recognized the need to create right conditions for stimulating new business opportunities by better coordinating spectrum assignment modalities.

This is echoed by main operators and other stakeholders in *The Manifesto for a timely deployment of 5G in Europe*[182] and a GSMA report which finds that "a key component of the strategy […] includes proposals for coordinated EU-wide conditions for spectrum policy management. […] various factors - including the timing and design of spectrum auctions; the cost, the duration and the terms of licences - all have a major impact on the availability, cost, quality and reach of mobile broadband services"[183].

In addition, academic research such as Bohlin, Caves and Eisenach (2014) concurs that "the performance of EU mobile wireless markets would be improved and the consumer welfare increased by reducing fragmentation among suppliers, thereby allowing them to capture economies of scale and scope; and, by removing barriers and increasing incentives for investment and innovation, thereby speeding the deployment of next generation wireless

[180] European Parliament, Reforming EU telecoms rules to create a Digital Union, 2016
[181] http://data.consilium.europa.eu/doc/document/ST-26-2016-INIT/en/pdf
[182] https://ec.europa.eu/digital-single-market/en/news/commissioner-oettinger-welcomes-5g-manifesto
[183] GSMA, socio-economic benefits of greater spectrum policy harmonisation across Europe, November 2015

broadband infrastructures and accelerating the growth of the mobile wireless ecosystem"[184]. In addition,

Social and environmental impacts

The potential environmental and social impacts of this option are the same as those described under Option 1. If this option does not lead to voluntary take-up among Member States, the impacts would be an opportunity cost of at least EUR 60bn per year as of 2025, as a result of 5G opportunity cost. At the same time, this option provides Member States with flexibility regarding how to assign spectrum and under what conditions.

In conclusion, if all Member States voluntarily take-up the Recommendation, this would lead to benefits that are very similar to those under option 3 (see quantification below). In such a scenario, it is likely that costs would be somewhat lower than under option 3 due to the greater level of flexibility afforded to Member States under this option which would allow them to tailor specific elements of timing of assignments and conditions of usage to their national / local needs. Although a Recommendation lacks the legal certainty of a binding measure, this instrument, if swiftly adopted could influence important spectrum assignment auctions, such as those for the 700 MHz band which will be assigned for wireless broadband by 2020, in almost all Member States. The Review, which is currently under preparation, is unlikely to be implemented until shortly before 2020.

Conversely, if none of the Member States take up the voluntary measures, then this option does not address the problems described in this section and it does not differ significantly from the baseline scenario of option 1. Such an outcome would not contribute to reducing fragmentation across the Single Market, nor would it lead to greater certainty for operators in terms of the timing and usage conditions of spectrum in future, thus leading to minimal economic impacts overall.

4.2.3.3 Option 3 – Binding and enforceable rules for enhancing coordination of spectrum management in the EU with greater focus on adapting spectrum rules to future 5G challenges

The main difference between option 2 and option 3 is the introduction of a peer review process to improve coordination and the use of a binding instrument instead of a Recommendation – a binding measure would introduce an obligation for all to comply and would therefore provide greater certainty to market operators.

Economic impacts

This option will have a number of positive impacts. First, long-term licence durations of at least 25 years proposed in this option will increase stability and certainty of investments as well as innovation requirements. In addition, long-term licence duration will create the right conditions for EU secondary spectrum markets to flourish. The potential benefits of spectrum markets for increasing the efficiency of spectrum allocations is widely acknowledged as spectrum markets allow a more efficient and dynamic use of spectrum. Allocations of spectrum to different applications by regulatory interventions are typically static, i.e. the international negotiations required for spectrum regulation[185] apply for many years. Hence changes in traffic demands, potential applications, user preferences, and available technologies over time and locations could

[184] Bohlin, Caves and Eisenach (2014), Mobile Wireless Performance in the EU and the US: Implications for Policy, Communications and Strategies, no. 93, 1st Q. 2014, p. 35. This research was supported by the GSMA.

[185] The World Radiocommunications Conference (WRC), the International Telecommunications Union (ITU) conference which revises the binding Radio Regulations at least every 3 years.

lead to inefficient use of spectrum resources. The secondary market for spectrum allows a dynamic allocation of spectrum resources by adapting to these variations over time- and geographic-scales. Thus, new technologies and services have more easily access to spectrum.

Second, setting in place a framework for tailored coverage obligations (that will also include main transport infrastructures) to be defined by Member States will create the right conditions to meet the ubiquitous connectivity needs of the DSM to the extent feasible through 5G wireless. Consistency of assignments and usage conditions will be improved and costs would be reduced compared with traditional assignments. The aim of this option would be to increase coordination and speed of assignments[186] – though it would not go as far as option 4 in terms of centralising spectrum governance at EU level.

Thirdly, it will promote a flexible and efficient use of spectrum to respond to future 5G challenges. A move to a licensing model more extensively based on general authorisations especially for higher spectrum bands, if accompanied by cross-border harmonisation, would mean that operators could have the same spectrum all over Europe, with similar conditions. Such a system would rapidly speed time to market, as there would be no decisions needed (either at national or EU level) on who gets what spectrum, access to spectrum will be faster for operators. When answering to the Public Consultation, many market actors and public authorities considered that a general authorisation regime would foster innovation and competition both for services and end-devices.

Finally, the binding peer review process of economic and regulatory elements concerning market shaping aspects of spectrum assignments will also inject greater consistency in the EU single market, in particular, with regard to spectrum assignment conditions. This would mean in practice that prior to granting, renewing or amending individual rights to spectrum, NRAs will have to inform BEREC and the Commission on the market elements of such a measure. BEREC will issue to the NRAs, together with a copy to the Commission, a public opinion on the draft measure assessing the impacts to the internal market on the suitability to bring about timely connectivity investments.

Greater consistency on spectrum assignments will ensure Europe's leadership in a synchronized roll-out of 5G networks and cross-border 5G services which is endorsed by leading telecom operators, IT vendors and industrial groups in *The Manifesto for a timely deployment of 5G in Europe*[187]. In total it is estimated **that benefits of €146.5 billion per annum** will arise from the introduction of 5G capabilities. €95.9 billion will arise from first order benefits in the four verticals i.e. Automotive, healthcare, transport and utilities. Benefits are distributed across the four sectors between strategic (€32 bn) and operational (€12 bn) benefits arising to organisations within the verticals. Relatively high levels of benefits were also recognised for the consumers of goods and services (€24 bn) from the verticals. Third party benefits (€27 bn) reach a similar level of magnitude but they primarily come from one source, the impact of telematics information for third parties in the automotive vertical.

Table 7 – Benefits for verticals

Verticals Benefits	**Automotive (€ mn)**	**Healthcare (€ mn)**	**Transport (€ mn)**	**Utilities (€ mn)**	**Total (€ mn)**

[186] As explained in section 1.1.1.the example of 4G shows that there is a link between the timing of spectrum awards, market penetration and ultimately economic growth.
[187] https://ec.europa.eu/digital-single-market/en/news/commissioner-oettinger-welcomes-5g-manifesto

Strategic	25,800	1,100	5,100	775	**32,770**
Operational	1,800	4,150	3,200	2,700	**11,850**
Consumer	20,900	207	-	3,000	**24,110**
Third Party	27,100	72	-	-	**27,170**
Total	**75,600**	**5,530**	**8,300**	**6,470**	**95,900**

Source: Study on the Identification and quantification of key socio-economic data for 5G in Europe SMART 2014/008

One of the key benefits (€10.5 bn) identified in rural areas is the ability of 5G to address the digital divide and overcome difficulties in providing ubiquitous broadband connectivity in more rural areas where current fixed networks struggle to provide adequate service. 63 per cent of the total vertical and environmental benefits of €146.5 bn per annum in 2025 are forecast to arise for businesses and 37 per cent will be provided for consumers and society.

However, the downside of this proposal will be the time frame of the EU policy-making process. Given the Commission proposals on the telecom review will likely be adopted by 2018, it will not be able to influence the assignment of the 700 MHz in a considerable number of Member States but that of only the second round of other important assignments of spectrum for wireless broadband, such as the 900 MHz, 1800 MHz and the 2 GHz (LTE bands renewals), as well as of new bands, with probably quite different characteristics, identified for 5G. Furthermore the peer review on market shaping elements of national plans for spectrum awards could lengthen the process in case the initial opinion triggers further discussions between participating authorities, or between the responsible national authority and its domestic stakeholders.

Social and environmental impacts

As for option 1 and 2, the environmental and social impacts need to be expressed in terms of potential opportunity costs compared with an ideal scenario of fast and successful 5G deployment as estimated in the study on the costs and benefits of 5G SMART 2014/0008. Under this option, 5G is deployed comprehensively and expeditiously in the Union and this would mean that all social and environmental benefits would materialise as of 2025 as estimated in the above study. This would lead to a total quantifiable impact of EUR 60bn per annum as of 2025 in the Union.

4.2.3.4 Option 4 - EU harmonisation of spectrum management and establishment of an EU regulator

This option will unify spectrum policy in the EU. Operators will easily develop their activities throughout the Union within an EU predictable framework. Under this option spectrum management will slowly move from a national (MS) to a supranational entity, the European Union in some bands (ECS bands).

Economic impacts

This option would lead to centralised decision-making which would likely be faster than the current governance arrangements or the more tightly coordinated procedures proposed under option 3. In addition, the introduction of a pan-European assignment procedure would create a "true" single market for spectrum resources that cuts across national boundaries. Such an option would be most likely to allow the European Union to make fast and coordinated spectrum decisions. Such a centralised procedure would mean that the EU has at its disposal the governance instruments to be as responsive as possible to spectrum needs in relation to 4G and –

more importantly - for the future introduction of 5G across the EU, which is estimated to give rise to benefits of 146bn EUR per year (as described in option 3)[188].

However, under this option Member States will not be able to assign spectrum in the way they consider most appropriate according to their national context and spectrum demand. This would create some socio-economic distortions as the needs of the variety of spectrum users and customers are different from country to country. There would be a risk that a pan-European procedure impedes faster Member States to move forward and potentially sterilizes a number of (national) spectrum bands for innovative services.

Although option 4 would not remove spectrum as a constraint to the development of different sectors, it is, however, the option that comes closest to providing the EU with the governance tools required to address spectrum constraints. In addition, this option will provide a centralised governance framework and set up an EU regulator that will also have competences on spectrum management. The impacts of option 4 of the institutional governance are included in section 4.5.3 .

Social and environmental impact

Under this option, like for option 3, 5G is deployed comprehensively and expeditiously in the Union and this would mean that all social and environmental benefits would materialise as of 2025 as estimated in SMART 2014/008. This would lead to a total quantifiable impact of EUR 60bn per annum as of 2025.

4.2.4 Comparison of options

4.2.4.1 Effectiveness

The effectiveness of non-binding measures under option 2 would depend to a large extent on the willingness of individual Member States to adopt the relevant guidance. Evidence from existing attempts to offer 'best practice guidance' in certain spectrum management activities suggest that given diverging interests, take up of such guidance might not be very high, thus undermining the effectiveness of this option.

Option 3 is most flexible in its design because it combines both voluntary and binding measures. Thus, this option 3 would be able to focus on the "quick wins" that would enable the Union to prepare the ground for the deployment of 5G and to deliver the DAE while leaving more controversial / less essential aspects for non-binding instruments. In addition this option would allow sufficient flexibility to generate the economies of scale and legal certainty required for operators who need to invest in mobile networks and infrastructure while at the same time offering sufficient protection to other spectrum users (including broadcasters[189], unlicensed users, etc.) and could be implemented in a timescale that is necessary to support the introduction of 5G.

Option 4 is ultimately most effective in terms of synchronising awards and coordinating license conditions. However, this may come at the expense of efficiency due to loss of flexibility to adapt to local conditions. In addition, any impacts would likely only come into effect after a very long time, given the need for substantial adaptation in terms of governance processes and for a

[188] DG CONNECT study on 'Identification and quantification of key socio-economic data to support strategic planning for 5G in Europe' SMART 2014/0008

[189] Any EU action should comply with the ITU Radio Regulations and the Geneva Agreement of 2006 (GE06) which protects digital terrestrial television in cross-border territories and could thus geographically constrain mobile broadband deployment. In addition, the RSPG opinion on long-term strategy for the future use of the UHF band protects broadcasting services in the sub-700MHz band until 2030.

long negotiation to develop the required legislation. This would in turn jeopardise the main aim of the intervention: i.e. facilitating preparation for the development of 5G (expected for 2020).

4.2.4.2 Efficiency

Option 4 is least efficient because it will require substantial reform of current governance processes and a long time to implement, especially given the likely reluctance of many Member States and among stakeholders. Option 3 will also require significant governance reform though the extent of this will depend on the range of aspects that would fall under a binding legislative instrument. Individual measures could be implemented more efficiently, speeding up the introduction of the most important factors. The creation of a peer review mechanism which could issue non-binding advice on economic and regulatory market shaping measures of spectrum assignments to individual MS and/or NRAs would be an efficient way to pool national resources and ensure that national authorities remain committed to common goals. Finally, option 2 would not entail any significant regulatory or enforcement costs nor would it lead to major changes in terms of spectrum governance.

4.2.4.3 Coherence

All options are coherent with broader EU policy objectives including the DAE, the development of the DSM and the upcoming development and roll-out of 5G in Europe. In addition, the options are internally coherent with clear links to the objectives of the review. Option 3 and 4 propose binding and centralised (only for option 4) regulatory instruments which could lead to the greatest level of internal coherence. Option 2 leaves greater flexibility to individual Member States and would therefore lead to a greater level of divergence and a lower level of coherence in terms of outcomes in line with the objectives of the review.

4.2.4.4 Impact on stakeholders

As regards the impact on stakeholders, MNOs (including SMEs), equipment manufacturers and consumers or business end-users would benefit most from the preferred option (option 3). This option would lead to more coordinated spectrum assignments and faster deployment of services. Spectrum is a key enabler of the Digital Single market which benefits cross-border operators and manufacturers of equipment that can operate at the same time, across the EU. SMEs would benefit mostly as a result of reductions in the cost of access to spectrum due to a greater emphasis on general authorisations as opposed to individual licenses (licensed)[190]. End-users (consumers and businesses) would benefit from earlier availability of innovative new services including deployment of new technology such as 5G, in particular in countries which would otherwise have delayed deployment of 5G services.

Option 2 would lead to greater uncertainty than Option 3 because it is based on voluntary guidance rather than a binding instrument. As a result, the eventual impact of this option on different stakeholders would depend on the extent to which the various provisions in the option are taken up in different Member States. In practice, take-up would be unlikely to be even across the Single Market, thus eliminating some of the positive impacts of scale for equipment manufacturers and for MNOs. Lack of certainty about take-up would mean that investment in new services / deployment of new technology is lower than under option 3, thus leading to a more mixed picture for end-users (businesses and consumers). SMEs would not benefit from reduced access costs to spectrum since there would not be a greater emphasis on general

[190] The value of access to unlicensed spectrum for new, innovative spectrum usage has been proven recently in the area of IoT. Actually, in available unlicensed bands, several networks based on various technologies have been rolled out – amongst others – by SMEs to provide connectivity for IoT applications and allowing other SMEs to implement smart city applications.

authorisations. However, SMAs – especially in smaller countries with fewer resources – would benefit from additional European guidance.

Option 1 – baseline would not address the problems identified in this report and therefore leads to negative impacts for all stakeholders. SMAs and other spectrum users other than MNOs would not be affected by this option. Finally, option 4 would lead to positive impacts that are similar to option 3 with the main difference lying in the significantly longer implementation delay which would mean benefits materialise only after 2020. This delay would be of particular significant for end-users (consumers and businesses) and for MNOs. For SMAs, this option is less attractive because it transfers significant powers to the European level and thereby reduces the ability of national SMAs to adapt spectrum assignments and conditions to local needs.

Effects on stakeholders are summarised in the table below:

Table 8: Effects on stakeholders – spectrum options

	Option 1: Status quo	Option 2: voluntary	Option 3: binding	Option 4: EU regulator
End-users (consumers and business)	Negative – late and uncoordinated deployment of 5G and lack of action on recent 700 MHz auctions means businesses are unable to develop new services (e.g. in transport, automotive, healthcare, utilities etc.) and consumers (including businesses) don't benefit from innovative services	Mixed – while this option could be in place fast, there is a high risk that voluntary measures would not be taken-up by many MS, leaving the same results as under option 1	Positive – this option delivers a coordinated approach to spectrum assignment and usage across the EU including for 5G (though it may come too late to influence 700 MHz assignments in some Member States)	Mixed – while this option sets up a governance structure to address the problem, the complexity of negotiating this set-up means it will come too late to influence 700 MHz auctions and will delay 5G deployment
SMEs	Negative – the impacts would not differ from those for other end-users	Mixed – the impacts would not differ from those for other end-users	Positive - the impacts would not differ from those of other end-users. Swift implementation of 5G would create opportunities for innovation and entrepreneurship which would benefit SMEs in particular.	Mixed - the impacts would not differ from those of other end-users. Swift implementation of 5G would create opportunities for innovation and entrepreneurship which would benefit SMEs in particular

			General authorisations could provide greater opportunities for SMEs to gain access to spectrum which (as regards the main ECS bands) is now only accessible to large companies with the financial power to purchase exclusive rights (e.g. MNOs, etc.)	
MNOs	Negative – this option risks repeating the 4G scenario where Europe lagged behind other regions for 5G with insufficient investment	Mixed – while this option could be in place fast, there is a high risk that voluntary measures would not be taken-up by many MS, leaving the same results as under option 1	Positive – this option delivers a coordinated approach to spectrum assignment and usage across the EU including for 5G (though it may come too late to influence 700 MHz assignments in a number of Member States)	Mixed – while this option sets up a governance structure to address the problem, the complexity of negotiating might delay 5G deployment
Other spectrum users (e.g. broadcasters, PMSE, etc.)	Nil – this option would continue the current set-up which engenders significant local variability, continued erosion of spectrum for some users and uncertainty about future spectrum availability	Nil - This option would likely not differ significantly from option 1	Uncertain - This option provides a greater level of regulatory certainty and consistency across MS, impacts on other spectrum users would depend on specific decisions taken by but the peer review mechanism could ensure that local needs of different spectrum users continue to be fully taken into account.	Uncertain - This option provides the greatest level of regulatory certainty – impacts on other spectrum users would depend on specific decisions taken by the EU regulator. There would be less scope for adaptation to local needs under this option.
Equipment manufacturers	Negative – this option repeats the 4G scenario (late & uncoordinated assignments) for 5G and therefore fails to provide legal certainty and it fails to capitalise on the size of the Single Market	Negative – this option risks repeating the 4G scenario for 5G and therefore fails to provide legal certainty and it fails to capitalise on the size of the Single Market	Positive – this option provides greater regulatory certainty and consistency to manufacturers proving them with incentives to invest now in order to serve the Single Market	Positive – this option provides greater regulatory certainty and consistency to manufacturers providing them with incentives to invest now in order to serve the Single Market

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4.2.4.5 EU added value

As it has been discussed above, Member States acting individually cannot capitalise the full potential of spectrum resource – the deployment of 5G will require a coordinated approach to ensure sufficient and adequate spectrum is made available on appropriate terms across the EU.

At the same time, the ability of Member States to adapt their spectrum decisions to the local and national context remains important. Hence, while binding instruments may be required in some instances (e.g. timing of assignments and certain usage conditions), it is not clear that this should be the case for all aspects of spectrum governance. Indeed, care should be taken that centralisation of decision-making is proportionate and limited to those areas with a clear cross-border element. For instance a fully centralized spectrum management in the EU, as foreseen in option 4 may be disproportionate given the very nature of spectrum as a natural national asset – the issue can perhaps be addressed sufficiently at a Member State level without requiring full harmonisation of spectrum management at EU level.

4.2.4.6 Summary table comparing spectrum options

	Effectiveness				**Efficiency**	**Coherence**			**EU added value**	
	Ultra-fast coverage	Ultra-fast take-up	Universal availability	Business Access	Cost complexity and enforceability	Disruption	Internal	External	Subsidiarity	Proportionality
O1 Status quo	0	0	0	0	0	0	0	0	0	0
O2 non-binding	0/+	0/+	0/+	0/+	0	0/+	0	0	+	+
O3 binding	**++**	**++**	**+**	**++**	**++**	**+**	**+**	**+**	**++**	**++**
O4 EU regulator	++	++	+	++	+	++	++	+	--	--

4.2.5 The preferred option

The Commission considers that option 3 on spectrum best fulfils the overall and specific policy objectives of the review of the telecom framework as presented in section 3.

This option does involve some reduction in the current degree of national flexibility with regard to spectrum assignments. The pay-off for this loss of flexibility is faster spectrum assignments (especially in countries that are currently not among the fastest) and more consistent obligations and usage conditions across the Single Market to support network deployment. In parallel,

greater consistency of assignments, particularly on long-term licence conditions of at least 25 years, will foster spectrum trading and leasing and pave the way for the establishment of an EU secondary spectrum market. These effects would not be achieved effectively with a non-binding instrument which would rely on Member States to take-up voluntary guidelines. Furthermore, a peer review mechanism will lead to further alignment in market shaping elements of spectrum assignments while maintaining national margin of assessment or detailed implementation aspects.

This option leads to a coordinated approach to spectrum management that allows a timely deployment of 5G in the Union while enabling the integration between technological innovation and access to ubiquitous and VHC networks. In total it is estimated that benefits of **€146.5 billion per annum** will arise from the introduction of 5G capabilities. €95.9 billion will arise from first order benefits in the four 5G verticals i.e. Automotive, healthcare, transport and utilities.

4.3 Universal Service

4.3.1 Options

Option 1 - No change

This option is based on the Universal Service policies in place covered by the Directive on Universal Service and Users' Rights and reflects possible developments of these in the absence of new EU-level action.

The aim of universal service is currently to provide a safety net ensuring that the most vulnerable in society as well as those in more remote areas could receive basic electronic communication services. At the time of the introduction of the USD in 2002, public pay phones and physical directories were still in widespread use and the need to have access to telephony services at a fixed location was considered a vital objective, alongside the more forward-looking concern that users needed access to a connection that permitted a non-broadband 'functional Internet access'. The Universal Service provisions cover connectivity and services, as well as the affordability of tariffs and accessibility for disabled users. They permit financing of any 'net cost' of USO either through a levy on operators or through public funds.

In the context of this option, the current situation would remain unchanged. The Member States will likely take increasingly different approaches in the universal service obligation by unilaterally removing outdated services from the scope on the national level. The consistency and coherence of the universal service regime across the Member States will dwindle without a common approach towards the inclusion of broadband in the universal service scope. The sectorial financing mechanism will continue to be a possibility for financing. The costs of financing the universal service obligation in the Member States would likely remain the same, depending on possible national approaches.

The majority of **Member States and regulators** agree that universal service has been effective and efficient in safeguarding end users from the risk of social exclusion, while **most of the operators** see little or no impact and efficiency at all.

Option 2 - Minimum adaption to trends

Only Public Access Telephony Services (PATS) and the provision of functional Internet access, are mandatory at EU level and can be financed from a universal service funding mechanism supported by the sector. However, Member States will still have the flexibility to add old legacy

universal services (directories/directory enquiries and public pay phones) at national level. If a Member State decides that other services shall be universally available in its territory, it can do so under stricter provision of Article 32 USD: such services can only be financed from the state budget under observance of State aid rules.

In the public consultation, most market actors, **Member States and consumer organisations** submit that obligations related to disabled end-users should be incorporated in horizontal law. Respondents stress that any obligations should apply equally to all market players. Through the broader implementation of the provisions of Article 23a of the Universal Service Directive, a wider choice of services and tariffs for disabled users could be achieved.

Option 3 - Incremental adaptation to trends with the focus on broadband affordability

This option builds on option 2 and, additionally, includes the provision of affordable broadband in the universal service scope. In this option affordable PATS is maintained in the USO scope. At the EU level, broadband would be defined by referring to a functional internet access connection defined on the basis of a minimum list of on-line services (web-browsing, eGovernment, VoIP etc.) that should be accessible. Affordability for the services would be at least at a fixed location, thus allowing Member States the possibility to include affordability measures by mobile.

This option focuses on the affordability of basic broadband. Broadband being a basic infrastructure, it provides benefits for the society and economy as a whole. Affordability measures would be specified at national level and could include special tariff options, direct consumer support or a combination of both. Availability will be primarily promoted by other policy tools (incentives to private investment, state aid, spectrum-related coverage obligations, etc.). Only in exceptional circumstances, after demonstration of market failure and after using other public policy tools, Member States would still have the flexibility to include the availability (i.e. deployment) of basic broadband in the universal service scope.

This option also requires a revision of financing mechanisms. Taking into account a broader range of beneficiaries (beyond the telecom sector) of universal broadband, sectorial funding needs to be reassessed. Furthermore, sectorial funding represents an administrative and financial burden for stakeholders causing market distortions and uncertainty. Taking the above into account, financing though general budget is the more equitable and least distortive way of funding the provision of universal service. Member States would be free at national level to maintain or add services, funded from the public budget.

The public consultation showed that the vast majority of **operators** consider that the review should be the opportunity to redefine or completely reconsider the universal service regime (including its financing), with many claiming that it has become obsolete. **Member States** mostly claim the need to maintain a universal service scheme, with flexibility at Member State level on funding and on broadband. With regard to the inclusion of **broadband within the scope of universal service**, while most **operators and their associations** have no doubts about the positive impact of broadband on social and economic life, they claim that USO is not the right instrument to foster broadband deployment. In any case, if broadband were to be included in the US regime, it would have to be revised substantially. Respondents supporting both in and out options (mostly **Member States and regulators)** submit that Member States should retain the flexibility to make the choice at national level. Most **operators and their associations, several Member States and regulators** consider that broadband under universal service bears high risks of market distortions and cost inefficiencies. In particular, industry funding is considered too distortive.

Option 4 - Significant adaptation to trends and connectivity objectives

This option is similar to option 3, but includes both affordability of broadband at least at a fixed location and availability (in terms of coverage obligation) of broadband at a fixed location, and it would also exclude PATS (from both affordability and availability measures)[191]. The exclusion of PATS is possible due to widespread availability and affordability of mobile voice and the tendency to fixed-mobile substitution. It can be also complemented by special accessibility measures (i.e. for disabled users), adopted in addition to the horizontal accessibility measures and applicable to all providers (not just the designated universal service provider). Alternative financing mechanisms would be introduced as under option 3. In the public consultation, m**ost market actors and regulators** agree that universal service is not the right instrument to foster very high-capacity connectivity for public places and therefore should not be linked to connectivity objectives.

4.3.2 Discarded options

This section outlines the options which have been discarded. A more detailed analysis can be found in Annex 3 on discarded options as well as the IA support studies.

- Connectivity to a network at all locations
- Terminate the universal service regime
- Provision of very high-capacity broadband networks in public areas and places of specific public interest as an addition to Options 3 and 4
- Changing the national financing regime in addition to other financing options under options 3-4
- Changing the financing regime in addition to other financing options under Options 3-4 by setting national user levies

4.3.3 Impacts

Universal service policy should specifically seek to support access to affordable connectivity, especially for vulnerable end-users, at a quality which reflects market and technological developments and enables societal and economic inclusion. Another key aim is to streamline and simplify the system (including associated financing arrangements) in order to reduce costs and inefficiencies and ensure the burden is fairly shared.

4.3.3.1 Option 1 No changes

Economic, social and environmental impacts

Lack of adequate changes to the universal service scope might contribute to hamper the competitiveness of the electronic communications industry, possibly affecting the development of online markets and the full adoption of services by the weakest parts of the population. Persisting digital divide will increase (risk of) inequality in participation in the Information Society and social exclusion.

The current cost of the universal service provision can be considered relatively modest as a significant number of the services is provided by the market and in some countries no universal

[191] Public Access Telephony Services

service providers were designated (Germany, Malta and Sweden).[192] To date, in about a half of Member States universal service providers have requested compensation for an unfair burden[193], and in countries where the net cost of the universal service provision has been calculated, it has been lower than estimated by the provider in advance and decreasing over years.[194] For instance, in Spain where the net cost has been calculated since 2003, it has been steadily dropping, from 120,4 mln euro in 2003 to 19,5 mln euro in 2013 (the last year when the numbers are available) – despite the expansion of functional Internet access to include 1Mbps broadband.[195] Yet, general assessment and comparison of the net cost across all Member States is difficult because it varies greatly from country to country due to differences in the universal service scope at the national level and size of the territory. While in some Member States the net cost stays below 1 mln euro, in other it exceeds 20 mln euro or even 30 mln euro.[196] Stakeholders have also criticized the overall administrative burden that arise from the current universal service regime for NRAs and for operators in the electronic communications sector.

4.3.3.2 Option 2 Minimum adaptation to trends

The scenario where pay phones, directory and directory enquiry services are excluded from the Union-level universal service scope affects not only electronic communications providers and end-users, but also Member States and NRAs.

Economic, social and environmental impacts

The light adaptation of the universal service scope to technological and market trends is unlikely to improve the prognosis presented in the baseline scenario, because the suggested changes do not strike at the heart of the problems, namely the taking into account the increased connectivity and development of NGA networks and risks of digital divide, the relationship between ECS and OTT providers, lack of legal certainty and coherence. The exclusion of certain services such as pay phones, directory and directory enquiry services will reduce the costs incurred by the USO operators and NRAs in calculating the amounts due for the imposition of the USO status. The social impact of excluding legacy services (public pay phones, directory and directory enquiry services) from the universal service scope is likely to be small, since these needs are already served effectively by other means, such as mobile communications, online directories and various search facilities, as explained in the problem definition. Furthermore, the use of public pay phones in the EU is very low. Environmental benefits will manifest themselves only in those Member States that introduce broadband speeds in the functional Internet access at the national level and, thus, will be able to improve energy efficiency and reduce pollution and carbon emissions. The scale effects of such improvements will be limited.

4.3.3.3 Option 3 Incremental adaptation to trends focusing on broadband affordability

This option is likely to have positive implications for a part of end-users as it is aimed at the extension of the use of broadband access to a number of enhanced services and information and, therefore, to reduce the number of citizens without a broadband connection. This option relies on the consideration that basic broadband (>256 kbps, and in reality at least 2 Mbps, through a mix of technologies) is currently available to all European citizens as mentioned in section 1.

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[192] See Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 23-25.

[193] However, another reason for a low number of requests for compensation is the complexity of the compensation procedure and uncertainty about the actual payment.

[194] See country reports in Commission Staff Working Document to the Report on the Implementation of the EU regulatory framework for electronic communications, SWD(2015) 126 of 19.06.2015.

[195] See the press release of the Spanish regulator CNMC of 16.03.2016: http://www.cnmc.es/CNMC/Prensa/TabId/254/ArtMID/6629/ArticleID/1689/El-coste-neto-del-servicio-universal-de-telecomunicaciones-en-2013-ascendi243-a-195-millones-de-euros.aspx .

[196] The presented amounts of net cost shall be treated with caution also because they are only available for different years. EC questionnaire on the implementation and application of the universal service provisions, BoR(14) 95, p. 17.

Economic, social and environmental impacts

Promotion of broadband affordability within the framework of universal service policy is likely to improve vulnerable citizens' access to a number of essential e-services (eGovernment, VoIP, ebanking etc.), to enhance their exercise of fundamental rights and participation in the Information Society. The socio-economic analysis[197] shows that those on low incomes, elderly, those that are less mobile or less able to leave home due to carer responsibilities are more prone to social exclusion. Broadband connection enables faster access to services, offers opportunity of instant communication with friends and family and access to information that are available around the clock and at lower costs as it does not incur travel expenses. These online activities develop or improve sense of community, reduce isolation of individuals and communities and support efforts to enhance equality and digital inclusion, which ultimately address social exclusion problems.[198]

Broadband provides economic and financial benefits on individual and societal levels. For individuals, a broadband connection offers new possibilities for improving (or receiving) education and professional skills, thus improving his/her chances of employment and self-employment. Households with a broadband connection enjoy financial savings due to the opportunity to shop online, pay bills, taxes and use other services.[199] Also growth and competitiveness of the industries benefitting from broadband will increase due to ICT-related efficiency and productivity resulting both from ICT and a more skilled workforce.[200] National affordability measures of direct consumer support will work as demand-support measures and may stimulate broadband market development. The changes to the financing mechanism will lead to less distortions of the competition between ECS and OTT providers.

Extending the affordability for the services to at least at a fixed location, would allow Member States the possibility to include affordability measures by mobile. This approach on affordability is supported by the fact that mobile phone ownership is much higher than fixed line telephone access with 93 % of households in the EU having access to a mobile phone[201] and that wireless technologies can already provide connectivity at virtually all locations relatively efficiently. The data shows that fixed voice telephony is not a preferred communication service, and the availability and affordability of mobile phones can provide a more adequate basis to combat social exclusion, also due to special designs for disabled users.[202]

The **cost of the provision of broadband affordability** depends on the exact definition of the connection, but is likely to be low due the narrow and precise universal service scope. When calculated as the cost of social tariffs, it is less than social tariffs for current universal service and is from min. 147.2 mln euro to max. 436.2 mln euro per year (at the 2014 price level).[203] The overall cost of specifically attributing universal service implementation responsibilities to NRAs (this responsibility currently lies at the discretion of Member States) is likely to be neutral. Many NRAs already have significant responsibility over policy and/or technical aspects of USO.

The increased use of broadband facilitated by this option is likely to have positive implications on reduction of greenhouse gas emissions, air pollution and waste[204]. By fostering the adoption of digital services, eCommerce, teleworking and other activities that generate less pollutants,

[197] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 56-57.
[198] Analysys Mason and Tech4i2 (2013). Socio-economic impact of bandwidth. SMART 2010/0033, pp. 49-51.
[199] Analysys Mason and Tech4i2 (2013). Socio-economic impact of bandwidth. SMART 2010/0033, pp. 52-54.
[200] Analysys Mason and Tech4i2 (2013). Socio-economic impact of bandwidth. SMART 2010/0033, pp. 38-42.
[201] Special Eurobarometer 438. Report. E-Communications and the Digital Single Market. May 2016, p. 45.
[202] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 89 – 90 and 36-38.
[203] The calculation methodology and data can be found in Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, Annex, pp. 121-123.
[204] Matthews, H.S., Hendrickson, C.T. and Soh, D. (2001) Environmental Implications of e-Commerce and Logistics. DOI: 10.1109/ISEE.2001.924525 .Available at: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=924525 .

increase energy efficiency of necessary real-life activities and reduce transportation needs, broadband contributes to the creation of sustainable, energy-productive and low-carbon economy.[205] A study of five EU Member States by the Global e-Sustainability Initiative (GeSI) found that broadband-enabled typical household activities result in **a reduction of 39 mln tonnes of annual carbon dioxide emissions**.[206]

4.3.3.4 Option 4 Significant adaptation to trends and connectivity objectives

Economic, social and environmental impacts

While impacts of this option for social inclusion, participation and reduction of digital divide are significant, it has serious economic drawbacks. The total costs of providing fixed wired (xDSL, cable and FTTx) broadband connections (excluding affordability costs) of 4 Mbps to all households in the territory, has been estimated to be 6.8 billion euro for EU-27 in 2015[207]. While costs for some of the Member States with very high penetration and subscription levels (Malta and the Netherlands) are negligible, Member States with large territory, difficult terrain and extensive rural areas will have to bear a disproportionately high cost (for instance, it has been estimated that Poland needs 1.3 billion euro).[208]

The provision of universal service is without constraints on the technical means and it is obvious that mobile wireless and satellites are viable alternative or complementary technologies and the required investments would likely be less[209]. Furthermore, if access has to be requested it is probable that not all unconnected households will make the request; this could considerably reduce deployment costs[210].

Further drawbacks of using the universal service instrument for broadband deployment refer to the high risk of market and competition distortions and cost deficiencies. Using universal service funds to deploy broadband may discourage private investments resulting in crowding-out effects and, potentially, delaying expansion of VHC networks. If sectorial funding is used, financial transfers between competitors may strengthen the dominant position of the designated universal service providers, especially the vertically integrated ones. This will not only damage competition in the market, but also distort price levels and negatively impact affordability of services.[211] It is therefore advisable to use other policy tools instead of universal service, focusing on incentivising commercial investment, coupled with targeted state aid, where market failures persist, and using pro-competitive and technologically neutral project models in specific areas.

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[205] See findings of the study by Global e-Susutainability Initiative and Boston Consulting Group (2012). GeSI SMARTer 2020: The role of ICT in driving a sustainable future: http://gesi.org/assets/js/lib/tinymce/jscripts/tiny_mce/plugins/ajaxfilemanager/uploaded/SMARTer%202020%20-%20The%20Role%20of%20ICT%20in%20Driving%20a%20Sustainable%20Future%20-%20December%202012.pdf

[206] See GeSI, Yankee Group and American Council for Energy-Efficient Economy (2012). Measuring the energy reduction of selected broadband-enabled activities within households: http://gesi.org/files/Reports/Measuring%20the%20Energy%20Reduction%20Impact%20of%20Selected%20Broadband-Enabled%20Activities%20within%20Households.pdf .

[207] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011

[208] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 72-73.

[209] However, these technologies can be affected by issues like data caps, the shared nature of a wireless channel, weather-dependence and, in the case of satellite, signal latency and end-user equipment costs. For more information on general wireless connection scenarios in the EU, see Analysys Mason (2016)
Costing the new potential connectivity needs.

[210] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 80 (Assessment of different modalities of how broadband should be provided within the Universal Service Regime)

[211] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, p. 75.

Environmental impacts of this option are similar to Policy Option 3. The positive implications will increase with a greater amount of people adopting broadband and making use of teleworking and telecommuting, which are responsible for the largest energy savings and reduction of carbon emissions.[212]

4.3.4 Comparison of options

4.3.4.1 Effectiveness

Neither Option 1 nor Option 2 can be considered to be sufficiently effective to achieve the objectives of universal service policy because they do not prevent social exclusion and inequality avoiding the necessary change in scope needed to offer a minimum of communications services reflecting technological and market developments.

Options 3 and 4 suggest modernisation of the universal service scope that takes into account the ongoing connectivity trends and shall provide an improved access to and use of the broadband connection as an important asset of participation in social and economic life. Options 3 and 4 also foresee an appropriate adjustment of the financing mechanism that would allow for a fair distribution of costs and benefits of broadband for all stakeholders. By comparison to Option 4, Option 3 provides for a greater flexibility at the national level. It is also more dynamic because it foresees an adjustment of the universal service scope by 2020 in accordance with market developments.

4.3.4.2 Efficiency

Option 3 is the most cost effective as the calculated cost lies below the cost of social tariffs for telephone subscription (1,07% v 1,95% of disposable income respectfully[213]). The cost of social tariffs if affordable broadband connection were included in the universal service scope is estimated to be between 147 mln euro and 436 mln euro per annum for EU-27. This is at a similar level to social telephony tariffs currently offered under national universal service schemes.[214] If combined with public funding, Option 3 offers an optimal combination of low cost and equitable distribution of their financing.

Option 4 is the most expensive one. It is estimated that already in 2015 the cost of connecting (fixed wired technologies[215]) all unconnected households in EU-27 amounted to at least 6.8 bn euro for 4 Mbps broadband connection (primary basket[216]). The cost increases considerably with higher speed connection[217]:

- Basket 2 (4.6 Mbps): 9.6 bn euro
- Basket 3 (8.3 Mbps): 15.6 bn euro
- Basket 4 (21 Mbps): 46.9 bn euro

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[212] See GeSI, Yankee Group and American Council for Energy-Efficient Economy (2012). Measuring the energy reduction of selected broadband-enabled activities within households: http://gesi.org/files/Reports/Measuring%20the%20Energy%20Reduction%20Impact%20of%20Selected%20Broadband-Enabled%20Activities%20within%20Households.pdf .

[213] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, Annex, p.120.

[214] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 87-91.

[215] Other technologies, such as mobile wireless and satellite, are good complements and could influence the cost calculations.

[216] In the study "Review of the scope of universal service, SMART 2014/0011" a methodology focusing on four baskets of online services was developed. The primary basket was comprised of online services, which provide social and digital inclusion, used by the majority of consumers. Three additional baskets of online services were developed, which did not meet the requirement for use by the majority of consumers required by Annex V of the Universal Service Directive.

[217] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, p.p. 72-73.

Extrapolated to the connectivity needs of 2020, the investment necessary to overcome the broadband inclusion gap to access the four baskets of online services in EU27Member States results in[218]:

- Basket 1 (9.6 Mbps): 13.7 bn euro
- Basket 2: (11.9 Mbps): 17.1 bn euro
- Basket 3: (21.5 Mbps): 32.5 bn euro
- Basket 4: (54.5 Mbps): 143.8 bn euro,

with the financial burden falling disproportionally on the population of scarcely populated Member States with large territory and difficult terrain.

The amount of funding can be adjusted by limiting the provision of broadband only to those households that reasonably request broadband access and to primary location, as currently required by the Universal Service Directive (see Recital 8 and Article 4 (1) USD). For such 'on request' households the investment needed in 2020 is estimated at:[219]

- Basket 1 (9.6 Mbps): 7.5 bn euro (difference – 6.2 bn euro)
- Basket 2: (11.9 Mbps): 9.4 bn euro (difference – 7.7 bn euro)
- Basket 3: (21.5 Mbps): 17.8 bn euro (difference – 14.6 bn euro)
- Basket 4: (54.5 Mbps): 79 bn euro (difference – 64.7 bn euro)

Furthermore, the provision of universal service is without constraints on the technical means and it is obvious that mobile wireless and satellites are viable alternative or complementary technologies and the required investments would likely be less, but subject to certain limitations[220].

Options 1 and 2 – although exhibiting the falling net cost of the universal service provision – represent a financial burden for the electronic communications industry. As indicated in Section 4.3.3, maintenance of payphones in the EU is estimated annually at 1 billion euro, which is a large cost considering the very infrequent use of the facility. Usage and cost of the provision of comprehensive directory and directory enquiry services is difficult to estimate, but the available data suggest that commercial provision by the market is viable and sufficient.[221]

4.3.4.3 Coherence

By comparison to Options 1 and 2, Options 3 and 4 are more strongly aligned with other policies of the EU in the field of the Information Society and the EU Charter of Fundamental Rights due to the significant revision of the scope. Broadband has developed into a basic platform for information and communication services and activities, and ensuring access to and use of it will facilitate full participation of the citizens in the social and economic life of the society. Broadband-based services and applications offer innovative possibilities for communication that may improve social and economic opportunities of people with disabilities and elderly people and support their independence and integration.

[218] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, p. 74.
[219] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 80-81.
[220] For more information on general wireless connection scenarios in the EU, see Analysys Mason (2016) Costing the new potential connectivity needs.
[221] Tech4i2 et al. (2016) Review of the scope of universal service, SMART 2014/0011, pp. 38-42.

Options 3 and 4 are more coherent with competition and investment policies as they improve the level playing field for ECS and OTT providers by reforming the financing arrangements for universal service and enhancing legal certainty.

Option 4, however, may collide with other policies fostering broadband deployment and with State aid rules because it foresees an instrument of far-reaching public support of broadband availability. By contrast, Option 3 suggests such possibility of flexibility for Member States to include the availability element only in exceptional circumstances, after demonstration of market failure and after using other more appropriate public funding tools such as state aid measures on broadband deployment, spectrum coverage conditions, regulatory incentives for investment, e.g. it might be reserved for more isolated cases, not easily captured by state aid schemes, or in the final uncovered percentile of population under spectrum coverage conditions.

4.3.4.4 Impact on stakeholders

See also table presented in Annex 12 specifying in detail impacts on stakeholders for each policy option.

While Options 1 and 2 seem to be most neutral in their impact on stakeholders, they fail to address the core problems that the universal service regime is supposed to solve, i.e. provision of a safety net for disadvantaged users in order to reduce the risk of social exclusion and digital divide. Additionally, the sectorial funding mechanism of universal service that is currently used by the majority of Member States creates economic burdens, and legal uncertainty with regard to compensation, especially for new entrants. By contrast, Options 3 and 4 modernise both the universal service scope and funding and score better in addressing the challenges described. At the same time, Options 3 and 4 are sufficiently flexible and leave Member States enough room to adjust the universal service scope to their national circumstances. The reformed financing alleviates financial and administrative burden for all types of providers and operators. However, inclusion of available broadband in the universal service scope (Option 4) is likely to have an adverse effect on alternative providers and new entrants by comparison to the incumbents because it might crowd out investments, distort competition and price levels and strengthen the market position of incumbents.

4.3.4.5 Summary table comparing Universal Service options

Table 9 - A comparison of options for universal service

	Effectiveness					Efficiency	Coherence			EU value add
	VHC coverage	VHC take-up	Universal availability	Competition (infra/service)	Fosters cross-border services /entry	Cost/complexity/ enforceability	Disruption from status quo (stability)	Internal coherence	External coherence	Additional impact vs MS acting alone
Option 1: status quo	0	0	0	0	0	0	0	0	0	0

Option 2: Light adjustment	0	0	0	0	0	0		-		-
Option 3: broadband affordability	0	0	+	+	+	+		+	+	+
Option 4: Broadband availability	+	+	+	-	+	-		+	-	+

4.3.5 The preferred option

The Commission considers that option 3 on Universal Service Obligation is the best option to achieve the overall and specific objectives of the review of the telecom framework as presented in section 3.

No macroeconomic effects could be quantified through modelling for this policy area.

4.4 Services and end-user protection

4.4.1 Options

Options under this header will be structured around the following topics: services; must carry and obligations applying to electronic programme guides (EPG obligations) and numbering.

4.4.1.1 Services:

Option 1 – Baseline scenario

Under the current framework the service policy is primarily aimed at protecting consumer interests including disadvantaged and disabled end-users. Consumer protection obligations are covered by the Directive on Universal Service and Users' Rights, including provisions on:

A. Obligations to facilitate switching including 1 day number portability obligations
B. Sectorial contractual obligations, including conditions on contract contents, contract duration and contract termination
C. Provisions concerning transparency on tariffs and other conditions
D. Ensuring equivalence in access and choice for disabled end-users
E. Provisions concerning transparency on Quality of Service and potential minimum QoS requirements

The types of services covered by these provisions include all electronic communication services' (ECS) commonly provided over networks including telephone calls, messaging and Internet access services. Electronic communications services are also subject to obligations concerning security and integrity,[222] while privacy is covered by a separate Directive,[223] which is subject to a separate review.[224] General legislation e.g. on consumer protection also applies to all ECS.

Under this option no change will be introduced to the regulatory framework relating to services, thus this scenario reflects possible developments in the absence of new EU-level action.

Option 2 – Streamlining of current provisions and addressing certain new challenges without modifying the scope of the Regulatory Framework

Option 2 would review the substantive provisions applicable to ECS providers while keeping the current scope of the framework, mainly based on the definition of ECS, including the notion of "conveyance of signals". Only telecom operators would remain subject to obligations and enjoy the rights provided by the regulatory framework as it is the case today.
Provisions which have become obsolete due to new legal, market and technological developments would be repealed. This includes the sector-specific provisions of the regulatory framework which overlap with general EU consumer law, for instance general consumer law rules on information requirements in contracts included in the Consumer Rights Directive. However, as general consumer law requirements would still be complemented with provisions that are sector specific the reduction of overlapping between sector specific and consumer protection legislation is likely to be rather limited, as in many cases it seems indispensable to keep certain sector specific provisions.
Provisions not covered by horizontal Union legislation will be maintained where they are still needed, repealed where no longer needed or adapted to respond to new challenges. This would for instance cover issues such as an adaptation of the rules to the increasing importance of bundled offers and possible barriers to switching: current rules have been very effective in empowering consumers to benefit from competition between voice telephony service providers and they should be adapted to the new context in order to continue fostering competition and consumers' choice. Other adaptations would include better readability of contracts and the possibility to impose an obligation on operators to provide consumption monitoring tools. In addition, this option would extend the already existing mandate to the Commission to impose technical implementing measures with the possibility to adopt delegated acts to ensure effective access to the single European emergency number 112 with regards to caller location, call routing to the Public Safety Answering Point (PSAP) and access for disabled end-users in a coherent way EU wide. Only such an approach can ensure cross border deployment and functioning of technical solutions. In light of the technical developments in the market the Commission would be able to adopt implementing or delegated acts for making access to emergency services more effective in particular with respect to caller location, performance of Public Safety Answering Points and access for disabled end-users.
As indicated in the problem definition, many stakeholders (BEREC, several Member States, most operator associations, most incumbents, some cable players, all user associations and some broadcasters) referred in the public consultation to the need to review the current definition of ECS, owing to the increasing uncertainty on the scope of the definition of ECS related to "conveyance of signals", the inconsistent regulatory obligations for similar services and the convergence of communications services. Only a minority of stakeholders opposed to a review

222 Article 13a Framework Directive
223 Directive 2002/58/EC as amended by Directive 2006/24/EC and Directive 2009/136/EC
224 See https://ec.europa.eu/digital-single-market/en/news/public-consultation-evaluation-and-review-eprivacy-directive

of the definition, arguing that the concept of ECS has proven itself and that changes could create regulatory, legal and investment uncertainty.

Option 3 – Internet Access Service (IAS) only

This option would limit the application of sector-specific legislation to *internet access services* (IAS) only, adapted to the increasing importance of bundled offers, whereas communications services that run on top of IAS would not be subject to such legislation. It is based on the idea that in an environment migrating towards all-IP, most communications services will be data-based. Hence, the IAS is likely to become the end-users' main gateway to access the internet and most communications services, resulting in a high unilateral dependency on the end-user side, which would justify the application of sector-specific rules to IAS.
It would rely on the definition of IAS in Article 2(2) of the Telecoms Single Market Regulation.
This option includes the streamlining exercise of Option 2, which would identify only those rights and obligations (including end-user protection rules) which are relevant for IAS: Some sector-specific rules (e.g. on contract duration or switching) would be maintained while others, which are relevant for IAS and essential to end-users, such as rules on transparency, will be adapted to market and regulatory developments. It would include a non-discrimination provision guaranteeing the freedom of end-users to use public electronic communications networks or services provided by an undertaking established in another Member State and prohibiting discrimination based on nationality or the place of residence of the end-user. This option could be accompanied by full harmonisation.
Communication services provided either traditionally, such as voice telephony, or on top of IAS, would not be subject to sector-specific legislation.
This option will put a special emphasis on broadening end-user rights for IAS only. For example, rights to have a facilitated switching process led by the receiving operator, the obligation to inform the end-user in due time, so that the end-user has sufficient time to oppose to an automatic roll-over, or the introduction of comparison tools and websites to ensure better transparency and comparability of tariffs and quality of service parameters.
With a few exceptions, stakeholders did not show support to a reduction of sector specific regulation to internet access service only, the main reason being that in a transition phase towards a full Internet-based model there should not be any inconsistencies nor different regulations and levels of consumer protection applying to different services that consumers perceive as substitutable in order to ensure a level playing field. Only some telecom operators advocated for such a possibility, but they considered that regulation should keep some consumer protection features such as number portability, emergency calls, confidentiality, safety and security obligations, transparency or cost control.

Option 4 – IAS and regulatory obligations for electronic communications services mainly linked to the use of numbering resources

This option builds on option 3 as described above. Additionally, it proposes, on top of the regulation of IAS (as IAS remains a critical access point for end-users to access other online services), to apply a limited set of sector-specific rules to communications services, provided either traditionally, such as voice telephony, or on top of IAS. The concept of communications services would include any functionally substitutable services used for inter-personal communications, in other words services that enable direct interactive communication between two or a determined number of natural persons (including those acting on behalf of legal persons, but excluding M2M services) irrespective of the technology used for their provision.
As regards regulatory obligations (i.e. the application of a minimum subset of communications-specific rules, as identified in the streamlining exercise described in option 2) applicable to

communications services, most of them would be linked to the use of public numbering resources ("use" being understood as provision of numbers to the service's own subscribers, or provision of a service that enables communication with other providers' subscribers via such numbers) – confirming an approach that has been identified by regulators[225] since at least the last review of the framework but which is widely contested by the relevant service providers and has not been widely applied in practice. The scope of access to emergency services would be redefined using the concept of communication services using numbers, but with necessary safeguards regarding the inability of many online services to assure quality of service of such calls. Rules that would apply to communications services using numbers cover inter alia contract duration, transparency, information on quality of service, number portability led by the gaining provider, provision of information to oppose automatic roll over of contracts, consumption monitoring tools, comparison tools for both prices and quality of service or switching rules for bundles to avoid lock-in effects.

However, there are certain areas where public policy interests may require applying regulatory obligations to all newly defined communications services, i.e. also to those that are provided over the IAS but do not use numbering resources. These are at least the following areas: security and confidentiality of communications[226] (the exact confidentiality obligations would be subject to further conclusions of the review of the e-privacy Directive) and portability of user generated content when switching services. Article 16 of the Digital Content Directive Proposal[227] would normally apply to communications services not covered by the current definition of electronic communications services (ECS). This provision would be extended to all ECS (i.e. traditional operators and OTT services using numbers, as well as other OTT communications services (which would in any event come within its scope if the ECS definition was not revised).

This option could be accompanied by full harmonisation with limited exceptions, making it easier for communications services to comply with the legislation.

Finally, for reasons of proportionality, this option does not immediately apply to OTT communications services obligations in the areas of interoperability and emergency services; but, as such obligations may become necessary in the future, it provides a mechanism giving the possibility to intervene, if so needed, in these two areas.

In the public consultation a clear majority of respondents were of the opinion that all functionally substitutable communications services should fall under a new, technology neutral common definition, but had significantly varying positions on the types of obligations that should apply to services falling within such a definition. Consumer organisations in particular expressed support for specific rules with regard to voice services for end-users, highlighting the importance of service availability and of voice quality as a distinctive characteristic. Only a minority of stakeholders, including OTTs, opposed this approach. Many respondents claimed that the definition should be independent from remuneration modalities (i.e. free / data driven) and that the condition that service are provided "for remuneration" should not only cover monetary but also direct or indirect remuneration (e.g. commercialisation of data).

A large number of stakeholders consider that all the voice services perceived by the users as substitutive to the current PSTN voice service (same look & feel) and also give access to E.164 numbers should be subject to the same obligations regarding the access to emergency services. In the same vein some NRAs support an obligation on communication services (including OTTs) that give access to numbers in the numbering plan. Legal clarity is requested by these NRAs and some operators regarding access to emergency services by all communication providers (OTTs included) that offer access to an E164 number.

[225] ERG Common Position on VoIP, December 2007

[226] SMART 2013/0019: 33% of respondents to the survey have concerns about privacy and claim this is a reason for not using OTT services.

[227] COM(2015) 634 final

Option 5 – Functional approach to communications services

This option builds on option 3 and would establish a two-tiered approach as in option 4 with the difference that, under this option, regulatory obligations would not be linked to the use of numbers exclusively but would apply to all communication services. The definition of communication services would be based on a functional and technology-neutral approach that would comprise all services with communication features, including new services to emerge. A minimum subset of communications-specific rules, as identified in the streamlining exercise described in option 2, would apply to all functionally substitutable communication services (both OTT and ex-ECS), for example to ensure protection against specific communications-related risks (confidentiality and security) and to facilitate switching with portability rules as in option 4, including portability of user generated content. The obligation to give access to emergency services would be extended to all these communication services wherever technically feasible. It would also include interconnection and interoperability obligations subject, however, to reasonableness considerations relative to technical feasibility, significance of take-up of a given service as well as cost considerations. This option could be accompanied by full harmonisation. As in option 4, a clear majority of respondents were of the opinion that all functionally substitutable communications services should fall under a new, technology neutral common definition, but there were significantly varying positions on the types of obligations that should apply to services falling within such a definition.

4.4.1.2 *Must carry and electronic programme guides (EPG) obligations*[228]

Option 1 – Maintain Member States' possibility to impose must carry and EPG obligations

Must carry and EPG obligations aim at ensuring that TV and radio channels of high public interest are broadcast by electronic communications providers, while avoiding unreasonable burden on the latter.

Under the current Regulatory Framework must carry rules: A) allow Member States to promote general interest content; B) Ensure that provisions are proportionate and notably do not disproportionately "crowd out" channels from commercial broadcasters or from other Member States; C) Ensure that the provision of broadcast transmission services by electronic communications networks operators can be a sustainable commercial activity on liberalised markets

The provisions in the Regulatory Framework regarding electronic programme guides allow: A) to promote fair competition (notably prevent EPGs affiliated with commercial platforms/broadcasters from discriminatory treatment against other platforms/broadcasters, including against providers of general interest channels); B) to facilitate access and orientation.

This option would keep the current must carry[229] and EPG rules in place. While there is a majority view from stakeholders that transmission obligations imposed on electronic network operators (must carry rules) and rules related to electronic programme guides should be adapted to new market and technological realities, there is sharp disagreement as to how such adaptation should be conceived. Extension of the current rules is supported by some Member States and most broadcasters, whereas most telecom operators are in favour of reducing the scope of the

[228] For an evaluation of the current must carry and findability provisions, please refer also to the corresponding sections of the Evaluation SWD, in particular 7.2.3.11 and 7.3.3.11.

[229] For the obligations currently in place see pp.23 of the study "Access to TV platforms: must carry rules, and access to free-DTT" by the European Audiovisual Observatory, December 2015, available at http://www.obs.coe.int/documents/205595/264629/Must+Carry+Report+(Dec.+2015)/bb229779-3fb2-488d-9c0e-d91e7d94b24d Individual country reports are on pp. 53.

rules. Accordingly, keeping existing must carry and EPG provisions in place can provide a certain degree of balance between these conflicting stakeholder positions.

The scope of current obligations is limited by the requirement that a significant number of end-users use the electronic communication network(s) concerned as their principal means to receive TV and radio[230] broadcast channels and that Member States review the obligations in regular intervals. It would be clarified that the transmission obligations may include data complementary to radio and TV channels which supports connected TV services and EPGs[231]. In addition, the newly adapted net neutrality rules would apply. Current obligations on EPGs would also remain in place.

Option 2 – Phase out must carry obligations

This option envisages an obligatory phase-out of 'must-carry' obligations by 2020-2025. This could be combined with the possibility for national and/or regional derogations where needed. This option assumes a certain pace of broadband roll-out capable of supporting online TV distribution. National and/or regional derogations could be granted where and for as long as ubiquitous broadband coverage has not been achieved.
Telecom operators are in favour of reducing the scope of the rules, other stakeholders did not show support to this option. Some cable and telecom operators call for complete removal of must carry obligations or at least to limit them to the main/most essential general interest channels.

Option 3 – Extend must carry obligations

This option considers extending the scope of must carry obligations which Member States may impose with respect to on-demand services and subject to the network's functionalities. Such extended must carry obligations would apply to any platforms that provide a significant, share[232] of TV and radio channels (including on-demand services) viewed in a Member State, regardless of whether they are transmitted directly via electronic communication networks or via specialised services provided over electronic communications networks.

The option to extend rules is supported by some Member States and most broadcasters. Telecom operators are opposed.

Numbering[233]

Option 1 – No change in the EU framework on numbering

Telephone numbers play an important role in the proper functioning of the telephone network, both fixed and mobile, notably in routing, management and identification. The use of numbers is

[230] Radio is an important part of the cultural landscape in Europe and accordingly an important element of the digital single market.
[231] This would allow Member States ensuring that signalling sent alongside broadcast signals and intended to ensure synchronisation of the linear broadcast channels with OTT services is not blocked. This would entail that red button services (providing additional programme information on demand) as offered by public and commercial broadcasters in several Member States would not be blocked by ECNs.
[232] As defined by Member States.
[233] For an evaluation of the current numbering provisions (and corresponding problems), please refer also to the corresponding sections of the Evaluation SWD, in particular 7.2.3.3 and 7.3.3.3.

coordinated by the ITU at the global level[234] and implemented by national governments in the national numbering plans[235].

The current regulatory framework requires Member States to ensure that adequate numbers and numbering ranges are provided for all publicly available electronic communication services, via objective, transparent and non-discriminatory procedures. The management of numbers at the national level is typically assigned to a government entity or agency, usually the National Regulatory Authority. The Ministry responsible for telecommunications policy typically retains the governance responsibility.

In addition, the Authorisation Directive lays down requirements on the assignment of numbers and the conditions for the right of use. Annex C to the Authorisation Directive provides for an exhaustive list of conditions which may be attached to the right of use for numbers.

Article 10 of the Framework Directive includes provisions requiring Member States to support the harmonisation of specific numbers or numbering ranges within the Community where it promotes both the functioning of the internal market and the development of pan-European services, and vests the Commission with the task to adopt implementing measures. Article 27 USD lays down technical provisions on international telephone access codes and on the European Telephone Numbering Space (ETNS), which has been dismantled in 2009 by the withdrawal of the number by ITU.

Option 1 foresees a baseline scenario where no change is introduced to the current Regulatory Framework. This baseline option would by definition not entail measures to cope with developments in the area of numbering (notably, the dismantling of ETNS), that would require adaptation of existing rules.
In the absence of further harmonisation or a Pan-European numbering range, Member States can freely establish the conditions for the use of their numbering resources, and create new national E.164 (telephony) number ranges as well as new E212 (mobile IMSI) ranges for M2M services and define individually or in a coordinated manner specific regulatory requirements for these new ranges to address shortage of existing numbering resources. Member States could also decide to relax national number assignment criteria and assign numbers to M2M providers in order to address the competition issue that non-electronic communication service providers are deprived of numbering resources in a some of the Member States. This option however does not provide solutions to regulatory fragmentation, and would not take into account requirements of the Single Market.

Option 2 – No change in the EU framework on numbering with repeal of redundant rules

This option would entail no new elements to the regulatory framework. Only Article 27 USD on European telephony access codes would be repealed due to the dismantling of ETNS, and the remaining provision on international access code would be moved to the existing Article 10 FWD. The competences and freedoms of Member States would remain as described in Option 1,

[234] International Telecommunications Union – Telecommunications Sector (ITU-T), which is originated as a treaty organisation of member states operating under the auspices of the United Nations. Today, it brings together 139 countries, 800 private-sector entities and academic institutions

[235] ITU-T's Recommendation E.164 defines the structure and functionality of the telephone numbering plans and is followed by national governments in the actual assignment of blocks of national numbers to operators, who assign a particular number to an end-user. Recommendation E.212 defines the International Mobile Subscription Identity (IMSI) used within mobile networks, . The IMSI is used in addition to an E.164 (mobile) telephone number and . It enables international roaming. For governance purposes, at regional level, regional organisations, such as the CEPT (European Conference of Postal and Telecommunications Administrations) in Europe, coordinate the interests of stakeholders at that level. CEPT further coordinates cross border issues among and its 48 Member Countries, that also encompass EU Member States. CEPT can make Recommendations and Decisions but they are not legally binding.

and no European solutions would be developed for the challenges posed by M2M development and cross border services on the Single Market.

Option 3 – Adapting the EU framework on numbering to address the competition issue on the M2M market

Under this option the EU framework would be adapted to allow the assignment of numbers by NRAs to non-MNOs, such as large M2M providers (as an explicit option for NRAs without imposing any obligation). This would be particularly relevant for E.212 (mobile IMSI) numbers, that are in some Member States reserved to MNOs exclusively. In this respect, current holders of numbers, in particular MNOs, highlighted implementation and security issues such as risk of fraud, partial exhaustion of national numbering resources, and problems concerning interoperability and end-to-end connectivity.
Concerning extra-territorial use of national numbers, a common new scope for extraterritorial use of numbering resources, and relevant common conditions for rights of use would be laid down in the EU framework, to establish harmonised conditions for extra-territorial use of national numbers in all Member States. The public consultation showed that there is a clear consensus that to cope with the numbering needs of M2M in the future, a clear framework for extra-territorial use of numbers is necessary to ensure sufficient numbering resources.
Finally, the framework would include a mechanism for introducing common EU-level numbering spaces in the future, in case extra-territorial use is not sufficient to meet the increasing demand. While the public consultation did not reveal a manifest support for a new European numbering initiative, the rapid developments in the area of M2M could bring fundamental changes to numbering regulation, which would be anticipated by such an enabling provision.

4.4.2 Discarded options

This section outlines the options which have been discarded. A more detailed analysis can be found in Annex 3 on discarded options as well as the IA support studies.

4.4.2.1 *Services*

- No sector-specific regulation for services in the future

4.4.2.2 *Numbering*

- Adapting the EU framework on numbering to address the competition issue on the M2M market, and directly creating (E.164 and E.212) European numbering ranges to promote a single market for M2M.

4.2.4.3 Must carry and f*indability (EPG)*

- Extending the scope of must carry obligations to OTT services
- Extending the scope of EPG obligations and introducing regulatory safeguards to improve findability

4.4.3 Impacts

4.4.3.1 *Services*

4.4.3.1.1 Option 1 – Baseline scenario

Option 1 involves a continuation of the existing regime. The current scope of the framework would be maintained, implying that the currently prevailing uncertainty on rights and obligations for the provision of equivalent services remains. Also current gaps with regards to consumer protection would persist. Moreover, this option would not address technology and market changes including emerging risks in the field of consumer protection related to the use of bundles.

Economic impacts

Discrepancies on rights and obligations of the rules may hinder confidence in future activities by communications service providers. Furthermore, it may also create new barriers for the internal market as it opens the door to different interpretations by Member States and lead to new issues of different regulatory treatment of similar services, depending on the degree of vertical integration of the providers.

Telecom operators operating in multiple countries will remain subject to heterogeneous compliance and consumer protection costs. This may impede telecom operators from expanding across borders. In relation to obsolete or redundant consumer protection provisions, telecom operators will remain subject to unnecessary administrative and compliance costs.

Annual economic growth is expected to advance as forecasted in the base scenario used in the supporting study of this document, i.e. 1.7% for the period 2021 to 2025.

Social and environmental impacts

The degree of protection with regards to security and privacy remains unchanged, and a significant number of consumers will remain confused as to the degree of legal protection of security and privacy when using a particular electronic communications service[236]. This hinders them in making informed decisions and leaves them without clear sector-specific legal protection, when using communications services of OTT providers. Certain new end-user challenges would go unaddressed, such as problems when switching multi-play bundles. The growing reliance of end-users on OTT communication services may effectively reduce accessibility of emergency services. The lack of accuracy of caller location in case of emergency communication hinders effective access to emergency service while EU wide interoperable accessibility solutions for disabled end-users are still not deployed. The net environmental impact will be neutral.

4.4.3.1.2 Option 2 – Streamlining of current provisions and addressing certain new challenges without modifying the scope of the Regulatory Framework

Option 2 envisages a streamlining exercise of the sector-specific rights and obligations but no change to the current definition of electronic communications services (ECS). It will also address new challenges based on recent commercial and technical developments in the telecommunications markets.

Economic impacts

[236] SMART 2013/0019: 33% of respondents to the survey do have concerns about privacy and claim this is a reason for not using OTT services

A significant impact on the objective of providing a European-wide pro-competitive regulatory framework for communications services is not expected. Compared to the baseline scenario, possible competitive distortions remain unchanged. Possible benefits for operators offered by the growing popularity of multi-play bundles and their associated lock-in effects would be mitigated as a result of new measures facilitating switching. These measures could have a chilling effect on pro-competitive bundles, potentially depriving consumers of some benefits of built-in discounts relative to stand-alone products or services.

The streamlining exercise would reduce some of the problems with regulatory heterogeneity, however, it would only very slightly reduce the problem of unequal treatment for ECS and OTT providers as it would lift some overlapping obligations and compliance costs for ECS and removed obsolete rules. However, there would remain a risk of (growing) regulatory heterogeneity resulting from current minimum harmonisation and doubts about the scope of the regulatory framework. New players would experience no change with regards to uncertainty about whether or not they fall within the scope of the framework.

Macro-economic growth will advance as forecasted in the base scenario with a very minimal upward correction.

Improvement in the accuracy of caller location, access for disabled end-users and the performance of Public Safety Answering Points would incur cost in the networks and Public Safety Answering Points but these would largely be offset by the benefits arising from the effectiveness of the emergency intervention (safeguarding public health and welfare).

Social and environmental impacts

Impacts on employment in the sector as well as macro-economic employment are negligible compared to the baseline option.

The degree of protection of end users with regards to security and privacy of communications would remain unchanged. Although there is still a risk that end-users could experience problems when switching multi-play bundles, the new consumer protection rules in this respect, applying key ECNS protections such as those on contract maximum duration and contract termination to all components of a bundle, will likely have positive consequences for future affordability and quality of communications services. More accurate caller location will be reflected in timely and effective emergency relief resulting in the mitigation of adverse effects of emergency situations to health and property. Accessibility solutions in emergency communications would ensure integration, safety and mobility of disabled-end-users.

4.4.3.1.3 Option 3 – Internet Access Service (IAS) only

Option 3 would reduce the scope of sector-specific rules to the internet access service (IAS), but leaves outside the scope any communication services (either traditional or provided on top of the IAS).

Economic impacts

Traditional telecommunications services such as voice and SMS are no longer subject to interconnection, interoperability and number portability obligations. This would in principle reduce many compliance and enforcement costs, but could create new ones related to IAS monitoring and reporting, and could as well create several competition issues. The possibility to implement this option should also be examined in view of international commitments (e.g. GATS) with regards to interconnection of public telecommunications services which would not be covered by this option, e.g. voice telephony services.

First, end-users would experience considerably higher switching costs related to the inability to port numbers which remain in widespread use. Second, new level playing field problems could arise since large telecom operators could push smaller operators out of the market by denying interconnection. This would not only have concentrating effects on the retail markets for voice and SMS but, via bundling, also for IAS and broadcasting services. It would lead to less competition between telecom operators and have an upward effect on fixed and mobile profit margins. The latter effect is (partially) countered by additional end-user measures facilitating the switching process and limiting automatic roll-over of contracts, as well as by comparison tools.

From an internal market perspective, the costs for telecom operators of operating in multiple countries would be reduced. It would also reduce uncertainty about the risk of regulatory heterogeneity resulting from current doubts about the scope of the regulatory framework. However, lower levels of competition in national telecom markets could be detrimental for the Internal Market as it implies rising (strategic rather than regulatory) barriers to enter national markets. All in all, option 3 will likely lead to less competition and at macro-economic level the impact may be neutral compared to the baseline as described under option 1.

Social and environmental impacts

Depending on the net effect on telecom revenues and profitability, some positive effects could be expected in terms of employment creation in the sector but these could be offset by synergies and economies of scale brought about by the likely market consolidation process. Given the role of the sector as an enabling input for the whole economy, a reduction in the efficiency of its functioning may have a negative impact on macro-economic employment.

The potential gains for consumers brought about by additional measures aiming at prohibiting discrimination based on nationality or the place of residence of the end-user and making easier to switch between providers of bundles could be countered by the likely market concentration. Option 3 will have a negative impact in terms of security and privacy protection regarding telecom services. The impacts in terms of affordability and/or quality are unclear.

4.4.3.1.4 Option 4 – IAS as in option 3 and regulatory obligations linked to the use of numbering resources

Besides the regulation of the IAS, this option would link the authorisation requirement for communications services (other than internet access service) and subsequent regulatory obligations to the use of numbers, while safeguarding other end-user and public policy interest (security, privacy) as described in 4.4.1.1.

Economic impacts

This approach would bring some clarification on the scope of application of the framework and make regulatory obligations legally binding for voice, text and other communication services that make use of numbering. It is not possible to estimate the annual costs associated with number-related obligations imposed on respective OTTs. However, the fact that OTT communication services like e.g. Skype Out / Skype In and Viber Out / Viber In would be clearly subject to the above set of obligations and associated costs is expected to have little impact on competition in the market. All OTTs would be subject to similar obligations with respect to confidentiality (and potentially privacy, subject to the ePrivacy Directive review) and this may imply that some of the current OTT business models may need to evolve. In terms of access to emergency services, once a standardised technical solution is available for routing OTT emergency communications, its implementation would ensure broader access to emergency services, hence larger scope for safeguarding life, health and property.

Enforcement and compliance costs would slightly go down with the streamlining of rules. The administrative burden may increase for OTT providers that use numbering resources as they will now be subject to more regulation. In addition, all OTTs (regardless of the technology used) will see an increased administrative burden in relation to the rules on security and privacy. In the absence of more information this burden is assumed to be of an equal size to the administrative burden imposed on OTTs in relation to numbering-related obligations. With regards to the costs associated to content portability, it is expected that one-off adaptation costs would be counterbalanced by the positive effects of a fully harmonised regime across the EU[237].

From a macro perspective, option 4 contributes to realising efficiency gains with lower transactional and compliance costs (fewer duplicate compliance efforts or data requests), a more equal regulatory treatment (particularly with regards to security and privacy), a reduction of regulatory risk as a result of more regulatory clarity and more confidence among end-users. The regulatory reform contributes to fostering the Internal Market. This increased efficiency effect may add 0.15 percentage points to the annual GDP growth. Annual macro-economic growth is estimated to be higher (1.85%) than the base scenario (1.70%)in the period 2021 to 2025.

Social and environmental impacts

Compared to the baseline, the direct impact on sectorial employment is likely to be negligible. However, due to macro-economic efficiency gains, the positive macro-economic impact on jobs and wages may be considerable.

End-users which value privacy, confidentiality and/or security are more likely to participate in popular and innovative communication networks[238]. Also, where this is (or may become) technologically feasible, end-users may use various communication services to contact emergency services subject to availability of standardised solutions. The suggested additional measures focussing on potential lock-in problems related to bundling and the prohibition of discrimination based on nationality or the place of residence of the end-user may support end-users' freedom of choice. A reduced risk to lock-in enhances competition among telecom providers to the benefit of affordability and/or quality.

4.4.3.1.5 Option 5 – Functional approach to communications services

Option 5 differs from option 4 in that, besides regulating the IAS as in option 3, all obligations apply equally to all newly defined communication services which are functionally substitutable and hence in a degree of competition, independent of whether they make use of numbering resources or not. Obligations to interconnect and to be interoperable are based entirely on an assessment of reasonableness considerations relative to technical feasibility, significance of take-up of a given service as well as cost considerations.

Economic impacts

The most direct impact of this option is that the current uncertainty about rights and obligations for the provision of equivalent services would disappear, subject only to reasonableness considerations in respect of interoperability. This would automatically create some more compliance and enforcement and possible legal appeals costs for public authorities as well as

[237] SWD/2015/0274 final/2 - 2015/0287 (COD) - COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT Accompanying the document Proposals for Directives of the European Parliament and of the Council (1) on certain aspects concerning contracts for the supply of digital content and (2) on certain aspects concerning contracts for the online and other distance sales of goods

[238] See SMART 20013/0019: 33% of respondents to a survey conducted for that study do have concerns about privacy and that this forms a reason for not using OTT services.

OTTs, which may be individually subject to interoperability and interconnection obligations based on an assessment of reasonability - a criterion which leaves room for uncertainty on the part of OTT services, which could also impact innovation.[239]

Social and environmental impacts

As in option 4, the impact on sectorial employment is likely negligible as far as sectorial employment is related to revenues. However, due to the contributions to macro-economic efficiency gains, the macro-economic impact on jobs and wages is considerable and positive for both skilled as well as unskilled labour. Similar to option 4, suggested measures on potential bundling-related lock-in problems and supporting switching will enhance end-users' freedom of choice, with a positive effect on affordability and/or quality for end-users. Moreover, as in option 4, end-users which value privacy, confidentiality and/or security are more likely to participate in popular and innovative communication networks. This option would increase the end-users' possibilities to establish emergency communications (for instance through multi-modal IP Multimedia subsystem) including by voice, video, instant messaging and likely increase the operational effectiveness of the emergency communications system, however subject to significant investments in upgrading of the PSAPs.

4.4.3.2 Must carry and EPG obligations

4.4.3.2.1 Option 1 – Maintain Member States' possibility to impose must carry and EPG obligations

Economic impacts

The direct economic impact (costs of implementation, compliance, and enforcement of must carry and EPG obligations) of option 1 is negligible. Online viewing behaviour will continue to grow and larger PSBs will have little difficulty in finding a prominent place in app stores as well as on equipment installed at consumer premises or hand-held equipment. Regional and local PSB will have more difficulty in this respect. Cooperation with larger PSBs to carry niche content in their apps (possibly imposed by national governments) is a likely solution. In addition, niche content providers can develop alternative routes to gain exposure via social media strategies.

The marginal costs of broadcasting a single channel are currently relatively low. But these costs automatically grow in relative terms as the shift from linear to online evolves, because fixed costs would have to be shared over a decreasing number of viewers. As such, the problem of proportionality of current obligations may grow but this can be addressed by ensuring that regular mandatory reviews of existing obligations are conducted at national level. Other stakeholders (end-users, PSBs, OTTs) will remain largely unaffected.

The marginal costs of transmitting data alongside single radio and TV channels enabling connected radio and TV services is negligible. A clarification that such transmission can be covered by must carry obligations could contribute to improving the predictability of the conditions for the introduction and further development of connected radio and TV services by public and commercial broadcasters benefitting from must carry obligations.

Social and environmental impacts

The diversity of content to which end users can have access will increase to the extent that Member State ensure broadcasters benefitting from must carry obligations can also provide red button services.

[239] See SMART 2013/0019 which points out that imposing interconnection and interoperability obligations on OTT business models may hamper innovativeness.

4.4.3.2.2 Option 2 – Phase out must carry obligations

Economic impacts

Compared to the baseline, this option assumes a particular pace in the shift from linear to online. This assumption is highly uncertain and differs (greatly) between Member States. The impact on the business models of both large and small PSBs may be detrimental in some Member States. Similarly, because the shift from linear to online follows a different pace for different Member States, the proportionality problem for ECNs differs between Member States. Even in Member States where there are currently no MC obligations (such as the UK), the impact of this option may not be zero. The mere possibility for the UK to impose must carry obligations may put some degree of discipline on network operators to voluntarily carry general interest channels. In Member States where MC obligations currently exist, but where online viewing behaviour increases rapidly (like in the Netherlands), the impact of phasing out MC obligations may be more limited. However, in those Member States where MC obligations currently exist and watching via OTT platforms increases only at a slow pace (like Germany and France), the negative impact on PSBs would be more significant. ECNs may receive increased feed-in fees[240] up to a maximum of 20 million EUR for a typical ECN operator in a large MS[241], which may benefit end-users in terms of lower subscription fees for the network. In any case, for the EU market as a whole, the impact on the business models of notably small PSBs may be detrimental. It follows that an orchestrated phase out may for some Member States be disproportionate from the perspective of the public interest.

Social and environmental impacts

Compared to the baseline, there is a risk that the impact on the diversity of content which can be accessed by end users may be negative for some Member States. PSBs may experience less exposure to the public, while end-users experience more difficulty in accessing content of public interest. OTTs will remain unaffected.

4.4.3.2.3 Option 3 – Extend must carry obligations

Economic impacts

The economic impact of this option on larger and smaller PSBs is negligible and may have some impact on the operations of ECNs. Extending a must carry obligation would impose an additional burden on IPTV and cable TV platforms to the extent that the on-demand content concerned is not already currently and voluntarily provided via these platforms. IPTV and cable TV platforms currently already customise their on-demand content offered to local preferences. Option 3 may lead to different treatment of IPTV and cable TV platforms by different Member States. The extent to which this option impacts on stakeholders may therefore be considered low.

Social and environmental impacts

Compared to the baseline, the positive impact on the diversity of accessible and findable content remains limited and has relatively low impact on large PSBs or on the variety of their content offered to (i.e. choice for) end-uses. Given the abundance of online content, extending must carry obligations to on demand content provided on IPTV and cable TV platforms could make it easier for some smaller PSBs to build a significant audience. However, such obligations do not appear to be necessary, see section 4.4.4.2.1 on effectiveness.

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[240] Except for ECNs in Member States for which temporary derogations may apply and must carry obligation would remain temporarily in place because broadband coverage and capacity would not yet be sufficient for widespread OTT viewing of TV and radio channels.

[241] SMART 2015/003, section 1.6.1

4.4.3.3 Numbering

4.4.3.3.1 Option 1 – No change in the EU framework on numbering

In global industry sectors such as the automotive sector, M2M communication becomes increasingly important to control high-quality consumer and capital goods. While in 2014 about 7% of global mobile terminals are used for M2M communication, this is expected to rise to 28% in 2019. Thus a considerable increase in devices, operators and services is expected.

In order to address the growing demand, and the competition issue of potential lock-in of M2M service providers with an initial mobile operator, Member States could decide to relax national number assignment criteria and assign numbers to M2M providers. In this case, mobile network codes (MNC, a portion of the E.212 IMSI) could represent a bottleneck. As two digit MNCs are assigned in most European countries, a maximum of 100 MNCs per country or per mobile country code (MCC) can be assigned. Such approach would thus result in a possible shortage of national E.212 numbers. To address the MNC shortage, Member States would have to assign a shared E.212 number range (operator prefixes) to several M2M providers, or/and to adopt a mixed use of 2- and 3-digit numbering ranges, and in excessive cases, to claim additional international country codes for E.212 numbers. The borderless (extra-territorial) use of national numbers would be difficult, if not impossible, to satisfy with this option, in the light of existing tendencies in numbering regulation (see e.g. relevant CEPT Recommendation). It is to be noted that ITU resources may provide an additional solution to many operators, but may not be suitable for smaller operators due to extensive costs, compared to fees of many of the Member States.

Economic impacts

Option 1 may result in aggravated fragmentation of the regulatory landscape in Europe. Moreover, in those Member States where MNCs remain reserved for M(V)NOS, M2M service providers would remain locked-in in at least the short term. Even after an eSIM standard has been adopted by the market, IoT service providers may remain locked-in; at least until their already installed SIM dependent machines become suitable for replacement following full depreciation. This period may possibly last longer as "over-the air-provisioning" (OTA) may continue to be hindered by the limitations of the current Article 30 of the USD in facilitating a change of providers, that was conceived for a market where the replacement of SIMs would not mean a considerable barrier.

Bottlenecks in the IoT value chain as well as limitations to cross-border use may inhibit innovations in IoT services by inter alia electricity providers, car manufacturers and producers of medical equipment and bring an upward effect on prices for IoT services.

From an administrative perspective, the base scenario would entail a number of management complexities (e.g. to implement shared national E.212 number ranges) and substantial implementation costs (creating new national E.164 ranges and/or new E.212 codes), translating into higher transaction/administrative costs.

Macro-economic overall gains from enabling the IoT have been estimated at 0.42%-points to 1.15%-points additional annual GDP growth. However, enabling the IoT involves other challenges besides those related to connectivity (e.g. in the area of standardisation and security and privacy). As such, it is difficult to isolate the impact on overall GDP of not solving the challenges related to numbering.

Social and environmental impacts

Some jobs and skills may become redundant due to automation, while the value of other jobs and skills will increase. McKinsey (2015) notes that "in general, manual work will come under increasing pressure from IoT and smart machines, but IoT will open up some new employment opportunities, too. Workers will be needed to install and maintain the physical elements of IoT systems—sensors, cameras, transponders, and so on. Other workers will be needed to design, develop, sell, and support IoT systems."

Similar to overall GDP gains from IoT, it is not possible to isolate the impact of dealing with numbering related challenges on employment from dealing with other challenges to enabling the IoT. Environmental impacts are difficult to estimate. For the purpose of this review we assume the net impact to be neutral.

4.4.3.3.2 Option 2 – No change in the EU framework on numbering with repeal of redundant rules

Option 2 has no impact in comparison to option 1 besides the fact that the Framework is cleaned from obsolete articles.

4.4.3.3.3 Option 3 – Adapting the EU framework on numbering to address the competition issue on the M2M market

The problem of IoT service provider lock-in is addressed in a coordinated manner as well as the use of extraterritorial use of numbers. Any potential barriers for efficient service provisions within and across countries stemming from current regulation are addressed.

Economic impacts

While Member States will start assigning MNCs to non-M(V)NOs, option 3 results in a less fragmented regulatory landscape in Europe. Independently of when an eSIM standard is adopted, IoT service providers will run less chances of becoming locked-in. Moreover, once eSIM has been adopted, the clarification of Article 30 USD in combination with the possibility for OTA will further facilitate the switching possibilities for IoT service providers.

Bottlenecks in the IoT value chain (related to lock-in, cross-border use, and permanent roaming) are efficiently addressed, having a downward effect on prices for IoT services as compared to the baseline. There is greater development and adoption of IoT applications by inter alia electricity providers, car manufacturers and producers of medical equipment. All in all, it follows that there are potential positive impacts for the competitiveness of the EU as a whole.

With regards to administrative costs, option 3 helps to reduce a number of management complexities and implementation costs related to network and functional testing, billing verification and updates, as operators could cover their overall demand with a less diverse numbering resource. At the same time, the currently proposed bilateral arrangements for extraterritorial use between NRA's responsible for numbering assignment may be replaced by a more harmonised governance structure that is much less burdensome in both procedure (time) and cost. This may require a possible extension of the activities (and costs) of BEREC as well as costs related to coordination with CEPT, which may still be much lower than the costs of the currently proposed multiple bilateral agreements between NRAs and telecom providers.

The macro-economic impacts associated with unlocking the full potential of the IoT, although difficult to isolate, are estimated 0.42% to 1.15% of additional annual GDP growth.

Social and environmental impacts

IoT users will experience lower prices for IoT services and a faster adoption / integration of IoT services by/in existing products and services. NRAs will also not experience increased

administrative / transaction costs associated with complexity of management issues or the increased of extraterritorial use of numbers.

4.4.4 Comparison of options

4.4.4.1 Services

4.4.4.1.1 Effectiveness

The effect of a reduction in administrative burden for ECS providers in option 2 is (slightly) undone by the suggested additional obligations regarding bundled offers. This option will only slightly reduce the gaps in consumer protection and not change the existing uncertainty about the scope and heterogeneous implementation of the framework and their associated regulatory risks for all stakeholders, not different from the base line. In terms of consumer's freedom of choice and their ability to benefit from innovative services, quality and lower rates, option 2 reduces sector specific protection measures only when consumers remain protected by either current horizontal rules or new market realities. As such, streamlining will have no impact in terms of consumer protection in the context of using telecom or OTT services. Measures to address new emerging risks regarding the use of multi-play bundles have a potential positive impact on consumer protection. Issues with regard to security and privacy remain. Since this option is based on minimum harmonisation, the degree of reducing regulatory heterogeneity depends on whether Member States will add obligations to those prescribed by the Framework. In addition, the mandate of the Commission to increase the effectiveness of access to emergency services would be clarified with regard to caller location, PSAP performance and access for disabled end-users.

Option 3 builds on option 2 and further reduces the administrative costs for ECS providers, for instance on switching or contract duration rules, as only the Internet Access Service would be subject to sector-specific legislation. There would, however, be no more sector-specific end-user protection for other ECS (e.g. telephony), provided either traditionally or over the Internet Access Service. This option would eliminate the uncertainty about rights and obligations and ensure regulatory harmonisation, but it would have a negative impact for small telecom operators and result in lower competition in traditional services.

Option 4 notably reduces the unequal regulatory treatment of telecom and the most directly comparable OTT services and reduces gaps in consumer protection, which may in turn foster the adoption of these services by consumers who are today concerned by the possible risks associated to security, privacy and access to emergency services. The scope of the rules is clear which reduces associated regulatory risks. Accompanied by full harmonisation, this option takes the benefits of option 3 without its disadvantages.

Compared to option 4, option 5 eliminates the different regulatory treatment of telecom and OTT services as it equally applies all obligations to all types of communication services. Consumers would be less concerned about confidentiality and security or access to emergency services. However, such regulatory extension involves some level of uncertainty in relation to the applicability of interconnection and interoperability obligations or technical feasibility of access to emergency services which may ultimately reduce the effectiveness of this option: it could limit innovativeness of current and new service providers, in particular with regards to hybrid communications services and new business models that may emerge in connection with machine-to-machine communications.

4.4.4.1.2 Efficiency

Efficiency will be mainly measured in terms of enforcement and compliance costs.

Option 1 entails direct costs associated with maintaining the status quo, including the cost of complying with redundant sector specific rules and unnecessary duplication of costs driven by regulatory heterogeneity when operating in multiple countries. There is considerable overlap between the rules in which Member States differ and the rules that are potentially redundant. An estimate of these costs is not available.

Option 2 brings some room for savings in unnecessary administrative costs such as duplication of costs associated with multi-country operations. Improvement in the accuracy of caller location, access for disabled end-users and performance of Public Safety Answering Points would incur costs in the networks and Public Safety Answering Points but would be largely offset by the benefits arising from the effectiveness of the emergency intervention (safeguarding public health and welfare).

The reduction in administrative costs under option 3 may be larger because more rules are abolished. The reduction in enforcement and compliance costs will partially be undone by the additional obligations regarding the Internet Access Service services.

Under option 4, the savings in administrative burden for telecom operators from streamlining is partly undone by an increase in administrative burden for IAS as in option 3. Many of the savings would contribute to reducing the duplication of costs associated with multi-country operations, while the increases in IAS-related obligations would not lead to unnecessary duplication of costs under the assumption of full harmonisation. The administrative burden may increase for OTT providers that use numbering resources as they will now be subject to more regulation. Moreover, all will experience an increased administrative burden in relation to rules on security and privacy. In addition, depending on the solution that is chosen for access to emergency services from OTTs to numbers in the PSTN network, interconnection and routing cost could be incurred.

Under option 5 the room for administrative relief for telecom operators is similar to option 4. The increase in administrative burden for OTTs is larger compared to option 4 as all OTTs will be subject to the same regulation as telecom providers and all obligations will be related to all clients and not only those that make use of the functionality to interconnect with services under the numbering regime.

As explained, obligations to interconnect and interoperate will only be imposed if this is reasonable subject to limitations of technical feasibility as well as cost. The reasonability clause leaves room for uncertainty and costs associated with implementation, enforcement and possible legal appeals.

4.4.4.1.3 Coherence

Coherence is evaluated in terms of 1) deviation (or disruption) of the status quo, 2) internal consistency with other directives, regulations and objectives of the framework, and 3) external consistency with the wider EU objectives and horizontal directives and rules fostering these objectives.

Option 2 is not a fundamental deviation from the status quo: no fundamental changes are proposed in the framework and the scope remains the same. The internal coherence with other rules in the framework is not affected. Coherence with horizontal rules will increase as there will no longer be differences between sector specific and horizontal rules that target the same objectives. Moreover, circular references between sector specific and horizontal rules will be

dropped. In terms of the improvement of caller location and Public Safety Answering Performance, the regulatory approach in the telecom legislation to access to emergency services would seek to ensure the same level of efficiency and effectiveness as the eCall EU legislation[242] does for in-vehicle emergency call systems.

Option 3 is a significant disruption from the status quo. It would require a full revision of other directives, regulations and objectives of the framework since only the IAS would be regulated, leaving all communications services subject only to horizontal consumer protection rules.

Option 4 is a deviation from the status quo. The scope of the rules is enlarged to include OTTs that use numbering resources, and other OTTs will be subject to a limited set of rules, specifically with respect to security and privacy regulation which may force them to evolve their business models. Internal coherence is stronger under option 4 as the framework now has dedicated rules fostering the roll-out as well as the take-up of connectivity services, and dedicated rules that safeguard competition and end-user protection in the domain of communication services. As such, the entire framework would show a better fit with market developments in which services are more and more detached from underlying (access) networks. External coherence is served similar to 2.

Option 5 is a further deviation from the status quo. As under option 4, internal coherence is larger: dedicated rules fostering the roll-out as well as the take-up of connectivity services, and dedicated rules that safeguard competition and end-user protection in the domain of communication services. Option 5, however, scores less than option 4 on internal as well as external coherence as the extension of all sector-specific rules to OTT communication services seems incompatible with the better regulation objective and with EU innovation policy.

4.4.4.1.4 Impact on stakeholders

Impact on consumers

Under options 1 and 2, people with a preference for privacy, confidentiality and/or security are deterred from participating in popular and innovative communication networks. This issue would increase under option 3 as end-users that are currently discouraged from using OTT services because of concerns about privacy, risk being left without a more private alternative (i.e. traditional telephony and SMS) that contains less unsolicited disturbances. Under options 4 and 5, people with preference for privacy, confidentiality and/or security experience fewer barriers to participate in modern communication networks.

Under option 1 there is a looming risk to lock-in with multi-play bundles. This may likely have negative consequences for future affordability and quality of the communications services. Options 2, 4 and 5 introduce specific measures to reduce these risks. Under option 3, measures to reduce lock-in with multi-play service providers may be offset by relaxing obligations for interconnection and subsequent concentration of the market.

Under options 1 and 2 access to emergency services is de facto reduced as consumer preferences for communication are gradually migrating to new OTT platforms that are currently exempt from the obligation to provide access to emergency services. Under option 3, the situation worsens as traditional telecom services would no longer be obliged to provide access to emergency services. Under options 4 and 5 (some) OTT services will be obliged to provide access to emergency services (where this is technologically feasible, and with appropriate

[242] Commission delegated regulation (EU) No 305/2013 of 26 November 2012 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the harmonised provision for an interoperable EU-wide eCall.

caveats to end-users as regards quality of service). Under option 4, however, this obligation applies only to a limited number of OTTs that seek interconnection with the numbering regime.

Under options 3, 4 and 5 consumers will be able to use public electronic communications networks or services regardless of their nationality or place of residence.

Impact on telecom operators

Options 1 and 2 maintain the unequal regulatory treatment of telecom operators, vis-à-vis OTTs. Option 3 would considerably reduce the asymmetric regulatory treatment as the reduction of the scope of the regulatory framework would give telecom operators more room to experiment with other revenue models (e.g. advertisement based). Options 4 and 5 would also reduce the regulatory asymmetry, but would not have any effect on operators' incentives to experiment with alternative revenue models since the options involve clarifying/extending the scope of the adapted regulatory framework.

Option 1 maintains currently redundant sector specific rules in place and hence maintains the current level of administrative burden experienced by telecom operators. Option 2 aims to reduce the administrative burden as much as possible by getting rid of sector specific rules that have become redundant either because of overlap with horizontal rules, or because of changing market conditions. Option 3 would further reduce the administrative burden by getting rid of all obligations regarding communication services, but this effect would be mitigated by the introduction of a number of new obligations (and associated administrative burden) for operators that offer IASs. From option 2 to options 4 and 5, the reduction in obligations for telecom operators when offering communication services remains the same, but the number of obligations when offering IASs would go up. Additional measures that impact on OTTs do not directly impact on telecommunication operators.

With respect to the Internal Market, the current costs of multi-country operations caused by regulatory heterogeneity remain as high as they are now under option 1. The streamlining exercise under options 2, 4 and 5 reduces the dimensions for regulatory heterogeneity that are faced by telecom operators. Similarly, regulatory heterogeneity is reduced under option 3, but the Internal Market will now be hindered by strategic barriers (caused by the absence of interconnection obligations), rather than regulatory barriers.

Impact on OTTs

OTTs face hardly any administrative and compliance costs under option 1, 2, and 3 since they are not subject (or in the case of those using numbers: not clearly subject) to most of the framework's obligations. Option 4 would impose additional administrative burden on a limited number of OTTs that interconnect with the numbering regime. In addition, all OTTs (regardless of the technology used) will experience an increased administrative burden in relation to complying with rules on security and privacy. Under option 5, the administrative burden for OTTs increases further as now all OTTs would be subjected to all rules in the framework. Furthermore, Option 5 introduces for OTTs an obligation to interconnect subject to "reasonable limitations of technical feasibility as well as cost limitations". This obligation gives rise to uncertainty and risks for innovation.

Impact on start-ups and SMEs

Because of the unclear scope of the regulatory framework under options 1 and 2, start-ups and SMEs trying to gain a foothold in new digital value chains (e.g. the IoT value chain) experience regulatory risk which lowers confidence in future planning and investments. Under options 3, 4, and 5 the scope of the RF is clear and takes away this cause for regulatory risk.

Impact on NRAs

The impact for NRAs relates mostly to enforcement costs. Under option 1, these remain at the current level. Option 2 will not have a major impact on enforcement costs. Abolishing overlapping rules would not bring any predictable savings; either because they are currently already enforced by competent authorities, because member states may decide to give responsibility for enforcing horizontal rules to the NRA, or because new responsibilities for NRAs may emerge in the form of providing technical assistance to competent authorities when they were to deal with sector specific issues. Under option 3, (compared to option 2) there is a risk of more need for ex-post interventions in which NRAs may need to support Competition Authorities. Moreover, while a number of activities related to monitoring transparency and quality of service of electronic communications services can be abolished, a number of these activities need to be re-introduced to enforce similar type of obligations imposed on internet access service. Under options 4 and 5 (compared to option 3), NRAs will need to devote more resources to regulating OTTs as well. Moreover, under option 5, the obligation to interconnect subject to "reasonable limitations of technical feasibility as well as cost limitations" gives rise to enforcement/implementation costs.

	Option 1: Status quo	Option 2:	Option 3:	Option 4:	Option 5:
Consumers	A) Security and privacy issues remain. B) Looming risk to lock-in with multi-play bundles C) As OTT usage increases, there is an effective reduction of access to emergency numbers	A) 0 B) Lower risk C) 0	A) More issues B) Unclear (iii) C) -	A) Fewer issues B) Lower risk C) +	A) Fewer issues B) Lower risk C) +
Telco's	D) Unequal regulatory treatment vis-à-vis OTTs remains. E) Compliance costs F) duplication of costs when operating in multiple countries	D) 0 E) go down F) down (ii)	D) ++ E) down less than in option 2 (i) F) market entry i.s.o. regulatory barriers (iv)	D) + E) go down less than in option 3 (i) F) same as 2	D) ++ E) same as 4 (i) F) same as 2
OTTs	G) no compliance cost except some legal cases as to the scope of the RF	G) 0	G) reduced	G) new compliance costs	G1) New compliance costs G2) regulatory risk (vii) G3) impede innovations(vii)
IoT Start-ups and SMEs	I) Low confidence in future planning and investments due to unclear scope of RF	I) 0	I) More clarity but more market risks (v)	I) clarity about scope	I) clarity about scope
NRAs	L) Enforcement costs	K) 0 (i)	K) go up (vi)	K) 0 (i)	K) go up (vii)

(i) Reduction in compliance costs due to cancelling redundant rules are significant. Reduction of enforcement costs by NRAs are zero. From option 2 to 3 the number of obligations for ECS reduce, but new obligations for ECN arise. From 2 to 4 and 5, the reduction in obligations for ECS remain the same, but the number of obligations for ECN go up. Additional measures that impact on OTTs do not impact on Telco's

(ii) Streamlining reduces the dimensions for regulatory heterogeneity. While lack of clarity about the scope of the RF may lead to evolution of interpretations by MS and create new heterogeneity of rules, this would not affect Telco's but rather OTTs and IoT.
(iii) Measures to reduce lock-in with multi-play service providers may be offset by relaxing obligations for interconnection and subsequent concentration of the market.
(iv) Relaxing obligations to interconnect may allow for the creation of market entry barriers as National Markets concentrate.
(v) IoT start-ups will have less uncertainty about rights and obligations and experience less duplication of costs when operating in multiple countries, however, Option 3 may introduce competition issues for number-based m2m service providers vis-à-vis large operators
(vi) Risk of more need for ex-post interventions in which NRAs may need to support CAs
(vii) Interconnection subject to "reasonable limitations of technical feasibility as well as cost limitations" gives rise to enforcement/implementation costs, uncertainty and risks for innovation

4.4.4.1.5 EU added value

The question addressed here is how does each option respond to the need for EU action?

Option 1 and 2 leave a lack of clarity about the scope of the regulatory framework and implicitly invite Member States to deal with the problem that similar services are subject to different rules. This may raise new issues regarding cross border service provision. Options 3, 4, and 5 bring clarity about the scope of the Regulatory Framework such that the need to take action at national level no longer exists. EU action in this case reduces the risk of new forms of regulatory heterogeneity. Option 3, however, creates potential new competition issues that require actions by national authorities with a real chance that they do not respond with similar remedies and thereby potentially contributing to new forms of regulatory heterogeneity and barriers for cross-border service delivery. Option 4 has the advantages of option 3 in terms of clarity about the scope of the rules but avoids the possibility of heterogeneous application at national level. Option 5, while bringing clarity, is likely to be disproportionate and fails to ensure the necessary level of regulatory certainty that the framework is meant to bring.

4.4.4.1.6 Summary table comparing services options

Table 10 - Comparison of options - Services

	Effectiveness				Efficiency	Coherence			EU value add
	Streamlining	Competition and innovation	Consumer protection	Fosters cross-border services/ entry	Cost/complexity/ enforceability	Disruption from status quo (stability)	Internal coherence	External coherence	Additional impact vs MS acting alone
Option 1: Status quo	0	0	0	0	0	0	0	0	0
Option 2: stream line only	+	+	+	?	++++	0	0	+	0

Option 3: IAS only	+	+/–	–	+/-	+++	– – –	–	–	?
Option 4: IAS + CS + E.164	+	++	+++	++	+++	–	++	+	+
Option 5: IAS + CS	+	++	++	+	+	– –	+	+/-	+

4.4.4.2 Must carry and EPG obligations

4.4.4.2.1 Effectiveness

Social and environmental effects of the options are set out in the previous section.

In addition, option 1 has no impact in terms of diversity of content offered and would provide some degree of balance between the benefits with regard to general interest objectives and the cost imposed on ECNs.

Option 2 would remove the burden imposed on ECNs over time (i.e. by 2020-2025) but would create disproportionate risks to the achievement of general interest objectives as some small PSBs would have less access to essential broadcasting networks.

Option 3 would risk imposing disproportionate burdens on IPTV and cable TV platforms while harm could be caused at the same time to general interest objectives by inappropriate and disproportionate intervention. The proposal amending the Audio-visual Media Services Directive explicitly refers to the competence of Member States to ensure discoverability of content of general interest under national legislation. Accordingly it is not necessary to rely on must carry obligations to pursue the same regulatory objective.

It follows that, taking into account also the social effects, option one scores best on effectiveness.

4.4.4.2.2 Efficiency

Genuine economic effects of the options are set out in in the previous section. In addition, under option 1, the costs of implementing, enforcing, and complying with must carry and EPG obligations are negligible for ECNs and NRAs: operational activities involved are limited and do not differ from regular operations (such as customer relations, legal advice, etc.). It follows that option 2 would hardly lead to lower costs. Under option 3, extending must carry obligations to on- demand content provided by IPTV and cable TV platforms would cause additional costs for implementation, enforcement and compliance. Accordingly, taking into account also the genuine economic effects, option 1 scores best in terms of efficiency.

4.4.4.2.3 Coherence

Option 1 is not a radical change from the current provision. There is limited positive impact on Single Market coherence as must carry obligations define a maximum scope for regulatory intervention by Member States and therefore determine the maximum degree of possible diversity between Member States. Similar coherence is not currently provided in the OTT area nor for presentational aspects of EPGs. For EPG access which can be imposed by NRAs, BEREC and art 7 procedures are available to ensure coherence[243].

For most Member States option 2 is a radical change from the current provisions. Maximum internal market coherence is achieved as removal of must carry obligations would by definition result in full coherence. However, option 2 may be incoherent with the Commission Communication on a European agenda for culture in a globalizing world[244], subsequently endorsed by Member States[245], according to which the promotion of cultural diversity represents one of the main objectives that should guide EU action in the field of culture. These negative impacts on internal coherence are considered to be more significant than the positive impacts on single market coherence, as even without must carry obligations conditions in national broadcasting markets across the EU will remain substantially different in terms of market size, transmission networks used and user preferences for content (depending i.a. on language and social-cultural identities).

Option 3 is also a radical change from the current provisions. As under option 1 there is limited positive impact on Single Market coherence as must carry obligations define a maximum scope for regulatory intervention by Member States and therefore determine the maximum degree of possible diversity between Member States. However, with regards to internal consistency, option 3 scores negatively. While must carry obligations are currently imposed on ECNs, the extension of must carry obligations to on demand content provided on IPTV and cable TV platforms would be incoherent with the split between the rules that apply to ECN and those that apply to audio-visual media content (see the penultimate paragraph of section 4.4.4.2.1). Again, the negative impacts on internal coherence are considered to dominate the limited positive effects on Single market coherence. Accordingly, option 1 scores best on coherence.

4.4.4.2.4 Impact on stakeholders

Consumers

Under option 1, consumers enjoy a certain degree of pluralism in the form of content of public interest adjusted to local preferences. Option 2 would in some Member States (where must carry obligations currently apply) experience less pluralism in return for (slightly) lower prices for ECN services as ECN providers may pass on part of the increased feed-in revenues to consumers. Option 3 would have no impact on pluralism or prices as it would not contribute to a more effective digitisation strategy for public service broadcasters.

Electronic Communication Network providers

Under options 1 and 3 ECN providers that are subject to must carry and EPG obligations miss out on feed-in fees. Under option 2, ECN providers would generate higher feed-in revenues.

Public Service Broadcasters

[243] For the details of the consolidation process under art 7 of the Framework Directive please refer to section 1.2.3.1
[244] COM(2007) 242 final
[245] Resolution of the Council of 16 November 2007 on a European Agenda for Culture, (2007/C 287/01)

Under options 1 and 3 public service broadcasters experience low barriers for broadcasting due to no/low feed-in fees. Under option 2, public service broadcasters would likely have to pay higher feed-in fees, causing some public service broadcasters to cease (certain) activities.

OTTs

Under options 1 and 2 OTTs remain unaffected. Option 3 would require OTTs to adjust their algorithms which may negatively impact on their business model (particularly if they apply an advertisement based business model).

Member States

Under option 1, Member States have some degree of freedom to use appropriate tools as required by local market circumstances. The scope remains limited to ECN services (but Member States would remain free as regards non-ECN providers, subject to the currently proposed revision of the Audio-visual Media Services Directive). Option 2 would limit the number of tools available (it takes away must carry obligations as a tool) and option 3 would extend the scope of these tools to include online services.

	Option 1: Status quo	Option 2: Phase out obligations	Option 3: Extend must carry obligations to OTT providers
Consumers	Positive, viewers continue to have access to PSB services via traditional TV networks, with adaptation to connected TV environment.	Negative, in some cases viewers may lose access to PSB services via traditional TV networks before OTT substitution is viable	Neutral compared to option 1: No impact on PSBs (neither small or large) or on the variety of content offered to (i.e. choice for) end-uses. The abundance of online content could make it more difficult for some smaller PSBs to build a significant audience
Larger and multi-national commercial content providers	Neutral – market entry might continue to focus on the OTT area which has less regulatory constraints	Positive - market entry could include traditional TV networks to the extent that transmission capacity becomes available subsequent to discontinuation of must carry obligations	Neutral. No change in the possibilities to make content available compared to status quo as OTT providers already include PSB content.
PSBs, including at regional and local level	Positive, existing privileges would remain in place	Negative, appropriate transmission on traditional TV networks would have to be negotiated under market conditions.	Negative as concepts for proportionate and appropriate intervention in the OTT area do not currently exist. Positive effects are possible in the long terms, if such intervention can finally be successfully conceived.
ECNs	Neutral/positive – existing regulatory burdens and constraints would remain, but with a perspective that they will be removed gradually over time subsequent to national reviews of obligations.	Strongly positive - existing regulatory burdens and constraints would disappear by 2020-2025	Neutral – no change of existing burdens and constraints
OTT service providers which are not	Neutral – existing obligations do not relate to	Neutral – existing obligations do not relate	Negative as concepts for proportionate and appropriate

themselves content providers	OTTs	to OTTs	intervention in the OTT area do not currently exist.

While there is a majority view that transmission obligations imposed on electronic network operators (must carry rules) and rules related to electronic programme guides should be adapted to new market and technological realities, there is sharp disagreement as to how such adaptation should be conceived. Extension of the current rules is supported by some Member States and most broadcasters, whereas most telecom **operators** are in favour of reducing the scope of the rules. Public service broadcasters consider that the future scope of rules should extend to interactive and non-linear services, should also cover hybrid TV signalling and should apply on a technologically neutral basis to all distributors of audio-visual content, not only to ECNs. Telecom **operators** call for a level playing field between broadcasters and online platforms and call for improving access to content rights. Some cable and telecom operators call for complete removal of must carry obligations or at least to limit them to the main/most essential general interest channels. Commercial broadcasters, one telecom operator and a citizen consider that the current provisions are adequate.

4.4.4.2.5 EU value added

The most important reason for EU actions on must carry and EPG access should be found in relation to the European Agenda for Culture which puts cultural diversity, including access to culture and cultural works, at the heart of any EU action on culture..

In the context of this review, the need for EU actions should be related to the mandate given by the EU to Member States in imposing must carry obligations and to NRAs in imposing EPG access obligations. The current provisions in the Regulatory Framework seem to be sufficient. Most PSBs, with an exception of small local PSBs offering niche content, do not experience difficulty in providing their on demand content on IPTV and cable TV platforms. The smaller PSBs find it difficult to build a large enough digital audience. Current provisions by the ECNS regulatory framework do not allow for extending MC and EPG obligations accordingly. Such extension does not appear to be necessary (as there are alternative options available, see the penultimate paragraph of section 4.4.4.2.1)..Accordingly, option 1 scores best in terms of EU value added.

4.4.4.2.6 Summary table comparing must carry and EPG options

Table 11 - Comparison of options – Must carry and EPG

	Effectiveness				Efficiency	Coherence			EU value add
	Streamlining	Competition and innovation	Consumer protection	Fosters cross-border services/entry	Cost/complexity/ enforceability	Disruption from status quo (stability)	Internal coherence	External coherence	Additional impact vs MS acting alone
Option 1: no change	0	0	0	0	0	0	0	0	0

Option 2: Phase out MC	-	-	0	0	0	0	0	-	n.r.
Option 3: Extend MC	+	0	0	0	0	-	-	0	n.r.

4.4.4.3 Numbering

4.4.4.3.1 Effectiveness

The redundant rules addressed by Option 2 do not involve administrative costs, do not have implications on competition and innovation and do not impact on consumers or on the Internal Market.

Option 3 likely results in a net reduction of administrative costs (notably related to permanent IoT/M2M roaming and extra-territorial use of numbers) and limits the risks of a lock-in of M2M service providers by connectivity providers. This benefits the competition between connectivity providers and creates a more level playing field for M2M service providers vis-à-vis telecom operators. Option 3 allows for more flexibility of business models for M2M services, resulting in more innovative services and benefiting the (faster) integration of more industries in the IoT. It leads to (faster) integration of diverse industries into the IoT. Option 3 contributes (via simplifying rules on / governance of permanent roaming and extra-territorial use of numbers) to cross border connectivity and thereby to cross border IoT services.

4.4.4.3.2 Efficiency

While the numbering resources do not face similar physical limitations as spectrum, the numbering requirements bear costs for the operators. With the rapid development of M2M, regulatory fragmentation under Option 1 and 2 may generate additional costs relating to the fulfilment of divergent conditions for the use of numbers. Option 3 would aim to ease this fragmentation and could thus reduce the underlying costs, with spillover effects on more efficient marketing of products throughout the single market (e.g. without a need to recall a connected car to replace the SIM when sold cross border).

4.4.4.3.3 Coherence

Option 2 is not a deviation from the status quo: there are minor changes proposed in the framework and the scope remains the same. Under option 2, neither internal nor external coherence is affected.

Option 3 is not a major deviation from the status quo; there are no fundamental changes proposed to the framework; the scope remains the same while option 3 mainly aims to provide clarity, coordination and guidance. Internal coherence (with regards to the overall telecom framework) is improved while objectives with regard to overall objectives of fostering competition, innovation and the internal market are better served in the context of the evolving IoT value chain. While these objectives are not only telecom specific, but also overall EU-wide objectives, external coherence is served as well. Moreover, the provision of clarity and guidance does not impact on the external coherence with existing governance arrangements between Member States and the ITU.

4.4.4.3.4 Impact on stakeholders

Consumers

Under option 1 and 2, bottlenecks in the IoT value chain as well limitations to cross border use may inhibit innovations in IoT applications and have an upward effect on prices for products and services relying on IoT services. Option 3 addresses a number of these bottlenecks.

IoT users (Industry 4.0)

Under option 1 and 2, bottlenecks in the IoT value chain as well limitations to cross border use of IoT services may lead to higher prices for IoT services and hinder the development and adoption of IoT applications by inter alia electricity providers, car manufacturers and producers of medical equipment. Such barriers could lead to a competitive disadvantage for these industries in the EU vis-à-vis the rest of the world. Option 3 addresses a number of these bottlenecks and hence facilitates the development and adoption of IoT applications by other industries.

IoT service providers (including SMEs)

Under options 1 and 2, because of the high costs related to physically swapping SIM cards in IoT devices, IoT service providers (relying on SIM based connectivity) run the risk of being locked-in with their connectivity provider, leading to higher prices for and lower quality of connectivity services. Moreover, as a result of unclear rules regarding permanent roaming and of complex procedures regarding extra-territorial use of number, options 1 and 2 would lead to IoT service providers facing difficulty in delivering reliable always and everywhere connected services (domestic and cross border). Measures under option 3 would lower the costs of switching to a different connectivity provider and indirectly result in lower prices and higher quality. Under option 3, the clarification, coordination and simplification of rules regarding permanent roaming and extraterritorial use would address these difficulties. All in all, compared to options 1 and 2, option 3 would provide more room for innovations of IoT services.

Operators

For telecom operators, options 1 and 2 would potentially result in higher revenues from connectivity services provided to IoT service providers. Furthermore, assuming an increasing demand for cross-border M2M services, operators would experience higher costs for administration and implementation. Under option 3, the measures aimed at lowering switching costs would lead to lower prices and revenues. The clarification, coordination and simplification of rules regarding permanent roaming and extraterritorial use would lower these costs.

NRAs

Assuming a growing demand for cross border M2M services, options 1 and 2 would also lead to increased implementation costs for NRAs, for similar reasons as those applying to electronic communication providers. Similarly, option 3 would largely prevent the increase in costs.

	Option 1: Status quo	Option 2: only Repeal of redundant rules	Option 3: Address competition
Consumers	A) Higher prices for IoT services	A) same as option 1	A) Lower prices
IoT users (Industry 4.0)	B) Higher prices for IoT services C) Potential barriers for cross border use of applications	B) same as option 1 C) same as option 1	D) Lower prices E) Less risk F) Fewer barriers

	D) Potential barrier for full integration into the IoT	D) same as option 1	
IoT service providers (including SMEs)	E) Potential lock-in with connectivity providers, leading to high prices and lower quality F) Potential bottlenecks in delivering reliable always and everywhere connected services (domestic and cross border) G) Less room for innovations of IoT services	E) same as option 1 F) same as option 1 G) same as option 1	E) Less risk F) Less bottlenecks G) More room for innovations
Telco's	H) High prices and profits I) Growing administrative costs related to extra-territorial use of numbers	H) same as option 1 I) same as option 1	H) Lower prices, less profits I) Lower administrative costs
NRAs	J) Growing administrative costs related to facilitating the extra-territorial use of numbers	J) same as option 1	J) Lower administrative costs

4.4.4.3.5 EU value added

Exiting arrangements such as the relevant recent CEPT recommendation seem to propose an authorisation regime that could prove burdensome and in any case seem to lack efficient enforcement possibilities. Regulatory fragmentation in the area of numbering management could seriously impede the development of the M2M sector, preventing operators to benefit from economies of scale granted by the Single Market.

4.4.4.3.6 Summary table comparing numbering options

	Effectiveness				Efficiency	Coherence			EU value add
	Streamlining	Competition and innovation	Consumer protection	Fosters cross-border services/entry	Cost/complexity/ enforceability	Disruption from status quo (stability)	Internal coherence	External coherence	Additional impact vs MS acting alone
Option 1: no change	0	0	0	0	0	0	0	0	0
Option 2: Repeal of redundant rules	0	0	0	0	0	0	0	0	0
Option 3: Address competition	+	+	+	+	+	0	+	+	+

4.4.5 The preferred option

4.4.5.1 Services

The Commission considers that option 4 on services is the best option to achieve the overall and specific objectives of the review of the telecom framework as presented in section 3.

Option 4 contributes most to realising efficiency gains: there are lower transactional and compliance costs (by reducing duplicate compliance efforts or duplicate data requests); there is a more equal regulatory treatment (particularly with regards to security and privacy obligations), a reduction of regulatory risk as a result of more clarity about the scope of the regulatory framework which promotes confident future planning and investments; and the regulatory reform contributes to fostering the Internal Market. Through these channels, increased efficiency gains may spur innovations that translate in the growth of total factor productivity and income per capita. The impact on GDP growth of regulatory reforms have been analysed by Haider (2012). The study analyses 1140 reforms in 172 countries during the period 2006-2010. Haider finds that each reform is associated (on average) with a **0.15 percentage points increase in annual economic growth**. These reforms in Haider's study did not include sectorial reforms but rather reforms of general regulation on doing business[246]. This option ensures effective access to emergency services envisaging the improvement of caller location, access to disabled end-users and the performance of Public Safety Answering Points (as defined in option 2) and it also brings regulatory clarity with regards the scope of the obligation to provide access to emergency services.

4.4.5.2 Must carry and EPG obligations

Given that option 1 scores best on all criteria (effectiveness, including genuine social impacts, efficiency, including genuine economic impacts, coherence and EU added value) the Commission considers that option 1 is the best option to achieve the overall and specific objectives of the review of the telecom framework as presented in section 3. No macroeconomic effects could be quantified through modelling for this policy area.

4.4.5.3 Numbering

The Commission considers that option 3 is the best option to achieve the overall and specific objectives of the review of the telecom framework as presented in section 3. The macroeconomic effects could not be quantified through modelling for this policy area, Nevertheless, the expected proliferation of M2M in all sectors of the economy from manufacturing to consumer electronics should have a considerable impact on the overall economy.

4.5 Institutional governance

4.5.1 Options

Any institutional structure needs to be functional to the future objectives that the legal framework which it will be called to fulfil and to the problems to be addressed by means of the public intervention. The scope of the European institutional dimension, intended as the governance template, and the procedural tools defined at EU level as necessary to support the future regulatory framework, therefore, depend on the scope and intensity of the desired EU

[246] The Woldbank Data on which the publication of Haider is based included mainly general reforms aiming to improve 'doing business' in the following dimensions: Starting a Business, Dealing with Construction, Permits, Getting Electricity, Registering Property, Getting Credit, Protecting Minority Investors, Paying Taxes, Trading Across Borders, Enforcing Contracts, and Resolving Insolvency – see http://www.doingbusiness.org/

harmonisation. The assessment of options for intervention levels below attempts to identify which tasks are likely to require a more co-ordinated, or harmonised, approach at EU level and what should/could be the intensity of such EU intervention.

The governance options flow from the options presented in each subject area and they assess at the same time the different governance levels/bodies (Commission, independent NRAs, BEREC, RSPG, etc.).

The analysis carried out by the consultant suggests that the maximum benefits can be gained from a more targeted streamlining of regulation, combined with measures to ensure greater consistency at an EU level on aspects which are still subject to regulatory intervention.

In the following sections we describe the potential governance solutions which would support the preferred options identified in each policy area, with a focus on the implications of these options for the distribution of tasks and resourcing of BEREC, the RSPG, NRAs and the Commission.

Option 1: status quo – baseline scenario

Today's regulatory framework provides a high degree of flexibility for national regulatory authorities and Member States. This provides significant scope for regulation to be tailored to meet specific national or local circumstances. However this system carries significant weakness in areas where consistency is essential or would better serve the common European interest.

The current framework harmonises very few competences assigned to national regulatory authorities responsible for ex ante market regulation and allows Member States to assign tasks under the framework to Ministerial bodies or other authorities. The result is a patchwork, since there is no other competence than ex ante market regulation for which all 28 national regulatory authorities members of BEREC are also competent for. Even the resolution of disputes between undertakings is not assigned in all Member States to the national regulatory authority responsible for ex ante market regulation (it is assigned in Belgium to the competition authority). As a result there is currently asymmetry of information between the different NRAs regarding market developments in the area of services, such as interoperability between communication services. Discrepancies exist for the general authorisation, for numbering, for consumer protection etc. This has an impact when the legislator has given BEREC a role in areas where competence at national level is not harmonised for its members, such as for instance the resolution of cross-border disputes.

As regards access regulation, the current governance structure requires a relatively complex (and some argue[247] inefficient) system of Recommendations, ex ante checks (under the so-called Article 7 procedure) and balances (with different roles for the Commission, BEREC, COCOM, and the national as well as European courts) to ensure that consistent outcomes are achieved, and yet even in cases where common approaches are agreed between the Commission and BEREC, the system does not achieve sufficient consistency. A key example, described more fully in SMART 2015/0002, concerns mobile termination rates, while business access is another area where the existing system does not appear to be yielding effective results.

In the spectrum area, spectrum allocation and technical conditions are harmonised with Commission decisions based on the Radio Spectrum Decision, with the participation of Member States in the Radio Spectrum Committee. There is no institutional set up for coordination of spectrum assignments. RSPG has a purely advisory role to the Commission on some more high level strategic spectrum issues.

247 See for example EP (2013) How to Build a Ubiquitous EU Digital Society page 29

Under the current framework the Commission scrutinises (with BEREC) draft *ex ante* market remedies notified by NRAs, but is not able to take binding action (e.g. to use a veto power) under the article 7a procedure. More general Decisions on remedies might be possible in theory under Article 19 of the Framework Directive, but may only be initiated two years following a Recommendation on the same subject (which may have its own period for entry into effect, to be first taken into account) and following a lengthy process involving BEREC and COCOM.

Under this option BEREC for access and the RSPG for spectrum would maintain their current advisory roles. Responsibilities for independent NRAs in areas such as consumer protection and spectrum would continue to vary to a degree at national level. The role of the Commission and BEREC in relation to ensuring consistency of draft measures proposed by NRAs concerning remedies in markets, in which operators with SMP have been identified, would remain of a non-binding nature.

The responses to the public consultation show diverging views with regards to the aptness of the current institutional set up at EU level. Almost half of the respondents to the PC agreed that the current institutional set-up should be revised in order better to ensure legal certainty and accountability. In particular some respondents called for making sure that institutions are accountable for their decisions (both politically and legally).

On the contrary, BEREC was of the view that the current sectorial institutional set-up has worked well so far and any intervention should be therefore carefully considered. According to BEREC, rootedness in its member regulators must remain core to the regulatory system.

Amongst those who favoured a revision of the current institutional set-up, proposals differed as regards BEREC from a limited advisory role to turning it into a EU regulatory authority with proper decision-making power. Some respondents called for strengthening BEREC's role within the Article 7 procedure and also for improving coordination (with other institutions, regulatory bodies and stakeholders).

Several respondents expressed their views that BEREC in its current form (as a body composed of 28 individual NRAs) has shown a limited ability to act strategically and in the interest of EU competitiveness and it does not contribute to the objectives of the Regulatory Framework in a satisfactory manner.

With regard to spectrum governance, in order to serve the future wireless connectivity needs of the EU, a common EU approach to governing spectrum access was welcomed by respondents to the public consultation in order to enable technologies to be used seamlessly, but respect for spectrum as a national asset was required. Delays in availability of spectrum and fragmentation between conditions of use in different Member Stated were noted.

Option 2: enhanced advisory role and strengthen competences

Under this option, in order to improve consistency in a number of areas identified in the previous sections of this report, it will be **proposed to strengthen the role of independent NRAs by establishing a minimum set of competences to be carried out by those NRAs across the EU.** This, in turn, should also have a positive effect on the efficiency of BEREC to achieve its objectives since all its members would have the necessary competences and experience in the relevant matters and, at the same time, a more efficient implementation of the best practice guidance provided by the Agency, given that all its members would be responsible for implementation at national level. The public consultation supported the alignment of a minimum set of competences. BEREC for instance called for identifying a common set of sector specific competences that should be entrusted to independent NRAs and aligning them to BEREC's own competences.

The harmonisation of the competences of independent NRAs will vest the NRAs with necessary competence to intervene in all main areas related to the electronic communications networks, except spectrum. As (some) NRAs would be assigned an increased portfolio of competences, it is essential to ensure that they are attributed the necessary human and financial resources to carry out those tasks.

At the EU level, both the Agency and RSPG would continue to have an advisory role and the Agency **should extend its advisory scope to the areas where the independent NRAs are competent in order to align BEREC tasks to those of the NRAs**. However, in order to increase its efficiency and provide more stable management, the governance structure of the new Agency would be adapted to substantially align with the 2012 Common approach on decentralised agencies[248]. This means that the regulatory functions would also be carried out under the Agency umbrella by a revised body which will operate with legal personality.[249] This would also address the lack of accountability of BEREC raised by respondents to the public consultation.

Although the seat of the Agency is an issue for political consideration, and it may be judged that any adapted agency should be considered as the successor of the current BEREC Office, whose seat has already been determined, the Common Approach states certain criteria to be considered, including assurance that the agency can be set up on time, accessibility of the location, existence of adequate education facilities and appropriate access to labour market, social security and medical care.

A new Management Board would be established to oversee the day-to-day governance of the overall Agency, replacing the current Board of Regulators and Management Committee. Moreover, a more stable governance structure is envisaged through the establishment of a Chairperson (to be selected amongst the members of the Management Board) with a longer term (currently the term is one year), to grant additional stability. The Executive Director will have extended powers compared to the current Administrative Manager of the BEREC Office and will be selected from a list of candidates proposed by the Commission following an open selection procedure as it is foreseen in the Common Approach and is the case in other agencies.

Under this option there will be an exchange of best practices within the RSPG regarding spectrum assignments practice of Member States, and for the rest it will continue advising with a particular focus on pre market-forming aspects.

Option 3: advisory role for BEREC/RSPG with certain normative powers for BEREC and improved process for market review and spectrum assignment

Under this option most elements from Option 2 would be maintained, in particular the minimum set of harmonised competences (now including also a competence to define the regulatory and market shaping elements of ECNS spectrum assignments), the alignment of NRAs and the Agency's tasks, the substantial alignment of the Agency governance structure with the Common Approach for EU agencies and the advisory role for RSPG .

Additionally, a number of changes are implemented in order to address some of the key obstacles identified in the substantive areas, in particular for access, spectrum, services and numbering. Accordingly, BEREC is vested with some additional tasks including certain binding powers. It is worth pointing out that the substantial alignment of the Agency governance

[248] See the Joint Statement of the European Parliament, the Council of the EU and the European Commission on decentralised agencies of 19 July 2012.

[249] In contrast to the current structure under which the Board of Regulators of BEREC is in charge of decisions on regulatory matters and the BEREC Office (established as an EU agency governed by a Management Committee and an Administrative Manager) is solely entrusted with a support administrative function to BEREC.

structure with the Common Approach on decentralised agencies will also address the concern raised by some PC respondents (in particular incumbent operators) that the current BEREC structure does not allow the body to fulfil executive and binding tasks but only advisory. The alignment with the Common approach will imply that the regulatory functions would be carried out under the Agency umbrella by a revised body which will operate with legal personality. Under the assessment carried out for access regulation, we identified the need to ensure greater consistency and co-ordination in the practices of NRAs concerning market analyses, in particular with regards to the choice of remedies with a cross-border dimension such as those used for business services. In order to improve the current situation where the Commission and BEREC have only non-binding powers as regards remedies, a **'double-lock' system** is proposed whereby, in cases where the Agency and the Commission agree on their position regarding the draft remedies proposed by an NRA, the NRA could be required by the Commission to amend or withdraw the draft measure and, if necessary, to re-notify the market analysis.

A majority of respondents to the public consultation agreed that the current role and responsibilities of the institutional actors should be amended. On one hand a group of (mainly) incumbent operators proposed more discretion for NRAs with a reduced role of the Commission (or BEREC), highlighting the need for taking account of national circumstances. On the other hand, there was a significant number of voices calling for an increased role of the Commission to ensure consistency (through a veto for remedies, for example).

Currently, neither the Commission, nor BEREC have a full picture of the exact footprint and capacity of electronic communications networks. While mapping initiatives have developed in most of the Member States, they differ in scope and level of detail and the information they provide is not easily available and comparable. It is therefore proposed that NRAs would, as part of the market analysis, conduct a periodic geographic analysis of the current and prospective reach of networks (including quality of service mapping) and make this information available to the Commission and the Agency in the context of their monitoring tasks. The Agency would also receive the power to request information directly from operators, a power which would be extended to also cover communications services, competence for which would have been harmonised at national level with the NRAs, as in option 2. This will make available to the Agency and the Commission the necessary information on networks and services to perform effectively their monitoring tasks. The Agency shall also to provide assistance to NRAs on the mapping exercise.

In some area the Agency will no longer have an advisory role to the Commission but it will get binding powers. Accordingly BEREC may adopt a decision identifying transnational markets, which previously was a power of the Commission. It will also gain a power to adopt guidelines on how NRAs can design market regulation to meet transnational demand. Furthermore it may also adopt decisions on cross-border disputes.

The Agency will also obtain the new non-binding competence to adopt guidelines on minimum criteria for the reference offer of an SMP operator. It will also obtain a new role in assisting the NRAs upon request.

As regard consumption control the Agency shall issue guidelines on the technical requirements of measurement facilities for the implementation of the obligations for providers of internet access services and providers of communications services using numbers to offer end-users the facility to monitor and control their usage of services billed on time or volume consumption.

The Agency shall also adopt guidelines on relevant quality of service parameters and the applicable measurement methods in order to fulfil the obligations of national regulatory authorities who should specify which parameters should be measured and published by providers.

The Agency will also be assigned additional tasks in the area of numbering with a view to assisting NRAs in ensuring an efficient management of extraterritorial use in compliance with the framework and with consumer protection rules. In particular, this task would entail the establishment of a registry on extraterritorial use of numbers and cross-border arrangements. Where extraterritorial use is applicable, BEREC shall facilitate and coordinate the exchange of information to assist the cross border aspects of enforcement and compliance with all the relevant national consumer protection rules or national law related to the use of these numbers.

In addition, BEREC shall develop harmonised criteria for the fulfilment of numbering management requirements in order to become assignees of numbering resources, and shall assist the harmonised development of the triggering factors and scope for scarcity safeguards, i.e. when and how can the NRAs restrict the assignment of numbering resources to prevent the exhaustion thereof.

It will also get new tasks in the area of standardisation by assisting the Commission and the NRAs in identifying a lack of interoperability of communications services that gives rise to significant barriers to market entry and innovation, or an appreciable threat to end-to-end connectivity between end users or a threat to effective access to emergency services, within one or several Member States or throughout the European Union which could be addressed by the imposition of existing European or international standards. When such standards are not available, it will be BEREC's task to assess whether further action should be taken by the Commission in the area of standardisation.

Furthermore, BEREC will be tasked to adopt guidelines on minimum criteria for the definition of harmonised reference offers for regulated wholesale access products taking into account the needs of access seekers and end users, in particular in the presence of a transnational demand for such products.

All this requires increased financial and human resources in order to enable the Agency effectively to fulfil these tasks, which are necessary to ensure more homogeneous market regulation and conditions at EU level, as well as for the independent NRAs as regards their competences (including ECNS spectrum assignment).

As regards spectrum, NRAs responsible for ex ante market regulation would gain decision-making competences concerning only the regulatory and market shaping conditions of spectrum assignment for electronic communications networks and services.

Furthermore, a **'peer review' system** within the EU body of competent national regulators is introduced as a new coordination mechanism in order to improve efficiency and coherence amongst Member States with regard to regulatory market elements of spectrum assignments. This new mechanism will foster common interpretation and implementation across the EU of elements of spectrum assignment which most impact business decisions and network deployment. Such mechanism will require NRAs to notify (in parallel to the national consultation) their measures concerning market shaping to BEREC for review and issuance of non-binding opinion. While the regulatory community encompassing both BEREC and RSPG was of the view that the EU already benefits from substantial coordination and harmonisation processes, and no further EU-level coordination procedures are necessary, the RSPG showed however openness to a peer-review mechanism as regards spectrum assignment and stakeholders broadly recognise the benefits that a peer review can bring in terms of greater consistency.

The administrative secretariat of RSPG would remain with the Commission as today.

Vesting the politically independent NRAs with competence for certain (economic and market regulatory) aspects of ECNS spectrum assignment would be done without reducing their level of independence, which will be extended to all their new areas of competence. While Member States would retain the power to set the objectives of spectrum assignment procedures in

accordance with the revised framework, and would be free to assign the competence of conducting the actual assignment procedure to the politically independent NRA or to any other body, the NRA would define at least all aspects which impact economic conditions and competition on the market, in complete independence not only from the operators, but also from any external intervention. This is important to reinforce the sentiment of regulatory certainty and consistency, necessary to the investment community.

Moreover, additional general normative powers would be accorded to the Commission with regard to laying down criteria for defining certain spectrum assignments elements (such e.g. as timing of awards, criteria to define coverage obligations, trading, leasing and sharing conditions, etc.), taking utmost account of advice of RSPG and based on adoption through comitology (COCOM) – to guide individual NRAs, and the Agency peer review. Such a common EU approach to governing spectrum was welcomed by respondents in order to enable technologies to be used seamlessly, but respect for spectrum as a national asset is required. In the public consultation, there was a split between regulators and (mainly) broadcasters that preferred a national approach and telecoms operators that supported a certain level of binding guidance. Most respondents supported the Commission intervening in assignment conditions and/or procedural aspects, including with binding measures.

The RSPG general spectrum advisory role would be more clearly reflected in the regulatory framework by reference to their opinions being taken into utmost account by the Commission before adopting implementing measures by comitology (excluding technical harmonisation decisions).

We could summarize the roles of the respective bodies as below:

The Radio Spectrum Policy Group will remain the advisory body for spectrum responsible for articulating and coordinating national administrations' views on high level strategic issues in spectrum policy and related developments. It will continue to be involved in the conception of multiannual radio spectrum policy programmes and provide advice on conditions necessary for deepening the Internal Market..

BEREC will be the forum for a new peer review process in the spectrum domain, which broadly resembles its role in market regulation. This concerns primarily the review of draft measures that will affect the functioning of wireless markets or otherwise significantly shape the economic conditions for networks and services using spectrum resources. BEREC will issue (non-binding) opinions on these draft measures that assess the need for such measures based on a thorough and objective assessment of the competitive market situation. These opinions serve to promote a more consistent use and application of such measures which most impact business and network investments decisions. Where national authorities intend to deviate from BEREC's opinion, they will be obliged to state reasons for doing so.

The Commission's role will continue to be to provide strategic orientation for EU spectrum policy, including in international contexts, to decide spectrum allocation and set out harmonised technical conditions under the Radio Spectrum Decision and to ensure compliance with the rules of the regulatory framework. With a number of new procedural obligations to be fulfilled by national authorities, its monitoring and enforcement function in these domains will evolve correspondingly. It will also be competent to present comments, together with BEREC's opinion, on the NRAs' notified draft measures on spectrum assignments.

Option 4: EU regulator with certain implementation/execution powers

A last option is the establishment of an EU regulator, as a reinforced EU agency with the necessary resources to accommodate a transfer of implementing powers, including supervision and enforcement powers. The EU Regulator could act with binding powers in areas where it is

necessary to ensure uniform application of EU rules; new services with pan-EU or global dimension, currently unregulated to a large extent or subject to unclear regulatory frameworks (M2M, OTT as well as in other areas where the EU interest is particularly acute, such as roaming or transnational markets).

As regards spectrum, there would also be an a priori peer review mechanism involving the EU Regulator, possibly with a Commission veto power. Furthermore, there would be the possibility for the EU Regulator to coordinate binding pan-European assignment procedures for specific bands. Finally, the EU agency would also institutionalise a good office mediation service for cross-border interference issues (as RSPG currently does ad hoc) and for cross-border regulatory issues.

When asked whether the establishment of an EU Agency with regulatory decision-making powers could positively contribute in achieving regulatory harmonisation in the EU telecoms single market, for all the different areas (market regulation, EU spectrum management, end-user protection and other) a majority disagree. It was argued that an EU agency would not be able to take into account national circumstances. There were also statements regarding administrative burden, bureaucracy, slow decisions, duplications, etc.

Some respondents (mainly operators) in favour for the establishment of such EU Agency recommended that it should be responsible for services of the EU single market or for issues such as service platforms whilst NRAs should continue dealing with local issues (e.g. network, access to network).

As regards spectrum and numbering there was a call for more harmonisation but divergent positions whether these issues should be dealt with by an EU agency. There was little demand expressed in the public consultation for mandatory pan-EU or regional assignments. Most respondents questioned the need for EU-wide licences, viewed assignment as a national matter, which would however benefit from more consistency and coordination, and stressed that any wider geographical scope should involve the Member States with some respondents viewing it as a Council matter..

Table 12 - Summary of governance options

	Institutional	Access, numbering and services	Spectrum
Option 1: Baseline scenario	BEREC and RSPG with advisory role. Independent NRAs represented in BEREC in charge of ex ante regulation and dispute resolution. The assignment of other competences at national level largely varies.	Market review process with EC/BEREC non-binding powers as regards remedies.	RSPG adopt opinions or reports advising the Commission, or upon request the Council or Parliament. Some NRAs have certain spectrum related competences.
Option 2: Enhanced advisory role + Strengthened competences	Harmonise a minimum set of independent NRAs competences (ex-spectrum) and align with BEREC tasks. Significantly align BEREC governance with Common approach on decentralised agencies.	Extend NRAs' competences: consumer protection, numbering, authorisation..	Improve process for adopting RSPG opinion or reports, working arrangements. Enhance the current RSPG Offices work through a specific mechanism to ensure cross-border

	Main role for BEREC and RSPG remain advisory.		coordination outcomes
Option 3: Advisory role BEREC/RSPG with certain normative powers for BEREC + Improved process for market review and spectrum assignment	Harmonise a minimum set of independent NRAs competences (including the regulatory and market shaping elements of spectrum assignment for ECNS, subject to governmental definition of objectives) and align with BEREC tasks. Significantly align BEREC governance with Common approach on decentralised agencies. Normative powers (EC implementing decisions) for certain spectrum assignment elements taking utmost account of RSPG opinion and adopted through comitology procedure.	As above + 'double-lock' mechanism for article 7a (EC decision possible if BEREC agrees) + BEREC additional guidelines as regards matters such as mapping, standardised wholesale inputs for business, technical aspects of numbering, switching and interoperability.	Notification to BEREC for peer review process of regulatory and market shaping spectrum assignment aspects, which issues non-binding opinion. RSPG to remain a Commission Advisory body, to articulate and coordinate national administrations' views on high level strategies issues in spectrum policy as well as contribute its opinion to preparation of binding guidance measures.
Option 4: EU regulator with certain implementation/execution powers	Transfer certain competences from national to EU regulator (possibly combining market regulation and spectrum) with implementation/execution and supervision powers. EU Regulator will have normative powers to issue binding pan-European assignment procedures for specific bands and institutionalise a good office mediation service for cross-border interference and other regulatory issues	The EU Regulator/EC would have supervision and enforcement powers implying ability to act where necessary to ensure uniform application of EU rules in cases where EU interest acute e.g. M2M, OTT, roaming.	The EU Regulator/EC would have supervision and enforcement powers implying ability to act where necessary to ensure uniform application of EU rules in cases where EU interest acute. Potential Commission veto power concerning spectrum assignment

4.5.2 Discarded options

This section outlines the options which have been discarded. A more detailed analysis can be found in Annex 3 on discarded options as well as the IA support studies.

- Commission powers to regulate markets directly
- Not having an EU agency at all: substituting the BEREC Office by secretarial support functions to the Board of regulators to be provided by the Commission.

4.5.3 Impacts

Governance options provide supporting mechanisms for the achievement of the policy options. They do not have social impact per se and their own economic impact is limited to their cost of implementation.

There is no separate analysis of economic, social and environmental impacts of the governance options. This is primarily because the substantive (per area) analysis already includes an assessment of what benefits could be gained from harmonising certain features of the existing regime, and the governance analysis simply seeks to assess which body or bodies (e.g. the EC with BEREC in advisory role, BEREC in a more normative capacity, or BEREC taking certain implementation/enforcement roles) would be best suited to achieve the harmonisation previously identified as a desirable outcome (with attendant benefits already identified). In the comparison of options part below we analyse the degree to which governance options are likely to effectively support these benefits, in particular in relation to the preferred options in the different policy areas. The social and environmental impacts of different governance options are unlikely to be different from those associated with the preferred substantive options we have already discussed.

There is nevertheless a separate economic impact related to institutional choices represented by the respective institutional costs of the different governance solutions which are analysed in detail in the Study SMART 2015/0005 and summarised under the cost of the institutional set up of various options below and Annex 12 includes a table with a more detailed presentation on institutional costs. The efficiency analysis, in section 4.5.4 examines the costs in relation to the anticipated benefits. In the same section, the impacts of the Governance options have been assessed in relation to their effectiveness in supporting ubiquitous connectivity, competition and end-user interests in the single market thereby supporting the economic, social and environmental benefits that have already been identified in relation to these objectives. Their coherence with the 2012 Common Approach on decentralised Agencies and with each other (and specifically whether they achieve synergies and convergence between fixed and mobile communications, content and services) and the degree to which they add value compared with Member States acting alone, and the degree to which they respect the principle of subsidiarity and proportionality, are also analysed in this section.

4.5.3.1 Cost of the institutional set up Option 1

The costs of the current institutional set-up consist in the costs of application of the framework at a national level by NRAs and Spectrum Management Authorities (which may in some cases be integrated into the NRA), and at European level in terms of the costs associated with developing implementing guidelines and conducting case by case reviews of national procedures. **The estimated total cost of the regulatory set-up for implementation of the electronic communication framework with overhead, is approximately €203 m per annum.**

4.5.3.2 Cost of the institutional set up Option 2

This option would entail some increase in the costs of BEREC as an agency resulting from its expanded advisory role and change in structure. There would also be increased support costs for BEREC and increased costs to NRAs resulting from BEREC's expanded advisory remit.250 The precise effect on BEREC Office costs is difficult to assess, but could be estimated at additional staffing of around 12FTE taking the total to 40FTE. The costs to NRAs of further advisory support to BEREC, could be estimated at 10FTEs (an uplift of around 20%), assuming four additional requests for advice per year, and based on an estimate of 2.5FTE per advice.251

The Commission's resourcing requirements and associated costs would also marginally increase, to reflect its remit in developing implementing guidelines for example in relation to mapping and standardised wholesale access products. Based on Commission estimates, we have modelled an increased resource of 5 FTEs for this task.

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250 It should be noted that NRAs do not have an equal level of participation in BEREC. Some NRAs may contribute more resources and leadership of working groups than others. The figures we use are an average.

251 Data supplied by BEREC suggests that advice provided on various Commission Recommendations required around 2.5FTE on each occasion

At national level, the budget of some NRAs would increase due to more effective resourcing. We have estimated an additional 10 FTEs for 5 NRAs which have expressed concerns252 over current resourcing levels. NRAs would also need to make greater contributions through BEREC's working groups, which we have reflected through an increase in NRAs current resourcing contributions to BEREC accounting for 10FTEs across the EU28. Additional resourcing in order to complete thorough mapping exercises may also be required for those NRAs which do not currently engage in such exercises.253 However, many NRAs already engage in such exercises and the extension of the market analysis process to 5 years should reduce costs for NRAs associated with market analysis.254 Moreover, cost savings might be achieved as a result of standardised wholesale product specifications which may remove the need for some of the duplicate processes that have occurred at national level.

It should be noted that, while NRAs gaining responsibility for consumer protection (in cases where they do not already have such responsibilities) would require an increase in their resources, this may not influence the costs of the system overall, as there should be a corresponding reduction in resources amongst the bodies previously addressing these issues.

As regards resourcing for spectrum, we have assumed that the Commission would continue to provide an administrative support function to RSPG equivalent to 2.5FTEs as in the status quo but that due to the additional advisory requirements stemming from increased guidance on spectrum co-ordination, the substantive contributions of SMAs to the RSPG would increase by around 50% compared with the status quo[255].

If cost savings at a national level of around 15% can be made as a result of the streamlining of the market analysis process and specifically the extension of the review period from 3 to 5 years and the potential reduction in the number of markets to be analysed, this scenario should result in costs of around €201m, a saving of around €2m across the EU compared with the status quo.. However, if no such synergies are achieved, this scenario would result in costs of around €211m, €8m more than the status quo. **The estimated total institutional set up cost for option 2** under intermediate assumptions concerning efficiencies would result in total costs of **approximately €206 m per annum**, around €3 m more than the status quo across the EU28.

4.5.3.3 Cost of the institutional set up Option 3

The main cost impact of option 3 is likely to be the additional resources required by BEREC in order to fulfil its expanded remit especially as regards (i) the preparation of detailed guidelines and decisions; (ii) extension of its remit to encompass market-shaping aspects of spectrum and the associated peer review of NRA decisions in this regard.. We have assumed that the enlarged BEREC would require 60FTE, implying a resourcing level in between the current BEREC Office and ACER. We also assume additional costs for NRAs contributing to BEREC working groups, expanding their current contributions by 20 FTE over the status quo.

As regards access and services, the Commission's remit would remain similar to present (although it would gain the power to issue Decisions on market analyses in cases where BEREC

[252] Data request April 2016 in context of SMART 2015/0002

[253] The additional resources required for mapping are difficult to estimate on a pan-European basis because many NRAs have already engaged in some degree of mapping activity. As regards the costs of setting up a physical infrastructure atlas the Impact Assessment for the Cost Reduction Directive 2014/61 suggests (see footnote 85) that costs may vary from relatively low amounts (1-2m for the German Infrastrakturatlas and Portugal CIS database) to 75-77m for the Flemish KLIP GS mapping and Polish GBDOT.

[254] Based on data received from NRAs, the resourcing associated with access regulation is currently estimated at 36% of the total. We have estimated 15% savings on this budget resulting from the decreased frequency of market reviews (and potential reduction in regulation over time) based on Ecorys (2013) assessment of the savings from reducing the number of markets to be analysed by NRAs.

255 This should be considered as the maximum percentage of increase in FTE. For prudential reasons the EC services prefer to overestimate the potential cost, rather than underestimate.

would agree with its serious doubts). However, its role in the development of spectrum guidelines and peer review is expected to require an additional 5 FTE.

Under this option, NRAs currently lacking ECS spectrum responsibilities in the field of market-shaping measures would gain such responsibilities. However, there may be little cost implication if this results in a transfer of resources from existing bodies. Moreover, there may be some cost savings for SMAs due to the introduction of mechanisms to co-ordinate assignment procedures and conditions. We have estimated a potential reduction of 1 FTE per SMA resulting from harmonised procedures resulting in total cost savings at the national level of around €2.6m across the EU28.

Assuming these savings could be achieved at a national level, the resulting costs for this option are similar to the status quo, at around €202m. If no such savings can be made at a national level and if the extended timeframes between market analyses also do not result in any national savings, then the total costs of this scenario would be around €215m. Costs under **intermediate assumptions concerning efficiencies** would result in total costs of €208.5m, around €5m more than the status quo across the EU28.

4.5.3.4 Cost of the institutional set up Option 4

Under this scenario, it is assumed that a larger scale Agency would be required along the lines of the EBA, with an associated cost of around €31m per annum. We assume that on issues other than spectrum NRAs would make an enhanced contribution to this Agency similar to that estimated for option 3 (i.e. 20FTE increased resource for BEREC contributions compared with the status quo). As spectrum management would be tightly co-ordinated at EU level under this scenario, NRAs (which would have full spectrum management responsibilities), would also make additional contributions to co-ordination on spectrum matters – amounting to around five times the existing contribution made by spectrum management authorities to the RSPG.

At the same time however, as responsibility for enforcing certain Decisions affecting the single market (such as those relating to certain digital services) would be transferred to the EU level, we assume a reduction of 5 FTEs for NRA activities excluding spectrum compared with option 3.

Similarly, as certain decisions relating to spectrum would transfer entirely to the EU level (to the enlarged BEREC), we assume further reductions of 5 FTE for each SMA (now incorporated with the NRA) compared with option 3.

Under this scenario, increased costs of the centralised Agency would be more than compensated by cost savings at the national level, resulting in a reduction in the overall costs of the institutional set-up to around €198m. However, if the costs of national authorities prove to be 'sticky' then in a worst case scenario absent synergies this scenario could cost €234m, with €216m in an 'average' view under intermediate assumptions concerning efficiencies.

4.5.4 Comparison of options

For the comparison between the different options, it is important to assess the degree to which they will be effective[256], efficient[257] and coherent[258] in supporting the identified objectives and specifically providing for the consistent application of regulation fostering VHC broadband, competition and consumer protection in the single market, and better regulation in terms of reduced cost.

[256] Effectiveness is evaluated on the basis of the degree to which the options would achieve these objectives.
[257] Efficiency is evaluated through an assessment of costs the complexity of the system.
[258] Coherence is evaluated in terms of the coherence of the option with the existing set-up (ie degree of disruption implied), with the 2012 Common approach on decentralised agencies and with other similar bodies

4.5.4.1 Effectiveness

Option 2 (the enhanced advisory role) is likely to result in greater co-ordination than the current set-up. However, like the status quo, an important aspect which may impede its effectiveness is the existence of separate EU bodies for access and services on the one hand and spectrum on the other, as well as the set-up which involves the Commission taking decisions or producing recommendations subject to input from independent advisory bodies. This would maintain the current complicated institutional structure and may risk slow processes, diverging views and incoherent outcomes, potentially undermining the effectiveness of the system.

An important improvement, which is likely to increase the effectiveness of Options 3 and 4 vs the status quo and Option 2, is that these options place greater responsibility with the EU level body for developing guidelines on technical issues, such as business access products, infrastructure mapping and extra-territorial numbering use, while maintaining the Commission's leading role in developing broad guidelines on key policy issues, such as on co-investment or Next Generation Access Networks and on spectrum. For this reason, they are able to derive more benefit from the expert resources of national regulatory authorities and spectrum experts, and in turn are likely to result in greater buy-in to the outcomes by national authorities which have contributed to them. Additionally, these options (and especially option 4) bring together all elements of the electronic communications sector (wired and wireless, networks and services) under the same authorities, both at national and EU level. This should allow these authorities to implement the framework in a manner which reflects the increasing convergence between fixed and mobile networks and services.[259]

It is reasonable to assume that these effects would make Options 3 and 4 more effective in promoting consistent best practice in fixed and wireless connectivity than options 1 and 2. A core distinction between Options 3 and 4 is that under Option 4 the EU Agency would have responsibility for certain decision-making and enforcement. Option 4 might be effective for those issues in which identical approaches are desirable. However, it is likely to be less effective than Option 3 in cases where knowledge of national and local conditions is required, which is typically the case especially concerning regulation of infrastructure.

We conclude that Option 3 is likely to be most effective in providing the appropriate degree of consistency to support VHC broadband deployment, competition, adequate consumer protection and spectrum assignments in the single market.

4.5.4.2 Efficiency

In assessing efficiency, we have estimated the institutional costs of each of the options. Based on a questionnaire submitted to NRAs via BEREC, as well as interviews with BEREC and the European Commission, we estimate that the total costs of the institutional set-up (including the costs for the Commission, BEREC, RSPG, NRAs and SMAs) under the status quo are around €203m. See for more details the analysis in section 4.5.3.1 and further details in the detailed institutional set-up analysis in SMART 0005/2015.

The costs of the other options depend on the degree to which harmonised best practice and co-ordination at EU level can be translated to efficiency savings at the national level. We therefore consider a range of costs for each option also in line with indications from the expert group [260].

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259 4G and 5G mobile technologies require increasing degrees of fibre backhaul, and there are increasing trends towards fixed mobile converged operators which can exploit synergies. At the same time, the take-up of bundled fixed mobile converged offers by consumers is increasing, and many businesses have expressed a desire but some difficulties in obtaining fixed and mobile services from a single provider (WIK 2013 business communications)

260 The range of costs takes into consideration different possible materialization in time of efficiency savings at national level and reflects the need to consider this aspect as expressed by the Expert group, see also Annex 13.

Under an enhanced advisory role (option 2), additional institutional costs would be incurred of around €8m compared with the status quo. The main sources of the increase are the increased resources required by the Commission for the drafting of further implementing guidelines under the revised Framework and increased costs to the Agency and RSPG associated with their expanded advisory role. There might also be additional costs for NRAs to address under-resourcing reported by several NRAs[261] and to expand the remit of those without consumer protection responsibilities (although because we assume that this cost would be transferred from other existing authorities it is not recorded in the figures). However, these institutional cost increases might be more than compensated resulting in total costs marginally less than the status quo if the cost of access regulation at national level is reduced as a result of extended market review periods,[262] and the implementation of standardised remedies for core wholesale products,[263] although requirements for more detailed market reviews involving mapping[264] may absorb some of those savings.[265]

Likewise, in the unlikely event that no efficiencies or synergies could be achieved as a result of more effective co-ordination or extended market review periods, Option 3 is estimated to result in total costs of around €215m (€12m more than the status quo). These additional costs stem from expanding the remit and tasks of BEREC and the introduction of a systematic peer review process for spectrum assignments involving the Commission and BEREC.[266] However, it is likely that they would be at least partly compensated by potential cost savings regarding spectrum management resulting from greater alignment of auction procedures and certain conditions,[267] as well as the extended market review periods. Indeed, **when these efficiencies are reflected, the resulting total cost of this set-up would be similar to the status quo.**

Costs for option 4, at around €234m in the absence of efficiency savings are the highest of the considered options. This is due to the fact that in this scenario the costs for the expanded EU Agency would be significantly higher than for the other options (a cost similar to the European Banking Authority is assumed). However, as certain functions would move from the national to the EU level, it is reasonable to assume that some cost reductions might be possible at a national level as regards access and consumer protection regulation as well as spectrum.[268] If these are taken into account, the total cost is projected to be €5m lower than the status quo.

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[261] Questionnaire April 2016 SMART 2015/0002

[262] Ecorys (2013) suggests potential cost savings of 10-15% resulting from a reduction in the number of markets on the list of relevant markets from 7 to 5. An extension in the review period from 3-5 years might be considered to have equivalent effect.

[263] SMART 2014/0023 recorded 13 parallel procedures for the specification of virtual unbundled local access – it seems reasonable to assume that costs to NRAs may have been reduced if common specifications had been pursued.

[264 A] May 2016 interview with ARCEP suggests a cost of €4.6m over 7 years (~€0.7m annually) to establish a regime similar to that which might be required under the adapted market analysis process. However, it is unclear how many of the activities might be been conducted in the context of a standard market review.

[265] A precise estimate of the cost difference compared with the status quo associated with mapping requirements is challenging as a significant number of member states have already conducted mapping assessments of various kinds and the cost may vary significantly depending on the type of mapping and detail involved. Moreover, if as is intended, responsibility for infrastructure, investment and quality of service mapping is consolidated within the NRA, it could achieve cost-savings in countries where these activities are distributed across a number of bodies. See SMART 005/2015 for further discussion of the cost implications of mapping.

[266] We assume that introducing a minimum remit for NRAs including market-shaping aspects of spectrum would be cost neutral, assuming that any resources currently residing in other departments would be transferred to the independent NRAs.

[267] These savings are estimated at around €2.6m across the 28 member states on the conservative assumption that each spectrum authority could reduce FTE by 1.

[268] These cost savings are estimated at around €29m across the EU28, assuming reductions of 5FTE per member state in access and service regulation and 6FTE in spectrum, but in practice may take time to materialise, as the costs of regulatory authorities may in practice be 'sticky'

When assessing efficiency, it is important not only to consider the costs for the institutional actors, but also the cost and complexity to market players. For example, Ecorys (2013) estimated that the costs to operators resulting from the market analysis process were more than four times greater than those for NRAs, and therefore an extension in the period for market reviews could also have a wider impact on industry cost savings.[269]

Because the institutional set-up for options 1, 2 and 3 involve different roles for different authorities in different countries and for different topics, this set-up is also likely to perpetuate high costs for stakeholders which would need to engage with and provide input to multiple bodies at national and EU level.

Conversely, under option 4, where NRA responsibilities would be extended to cover the full range of electronic communication issues and where a single body (the enhanced BEREC) takes a leading role in implementing guidelines, thereby addressing tasks that would otherwise be taken by the Commission and/or RSPG, this set-up should result in reduced costs to stakeholders, especially those with a multi-national footprint.

We conclude that if the potential synergies could be achieved, option 4 is likely to be the most efficient solution. However, as costs can prove to be sticky and synergies might not be fully achieved, option 3 may provide the most cost effective solution in relation to the potential benefits that could be achieved through better co-ordination.

4.5.4.3 Coherence

All options would be significantly more coherent with the 2012 Common Approach on Decentralised Agencies than the status quo which departs markedly from the model. Option 2 would provide greater coherence in the handling of consumer protection, but would maintain separate bodies for spectrum and parallel roles for the Commission and BEREC on implementing guidelines, which may result in complex or incoherent outcomes. On the other hand, option 3 is likely to increase the coherence of regulatory decisions by bringing together responsibilities over market reviews and market-shaping aspects of spectrum. Under options 3 and 4 the NRAs competences would also include economic and market regulation aspects of spectrum assignment, meaning that all main tasks related to market-shaping can be dealt with NRAs, adding greater coherence. Furthermore the peer review mechanism, which requires NRAs to notify to BEREC their draft plans for spectrum awards and draft assignment conditions would foster common interpretation and great coherence in the implementation of EU assignment procedures and conditions across the EU. Option 4 would go even further towards this goal by fully consolidating spectrum responsibility with the NRA and to a large extent consolidating responsibility for governance of the electronic communication sector at EU level.

4.5.4.4 Impact on stakeholders

The preferred option for Governance (option 3) involves the consolidation and alignment of the remit of Regulatory Authorities at national level, as well as the extension of NRAs' remit to at least market-shaping economic and regulatory aspects of spectrum assignment. BEREC would also receive a consultative role in this regard. Its remit would also be extended to take certain normative powers in relation to developing implementing guidelines in respect of transnational demand (which would be adopted by the Commission) as well as playing a deciding role in enabling a Commission 'decision' in relation to case by case assessment of remedies (under an

[269] See Ecorys et al (2013) Future electronic communications markets subject to ex ante regulation https://ec.europa.eu/digital-single-market/en/news/future-electronic-communications-markets-subject-ex-ante-regulation institutional costs are estimated at €50m in contrast with more than €200m for operators.

expanded article 7a FD process). BEREC would also perform the peer review of market shaping aspects of national spectrum assignment procedures.

Alignment of governance mechanisms as well as full harmonisation and greater co-ordination at EU level is likely to benefit OTT players which frequently operate in a multi-national or even global environment, if the status quo would otherwise lead to fragmented national initiatives to regulate aspects of their activities. SMEs will not be directly impacted by changes in governance, but may benefit cross-border operations for smaller businesses by ensuring consistent application of the rules, and interaction with fewer interlocutors. Consumers will indirectly benefit from greater connectivity, cross-border entry and competition that may result from more effective co-ordination at EU level.

The proposed changes to the EU framework for electronic communications would require transposition into national legislation, and will entail changes to the national institutional set-up in countries which do not already have arrangements in place corresponding to the revised EU rules on structures and procedures, as well as changes at EU level. Specifically, at national level, NRAs' remit would be subject to minimum harmonisation (to cover at least market-shaping spectrum assignment issues and sector specific regulation in areas such as consumer protection). Likewise, at EU level the preferred option would give BEREC an expanded consultative role for market-shaping aspects of spectrum assignment and services alongside access, as well as increased responsibilities including responsibility for developing implementing guidelines and an enhanced role in the article 7a process on remedies as well as a peer review role on market-shaping aspects of spectrum assignments.

Additional expenses are expected to vary between member states, but across the EU28 overall additional expenses for the resourcing of NRAs are expected to be minimal. Certain NRAs may also need greater resourcing in order to adequately perform duties such as market analyses under the revised framework including the proposed requirement for geographic survey of infrastructure. The additional obligations are however only incremental to the initiatives that already exist in some Member States that implemented advanced mapping systems and to the transparency measures linked to the implementation of the Cost reduction Directive (such as advanced notification of civil works) and to the reporting obligations already undertaken for identification of white areas and investment mapping before notification of State Aid schemes by Member States. There is a cost reduction potential in streamlining and coordination.

Stakeholders' views vary on the degree to which consistency in regulation is important vs flexibility at national level. There is widespread agreement amongst electronic communication providers and digital service providers that consistency is helpful in the field of digital services, which can in principle be supplied and consumed cross-border. More consistency in spectrum regulation is also requested by many cross-border mobile operators.

Interviews conducted for the study SMART 2015/0002 as well as SMART 2014/0023 suggest that consistency in regulation is also important for business end-users and certain suppliers of business and mass-market services, which rely on wholesale access for a substantial element of their customer base. However, it is less important for some nationally focused providers, while many operators designated with SMP in local access prefer regulation to be more tailored to local circumstances.

It should therefore be borne in mind that not all stakeholders seek governance mechanisms which serve to foster the consistent application of the framework. Rather the view of incumbent operators is that institutional streamlining could better be achieved through a reduction in ex ante regulation, which would limit the need for co-ordinating measures at EU level.[270]

[270] Interview with ETNO SMART 2015/0002

For those stakeholders for whom consistency is important, the impacts of the governance options are associated with their potential effectiveness in achieving the objectives for very high capacity connectivity, competition and consumer welfare in the single market, the potential for the options to achieve coherent decision-making, and the potential to streamline engagement, avoiding the need for multiple parallel contacts at national and EU level. Option 4 would in particular benefit multi-national operators with significant spectrum and/or wholesale access interests as well as business end-users, while option 3 would also bring greater benefits to these stakeholders than the status quo.

The increased focus on harmonisation and monitoring of consumer protection measures in option 3 would also meet the demands of consumer groups[271] for greater attention from BEREC on consumer matters.

On the other hand NRAs call for more incremental and flexible approaches to governance at EU level combined with better resourcing and an expanded remit for NRAs at national level, which might be better served through an enhanced advisory role as envisaged in option 2.

Many Member states are also cautious about approaches which entail a reduction in their flexibility to assign responsibilities at national level, especially as regards important resources such as spectrum.

See also tables presented in Annex 12 specifying in detail impacts on stakeholders for each policy option and cost implications.

4.5.4.5 EU value added

Option 2 provides considerable scope for flexibility at national level, and therefore should allow regulation to be tailored towards national circumstances. However, it is unlikely to provide significant added value at EU level compared with the status quo. On the other hand, option 4 is likely to provide significant EU added value compared with Member States acting alone, but likely does not permit sufficient scope for deviation to reflect national circumstances, and therefore is unlikely to be proportionate. Option 3 provides the best added value as compared to Member States acting alone and maintains an proportionate and appropriate balance between EU and national responsibilities.

4.5.4.6 Summary table comparing institutional governance options

Table 13 - Comparing the impacts of governance options

[271] As expressed in an interview with BEUC in the context of SMART 2015/0002

	Effectiveness (wrt connectivity imperative, consistency)		Institutional cost	Cost to stakeholders	Coherence		EU value ad
Option 1: status quo	0	Fragmentation in access, spectrum and services policy persists	~€203m	0	0	Incompatible with Common approach	0
Option 2: Enhanced advisory role	+	Stronger EU guidance, but continued advisory roles for BEREC, RSPG impedes buy-in, effectiveness	~€206m	0	+	Reflects Common Approach but maintains parallel processes	+
Option 3: Some normative powers + synergy	++	Greater role and expanded remit for BEREC fosters buy-in, spectrum consistency	~€208m	0	++	Reflects Common Approach, greater spectrum alignment	+
Option 4: Some supervisory powers + synergy	+	Effectiveness impeded by distance from national markets	~€216m	+	+++	Reflects Common Approach & convergence	++

The average (mid-range) assumptions for efficiency savings are used in this assessment of institutional cost. Under full efficiency saving assumptions (best case scenario), the costs for the different options do not differ significantly

Source: WIK-Consult

4.5.5 The preferred option

Based on the analysis provided above, option 3 appears to provide the greatest overall benefits in relation to the cost. Specifically, it is likely to be more effective and coherent than option 2 in meeting the objectives of fostering very high capacity connectivity, competition and end-user protection because it provides a core role for BEREC in developing implementing guidelines, avoiding potential complexities and divergence between the Commission and BEREC, and fostering buy-in from NRAs. It also extends NRAs' and BEREC's responsibilities for fixed market analysis to market shaping aspects of spectrum management, ensuring a coherent approach between the two. It empowers the EC and BEREC to impose consistent regulatory practices on access remedies where necessary, with BEREC's NRA-based composition ensuring that adaptations to objective national or local differences will be duly respected.[272].

Although option 4 is positive in several respects and could be a relevant solution for aspects of sector specific regulation which require full harmonisation, it appears in the final analysis that across the balance of issues, option 3 is likely to provide the most effective and efficient outcome in achieving consistent application of electronic communication sector rules, while respecting the principle of subsidiarity. Aligning the responsibilities of NRAs and the corresponding EU body to include market shaping aspects of electronic communications spectrum assignment should create synergies in policy development enabling NRAs and the combined body to reflect the many inter-related aspects in a converging environment. In addition to potentially enabling cost savings in national spectrum assignment processes, the increased effectiveness, coherence and buy-in associated with this option are likely to reap

[272] Option 4 which foresees a level of centralised enforcement could on the other hand be very effective and efficient for specific issues. This option could be considered for these specific cases. However, it is unclear at this stage whether there are sufficient issues requiring uniform treatment to make this option worthwhile, and it would be disproportionate and likely ineffective in achieving the objectives in cases where local expertise is needed to provide more tailored solutions.

benefits in increased connectivity that considerably exceed the status quo. For example, spectrum assignment policies and conditions affect the deployment and take-up of very high capacity broadband, while mobile broadband may also impact competitive conditions in the supply of broadband more widely. Meanwhile, the construction of fibre networks is important for the development of new generation mobile technologies.

Importantly, this option also preserves the flexibility of Member States to set objectives relating to spectrum governance, including for specific assignment procedures.

No macroeconomic effects could be quantified through modelling for this policy area.

4.6 Who would be targeted by the different policy options?

The provisions included under the umbrella of the review of the telecom framework have several impacts on a wide range of stakeholders. This includes not only telecom operators (incumbent and challengers, but also entities operating in the wider digital environment such as OTTs and other non-telecom operators, SMEs, consumers and institutional bodies such as NRAs and Member States' bodies dealing with regulatory aspects. Given this level of complexity, a detailed analysis of the different stakeholders affected by the different policy options is provided in Annex 2 which summarises the process of consultation and its outcome and annex 4 which spells out in more detail the impacts from the preferred options on the various stakeholders' groups. Annex 12 presents the impacts of alternative options on groups of stakeholders.

4.7 Applying the Think Small Principle

When analysing the enterprise market, and with specific respect to access regulation we need to draw a distinction between the two core targets: small and medium enterprises (SME) and large businesses. The former have characteristics in common with residential users, as they tend to be very much scattered over the territory and cannot afford dedicated capacity lines, as opposed to large business. Micro enterprises and smaller enterprises outside central business districts (including small businesses in rural areas) are likely to be important beneficiaries of strategies which boost the widespread deployment of connectivity, as these organisations may today be under-served compared with larger corporations which may already have fibre connectivity installed to their premises. For example, the UK NRA Ofcom found in the context of research conducted in 2015[273] that a significant minority of SMEs had had less favourable experiences with broadband, including a lack of widespread superfast broadband availability, a concentrated retail market structure, and dissatisfaction in relation to quality of service.

One of the cloud's main attractions for SMEs are Software as a Service (SaaS) solutions that enable them to access familiar applications and pay on the basis of their usage, rather than acquiring an expensive licence. Big businesses can use cloud computing solutions to virtualise their existing infrastructure and streamline their use of it. Infrastructure as a Service (IaaS) can enable them to handle peak loads on their in-house system. SaaS solutions may also be adopted as a way to manage their enterprise software better, especially resource planning (ERP), customer relationship management (CRM), mail, desktop software, etc.

End-users and businesses (including SMEs) in countries and areas currently lacking infrastructure competition are likely to be the main beneficiaries of measures to support the deployment of VHC broadband networks. Measures to support the consistent specification of wholesale remedies may also shorten the time to market for new wholesale offers and boost

[273] http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/sme/bb-for-smes.pdf

service competition benefiting consumers in areas where infrastructure competition is not in prospect.

A greater focus on general authorisations over individual licenses has the potential to open up spectrum resources to innovative smaller companies which are not at present able to purchase exclusive access. In addition, many of the end-user businesses which will benefit from accelerated access to spectrum and introduction of 5G will be smaller companies. By opening access to spectrum resources and accelerating 4G and 5G coverage across the Digital Single Market, the spectrum option will facilitate innovation and entrepreneurship which benefits primarily (though not only) start-ups and smaller companies. For instance, there might be companies aiming to bring innovative new applications to market that rely on 5G availability and reliability in sectors such as utilities, automotive and transportation or e-health.

Most of the provisions on services and end-user protection will continue to apply to all end-users. The contract provisions will also benefit small and micro-businesses, who so request, in the same way as consumers. Small and micro- enterprises, many of which provide innovative online services, are in a comparable situation as consumers whereas larger end-users (who may also opt-in under the current rules) are able to negotiate individual contracts for of electronic communications services.

In order to ensure consumer rights and public policy interest, small providers of electronic communications services will have to comply with rules on end-user rights as any other provider. Public interest objectives justify the imposition of security and privacy[274] measures on all kinds of providers of electronic communications services. With regards to interconnection and interoperability obligations, their extension to OTTs providing communications services would be subject to an assessment of reasonableness considerations relative to technical feasibility, significance of take-up of a given service as well as cost considerations. No lighter regimes or exceptions are considered for micro enterprises since no telecommunications operators are likely to fall under that category (less than ten employees and a turnover or balance sheet total equal to or less than €2 million).

For an analysis of the implications of the preferred options on SMEs please see Annex 4 on Who is affected by the preferred option and the specific chapter on SMEs..

4.8 Positive and negative impacts, direct and indirect, changes in impacts, potential obstacles

Positive and negative impacts on different stakeholders are included in Annex 12 with an assessment of impacts on groups of stakeholders by policy area for all options and Annex 4 focusing on representative groups of stakeholders and assessing implications of preferred options for electronic communication network and service providers, Over-the-Top players, SMEs, Consumers, Ministries, National Regulatory Authorities and Spectrum Management Authorities. The analysis of the negative and positive and direct and indirect impacts is run for all the main groups of stakeholders identified in the public consultation (see Annex 2).

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4.9 How the preferred options relate to the specific objectives

Section 3.2 already identifies for each specific objective, the link with the problems identified in section 1.2 and the link to the main measures that are included under the options for the policy areas identified in section 4.

[274] The exact confidentiality obligations would be subject to further conclusions of the review of the e-privacy Directive

4.9.1 Contribute to ubiquitous VHC connectivity in the single market

This specific objective is linked to the policy measures proposed under access, spectrum, universal service and governance preferred options.

The preferred option bundle will meet the ubiquitous VHC connectivity objective by fostering infrastructure-based competition in fibre networks in areas where this is feasible (thereby incentivising network upgrades and delivering a more stable competitive structure), while elsewhere providing certainty and flexibility for NGA investors and promoting competition through long-term co-investment or open (such as wholesale only) business models for fibre infrastructure, in preference to the current prevalent short-term rental arrangements which are vulnerable to technological and regulatory change. This option also involves an extension of the timing of the current market review process, thereby increasing certainty and reducing costs.

Under this option, NRAs will take responsibility for mapping existing infrastructure and assessing the potential for further deployment, which should also enable them to support deployments in challenge areas which may be less attractive for commercial operators. The system could be accompanied by a system of action/sanction by NRAs in relation to challenge areas to ensure promised network roll-out is undertaken or to provide protection for new networks if investments plans are changed without a reasonable justification and potentially for predatory reasons. Rural investors and their customers may also benefit from the potential for longer contractual commitments linked to instalment payments for physical connections, where needed in exchange for connecting households with high quality networks.

The added boost to fibre deployment under this scenario should support fixed as well as mobile next generation developments, which require fibre backhaul to support higher speeds and quality. The preferred option bundle also provides for the adoption of harmonised wholesale product specifications to reduce needless duplication of specification processes, reduce 'time to market', foster cross-border expansion and support the provision of services to multi-national corporations.

In addition, the availability of new mobile technologies will be accelerated across the EU, by reducing the time required to bring spectrum to market, providing the potential for common deadlines for spectrum awards as well as fostering consistent EU criteria for assignment conditions through implementing decisions accompanied by a system of peer review. This could pave the way for extended durations of licences combined with common measures to foster efficient use of spectrum and thereby extend coverage and improve quality. Greater co-ordination and regulatory certainty across countries and over time should in turn speed up investment in infrastructure and services. Measures to facilitate permit granting to foster deployment of small cells and to access Wi-Fi networks will contribute to reduce the costs of future 5G network deployment and support the development of 5G in general, also ensuring faster time to market for spectrum resources.

Moreover, the deployment of these new networks will require greater flexibility in the way spectrum is accessed and used; a wider consideration of the possibilities of sharing; a consistent approach to frequency assignment between neighbouring countries and potentially the identification of more unlicensed spectrum.

In addition, the envisaged package would seek to ensure that price does not present a barrier to the uptake of broadband services, by modernising the universal service concept and focusing it around affordability of broadband connections.

The Single market dimension is specifically addressed by the measures related to the promotion of EU-wide access products for cross-border services to business users in the single market. Spectrum measures are in addition promoting greater consistency of spectrum management elements to achieve a timely deployment of 5G networks and services throughout the EU. The

proposed regulation will ensure harmonised means of determining and mapping end user ubiquitous connectivity comprising also quality of service. These measures will be accompanied by a governance structure and effective EU coordination mechanisms that can enable and foster connectivity, including new tasks for BEREC and NRAs, in the area of mapping (including investments, infrastructure and quality of services) and the market shaping elements of spectrum assignments conditions. .

4.9.2 Competition and user choice in the single market

This objective is linked to the policy measures proposed under access, spectrum, services and end users, must carry and EPG, numbering, universal service and governance.

A key aspect of the review is to assess to what extent sector-specific end-user protection rules are still warranted in view of technology and market changes and of horizontal consumer protection legislation and to what extent effective protection of the underlying public interest as well as of competition would require extension of some of the sector-specific rules to OTTs. At the same time, consumer protection measures should be coherent and not present a barrier to the single market, and costs to operators should be minimised.

The preferred option bundle tries to ensure a European-wide pro-competitive regulatory framework for networks, internet access services and communication services, enabling choice and affordable prices for European citizens in electronic communication services while addressing new, emerging end-user rights issues based on market developments.

The preferred option fosters trust while creating a regulatory level playing field by applying a limited set of sector-specific rules to communications services, including more extensive obligations for certain OTT services for which the use of numbers constitutes a key feature of the functioning of the service (clarifying thereby the current scope of such rules). Consumers will also benefit from a facilitated switching process for Internet Access, a protection against discrimination based on nationality or the place of residence, protection from automatic roll-over of contracts, better readability of contracts as well as the introduction of comparison tools and websites and the facility to monitor and control their usage of services. In addition, other end-user and public policy interests which are not covered by horizontal rules (e.g. security and potentially confidentiality of communications) will be safeguarded in relation to all newly defined communication services, regardless of how they are supplied.

In addition, in order to foster the development and take-up of digital services across the single market, avoid any lack of coherence, ensure regulatory consistency and guarantee the framework's best contribution to the development of the single market objective, full harmonisation of sector-specific rules applying to digital communications services (such as calls and messaging) is proposed. This should ensure uniform transposition of rules in EU Member States, making it easier for stakeholders to understand and comply with legislation. Full harmonisation will also facilitate that end-users obtain a connection through specific contract arrangements in the EU, including a protection against discrimination based on nationality or the place of residence, and the setting-up of an EU-wide protection regime for end-users of all communications services in terms of security, interoperability (in case of need) and (potentially) confidentiality.

Finally, in order to address challenges associated with connected ‘Things’, the package envisages adaptations to the current framework in order to enable ‘permanent’ extra-territorial use under certain circumstances, to promote the remote (over the air) SIM switching to solve the lock-in of M2M providers, and the harmonisation of conditions for the extra-territorial use of national numbers.

4.9.3 The REFIT potential: simplification of the regulatory intervention and single market coherence

The policy measures proposed under the preferred option bundle support the REFIT agenda and address the objective of simplification and reduction of administrative burden **in line with the findings of the evaluation exercise on the REFIT potential of the review (see section 1.2.3.1 for more details). Several of the proposed changes** under access, spectrum, universal service, services/end users, numbering and governance policy areas aim to make rules clear; allow parties to easily understand their rights and obligations; and to avoid overregulation and administrative burdens.

The proposed changes include specifically: the streamlining and geographic targeting of access regulation; the use (wherever possible) of general authorisation in preference to individual licenses for spectrum; fostering secondary markets for spectrum; the removal of redundant universal service obligations such as requirements to ensure the provision of payphones and physical directories; narrowing of the scope of universal service availability and ending of the sectorial sharing mechanism; clarifying the scope of the Regulatory Framework and the removal of redundant consumer protection obligations where these would already be addressed through horizontal legislation or met by the market; harmonisation and clarification of rules and governance of numbering in the M2M context; and aligning the remit of NRAs with BEREC.

The simplification measures in the preferred options have also a **single market coherence dimension** as they will ensure greater consistency in access remedies and in spectrum assignment processes, which at the moment tend to generate complexity for operators wanting to use spectrum in various Member States, and can also (in case of divergent timetables) cause interference in border areas. Equally the introduction of standardised wholesale remedies for example in relation to business access also facilitates businesses operating cross-border and the lengthening of the spectrum licences fosters the creation of a pan-European secondary market for spectrum as well as a more investment-friendly environment for holders of such licences.

A summary of the likely benefits that may arise as a result of these measures is presented below..

4.9.3.1 The streamlining and geographic targeting of access regulation

Measures proposed aim to provide more guarantees that wholesale access regulation is only applied where needed to address retail market failures (including codification in the law of the "three criteria test"). This should **limit the scope for over-regulation.** The bundle of preferred options also includes an increase of the period in between successive market reviews from 3 to 5 years, which should **increase certainty** for stakeholders and **reduce administrative costs**. Costs savings have been estimated at 10-15% of the current costs involved with market reviews (a saving of up to €7.5m)[275].

As regards the market review process, NRAs will be required to conduct mapping exercises before starting a market review which will improve the geographic targeting of regulation. This measure ensures that access obligations are applied only in areas where they are necessary and are the minimum necessary to address the identified problems, thereby contributing to **reducing the scope for over-regulation**.

Giving NRAs a core role in relation to infrastructure, investment and quality of service mapping should also serve to consolidate what are in some countries multiple mapping processes conducted by separate bodies. This should make the process more coherent, ensuring consistency

[275] Estimates from Ecorys (2013) suggested that removing 2 markets from the original 7 markets listed in the 2007 Relevant Market Recommendation might result in savings on the market analysis process of 10-15% (a saving of up to €7.5m). This could be viewed as an equivalent change to extending the frequency of reviews from every 3 to every 5 years.

between broadband state aid, ex ante regulation, and mapping conducted in the context of the Cost Reduction Directive. It should also **save in administrative costs and simplify** the data provision exercise for stakeholders.

Furthermore, measures contribute to **making rules clear** by shedding light on the relationship between the SMP status and symmetric obligations for access to civil infrastructure, so that such symmetric obligations[276] can be considered by NRAs when conducting market reviews.

Lastly, the adoption of standardised specifications for key wholesale products used by businesses should **minimise duplicate processes** for wholesale product specification, **reducing the cost** for NRAs and cross-border service providers, although there may be some set-up costs involved if common specifications require changes to previously applied wholesale obligations.[277] SMART 2014/0023 shows that as of April 2015, 13 separate processes had been applied for the specification of VULA in different Member States. Standardisation of future key wholesale products could help to limit duplicate effort and thereby speed time to market.

4.9.3.2 General authorisation in preference to individual licenses for spectrum, fostering secondary markets for spectrum and coordination in spectrum management

In the field of spectrum, the preferred option includes a greater emphasis on general authorisations as opposed to individual licenses in an attempt to ensure that national authorities deliver the most appropriate future licensing models to underpin the full benefits of 5G. Such a move toward general authorisations, as well as licensed shared access, would mean that the rules for access to a particular band covered by this general regime are redrafted at EU level to allow for cross-border harmonisation

A greater emphasis on general authorisations in a number of EU spectrum bands would therefore lead to **clearer and more comprehensible assignment rules** across the Union. This would be of particular benefit to smaller companies with more limited resources and which are unable to purchase exclusive access to spectrum in each Member State.

In addition, general authorisations would contribute to **avoiding overregulation and administrative burdens**. This regime will better fit 5G regulatory needs and thus, create the right conditions for accessing and using spectrum in a flexible way – **barriers to spectrum entry** will be lowered to stimulate innovation and new services. Focus on general authorisations would mean that operators could have the same spectrum all over Europe, with similar conditions which in turn would eliminate the need for individual decisions (either at national or EU level) on who gets what spectrum.

Also the measures fostering the creation of a pan European secondary market for spectrum, mainly through lengthening the licence duration, will reduce the administrative burden related to auction processes for authorities and operators. The secondary market for spectrum will allow a dynamic allocation of spectrum in the Union by adapting to the variations of demand over time, new technologies and services will have an easily access to spectrum

The IA study estimated potential cost savings regarding spectrum management resulting from greater alignment of auction procedures and certain conditions, These savings are estimated in section 4.5.3.3.

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[276] Stemming from of the 2014 Cost Reduction Directive, as well as facility sharing obligations mandated under article 12 of the Framework Directive.

[277] See discussion in SMART 2014/0023. Such costs could be mitigated by phasing in changes to coincide with the refresh of systems.

4.9.3.3 The removal of redundant universal service obligations

In the field of universal service, the preferred option foresees exclusion of the following services from the universal service scope at the EU level: pay phones, directory services and directory enquiry services. These services are considered redundant because in the majority of cases they are sufficiently provided by the market by competing providers, and the respective USOs are increasingly lacking at the national level.

Such amendment would render universal service **rules clearer** as the EU-wide universal service scope would be narrowly defined and focused on affordability. This, in its turn, would make the universal service rules **more comprehensible for the affected end-users** who would be able to better grasp the idea of basic communications services, to which they are entitled, and **understand** the amount of **relevant rights**. It would also **reduce administrative burden** for the providers that will not have to supply the redundant services and comply with respective Quality of Service and reporting requirements imposed on them as designated universal service providers.

The **ending of the current sectorial sharing mechanism** possibility for financing will lead to further simplification and reduction of administrative burden. Financing through public funds will be easier to implement so that it will lessen administrative costs and will contribute to a fairer distribution of costs and benefits of the universal service provision among all market participants with less distortion to competition

4.9.3.4 Clarifying the scope of the Regulatory Framework and the removal of redundant consumer protection obligations

By linking authorisation requirements to the use of numbers and by extending the scope of sector specific rules on security (and potentially confidentiality of communications) to include all communication services (independent of whether they make use of numbers) the proposed measures aim to resolve the lack of clarity which is currently resulting from the 'conveyance of signals' definition. The measures thereby contribute to making rules **comprehensible and clear** and to allow parties to **easily understand their rights and obligations**. A majority of respondents to the consultation (strongly) agreed that there was need for more clarity about the scope of the Regulatory Framework. The redefined scope not only addresses regulatory uncertainty perceived by current stakeholders, but also regulatory insecurity for future stakeholders operating in future new digital value chains (such as the IoT). Moreover, clarity about the scope of the regulatory framework **prevents growing regulatory heterogeneity (and associated costs)** that may otherwise result from national authorities responding with their own measures and interpretations of the scope of the Regulatory Framework.

The proposed widening of the scope of the Regulatory Framework leads to a *de facto* **increase of the administrative burden** for a limited number of OTTs that use numbering resources as they will now be subject to more regulation (relative to the current situation, where the applicability of the framework is not widely recognised or implemented). However, not all obligations will result in increased administrative burden. E.g. interoperability and interconnection obligations will have little impact since interconnection and interoperability with the numbering regime is already part of the respective service. Additional burden may result from portability obligations[278] and from administrative charges related to Article 12 and 13 of the Authorisation Directive, which should however be appropriately modulated by reference to effective revenues[279]. Furthermore, option 4 makes it explicit for OTTs to provide access to emergency

[278] Provided Member States do not already impose these obligations following the ERG 2007 guidelines; otherwise there would be no additional burden from the proposed measures.

[279] which may add up to 5 to 10 million EUR for an OTT with 7.5 to 15 million paying clients, according to the figures quoted in SMART 2015/0005 in section 7.4.4.

services as far as this is technically feasible[278]. All OTTs (regardless of the technology used) will experience an increased administrative burden in relation to complying with rules on security and privacy.

The bundle of proposed measures simultaneously aims to **reduce administrative burden** by **removing redundant sector specific consumer protection rules** where these would already be addressed through horizontal legislation or met by the market. Sector specific obligations identified as being redundant relate to transparency[280], quality of service[280], contractual rights[280], and out-of-court dispute resolution. Telecom operators found it difficult to provide robust calculations of related compliance costs. In qualitative terms they indicated that the overlapping information requirements create additional burdens for businesses that have to check all sets of requirements for any small or national differences and engage with two different sets of regulators in relation to enforcement[281]. The **reduction in administrative costs will partially be undone** by the additional obligations regarding the quality of IASs, which likely remain limited given the already existing Quality of Service reporting obligations under the Net Neutrality rules and associated BEREC guidelines. Furthermore, facilitated switching processes for IAS services will impose an additional burden on ECN providers.

For NRAs, the widening of the scope of the Regulatory Framework may involve additional administrative burden. Regulators indicate that removing redundant rules would hardly affect their operations, amongst others because if these redundancies and associated tasks for NRAs would disappear, new responsibilities for NRAs would arise in the form of providing technical assistance to more horizontal competent authorities when they were to deal with sector specific issues[282]

With regards to consumer protection, the impact of the proposed measures is largely positive: consumers are more protected with regards to security (and potentially confidentiality) when using OTT services; consumers are more protected with regards to transparency and switching in relation to IASs; consumers are not less protected with regards to other communication services as the proposed measures only remove sector specific consumer protection rules addressing consumer protection needs that are already addressed through horizontal legislation or that are met by the market, or which have become redundant due to market developments (e.g. Article 17 USD).

Table 14 – Summary table on the scope of rules and impact on selected stakeholders

	Wider scope of RF	Redundant rules	Additional IAS rules
NRA	+	0	+
ECS/ECN	0	- - -	+
OTT	+	0	0
Consumer protection	+	0	+

4.9.3.5 Harmonisation and clarification of rules and governance of numbering in the M2M context

Improved governance of the extra-territorial use of national numbers (in order to realise country agnostic connectivity for M2M applications) will **avoid substantial administrative costs** that

[280] Where these apply to communication services other than the IAS

[281] For more details see SMART 0005/2015 with further analysis on activities driving compliance related administrative burden for operators regarding contractual terms and transparency

[282] For more details see SMART 0005/2015 with further analysis on relief potential of enforcement costs for NRAs

are currently preventing extra-territorial use[283]. A more harmonised governance structure may require a possible extension of the activities (and costs) of BEREC as well as costs related to coordination with CEPT. However, these costs are likely much lower than the costs of the currently required multiple bilateral agreements between NRAs and telecom providers[284].

The proposed measures do not directly impact on consumer protection. However, consumers will benefit since the proposed numbering regime will contribute to the removal of bottlenecks in the IoT value chain and the promotion of innovations in IoT applications, with a positive effect on choice and prices for products and services relying on IoT services.

4.9.3.6 Aligning the remit of NRAs with BEREC

The Governance preferred option aims at simplification through harmonizing a minimum set of competences for independent national regulatory authorities essential for market shaping aligned with BEREC tasks focused on the cross-border dimension. This should serve to consolidate responsibilities and expertise within NRAs and simplify the engagement process for stakeholders.

Moreover, the preferred governance option would lead to a streamlined and more efficient governance set-up, in particular with a simplified structure for BEREC in line with the Common Approach for decentralised agencies.

4.10 The legal form of the preferred options

The scope of the current Refit exercise includes four Directives (Framework, Authorisation, Access and Universal Service Directive) and a Regulation (BEREC Regulation)[285]. Each of the Directives contains measures applicable to electronic communications networks and to electronic communications services providers, consistently with the history of the sector in which undertakings were vertically integrated i.e. active in both the provision of networks and of services. The review offers an occasion to simplify the current structure, with the view to reinforcing its coherence and accessibility, consistently with the Refit objective. It offers also the possibility to adapt the structure to the new market reality, where the provision of communications services is not any more necessarily bundled to the provision of a network. Unlike networks, which are local, these services are more and more pan-European, or even global. In order not to hinder innovation, we should avoid over-regulating these services. Separating the network from the services regulation offers the possibility to establish a lighter and more proportionate regime adapted to different types of services. Any obligation should comply with the principle of proportionality. Restructuring the framework in a way to distinguish network from services regulation will allow precisely to better calibrate the

[283] Currently, extra-territorial use of number is governed by Annex E of the ITU E.212 recommendation, advising operators wishing to implement the extra-territorial use of an MCC+MNC, to seek approval of the relevant administrations of both Country A and Country B. The administrations should then confer together on the extra-territorial use of the MCC+ MNC and notify the applicant and all other operators operating in Country A and Country B of their decision. This is a costly administrative exercise in relation to M2M services, given the potential volume of multiple (possible hundreds of) thousand SIM based machines served by a single M2M service provider. For more details see SMART 0005/2015

[284] Under the current highly inefficient arrangements for extra-territorial use of numbers, operators choose to arrange for country agnostic connectivity via the use of shared MCC901 numbers issued by the ITU. However, the range of numbers under MCC901 is too limited to support the growing number of M2M applications and the option of a new shared MCC90x involves several practical and costly problems. See SMART 0005/2015 for more details on current arrangements for extra-territorial use of national numbers

[285] The structure of the Regulatory Framework is completed by a number of other instruments, such as the ePrivacy Directive and the Roaming Regulation which are not part of this exercise.

obligations and in general the regime applicable to networks and services. Furthermore, since the previous review, new non-vertically integrated players have also entered the upstream markets, as well as providers of physical infrastructure only (ducts, poles etc.). These network operators, who have no aspiration of entering the services market and have hence no contractual relationship with end-users, should be subject to clearly separate and proportionate rules, excluding for instance consumer protection.

Recasting will also allow addressing certain inconsistencies of the current structure. Currently, the Authorisation procedure is in a different Directive than the general framework. Also, the market analysis procedure is in the Framework Directive, while the access obligations are in the Access Directive. It would be simpler if the procedure was brought closer to the obligations. Furthermore, currently, symmetric obligations are scattered in the Framework (Article 12) and the Access (Article 5) Directives. There is a gain in clarity if symmetric remedies are brought together and close to the asymmetric remedies.

It is therefore proposed to proceed to a horizontal recasting[286] of the four Directives, bringing them all under a single Directive divided in three parts: one part on Generally applicable rules (framework), one part on networks and one on services (alternatively three directives organised on these lines). Furthermore, since BEREC is to be transformed into an EU agency, the BEREC Regulation must be significantly redrafted into a new Regulation. This choice will minimise the changes to those current texts which will be retained intact or only lightly amended, and will ensure that the balance between directly applicable rules and rules allowing Member States to take the necessary organisational measures for the sector is maintained.

4.11 The impact of the preferred options

This section presents in brief the results of the **macroeconomic impact assessment** that was carried out as a part of the support study to this impact assessment. Further details on the methodology, calculations and results of the model are provided **in Annex 5.**

Practical implications of these preferred options for **representative stakeholder groups** such as Over-the-Top players, SMEs, Consumers, Ministries, National Regulatory Authorities and Spectrum Management Authorities are described in **Annex 4**.

The preferred policy options should make a significant contribution towards boosting EU productivity and innovation. Such innovation effects are particularly relevant in view of the fact that the review of the electronic communications framework could support, among other processes, the development and use of the 'Internet of Things' (IoT)[287] and digitalization of industry inter alia. If benefits are to be fully reaped, supply-side policies for electronic communications, including the regulatory environment need to be complemented by initiatives to support the absorption of new technologies within businesses of all sizes[288]. The impact on competitiveness and innovation is described in Annex 7,

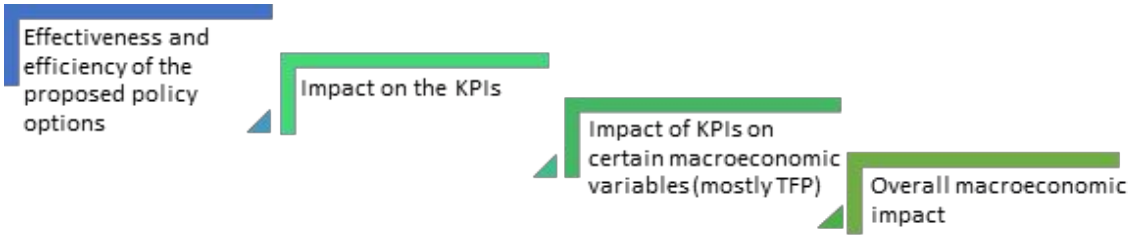
[286] For more information on this technique, cf. http://ec.europa.eu/dgs/legal_service/recasting_en.htm.

[287] BEREC (2016) and McKinsey (2015) identify a number of key enablers that contribute to unlocking the full potential of the IoT. Key enablers are optimal fixed and mobile connectivity (which is realised through policy measures with regards to access, spectrum and numbering), regulatory security for new players in the IoT value chain (which is realised by clarifying the scope of the RF) as well as end-users confidence about security, privacy and confidentiality.

[288] See also the EC initiative "**Digitising Industry**" under the DSM package. launched on 19 April 2016.

4.11.1 Methodology

The impacts from the implementation of the preferred policy options have been quantified using a combination of theoretical models, econometric and computable general equilibrium methods and reference to relevant literature. The four steps are described below.



As a first step, the evaluated impact in terms of effectiveness and efficiency of the proposed policy measures is translated into quantitative (where possible) key performance indicators (KPIs), based on evidence from case studies and theoretical models.

To provide a link between the KPIs and the macroeconomic framework, as a second step, econometric estimates of the effect of the indicators on certain macroeconomic variables are performed.[289] These are complemented by other estimates, based on relevant economic literature.

Finally, the evaluated impacts are fed into the CGE modelling framework as an input shock and the effects are multiplied and spread across the entire economy through the model system of equations. The impact of the preferred scenario is evaluated quantitatively by means of comparison against the baseline in each of the considered policy areas.

It should be cautioned that there are **some limitations to the CGE approach**. In particular, it is not best suited to capture the effect of disruptive changes resulting from the digitalization of industry. In addition, achievement of structurally different economic growth will be strongly dependent on the ability of businesses to effectively and efficiently absorb new technologies and benefit to the highest extent from the competitive advantages such technologies might provide. Further opportunities and challenges are discussed in sections 4.11.4 and following.

The use of a CGE framework entails the **following assumptions**:

- No change in the input-output structure of the economies modelled. As already discussed, in the context of the current evaluation this implies that the estimated impacts are very conservative, where there is potential for higher benefits in case of disruptive technologies and innovations.
- Constant share of public investment with respect to the gross value added in the absence of policies
- Constant share of sectorial public investment with respect to the total capital expenditures of the government in the absence of policies
- Assumptions about important model parameters, which are presented in detail in the macroeconomic modelling annex. They are calibrated in order to ensure a plausible trajectory of the macroeconomic variables in the baseline.

[289] To estimate the impact of the KPIs on TFP we have applied stochastic frontier analysis and identified TFP with the efficiency term in the estimated production function. Then, the impact of various e-communication key performance indicators on TFP was evaluated.

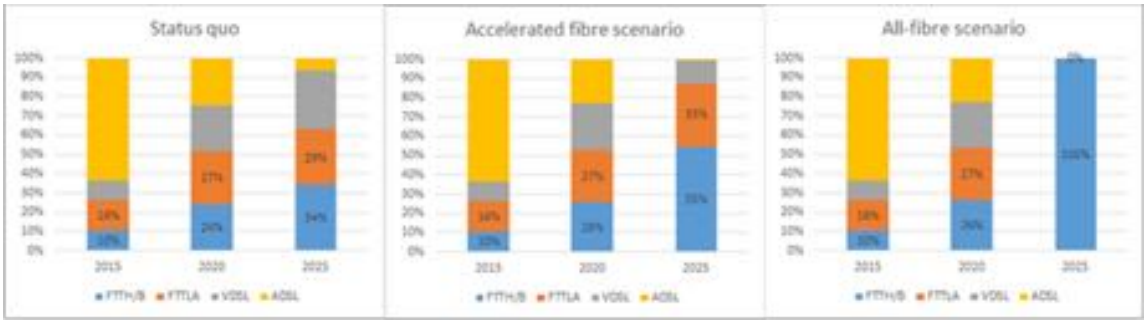
In order to present estimates of the magnitude of the estimated impacts in nominal terms, we have also adopted the assumptions that in the **baseline scenario** annual GDP growth in the EU will be 2%, while employment will increase by 0.3% per annum and finally, that annual growth in gross fixed capital accumulation will be around 5%.

Further details on the macroeconomic methodology and results are provided in the specific Annex 5 (see section **Error! Reference source not found.**) on this subject.

4.11.2 Impacts of preferred policies on fixed and wireless broadband availability and quality

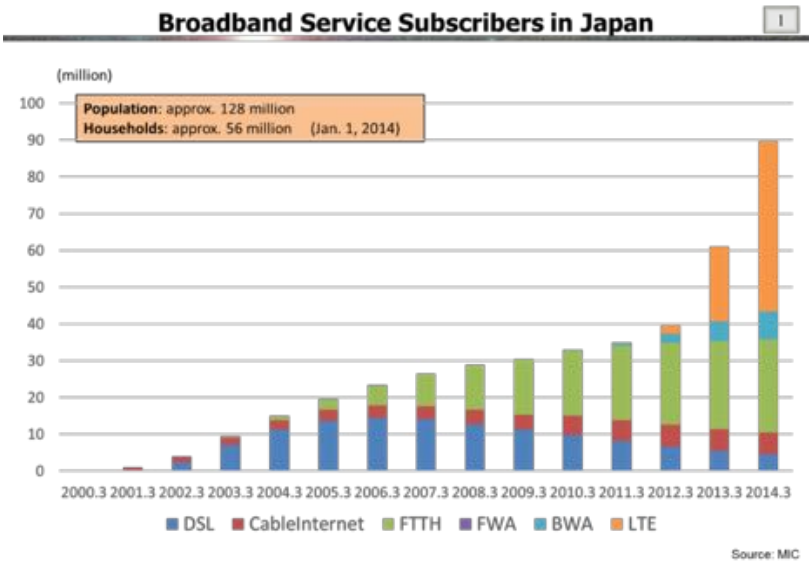
In the field of access, it is assumed that the inter-institutional process of developing the revised electronic communications framework and its subsequent adoption and transposition will result in adaptations to the market analysis process which stimulates greater deployment of VHC infrastructure from the end of 2020 onwards. In an accelerated fibre scenario, it is assumed that FTTH/B expands to account for 54% of connections in 2025 with an additional 28% consisting in high speed cable connections. Although this scenario is unlikely to be realised, we also model for comparison an all-fibre scenario in which all broadband connections are supplied by means of FTTH/B by 2025.

Figure 21 - Technology mix under different scenarios



Although ambitious, it is notable that the growth pattern shown for the accelerated fibre scenario is conservative in comparison with the expansion in fibre take-up experienced in Japan between 2005-2010 as shown in the following figure, and there are also examples of high fibre penetration being achieved in some countries in Europe as can be seen from Figure 13 above.

Figure 22 – Broadband in Japan



These technological projections combined with data on actual speeds by technology from Samknows and speed growth trends might result in the following projected speed increases under different scenarios (see **Error! Reference source not found.** in annex 5).

Meanwhile, the impact of co-ordinated spectrum assignments on the timeframe to achieve full coverage of enhanced mobile broadband aspects of 5G[290] is assessed with reference to experience from the leading Member States as regards assignment of LTE. See Annex 5.

In the 'no change' policy scenario, full eMBB coverage would be achieved only in 2030 due to the different starting dates for availability, while under Option 3, widespread coverage of fast mobile broadband (although not full 5G capabilities which also depend on fibre backhaul deployment), might be expected to be established considerably sooner due to aligned assignment deadlines. Three years is taken as a benchmark based on the time taken for full coverage of LTE in countries such as Sweden.

4.11.3 Impact of improved broadband quality and electronic communication service development on TFP

Based on the methodology adopted various calculations were performed, assuming that the impact of the preferred policy options will be channelled through total factor productivity (TFP). The latter measures the efficiency with which the production factors (capital and labour) are used in production. Therefore innovations in the production processes are typically reflected in this term.

Confirming the importance of broadband availability and quality for the economy at large, we found, through econometric analysis, that there is a statistically significant relationship (in logarithms) between Total Factor Productivity[291] and 4G mobile broadband coverage as percent of households (0.003) and average broadband connection speed (0.021), where estimated coefficients are given in parenthesis.[292] We also found a link between TFP and the Heritage

[290] Other aspects requiring intensive densification of networks may take longer to achieve full coverage

[291] Total factor productivity is a measure of the long-term technological progress. It is typically estimated in a production, where it represents the (Solow) residual that is not attributed to the production factors used (usually labour and capital).

[292] This means for example that TFP is likely to grow by the connection speed growth to the power 0.021, while TFP growth would be equal to the 4G mobile broadband coverage to the power 0.003.

index of economic freedom (0.225).[293] The elasticities applied in the simulations are presented in the table below[294]:

Variable (in logs)	AGR	LOWMAN	HIGHMAN	ENERGY	TRANS	TELECOM	ECOM	SER
heritage[295]	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
mbb_ltecov[296]	0.003	0.005	0.003	-0.00000004	-0.00000004	0.003	0.012	0.003
speed[297]	0.021	0.032	0.035	-0.0000009	-0.0000009	0.072	0.072	0.021

The estimated implications of the preferred access and spectrum options on TFP growth could then be directly inserted in the CGE modelling framework.

The policy options in the area of services should also have positive impact mainly on regulatory efficiency and effectiveness in the electronic communication sector. However, the magnitude of this impact is not easy to quantify. In order to overcome this difficulty, we relied on the results of a study by Haidar (2012) [298], which indicates that impact of a more significant regulatory reform on the growth rate of GDP per capita is 0.15% on average. We have assumed that such an impact will be channelled through improved TFP in the e-communication sectors and by means of iterations estimated that an average increase in GDP growth rate of 0.15 percentage points is associated with a 4% annual increase in TFP in the TELECOM and ECOM sectors, starting from 2020.

4.11.4 Implications for jobs and growth

The specific estimated economic and social impacts of the preferred options for access, spectrum and services – in terms of GDP, consumption, investment and employment, split by country type (state of digital and economic development), are shown in Table 15 below.[299]

The estimates are considered as conservative as they do not incorporate the possibility for significant structural changes, which might take place if disruptive technologies are introduced as a result of the expected increases in broadband connection speed, introduction of 5G and efficiency gains. Additionally, given their current economic structure, the less digitally and

[293] The Heritage index is used as a proxy of the regulation effectiveness and efficiency and, more generally, of the business and consumer climate.

[294] Sector abbreviations: AGR – agriculture, LOWMAN - low-tech manufacturing, HIGHMAN - high-tech manufacturing, ENERGY - energy sector, TRANS - transport, TELECOM - telecommunications, ECOM - other electronic communication-related services, SER - Other services.

[295] Heritage index of economic freedom, which is mostly used as a proxy of the regulation effectiveness and efficiency and, more generally of the business and consumer climate.

[296] 4G mobile broadband coverage (as % of all households)

[297] Average broadband connection speed

[298] Haidar J. I. (2012) "The impact of business regulatory reforms on economic growth", *Journal of The Japanese and International Economies*, 26 (2012), pp. 285-307.

[299] The clusters of EU countries according to their economic and digital development and size are as follows:

- *Advanced*: LU, Denmark, Sweden, Finland, Netherlands, Belgium, UK, Germany, Ireland, Austria and France;
- *Intermediate*: Lithuania, Estonia, Malta, Portugal, Czech Republic, Latvia, Slovakia and Slovenia;
- *Less advanced*: Bulgaria, Romania, Greece, Cyprus, Italy, Hungary and Poland

As identified, the clusters are similar to the groupings of countries, based on DESI (https://ec.europa.eu/digital-single-market/en/desi), but they are not identical, as for the purposes of CGE modelling we consider GDP in mln EUR rather than its growth rate, thus taking into account more long-term characteristics of the economies - the level of economic development and the size of the economy.

economically advanced economies are now estimated to benefit to a smaller extent from the expected improvements in the e-communication services. There is however a possibility that these economies experience a leapfrogging effect and, in particular, that new e-communication technologies help address the lack of adequate fixed infrastructure in some of the countries.

Table 15 - Impact of assessed scenarios on GDP, consumption, investment and employment (source: Ecorys)

	GDP		Consumption		Investment		Employment	
	2021	2025	2021	2025	2021	2025	2021	2025
Accelerated fibre								
Advanced	0.06%	0.54%	0.04%	0.38%	0.14%	1.11%	0.00%	0.03%
Intermediate	0.07%	0.57%	0.04%	0.35%	0.12%	0.66%	0.01%	0.02%
Less advanced	0.06%	0.52%	0.04%	0.40%	0.08%	0.22%	0.00%	-0.03%
EU28	0.06%	0.54%	0.04%	0.38%	0.13%	0.89%	0.00%	0.01%
All fibre								
Advanced	0.08%	0.96%	0.05%	0.66%	0.16%	1.92%	0.00%	0.04%
Intermediate	0.08%	1.00%	0.04%	0.62%	0.14%	1.09%	0.01%	0.03%
Less advanced	0.07%	0.91%	0.05%	0.71%	0.10%	0.34%	0.00%	-0.05%
EU28	0.07%	0.95%	0.05%	0.67%	0.15%	1.54%	0.00%	0.02%
Services-efficiency gains								
Advanced	0.11%	0.62%	0.10%	0.63%	0.30%	1.38%	0.02%	0.14%
Intermediate	0.11%	0.67%	0.05%	0.49%	0.62%	3.06%	0.01%	0.21%
Less advanced	0.22%	1.25%	0.23%	1.12%	-0.44%	-8.80%	0.06%	0.16%
EU28	0.13%	0.74%	0.12%	0.70%	0.20%	-0.30%	0.02%	0.15%
Spectrum								
Advanced	0.00%	0.16%	0.00%	0.12%	0.00%	0.48%	0.00%	0.01%
Intermediate	0.00%	0.23%	0.00%	0.14%	0.00%	0.74%	0.00%	0.04%
Less advanced	0.00%	0.16%	0.00%	0.12%	0.00%	0.24%	0.00%	0.01%
EU28	0.00%	0.16%	0.00%	0.12%	0.00%	0.47%	0.00%	0.02%

Generally, for all assessed scenarios GDP is expected to increase compared with the baseline, with an anticipated **GDP uplift of 0.16% in 2025 for spectrum policies** compared with the baseline and a **GDP uplift of 0.54% for access policies** based on the 'accelerated fibre' scenario, as described in section **Error! Reference source not found.**.

The cumulative impact up to 2025 is expected to be significant due to the expected supply side impacts, which are built up over time. More positive economic developments will have a significant impact on investment, while the effects on consumption with be more moderate, along with the life-cycle hypothesis for consumption smoothing. In the access scenarios the

effects are larger for the intermediate and most economically and digitally advanced economies in the EU, which have the potential to capitalize best the benefits from applying the preferred policy options. In the spectrum scenario, intermediate economies are expected to perform better against the remaining EU countries, as 5G will most probably induce more investments both in the e-communication sectors and manufacturing.

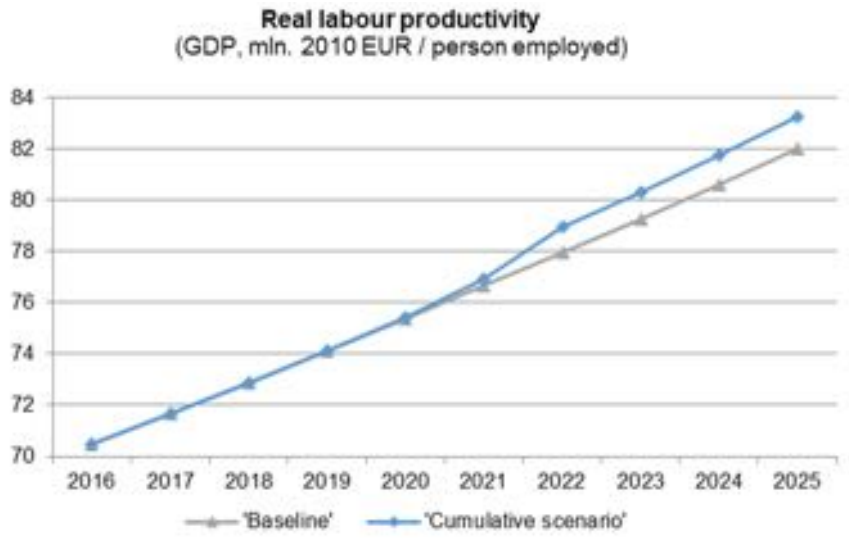
We also find some positive employment impacts from **access and spectrum policies (0.02% higher than the baseline)**, while the efficiency gains potentially driven by reforms fostering **digital services,** might result in increases in employment of **up to 0.15%** compared to status quo.

4.11.5 Impact on competitiveness

The results of the CGE modelling provide some indications as regards the implications of changes to the framework on labour productivity – one measure of EU competitiveness.

In the cumulative scenario case, where preferred policy options are implemented in all areas, real labour productivity will exceed the baseline by an average of 0.8% for the period 2020-2025. This is equivalent to an average of 0.2 percentage points higher growth rate of productivity in the simulation scenario as compared to the baseline.

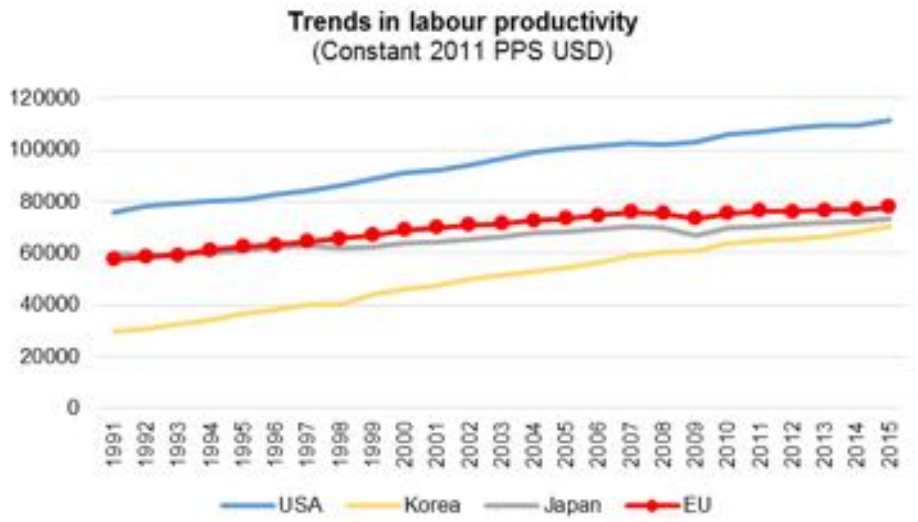
Figure 23 - Real labour productivity (preferred options vs status quo)



Source: Eurostat, own calculations

Viewed in international perspective, historically over the past quarter century labour productivity growth in EU has been lagging by an average of 0.4 percentage points as compared to the US and by 2.4 percentage points as compared to Korea (due its lower base). One can realistically expect productivity growth acceleration in the US and Korea in the forthcoming years as well. Despite this, the implementation of the considered policy changes should make a significant contribution towards boosting EU productivity, and potentially closing the gap.

Figure 24 -Trends in labour productivity – international comparisons



Source: World Bank, World Development Indicators database

4.11.6 Potential for disruptive change through innovation

The assumption underlying the CGE model is that clearer regulation of communication services and better connectivity will allow all sectors of the economy to operate more efficiently and realise higher total factor productivity rates.

In addition, the implementation of the preferred policy options might give a significant boost to innovation. Such innovation effects are particularly relevant in view of the fact that the review of the electronic communications framework could support the development and use of the 'Internet of Things' (IoT) [300] and digitalization of industry inter alia by fostering:

- More regulatory certainty for all players throughout the IoT value chain contributing to a better investment climate;
- Levelling barriers for scaling up in Europe (by reducing regulatory heterogeneity) to the benefit of start-ups entering as new players shaping the IoT value chain.
- Improving connectivity for SIM based M2M services;
- End-users confidence about security, privacy and confidentiality[301].

[300] BEREC (2016) and McKinsey (2015) identify a number of key enablers that contribute to unlocking the full potential of the IoT. Key enablers are optimal fixed and mobile connectivity (which is realised through policy measures with regards to access, spectrum and numbering), regulatory security for new players in the IoT value chain (which is realised by clarifying the scope of the RF) as well as end-users confidence about security, privacy and confidentiality.

[301] The reason, as explained by BEREC and McKinsey, is that new categories of risks are introduced by the Internet of Things. McKinsey argues that more devices means more opportunities for potential breaches and BEREC argues that "*[d]ue to limited resources in terms of energy and computing power, […] IoT devices may be vulnerable to cyber-attacks*". Furthermore, McKinsey argues that the impact of a data breach is much larger in the context of the IoT. "*when IoT is used to control physical assets, whether water treatment plants or automobiles, the consequences associated with a breach in security extend beyond the unauthorized release of information—they could potentially cause physical harm*". BEREC concludes that *"If users do not trust that their data is being handled appropriately*

- Faster adoption of 5G; and
- A more ubiquitous roll-out of fibre networks to homes and lamp posts as to provide a backbone with the stability and low latency that is required by many IoT applications.

In turn, IoT implies an increased role for communication services in (and increased dependency on connectivity by) various industries, including automotive, agriculture, health, transport, etc. As such, policies which unlock the full potential of IoT and the digitization of industry could trigger a so-called "disruptive growth path".[302]

It is not possible to estimate ex ante the impact of such structural economic changes on the basis of CGE modelling. Therefore, the CGE estimates should be treated as a lower bound. Assessing the impact of disruptive structure changes would require a case study approach examining how precisely production processes would change as a consequence of a progressing IoT. Such analysis has been done by McKinsey (2015) "The internet of things: mapping the value beyond the hype" which analyses a number of IoT use cases [303] involving sectors that are key for EU competitiveness.

- IoT will particularly increase **productivity and innovation** in sectors that are considered essential for Europe's **global competitiveness** (such as automotive[304] and electrical engineering[305]). Realising the full potential of the IoT in Europe contributes to maintaining/strengthening that position. Not realising the full potential of the IoT in Europe may lead to other parts of the world overtaking that position.
- IoT will also increase **productivity and innovation** in as well as in agriculture[306] which is an essential sector for the **regional competitiveness** of Europe's peripheral areas[307].
- Furthermore, IoT contributes to **cost savings** in a wide variety of other sectors such as E-health, smart metering/grids, smart homes and cities, etc.

McKinsey estimates for the global economy that by 2025, the full potential of IoT amounts to approximately 3.9 to 11.1 trillion dollars per year (including consumer surplus). In terms of % of global GDP this amounts to 3.3% to 9.4% according to our own calculations.[308] If Europe could

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there is a risk that they might restrict or completely opt out of its use and sharing, which could impede the successful development of IoT."

[302] See: "Information Technologies and Labour Market Disruptions - A Cross-Atlantic Dialogue" background document by the "interdisciplinary, cross-sector roundtable organised by the European Commission (DG Enterprise and Industry and DG Communication Networks, Content and Technology) in cooperation with The Conference Board and Cornell University ILR School" 3/11/2014, p. 11

[303] Outside, Home, Human, Cities, Factories, Worksites, Offices, Retail, environments, and Vehicles,

[304] BEREC BoR(16)39 as well as McKinsey (2015) identify automotive as key sector that will adopt IoT applications. At the same time, it considered a strategic sector of the EU economy http://ec.europa.eu/growth/sectors/automotive/index_en.htm

[305] Electrical engineering is a sector in which the EU is the global leader and which will benefit greatly from the ongoing growth in mobile devices see: http://ec.europa.eu/growth/sectors/electrical-engineering/index_en.htm

[306] BEREC BoR(16)39 as well as McKinsey (2015) identify agriculture as key sector that will adopt IoT applications.

[307] Thissen, van Oort, and Diodato (2013)

[308] On the basis of data and forecasts provided by the Conference board, global GDP may grow from 88 trillion dollars in 2015 to 117 trillion dollars in 2025, not accounting for a disruptive boost like the IoT. As such, the IoT may create up to 3.3% to 9.4% additional income at global level by 2025. See https://www.conference-board.org/data/economydatabase/index.cfm?id=27762 and https://www.conference-board.org/data/globaloutlook/index.cfm?id=27451

realise a similar gain by fostering key IoT enablers, this would amount to an additional GDP of 0.56 and 1.59 trillion euros in the year 2025.[309]

The contributions to European competitiveness that could be made from the proposed changes to the EU regulatory framework are summarised in the following table.

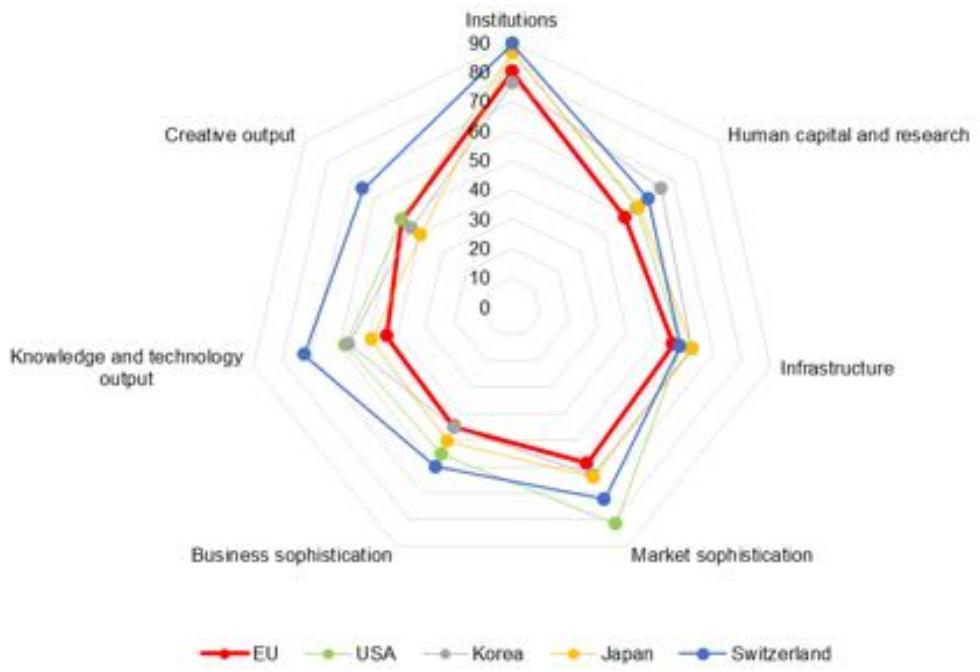
[309] Assuming the EU economy has grown to 16.58 trillion euros by 2025 (based on forecasts by the Conference board). 0.33% of 16.58 trillion euros = 0.56 trillion euros. 9.4% of of 16.58 trillion euros = 1.59 trillion euros

Figure 25 - Overview of competitiveness impacts

	Access	Spectrum	Services
Cost competitiveness	VHC connectivity supports the digitalisation of services, reducing cost and time to market. Standardising wholesale products used for business should also reduce costs and increase efficiency within cross-border organisations	Positive (general authorisation will make access to spectrum more affordable and lower administrative / regulatory costs). This is of particular benefit to smaller companies with more limited resources	The reduction of administrative burden and of regulatory heterogeneity realises cost savings for telecom operators.
International competitiveness	Access policies are likely to boost infrastructure deployment in Europe, closing the investment gap with other economies. Increased bandwidth is likely over time to support increased use of digital services and the attractiveness of the EU as a platform for technological and service development.	Positive (as a result of e.g. device manufacturers seeing Europe as a single market, offering significant scaling opportunities, and producing devices that are able to operate in "European" bands)	Less regulatory heterogeneity contributes to the realisation of a digital single market which facilitates a faster scale-up of European start-ups in the global digital economy.
Innovation competitiveness	The deployment of fibre to lampposts and homes supports 5G development, and new applications. A connected economy may also drive disruptive change in business processes	Positive (general authorisation will open up spectrum access to innovative services, faster roll-out of 4G/5G will foster development of new services based in Europe)	More clarity and equality throughout the value chain with regards to regulation reduces regulatory risk for new (small medium sized and large) players. This increases their willingness to invest and innovate

A key challenge however in realizing the benefits identified from innovations including those stemming from IoT is the capability of European businesses to leverage innovation. For example, comparing EU[310] innovation capacity and results against peer economies, according to the Global Innovation Index for 2015,[311] the EU seems to be lagging behind in terms of many aspects of innovation,[312] although some countries within Europe including Finland, Sweden, Luxembourg, Denmark and Germany are reported to be relatively strong in making use of innovations specifically in ICT.

Figure 26 - EU innovation capacity in comparison with other regions



Source: Global innovation index, own calculations

If benefits are to be fully realized, this highlights the need for levelling up within Europe, not only in terms of supply-side policies for electronic communications including the regulatory environment, but also – importantly – on initiatives to support the absorption of new technologies within businesses of all sizes.

[310] EU figures are derived aggregating the member states scores, weighting them with the respective country population.

311 The Global Innovation Index is an annual ranking of countries by their capacity for, and success in, innovation. It is published by INSEAD and the World Intellectual Property Organization, in partnership with other organisations and institutions. It is based on both subjective and objective data derived from several sources, including the International Telecommunication Union, the World Bank and the World Economic Forum.

312 There are clear differences for the business sophistication pillar of the index, which includes knowledge workers and R&D activities performed in the business sector, links between the business sector and the academia and means of knowledge absorption. Another aspect where EU is performing relatively worse concerns indicators for 'knowledge and technology' including knowledge creation, diffusion and impact.

4.11.7 Conclusions

Overall, if all the preferred options are pursued as a result of the review of the electronic communications framework, we expect expanded market-driven investment and consumption and a cumulative effect **on growth of 1.45% and on employment of 0.18% in 2025**, assuming that the reforms are implemented by 2020. A step change of 0.8% in labour productivity is also envisaged during the period 2020-2025.

Assuming a baseline with an average annual EU growth of 2% and average annual increase in employment of 0.3%, the cumulative impacts by 2025 on economic activity and job creation in nominal terms will amount respectively to EUR 910 bn. and 1.304 million additional jobs. This is a conservative estimate, as it does not take into account the possible synergetic effects that might occur in case the preferred options in all policy areas are implemented simultaneously. The model does not capture the potential for technological developments to drive disruptive change throughout industry, as might occur if Europe leverages on strong infrastructure and single market for digital services to achieve leadership in the Internet of Things (see Annex 7).

While absolutely necessary, changes to the electronic communications framework are not sufficient in themselves. Initiatives to support the creation of the Digital Single Market and enable business to take full advantage of the potential offered by digitalisation, will also play a crucial role in driving Europe's competitiveness.

5 HOW WOULD ACTUAL IMPACTS BE MONITORED AND EVALUATED?

5.1 Plan for future monitoring and evaluation - consider what should be monitored and evaluated and when.

The present section explains how the impacts that were identified in section 4 above will be monitored and evaluated once the revised telecoms framework comes in place. Some entities may be subject to specific evaluation requirement enshrined in their legal base.

5.1.1 The European Digital Progress Report

The **European Digital Progress Report** (EDPR) covers 28 Member States and provides comprehensive data and analysis of market, regulatory and consumer developments in the digital economy. It is based inter alia on DESI[313] (Digital Economy and Society Index) and the Telecom Implementation Report[314]. It combines the quantitative evidence from the DESI with country-specific policy insights. DESI is based on data from Eurostat and various studies and surveys[315], and structured in five dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services. European Digital Progress Report also includes a section on R&D.

Insights on national policies come directly from the in-house expertise and research of country teams and daily work on telecom issues and the input from Member States. The information provided is complemented by information collected through country visits.

[313] DESI reports available here: https://ec.europa.eu/digital-single-market/en/desi
[314] Latest Telecom Implementation Report available here: https://ec.europa.eu/digital-single-market/en/news/implementation-eu-regulatory-framework-electronic-communications-2015
[315] Indicators and sources are available here: http://digital-agenda-data.eu/datasets/desi/indicators

The EDPR combines the reports and all evidence published for the Digital Scoreboard[316] with the Telecom Implementation report, and adds country reports. The EDPR is thus fed with evidence coming from:

- **Digital Scoreboard**, which measures progress of the European Digital Economy. It is fed by data conveyed by the National Regulatory Authorities, Eurostat and additional relevant sources and includes data about the general situation of all dimensions of Digital Economy Society Index in the EU Member States[317]. DG CONNECT together with European Commission services selected around 100 indicators, divided into thematic groups, which illustrate some key dimensions of the European information society (Telecom sector, Broadband, Mobile, Internet usage, Internet services, eGovernment, eCommerce, eBusiness, ICT Skills, Research and Development). These indicators allow a comparison of progress across European countries as well as over time[318].

- **Telecom reports on European electronic communications regulation and markets**, which provide comprehensive data and analysis of market, regulatory and consumer developments in the sector. These reports cover a broad set of indicators such as prices, number of alternative providers, investment by incumbents and new entrants, market shares of operators, broadband and NGA coverage and take-up, and development of new technologies. As explained in section 4.5 above, NRAs and BEREC would receive new tasks which would facilitate monitoring of electronic communications markets. On the one hand, NRAs would receive the task of performing a periodic geographic analysis of the current and prospective reach of networks and BEREC that of developing technical guidelines for infrastructure mapping. On the other hand, the harmonisation of powers of NRAs to include services will also facilitate monitoring from the Commission and BEREC, in particular since the latter will be vested with a power to request directly information from undertakings.

5.1.2 Eurobarometer annual household survey

The current Eurobarometer survey provides insight of how the e-comms market performed for end-users and on the consumer's attitude on service platforms uptake and usage of services in relation with a number of consumer protection-related issues. As an example, the 2016 edition[319] focuses on a number of end-user rights' issues in relation with the topics addressed as part of the review of the Telecom Regulatory Framework, e.g. transparency, switching, contracts, but also explores the perception and the actual take-up rates of Internet-based communications services as compared to more traditional telecom services (e.g. instant messaging v SMS).

5.2 Core monitoring indicators for the main policy objectives and the corresponding benchmarks against which progress will be evaluated;

The table below outlines the core indicators of progress that will be monitored by the Commission Services to evaluate whether the objectives of this initiative are being met. The indicators will be monitored through various sources including Commission's missions in Member States and permanent dialogue with National Regulatory Authorities, the yearly European Digital Progress Report and the statistics provided by the National Regulatory Authorities, Eurostat and additional

[316] The reports are available at: https://ec.europa.eu/digital-single-market/en/digital-scoreboard
[317] All information is available here: https://ec.europa.eu/digital-single-market/en/download-scoreboard-reports
[318] All data is available at: http://semantic.digital-agenda-data.eu/dataset/digital-agenda-scoreboard-key-indicators
[319] See: https://ec.europa.eu/digital-single-market/en/news/new-data-shows-mobile-internet-used-more-phone-call-remains-most-popular-communication

sources, included in the Digital Scoreboard [320] and Digital Data Tool[321] as well as ad-hoc studies in case is needed for specific policy monitoring purposes.

Table 16 - Monitoring indicators by policy objective

Policy objective	Monitoring indicators
Contribute to ubiquitous VHC connectivity in the single market	Connectivity indicators in EDPR
	Fixed and mobile Coverage and take-up by technology, speed and QoS.
	Analysis of retail prices, bundles and number of operators in the market
	Time to market for spectrum resources
	USO affordability analysis. Quantification of investment needs and developments to reach objectives .
Competition and user choice in the Single market	Competition and End-user Market indicators in EDPR. USO affordability analysis. Trends in switching.
Simplification of the regulatory intervention and single market coherence	Telecom regulatory Indicators in EDPR at EU and MS level.
	MHz assigned on the basis of general authorisations (as opposed to individual rights)
	Governance costs

5.2.1 Benchmarks

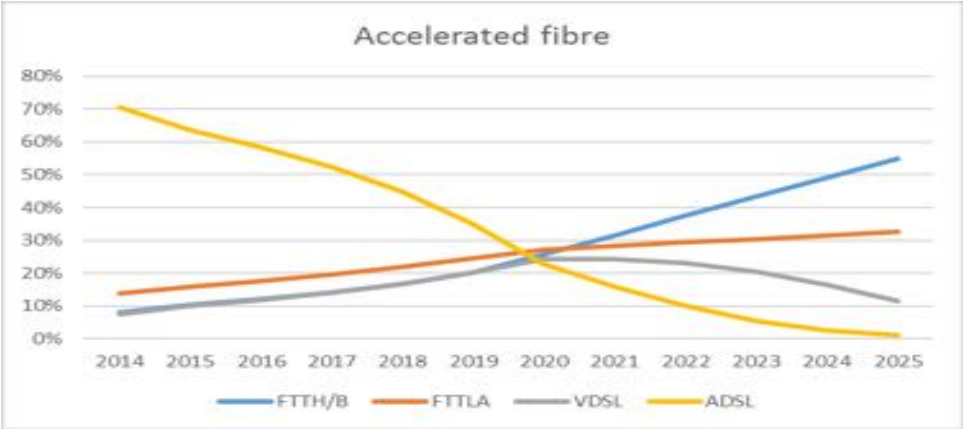
It is important to define measurement indicators in relation to a standard against which progress can be compared.

Contribute to ubiquitous VHC connectivity in the single market

The Impact Assessment conducted for this study is based on a projection of accelerated FTTH/B deployment resulting in 55% of broadband connections being on the basis of FTTH/B by 2025, from a business as usual projected 'starting point' of 20% in 2019. Take-up could therefore be gauged against this metric (Specific targets might be decided in the context of the European Gigabit Society strategy). The projections also envisage that 87% of broadband connections would be supplied on the basis of very high capacity connections (via FTTH/B (potentially including G.fast) or cable Docsis 3.1), which could provide a broader measure.

Figure 27 - Projected FTTH/B take-up (as % BB)

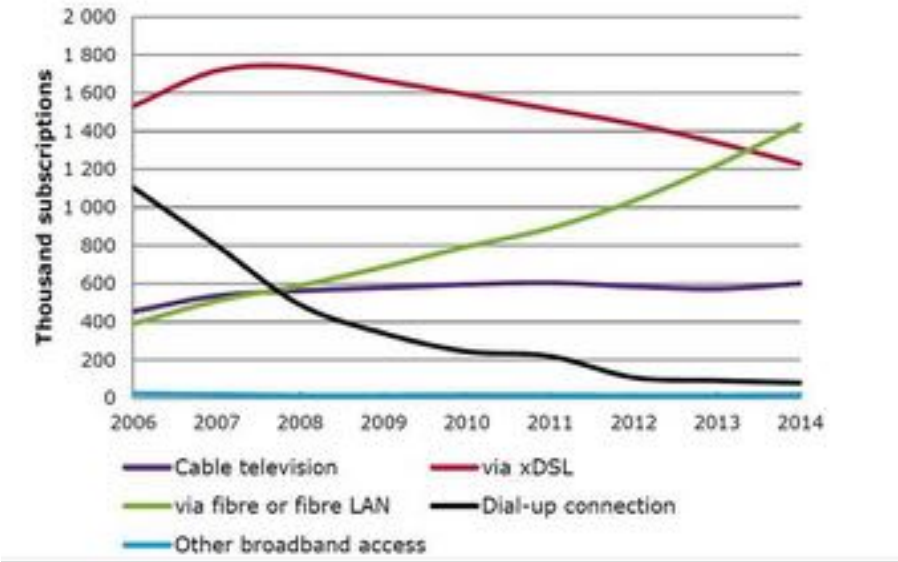
[320] All information is available here: https://ec.europa.eu/digital-single-market/en/download-scoreboard-reports
[321] Available here: https://digital-agenda-data.eu/



Source: WIK-consult – baseline to 2020 based on IDATE forecasts SMART 2015/0002

Data on the diffusion of fibre in Japan (see case study in SMART 2015/0002) as well as that shown for Sweden below suggests that such a take-up target for very high capacity broadband could be achievable within a ten year timeframe, even starting from a low base.

Figure 28 - Broadband take-up by technology in Sweden



Source: PTS

High take-up rates require high *very high capacity broadband coverage*. FTTH/B coverage in Sweden stood at 70% and exceeded 90% in Japan in 2014,[322] thereby meeting a FTTH/B coverage target which had been set by Japanese policy-makers for 2011.[323] Indicators for very high capacity

[322] FTTH FTTx watch
[323] http://point-topic.com/content/operatorSource/profiles2/ japan-broadband-overview.htm

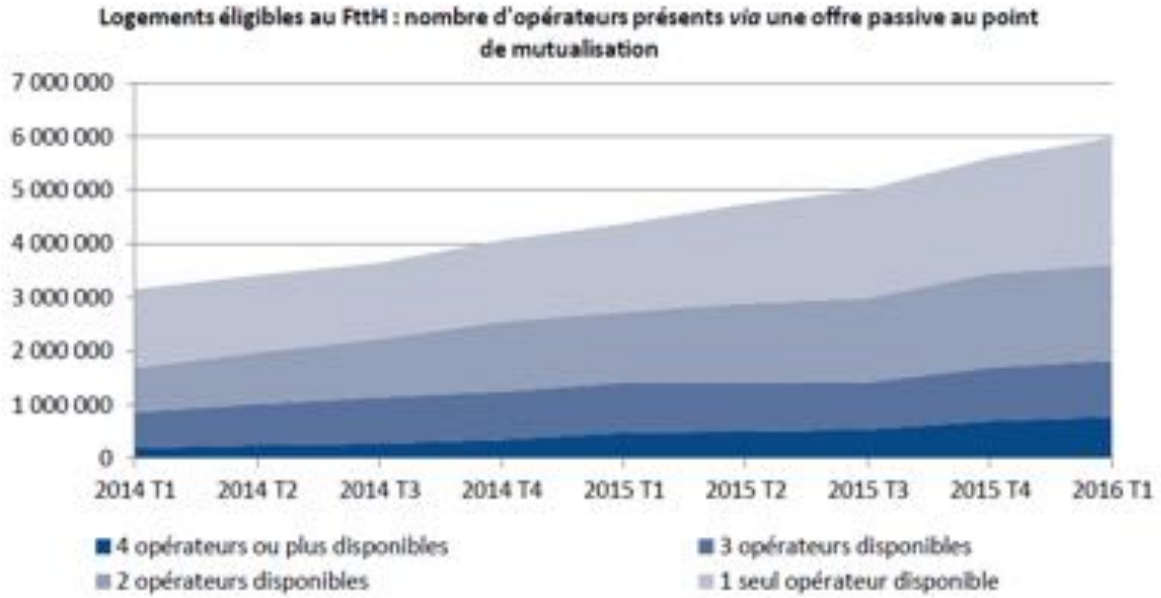
broadband coverage could be measured against benchmarks such as these based on fibre technologies (as in Japan) or Gigabit capabilities (as in Singapore).[324]

The Impact Assessment conducted for this study is based on a 5G deployment scenario which can be used as a benchmark against which to judge actual deployment. In addition, just like for access, European wireless broadband deployment figures can be compared to other world regions such as the US, Japan or South Korea.

Metrics for average actual download (and upload) speed within individual countries and the EU as a whole could also be compared with high performing countries such as Sweden or Japan and South Korea, drawing on research from companies such as Samknows and/or publicly available data from Akamai and/or Opensignal.

As regards operational metrics, take-up rates of duct access in Spain (see SMART 2015/0002) provide a useful example as regards take-up rates that could be targeted in countries where ducts are available and where investors of suitable scale exist.

Meanwhile, data from ARCEP illustrates how the availability of choice (of 2, 3 or 4+ providers) in very high capacity fibre networks might be illustrated, although it shows that, notwithstanding significant progress, there are still limitations in the infrastructure-based competition available in high speed broadband in the French market.



Source: ARCEP observatory Q1 2016[325]

Competition and user choice in the Single market

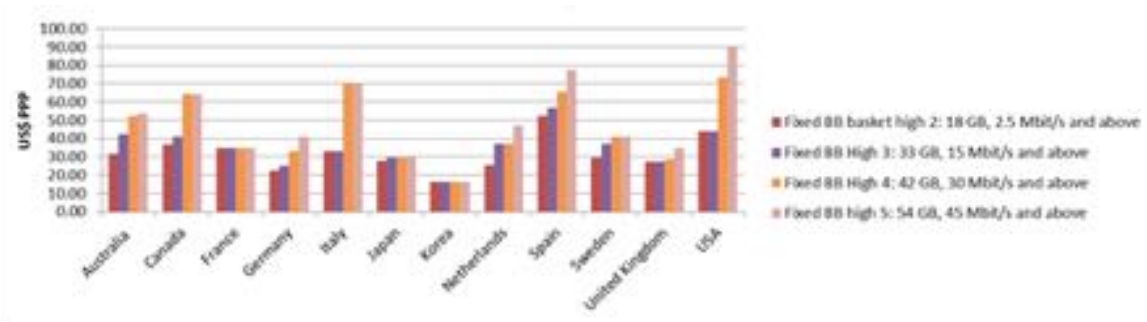
[324] Singapore targeted 1Gbit/s for 95% of households by 2012, albeit with the support of an extensive state aid programme. See Cullen International Benchmarking 15 national broadband plans http://www.cullen-international.com/asset/?location=/content/assets/research/studies/2014/ericsson-benchmaking-15-national-broadband-plans.pdf/ericsson-benchmaking-15-national-broadband-plans.pdf

[325] http://www.arcep.fr/fileadmin/reprise/observatoire/hd-thd-gros/t1-2016/Obs_HD-THD_T1-2016-deploiements.pdf

Usage can be a useful measure of the utilisation of VHC broadband and of **user choice**. Usage measures are currently high in countries such as the US, which have significant diffusion of online video and cloud services, and within Europe are typically higher in Nordic countries compared with Southern Europe countries, notwithstanding the strong fibre coverage in some of the latter. An internal EU-benchmark could be used as well as a comparison of usage in EU member states compared with the US, South Korea and Japan.

Price baskets are a measure of **competition** and affordability of users' choice. They will need to be adapted to capture future targets for very high capacity coverage and take-up (potential at speeds well above 100Mbit/s). As illustrated below from OECD data, comparisons should be made not only within Europe, but with countries such as Japan and South Korea which have achieved high coverage at relatively low prices. It should be noted however that pricing can be affected by exogenous factors such as cost differences, which in turn may be influenced by population density and dispersion.

Figure 29 - Fixed broadband price baskets 2012



Simplification of the regulatory intervention and single market coherence

Given the unique status of European regulation in the context of the single market it is more difficult to propose international benchmarks for this specific objective. Benchmarks for this area should be based on EU best practices.

The European Commission could launch a multi-year benchmarking study to survey the NRAs, the ministries and other interested entities have implemented the measures proposed in the preferred options of this IA. NRAs would then be benchmarked among each other to understand how effective and efficient they were in streamlining the market analysis process and ensure coherence between the Framework, broadband state aid and the CRD. The impact on the European Commission services should also be part of the analysis.

5.2.2 Summary

A summary of potential benchmarks is shown in the table below.

Table 17 – Summary of potential benchmarks

Indicator	Potential benchmarks
Take-up of VHC	More than 50% take-up of FTTH/B by 2025 More than 85% take-up of very high speed technologies by 2025

	Based on forecasts used in the Impact Assessment cross-checked against progress in Japan and Sweden
Speed of 5G deployment	Compared with 4G deployment speed and patterns in Europe as well as against other regions in the world
Coverage of VHC	More than 90% coverage of FTTH/B or Gigabit technologies by 2025 based on 2011/12 targets in Japan
Wireless broadband and 5G coverage	Coefficient of variation in wireless broadband and 5G coverage across Member States and regions
Speed	Measure against average and peak actual speeds in countries such as Sweden, Japan and South Korea
Usage	Compare GB per user per month within Europe against US, Japan and South Korea
Pricing	Compare updated price baskets (based on speed/technological targets) with benchmarks within Europe and with US, Japan and South Korea
Duct usage	Compare duct usage (km/total) in comparison with countries with established duct access such as Spain, France and Portugal
Infrastructure-based competition (including co-investment)	Compare % households with choice of 2, 3 or 4+ very high bandwidth connections against statistics from countries with established infrastructure based competition and/or co-investment such as France, Spain and Portugal

5.3 Monitoring of the preferred policy option:

The set of preferred options selected above will be monitored by the indicators listed in this section and organised along operational objectives deriving by each of the preferred options. The table below summarises this process.

Table 18 – Operational objectives for preferred options

Policy area	Preferred option	Operational objectives	List of monitoring indicators
Access regulation	Option 3 – Focusing regulation on VHC connectivity and the transition to NGA rollout	• support deployment of VHC networks • ensure competition on price • ensure competition on quality • ensure consumer choice	Coverage of NGA and VHC networks Take-up of NGA and VHC networks - Number of players in European markets (fixed and mobile) - Number of new entrants (fixed and mobile) - Market share of incumbent operators - HHI index in EU markets - Timeframe of implementing regulatory actions in the European markets - Number of BEREC opinions guidelines and/or recommendations - Number of art.7 vetoes/ number of notifications

			- Pricing resulting in the EU for comparable offers/bundles in 2009-2014 and - % increase of households than can benefit from at least 2 NGA connections
Spectrum	Option 3 –Binding and enforceable EU coordination of spectrum management with greater focus to adapt spectrum rules to the future 5G challenges	• Faster time to market of spectrum resources • increase consistency in some aspects of MS spectrum management • support deployment of dense 5G networks	Timeframe (years) between technical harmonisation and assignment of the band. Number of Peer-reviewed assignment procedures Type and nature of coverage obligations in new licenses Number of new licenses to expire beyond 25 years Number of assignment processes with coordinated timing Number of sharing agreements between operators Number of MHz assigned on basis of general authorisations Number of small and macro cells roll-out on cost sharing Number and content of implementing measures adopted by COM
USO	Option 3 Incremental adaptation to trends with the focus on broadband affordability	• Inclusion of affordable broadband under USO in MS	Fixed BB Price Development of social tariffs
Services	Option 4 – IAS and regulatory obligations linked to the use of numbering resources	• Streamlining of current provisions concerning ECS • link the authorisation requirement for ECS services and subsequent regulatory obligations to the use of numbers, • safeguarding other end-user and public policy interest (not covered by horizontal rules) • access to emergency services, including disabled end-users • operationally adequate caller location accuracy	- Internet Users - Take up of bundles -_Use of the internet for different communications services COCOM 112 Key Performance Indicators[326]
Must carry	Option 1 – Maintain MS' possibility to	• Include reporting about reviews of must carry	The review of must carry obligations will be done at MS level. MS may define the

[326] https://ec.europa.eu/digital-single-market/en/news/implementation-european-emergency-number-112-results-ninth-data-gathering-round

	impose must carry obligations	obligations in the implementation reports • Facilitate exchange of experience and best practice in reviewing must carry obligations where necessary ad hoc via discussion in COCOM	monitoring and evaluation processes and the respective competences of national authorities
Numbering	Option 3 – Adapting the EU framework on numbering to address the competition issue on the M2M market	• assignment of numbers (in particular E.212 numbers) by NRAs to non-MNOs	

There are several ways to monitor the impact of the preferred governance options. One solution could be to require BEREC to periodically report on the achievement of the objectives assigned to it, as. Another could imply an obligation for the Commission to prepare an evaluation report on the experience acquired as a result of the operation of the new agency. Annual reports should also be sent to the European Parliament in order to enhance transparency and accountability of the agency.

With regard to NRAs, the annual reporting obligation and the already existing transparency obligations allow monitoring their performance in their new or amended tasks.

6 ANNEXES

6.1 ANNEX 1 - Procedural Information

6.1.1 Identification;

This Staff Working Paper was prepared by Directorate B 'Electronic Communications Networks and Services' of Directorate General 'Communications Networks, Content and Technology'. The RWP reference of this initiative is 2016/CNECT/XX.

This Staff Working Paper is accompanied by the Fitness Check SWD for the current regulatory framework conducted in the context of the REFIT programme assessed not only in terms of achievement of the original goals, but also in view of potential simplification and reduction of the regulatory burden.

6.1.2 Organisation and chronology:

Several other services of the Commission with a policy interest in the review of the telecom framework have been associated in the development of this analysis. The Telecoms Framework Inter-Service Steering Group met for the first time on the 7 May 2015.

A second Telecoms Framework Inter-Service Steering Group meeting took place on 9 July 2015

A third Telecoms Framework Inter-Service Steering Group took place on 26 January 2016 .

A fourth Telecoms Framework Inter-Service Steering Group Impact Assessment Steering Group took place on 14 April 2016 to discuss a draft evaluation report and the problem definition of the IA. Comments were received by 21 April 2016.

A fifth Telecoms Framework Inter-Service Steering Group took place on 30 May 2016 to discuss the draft Impact Assessment

In the ISSG, chaired by SG, DG CONNECT, was flanked by DG DIGIT, DG COMP, DG JUST, DG GROW, DG ECFIN, DG FISMA, DG TAXUD, DG TRADE, DG RTD, DG JRC, DG SANTE, DG EMPL, DG EAC, DG NEAR, DG ENV, LS, DG REGIO, DG HOME, DG ENER, DG AGRI, DG MOVE, EUROSTAT, EPSC.

DG Connect also benefited from the support received by the JRC Information Society Unit for the assessment of the model elaborated for the IA support study *SMART 2015/0005* presented in section 4.11 and Annex 5..In particular, the analysis carried out by JRC concluded that "*the consultants constructed a CGE model with a rich sectorial and geographical setup (8 sectors and 4 representative countries). Also, the policy considered in the analysis is entered into the CGE model through immediate costs are introduced in the form of (private and public) investments and public expenditures. In addition the sector TFP is adjusted following the estimated impacts from KPIs. This seems a fine way to capture the economic impacts from the policy considered*".

6.1.3 Regulatory Scrutiny Board

This staff working document will be discussed at the regulatory scrutiny board meeting of 7 July 2016.

6.1.4 Evidence

The options considered in this impact assessment were designed by taking into account the following main inputs:

(i) the contributions to the Telecom Framework Review public consultation, a summary of which is attached in Annex 2 to this report.

(ii) the BEREC opinion on the review of the regulatory framework released on 10 December 2015[327],

The three review studies (delivered together with this Impact Assessment report) are:

(iii) "*Support for the preparation of the impact assessment accompanying the review of the regulatory framework for e-communications*" *(SMART 2015/0005)*

(iv) *Regulatory, in particular access, regimes for network investment models in Europe*" (SMART 2015/0002)

(v) *Substantive issues for review in the areas of market entry, management of scarce resources and general consumer issues*" (SMART 2015/0003).

The Impact assessment was carried out on the basis of interim study results of the three review studies quoted above. Finalisation is planned at this stage by the end of July 2016 for SMART /002, by end of August for SMART 003 and by the end of September for SMART/005.

Other recent DG Connect studies in the field of Electronic communication:

(vi) *"Review of the scope of universal service" (SMART 2014/11),*

(vii) *"Study on future trends and business models in communications services and their regulatory impact" (SMART 2013/0019),*

(viii) *"Identification and quantification of key socio-economic data for the strategic planning of 5G introduction in Europe" (SMART 2014/0008)*

(ix) *"Economic and Social Impact of repurposing the 700MHz band for wireless broadband services in the European Union" (SMART 2015/0010),*

(x) *'Costing the New Potential Connectivity Needs' (SMART 2015/0068)*

(xi) *"Impact of Traffic Offloading and Technological Trends on the Demand for Wireless Broadband Spectrum" (SMART 2012/0015)28,*

(xii) *"Spectrum Policy. Analysis of Technology Trends, Future Needs and Demand for Spectrum in line with Article 9 of the RSPP" (SMART 2012/0005)27,*

(xiii) *Survey and data gathering to support the Impact Assessment of a possible new legislative proposal concerning Directive 2010/13/EU (AVMSD) and in particular the provisions on media freedom, public interest and access for disabled people,*

The other relevant sources quoted in the document are indicated in the bibliography and range from academic papers to industry figures and estimates.

[327] See; http://berec.europa.eu/eng/document_register/subject_matter/berec/opinions/5577-berec-opinion-on-the-review-of-the-eu-electronic-communications-regulatory-framework

6.1.5 External expertise

The European Commission sought external expertise on the technical field as well as on the socio-economic impacts of the options presented above. The Commission contracted WIK-Consult, Ecorys and VVA Europe to support the preparation of this impact assessment accompanying the review of the regulatory framework for e-communications. In the framework of the study an expert panel of top-level, globally recognised and reputable specialists (scholars, experts in the field). was organized to provide feedback on the preliminary conclusions reached by the consultants concerning the impact of planned changes to the e-communications framework.

A **high level expert panel** was held on 30 May 2016 conducted in the framework of study SMART 2015/0005. Participants were Prof. Joan Calzada, Prof. Frédéric Jenny, Prof. Brigitte Preissl, Prof. Luc Soete, Prof. Reza Tadayoni, Prof. William Webb, Prof. Brett Frischmann, Prof. Eli Noam. Experts profiles and a report of the discussion are presented in Annex 13.

In addition to the review and other studies quoted above also the following EC studies in the field of Electronic communication were considered

- *"Identification of the market of radio equipment operating in license-exempt frequency bands to assess medium and long-term spectrum usage densities" (SMART 2014/0012),*
- *"Eurobarometer household survey on eCommunications" - SMART 2014/0014,*
- *"Investigation into access and interoperability standards for the promotion of the internal market for electronic communications networks and services" (SMART 2014/0023) a study on the 'standardisation' of wholesale access products*
- *"Mapping of Broadband and Infrastructure Study" (SMART 2012/0022),*
- *"Mapping broadband infrastructures and services (phase II)" (SMART 2014/0016),*
- *"Impact of Traffic Offloading and Technological Trends on the Demand for Wireless Broadband Spectrum" (SMART 2012/0015)28,*
- *"Spectrum Policy. Analysis of Technology Trends, Future Needs and Demand for Spectrum in line with Article 9 of the RSPP" (SMART 2012/0005)27,*
- *"Study in support of the preparation of an impact assessment to accompany an EU initiative on reducing the costs of high-speed broadband passive infrastructure deployment" (SMART 2012/0013).*
- *"Steps towards a truly Internal Market for e-communications in the run-up to 2020" (SMART 2010/0016),328*
- *"Study on the socio-economic impact of bandwidth" (SMART 2010/0033),*
- *"Broadband coverage in Europe in 2013" Updated on an annual basis (SMART 2013/0054),*
- *"Broadband retail broadband access prices in 2013" Updated on an annual basis (SMART 2010/0038),*
- *"Challenges and Opportunities of Broadcast-Broadband Convergence and its Impact on Spectrum and Network Use" (SMART 2013/0014),*

[328] https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/final_report_internal_market_ecom.pdf, http://europa.eu/rapid/press-release_IP-12-193_en.htm?locale=en

- *"Use of commercial mobile networks and equipment for mission-critical high-speed broadband communications in specific sectors " (SMART 2013/0016),*
- *"Study in support of the preparation of an impact assessment to accompany an EU initiative on reducing the costs of high-speed broadband passive infrastructure deployment" (SMART 2012/0013).*

6.2 ANNEX 2 - Stakeholders and Public Consultation

6.2.1 The stakeholders engagement strategy

A continuous and active stakeholder engagement strategy was devised and followed for the evaluation and review of the regulatory framework for electronic communications networks and services. From the outset key ideas for evaluation and reform of the regulatory framework were outlined in a public roadmap[329] that followed the Political Guidelines[330] of the new Commission and the subsequent DSM Communication[331]. The published roadmap explained what the Commission was considering, describing the scope of and outlining the main change drivers underpinning this initiative and announced further details of stakeholder consultation strategy. This fed into the subsequent consultation activities, ensued an inclusive process with all interested parties having an opportunity to contribute.

A dedicated 12 weeks open **public consultation** was launched on 11 September 2015 that gathered inputs for the evaluation process in order to assess the current rules and to seek views on possible adaptations to the framework in light of market and technological developments and thus contributing towards the DSM. The consultation document was both broad and detailed, eliciting extensive inputs from consumers, providers of electronic communications networks and services, national and EU operator associations, civil society organisations, broadcasters, technology providers, Internet and online service providers, undertakings relying on connectivity and wider digital economy players, national authorities at all levels, national regulators and other interested stakeholders. Inputs provided include stakeholders affected by the policy, those who have to implement it and those with a stated interest in the policy. The consultation gathered a total of 244 online replies from stakeholders in all Member States as well as from outside the Union.

On 11 November 2015, halfway through a public consultation process, **public hearing** was organised in Brussels as well as broadcasted online[332]. This offered an opportunity for in-depth discussions on issues outlined in the public consultation document, allowing for reasonable time to formulate and gather effective feedback from all relevant stakeholder groups, allowing the collection of all relevant evidence (comprising data/information) and views.

During the consultation process broad public events were combined with more targeted consultation. This in particular relate to a serious of consultation events held with sector regulatory community that is entrusted with key supervisory and implementing tasks stemming from the regulatory framework. Following a series of such events and at the request of the Commission, BEREC provided an input to

[329] http://ec.europa.eu/smart-regulation/roadmaps/docs/2015_cnect_007_evaluation__elec_communication_networks_en.pdf
[330] http://ec.europa.eu/priorities/publications/president-junckers-political-guidelines_en
[331] http://europa.eu/rapid/press-release_IP-15-4919_en.htm
[332] https://webcast.ec.europa.eu/public-hearing

the evaluation and the review process and published its opinion in December 2015[333]. In addition, the RSPG had provided its opinion on DSM and the Framework Review[334].

In parallel to the public consultation, and as part of such targeted consultation efforts, on 7 October 2015 the Commission convened a **dedicated meeting of e-Communications Administrations High Level Group**, comprising representatives of the relevant ministries. At this meeting national authorities shared their views and discussed challenges, focusing on the need to develop the fixed and wireless connectivity networks of the future and to drive take-up and innovative services across Europe.

As part of the evaluation process the Commission has also contracted a number of studies. Implementation of these studies encompassed public workshops that allowed stakeholders to comment and provide feedback to the ongoing evaluation work.

Several such public workshops took place that allowed cross checking of findings and verifying inputs and assumptions.

On 6 April 2016 was held in the Commission's premises a public workshop to validate the interim findings a study Smart 002/20015 conducted by WIK, IDATE and Deloitte on "regulatory, in particular access, regimes for network investments models in Europe" in the context of the preparation of the regulatory framework for electronic communications networks and services. The workshop was attended by 60 external participants – not counting the team of consultants, from the main European industry associations of the sector, from the telecom industry, e.g. operators, service providers, vendors, business users, OTTs, banks and local governments, as well as representatives from BEREC and national regulatory authorities.

On 2 May 2016, a public workshop was held at Commission premises to validate the interim findings of a study conducted by WIK, CRIDS and Cullen on "Substantive issues for review in the areas of market entry, management of scarce resources and general end-user issues" (SMART 2015/003) in the context of preparing the review of the EU regulatory framework for electronic communications. The workshop was attended by around 100 external participants representing EU and national sectorial industry associations, electronic communications network operators and service providers, cable network operators, broadcasters, consumer interest associations, vendors, business users, as well as members of RSPG, Member States and National Regulatory Authorities.

In addition, the Commission responded positively to numerous requests to participate and update on the review progress at conferences, seminars and workshops, keeping open exchange with all stakeholders.

The consultation strategy followed by the Commission allowed the widest possible dissemination of information and allowing stakeholders for a reasonable time to formulate and gather effective feedback on all key elements of both the evaluation and the review process. This among other included problem identification, subsidiarity and the need for EU action, outlining possible policy response and anticipating impacts of such response. The consultation strategy followed ensured that both general principles and the five minimum standards were respected and met. The results of these

[333] http://berec.europa.eu/eng/document_register/subject_matter/berec/opinions/5577-berec-opinion-on-the-review-of-the-eu-electronic-communications-regulatory-framework
[334] http://rspg-spectrum.eu/wp-content/uploads/2013/05/RSPG16-001-DSM_opinion.pdf

consultation activities are summarised in the published synopsis report[335] which is annexed to this report.

6.2.2 The outcome of the public consultation

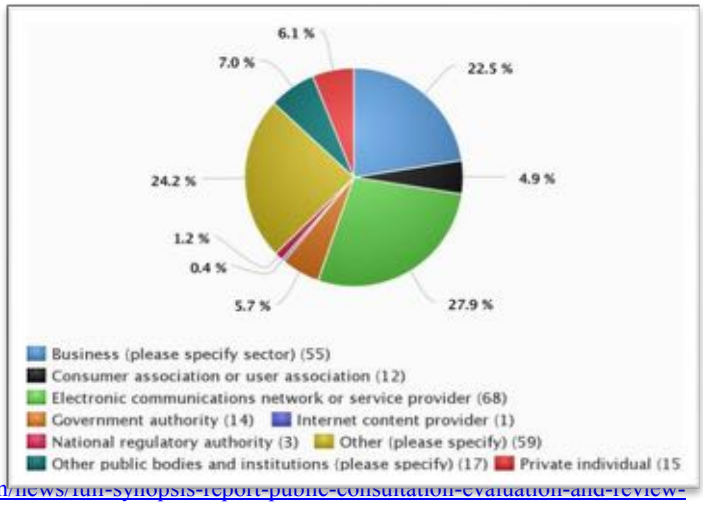
The synoptic report summarising the main outcome of the public consolation carried out for the review of the telecoms framework has been published in April 2016.

6.2.2.1 Introduction

The consultation on the regulatory framework for electronic communications networks and services was launched to gather input for the evaluation process in order to assess the current rules and to seek views on possible adaptations to the framework in light of market and technological developments, with the objective of contributing to the Digital Single Market Strategy.

The consultation targeted consumers, providers of electronic communications networks and services, national and EU operator associations, civil society organisations, broadcasters, technology providers, Internet and online service providers, undertakings relying on connectivity and wider digital economy players, national authorities at all levels, national regulators and other interested stakeholders. The consultation gathered a total of 244 online replies from stakeholders in all Member States as well as from outside the Union. The consultation elicited both consolidated contributions from umbrella organisations and individual contributions from various stakeholders.

The participation of different stakeholder categories was overall balanced with stakeholders from the wider digital economy actively responding as well as consumer groups, public authorities and electronic communications networks and services providers. This includes stakeholders affected by the policy, those who have to implement it and those with a stated interest in the policy. Online contributions by public authorities (national administrations and sector regulators) were relatively fewer than the inputs of electronic communications network or service providers or wider digital economy market actors. Among stakeholders representing electronic communications networks and services providers, different clusters of economic actors with diverse economic power gave input –

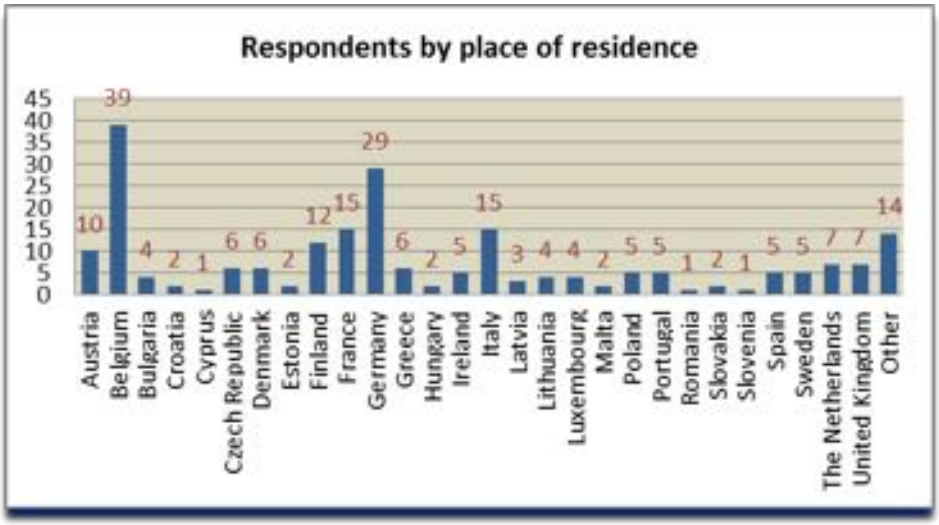


[335] https://ec.europa.eu/digital-single-market/en/news/full-synopsis-report-public-consultation-evaluation-and-review-regulatory-framework-electronic

traditional/incumbent operators, alternative operators.

This report uses the above categorisation of stakeholders in presenting converging or differing views on issues addressed in the consultation. The contributions of the stakeholders who gave their consent to publication are available online. This report also takes account of BEREC's[336] input to the evaluation and the review process provided at the request of the Commission, the RSPG[337] opinion on DSM and the Framework Review and some 20 other contributions received outside the online consultation as well as feedback received via the dedicated public hearing dedicated to this review . The BEREC opinion was published in December 2015, and can be found on this website.

This analysis does not represent the official position of the Commission and its services and thus does not bind the Commission.



The input gathered corresponds to the objective of the consultation in both assessing the performance of the regulatory framework to date and also providing insights about possible adjustments in order to respond to market and technological advancements and prospective challenges.

6.2.2.2 Analysis of responses

The analysis in subsequent sections of this report is based on inputs received by different stakeholder categories.

[336] Body of European Regulators for Electronic Communications
[337] Radio Spectrum Policy Group

6.2.2.2.1 Objectives and overall performance

In terms of the *effectiveness*, it is acknowledged by most stakeholders (**consumer organisations, Member States, operators, regulators, other**) that while the framework has been successful in bringing more competition in the market and promoting the interests of EU citizens, it was less successful in promoting the internal market.

On the objective of achieving the internal market, most respondents indicated a moderate contribution. Alternative operators generally perceive the framework as having set the right environment for the internal market to develop. Conversely, several incumbents are rather negative on this point and also some small players point out that the provisions of the framework are not apt to foster cross-border deployments. Many respondents have stated that this objective has not been achieved owing to the lack of a consistent approach by NRAs (national regulatory authorities), with some of them being seen as more willing and ready to enforce framework provisions than others. Hence this objective can be considered as only partially achieved.

The framework's contribution to the objective of protecting the interest of European citizens is rated more positively. Most stakeholder groups (alternative operators, incumbents, others) consider that the framework has contributed moderately to citizens' rights and interest. **Alternative operators and small fibre operators** tend to attribute a more significant impact on EU citizens' interests, while **several incumbents** are rather negative on this point, considering that the interest of the European citizens has been promoted only to a certain extent, owing to the hurdles to investment in NGA allegedly caused by access regulation. **Some large operators** and entities wonder if the interest of citizens has been harmed by the focus on lower tariffs rather than on network quality. Finally, the sparse contributions by **private individuals** have a much more negative character, with 8 out 12 pointing to little or no impact at all.

In terms of *efficiency* and whether the costs involved were reasonable, there was a somewhat negative perception. Larger operators (**incumbents and those with mobile arms**) consider that the administrative and regulatory costs borne have exceeded the results achieved. **Alternative operators** believe, on the contrary, that the benefits have exceeded the costs, underlining that competition, economical offers and several clear consumer benefits would not exist without the framework and that access regulation is necessary and proportionate. **Some alternative operators** underline the value of having a stable, predictable regulatory regime, whilst also highlighting some unnecessary costs: the costs of market analysis for termination markets where the outcome of the analysis in any event is stable, the cost of questionnaires, the overlap of tasks of public authorities, the lack of harmonisation in consumer regulation including data protection and data retention, of universal service obligations.

In terms of *relevance* of the framework and whether EU action is still necessary, the general perception is that framework is still necessary and there is a consensus amongst **incumbents**

and alternatives, large and small, consumer organisations. **Alternative operators, consumer associations, wholesale operators** underline that competition cannot be maintained without ex ante regulation and that full duplication of network infrastructures is not realistic. Most **incumbents** argue for a simplified access regulation (limited to fixed infrastructures, with only one access product, based on commercial negotiations and dispute resolution rather than on ex ante cost orientation). Some **operators** and **equipment manufacturers** argue for a progressive transition to ex-post competition law. Many respondents groups support the relevance of the framework for network and service security.

In terms of *EU added value* and whether similar progress could have been achieved at national or regional levels, **most operators** highlighted the importance of competition for increasing choice and transparency, lowering prices and bolstering consumer rights. **Incumbents** acknowledged the role of the framework in liberalising monopolies. Many respondents highlighted a risk of fragmentation due to national implementing measures and of incoherence with other regulation and competition law. **Equipment vendors** in particular acknowledged the role of the framework in promoting competition. While the desire to deregulate in one form or another is present in almost all categories of contributors, albeit not equally, none of the contributions concludes that full repeal of the framework is warranted. Consumer protection rules and universal service were the subject of widely contradictory opinions from different stakeholder groups, with disabled user group noting that without the framework, many measures to facilitate a disabled person's access might not have happened. In terms of process, there were calls from some operators for a full harmonisation to address fragmentation.

Connectivity is the overall converging theme in many contributions across different stakeholder groups, with many suggesting that it should be a more prominent focal point in the revised framework. Including investment as one of the objectives, however, divides the respondents. In particular, **consumer organisations**, **alternative operators** and **regulators** fear that this could be seen as undermining the current competition objective. **Incumbents** and many **mobile operators** stress the increased need for connectivity and investment but diverge in the proposed solutions. Connectivity to the benefit of end-users as an overarching objective to which competition, internal market and investments provide the means, could be considered as a central theme supported by most stakeholder groups.

1.1. Network access regulation

Extensive inputs were received from all of the major fixed and converged fixed/mobile electronic communications providers active in the EU, whether they are former monopolies, small or large access seekers relying on their networks, or independent fixed infrastructure owners including cable and independent fibre networks.

Good connectivity is perceived as a necessary condition to achieve the Digital Single Market, with many respondents pointing to the need for policy measures and possible adjustments to current policy and regulatory tools to support the deployment of infrastructure in line with future needs.

6.2.2.2.2 Evaluation of the network access regulation

Amongst stakeholders from the industry, the positions expressed on network access and interconnection regulation, including the current SMP-based approach, can be divided in two blocks, with on the one hand operators whose business model predominantly relies on access (and who strongly support the current ex-ante regulatory approach) as well as broadcasters, and on the other hand the incumbents (who call for a reform of the regulatory regime in place). Cable operators are supportive of the role that the SMP regime has had to promote competition, but warn that overly aggressive regulation could hinder infrastructure deployment.

The main argument from alternative operators and their national and European trade associations is that regulated access and interconnection have driven competition, innovation and investment and that with the ongoing shift to NGA networks the needs for SMP-based regulated access to broadband networks will remain acute. In addition, they submit that the current regulatory approach provides NRAs with the right level of flexibility. Telecom users are also strongly in favour of the current access regulation, with the exception of one business users association which considers that the emphasis should be put on service competition rather than on the underlying infrastructure, and that the sharing of infrastructure should be emphasised.

On the other hand, incumbents consider that the access regime in general is a deterrent to investment in NGA networks, does not provide enough predictability, and is a burden for operators and regulatory authorities with high administrative costs. They claim in particular that promoting infrastructure investments by enabling competition downstream (first by the imposition of wholesale remedies and then by encouraging access seekers to gradually build their own infrastructure closer and closer to end customers), the so called "ladder of investment" approach, has failed, in particular when applied to NGAs, and that a lighter regime should be put in place with a focus only on situations where monopolistic conditions persist. The need to incentivize investment is raised by many incumbent operators. While many mobile operators also follow this line of thought, some of the mobile operators support the regulatory approach in place.

Regulators consider that the current approach drives investment. On the other hand, some responding Member States call in general for a pro-investment regulatory regime, estimating that the current ex-ante SMP-regulation is outdated and should be adapted, with some suggesting that it should enable NRAs to apply a more flexible approach for imposing symmetrical obligations of access to high-capacity networks.

With respect to the interconnection of voice, mobile operators and certain incumbents call for a phasing out of the ex-ante regime in place, arguing that the IP-based delivery of voice services is modifying market circumstances. MVNOs have an opposing view on the matter, on the ground that terminating networks will always remain a bottleneck. OTTs consider that interconnection rules are needed to avoid discrimination.

Many of the **access seekers** consider that the current rules were effective in addressing single dominance. This view is also shared by **consumer organisations** and part of the **regulatory community**. Those operators in principle agree with the existing scope of access remedies, while raising issues with its implementation in detail. On the other hand **incumbent operators** consider that the full set of access remedies is often imposed mechanically, without cost/benefits assessment and without regard to modulation according to actual problems identified. Intrusive access remedies, imposed at all levels of the "ladder of investment" hamper investments in modern networks. Moreover, the broad provisions concerning access regulation contained in the current framework allows NRAs to engage in product micro-management, business case design and steering market outcomes. This is said to cause significant delays in delivering new technologies and network upgrades.

6.2.2.2.3 Review of the network access regulation

The majority of **Member States/public authorities** that have responded highlight the positive effect that the implementation of the Framework has had on the market and the role of competition in promoting investments. However, there is an acceptance that updating the framework will be necessary, for reasons varying from promoting investment in next-generation infrastructures, responding to technological and market changes and diminishing administrative costs. Some Member States argue for flexibility in the application of incentives to meet future challenges at a national or sub-national level. **Access seekers** and some other operators also call for greater guidance to be given to NRAs to analyse sub-geographic markets to increase consistency. There are also calls from certain Member States, which perceive limits in dealing with oligopolistic market structures, for a greater role for symmetrical rules. **Regulators** broadly underline the achievements of the current system but argue that some flexibility may be needed, for instance by considering more prominently symmetrical obligations or by simplifying the regulatory approach to the termination rates markets.

Among **operators,** the responses of the two largest groups of stakeholders (incumbents on one side and access seekers on the other) correspond to the general lines of the two groups: the first advocating a de-regulatory push in the name of changed market dynamics and the risks involved in future investment plans, the second defending the link between competition and investments and calling for a protection of access rights to legacy networks as well as to upgraded networks, where they fear that a deregulatory approach would lead to the loss of the welfare gains achieved so far by the regulatory framework. Those seeking further deregulation resist ideas that they fear may result in an increase of the regulatory burden, particularly in relation to regulatory measures that may lead to the continued regulation of markets even in the absence of proven market power. On the other hand, those that rely on regulation resist proposals that imply establishing a link between investment incentives and a lighter regulatory approach, as they fear that upgraded networks will become increasingly inaccessible and that broadband markets will become increasingly concentrated or even re-monopolised. In each case, however, the general approach is typically also accompanied by a

recognition that regulated networks and their related markets have changed, leaving scope for adaptations.

In relation to the simplification of access products and focussing on key access points, **network owners** responded in favour of a drastic simplification to a single access product (if at all necessary), whereas **access seekers** insist on the importance of different access products to compete at the retail level. On the other hand, **access seekers** reject the idea that retail market considerations should be the focus of wholesale regulation, an idea that is strongly supported by **network owners**, who consider that continued wholesale regulation is not justified if retail markets are competitive.

In relation to different treatment of legacy copper networks (whether pure copper access networks or upgraded FttC networks with copper sub-loops) to incentivise upgrades, operators invoked the principle of technological neutrality and leaving the market to decide how to best meet demand. However, a number of contributors consider that copper-based solutions will not represent a credible alternative in the long term. **Investors** in FTTH solutions and some **access seekers** call for a recognition that the risk involved in rolling out fibre to the premises is higher than upgrading copper, so that regulatory incentives, if any, should not include FttC solutions. **Regulators** also propose the idea that any risks specific to a particular new investment network project should be considered if wholesale tariffs are subject to regulation, in order to allow the operator a reasonable rate of return on adequate capital employed.

Network owners request discretion to decide whether and how to continue to use copper assets (full copper loop or sub-loop), whereas **access seekers** request guarantees that physical access to copper networks will continue to be guaranteed. While a majority of respondents, including **regulators**, would not agree to mandating the switch-off of copper networks where fibre is present, they still see a role for regulators to manage the transition where switching off copper makes economic sense, with **copper networks owners** advocating minimal intervention, and others rather invoking public intervention to preserve competition (e.g. transitional migration regime).

With regard to co-investment models, many stakeholders can see the advantages of co-investment for increasing the reach of NGA networks, for example, in less densely populated areas. Their views however differ on the related regulatory regime. While **incumbents** favour co-investments on commercially negotiated terms, **access seekers** call for strict conditionality to ensure fairness and openness of the co-investment.

The responses overwhelmingly affirm the important role that civil engineering plays in the roll-out of NGA. Some **Member States** and a number of **infrastructure owners** don't see the need to further intervene to ensure access to civil engineering falling within the scope of the Cost Reduction Directive (2014/61/EU). However, **alternative operators** highlight the importance of detailed SMP obligations, beyond the general obligations in that directive. Furthermore, **incumbent operators** call for symmetrical access to in-house wiring.

There is broad alignment between **regulators, Member States** and many others that longer review periods (compared to the current mandatory three years) would be beneficial, particularly in stable markets such as termination rates.

Regarding measures aimed at facilitating the roll-out of high-speed networks in the most challenging areas, responses were cautious with regards to any first mover advantages (to operators that are willing to roll out next generation networks in challenge areas). **Access seekers** and **consumer associations** warned about the risk of re-monopolisation, whereas **network owners** challenged the proposition that a risk of strategic overbuild can be defined and distinguished from competition. Some **Member States** highlighted the need for local responses to sub-national competitive and investment challenges, indicating openness to consider approaches to incentivise first movers on a geographical basis, subject to suitable safeguards being built in. In supporting first mover incentives, **vendors** and wider digital economy players suggest a concession model, with some operators noting that in such a case regulators should be able to define a period in which the network operator is allowed to use its network exclusively. Most stakeholders agreed that any first mover advantage should be subject to safeguards against re-monopolisation. Wholesale-only models (which may counterbalance fears of re-monopolisation) found the support of **equipment vendors and smaller/fibre-only network operators**, but **operators in general and public authorities** disagree on whether such models would have a positive effect on investment.

On oligopolistic markets, on the basis of BEREC's recently adopted report, all respondent **regulators** and **some Member States** are calling for the widening/strengthening of regulatory powers to deal with new duopolies or oligopolies (where such market structures lead to sub-optimal market outcomes) albeit still with a high threshold for intervention. Some propose symmetrical regulation as a possible solution. Some alternative operators also raised concerns about the adequacy of approach under the current SMP test and guidelines to tackle joint dominance or "tight oligopoly" market structures. However, many operators warn of the risk of over-regulation if ex ante regulation tools are broadened, without a clear economic underpinning, to tackle oligopolistic conditions beyond the current joint dominance test, as set out in Annex II of the Access Directive and the SMP Guidelines, or beyond the current threshold for applying symmetrical rules.

6.2.2.2.4 Spectrum management and wireless connectivity

The importance of wireless connectivity and wireless broadband, and its link and complementarity to a very high capacity fixed connectivity is acknowledged in consultation responses. Industry is supportive of a more co-ordinated approach and looks for additional certainty in investment and possibilities to develop throughout the EU new wireless and mobile communications including 5G. Member States generally underline the achievements in the field of technical harmonisation, and the need for additional coordination to be bottom-up and voluntary; some of them call for a better balance between harmonisation and flexibility. There is widespread recognition of the importance of more flexible access and use

of spectrum in the future from both operators and public authorities, although disagreeing about how to realise this.

6.2.2.2.5 Evaluation of the current rules on spectrum management

While a majority of respondents consider the current regime to have significantly contributed to promoting competition, almost half say it has only moderately achieved the aims of providing market operators with sufficient transparency and regulatory predictability, promoting citizens' interests and ensuring effective and efficient spectrum use. A third of respondents considered that the current regime had only a minor impact on keeping the administrative burden appropriate and on promoting the Internal Market.

A majority of respondents that spans public authorities, regulatory and trade bodies both in and outside the electronic communications sectors, MNOs, converged and satellite operators, user associations and vendors, consider the current regime to have contributed to harmonised conditions for the availability and efficient use of spectrum. Member States and regulators have in particular, been consistent supporters of this position. More reserved views are found among broadcasters and other respondents, notably from the transport sector. The regime has been significantly more effective for new bands than for bands still requiring freeing.

There is a general perception among several respondents (converged operators, operator associations, vendors) that technical harmonisation has worked well and that the involved actors (RSPG, RSC/CEPT and the Commission) have delivered. Even those parties seeing little or no benefit from the existing regime (M(V)NOs, cable, converged operators, non-ECS associations) acknowledge the achievements in technical harmonisation, but stress persistent regulatory fragmentation. Points of criticism concern the ineffectiveness in addressing interference issues (transport) and ensuring usage efficiency.

As for the selection processes for limiting the number of rights of use, industry respondents, including operators and vendors, criticize a lack of consistency as well as sometimes unnecessary restrictions of usage rights. Some respondents recognise coherence of application in the sense of certain rules being widely used, while results still differ (converged operators, ECS associations). A majority of respondents (spanning ECS and non-ECS associations, M(V)NOs, converged operators and vendors) considered that the lack of coordination of selection methods and assignment conditions has impaired the development of electronic communications services. The authorisation methods most often mentioned as efficient for wireless broadband were auctions and general authorisations.

While respondents comprising broadcasters, mobile operators, associations of mobile and alternative operators, regulators and vendors consider that inclusion of spectrum provisions in several instruments should not per se impede their effective interpretation and/or implementation, several respondents including incumbent operators and some Member States nevertheless consider a single instrument to be potentially more effective, stressing the benefits of applying the same set of rules to all spectrum users, which is also supported by most vendors and operators/associations, subject to the rules being consistently applied.

6.2.2.2.6 Review of spectrum management rules

Regarding objectives and principles, **most economic actors and some Member States** seek more consistency in spectrum management to increase legal certainty and spectrum value, and to secure greater transparency and predictability for investment, in particular on licence durations, pricing and availability of spectrum. There is also large support from public authorities to remove barriers to access harmonised spectrum across the EU, in order to foster economies of scale for wireless innovations and to promote competition and investment, as well as to avoid cross-border service impairments. **Operators** also stress problems - in particular, late access to spectrum, high reserve prices, inefficient spectrum packaging, spectrum left idle and lack of long-term vision.

The majority of respondents consider that spectrum assignment procedures have a significant impact on structuring the mobile markets and their competitive landscape, e.g. number of operators, price, network investment, and consumer prices. Some (generally **large operators**) criticise the use of assignment measures as indirect means to ex ante regulate the market (through caps, reservations) without the associated objective criteria. Others (**vendors, some regulators**) also consider that additional factors such as regulatory conditions (e.g. access obligations for MVNOs) and historical national market development have a similar structuring impact.

Most responding **Member States, broadcasters and alternative operators associations** insisted on national specificities and are generally satisfied with the current framework. While public authorities could envisage limited coordination through common deadlines for making a band available or the common definition of certain general principles, many economic actors seek greater harmonisation of award methods and procedures (need and timing of spectrum release and selections, general principles and objectives, transparency, ex-ante competition assessment, refarming conditions, timing of advanced information to market participants, measures to promote use efficiency, spectrum packaging) so as to enhance legal certainty, support investments, promote competition, provide more clarity to manufacturers and support economies of scale. **Member States** expressed much resistance regarding coordination of spectrum valuation and payment modalities, while many **operators** oppose fee disparities and excesses, and in general support greater coordination of assignment processes. Most **vendors** supported harmonisation for predictability and a robust end-to-end value chain, but warn that timetables alignment should not delay early movers.

Assignment conditions generally are considered as heavily impacting investment and business decisions, competition and the single market. Most **operators** agree on the need for more consistent binding assignment conditions to increase investment predictability, and in particular to support and ensure objective, transparent and non-discriminatory treatment of operators, transparency and alignment of timing and conditions of licence renewals, longer licence duration, flexibility to trade, lease or share, technology and service neutrality limits, refarming conditions, technical performance, use-it-or-lose-it clauses and interference mitigation before assignment decisions are taken. On the contrary, there is strong opposition

to harmonise or even use wholesale access conditions from **operators** and to a certain extent to harmonisation of coverage obligations from **Member States**. For **broadcasters**, decisions on criteria and conditions should remain at national level to consider local specificities or media pluralism and cultural diversity. Some also insist on the need for compensation in case of refarming.

Member States reject full harmonisation but are open to a more common approach to spectrum management, some could accept a peer review of national assignment plans as well as a certain level of harmonisation or approximation of conditions and selection processes. A number of Member States expressed their desire to remain flexible to support early take-up of new technologies and to adequately balance harmonisation and flexibility in order to be able to adapt to market demand.

Most public and commercial respondents are calling for flexible or shared access to spectrum to meet future demand, in particular for 5G, preferably on a voluntary basis; **vendors** and **operators** insist on exclusive or licensed shared access for quality purposes. **Broadcasters** raise interference issues and thus urge for careful selection of compatible sharing usages; in addition, some point to their incapacity to at the same time compete for spectrum and meet cultural targets if flexibility is purely market-based.

On refarming, a large majority including operators, vendors and their associations as well as responding Member States and regulators seek further facilitation, notably on a voluntary basis except in cases of inefficient use. The large majority of operators, vendors and their associations consider that longer licence duration would be helpful in this regard. Most operators see a need to protect and give priority to existing users to safeguard investments or avoid interference, while a minority believes that appropriate spectrum pricing, trading and auctions can address this issue. When facilitating refarming, some seek a careful balance between flexibility and preservation of harmonisation.

With regard to facilitating deployment of denser networks, many respondents pointed to obstacles - lengthy permit process, high administrative fees for back-haul provision, inappropriate fee structure, lack of harmonisation of management of electromagnetic fields' emission - to the roll-out of small area access points needed for mobile services, while some **Member States** disagree. Many market actors and public authorities consider that a general authorisation regime would foster innovation and competition both for services and end-devices and should include access rights to public and private property to build a network. **Vendors** seek a common definition of small-area wireless access points and the harmonisation of technical characteristics about their design, deployment and operation.

While opinions are divided as to whether end-users should be entitled to share access to their Wi-Fi connections with others as a key prerequisite for the sustainable deployment of denser small cell networks in licence-exempt bands, many public authorities and private respondents supported the deployment of commercial/municipal Wi-Fi networks in public premises, while seeking appropriate regulatory safeguards for a.o. liability or exposure to EMF. Some

operators reject such idea as network roll-out could be facilitated via various forms of public-private partnerships, many stressed that any such public support should be technologically neutral.

With regard to public protection and disaster relief (PPDR)**,** a majority of respondents reject the inclusion in licence conditions of obligations of service quality and resilience of network infrastructure to enable a dual use of commercial mobile networks for PPDR, as MNOs' individual business models do not combine easily with stringent PPDR requirements, and therefore should be on a voluntary commercial basis only and based on net neutrality rules. Some operators believe that providing PPDR services via commercial networks would be economically more efficient than funding a separate network for PPDR services.

6.2.2.3 Sector-specific regulation for communications services

6.2.2.3.1 Evaluation of the current sector specific regulation for electronic communications services

With regard to the effectiveness of the current regulatory framework in ensuring a high level of consumer protection, the clear majority of respondents (**Member States, telecom operators** and their **associations, broadcasters, vendors and OTT providers**) believe that the current framework contributed to effectively achieving the goal of ensuring a high level of consumer protection in the electronic communications sector across the EU. **Member States** noted that in general the framework had positive effects on the protection of consumer rights regarding traditional electronic communication services (ECS). In particular, provisions related to contracts and those facilitating change of provider (switching) have diminished unfair lock-in practices and ensure a high level of consumer protection. **Users and ECS/ECN associations**, as well as the majority of **operators** consider that the existing rules have delivered good outcomes and high levels of consumer satisfaction.

Many respondents, however, consider that the current regulatory framework has failed to deliver consumer protection with respect to emerging services, which are based on new technological developments and currently fall outside the remit of the sector-specific rules. Most responding **Member States** support specific requirements to be applied to all communications services irrespective of the provider ("traditional" telecom operators or "new" OTTs) in order to avoid risks of (a) insufficient customer protection, (b) a lack of clarity, and (c) confusion among consumers who might mistakenly believe that their communication is protected by sector-specific rules.

Some **telecom operators** think that the current provisions have become outdated with little substantial value for consumers, except for basic provisions on emergency services, number portability and interconnection and argue that competition in the sector would allow for the removal of regulation.

Regarding provisions constituting a particular administrative or operational burden, a majority of respondents (**mainly operators and their associations**) believe that there are administratively or operationally burdensome provisions. The biggest concerns are expressed regarding different and overlapping legal frameworks, e.g. Consumer Rights Directive (CRD); Universal Service Directive; Unfair Commercial Practices Directive. Some respondents argue that this leads to over-regulation, too detailed provisions, and inconsistency of rules. Some **alternative operators** consider the application of end-user protection rules to business customers as burdensome. According to other **incumbents and their subsidiaries** almost the entire Universal Service Directive is burdensome.

With regard to provisions to be repealed, the majority of respondents (mainly **telecom operators** and **their associations**, a **few broadcasters, vendors and OTTs and a Member State**) have identified certain sector-specific end-user rights' provisions, which they consider are no longer relevant. These include provisions such as contract rules which are covered by various other directives, in particular the CRD. Regarding the maximum contract duration, some **telecom operators** suggest either an application of these rules also to OTT communications, or their abolition. One **telecom operator** suggests the repeal of Art. 34 USD as out-of-court dispute settlements are also addressed in the Directive on Consumer Alternative Dispute Resolution (ADR) and the Regulation on Consumer Online Dispute Resolution (ODR). Some **operators** suggest the repeal of the provisions on printed directories and public payphones. Some **Member States**, **mobile operator association, EU and national consumer associations and a trade union** have not identified any provision to be repealed.

With respect to provisions protecting disabled end-users, the USD contains specific requirements under the universal service obligation (USO) and regarding the equivalence in access and choice. The majority of the respondents (**telecom associations, telecom operators, users' associations, an association of users with disability, other NGOs, regulators and Member States**) found that the current regulatory framework has been effective in achieving these goals. Several **operators and NGOs** stated that the relevant Art. 23a is too weak ("Member States shall encourage"), it leaves too much discretion ("where appropriate") and does not contain financing provisions. They consider that it has therefore been only moderately effective in achieving the goals of providing equivalent access. As a consequence, an inconsistent diversity of approaches has developed across the EU.

Incumbent and larger operators raised the financing issue. Initiatives designed to improve accessibility of services to disabled people should be borne by the public authorities. If any contribution is required from the sector, it should be requested to all players, including OTTs, in proportion to their incomes and the number of users ("responsibility-sharing based on a proportionality principle").

With regard to the efficient implementation of number portability (NP) provisions, a large majority of respondents consider that the current NP provisions allow significantly or

moderately for their efficient implementation. However, **operators** criticised the diversity of approaches, and of technical means put in place, in various Member States. In some Member States, there is no common database of ported numbers and in a few of them direct routing of ported calls is still not available. Some **operators and their associations** argued in favour of a receiving provider-led porting process. Some respondents stated that the current NP obligations are not well suited to new services such as M2M or IoT.

With regard to the relevance of 112 provisions to ensure an effective access to emergency services, a large majority of respondents agreed with the significant relevance of the scope and requirements of the current regulation of access to emergency services. **National authorities** are also in line with this trend. The **telecom industry** highlights the importance of reliable access to emergency services that, in view of the technical standards and legal arrangements in place today, can be provided today only through ECS.ECN/ECS argue that access to 112 obligations should be imposed on OTTs as well, if technically feasible. A large number of stakeholders consider that all the voice services perceived by the users as substitutive to the current PSTN voice service and which also give access to E.164 numbers should be subject to the same obligations regarding the access to emergency services. In the same vein **regulators** support an obligation on all communication services (including OTTs) that give access to numbers in the numbering plan.

As regards the effectiveness of network and service security rules in achieving their objectives, over half of all respondents (including several **Member States,** most **telecom operators** and some **vendors**) consider that the rules have been effective. A minority (one **Member State, a** few **telecom operators** and some **associations of operators**) found them ineffective. More than a third of the respondents (many incumbent and alternative telecom operators and associations, several ENISA- member national authorities) underlined the need to involve the complete Internet value chain (including OTT services, software and hardware).

6.2.2.3.2 Review of the sector specific rules for communications services

With regard to the scope of the future rules and the need for sector-specific regulation of communication services, the majority of respondents including **BEREC, Member States, several associations of broadcasters, of cable operators and of alternative operators, consumer associations, cable players and OTTs** note that there is still a need for sector-specific regulation of communications services as ECS have become an essential service in every person's life, crucial to ensuring a well-functioning society and economy. Therefore sector-specific rules are still considered necessary for sustainable competition, innovation, a healthy low concentration of providers' market power and also to guarantee that consumers can reap the benefits of such competition. Several areas were listed, where sector–specific regulation is still needed: retail Internet access services, numbering, end-user protection, universal service obligations, roaming and downstream availability and accessibility of a wide variety of audio-visual services etc. Nevertheless, several of those respondents prefer

horizontal to sector-specific regulation wherever possible. A few of them, however, oppose the inclusion of OTTs within the scope of such rules, because there remain fundamental differences between the telecoms market and the market for Internet applications and content, and applying the same detailed sector-specific obligations would be a disproportionate burden for a highly dynamic industry sector.

Regarding the revision of the current ECS definition**, BEREC, several Member States, most operator associations, most incumbents, some cable players, all user associations and some broadcasters** consider that the current definition of ECS should be reviewed owing to the increasing uncertainty on the scope of the definition of ECS related to "conveyance of signals", the inconsistent regulatory obligations for similar services and the convergence of communications services. Several respondents emphasised that a future-proof definition needs to be end-user-centric, the key factor being substitutability from a customer perspective. Those opposing revision of the definition, (some **Member States, OTTs, software and equipment vendors, cable operators, some broadcasters and a few individuals)**, argue that the concept of ECS has proven itself and changes may create regulatory, legal and investment uncertainty. According to some stakeholders, instead of including OTT services in the definition of ECS, the current regulatory requirements on traditional electronic communications providers should be loosened. In **OTTs'** view, if the definition is reviewed, the difference between Information Society Services and telecoms networks should be maintained.

The majority of respondents (some **Member States, operator associations, most incumbents and vendors)** are of the opinion that for consumers OTT services are a functional substitute for traditional ECS. The minority of respondents (some **Member States, a few operators, OTTs and consumer and user associations**) submit that OTT services are functionally different from ECS. The majority of respondents (**Member States, regulators, most incumbents, alternative operators, associations, trade unions, vendors**) are of the opinion that all functionally substitutable communications services should fall under a new common definition, but have significantly varying positions on the types of obligations that should apply to services falling within such a definition.

The minority of the respondents (**several Member States, NRAs, some associations, broadcasters, OTTs, a few cable and fixed players**) suggest maintaining the "conveyance of signals" criterion in the definition of ECS. For broadcasters that criterion helps in distinguishing telecommunications from audio-visual services. However, the majority of respondents (**several associations, most MNOs, most incumbents and few software and equipment vendors**) do not consider "conveyance of signals" as a necessary criterion. Rather, the lack of clarity in the ECS definition, when assessing whether services “consist wholly or mainly in the conveyance of signals”, opens the door to different interpretations and inconsistencies. According to **BEREC**, it "is worthwhile to examine whether it is still an appropriate distinguishing factor."

With regard to the elements of the ECS definition related to transmission services in networks used for broadcasting, **all broadcasters and their associations, alternative operators and their associations, many fixed and converged fixed/mobile operators, an equipment vendor and private individuals** advocate that these should continue to be considered as ECS. For **broadcasters**, excluding transmission services from the definition would mean that they are omitted entirely from the telecom framework, undermining important legal protections for broadcasting (e.g. transmission obligations). For some respondents "transmission services in networks used for broadcasting" should not be considered as ECS. They argue that in the light of the convergence of the legacy broadcasting transmission services and internet media services (including broadcasting), the transmission of the service is platform-based and no longer network-based and any reference to services provided on a network has to be eliminated.

With regard to a possible differentiation between managed and best-effort services in the ECS definition, the majority of respondents (**incumbents** and **alternative** operators and their **associations, vendors and broadcasters**) prefer no differentiation between *managed and best-effort* services in the ECS definition as such a differentiation would facilitate circumvention of the rules by opting for 'best effort provision' free of obligations. As to the question whether sector-specific regulation should be limited to Internet Access Service, there is almost no support for such reduction, with only a few exceptions.

Regarding the application of sector-specific provisions (end-user and other) to the IAS, **telecom operators, industry associations and vendors** agree that as a general rule only horizontal competition and consumer law should apply to internet access service and that, if any sector-specific provisions are needed, these should apply to all other digital services. Almost all **national authorities**, user **associations, OTTs, some broadcasters and IT service providers** see a need for further end-user rights in relation to IAS in addition to those included in the proposal for the Telecoms Single Market Regulation, although in many cases these stakeholders do not provide detailed arguments to explain this position.

On the issue of definition of communication services, a significant number of respondents (**incumbents and alternative operators**) emphasise that in an "all IP" environment network interconnection is to be distinguished from the interoperability of services as users would be tied to a single connectivity provider but not to a single communications service provider any more.

Some respondents do not believe that there is a need to apply the existing, as well as any further end-user rights, to communication services (some **Member States, a large number of mobile, fixed, and cable operators, and OTTs**). The main argument put forward by them is that horizontal regulation (consumer and data protection), together with competition-law tools, should suffice. Those who were in favour of having end-user rights applicable to communication services are mostly **Member States and consumer protection bodies,** while **alternative operators** suggested that full harmonisation is needed for contractual information, transparency measures, contract duration, switching, and bundles.

Several associations, most broadcasters, a few incumbents and converged fixed/mobile players consider that there are new sector-specific end-user protection issues that need to be addressed. Among the areas listed are: bundling of contracts and their impact on switching; communications contracts with subsidised equipment; continuity of service (telephone or internet) when switching; control of consumption; contract termination in case of the tacit extension of contracts; rights of the end-users when relocating; improved rules for end-users with disabilities, findability of public-interest content.

Finally, **regulators and others** indicated that some new end-user protection concerns can be anticipated in relation to services which are substitutable to traditional ECS, including access to emergency services, network resilience, cyber security and interoperability between different digital services, , transparency, protection of data confidentiality and privacy.

Trade unions, consumer organisations, vendors and directory services expressed support for specific rules with regard to voice services for end-users. These contributions highlighted the importance of availability (call to emergency services, functionality during power outages and disasters) and the importance of voice quality as a distinctive characteristic. Some **mobile operators** considered voice-specific requirements still relevant, noting the need to ensure interconnection and access to emergency services, while others noted the importance of requirements such as data retention/lawful intercept. In general most **incumbent operators** would prefer horizontal regulation, while maintaining the possibility of a few specific requirements (such as emergency services) and consumer information was noted as safeguard measure. Directory service providers noted a risk that without a specific requirement (Art. 25 USD), operators might not provide them with subscriber information on a fair, objective, cost-oriented and non-discriminatory basis.

Half of the respondents (some **Member States, broadcasters, a few telecom operators and consumer protection bodies**) are of the view that providers of communication services as newly to be defined should potentially be subject to an SMP-based regulatory regime, if they can limit competition, based on a market analysis and consistent with the non-discrimination principle. Those disagreeing (some **Member States, associations of incumbents, alternative and mobile operators, vendors and OTTs**) highlighted the existing high level of competition, market dynamics and diversification of providers, and stated that competition law and horizontal consumer protection offer sufficient protection in this regard.

There is a majority support ranging from **national authorities to mobile operators and incumbents**, to extend the scope of the access obligations to emergency services to best-effort services. At the same time, it is recognized by all stakeholders that minimum quality of service should be ensured for emergency communications and best-effort communication cannot provide the end-to-end quality that managed services can. Some **operators** support imposition of a general obligation to give access to emergency services, adapted to the quality of service requirements that each type of services (managed vs. best-effort) can provide.

Regarding numbering resources and assigning numbers directly to M2M users, **most MNOs, including smaller ones**, highlight that this solution raises many implementation and security issues and risks of fraud, could exhaust national numbers, would endanger interoperability and end-to-end connectivity. There is a clear consensus that to cope with the numbering needs of M2M in the future, a clear framework for extra-territorial use of numbers is necessary to ensure sufficient numbering resources. A majority of respondents see a demand for over-the-air provisioning of SIM cards for M2M communications, and to a lesser extent for end-users' own devices later on. However, the idea of regulatory promotion of over-the-air provisioning is not supported, with the argument that it should be up to the markets to decide on specific technological options.

While there is a majority view that transmission obligations imposed on electronic network operators (must carry rules) and rules related to electronic programme guides should be adapted to new market and technological realities, there is sharp disagreement as to how such adaptation should be conceived. Extension of the current rules is supported by some **Member States** and most **broadcasters**, whereas most **telecom operators** are in favour of reducing the scope of the rules. **Public service broadcasters** consider that the future scope of rules should extend to interactive and non-linear services, should also cover hybrid TV signalling and should apply on a technologically neutral basis to all distributors of audio-visual content, not only to ECNs. Telecom **operators** call for a level playing field between broadcasters and online platforms and call for improving access to content rights. Some **cable and telecom operators** call for complete removal of must carry obligations or at least to limit them to the main/most essential general interest channels. **Commercial broadcasters**, **one telecom operator** and a citizen consider that the current provisions are adequate.

Media regulators and some **telecom** and **cable operators** consider that the presentation and the order on navigation interfaces is crucial for user choices of audio-visual content and that ensuring non-discrimination of general interest content is sufficient. **Public service broadcasters** consider that Member States should be competent to ensure 'findability' of general interest content on user interfaces of significant networks and audio-visual platforms and that regulated EPGs should be included in new TV sets. A **pay-tv provider** considers that prominence of content could also be improved by better referencing/tagging of national and European offers. Several **telecom operators** point to the need for broadcasters to be obliged to make real-time signalling available, in order for EPGs to work satisfactorily.

6.2.2.4 The universal service regime

6.2.2.4.1 Evaluation of the current rules on universal service

The majority of **Member States and regulators** agree that universal service has been effective and efficient in safeguarding end users from the risk of social exclusion, while **most of the operators** see little or no impact and efficiency at all. Proponents of universal service argue that the availability of certain basic services increased and that services became

affordable and accessible to all. Opponents claim that (1) the universal service regime has become outdated; (2) the high level of competition for fixed and mobile services ensures the affordability of tariffs and not the regulatory obligation; (3) the calculation of net costs have been fraught with controversy, challenges, and appeals; and (4) the overall administrative burden and regulatory uncertainty have been very high, for a regime which has not produced major benefits.

As for coherency with other rules, the majority of **Member States** agree that universal service has been coherent with other provisions of the framework and state aid, while most of the **operators** see little or no coherence at all.

The vast majority of **operators** consider that this review should be the opportunity to redefine or completely reconsider the universal service regime (including its financing), with many claiming that it has become obsolete. **Member States** mostly claim the need to maintain a universal service scheme, with flexibility at Member State level on funding and on broadband. **Regulators** support maintaining the status quo.

6.2.2.4.2 Review of the universal service rules

With regard to the scope of universal service most respondents consider that the current scope is outdated because it was shaped in a context of market liberalisation and since then market conditions have drastically evolved, with more competition and choice available to consumers.

There is a general acceptance among the respondents to exclude public payphones and comprehensive directories and directory enquiry services from the scope. Due to availability of mobile telephony and internet, there is no usage of or demand for public pay phones. **Regulators** acknowledge a decreasing demand/usage for public pay phones but argue that Member States should retain flexibility to include pay phones within the scope. As for directories, the availability of the same information through the internet is a further competitive alternative. However, some directory and local search providers underline that access to data risks being refused in the future, absent a universal service obligation guaranteeing access to directory enquiry services.

Concerning the provision of telephony services at a fixed location, **operators** mostly agree that this inclusion in the universal service scope is no longer necessary, because various types of players are providing voice services (mobile, VoIP) on a competitive basis while **regulators and Member States** mostly claim the opposite.

With regard to the inclusion of **broadband within the scope of universal service**, while most **operators and their associations** have no doubts about the positive impact of broadband on social and economic life, they claim that USO is not the right instrument to foster broadband deployment. In any case, if broadband were to be included in the US

regime, it would have to be revised substantially. Respondents supporting both in and out options (mostly **Member States and regulators)** submit that Member States should retain the flexibility to make the choice at national level.

Most **operators and their associations, several Member States and regulators** consider that broadband under universal service bears high risks of market distortions and cost inefficiencies. In particular, industry funding is considered too distortive. The risk of lowering incentives to invest, crowding-out effects, delays in network expansion and unpredictable large financial transfers between competitors (if industry funding is used) are considerable. Instead, an investment-friendly regulatory framework, lowering of deployment costs, demand stimulation, and well-designed public subsidy schemes targeted at cases of clear market failure (evaluated by an impact assessment) should be used for fostering broadband instead of USO. Many also highlight the need to promote competition and commercial investment via regulatory tools. The use of such other public policy measures should be based on timeliness (so as not to come in too early to disrupt or crowd out private investments), proportionality, non-discrimination and technological neutrality.

As to how broadband should be defined if included: those favouring the speed aspect (**consumer groups, several Member States, media players, operators**) consider it a simpler and more neutral parameter. **Media players** argue for sufficient speeds to deliver media content. Those favouring the criterion of the use of certain types of services (**ECS/N associations**) generally feel that it is more flexible, able to evolve with time, more technologically neutral and has a more direct link to social inclusion. Some players are wary of setting the speeds based on the average speeds used by the majority of the population, so that the speeds are not set at a high level. With regard to the list of essential services, most of the respondents agree that the list of services should be based on what is necessary for social (digital) inclusion, but they have varying views on what set services this would entail.

With regard to financing universal service, most **operators and associations** agree that the most appropriate and equitable way of financing the universal service, in particular in light of the possibility to include broadband within the universal service, would be through public funds. Broadband for all should be supported through general taxation since it is a general public interest goal that benefits society as a whole. The scope of universal service should be defined narrowly, representing only **a safety net** in a market-driven sector. Many **operators** state that industry funding, especially when limited to operators, is disproportionate. The use of public funds would have the advantage of limiting the risk of setting too high targets for the universal service and is the only way of ensuring that Member States properly weigh the needs against costs because of the need of reducing public expenditure and maximising public economic welfare. The high uncertainty of the right to compensation in the present universal service system and the difficult enforcement that led to numerous disputes/litigations are a considerable weakness to be eliminated.

Several actors considered a combination of public funding and industry funding acceptable with the **majority of respondents** however specifying that providers of on-line content,

applications and services should contribute, given they are the biggest beneficiaries of access. **Broadcasters** warned against the redirection of resources from audio-visual content, innovative online services and digital skills activities to the financing of infrastructure, since availability of such content is an important determinant for the development of broadband networks.

According to **regulators**, the current funding mechanisms for USO remain relevant and that flexibility should be retained, allowing Member States to choose the appropriate mechanism.

Most market actors and regulators agree that universal service is not the right instrument to foster very high-capacity connectivity for public places. Market forces deliver these services and other public funding policies should be used because the service is of public interest. Only a small minority of respondents (**satellite operators**) agree that universal service should play a future role in to help realise public interest objectives, but this should be financed by public funds.

Most market actors, **Member States and consumer organisations** submit that obligations related to disabled end-users should be incorporated in horizontal law. Respondents stress that any obligations should apply equally to all market players. Through the broader implementation of the provisions of Article 23a of the Universal Service Directive, a wider choice of services and tariffs for disabled users could be achieved. According to **regulators**, specific provisions for disabled end users are already included in the national regulatory frameworks of many Member States. Measures in the Directives should continue to be flexible enough to adapt to the situation of each country.

6.2.2.5 Institutional set-up and governance

6.2.2.5.1 Evaluation of the current institutional set up and governance structure

The perception as regards NRAs' independence is generally positive, in particular those safeguards applicable to independent NRAs. This perception is supported by different kinds of stakeholders, in particular public and private, including **operators** (**mostly incumbents as well as some alternative operators and trade associations**).

Just over half of the respondents consider that there is generally a sufficient degree of coherence in the application of the regulatory framework by the various institutional players (NRAs, BEREC, the European Commission). This idea was supported by **public authorities, especially regulators** and approximately **half of the operators**. Some operators propose to reduce the overlapping competences at EU and national level and to reduce and prioritise the objectives of the framework.

BEREC's role is positively perceived in relation to the Art.7 procedure, roaming, net neutrality, M2M communications and advice to EU Institutions. While more than half of respondents (including national regulators) considered that BEREC has achieved its main

objective, a group of **incumbent operators**, on the contrary, considered that BEREC has not achieved its main objective, arguing that flexibility is overall favoured compared to harmonisation/consistency of application and that BEREC has a tendency to support over-regulation. Some **operators** stated that BEREC should be constituted as a supervisory authority independent from national interests or that it should be a proper EU regulatory authority with decision-making powers.

Some respondents submit that BEREC's current institutional set-up results in it opting for greater flexibility at national level or the lowest common denominator instead of focusing on a more consistent or harmonised approach for the single market, and therefore, BEREC's Positions and Guidelines are sometimes just descriptive documents and not a collective commitment or a development of best practice guidelines. Suggested proposals for addressing this include: allowing BEREC to make binding decisions, appointing board members for four years, establishing a Director appointed by the Board, more adequate funding, reassessment of the location of the BEREC Office, more consistent launch of consultations, longer consultation periods and introducing a two-stage consultation process on key policy matters. There were also calls for a stronger advisory role to the Commission, more pro-activeness, and improved transparency and stakeholders' involvement.

As regards consistency of market regulation, just over half of the respondents answered that the Art.7/7a process had been effective in achieving greater regulatory consistency, while a third were of the opinion that this process had little or no effect on consistency. In the first category of positive responses, there were many **alternative operators, FTTH-operators** and some **incumbents and MVNOs**. Also those **regulators and Member States** who responded were largely positive. With regards to areas which could be improved, many respondents who were generally positive suggested that the entire process could be streamlined, made less burdensome for all stakeholders and that the Commission's role vis-à-vis remedies (under Art.7a) should be strengthened, either by a veto power, or by a so-called double-lock veto (i.e. regulators would be required to withdraw the draft regulatory measures if BEREC agrees with the Commission's serious doubts).

Those who disagree, are mainly **incumbents** as well as some **individual respondents**. The main arguments brought forward for this view differ widely. On one hand, it is criticised that the current process does not lead to enough consistency. On the other hand, some respondents complained that the current system attempts a 'one-size-fits-all' approach not taking sufficient account of the need for different solutions in different Member States, i.e. not giving regulators enough discretion. **Regulators** challenged the need to ensure further regulatory consistency and the link between the lack of consistency and the current institutional set-up. **Regulators** state that access markets are intrinsically local and the nature of competition is not homogeneous either for supply or demand reasons.

As regards the current spectrum governance, the technical side of harmonisation is seen by most respondents to be working well with its aim of harmonising the least restrictive conditions. There is criticism of the present system's capability to bring the actual services into being in a coordinated and timely manner.

There is significant support for the role of RSPG in assisting and advising the Commission on radio spectrum policy issues, with some respondents promoting it for a status similar to BEREC. The interplay between national experts and the European format is seen to work well. In particular, vendors would like the RSPG deliberations to be more open to industry participation.

6.2.2.5.2 Review of the institutional set-up and governance structure

Institutional set-up for market regulation

Almost half of the respondents agree that the current institutional set-up at EU level should be revised in order better to ensure legal certainty and accountability. Respondents call for i) a clearer division of powers between the different institutions (to avoid overlapping), ii) making sure that institutions are accountable for their decisions (both politically and legally), iii) a high level of transparency in decision-making (improved stakeholders' involvement). The arguments brought forward for change, however, differed considerably. On the one hand, a group of mainly **incumbent** operators proposed more discretion for NRAs with a reduced role of the Commission (or BEREC), highlighting the need for taking account of national circumstances. On the other hand, a number of voices have called either for an increased role of the Commission to ensure consistency (through a veto for remedies, for example), or even the establishment of a pan-EU regulator. **The regulatory community** was of the view that there are benefits associated with all NRAs having a common toolkit and flexibility to determine which tools to use, in particular in view of the increasing complexity of the sector.

Amongst those who favoured a revision of the current institutional set-up, proposals differed from BEREC adopting a limited advisory or benchmarking role (giving opinions and giving assistance to NRAs where needed, providing timely technical guidance, etc.) to turning it into an EU regulatory authority with proper decision-making power. Some respondents called for strengthening BEREC's role within the Art.7 procedure and also for improving coordination rather than implementing institutional changes. Some i**ncumbents** and **alternative operators** submit that BEREC in its current form has shown a limited ability to act strategically and in the interest of EU competitiveness and, in particular, for the development of the single market. Further it was alleged that it does not contribute to the objectives of the framework in a satisfactory manner. Most respondents (**all types of operators and public bodies**) considered that the current EU consultation process can be streamlined. However, in the detail as to how this could be done the respondents vary considerably. Whilst some respondents call for more NRA discretion (and a less prominent role for the Commission), others ask for full harmonisation measures, at a minimum regarding the termination markets. In addition, a shift from *ex-ante* to *ex-post* control is proposed, rendering an Art.7 procedure less relevant. Among those who disagree (largely **alternative operators**), most argue that the current process is well-balanced and has proved effective.

Some **incumbents** advocate for dividing competence between EU and national levels, making BEREC redundant, arguing that stronger compliance or a more binding nature of BEREC guidance would not be appropriate. On the contrary, some **alternative** operators

supported a stronger role of BEREC within the Art.7 procedure and the strengthening of its influence on the scope of remedies in case of a veto of the Commission. The sentiment as regards whether BEREC should be given more executive tasks or binding powers is generally negative (including the **majority of operators as well as public authorities**). Some respondents are concerned by the lack of accountability of BEREC because it has a '*de facto*' significant influence on national regulatory decisions and decisions by the Commission.

The majority of the respondents disagreed with the establishment of an EU Agency with regulatory decision-making powers for all the different areas (market regulation, EU spectrum management, end-user protection and other). Some respondents, mainly **operators,** recommended that an EU agency should be responsible for services of the EU single market or for issues such as consumer protection, content, service platforms, whilst NRAs should continue dealing with local issues (e.g. network access). As regards spectrum and numbering there was a call for more harmonisation, but there were divergent positions as to whether these issues should be dealt with by an EU agency.

The regulatory community expressed its view against further harmonisation and indicated that differences in regulatory approaches can be beneficial where they allow experimentation and innovation (leading to the discovery of new best practices). Respondents were divided as to whether a common EU approach would add value in addressing the differences in the regulatory approach chosen by NRAs for individual markets in similar circumstances. **The regulatory community** also notes that, in the wider digital ecosystem, it is particularly important to adopt a “light touch” regulatory approach so as not to undermine investment and innovation. In principle, there could be more room for co-regulation and self-regulation mechanisms. According to **regulators**, while this kind of innovative and “softer” approach to regulation can be effective, where it is pursued it will be important that its details are defined “bottom-up”, through the direct involvement of the affected stakeholders.

Consumer associations called for caution and considered that co-regulation and self-regulation should only be used on very specific issues and under strict conditions, such as: strong independent governance of the self-regulatory scheme, oversight and enforcement across the sector, and the presence of effective sanctions in cases of non-compliance.

As regards BEREC and the BEREC Office, almost half of the respondents had identified provisions in the framework which in their opinion should be revised. Proposals put forward include longer or extendable mandates for the BEREC Chair, relocation of the BEREC Office and definition of the role of BEREC in drafting Recommendations. Some **national regulators** considered that the governance structure is satisfactory but suggested a number of proposals for the mandate (consultation by the Commission on legislative initiatives, new responsibilities as regards connectivity objectives, more involvement in the area of spectrum through the exchange of best practices in the design of auctions and beauty contests and monitoring of coverage and QoS), deliverables (binding acts in limited circumstances, reinforced data collection) and functioning (simplification of the role of the Management Committee, establishment of an office in Brussels).

Consumer and civil society organisations referred to the need for better collaboration of BEREC with consumer organisations, civil society organisations and individual operators in

addition to operators' associations as well as with other bodies/agencies such as ERGA and ENISA. The **regulatory community** has also identified the need to strengthen the cooperation with other networks of regulators established in adjacent economic sectors.

NRA status and competences

There is overall support for strengthening NRAs' independence, in particular by ensuring i) complete separation between ownership of providers and regulatory tasks, ii) political independence in particular in cases of restructuring, iii) control of adequate human and financial resources and iv) no political appointment of Board members. **Alternative operators** stated that NRAs' independence may also be affected when sector-specific NRAs are merged with other authorities. Respondents favoured that the powers of NRAs are extended to areas such as State Aid, consumer protection and coordination of spectrum policies. **The regulatory community** stressed the need of aligning the minimum competences (including end-user protection) of NRAs to those of BEREC.

A clear majority of respondents considered that NRAs should have a role in mapping areas of investment deficit or infrastructure presence because they are vested with the necessary powers to access relevant information and have the necessary expertise, as well as independence. Those opposed to such a role contested as a matter of principle any public interference with investment. There is strong support to a revision of the framework to better accommodate the role of NRAs regarding state aid, notably i) identification of target areas, ii) setting access price and access obligations, iii) ensuring better coherence between state aid and ex-ante regulation and iv) resolution of disputes. A few respondents propose that the role of NRAs regarding mapping of infrastructures or setting target areas must be limited to provide technical assistance to the relevant competent authorities or to being consulted.

Most **operators** indicated the need to revise several aspects of the general authorisation conditions, strictly interlinked with some general substantive choices on the scope and extent of regulation on ECNS (level playing field), in order not to hinder the cross-border provision of electronic communications services and networks. Several operators suggested a specific lighter regime for some categories of services (best efforts OTT, business services, small cross-border providers) in order to reduce cross-border obstacles. Other suggestions included the harmonisation of Mobile Network Codes conditions, reducing the scope of national discretion in setting the conditions attached to rights of use, and a common notification template.

The principle according to which established and non-established operators should be subject to the same rules in the country of provision was stressed by several respondents. The extension of notification requirements to OTTs as well as the harmonisation of a notification template and administrative simplification (online submission, single language version, one-stop-shop, harmonisation of categories of services) were suggested, in particular by business users and **cross-border providers**.

On numbering, most respondents do not consider it necessary to allocate more executive powers to BEREC, in particular since numbering is a national competence and existing

harmonisation at CEPT/ITU/COCOM level seems to be working. On the contrary, some **operators** did not exclude the power to grant pan-EU numbers for specific services (M2M).

Institutional set-up for spectrum management

With regard to spectrum governance, in order to serve the future wireless connectivity needs of the EU, a common EU approach to governing spectrum access was welcomed by respondents in order to enable technologies to be used seamlessly, but respect for spectrum as a national asset is required. Delays in availability of spectrum and fragmentation between conditions of use in different Member Stated were noted. Some respondents promoted a stronger role of the Commission. Some respondents disagreed and stressed the national character of spectrum policy.

As regards spectrum management, **the regulatory community** encompassing both BEREC and RSPG was of the view that the EU already benefits from substantial coordination and harmonisation processes, and no further EU-level coordination procedures are necessary. However, RSPG showed openness to a peer-review mechanism as regards spectrum assignment.

As regards the need for binding guidance on certain aspects of assignment procedures and conditions, there was a split between **regulators** and (mainly) **broadcasters** that preferred a national approach and telecoms operators that supported a certain level of binding guidance. Most respondents supported the Commission issuing Recommendations (Art.19 FD) on assignment conditions and/or procedural aspects, often qualifying it with basing any Recommendation on an RSPG/RSC process. The majority of respondents supported the idea of establishing a mechanism similar to that set by Article 4 of the Radio Spectrum Decision for certain key assignment parameters, at times pointing out the need to choose between this process and the one under Art.19 FD.

There is little demand for mandatory **pan-EU or regional assignments**. Most respondents questioned the need for EU-wide licences. A preponderance of answers viewed assignment as a national matter. Any wider geographical scope should involve the Member States with some respondents viewing it as a Council matter.

6.3 ANNEX 3 - Discarded options

The following annex presents the options discarded that were not assessed in terms of impacts and provides a rationale of the reason why they were not retained. The topics included below are further investigated in the IA support study, SMART 2015/0005.

6.3.1 Access regulation

- **Full deregulation of telecoms networks;** Full deregulation of telecoms networks similar to the system that applied following market liberalisation in New Zealand and now applies in the US. This option was considered in light of the fact that when it was first introduced, it was envisaged that the framework would enable a gradual roll-back of regulation with eventual reliance on competition law. However, a full deregulation was discarded due to the disruption it would bring to the industry (although option 4 describes a sunset-clause scenario).
- **Regulation of non-collusive oligopolies on the basis of a unilateral effects test similar to the one used under the European Merger control regulation.** This approach has been considered by some NRAs and new entrants in the market as an alternative to the finding of joint SMP, or 'joint dominance', as a basis for imposing regulatory remedies to redress market failures on oligopolistic markets. It should be kept in mind that oligopolistic market structures in network industries are likely, and in certain cases efficient, market outcomes. They are also the result of the market liberalisation over the past twenty years. It is thus far not clear on what economic grounds such an additional concept could be identified, and the merger-specific concept of unilateral effects is not adequate. BEREC has raised this issue, but has recognised that the underlying economic assessment approach is not yet clear. As criteria for such a new intervention threshold are difficult to establish and therefore the risk of overregulation and further regulatory fragmentation increases, it does not seem appropriate to increase the regulatory burden by deviating from the current significant market power test.

  Any competition concerns that may arise could be alleviated by facilitating alternative infrastructure roll-out through symmetric access for strictly non-replicable assets and by providing long enough transitional periods when regulation is removed. Furthermore, the **future revision of the current guidelines on market analysis and the assessment of significant market power (SMP guidelines**) is intended to bring more clarity on the criteria for the finding of joint dominance, based on the experience with the Article 7 case practice and relevant jurisprudence, which would assist NRAs to identify joint dominance. For this purpose, the present SMP Guidelines need to be reviewed in line with the developments of EU law, with the aim of further clarifying the tools for the correct application of this concept in the electronic communications sector.

  The experience in applying the principle of collective dominance by NRAs is limited. Since 2002, less than ten cases proposing a joint SMP finding have been notified to the Commission (out of more than 1,800 notifications in total), primarily in mobile origination markets (Market 15 of the 2003 Recommendation on Relevant Markets). The reasons for this could be manifold and will be explored when SMP guidelines will be reviewed.

- **Mandatory structural separation of former monopolies; this option would entail a mandatory breakdown of the incumbent telecom operator.** Under this option a structurally separate operator supplies dark fibre on a wholesale –only basis and cannot compete on services. The ownership of the two operators would then be distinct. The model would follow the experiences being developed in New Zealand[338], Australia or Singapore. The current regulatory framework already contains a procedure for exceptional measures, potentially beyond voluntary separation. Thus, on the basis of the Access Directive, structural separation is a remedy which is already available to NRAs. The concrete legal basis, would be Art. 8(3) for forms of separation going beyond the functional separation foreseen in Art. 13a. Although this measure has been advocated by a number of competitive and fibre operators in the public consultation, a mandatory structural separation would impinge on the existing ownership rights and it was decided not to pursue this option as a central part of the EU-level policy prescriptions. The proportionality of such a measure would be put into question by the fact that voluntary separation is already promoted by the measures described in chapter 4.
- **Mandatory copper switch off.** This option was discussed because **c**ompetitive pressure from legacy copper networks can be considered as one of the barriers to NGA deployment. Some MS have trialled copper switch-off and operators have already announced the de-commissioning of local exchanges and copper network switch-off in order transfer their customers base to their NGA platform only. To date, however, no copper switch-off was mandated in any MS. Network owners strongly opposed it in the public consultation the mandatory nature of such a move which would cause disruption in network management. A mandatory copper switch-off was judged as not feasible for proportionality and legal reasons, but a clearer and more predicable mechanism can be provided to the incumbents who decide to switch off copper network, as envisaged under option 3 for access.
- **Explicitly reducing legacy copper access charges** with the aim of incentivising incumbents to deploy FTTH/B and switch-off the copper network. This strategy to accelerate the deployment of fibre by regulated incumbents was proposed by alternative operators during the course of the development of the 2013 Recommendation on cost methodologies and non-discrimination and not retained.[339] This option was rejected on the basis that it could make copper-based access relatively more attractive compared with fibre-based access (to both access-seekers and consumers), and therefore impede investment in and the migration to higher speed offers, which would ultimately provide better quality, social and economic benefits.
- **Remove the special competences for the Commission to recommend and ultimately mandate ECNS standards and to rely fully on the mechanisms established for general ICT standardisation.** The instruments provided by ECNS legislation have been used very carefully by the Commission since the last amendment of the Framework Directive in 2009. There have been no changes to the list of voluntary standards and there have been no standards mandated. The Commission has only issued a mandate to ETSI in the area of emergency call location. It had therefore to be considered to remove the special competences of the Commission related to ECNS standards. However a November 2011 study conducted for the EC [340] identified substantial

[338] In Australia and New Zealand structural separation has been imposed in combination with massive public investment.
[339] A discussion of this point can be found in section 6.1.2.2. of the IA accompanying that recommendation http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2013/swd_2013_0329_en.pdf
[340] Ecorys/TNO/TU Delft (2011) 'Steps towards a truly internal market for electronic communications' https://ec.europa.eu/digital-agenda/en/news/steps-towards-truly-internal-market

benefits from greater standardisation of solutions within the EU. While this could in principle be achieved under the mechanisms established for general ICT standardisation[341], the possibility to encourage and ultimately mandate the use of ECNS standards could help fostering the process. The ongoing work in the area of emergency call location might also benefit from the possibility – once the work is finished and a standard has been established - to encourage its use. Furthermore, the second impact assessment interim report by WIK/Ecorys[342], explains that voluntary standardisation may not be sufficient in the area of wholesale products used for business access products, in particular when provided cross-border. It would therefore appear not to be appropriate to remove the special Commission competences in the area of ECNS standards. Moreover, technical adaptations to the current provisions can be used to ensure that BEREC expertise can be relied upon when the Commission issues mandates to European standardisation organisations (ESOs) and to clarify the details of the procedure which would apply before the Commission makes the use of a specific ECNS standard mandatory.

6.3.2 Spectrum

Several options have been envisaged or have been suggested by a few respondents to the public consultation but will not be further considered at this stage .

- **Full harmonisation**, in the directive on all aspects of spectrum assignment, and especially of the method to determine and/or collect spectrum fees; fee determination and collection has always been considered as a national regalian competence. Therefore in regard to these elements coordination should be limited to the main criteria used by MS when determining and collecting fees and avoid revenue maximisation being used as the primary objective and criterion. Implementing measures would be more suitable to enhance coordination in the definition of these and other key spectrum assignments elements.
- **Creation of a single EU spectrum license** which would be granted by an EU body be it the Commission or an agency. Besides the fact that this would only be justified in case of truly pan-European services relying on spectrum (which to date have not emerged except for satellites), it would be very difficult to create from a legal point of view and the principle has proven to be politically unacceptable; even the implementation of a coordinated solution which required similar national licenses to be granted to commonly selected applicants by the MS themselves has been very difficult to put in place (see MSS case).
- **Grant delegated powers to the Commission** to further define harmonised conditions for assignment of spectrum: as these are national competence, MS would possibly be less keen to accept such a procedure and would possibly prefer the use of implementing decisions through comitology. Moreover delegated acts are not always suitable from a substance point of view.

[341] Regulation 1025/2012 EC on European Standardisation, see http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:316:0012:0033:EN:PDF

[342] Annexed to this document, p35, the importance of standardisation in this area is also highlighted on p40 and p97.

6.3.3 Universal Service

Connectivity to a network at all locations: This option is to enhance the focus of universal service on individual end- users and to provide connectivity to a network in all locations (by contrast to the current provision at a fixed location, which may be restricted to user's primary location or residence). This option is discarded because the expected deployment cost to deliver connectivity at all locations were much higher than the cost to deliver connectivity at the end-user's primary location or residence. The universal service cost needs to be kept at what is necessary to achieve a minimum safety net, with other tools being prioritised to enlarge both fixed and mobile coverage.

- **Terminate the universal service regime:** Taking into account the current social, economic and technological developments, this option suggests terminating universal service completely. This option could be accompanied by the introduction of horizontal accessibility obligations on all providers to ensure equivalence of access and choice for disabled users. This option is discarded because universal service is still considered a valid concept by most stakeholders (i.e. MS, NRAs, consumer organisations and most of industry players) and there are identifiable affordability needs for the most vulnerable sections of the population even under competitive market conditions, which can be met at limited cost.
- **Provision of very high-capacity broadband networks in public areas and places of specific public interest as an addition to Options 3 and 4:** As an additional measure to Options 3-4, it has been suggested providing very high-capacity broadband networks in public areas and places of specific public interest such as schools, universities, libraries, education centres, digital community centres, research centres, health care centres and town halls. Such provision under USO would apply when private and other public investments do not deliver, and would be financed from public funds due to its general social benefits. This option is discarded because there are other EU and national policies supporting NGA deployment in such specific places (for instance, ERDF, GÉANT) and because USO cannot be considered a suitable instrument to foster high capacity connectivity by comparison to private investment, PPP or other public policy instruments (e.g. public procurement for public-service needs).
- **Changing the national financing regime in addition to other financing options under options 3-4:** In addition to other approaches, this option suggests establishing a system administered at EU level which would permit contributions to be distributed across MS. This would allow to bridge digital divide between less developed and more developed broadband areas. The providers established in one MS only may be targeted more effectively. This option is discarded because it requires significant changes to the institutional setup (i.e. delegating powers to the existing entity or creation of a new entity for administration of the financial scheme at the EU level) that might be difficult to achieve. Also, the suggested processing of the financing requests will result in a heavy administrative burden.
- **Changing the financing regime in addition to other financing options under Options 3-4 by setting national user levies:** In addition to other approaches, this option suggests setting national user levies via direct surcharge on user invoice. This could also be another option for a social solidarity scheme within the context and rationale of universal service where broadband were to be included in universal service. While this approach should be relatively simple to manage, any approach that targets subscribers directly elevates the retail price and risks both undercharging and overcharging and impeding broader digital take-up.

6.3.4 Services and end-user protection options

6.3.4.1 *Services*

- **No sector-specific regulation for services in the future:** This option would consist in abolishing provisions related to services from the Regulatory Framework. As a consequence of this measure, there would not exist any sector-specific consumer protection that is not desirable given the highly technical nature of telecommunications services. General consumer protection rules would not suffice to protect consumers sufficiently in all respects.

6.3.4.2 *Numbering*

- **Adapting the EU framework on numbering to address the competition issue on the M2M market, and creating (E.164 and E.212) European numbering ranges to promote a single market for M2M:** This option would complement the option 3 under numbering. A European numbering solution could provide the additional numbering resources necessary for M2M in Europe, with M2M-adapted and common requirements, and a country-agnostic use within Europe adapted to cross-border operating M2M applications. However past experience with ETNS and the results of the public consultation did not reveal a preference for a European numbering range. Therefore this option is not pursued at this stage. However, building on the current provisions of the framework with regard to further harmonisation of specific numbers or numbering ranges a mechanism is foreseen which allows for introducing a common EU-level numbering space in the future in case extra-territorial use of national numbering resources is not sufficient to meet the increasing demand.

6.3.4.3 Must carry and findability

- **Extending the scope of must carry obligations to OTT services.** This option would extend the scope of operators on which must carry obligations could be imposed to OTT providers. In case broadcasters, and more generally any content provider would provide their content via OTT services, net neutrality provisions (in particular Art 3(1) and 3(3) of Regulation (EU) 2015/2120) ensure that broadcasters as end users of Internet access services can distribute their content to their viewers without discrimination. It is therefore not necessary to extend the potential scope of must carry rules to OTT services.
- **Extending the scope of EPG obligations and introduce regulatory safeguards to improve findability.** This option would extend the scope of existing EPG access and presentational obligations by modifying the definition of an EPG, which could include services and facilities providing access to on-demand content and recommendation engines. It would be envisaged to define at EU level the scope of possible measures under national law. Online viewing will continue to grow and larger PSBs will have little difficulty in finding a prominent place in app stores as well as on equipment installed at consumer premises or hand-held equipment. Regional and local PSB will have more difficulty in this respect. Cooperation with larger PSBs to carry niche content in their apps (possibly imposed by national governments) is a possible solution. In addition, niche content providers can develop alternative routes to gain exposure via social media strategies. Extending EPG obligations would not impose a great additional burden on OTT platforms as many of the essential platforms (like app stores and streaming platforms like YouTube and Daily Motion) include content of public interest in their current navigation facilities anyway. MS have already the possibility under national legislation to introduce prominence obligations on

online service providers.[343] So far, MS have not made use of this possibility and the public consultation on the ECNS review has not revealed any concrete concepts how such obligations could be conceived.

The considerations outlined above (platforms already provide navigation facilities + lack of action at national level) put into question whether such obligations would be necessary and could achieve their intended purpose. It would therefore appear to be premature to define at EU level the scope of possible measures under national law and the option has therefore be discarded at an early stage of the analysis.

6.3.5 Institutional governance

- Commission powers to regulate markets directly

This option would mean the transfer of powers from national level (NRAs) to EU level (Commission). This option was discarded at an early stage as, even though it would likely serve to increase consistency, it does not meet political feasibility, the subsidiarity requirements and the need to build some flexibility into the system to efficiently ensure that national circumstances can be adequately addressed and taken into account.

- Not having an EU agency at all: substituting the BEREC Office by secretarial support functions to the Board of regulators to be provided by the Commission

This option, which is currently used for other EU bodies --- COCOM, RSPG or ERPG – could help in avoiding the application of the detailed set of rules that applies to all EU agencies (financial, staff/implementing rules, procurement, reporting, etc.) to a small organisation such as the BEREC Office. However, it was discarded as these difficulties could also be overcome by the option of establishing an EU agency carrying out certain regulatory tasks (not only a support function) with the additional benefit of ensuring more autonomy.

Moreover, the political feasibility of this option is not guaranteed as the European Parliament in its DSM report has called the Commission to ensure that a more efficient institutional framework is in place by strengthening the role, capacity and decisions of BEREC in order to achieve consistent application of the regulatory framework. In particular, the need to improve the financial and human resources and further enhance the governance structure of BEREC was highlighted.

6.4 ANNEX 4 - Who is affected by the preferred options and specific impacts on stakeholders

This annex describes the practical implications of the preferred options identified in the Impact Assessment for the Review of the Framework for electronic communications for representative groups likely to be directly or indirectly affected by the legislation including electronic communication network and service providers, Over-the-Top players, SMEs and consumers, Ministries, National Regulatory Authorities and Spectrum Management Authorities.

For each stakeholder group, we discuss the relevant impacts of the preferred options, the key obligations that will need to be fulfilled and when these might need to be fulfilled in order to comply with obligations under the revised framework. Wherever possible, we also indicate potential costs that may be incurred in meeting those obligations.

[343] See Commission Staff working document AVMSD impact assessment, p.52

The opportunities and challenges presented by the proposed revisions to the electronic communications framework are described in the following table.

It is envisaged that consumers and SMEs will be the greatest beneficiaries of reforms to the electronic communications framework. These stakeholders will benefit from greater availability and choice in very high speed fixed and mobile connectivity, as well as an increased focus on the affordability of broadband and measures enabling them to defray the costs for newly installed fibre connections. Consumes and SMEs will also benefit from an extension in privacy and security protections for OTT services and improved switching for broadband bundles. Multi-national businesses should also benefit from more consistent standards for high quality connectivity cross-border.

Although they will need to meet tighter privacy and security standards, new (including European) players in the OTT and IoT space should also benefit from improved broadband connectivity as well as provisions, such as maximum harmonisation of consumer protection rules, and mechanisms for permanent roaming and cross-border number utilisation which should foster the scaling up of service provision across the EU.

The package includes several measures which should benefit electronic communication network providers which intend to invest in high speed networks. Such investors should benefit from increased attention to duct access and symmetric access to non-replicable assets such as in-building wiring – which are core elements facilitating the deployment of high speed networks. They should also benefit from measures to co-ordinate deployment in rural areas to avoid overbuild and the potential to defray connection costs over a longer period. Finally, the revisions to the Directive will explicitly recognise the important role that wholesale only models and co-investment play in supporting sustainable competition in the market. Such models will be subject to lighter touch regulatory controls. Incumbent operators which have been subject to tight regulatory controls on wholesale access, may also receive regulatory relief in areas where there is effective competition or where they make genuine co-investment offers.

Electronic communication network providers of all kinds should benefit from the increased certainty and reduced administrative costs associated with longer periods between market reviews (of 5 rather than 3 years except where there are material differences in the market situation). However, in countries which do not yet pursue such strategies, there may be additional effort required to submit mapping data to the NRA (to enable the geographic targeting of regulation) – and for operators with SMP to make duct access operational and adapt product specifications for business access to meet standardised requirements (following a suitable period).

The proposed revisions to the framework entail measures to increase reliance on general authorisations for spectrum, speed up spectrum assignment and foster consistency in assignment and core licence conditions. These provisions are broadly beneficial to electronic communication network providers and should reduce costs, improve spectrum availability and facilitate multi-national operations and service provision.

Operators offering broadband Internet access will need to meet more stringent requirements relating to transparency and quality of service. However, they will benefit from a streamlining of the rules applying to other electronic communication services. All operators should also benefit from a planned removal of redundant universal service obligations and switch away from sectorial levies which should reduce the regulatory burden on designated universal service providers and more widely reduce administrative cost.

Member States should benefit from the greater broadband diffusion, consumer trust and associated economic benefits associated with the preferred policy options. It is also possible, but not assured, that

streamlining of regulatory approaches (such as the consolidation of mapping responsibilities) could save costs at a national level. However, where not already the case, Ministries will need to ensure adequate resourcing and empowerment of NRAs, and the introduction of a minimum remit for independent National Regulatory Authorities may require a transfer of certain responsibilities in a few member states.

NRAs will benefit from the changes in a number of ways. Their independence and empowerment will be reinforced, and certain NRAs would benefit from an expanded remit concerning consumer protection and/or market-shaping aspects of spectrum. Burdens from market analyses should be reduced by extending the period between reviews. NRAs will also play a more formal and decisive role in an enhanced BEREC. However, NRAs will also need to conduct more geographically targeted reviews, and will need to ensure they have adequate expertise to take on a more extensive remit in relation to infrastructure, investment and quality of service mapping, as well as ensuring that regulation is adapted to support infrastructure competition (if not already the case).

Table 19 - Summary stakeholder impacts

	Opportunities	Challenges
Incumbent fixed and mobile telecommunication operators	☑ More geographically targeted access regulation ☑ Lighter regulation in presence of co-investment or wholesale only business models ☑ Savings from less frequent market reviews ☑ Increased efficiency in engagement with bodies handling e-comms regulation due to converged set-up ☑ Faster access to spectrum, greater regulatory certainty concerning spectrum assignments and more consistent usage conditions ☑ Lower spectrum access cost and regulatory burdens in bands subject to general authorisation ☑ Fewer consumer protection obligations regarding electronic communication services resulting in administrative savings ☑ Elimination of redundant USO obligations and abolition of sectoral funding leading to reduced administrative cost and financial burden	☒ Requirement to supply infrastructure/investment mapping data for market reviews and operationalise duct access (where not already applied) ☒ Greater (commercial) pressure to invest in infrastructure due to additional infrastructure competition ☒ Need to standardise business wholesale products (given due notice) ☒ Further obligations concerning Internet access (to aid transparency QoS and switching)
Alternative fixed and mobile telecommunication operators	☑ Operational duct access, co-investment and wholesale only incentives support more sustainable competition ☑ Standardised business wholesale products foster cross-border entry and competition ☑ Savings from less frequent market reviews ☑ Increased efficiency in engagement with bodies handling e-comms regulation due to converged set-up	☒ Less regulation of short-term fixed access rental ☒ Greater pressure to invest or co-invest in own NGA infrastructure ☒ Requirement to supply infrastructure/investment mapping data (where not already the case) ☒ Further obligations concerning Internet access (to aid transparency QoS and switching)

	☑ Faster access to spectrum, greater regulatory certainty concerning spectrum assignment and more consistent usage conditions ☑ Lower spectrum access cost and regulatory burdens in bands subject to general authorisation ☑ Fewer consumer protection obligations regarding electronic communication services resulting in administrative savings ☑ Abolition of sectoral USO funding leading to reduced financial burden	
Alternative (cable and fibre) infrastructure investors	☑ Greater focus on infrastructure competition and regulatory targeting supports commercial flexibility ☑ Operational duct access may support network expansion ☑ Measures to extend contract duration for connections and avoid overbuild in challenge areas, as well as regulatory support for wholesale only models, are likely to benefit municipal and regional fibre investors ☑ Savings from less frequent market reviews ☑ Increased efficiency in engagement with bodies handling e-comms regulation due to converged set-up ☑ Fewer consumer protection obligations regarding electronic communication services resulting in administrative savings ☑ Abolition of sectorial USO funding leading to reduced financial burden	☒ Requirement to supply infrastructure/investment mapping data (where not already the case) ☒ Greater use of symmetric obligations for non-replicable assets (where not already the case) ☒ Further obligations concerning Internet access (to aid transparency QoS and switching)
OTT and IoT providers	☑ Greater availability and quality of fixed and mobile bandwidth supports OTT and IoT service delivery and innovation ☑ Reduced barriers to entry and expansion for OTT and IoT firms due to maximum consumer protection harmonisation, and provisions to foster permanent roaming and cross-border use of numbers ☑ Increased efficiency in engagement with bodies handling e-comms regulation	☒ Switching and portability procedures currently existing for EC(N)S need to implemented by OTTs that interconnect with E.164 ☒ Privacy and security obligations need to be implemented by all OTTs ☒ OTT that interconnect with E.164 potentially subject to

	due to converged set-up	levies for administration of regulatory authority
SMEs	☑ Greater availability of and choice in very high bandwidth connectivity with continued choice and value in basic broadband ☑ Improved affordability for fibre connections through defraying connection charge ☑ Potential to connect business sites cross-border boosted through standardised wholesale offers ☑ Reduced barriers to entry and expansion for smaller OTT and IoT firms due to maximum consumer protection harmonisation, and provisions to foster permanent roaming and cross-border use of numbers ☑ Lower cost of access to spectrum (through greater use of general authorisations and best practice in assignment conditions) leading to greater access for smaller electronic communication companies ☑ Greater predictability and trust amongst SMEs as users of ECS and OTT, improved transparency concerning IAS ☑ Reduced USO contributions for small suppliers (where previously captured) ☑ Increased ease of engagement, reduced administrative burdens due to converged governance	☒ Smaller electronic communication providers may be less well placed to invest or co-invest in infrastructure ☒ Potential new obligations and NRA contributions for small OTT in relation to E.164 interconnection, privacy and security
Consumers	☑ Greater access to and choice in high quality broadband connectivity ☑ Improved affordability for fibre connections through defraying connection charge ☑ Greater availability and innovation in services relying on 5G and future generation wireless technologies ☑ Accelerated fast mobile broadband ☑ Greater predictability and trust amongst users of ECS and OTT due to extended privacy and security measures ☑ Increased ease of switching in relation to bundled offers	☒ Potentially less detailed obligations on some ECS, but practical implications limited since consumer protection would be covered by horizontal rules or addressed through competitive markets

	☑ Greater end-to-end connectivity and access to emergency services when using OTT interconnecting with E164 ☑ Improved transparency concerning IAS ☑ Potentially improved access to affordable broadband	
Member States	☑ Streamlining of regulatory approaches and governance at national and EU level should drive synergies and may enable cost savings ☑ The proposed changes should support the diffusion of fixed and mobile connectivity, thereby supporting economic development and social welfare	☒ Ministries will need to ensure adequate resourcing and empowerment of NRAs (where not already the case), and governance changes may require a transfer of certain responsibilities in some member states
NRAs	☑ NRAs will see a reinforcement of independence and empowerment as well as a harmonisation of their remit to provide a more converged regulatory approach (for example in relation to consumer protection and broadband mapping (including for state aid and broadband cost reduction) ☑ NRAs will play a more formal and decisive role in EU policy-making through the enhanced BEREC ☑ NRAs will benefit from a longer period between market reviews reducing administrative costs and enabling longer-term decision making	☒ NRAs not already pursuing such strategies will need to ensure competence in mapping, ensure the effective operationalization of measures to ensure infrastructure competition in broadband, support the deployment of broadband in challenge areas and provide standardised solutions for business access

6.4.1 Implications for telecommunications network operators and service providers

6.4.1.1 Access Provisions

Under the preferred option for access (Option 3 NGA+), telecommunication network operators and service providers will be affected by adaptations to the market analysis process. This may affect telecommunications operators differently depending on whether they are incumbent operators, which are subject to SMP obligations, alternative operators which may rely to a degree on regulated wholesale access, or other competitive operators making use of their own network infrastructure.

6.4.1.1.1 Access provisions and operators subject to SMP obligations

Economic impacts

Incumbent operators which are today typically subject to SMP regulatory obligations are expected to benefit from better motivated, more targeted and, in some instances, less onerous regulatory obligations resulting from a requirement for NRAs to place greater focus on retail market failure prior to intervention and from more granular geographic market analyses which may result in deregulation in some areas. Incumbents may also benefit from greater flexibility (for example in price setting) and reduced costs resulting from potential reduction on regulatory access obligations in cases where they propose adequate co-investment or commercial offers, or where they pursue voluntary structural separation.

The preferred option is also expected to increase commercial incentives on incumbent operators to invest in upgrading networks in order both to protect their market share and to compensate for the loss of wholesale revenues in a more competitive environment, as well as to benefit from the proposed lighter regulatory treatment for new upgraded networks. As a result, it is expected that following transposition and implementation of the legal provisions, CAPEX intensity amongst incumbent operators in countries which have not already undertaken significant network upgrades to VHC connectivity may increase.

Administrative impacts

Changes to the market review process are likely to result in certain administrative requirements, as well as change in the nature of access obligations resulting from a shift in focus towards infrastructure based competition (in countries where this is not already the case). Specifically, in the early stage, immediately following the adoption of a revised framework and during an estimated period thereafter of around 3-5 years, incumbents in countries which are not already subject to such obligations may have the additional requirements to submit infrastructure coverage data and plans concerning infrastructure deployment to support mapping by the NRA.

It should be noted that such obligations are only incremental to the data collection exercises that already exist or are planned in many member states, as described in the study (SMART 2012/0022) on the mapping of broadband and infrastructures,[344] and (when combined with planned guidance in this area) should ideally serve to streamline and bring some coherence between data collection for market analysis purposes and the transparency obligations that exist in what may currently be viewed as separate exercises. For example, the Cost Reduction Directive already includes obligations to provide information concerning civil works to be performed in the next 6 months (Article 6 Directive 2014/61/EU) – relevant for investment

[344] See Table 5-1 https://ec.europa.eu/digital-single-market/en/news/mapping-broadband-and-infrastructure-study-smart-20120022

mapping, while reporting obligations are already undertaken to undertake investment mapping in the context of State Aid schemes for broadband.

Measures to operationalise duct access and symmetric obligations aimed at sharing non-replicable assets

The greater focus on infrastructure competition in the framework is likely to result (for those Member States not already pursuing such strategies) in a shift towards passive access and greater attention to symmetric obligations concerning non-replicable assets. This may require incumbents to provide information on availability of duct access, and potentially automated systems to support ordering, provisioning and repair, in cases where duct access is feasible and would be proportionate, but is not already fully operational. For incumbents in countries where such obligations are not yet fully effective the operationalization of duct access could result in one-off costs as well as ongoing costs associated with maintaining an online database for duct access availability and meeting access requests (if not already incurred)..[345]

Moreover, administrative costs from the operationalization of duct and symmetric access may be offset if these obligations result in infrastructure competition, which enables the relaxation or removal of downstream asymmetric (SMP) access obligations.

Standardised wholesale offers for business

Incumbents may also be affected by requirements to move towards standardised wholesale offers for business access, in areas where such access is required.[346] The study SMART 2014/0023[347] assessed the impact of such a requirement, and concluded that while (some not readily quantifiable) costs may be incurred in adapting product offers, systems and processes, these could be mitigated by a phased introduction of the obligation, permitting these changes to be introduced during a refresh of systems. NRAs could determine the timing of such a required change subject to national circumstances, but for the benefits to be realised introduction should be subject to a deadline, which could be determined in Implementing Guidelines associated with the revised Framework.

Extension of market review period

Another planned change to the market review process is a reduction in the frequency of market reviews, which would be required every 5 years rather than every 3, with the potential for an interim review if needed in light of changed market circumstances. This change should in principle reduce the administrative burden involved in supplying market and operational data to the NRA and preparing information for cost modelling purposes. However, these cost savings are unlikely to be significant in the context of sector revenues, and it is possible that this change could negatively impact incumbent operators if it results in obligations being in place for longer than under the current cycle (although the reverse is also possible, in cases where regulatory obligations are withheld, for example on newly installed infrastructure in the presence of reasonable co-investment offers).

[345] However, it should be noted that duct access and symmetric obligations are already operational in several member states including Portugal, Spain and France, while there are ongoing initiatives to operationalise duct access in countries such as the UK, which should be complete before the framework review comes into effect. See for instance Feb 2016 Ofcom Digital Communications Review Statement http://stakeholders.ofcom.org.uk/telecoms/policy/digital-comms-review/dcr-feb-16/

[346] For example, where there is no prospect of effective infrastructure-based competition

[347] Investigation into access and interoperability standards for the promotion of the internal market for electronic communications https://ec.europa.eu/digital-single-market/en/news/investigation-access-and-interoperability-standards-promotion-internal-market-electronic

6.4.1.1.2 Access provisions and Alternative operators

It is anticipated that the increased focus on measures to boost infrastructure competition and foster investment is likely to impact the business models of alternative operators, supporting a move to more self-sustaining models based on investment, co-investment and/or longer term remedies or commercial solutions.

As this model is likely to involving upfront commitments, this may entail greater initial capital expenditures for these alternative operators, which would be offset in subsequent years by lower operational expenditures as business models shift from rental towards investment, co-investment or risk sharing arrangements. Engagement in infrastructure build or long-term agreements is likely to provide greater predictability for alternative operators than the current short-term arrangements, although it will also entail greater upfront risks.

In turn, as and when alternative operators invest in their own VHC infrastructure they may be subject to obligations to provide data concerning existing and planned fibre deployment as part of the expanded mapping process. They may also be subject to symmetric obligations for the sharing of in-building wiring or wiring up the first distribution point, in countries which do not already pursue such approaches, although it should be noted that such obligations are already operational under the existing framework in some countries[348]..

Precise cost impacts on alternative operators willing to invest in own infrastructure resulting from changes to the framework are difficult to estimate. However, the expectation is that the greater focus on infrastructure-based competition in NGA and VHC may result in different (more capex-intensive) business models for entrants, rather than increased costs overall.

As regards the standardisation of wholesale offers for business end users, changes to incumbent systems may also imply a need for adjustments to access-seekers' ordering and repair processes and systems, which could be made after a suitable period determined by the NRA as discussed above. On the other hand, standardised offers should lower barriers to expansion for operators which do not have nation-wide coverage in specific countries.

Finally, alternative operators which currently make use of wholesale access would, like incumbent operators, also benefit from reduced administrative costs associated with longer market review periods, although these administrative savings are not expected to be very significant as compared to other categories of costs and savings considered in this chapter.

6.4.1.1.3 Access provisions and other competitive operators

Cable operators and regional fibre investors are unlikely to be significantly impacted by the proposed changes to the market analysis process. Nonetheless, these operators are expected to benefit from an enhanced focus in the framework on infrastructure competition and more geographically targeted regulation. Specifically, they may be able to exploit operational duct access and symmetric measures to expand their existing footprint, and they may also benefit indirectly from the possible relaxation of SMP obligations in certain areas where infrastructure competition emerges, if this results in greater potential for pricing flexibility and tailoring of products and bundles to specific customer groups for the market as a whole.

[348] Symmetric obligations on in-building wiring and terminating segments on all operators are possible under the current Framework and are already operational and in place in countries such as Spain, France and Portugal. Furthermore, under the cost reduction directive, any owner or user of in-building physical infrastructure should meet reasonable requests for access in view of deploying high-speed electronic communications networks.

Regional fibre investors including municipal investors may also benefit from specific provisions within the NGA+ option which aim to identify underserved areas that may offer deployment opportunities for this operator group, as well as benefiting from measures which are designed to hold operators to account as regards their investment commitments, in order to avoid strategic overbuild, which was mentioned as a threat by many of those operators in the public consultation..

On the other hand, VHC networks built by these operators may become subject to symmetric obligations as regards sharing of in-building wiring or the non-replicable terminating segment, which will entail additional cost. However, it should be noted that in several countries, these rules are already in place, and it is envisaged under proposed revisions to the framework that operators could be exempted from such obligations if they operate wholesale only business models.

Like other operators they would benefit from reduced administrative costs resulting from extended market review periods, but may need to supply additional information in order to facilitate infrastructure mapping by the NRA, in those countries which have not already pursued such procedures.

6.4.1.2 Spectrum provisions

The preferred spectrum option emphasises the need to prepare Europe for the future deployment of 5G and to speed up access to spectrum resources. The preferred spectrum option (Option 3: binding criteria) introduces (amongst other provisions) common criteria for most relevant elements of spectrum assignments such as for example timing of awards, license duration and coverage, a greater focus on general authorisations versus individual licenses and provisions to facilitate the deployment of small cells and Wi-Fi. These provisions affect network and services providers in terms of speed and access to spectrum resources across the Single Market and the cost of such access. Under the preferred option these common criteria would be binding on Member States.

6.4.1.2.1 Common assignment criteria and licence conditions

Mobile Network Operators (MNOs) are some of the main users of spectrum and they will therefore be affected by common assignment criteria and obligations attached to rights of use (e.g. license duration, spectrum caps, timing of assignment, methods for determining coverage obligations, etc.). The nature of the impact will depend on the specific decisions taken at EU level which are not specified in the option and are subject to negotiation.

However, it is already clear that under the preferred option, compared with the baseline, all mobile network operators will be subject to more consistent conditions to access and use spectrum resources across the Single Market. This will likely generate greater regulatory certainty and foster the development of a level playing field across the EU. For instance, if the regulatory framework specifies that e.g. spectrum auctions should reflect a due balance of overall spectrum objectives, this should bring greater consistency in the conditions that will govern spectrum assignment across the Union.

6.4.1.2.2 Greater focus on general authorisations over individual licenses

A greater focus on general authorisations is likely to significantly reduce access costs to spectrum resources thus making spectrum available to smaller companies which cannot afford purchasing exclusive access under individual licenses e.g. in an auction.

Operators who are already present in multiple countries would benefit because they could have access to the same frequencies all over Europe, with similar conditions. Such a system would rapidly speed time to market, as there would be no decisions needed (either at national or EU level) on which operator obtains which spectrum. Furthermore, consistency of usage conditions could be improved (e.g. if a harmonised EU band plan was agreed to) and costs would be reduced compared with traditional assignments.

6.4.1.3 Universal service provisions

The preferred option with regard to universal service is Option 3 (incremental adaptation to trends with the focus on broadband affordability). This option foresees exclusion of payphones and accessory services from the universal service scope at the EU level. The universal service scope shall cover PATS and affordable broadband at least at a fixed location meaning that Member States may introduce USO for affordable mobile broadband (connection at least at a fixed location) at the national level. At the EU level, broadband can be defined by referring to certain services to be accessible via the connection (web-browsing, eGovernment, VoIP etc.). This option would ensure only the *affordability* of broadband (i.e. affordable retail pricing measures), that shall be ensured at least at a fixed location, thus allowing Member States the possibility to include affordability measures by mobile, while its availability shall be further promoted by other policy tools (incentives to private investment, state aid, etc.). Availability of broadband can be ensured only at a fixed location. Minimum harmonisation would be applied at EU level, such that Member States could enhance the basic services baskets. Member States may also decide, in exceptional circumstances, to support availability of broadband additionally to its affordability. The preferred financing option is through general budget as a more equitable, fair and least distortive way of funding of the provision of universal service.

ECS providers are likely to benefit from the revision of universal service according to Option 3 as it will likely reduce the uncertainty and administrative and financial burden on them. For instance, they will not be obliged to provide pay phones that are considered redundant and largely function at loss. Financing through public funds is easier to implement so that it will lessen administrative costs and will contribute to a fairer distribution of costs and benefits of the universal service provision among all market participants with less distortion to competition.

6.4.1.4 Provisions relating to electronic communications services

The preferred option regarding services (option 4) reduces, for services other than the IAS, the burden relative to a number of USD obligations for ECS providers regarding contractual rights, transparency, quality of services (QoS) monitoring, and out-of-court dispute resolutions. Additional costs might be attached to the role that access network providers might have in the standards that enable the routing of emergency calls from OTTs to numbers in the PSTN network. Option 4 also introduces a number of new obligations for ECN providers applying to IAS regarding transparency, QoS, and switching to other providers (including facilitated switching process). The preferred option regarding numbering saves telecom operators from inefficiencies in relation to permanent roaming and extra-territorial use of numbers. The option on must carry/EPG does not impact on telecommunications network and service providers.

6.4.1.4.1 Reductions in obligations regarding ECS

In relation to overlapping consumer protection provisions, telecom operators will be relieved from unnecessary administrative and compliance costs regarding contractual rights, transparency, quality of services (QoS) monitoring, and out-of-court dispute resolutions. It is however not possible to estimate the overall costs for telecom operators of complying to potentially redundant rules.

In a survey among telecom operators organised in the context of this impact assessment, telecom operators indicate having to incur higher compliance costs resulting from existence of the rules that overlap with horizontal rules and/or rules having become redundant due to market forces. The overlapping information requirements create additional burdens for businesses that have to check all sets of requirements for any small or national differences and engage with two different sets of regulators in relation to enforcement. Activities that drive administrative burden and are related to complying with sector specific obligations regarding contractual terms and transparency are (amongst others):

- Activities related to regulatory/legal discussions with authorities on the terms of obligations;
- Activities related to assuring proper implementation of elaborate guidelines for marketing and sales (including specific provisions in contracts, in scripts for sales, in supporting IT, etc.);
- Other activities involved with assuring internal compliance with regulation;
- The need to inform customers about the corresponding regulatory provisions have the effect of making sales activities more lengthy and complex;
- Similarly, discussions with suppliers and partners (device suppliers, resellers) are made complex and imbalanced by the constraints on contracts terms;
- Activities involved with in potential litigations;
- Public Affairs involved in potential public controversies relating to the compliance with the rule.

In addition, specific resources may be dedicated to answering questions and to regularly updating online information in order to comply with transparency obligations. Telecom operators found it difficult to provide robust calculations of all compliance costs.

6.4.1.4.2 Introduction of new obligations regarding IAS

The reduction in enforcement and compliance costs regarding ECS will partially be undone by the additional obligations applying to IAS regarding transparency (related to consumption monitoring and comparison tools), QoS (reporting and, when criteria are not met, fines/compensation/termination of contracts), and switching (facilitated switching process).

6.4.1.4.3 Changes with regards to permanent roaming and extra-territorial use of numbers.

Compared to the base scenario a number of management complexities and implementation costs may be prevented, such as: "*Network testing, functional testing, billing verification, table updates (in switches, STPs, HLRs, billing systems, etc.) [which] would need to be performed by the operator and each of its roaming partners.*"[349] More streamlined extraterritorial usage would

[349] http://www.attglobalpolicy.com/wp-content/uploads/2014/06/ATT-Comments_BEREC-M2M-Project-Team-_19-June-2014.pdf

allow operators to gain efficiency by benefiting from economies of scale granted by the Single Market. Thus operators can provide cross border services without the need to change numbers., and can enter new markets without requesting a block of numbers in that country. At the same time, current bilateral arrangements for extraterritorial use (resulting in an equally burdensome costs for operators and roaming partners) may be replaced by a more harmonised governance structure that is much less burdensome on operators. This may require a possible extension of the activities (and costs) of BEREC as well as costs related to coordination with CEPT. However, these costs are likely much lower than the costs of the currently required multiple bilateral agreements between NRAs and telecom providers.

6.4.1.5 Governance provisions

The preferred option for Governance (option 3) involves the alignment of the remit of Regulatory Authorities at national level, as well as the extension of BEREC's remit to encompass responsibility for market-shaping aspects of spectrum assignment and to take certain normative powers in relation to developing implementing guidelines (which would be adopted by the Commission) as well as playing a deciding role in enabling a Commission 'decision' in relation to case by case assessment of remedies (under an expanded article 7a process). BEREC would also perform the peer review of national spectrum assignment procedures.

This consolidation of responsibilities for market-shaping measures in fixed and mobile networks as well as service regulation is likely to have a positive impact especially for those electronic communication network and service providers, which are converged and/or operate or aspire to operate cross-border. Converged regulatory responsibilities should lead to more coherent decisions, while greater consistency at EU level may enable cross-border suppliers to achieve cost savings from reduced regulatory variation.

Notwithstanding these potential benefits to electronic communication operators however, increased consistency which reduces barriers to access or service provision between member states, may pose competition challenges for operators which currently have a strong position in national markets.[350]

6.4.1.6 Overview table

The following table summarises the changes obligations per subject area and associated practical implications and costs.

[350] For example, in the context of interviews for SMART 2015/0002 and SMART 2014/0023, multi-national business end-users claimed that incumbent operators aimed to protect national markets. Additional cross-border competition from OTT players might also pose a challenge to the service revenues of traditional electronic communication providers.

Table 20 - Practical implications of preferred options for telecommunication network and service providers

	Changed obligations	Practical implications	Costs
Access	- Longer market review periods - Requirement to demonstrate retail failure - Infrastructure mapping with commitment in ‚challenge areas' - Greater infrastructure competition focus involving duct access, symmetric rules, incentives for co-investment, long-term commitment - Potential for non-imposition of access obligations on new high capacity networks deployed on the basis of an open co-investment offer - Standardised wholesale remedies for business end users	- Reduced admin burden for market reviews due to longer periods, focus on commercial rather than regulatory solutions, but increased burden in some countries for mapping, duct access, greater focus on symmetric rules for non-replicable assets - Requirement to standardise specifications (and potentially certain systems) for wholesale products designed for business	- Potential savings from less frequent market reviews ~€28m - Other costs e.g. mapping difficult to quantify and vary depending on whether rules are already in place - Standardised wholesale products may involve set-up costs if/where they require changes to systems and processes, but these costs could be mitigated by phased introduction. Operational costs for multi-national providers should be reduced
Spectrum	- Harmonised assignment criteria and licence conditions (e.g. license duration) in all markets - Greater use of general authorisations rather than individual licenses	- More consistency across the Single market - Greater regulatory certainty - Definition of coverage that is better suited to a wireless environment (e.g. not based on households but based on share of time the service is available) - Faster access to spectrum - More efficient use of spectrum	- Lower cost of access to spectrum leading to greater access for smaller companies - Reduction in administrative costs associated with assignment procedures
Services and numbering	1. Less obligations regarding ECS: • Transparency • Contractual rights • QoS • Dispute resolution 2. More obligations regarding IAS • Transparency	A number of activities/resources can be downsized as a result of 1), such as: Regulatory affairs, Legal advice, Customer Care, IT-Resources, Product development, Product lifecycle management, Terms and conditions management, Billing. A number of activities resources will be re-introduced as a consequence of 2)	1) and 2) lead to a net relief of administrative burden. No information on the monetary implications of 3).

	• QoS • Switching 3. Different arrangements for permanent roaming and extra-territorial use of numbers	Compared to the base scenario inefficient bilateral agreements on extra-territorial use of numbers are replaced by a more efficient system. A number of management complexities and implementation costs relate to roaming may be prevented.	
USO	Affordability measures for broadband at least at a fixed location Abolition of sectorial funding, instead financing through public funding	Reduced administrative burden due to clearer and easier to implement funding mechanism Reduced financial burden due to exclusion of redundant services at the EU level and introduction of public funding	Reduced administrative costs Potential cost savings due to exclusion of pay phones and accessory services for EU-28 – (pay phones alone – 1 bn euro annually) Cost of affordable broadband at a fixed location – from 147 mln euro to 436 mln euro per annum for EU-28
Governance	- Merged institutional structure covering access, services and aspects of spectrum at national and EU level - BEREC to take prime responsibility for the drafting of implementing guidelines	- Greater policy alignment - Increased institutional alignment on fixed and mobile regulation and consumer protection	- Coherence in regulatory responsibilities should benefit converged players while greater EU consistency should reduce administrative costs, especially for cross-border providers, but may increase cross-border entry and service competition, challenging the service revenues of traditional players

6.4.2 OTT providers and non-telco

6.4.2.1 Access and spectrum

Changes to access and spectrum rules do not entail any changes to obligations for OTT providers. However, as for other sectors of the economy, but likely to an even greater degree, OTT providers will benefit indirectly if the preferred options lead to greater deployment of fixed and wireless network and technology and greater take-up among consumers across the Single Market.

Similarly, greater coordination of spectrum assignments under the preferred option does not directly affect users in industries that might develop 5G applications and services. However, if this option leads to successful and fast deployment of 5G in Europe it will constitute a significant growth opportunity in some sectors (e.g. automotive, transport, health, utilities, and others) and for consumers who benefit from the resulting innovations by way of greater safety, energy efficiency, and environmental sustainability, etc.). In addition, a greater focus on general authorisations could put spectrum resources within the reach of operators who are not at present able to purchase exclusive access.

In terms of other current spectrum users such as broadcasters, the preferred option does not have any direct impact since it focuses on assignment criteria and usage conditions for the provision of electronic communication services other than broadcasting rather than on allocations of spectrum bands. Of course, future deployment of 5G will affect all current spectrum users - both in terms of spectrum demand and supply, as well as in terms of optimal allocation of spectrum to different uses. These considerations go beyond the assignment criteria and usage conditions in the preferred option.

6.4.2.2 Universal service

The adoption of Option 3 for universal service will reduce the number of unconnected households and improve access to a number of enhanced communications services. Due to these developments, OTT providers are likely to benefit from the inclusion of affordable broadband in the universal service scope as they can make better use of the increased connectivity and reach a larger pool of users.

6.4.2.3 Electronic communication services

The preferred option regarding services (option 4) introduces additional administrative burden for OTT providers that use numbering resources as they will be subject to additional sector regulation. All communications services providers (regardless of the technology used, this includes OTTs) will experience an increased administrative burden in relation to complying with rules on security and privacy and content portability. The preferred option regarding numbering does not impose additional administrative burden on OTTs/IoT. OTTs may, however, have easier access to numbering ranges. The option on must carry/EPG does not impact on OTTs.

The ERG 2007 guidelines indicate that NRAs may subject OTT voice services that interconnect with the number regime to certain obligations. However, these guidelines are not binding and SMART 2013/0019 concludes that many NRAs do not follow these guidelines in practice. Under option 4, the obligations become binding and will have to be enforced by NRA's for all OTT services that make use of the numbering regime (i.e. including OTT messaging services). As such, compared to the baseline, the administrative burden may increase for OTT providers that use numbering resources as they will now be subject to the same regulation. Most of the obligations and costs (except those related to accessing emergency services) would be associated only with paying customers, as direct revenues[351] largely relate to customers paying for interconnecting with the numbering plan. There is no quantitative information available on the size of the impact.

OTT services that make use of numbers (like Skype, Viber, or Google Voice) will be subject to the same obligations with regards to interoperability, end-to-end connectivity, and number portability. Since interconnection with the numbering regime is already part of the respective service, the obligation to provide interoperability and end-to-end connectivity will have little to no impact on current business models of the respective OTTs. With regards to portability (and associated activities to facilitate the switching process) it is

[351] not accounting for the indirect revenues as a result of e.g. integration in the wider MS Office suite in the case of Skype In / Out

not clear to what extent OTTs are currently de facto subjected to obligations. Following the ERG 2007 guidelines they could be, but in practice they are often not[352]. Under option 4, it becomes explicitly clear that OTTs will have to be subjected to portability obligations and this may have an impact on compliance costs, but we don't have information on the size of this effect.

In addition, Article 12 and 13 of the Authorisation Directive would also apply to respective OTTs, which implies that NRAs may levy administrative charges. While following the ERG 2007 guidelines, NRAs could already impose such levies on OTTs that interconnect with the numbering regime, in practice this is not the case. The financial burden differs per Member State, but the size is relatively small. For example, in Italy the charges under Article 12 may add up to a maximum of 0.2% of turnover[353]. For a mobile operator with an annual ARPU of 250 to 400 EUR, this boils down to an average annual burden of €0.65 per paying customer.

Finally, OTTs would also be obliged to provide access to PSAPs, as far as this is technically feasible. In some Member States (such as the Denmark, Finland and UK) such functionality is already enabled[354] in other Member States this is currently not the case. There is no information available on the size of the costs.

All OTTs (regardless of the technology used) will experience an increased administrative burden in relation to complying with rules on security and privacy and this may imply that some of the current OTT business models may need to evolve. There is no information available on which to base a concrete estimate of this burden.

6.4.2.4 Governance

The preferred Governance option (option 3) envisages that the responsibilities of all NRAs would be aligned with that of BEREC, and would therefore cover inter alia issues relating to sector specific consumer protection. Alignment of governance mechanisms as well as maximum harmonisation and greater co-ordination at EU level is likely to benefit OTT players which frequently operate in a multi-national or even global environment.

6.4.2.5 Overview table

The following table provides an overview of the practical implications of the preferred options on OTT players and other non-telco users of electronic communication networks.

[352] SMART 2013/0019 and addtional interviews with NRAs in relation tot his study.
[353] As indicated in the answers to the consultation by an Italian telecom operator

Table 21 - Summary of impacts on OTT

	Changed obligations	Practical implications	Costs
Access	Na	Na	na
Spectrum	Na	Na	na
USO	Na	Na	na
Services and numbering	**For E.164 OTTs** - Interoperability - Interconnections - Portability - Access to emergency services **For all OTTs** - Privacy & security - Content portability	Interoperability and interconnection are currently already in place. switching and portability procedures currently existing for EC(N)S need to implemented by OTTs that interconnect with E.164 Privacy and security obligations need to be implemented by all OTTs	Extended obligations may entail some additional costs. No detailed estimate possible
NRA financing	OTT potentially captured within levies for financing NRAs, where relevant	Additional administrative obligations and costs	Costs for NRA financing likely to vary by member state, but experience suggests limited. No detailed estimate possible
Governance	Alignment of responsibility for sectoral service regulation	May affect relevant bodies for engagement in certain MS	Streamlining of consumer protection responsibilities and increased EU-level guidance should allow reduced engagement cost

6.4.3 SMEs

6.4.3.1 Access and SMEs

Micro enterprises and smaller enterprises outside central business districts (including small businesses in rural areas) are likely to be important beneficiaries of strategies which boost the widespread deployment of fibre, as these organisations may today be under-served compared with larger corporations which may already have fibre connectivity installed to their premises. For example, the UK NRA Ofcom found in the context of research conducted in 2015[355] that a significant minority of SMEs had had less favourable experiences with broadband, including a lack of widespread superfast broadband availability, a concentrated retail market structure, and dissatisfaction in relation to quality of service.

In addition to potentially benefiting from the installation of higher speed broadband, small businesses should benefit from a choice in high speed offers either as a result of infrastructure competition or otherwise through co-investment or regulated access (in the absence of co-investment offers). Competition in standard broadband services via regulated access will also remain. Small businesses which have or aspire to multi-national operations should also benefit from measures to ensure consistent product and service specifications, which should increase competition in the provision of cross-border services in addition to supporting seamless service characteristics.[356]

The preferred option for access envisages that payments for newly installed very high capacity connections in rural areas (which might not otherwise be economic) could be defrayed over a longer period than 24 months, [357] while maintaining the current rules for contract duration for service contracts. This could support affordability of VHC connections for SMEs that may not be able to pay high costs up front. It is not envisaged that the potential for longer term payments for the installation, would impact customers' rights as regards switching service providers.

Finally, the provisions on mapping of quality of infrastructure, will have a positive effect on SMEs, as they entail the publication of this data. Businesses will therefore be able to gauge in advance the status of connectivity (by means of line-specific tests and not by headline speed) in a given area. This will be useful for instance when setting up a new business or relocate an existing one.

There are few electronic communication network providers that could be characterised as SMEs with fewer than 250 employees, as the capital and resources required to install and operate networks mean that most providers are larger in scale. However, smaller players may exist, for example in the installation of regional networks or the provision of targeted electronic communication services, and certain providers with scale across the EU such as suppliers of business communications, may nonetheless operate at small scale in individual national markets. These providers would in principle be subject to the same rules as other electronic communication providers with attendant advantages and costs as described in section 4.5 except that, as today, NRAs are required to ensure that obligations are '*proportionate* and justified' in light of the objectives.[358] More specifically, smaller regional fibre investors are likely to benefit from an increased focus on infrastructure competition and infrastructure mapping to avoid overbuild, while business providers (which may have small scale in individual countries) will benefit from standardised wholesale offers. Smaller alternative operators serving the mass market which rely primarily on regulated access will be able to continue to offer competitive broadband services at standard speeds (on the basis of regulated wholesale access in cases where SMP persists). However, they may be less well placed to invest or co-invest in their own VHC network infrastructure than larger scale players.

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[355] http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/sme/bb-for-smes.pdf
[356] The impacts of consistent wholesale offers are described in more detail in SMART 2014/0024
[357] The currently allowed period under Article 30(5) Universal service and User Rights Directive
[358] Article 8 Access Directive

Smaller OTT players are not directly affected by network access obligations, but would benefit from the additional capacity that may result from the focus on supporting infrastructure deployment.

6.4.3.2 Spectrum and SMEs

Under the preferred spectrum option, a greater focus on general authorisations over individual licenses has the potential to open up spectrum resources to smaller companies which are not at present able to purchase exclusive access. In addition, many of the end-user businesses which will benefit from accelerated access to spectrum and introduction of 5G will be smaller companies. By opening access to spectrum resources and accelerating 4G and 5G coverage across the Digital Single Market, the preferred spectrum option will facilitate innovation and entrepreneurship which benefits primarily (though not only) start-ups and smaller companies. For instance, there might be companies aiming to bring innovative new applications to market that rely on 5G availability and reliability in sectors such as utilities, automotive and transportation or e-health.

6.4.3.3 Universal service and SMEs

There are likely to be few implications of the universal service option on SMEs as the proposals aim specifically to target broadband affordability for remote or vulnerable consumers. However, affordable broadband home connections may also support the development of self-employment and micro-organisations.

6.4.3.4 Services and SMEs

The preferred option as regards services creates more equality in regulatory treatment as obligations on security and privacy and content portability would now apply to all types of communication services (telecom and OTT), regardless of how they are provided. There may be some costs to smaller OTT providers which would need to meet extended obligations (which are difficult to quantify). However, the changes would also provide greater regulatory certainty for all players, as well as increased trust for SMEs as end-users of OTT services, potentially thereby supporting increased take-up of OTT services including European OTT start-ups.

A further important benefit which is especially relevant to OTT start-ups is the proposal to apply full harmonisation for sectorial consumer protection rules. This should reduce barriers for scaling up in Europe (by reducing regulatory heterogeneity) to the benefit of start-ups entering as new players shaping the IoT value chain. As users of communication services, SMEs are not covered by horizontal consumer protection rules, yet they still enjoy a certain degree of protection through competitive markets. Furthermore, SMEs in new digital value chains (e.g. IoT) enjoy more trust and predictability as regards the scope of the Regulatory Framework, contributing to confidence in future planning and investment. SMEs in all sectors will be more inclined to embrace IoT applications and services as these can now be purchased at lower prices and higher quality (including better guarantees for being always and everywhere online). This will give more room for innovations by SMEs within the IoT value chain as well as in other sectors.

6.4.3.5 Governance and SMEs

Changes to Governance will not impact SMEs directly, but may benefit cross-border operations for smaller businesses supplying and using electronic communications services by ensuring consistent application of the rules and by requiring interaction with fewer interlocutors.

6.4.3.6 Overview table

The following table summarises the changes obligations per subject area and associated practical implications and costs.

Table 22 - Practical implications of preferred options for SMEs

	Changed obligations	Practical implications	Costs
Access	- Greater infrastructure competition focus involving duct access, symmetric rules, incentives for co-investment, long-term commitment - Potential for longer contract duration for connectivity - Obligations for the publication of broadband QoS data - Standardised wholesale remedies for business end users	- Greater access to and choice in high quality broadband connectivity - Improved affordability for fibre connections through defraying connection charge - Better availability and competition in cross-border business connectivity (also benefiting providers) - Greater transparency on line quality - Smaller electronic communication providers may be less well placed to invest or co-invest in infrastructure	- na
Spectrum	- Faster access to spectrum - Greater use of general authorisations rather than individual licenses	- Lower cost and improved potential for smaller firms to access spectrum - Facilitate innovation and entrepreneurship amongst services relying on 5G and future generation wireless technologies	- na
Services and numbering	- Clarity with regards to the scope of the Regulatory Framework - More equivalence in approach to ECS and OTT providers offering ostensibly equivalent services - Maximum harmonisation: - Less obligations regarding ECS: • Transparency • Contractual rights • QoS • Dispute resolution - More obligations regarding IAS • Transparency • QoS	- For SMEs as customers - Greater predictability and trust amongst SMEs as users of ECS and OTT - Improved transparency, affordability and quality concerning IAS - Less barriers to embrace new digital applications and services (notably IoT). - The reduction in sector specific obligations (regarding ECS) may impact negatively on SMEs since equivalent horizontal obligations only apply to consumers. However,	- Extended OTT obligations and potential contribution to NRA financing may imply some cost increases for SME suppliers – level difficult to estimate - Max harmonisation for consumer protection should reduce compliance costs

	• Switching - Potential contribution to NRA admin costs - Clearer and Improved arrangements for permanent roaming and extra-territorial use of numbers	SMEs will enjoy protection through competitive markets. For SMEs as suppliers - Increased consistency and reduced barriers to cross-border provision - Potential contribution to NRA (but may be subject to threshold) - Potential new obligations (in relation to E.164 interconnection, as well as privacy and security)	
USO	Sectorial contributions excluded for broadband USO	Reduced contributions for SMEs as suppliers	- Potentially reduced costs for SME suppliers in member states which applied sectorial financing
Governance	- Alignment of responsibility for consumer protection and market-shaping spectrum regulation	Increased coherence in fixed, mobile and service regulation, greater consistency	- Greater consistency may reduce administrative cost for multi-national companies

6.4.4 Consumers

6.4.4.1 Access and consumers

Consumers in countries and areas currently lacking infrastructure competition (including rural areas) are likely to be the main beneficiaries of measures to support the deployment of VHC networks. This may lead to the availability of broadband services with significantly higher quality than is available today. In addition, consumers will benefit from a continuation of the degree of competition in existing broadband services (as access obligations offering quality levels equivalent to those prior to new infrastructure deployment will remain). This is unlikely to alter the current pricing dynamics for broadband currently experienced in Europe.

From experience in countries such as France and Portugal, it is also expected that consumers will benefit from competition in high speed offers and affordable prices resulting from infrastructure competition or co-investment in very high capacity infrastructure. In cases where infrastructure competition or co-investment does not materialise as expected, such choice can and should also be preserved through regulated wholesale access. Experience from countries which have pursued a similar approach to that advocated in the preferred option, including France, Spain and Portugal, suggests that pricing for VHC broadband is likely to be reasonable.[359]

[359] See SMART 2015/0002

Affordable prices for VHC broadband are likely to be supported not only by competition in the provision of high bandwidth services, but also as a result of continued support for competition in copper-based networks , which is likely to result in 'anchor' prices for standard speeds, which constrain the levels offered for higher speeds. Econometric analysis in the context of SMART 2015/0002 also tend to confirm that access regulation for standard broadband (through local loop unbundling) can have an influence on prices for NGA and VHC broadband, which in turn support take-up.[360]

The preferred option for access envisages to enable the cost of the (network) connection to be defrayed over a longer period than the current contract duration (24 month) while maintaining the current rules for contract duration for service contracts.[361] This could support affordability of VHC connections for customers that may not be able to pay high costs up front. It is not envisaged that the potential for longer term payments for the installation, would impact consumers' rights as regards switching service providers.

Finally, the provisions on mapping of quality of infrastructure, will have a positive effect on consumers, as they foresee the publication of these data. Consumers and businesses will therefore be enabled to know in advance the status of connectivity (by means of line-specific tests and not by headline speed) in a given area. This will be useful for instance when setting up a new business or relocate an existing one or when moving to a new house with additional effects in terms of house prices, repopulation, relocation of economic activity which in turn will drive more demand for connectivity.

6.4.4.2 Spectrum and consumers

While the spectrum options do not directly impact on end-consumers /citizens, greater and faster 4G and 5G coverage will enable consumers across the Single Market to benefit from advanced wireless data services and innovative applications resulting in particular from the deployment of 5G . These applications are likely to cover sectors as diverse as e-health , automotive / transportation and utilities , all of which potentially affect a large share of EU citizens. In addition, common methods for determining coverage obligations and improved connectivity across the DSM will contribute to reducing social inequalities (e.g. by fostering digital inclusion). Finally, the introduction of 5G services is likely to create a significant number of jobs (estimated at 2.39m across the EU)

6.4.4.3 Universal service and consumers

The preferred option for universal service is likely to have positive implications for end-users (and particularly consumers) by reducing the number of unconnected households (currently 20% to 30% of households), especially in rural and remote areas, where cost is the main reason for not subscribing. This would allow for an improved access to essential e-services (eGovernment, VoIP, ebanking etc) and would enhance citizens' social participation and their exercise of fundamental rights, for instance right to information, right to conduct business and right to education. For vulnerable groups of consumers (those on low incomes, elderly, those that are less mobile or less able to leave home due to carer responsibilities), affordable broadband is likely to reduce social isolation, improve sense of community and promote social inclusion.

[360] See SMART 2015/0002 – also discussed in interim presentation slides http://www.wik.org/fileadmin/Konferenzbeitraege/2016/Public_Workshop_April/Public_Workshop_slide_presentation.pdf
[361] Article 30(5) Universal service and User Rights Directive

6.4.4.4 Services and consumers

Suggested measures focussing on potential bundling related lock-in problems and other measures supporting transparency and switching will support end-users' protection and freedom of choice which will have a positive impact in terms of affordability and/or quality for the end-user. People with a preference for privacy, confidentiality and/or security are more likely to be included in participating in popular and innovative communication networks. The options for consumers to reach PSAPs (when technically possible) will increase, however, while only a few OTTs seek to interconnect with the numbering regime, the impact is limited.

Although the number of rules dealing with sector specific consumer protection would reduce, this would not be at the expense of consumer protection. Rules are abolished only if respective consumer issues are sufficiently protected by horizontal rules and/or if they are sufficiently protected by competitive constraints imposed on market players.

6.4.4.5 Governance and consumers

Changes to governance will not impact consumers directly, although consumers will indirectly benefit from greater connectivity, cross-border entry and competition that may result from more effective co-ordination at EU level.

6.4.4.6 Overview table

Table 23 - Practical implications of preferred options for consumers

	Changed obligations	**Practical implications**	**Costs**
Access	- Greater infrastructure competition focus involving duct access, symmetric rules, incentives for co-investment, long-term commitment - Potential for longer contract duration for connectivity - Obligations to publish QoS mapping data	- Greater access to and choice in high quality broadband connectivity - Improved affordability for fibre connections through defraying connection charge - Greater transparency over quality of service	- na
Spectrum	- Faster access to spectrum - Greater use of general authorisations rather than individual licenses	- Greater availability and innovation in services relying on 5G and future generation wireless technologies - Accelerated fast mobile broadband	- na

Services and numbering	- Equivalence in approach to ECS and OTT providers offering ostensibly equivalent services - Measures to reduce bundling-related lock-in - Interoperability, emergency service access and portability requirements for OTT interconnecting with E164 - Less obligations regarding ECS, but More obligations regarding IAS • Transparency • QoS • Switching	- Greater predictability and trust amongst users of ECS and OTT due to extended privacy and security measures - Increased ease of switching in relation to bundled offers - Greater end-to-end connectivity and access to emergency services when using OTT interconnecting with E164 - Improved transparency concerning IAS - Potentially less detailed obligations on some ECS, but practical implications limited since consumer protection would be covered by horizontal rules or addressed through competitive markets. - a positive impact in terms of affordability and/or quality for the end-user	na
USO	- Focus on broadband affordability at least at a fixed location	-Potentially improved access to affordable broadband	na
Governance	- Alignment of responsibility for sectoral service regulation	- Increased ease of engagement, reduced administrative burdens	- na

6.4.5 Member States' authorities

6.4.5.1 MS and Governance

The proposed changes to the EU framework for electronic communications would require transposition into national legislation, and will entail certain changes to the institutional set-up in countries which do not already implement the revised structures and procedures as well as changes at EU level. Specifically, at national level, NRAs remit would be subject to minimum harmonisation (to cover inter alia market-shaping spectrum assignment issues and sector specific regulation in areas such as consumer protection). Likewise, at EU level the preferred option would give BEREC an expanded remit for market-shaping aspects of spectrum assignment and services alongside access, as well as increased responsibilities including responsibility for developing implementing guidelines and an enhanced role in the article 7a process on remedies as well as a peer review role on market-shaping aspects of spectrum assignments. These changes may have the following implications for member states' responsibilities and budget.

Taking into account factors which may reduce costs as well as those which increase them, the preferred option is projected to result in costs which are similar to the status quo (see discussion in the detailed chapter on Governance in SMART 2015/0005). However, in a scenario where the projected efficiencies are only partially achieved, the preferred option could entail additional costs of around €5.5m across the EU28, with costs varying for different countries. The implications of the adapted governance structure on member states' responsibilities and budget are described in more detail below.

6.4.5.1.1 National level

An important change at national level will be the allocation of responsibilities in the field of consumer protection and spectrum awards design under the framework to those NRAs[362] which do not currently have such responsibilities. This affects a subset of member states.[363] If it entails a transfer of responsibilities for existing tasks, cost implications may not be significant.

The preferred option also entails a requirement to ensure appropriate resourcing for NRAs both to conduct their duties at a national level, and contribute to the expanded remit of BEREC.

Additional expenses are expected to vary between member states, depending on the current resourcing available to the NRAs, but across the EU28 overall additional expenses for the resourcing of NRAs are expected to be minimal.

Based on an additional 20FTE from NRAs across the EU28 contributing to BEREC (in addition to the current estimated 49FTE),[364] and a 50% increase in contributions from national authorities[365] to EU spectrum co-ordination (concerning the design of auctions and market-shaping measures), the increased cost to NRAs for BEREC contribution is estimated at €2m in the EU 28 under the preferred option.

Certain NRAs may also need greater resourcing in order to adequately perform duties such as market analyses under the revised framework including the proposed requirement for infrastructure mapping.

[362] Independent National Regulatory Authorities within the meaning of article 3 Framework Directive

[363] According to data from Cullen, NRAs in Denmark, Estonia, Latvia, Malta, Poland and Spain do not currently have responsibility for consumer protection, while NRAs in Netherlands, Spain, Cyprus and to some extent Slovakia and Portugal do not have primary responsibility concerning regulatory aspects of spectrum management

[364] Based on BEREC interview

[365] Today contributions are made to the RSPG by various bodies at national level, but would under the revised framework proposals be made by NRAs as regards spectrum auction design and market-shaping measures

However, as elaborated in the detailed analysis of impacts resulting from changes to the access regime conducted under SMART 2015/0005, the additional mapping obligations are only incremental to the advanced mapping initiatives that already exist in many Member States. Such mapping processes may already have been developed for market analysis purposes, for the implementation of transparency measures required under the Cost Reduction Directive (such as advance notification of civil works) and to meet reporting obligations for identification of white areas through investment mapping before notification of State Aid schemes. Indeed, it would be recommended for those national administrations which have not already done so, to streamline these 'mapping' processes under the remit of NRAs, which should ensure that the assessments are coherent, and may ultimately reduce complexity and cost.

Other policy approaches such as extended market review periods and standardised wholesale specifications for certain products with EU-level relevance, could also be expected to reduce costs for NRAs on average.

Moreover, the introduction of greater co-ordination concerning certain aspects of spectrum assignment, may result in reduced resourcing requirements for the management of spectrum resulting in a reduced overall national burden associated with regulation of the electronic communication sector at national level.

If costs for the application of non-spectrum aspects of regulation are broadly stable (taking into account positive and negative factors), but spectrum-related resourcing could be reduced by an average of 1FTE per member state due to greater co-ordination, the average estimated reduction in national costs for application of the electronic communication framework as a whole would be around €2.6m per annum across 28 Member States, but not necessarily equally distributed, since resourcing levels vary widely.

6.4.5.1.2 EU level

As regards EU co-ordination, the reinforcement of BEREC's responsibilities and its structure to conform with the 2012 Common Approach will entail increased annual costs of an estimated €7m compared with the status quo. This increased cost could be met from the EU budget[366]. The preferred option bundle may also entail increased resourcing requirements for the Commission (especially relating to the proposed spectrum assignments peer review) with an estimated budgetary implication of around €0.6m.

At EU level, Ministries would continue to play a role in comitology bodies such as COCOM.

6.4.5.2 MS and Services

In general, sector specific rules would be followed by the NRA and the attribution of horizontal rules would be at national discretion. Some Member States might opt to give all consumer questions relevant for a sector to the sector specific regulator. Options with regards to numbering and with regards to must carry/EPG do not require actions from ministries, besides transposing new rules (regarding the assignment of MNCs to non-MVNOs, regarding permanent roaming, and regarding extra-territorial use of national numbers) into national law.

6.4.5.3 MS and Universal service

Adoption of Option 3 for universal service will have implications for ministries of some Member States where ministries share the relevant competences with NRAs (for instance, in Austria, Estonia, Finland, France, Italy and Greece). In such countries, powers of ministries will reduce with regard to the definition of the scope of universal service and universal service obligations at the national level,

[366] Some EU agencies are partly financed by fees but no specific tasks carried out by BEREC which could be subject to a fee paid by the beneficiaries of those tasks have been identified.

because Option 3 foresees only PATS and affordable broadband for the scope. Yet, depending on the national distribution of competences, ministries may retain the task of the defining broadband at the national level (for example, by reference to specific communications services) as well as to assess affordability. Nevertheless, flexibility of Member States will be preserved due to a minimum harmonization at the EU level, i.e. the accessible communications services basket can be enhanced at the national level and broadband affordability can be expanded to at least at a fixed location. In addition, if a need is demonstrated at national level, Member States would have the possibility to include the availability component in the universal service obligation and to maintain services, which are currently part of USO at the respective national level (i.e. payphones and accessory services).This potential extension of scope means that coordination and/or guidelines by BEREC may be necessary to ensure consistency of implementation across the EU. There is a further limitation of discretion of Member States as regards the choice between different financing options, if public funding (as opposed to optional funding from the industry) is mandated at the EU level.

6.4.5.4 Overview table

An overview of the impacts for member states is shown in the following table.

Table 24 - Practical implications for Member States

	Obligations	Steps to be taken	Costs
Access	- Extension of market review periods, more detailed reviews (including mapping), harmonised wholesale specifications - BEREC to develop Implementing guidelines on adapted market analysis process and standardised wholesale products	- Ensure adequate resourcing of NRAs to conduct market analyses and contribute to BEREC	Increased costs of ~€2m (+20FTE across EU28) to support NRAs in contributing to BEREC, some increased costs also to ensure effective NRA resourcing where not currently the case, but may be balanced by potential for reduced costs from extended market reviews
Spectrum	- EC to adopt implementing Decisions subject to RSPG input and comitology - BEREC to play role in peer review of spectrum assignment	- Ensure adequate resourcing of NRAs to contribute to BEREC/ RSPG -	Some additional costs to support spectrum co-ordination (see governance), but overall potential saving of approx. €2.6m across EU28 for ECS spectrum management if co-ordination reduces resourcing requirement (by 1FTE) at national level
Services and numbering	- In general, sector specific rules would be followed by the NRA and the attribution of horizontal rules would be at national discretion. Some MS might opt to give all consumer questions relevant for a sector to the sector specific regulator	- Ensure adequate resourcing of NRAs	- Limited impact as the responsibilities of NRAs in enforcing current sector specific obligations can be downsized as a result of the preferred option.
USO	BEREC could collect best practices and develop guidelines for defining broadband and assessing affordability at the national level	NRAs already have significant responsibilities on technical implementation of universal service, only a (slight) adjustment of them will be necessary	The overall cost of specifically attributing US implementation responsibilities to NRA is likely to be neutral
Governance	- Harmonised minimum remit for NRAs to include consumer protection and market shaping aspects of spectrum - Expanded remit for BEREC to encompass consumer protection, spectrum and alignment of structure with Common Approach - Peer review process for spectrum (involving BEREC, EC)	- Transfer responsibilities for consumer protection and market shaping aspects of spectrum to NRAs (where not already lying with independent NRA) - Potential increased contribution to BEREC and EC costs -	Cost of transferring responsibilities between national authorities may be limited Estimated increased costs of reinforced EU co-ordination ~€4.4m for enhanced BEREC, and ~€0.6m for Commission (although potential national savings from spectrum co-ordination described above)

6.4.6 National regulatory authorities (NRAs) and spectrum regulatory authorities (SRAs)

Under the preferred option bundle, NRAs will have full responsibility for implementation of regulatory rules under the EU framework for electronic communications including those associated with consumer protection and market-shaping aspects of spectrum assignment. This will entail an expanded remit and associated resources for those NRAs which do not already have these responsibilities. [367] NRAs will also need to make additional contributions to the output of an enlarged BEREC. This may have the following practical implications.

6.4.6.1 NRAs and Access regulation

As regards implementation of the framework at a national level, the market analysis process will be adapted to include infrastructure mapping, greater consideration of duct access and clarifications in relation to the application of symmetric obligations, as well as co-investment and other commercial arrangements, prior to mandating obligations for access on the basis of SMP. NRAs can already adapt market analysis processes on a voluntary basis to reflect this approach, but will be obliged to follow this approach in the reviews subsequent to the adoption of the revised EU framework for electronic communications. These additional considerations – and especially mapping and the potential greater focus on duct access and symmetric remedies may imply additional effort and resource for those NRAs which have not already undertaken such analysis, especially in the first review process following the application of the revised framework. However, many NRAs or regional authorities already conduct mapping assessments thereby reducing the additional burden entailed by such an obligation (see SMART 2015/0002 and section 2 (access) of the detailed Impact Assessment, while the required effort in relation to duct access and symmetric remedies should be reduced in subsequent reviews.

The preferred option also provides a role for NRAs in identifying 'challenge' areas and will enable them to implement a system whereby operators could be penalised for failing to abide by deployment commitments where this results in overbuild rendering the infrastructure investments of alternative operators unviable. This may result in greater engagement by NRAs with the process of broadband state aid allocation, which also involves the identification of areas in which NGA deployment is unlikely.

However, in addition to measures which may increase resourcing requirements for certain NRAs, there are measures which are likely to reduce the effort needed . Market reviews will be required only every 5 years as opposed to 3 years as currently,[368] and the introduction of standardised wholesale remedies for example in relation to business access, will avoid duplicate processes for the specification of new wholesale remedies, and simplify the imposition of remedies (in cases where such remedies would be appropriate).

NRAs will need to be effectively resourced not only to fulfil their national functions under the electronic communications framework, but to contribute to an expanded BEREC, which will have responsibility for the development of implementing guidelines as regards issues such as infrastructure mapping and the development of standardised wholesale offers to support business communications. NRAs would also contribute via BEREC to an updated article 7a process whereby a Commission veto on remedies would be possible in circumstances where BEREC agrees.

Some of the changed requirements are likely to result in increased budgetary and resourcing requirements for a subset of NRAs. These include obligations to ensure adequate resourcing, responsibility for market shaping aspects of spectrum and consumer protection (where not already the

[367] According to data from Cullen, NRAs in Denmark, Estonia, Latvia, Malta, Poland and Spain do not currently have responsibility for consumer protection, while NRAs in Netherlands, Spain, Cyprus and to some extent Slovakia and Portugal do not have primary responsibility concerning regulatory aspects of spectrum management

[368] The 2014 Recommendation on Relevant Markets susceptible to ex ante regulation also involves two fewer markets than the previous 2007 Recommendation, which should also entail reduced effort as the markets removed from the list are progressively deregulated

case), and the requirement to conduct robust mapping exercises in relation to market analyses (where not already the case). Additional contribution to BEREC would also need to be resourced.

However, many NRAs already have sufficient resourcing, scope and undertake detailed mapping, and as discussed there are other aspects of the preferred package that may result in cost savings. Cost implications for changes to NRA duties under the preferred option (excluding spectrum) may therefore be considered neutral on average, although with variations amongst member states.

6.4.6.2 NRAs and Spectrum

In terms of the preferred spectrum option, NRAs would also need to have sufficient resources to deal with the spectrum assignment selection processes and the related peer review and to engage with BEREC accordingly. However, increased co-ordination of certain aspects of spectrum assignments at EU level, may allow for cost savings in spectrum management to be made at national level. For example, an estimated €2.6m could be saved across the EU, if greater spectrum co-ordination permitted a reduction in spectrum management staffing of 1 FTE per member state.

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6.4.6.3 NRAs and Electronic Communication Services

Under the preferred option, NRAs indicate that the impact on enforcement costs for consumer protection is not a major issue. Abolishing the rules that overlap with horizontal rules would not bring any savings in terms of the enforcement costs; either because they are currently already enforced by competent authorities or because MS may decide to give responsibility for enforcing horizontal rules to the NRA. Moreover, while NRAs may reduce a number of activities related to transparency and QoS monitoring in relation to ECS, a number of these activities need to be re-introduced to enforce similar type of obligations imposed on IAS.

The obligations imposed on OTTs that provide communications services with regards to security and privacy may require additional activities to guide OTTs in implementing obligations (which may include legal enforcement activities). While OTT business models are EU-wide it may require coordination of activities at BEREC. The preferred option as regards numbering makes current procedures with regard to permanent roaming and extra-territorial use of numbers much more efficient. This may require an increase of activities as it may lead to more applications for permanent roaming and extra-territorial use of numbers. Moreover, the ability of non-M(V)NOs to apply for MNCs may also require more resources for NRAs. With regards to must carry and EPG, there is no impact on NRAs.

6.4.6.4 NRAs and Universal service

Where all universal service related competences lie with NRAs (i.e. not shared with ministries) and, hence, NRAs are responsible for the precise development of national universal service scope and obligations, all the concerns expressed in section 4.5 apply. This also means that coordination via BEREC may be necessary to ensure consistent implementation of universal service with regard to the defining broadband and assessing affordability. In particular, BEREC could provide guidance in identification of communications services accessible via broadband, establishment of necessary transmission speeds and QoS requirements.

Introduction of public funding of the universal service provision could require BEREC guidelines for NRAs on the technical aspects of financing. Overview table

An overview of the implications for NRAs is shown in the following table.

Table 25 - Practical implications for NRAs/SRAs

	Obligations	Steps to be taken	Costs
Access	- Longer market review periods, requirement to demonstrate retail failure - Infrastructure mapping with commitment in challenge areas' - Greater infrastructure competition focus involving duct access, symmetric rules, incentives for co-investment, long-term commitment - Standardised wholesale remedies for business	- Implement revised market analysis process in market reviews following application of the framework to be conducted on 5 yearly basis. - Conduct infrastructure mapping exercises (where not already implemented) - Investigate and where appropriate apply measures to make duct access and symmetric access to non-replicable assets effective - Include additional assessment e.g. of co-investment, commercial offers, prior to imposition of any additional SMP remedies - Implement standardised wholesale solutions (after adoption and following suitable period)	Difficult to precisely estimate and likely to vary between NRAs as some may already comply with the spirit of the preferred option, while others require further resourcing in order to do so. Given balance between positive and negative cost impacts, overall impact may be neutral
Spectrum	- Negotiate assignment criteria and usage obligations which would form part of EC implementing decisions - Adopt system promoting general authorisations over individual licenses	- Take on new responsibilities and provide necessary resources - Engage with spectrum advisory board	- Greater EU co-ordination in spectrum assignment processes and licence conditions requires additional engagement with RSPG but may allow cost savings estimated at ~€2.6m based on reduction of 1FTE per SMA on average - Transfer of certain spectrum competences to NRAs in countries where not already the case considered cost neutral

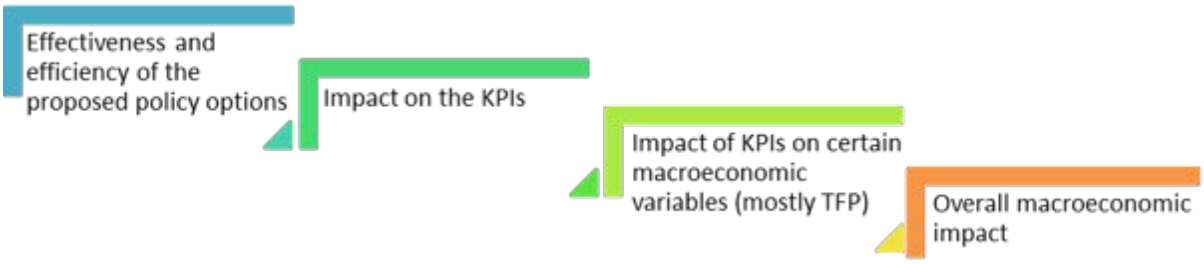
Services and numbering	1. Enforcement of obligations on IAS and ECS 2. Assist OTTs in implementing security and privacy obligations 3. Enforcement of new OTT obligations 4. Operationalise new (more efficient procedures) regarding roaming and extra-territorial use 5. Clear possibility to assign numbers to non-M(V)NOs	1. Adapt activities in enforcement of some IAS and ECS obligations 2. Interact with OTTs, coordinate with BEREC, legal challenges. 3. Integrate enforcement of OTT obligations into current operations 4. Intensify cooperation between NRA's as the relevance of cross border aspects may increase 5. Increase resources as number of applications may increase	• Net impact of 1 and 2 is likely zero • Impact of 2 is mostly during a brief transition period following implementation of option 3. It requires coordination with other NRAs and may involve legal challenges. • Impact of 4 is negligible • 4 and 5 may require some additional resources because increased efficiency may lead to an increase of the number of applications (where the current nr of applications is close to zero)
USO	BEREC could collect best practices and develop guidelines for defining broadband (for instance, via a list of accessible services) and assessing affordability at the national level BEREC to develop methodology for calculation of net cost and unfair burden	NRAs already have significant responsibilities on technical implementation of universal service, only a (slight) adjustment of them will be necessary	The overall cost of specifically attributing US implementation responsibilities to NRA is likely to be neutral
Governance	- BEREC to develop Implementing guidelines on adapted market analysis process and standardised wholesale products - EC to adopt implementing Decisions subject to RSPG input and comitology - Double-lock veto on draft SMP remedies under Article 7 - BEREC to play role in peer review of spectrum assignment	- Contribute to expanded BEREC and RSPG responsibilities	~€2m per year (for an additional 20FTE) contributing to BEREC (over current estimate of 39FTE) and some additional contribution to RSPG

6.5 ANNEX 5 - Analytical models used in preparing the impact assessment.

6.5.1 Modelling the gains from intervention

The impact of the preferred policy options is estimated quantitatively using a mix of econometric and computable general equilibrium (CGE) techniques. The algorithm for performing the impact evaluation is presented very generally in the figure below. As a first step, the evaluated impact in terms of effectiveness and efficiency of the proposed policy measures is translated into quantitative (where possible) key performance indicators (KPIs).

To provide a link between the KPIs and the macroeconomic framework, econometric estimates of the effect of the indicators on certain macroeconomic variables are performed. These are complemented by other estimates, based on relevant economic literature. Finally, the evaluated impacts are fed into the CGE modelling framework as an input shock and the effects are multiplied and spread across the entire economy through the model system of equations. The impact is evaluated quantitatively by means of comparison of a baseline (largely extrapolation-based) and relevant alternative scenarios for the preferred policy options in each of the considered policy areas.



The choice of a CGE modelling framework for the estimation of the macroeconomic gains from intervening is justified by the suitability and widespread use of this type of models for evaluation of the impact of policy interventions. As the behaviour of various economic agents, such as consumers and different businesses, is explicitly modelled, this framework provides also estimations on the impact of the evaluated changes on different types of stakeholders, as well as the economy as a whole (through aggregate measures such as GDP or welfare). As the model is recursively-dynamic in its nature, it allows us to estimate also the transition paths for the macroeconomic variables, where, for the purposes of the current impact assessment, we have considered the cumulative impacts up to 2025.

6.5.2 Assumptions and limitations of the modelling approach

The modelling approach relies on the assumptions that the selected KPIs reflect sufficiently enough the expected developments in each policy area and that the estimated econometric relationship with the total factor productivity (TFP) will not change as a result of the implemented policies. The implementation of a CGE framework is also based on the following assumptions:

- No change in the input-output structure of the economies modelled. As already discussed, in the context of the current evaluation this implies that the estimated impacts are very conservative, where there is potential for higher benefits in case of disruptive technologies and innovations.
- Constant share of public investment with respect to the gross value added in the absence of policies
- Constant share of sectorial public investment with respect to the total capital expenditures of the government in the absence of policies

- Assumptions about important model parameters, which are presented in detail below in the current macroeconomic modelling annex. They are calibrated in order to ensure a plausible trajectory of the macroeconomic variables in the baseline.
- Also, in order to present estimates of the magnitude of the estimated impacts in nominal terms, we have also adopted the assumptions that in the baseline scenario annual GDP growth in the EU will be 2%, while employment will increase by 0.3% per annum and finally, that annual growth in gross fixed capital accumulation will be around 5%.

More generally, it is important to note that there are limitations on what can be estimated on the basis of the model. Specifically, we note that the implementation of the preferred policy options might have a significant boost on innovation and ultimately lead to disruptive growth. By their definition, however, such structural economic changes cannot be estimated ex ante. Therefore, the estimates presented below should be treated as a lower bound on might be practically achievable in case the implemented policies facilitate the development and application of disruptive technologies with an important implications on a wide variety of businesses and, eventually, on the economy as a whole.

The achievement of a structurally different economic growth however will be strongly dependent on the ability of the business to absorb efficiently and effectively new technologies and benefit to the highest extent from the competitive advantages such technologies might provide. More generally, the impact of the proposed policies will be also contingent on the application of relevant innovation policies.

Finally, as a recommendation for an ex post impact assessment, a dynamic study of the behaviour of the various businesses at firm level before and after the introduction of the proposed policy changes in the e-communication regulatory framework and the respective legislative and institutional setups might provide useful insights. Also, if feasible, a large scale study with richer regional specifications might have high value added, as territorial variations might prove significant.

6.5.3 Impact of the proposed policy options on the KPIs

6.5.3.1 Access

The economic literature recognizes the positive effect of improved broadband access and uptake for achieving higher productivity and economic growth. Policy options in this domain relate to measures fostering the adaptation of the existing infrastructure to be 'fibre-ready' and provide stimulus for the development of the single market.

While the implementation of the policy options will be associated with significant CAPEX costs and transition periods, they should also lead to higher-speed broadband access and improved business and consumer climate.

6.5.3.2 Spectrum

As pointed out in the relevant section, spectrum has important implications on the deployment on mobile and fixed wireless networks, as well as on mobile competition, thus on the quality and prices of the services provided. Policy options, related to spectrum consist mainly of different degree of harmonization (more or less binding rules) of the regulatory framework on spectrum management, ranging from maintenance of the current status quo to full harmonization.

The enhanced harmonization of the spectrum regulations should lead eventually to higher speed due to realized economies of scale and investments and improved transparency and certainty for the end consumers.

It will, however, also lead to higher regulatory costs and various implementation-related expenditures. It will require a certain transition period and, in case of higher harmonization, will reduce the flexibility of the national authorities to conduct policies.

6.5.3.3 Services

Electronic communication services regulations need to be streamlined to level the playing field for all market participants, while ensuring the safe and continuous provision of the services. Various policy options are being considered, related mainly to identification of redundant regulations and/ or extension of some of the existing rules to all market participants and specification of the role of the National Regulatory Authorities and of BEREC.

The implementation of the envisaged measures might cause some additional administrative costs but should in the end promote competition in the sector and, at the same time improve the business climate through optimized regulation. In the end consumers are expected to benefit from higher quality and more securely provided e-communication services.

The problem with the must carry and EPG is also related to the provision of e-com services. However, the regulation of the access of public service broadcasters to online platforms falls out of the E-communication regulation and will not be considered in the current impact assessment.

6.5.3.4 Numbering

The problem with the numbering is closely related to the observed trend of expansion of the M2M applications and possible negative implications of solutions implemented only at national level. The policy options considered are related to the establishment of a common basis for extra-territorial use of national numbers throughout the entire EU and the use of M2M across borders.

Implementation costs for some of the policy options considered might be significant, but they should eventually lead to a boom in the development of M2M applications and, thus of innovations and economic growth.

6.5.3.5 Universal Services

Universal services have important social impacts and therefore it is essential to ensure that their scope and coverage is aligned with the societal and technological developments. The policy options considered in this respect comprise of exclusion of certain services from the US scope, which have become redundant (payphones, directories and directory enquiry services), inclusion of broadband affordability and, possibly, availability and, thirdly, adjustments in the pool of US contributors.

Optimizations in the scope of the universal services and contributors will enhance efficiency and effectiveness in the provision of these services, leading possible to lower financial burden for the contributors and better alignment of the US with the current technological, societal and economic developments in the EU.

6.5.4 Impact of the KPIs on some macroeconomic variables

The literature review of the impact of the various policy areas considered under this study, shows a multitude of studies assessing the effect from broadband access and uptake and some evidences on the impact of 4G on economic growth, productivity and employment. Estimations of the macroeconomic impact of high-speed broadband are however still limited in number and scope.

As can be inferred from the introductory section to this annex, the approach followed consists of estimation of the impact mainly on total factor productivity (TFP) and predominantly the effect from it to the other macroeconomic variables through the CGE model. To this end, we have constructed a two-factor productivity function, where economic growth is explained by the contribution of capital (public and private) and labour (skilled and unskilled). Contrary to the typical estimation of the TFP as a residual in the production function, we have adopted the approach, used in GSMA and Deloitte (2012)[369], where Stochastic Frontier Analysis (SFA) is used to proxy total factor productivity as a measure of efficiency. The main advantage of this approach to TFP estimation is that it allows for

[369] GSMA and Deloitte, 2012, "What Is the Impact of Mobile Telephony on Economic Growth?", Report prepared for the GSM Association, available at: http://www.gsma.com/publicpolicy/wp-content/uploads/2012/11/gsma-deloitte-impact-mobile-telephony-economic-growth.pdf .

decomposition of the TFP into two analytically useful components: 1. technical progress over time and 2. different efficiency levels, measured as deviations of the respective economies from the (maximum achievable) production frontier.[370] The results of the SFA estimation are given below.

As a first step, TFP was estimated by regressing GDP in volumes against the two typical production factors – capital (CAP) and labour ($EMPL$), respectively measured as cumulative investments, assuming a 10% depreciation rate, and employment. The remaining variables take into account the economic crisis after 2008 (dummy variable $dCRISIS$), evolution of the GDP in time ($Time$), i.e. technical progress, a constant (Intercept) and country fixed effects. The parameter $Gamma \in [0,1]$ estimates the proportion of total residual variance, which is attributed to inefficiencies. Meanwhile $sigmaSq$ measures the sum of the variances in the error components (inefficiency and statistical noise).[371]

Variable	Estimate	Significance	Variable	Estimate	Significance
(Intercept)	3.37	***	**FI**	0.07	*
log(CAP)	0.09	*	**FR**	-0.10	
log(EM)	0.97	***	**HR**	-0.83	***
dCRISIS	-0.03	***	**HU**	-0.89	***
sigmaSq	0.00	**	**IE**	0.27	***
Gamma	0.80	***	**IT**	-0.24	**
Time	0.13	***	**LT**	-0.78	***
BE	0.09	***	**LU**	1.04	***
BG	-1.62	***	**LV**	-0.87	***
CY	-0.24	.	**PL**	-0.98	***
CZ	-0.72	***	**PT**	-0.63	***
DE	-0.26	*	**RO**	-1.35	***
DK	0.22	***	**SE**	0.13	***
EE	-0.72	***	**SI**	-0.46	***
EL	-0.39	***	**SK**	-0.68	***
ES	-0.35	***	**UK**	-0.22	*

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The results indicate much bigger elasticity of output to labour (0.97) as compared to capital (0.09) and show returns to scale, which are close to constant (the sum of the coefficients in front of capital and labour inputs is 1.06). If estimated only on the subset of Eurostat data for 2000-2007, the elasticities of output to capital and labour are much more balanced, standing respectively at 0.45 and 0.46. The

[370] The method and data used are described more in length below in the chapter devoted to the Elaboration of the methodology.

[371] Technically, $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and $= {\sigma_u^2}/{\sigma^2}$, where are the variances in the assumed distributions of the inefficiency (u) and statistical noise (v) components in the error term.

estimation results show a positive time trend in national income with an elasticity of 13% and the downturn from 2008 is estimated to provide a negative contribution to GDP of around 3%.

The mean efficiency for the dataset, including 28 EU MS in the period between 2000 and 2015 stands at 0.88, where fixed effects are calculated negative mostly for the converging economies (highest for Bulgaria and Romania) and positive for the highest income countries in the EU – Luxembourg and Denmark, but also for Ireland.

Once efficiencies are estimated, they are used as proxy for the total factor productivity and are regressed against:

- Heritage index of economic freedom $heritage_{rt}$, which is mostly used as a proxy of the regulation effectiveness and efficiency and, more generally of the business and consumer climate.
- 4G mobile broadband coverage (as % of all households) mbb_ltecov_{rt}
- Average broadband connection speed $speed_{rt}$

Finally, as no data for Croatia was available for the speed of connection, it was excluded from the estimation panel.

Variable	Estimate[372]	Significance	Variable	Estimate	Significance
log(heritage)	0.225	***	**HU**	-1.176	
log(mbb_ltecov)	0.003	**	**IE**	-1.210	
log(speed)	0.021	***	**IT**	-1.099	
AT	-1.169		**LT**	-1.285	
BE	-1.166		**LU**	-1.187	
BG	-1.207		**LV**	-1.253	
CY	-1.142		**MT**	-1.160	
CZ	-1.216		**NL**	-1.191	
DE	-1.174		**PL**	-1.212	
DK	-1.193		**PT**	-1.153	
EE	-1.234		**RO**	-1.263	
EL	-1.091		**SE**	-1.200	
ES	-1.153		**SI**	-1.163	
FI	-1.179		**SK**	-1.224	
FR	-1.137		**UK**	-1.191	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The estimation results indicate significant impact of economic freedom of the total factor productivity (elasticity of 0.225), including also important governance aspects. Higher broadband speed and expansion of the LTE mobile broadband also turned out to be statistically significant, though their coefficients are much lower - 0.021 and 0.003 respectively.

[372] The country fixed effects are all negative due to the lack of constant in the equation specification.

In addition to the results for the entire economies, sectorial production functions were also estimated. As sectorial breakdowns for Croatia were not available on the Eurostat website, it was excluded from the panel. The table below summarizes the results of the estimates performed for the seven sectorial aggregates that are incorporated in the CGE model for estimation of the macroeconomic impact[373].

Variable (in logs)	TOTAL		AGR		LOWMAN		HIGHMAN		ENERGY	
heritage	0.225	***	0.300		0.058		-0.163	*	0.107	
mbb_ltecov	0.003	**	0.001		0.005	**	0.003	**	-0.006	
speed	0.021	***	-0.078	***	0.032	***	0.035	***	-0.136	***

Variable (in logs)	TRANS		TELECOM		ECOM		SER	
heritage	0.0000002		-0.123		-0.412	*	0.141	.
mbb_ltecov	-0.00000004	**	-0.020		0.012	***	0.003	*
speed	-0.0000009	***	-0.139		0.072	***	0.012	**

Sector abbreviations: AGR – agriculture, LOWMAN - low-tech manufacturing, HIGHMAN - high-tech manufacturing, ENERGY - energy sector, TRANS - transport, TELECOM - telecommunications, ECOM - other electronic communication-related services, SER - Other services.[374]

Based on these estimates, we have assumed the following coefficients for the impacts in the CGE model, taking into account both the statistical significance of the coefficients and the logics behind the estimates. The table below summarizes the elasticities of the total factor productivity to the KPIs, used for the subsequent estimations:

Variable (in logs)	AGR	LOWMAN	HIGHMAN	ENERGY	TRANS	TELECOM	ECOM	SER
heritage	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
mbb_ltecov	0.003	0.005	0.003	-0.00000004	-0.00000004	0.003	0.012	0.003
speed	0.021	0.032	0.035	-0.0000009	-0.0000009	0.072	0.072	0.021

As estimated, the impacts of connection speed and 4G mobile broadband coverage on the sectorial total factor productivity is higher in the e-communication services (ECOM and TELECOM) and manufacturing and much less – in transport and energy sectors.

6.5.5 Overall macroeconomic, social and environmental impacts

Having established a link from the policy options, through the KPIs to some macroeconomic variables and parameters allows us to perform an overall macroeconomic impact assessment. To this end, we have constructed a CGE model, which is run for the three modelled economies (Germany, Czech Republic and Bulgaria), selected based on a cluster analysis, taking into account the digital and economic development and the size of the economies.

[373] Estimates in grey are not statistically significant.
[374] The definition of the sectors is discussed in length in the section, describing the structure of the CGE model.

Each of these three economies is inhabited with a government, eight production sectors and a single representative household, maximizing its utility from consumption, skilled and unskilled labour and savings, given its budget constraint. The economic sectors comprise of agriculture, low-tech manufacturing, high-tech manufacturing, energy, transport, telecommunications, other electronic communication-related services and other services. Each of them maximizes its profit, based on its production technology. The government is formalized through its budget constraint. The link with the foreign sector is made through the invest-savings balance. Armington and constant elasticity of transformation aggregation functions are used to determine the quantity and relative price of the imports and exports.

The model is static in its essence, as all optimizing agents choose their optimal values only for the current period. However, the model features also some transitional dynamics, defined through the capital accumulation equation and an equation for total factor productivity growth.

The quantitative modelling approach can be schematically presented as in **Error! Reference source not found.**. The next **Error! Reference source not found.** presents an overview of the impact mechanisms of the preferred policy options. To simulate the impact of the preferred policy options on the economy, shocks to the TFP have been introduced. Their magnitude is estimated based on the expected size and timing of the of the respective KPIs and their identified econometric relationship with TFP. Most of the shocks were introduced in 2020 and had impact already in 2021. Exceptions include accelerated fibre scenario, where impacts begin to be felt in 2019 as market analysis processes are voluntarily adapted in anticipation of the modification of the electronic communications framework and the 5G spectrum scenario, where impacts are not experienced before 2021, on the expectation that 5G technologies will not be ready for service before that date.

Figure 30 - Overview of the quantitative modelling framework

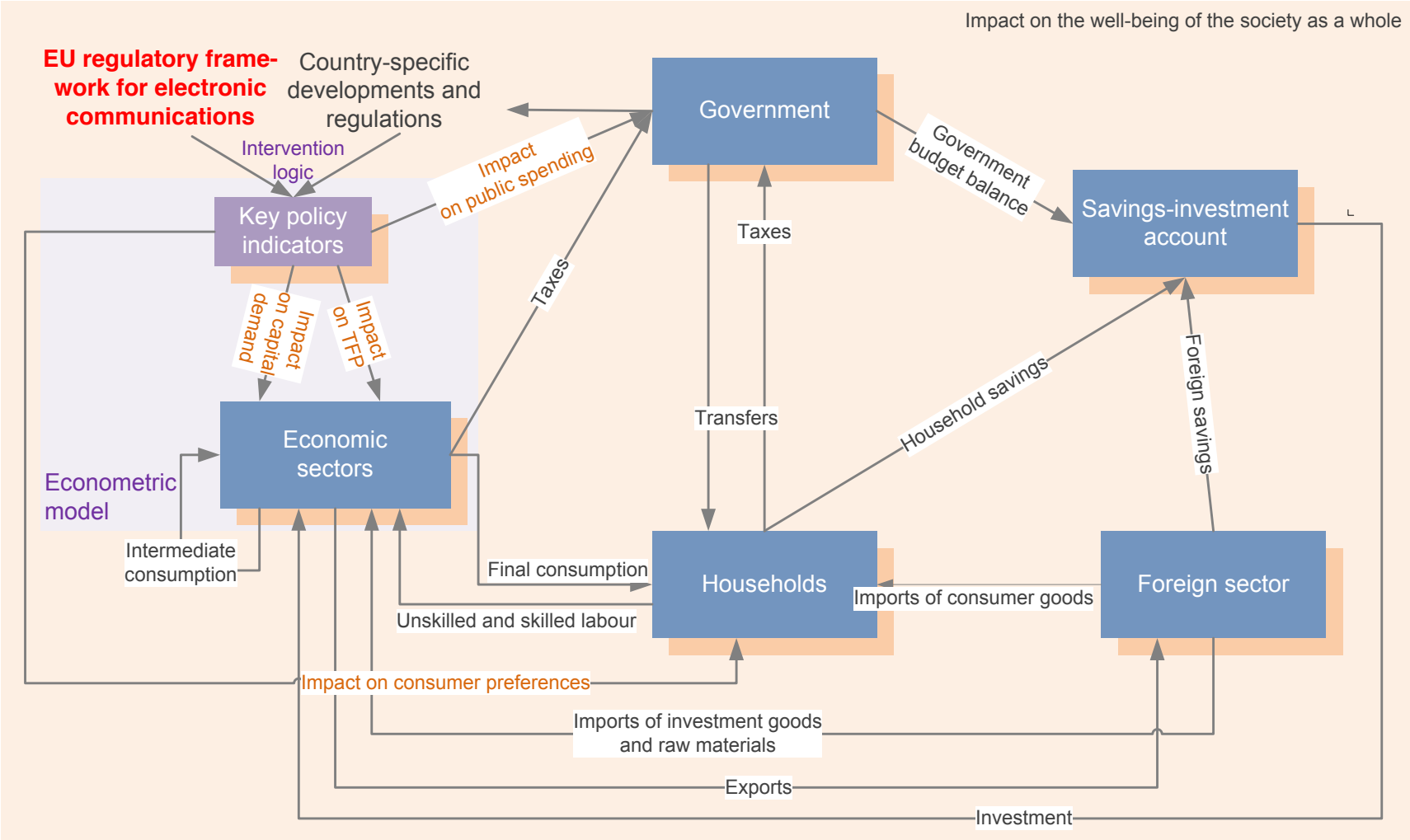
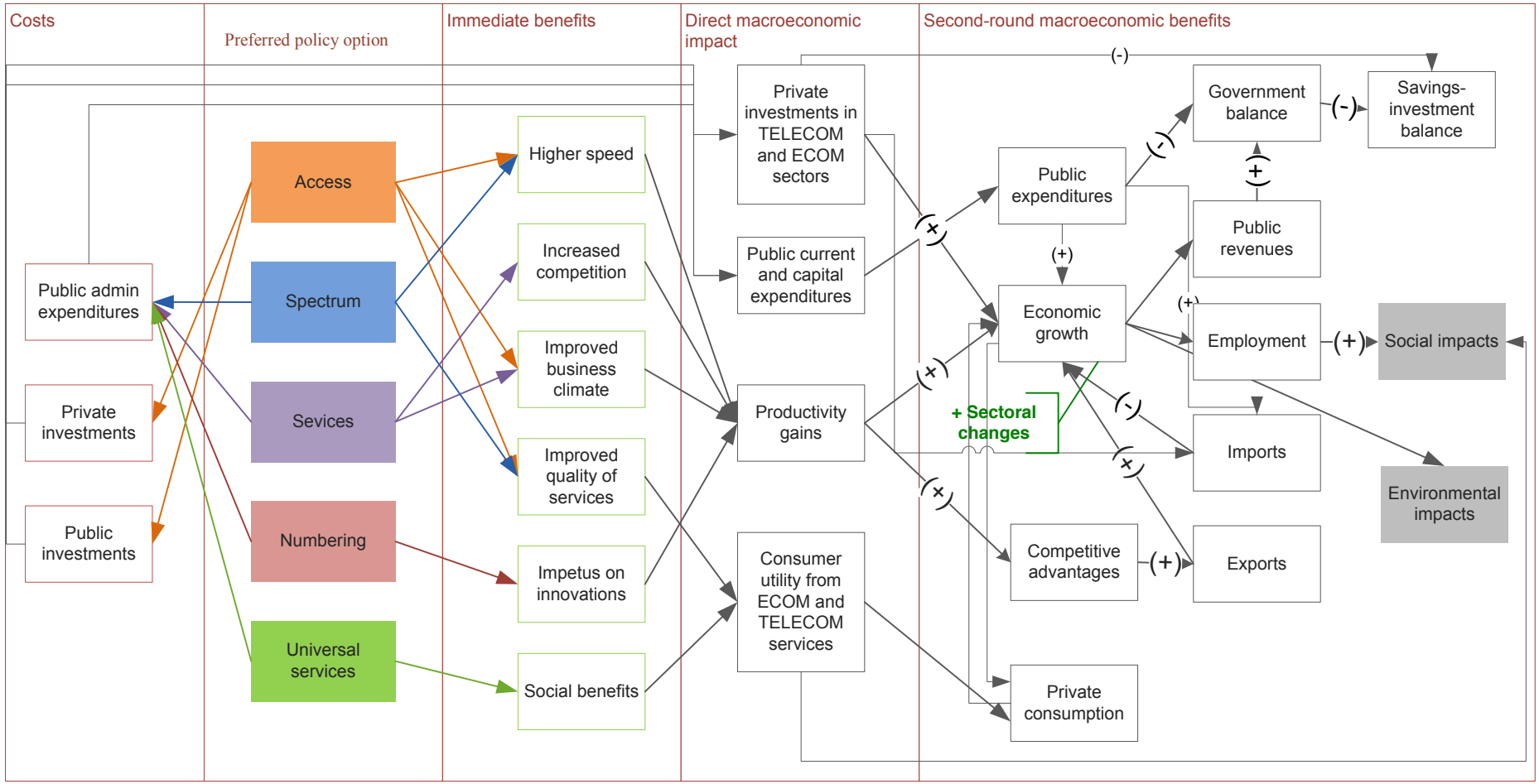


Figure 31 - Overview of the impact mechanisms of the preferred policy options.

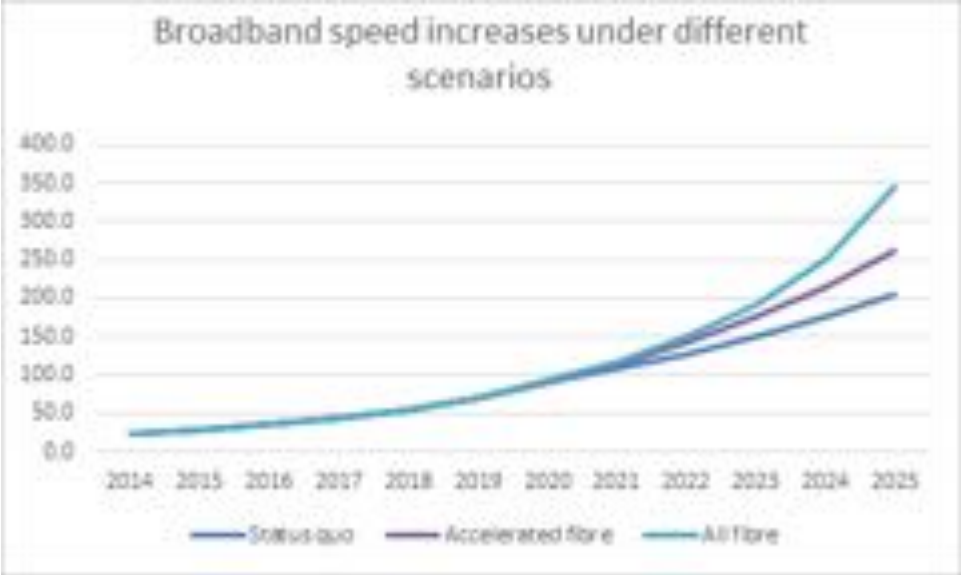


6.5.6 Simulation results, based on the preferred policy scenarios

Access

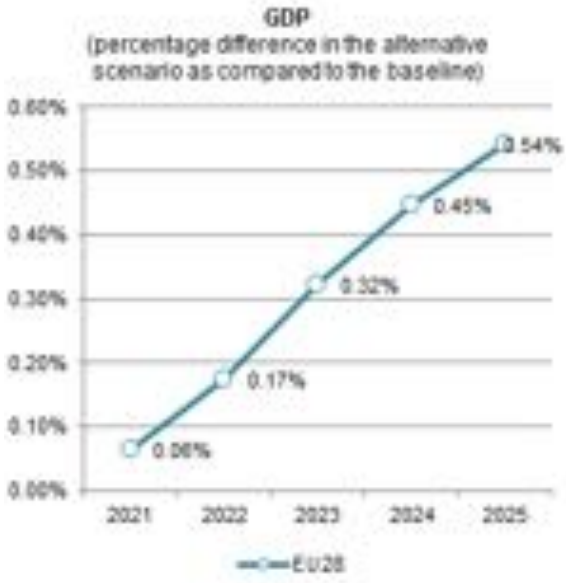
The impacts on broadband download speed from the implementation of the preferred policy options with respect to access are summarized in **Error! Reference source not found.** below:

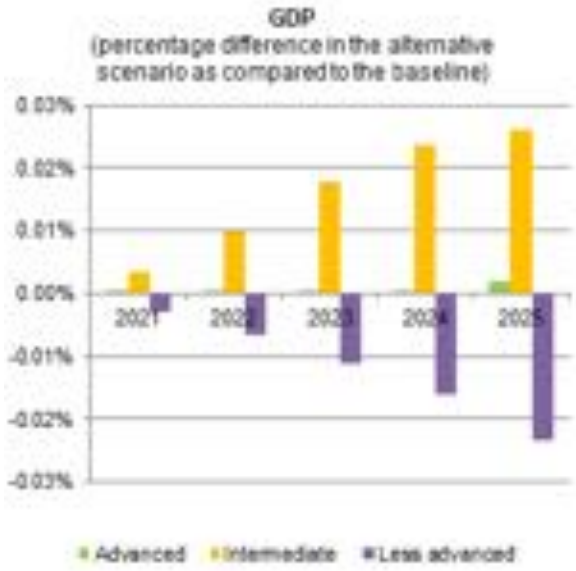
Figure 32 – Broadband speed increases under different scenarios



Under both alternative policy scenarios, connection speed growth is expected to exceed that of the baseline, respectively by an average of 3 percentage points in the accelerated fibre scenario and twice higher in the all fibre scenario. In the accelerated growth scenario deviations in connection speed growth amount to 6 p.p. in 2025. In the all fibre scenario, the gap in growth increases to 22 p.p. by 2025.

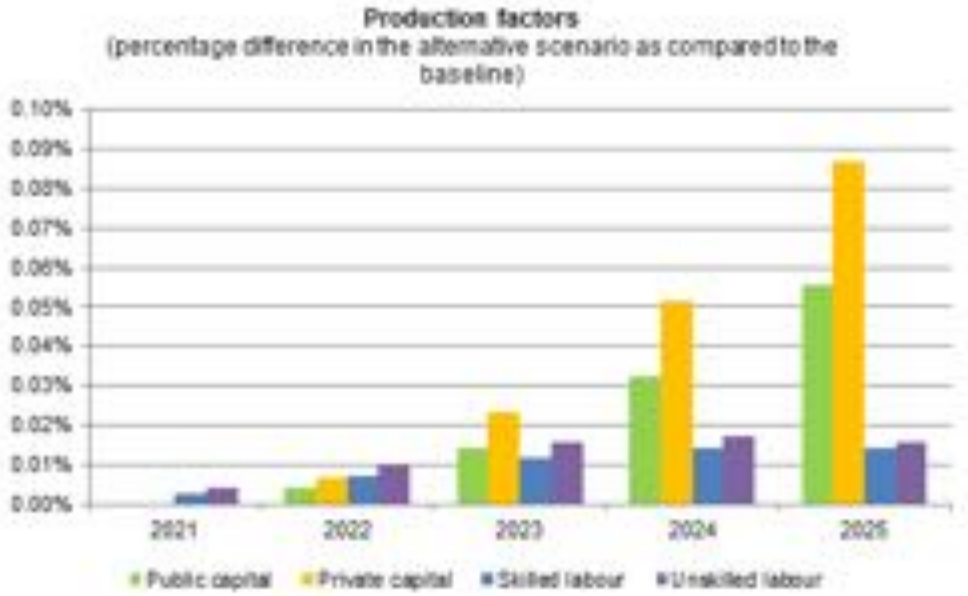
In the **accelerated fibre scenario**, the impact on GDP is expected to be positive by 0.06% already in 2021 and deepen to 0.54% by 2025. The impact will not be evenly spread across all EU economies. Specifically, the middle group of countries will benefit most from the proposed policy changes, while the group of less economically and digitally advanced economies is expected to gain slightly less than the average from the increase in average connection speed.





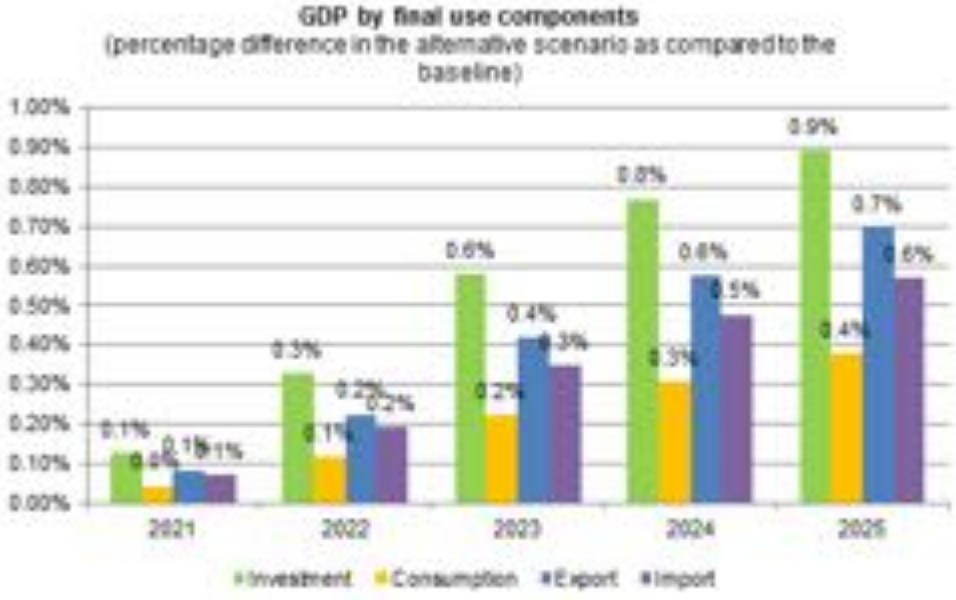
From the supply side, private capital increases are expected to have the highest contribution to economic growth, while the increases in labour will be modest (around 0.01%). Generally, employment is expected to decline somewhat in the TELECOM sector, and, as this sector uses skilled labour more intensively, overall growth in skilled labour is projected to be marginally lower as compared to the unskilled labour. In the less digitally advanced economies the replacement of the labour factor with higher productivity is expected to be more intensive and therefore in these economies the overall employment growth will be marginal as employment is expected to decline slightly also in the manufacturing sectors.

Figure 33 – Production factors



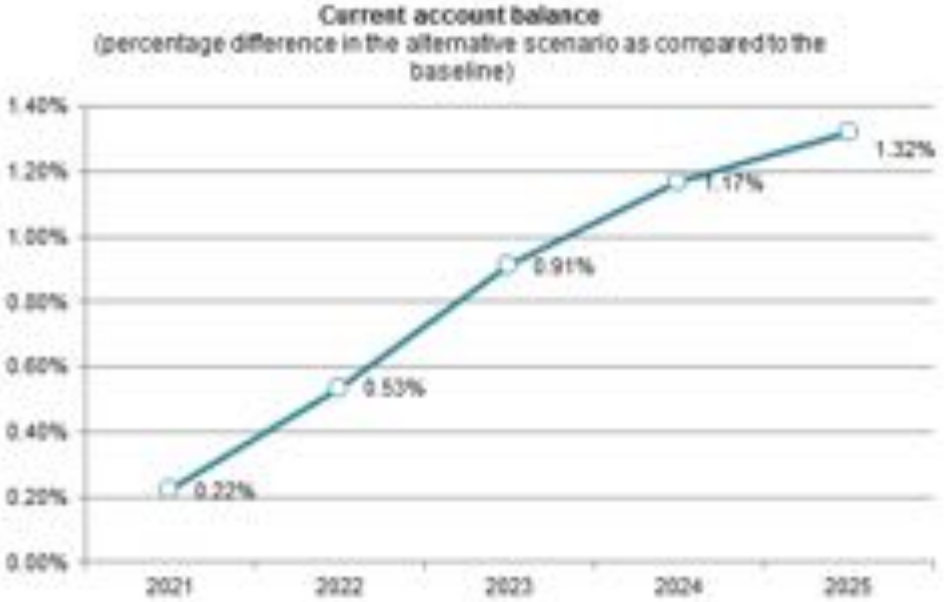
In terms of GDP composition by final use components, expectedly the highest deviation in the alternative scenario as compared to the baseline will be recorded in investments, as they are typically more volatile and respond more quickly to positive economic developments. In 2025 the cumulative deviation of investments against the baseline will amount to 0.9%.

Figure 34 – GDP by final use components



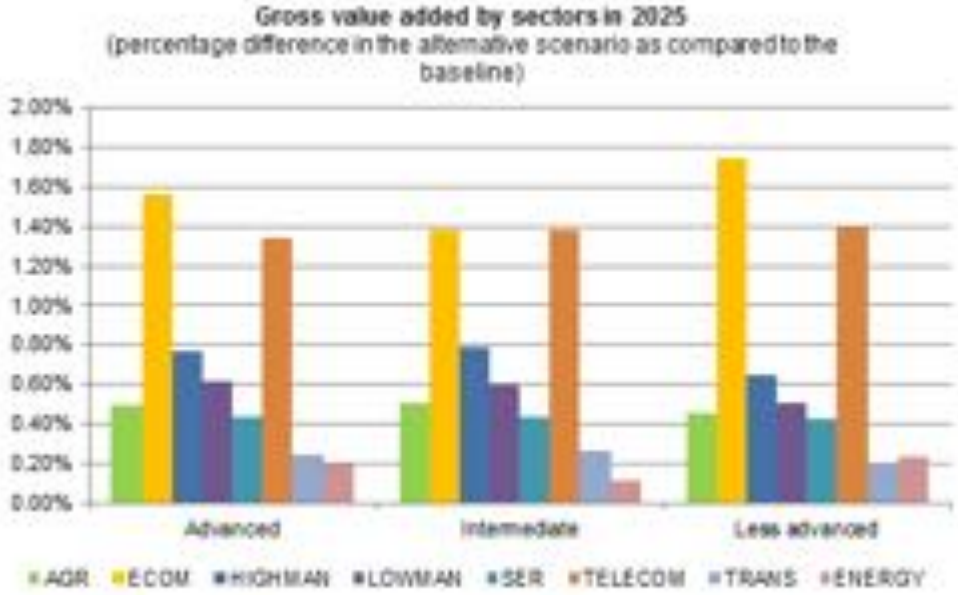
In contrast, consumption growth will be much more moderate - the deviation will amount to 0.4% in 2025. With respect to the external sector, exports will increase faster than imports and thus the current account will improve.

Figure 35 – Current account balance, % GDP



As the largest impact from higher broadband connection speed was estimated in the electronic communication sectors, they also exhibit the highest growth in value added, where other e-com services increases slightly more than telecom due to the very low share of the former in total gross value added. Manufacturing is also expected to benefit largely from higher connection speed, while the impact on transport and energy will be much lower, around 0.2% in 2025, thus contributing to the achievement of greener and more sustainable economic development.

Figure 36 – Gross value added by sectors in 2025



With respect to other important macroeconomic variables, relative prices of the e-communication sectors are expected to decline, thus exercising downward pressure on inflation.

Finally, it should be noted that the realization of the preferred policy options is also associated with some costs. For access policies, it has been estimated that the achievement of the accelerated fibre scenario is associated with a need for investment of EUR 92 bn for EU 28. If we assume that half of it is covered with public resources and financed through foreign borrowing and if it is divided equally in the years between 2018 and 2020, than this public spending is estimated to have an initial positive impact on GDP of around 0.1% from the demand side. However it will also imply worsening of the government budget balance and the external balances of the EU member states. This public spending is not expected to have a significant long-term impact on employment or consumption. In the much more ambitious scenario, where a total of EUR 200 bn is to be invested, the impacts are similar only scaled up around 2 times.

In case all investment costs are covered out of public resources, GDP grows by around 0.22% in 2018-2020, but afterwards budget and consumption restrictions induce small declines of GDP as compared to the baseline scenario. In the initial years of public investment, it also induces private capital formation, where the latter increases by 0.2% and 0.3% respectively in 2019 and 2020 as compared to the baseline.

In the **all fibre scenario**, macroeconomic developments are largely the same, only scaled upwards. The deviation in GDP from the baseline in 2025 will be as high as 0.95%, fuelled by larger investment by 1.5% and 0.7% expansion in consumption as compared to the baseline. Meanwhile, higher exports as compared to imports will determine the improvement in the current account balances. In this scenario, employment in the less advanced economies in the EU is already expected to decline on the account of lower job creation in the e-communication and manufacturing sectors.

Table 26 - Percentage deviations in the all fibre scenario as compared to the baseline in the main macroeconomic variables.

	2021	2022	2023	2024	2025
GDP	0.07%	0.23%	0.45%	0.67%	0.95%
Public capital	0.00%	0.00%	0.02%	0.04%	0.08%
Private capital	0.00%	0.01%	0.03%	0.07%	0.12%
Skilled labour	0.00%	0.01%	0.02%	0.02%	0.02%
Unskilled labour	0.00%	0.01%	0.02%	0.03%	0.02%
Investment	0.15%	0.43%	0.80%	1.15%	1.54%
Consumption	0.05%	0.16%	0.31%	0.46%	0.67%
Export	0.10%	0.30%	0.58%	0.87%	1.23%
Import	0.08%	0.25%	0.48%	0.72%	1.00%
Current account	0.26%	0.71%	1.27%	1.78%	2.39%

Table 27 - Percentage deviations in the all fibre scenario as compared to the baseline in the gross value added in 2025.

Gross value added	Advanced	Intermediate	Less advanced
AGR	0.87%	0.88%	0.80%
ECOM	2.81%	2.46%	3.14%
HIGHMAN	1.36%	1.39%	1.15%
LOWMAN	1.08%	1.04%	0.88%
SER	0.77%	0.77%	0.74%
TELECOM	2.39%	2.47%	2.49%
TRANS	0.43%	0.45%	0.34%
ENERGY	0.32%	0.18%	0.39%

Spectrum

The impacts from the implementation of the preferred policy options with respect to enhanced mobile broadband aspects of 5G[375] are summarized in the table below:

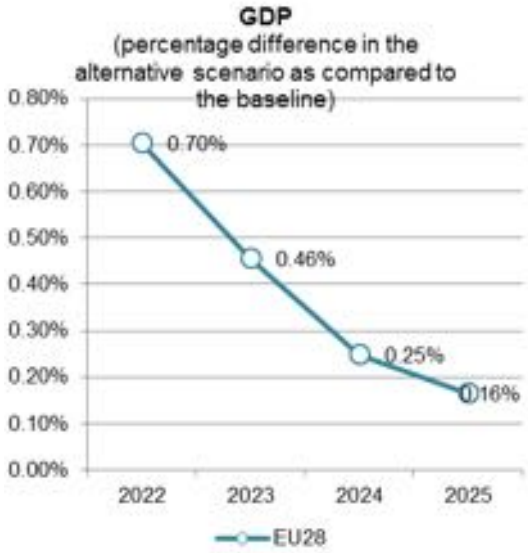
Table 28 – Impact from the preferred policy option

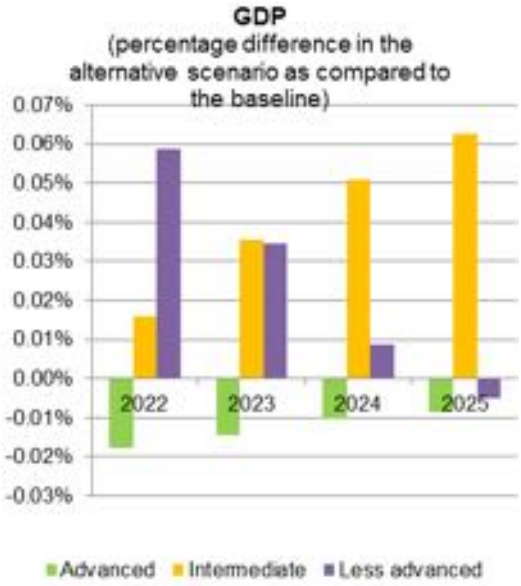
Year	EU eMBB 5G Coverage under baseline	Estimated eMBB 5G coverage under Option 3
2021	8.3	70.0
2022	27.0	93.3
2023	59.1	100.0
2024	79.4	100.0
2025	85.9	100.0
2026	89.0	100.0
2027	92.0	100.0

[375] 5G as a network of networks will consist in different scenarios (i) enhanced mobile broadband (eMBB) (ii) massive machine-to-machine communications (very dense networks) and (iii) ultra-reliable and low latency networks. The coverage requirements of two specificities of 5G networks ie density and latency, will not reach 70% of EU population by 2020. However, as the economic gains are modelled on the gains assessed from LTE, a comparison with eMBB is considered to be more relevant. Other aspects of 5G which support IoT may in turn unlock further disruptive growth opportunities as discussed in the overview to the study

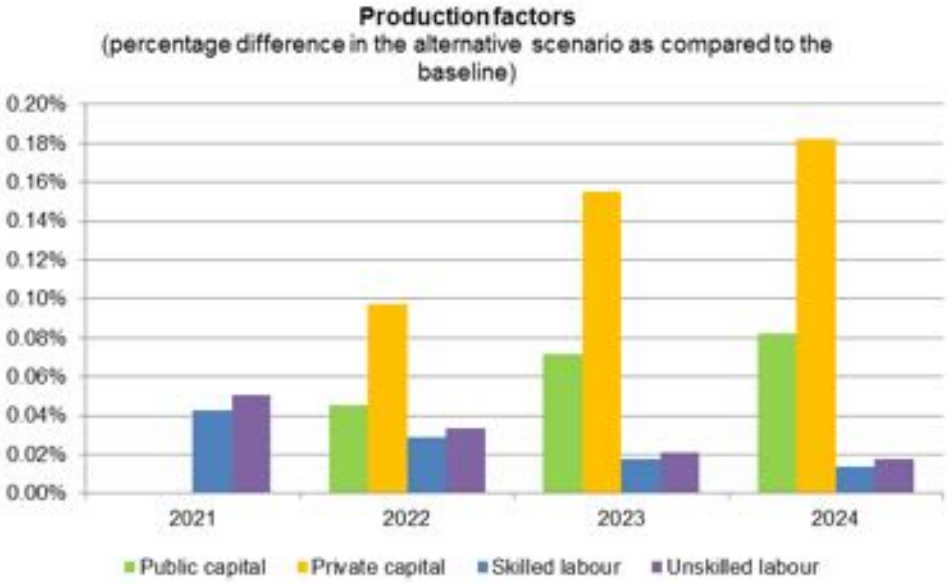
2028	95.0	100.0
2029	98.0	100.0
2030	100.0	100.0

In the 'no change' policy scenario full eMBB coverage will achieved only in 2030, while under Option 3, a 100% coverage might be expected to be established in only 4 years (from 2020 up to 2023). If we assume that the impact on total factor productivity from eMBB aspects of 5G will be of the same magnitude as that of 4G, then it will have an effect on GDP of 0.16% in 2025. The impact will be highest in 2021, when almost 3/4 of the eMBB coverage will be realized. In terms of variations between EU countries the intermediate and less economically and digitally advanced countries are expected to benefit more from enhanced mobile broadband.

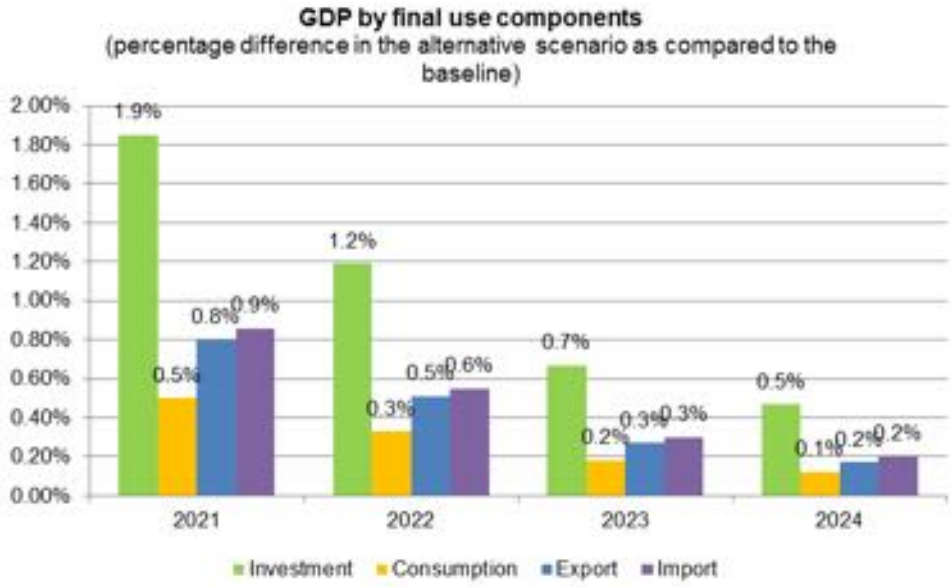




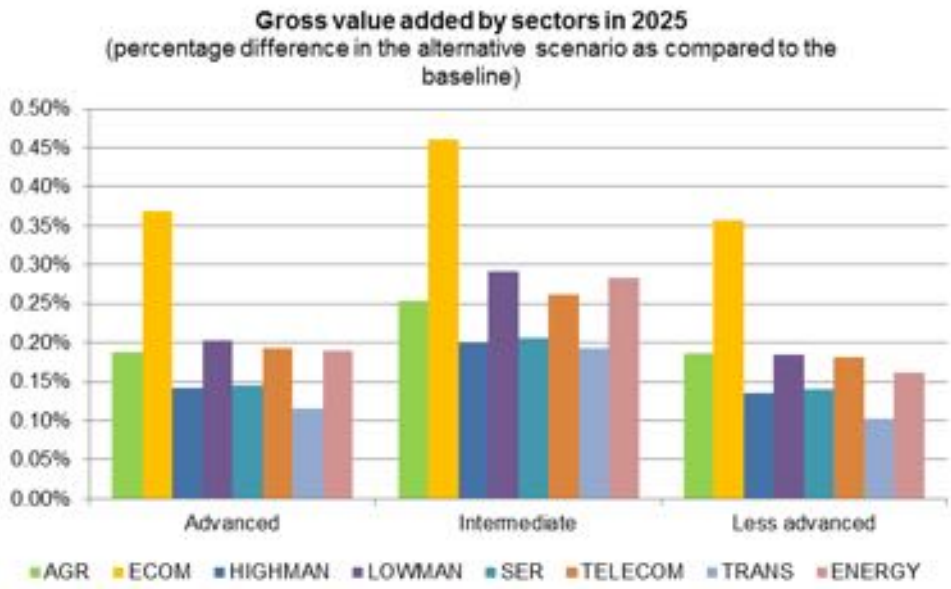
Similar to the simulations, based on access policies, faster coverage will have an important impact on capital and a marginally positive effect on employment.



Again, gross fixed capital formation will expand most, by 1.9% in 2021 and 0.5% in 2025, while consumption dynamics will be much smoother. In contrast to the access scenarios, in this spectrum-related scenario import will grow slightly faster than export, leading to a nearly balanced external sector.



E-communication sectors again will benefit most from higher eMBB coverage, this time followed by low-tech manufacturing and the production of electricity, thermal energy and gas.



Services – efficiency gains

The policy options in this area will have positive impact mainly on regulatory efficiency and effectiveness in the electronic communication sectors. However the magnitude of this impact is not directly quantitatively measurable. In order to overcome this difficulty, we have used the

results of a study by Haidar (2012)[376], which indicates that impact of a more significant regulatory reform on the growth rate of GDP per capita is 0.15% on average. We have assumed that such an impact will be channelled through improved TFP in the e-communication sectors and by means of iterations estimated that an average increase in GDP growth rate of 0.15 percentage points is associated with a 4% annual increase in TFP in the TELECOM and ECOM sectors, starting from 2020.

Under this scenario, GDP is expected to be by 0.74% higher than the baseline in 2025. However, this scenario will be associated with somewhat lower investment (or postponed consumption) at the expense of higher current consumption growth. Due to the fact that services policies will have direct impact on the TFP in the e-communication sectors only, it is associated with higher increases in skilled labour.

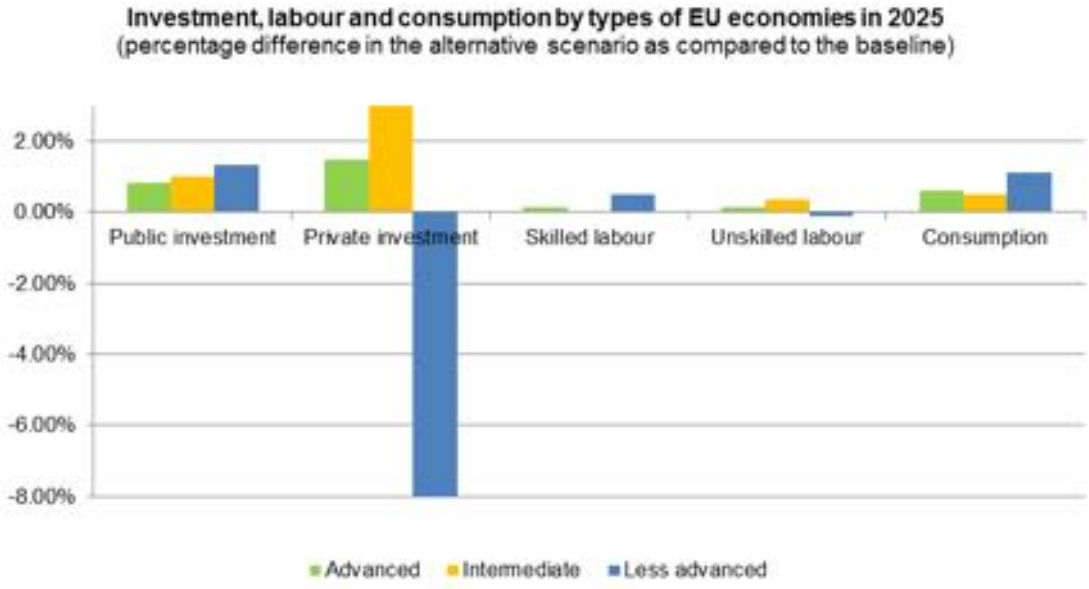
Table 29 - Percentage deviations in the services scenario as compared to the baseline in the main macroeconomic variables.

	2021	2022	2023	2024	2025
GDP	0.13%	0.27%	0.42%	0.57%	0.74%
Public capital	0.00%	0.01%	0.03%	0.07%	0.11%
Private capital	0.00%	0.01%	0.01%	0.01%	-0.02%
Skilled labour	0.01%	0.04%	0.08%	0.14%	0.20%
Unskilled labour	0.04%	0.07%	0.09%	0.11%	0.13%
Investment	0.20%	0.30%	0.29%	0.12%	-0.30%
Consumption	0.12%	0.25%	0.40%	0.55%	0.70%
Export	0.12%	0.26%	0.43%	0.63%	0.87%
Import	0.08%	0.16%	0.24%	0.29%	0.31%
Current account, % GDP (ppt)	0.02	0.07	0.14	0.25	0.40

The variation in the responses of the EU MS economies is larger in this scenario as well. The groups of less economically and digitally advanced economies, in particular, stands out as this scenario estimates a relatively higher increase in public investment in these economies, crowding out private investment. Also, in this cluster of EU MS the expansion in skilled labour is expected to outweigh significantly that of the unskilled labour.

Table 30 - Percentage deviations in the services scenario as compared to the baseline in investment, labour and consumption by clusters of EU Member States in 2025.

[376] Haidar J. I. (2012) "The impact of business regulatory reforms on economic growth", *Journal of The Japanese and International Economies*, 26 (2012), pp. 285-307.



6.5.6.1 Cumulative impact

Generally, for all assessed scenarios GDP is expected to increase compared with the baseline, with an anticipated **GDP uplift of 0.16% in 2025 for spectrum policies** compared with the baseline and a **GDP uplift of 0.54% for access policies** based on the more conservative 'accelerated fibre' scenario.

The cumulative impact up to 2025 is expected to be significant due to the expected supply side impacts, which are built up over time. More positive economic developments will have a significant impact on investment, while the effects on consumption with be more moderate, along with the life-cycle hypothesis for consumption smoothing. In the access scenarios the effects are larger for the intermediate and the most economically and digitally advanced economies in the EU, which have the potential to capitalize best the benefits from applying the preferred policy options, and for the least advanced economies in the EU, which start from a lower base. In the spectrum scenario, intermediate economies are expected to perform better against the remaining EU countries, as 5G will most probably induce more investments both in the e-communication sectors and manufacturing.

We also find **some positive employment impacts from access and spectrum policies (around 0.02% higher than the baseline)**, while the efficiency gains potentially driven by reforms fostering **digital services, might result in increases in employment of up to 0.15%** compared to status quo.

Table 31 - Impact of assessed scenarios on GDP, consumption, investment and employment

	GDP		Consumption		Investment		Employment	
	2021	2025	2021	2025	2021	2025	2021	2025
Accelerated fibre								
Advanced	0.06%	0.54%	0.04%	0.38%	0.14%	1.11%	0.00%	0.03%
Intermediate	0.07%	0.57%	0.04%	0.35%	0.12%	0.66%	0.01%	0.02%
Less advanced	0.06%	0.52%	0.04%	0.40%	0.08%	0.22%	0.00%	-0.03%
EU28	**0.06%**	**0.54%**	**0.04%**	**0.38%**	**0.13%**	**0.89%**	**0.00%**	**0.01%**
All fibre								
Advanced	0.08%	0.96%	0.05%	0.66%	0.16%	1.92%	0.00%	0.04%
Intermediate	0.08%	1.00%	0.04%	0.62%	0.14%	1.09%	0.01%	0.03%
Less advanced	0.07%	0.91%	0.05%	0.71%	0.10%	0.34%	0.00%	-0.05%
EU28	**0.07%**	**0.95%**	**0.05%**	**0.67%**	**0.15%**	**1.54%**	**0.00%**	**0.02%**
Services-efficiency gains								
Advanced	0.11%	0.62%	0.10%	0.63%	0.30%	1.38%	0.02%	0.14%
Intermediate	0.11%	0.67%	0.05%	0.49%	0.62%	3.06%	0.01%	0.21%
Less advanced	0.22%	1.25%	0.23%	1.12%	-0.44%	-8.80%	0.06%	0.16%
EU28	**0.13%**	**0.74%**	**0.12%**	**0.70%**	**0.20%**	**-0.30%**	**0.02%**	**0.15%**
Spectrum								
Advanced	0.00%	0.16%	0.00%	0.12%	0.00%	0.48%	0.00%	0.01%
Intermediate	0.00%	0.23%	0.00%	0.14%	0.00%	0.74%	0.00%	0.04%
Less advanced	0.00%	0.16%	0.00%	0.12%	0.00%	0.24%	0.00%	0.01%
EU28	**0.00%**	**0.16%**	**0.00%**	**0.12%**	**0.00%**	**0.47%**	**0.00%**	**0.02%**
Cumulative								
Advanced	0.17%	1.32%	0.14%	1.13%	0.44%	2.91%	0.02%	0.18%
Intermediate	0.17%	1.46%	0.09%	1.00%	0.73%	4.33%	0.02%	0.26%
Less advanced	0.28%	1.93%	0.28%	1.66%	-0.36%	-8.62%	0.06%	0.13%
EU28	**0.19%**	**1.45%**	**0.16%**	**1.22%**	**0.33%**	**0.96%**	**0.03%**	**0.18%**

Source: Ecorys

6.5.7 Earlier literature on modelling e-communications and ICT

Overall, the economic literature acknowledges that e-communications and ICT are an important driver of growth in the long-run, mainly through higher productivity. EC White paper on "Growth, competitiveness, employment: The challenges and ways forward into the 21st century"[377] and US International Trade Commission study on the "Global competitiveness of U.S. Advanced Technology Manufacturing Industries"[378] already in the early 1990s draw attention to the development of the information society as a key driver of growth and competitiveness. Later studies, such as a study by OECD on "Globalization of Services and Jobs"[379] and an UN paper from 2007[380] also indicate that efficient IT has become crucial infrastructure for improvement of the tradability of certain services and for long-term economic development.

Recently, there has been a multitude of studies, which either estimate the trends in the development in e-communication services or the socio-economic benefits from higher connectivity. The first group of studies incorporates either the construction of some measures of digitalization or other indexes for IT readiness or use, like the 2013 "Global Information Technology Report 2013: Growth and Jobs in a Hyperconnected World", edited by Beñat

[377] http://europa.eu/documentation/official-docs/white-papers/pdf/growth_wp_com_93_700_parts_a_b.pdf
[378] https://www.usitc.gov/publications/332/pub2434.pdf
[379] http://www.oecd.org/site/tadicite/50287724.pdf
[380] United Nations, 2007, "Technology, globalization, and international competitiveness: Challenges for developing countries" in Industrial Development for the 21st Century", http://www.un.org/esa/sustdev/publications/industrial_development/full_report.pdf

Bilbao-Osorio, Soumitra Dutta and Bruno Lanvin[381], or some market analysis, such as the Telco 2015 report[382].

The aforementioned 2013 Global Information Technology Report, in addition to the provision of various measures of technological readiness and digitalization, also identifies a significant favourable impact of digitalization of GDP per capita and for curbing unemployment. Sectorial impacts in the same paper show profound and accelerating effects of digitalization, which lead to modification of the business models and lower barriers to entry, enhanced communication and service provision to customers, optimization of the production process and streamlined operations of the companies. The Global IT report from 2013 also provides evidence of the 3G penetration on economic growth, as well as on the social and economic impacts the electronic healthcare records.

Based on the above-mentioned studies, there is a general acknowledgement of the fact that the development of electronic communication services has a significant positive impact on trade, productivity and GDP. More specifically, the economic literature outlines the following impacts of the enhanced use of e-communications:

- **Human capital**. The impact is channelled through two mechanisms: 1. an enhanced use of e-communications would require more skilled labour and 2. the use of e-communications makes information more easily available and favours more flexible and distance learning.
- **Labour mobility, business costs and environment**. The use of video conferences or other means of distance communication enables individuals to work from distance and reduces both operating costs for the respective businesses and the traffic in the transport network.
- **Disintermediation and reduced transaction costs**. The use of e-communications allows for shortening the supply chain in the provision of a large number of goods and services.
- **Social benefits**, like connection of excluded regions (e.g. rural regions) and gaining collective power (e.g. by using social media). However the effect on employment is not always unambiguous: sometimes technological progress might lead to less intensive use of labour or facilitate outsourcing to countries with cheaper labour.
- Introduction of **new products and services**.
- With the use of e-communications **more time becomes available** for leisure or work.
- E-communications **fosters innovation**.

With respect to the methodological approach to the estimation of the social, economic and environmental impact of various policies, affecting the e-communication sector, there is a multitude of modelling alternatives. Recently applied methods include mostly econometric modelling, but also computable general equilibrium (CGE) models and even dynamic stochastic general equilibrium (DSGE) models.[383]

[381] http://www3.weforum.org/docs/WEF_GITR_Report_2013.pdf
[382] Telco 2015: Five Telling Years, Four future Scenarios, IBM, http://public.dhe.ibm.com/common/ssi/ecm/gb/en/gbe03304usen/GBE03304USEN.PDF
[383] DSGEs have become a popular tool for economic modelling, but they are still limited to a highly stylized representation of the economy due to the challenges related to their numerical solution. Taking into account the need to design a multi-sector model for the implementation of the current impact assessment, the development of a large-scale DSGE model will be too ambitious within the scope of this project.

6.5.8 Econometric modelling

Examples of the **econometric modelling** approach are:

- Czernich et al. (2009)[384] specifying a production function, assuming that increased use of broadband services has a positive impact of the total factor productivity in the economy. In their estimations, however, they use instrumental variables to control for the broadband penetration already achieved. Thus, an increase in the broadband penetration rate by 10 p.p is estimated to contribute to annual GDP growth per capita by 0.9-1.5 p.p. It should, however, be taken into account that the results of this study cannot be directly used in our work, as they relate more to increased coverage, rather than to higher speed access. Nonetheless, this study could be useful from a methodological point of view.
- Spiezia (2012)[385] constructs a production function, where three types of ICT investment are incorporated: computer, software and communication. It is then estimated econometrically for 26 industries and 18 OECD countries for the period between 1995 and 2007. ICT investments are found to contribute to economic growth by 0.4-1 % per annum.
- Oliner et al. (2007)[386] and Jorgenson et al. (2008)[387] providing an estimation of the impact of information technologies for the productivity increases in the US by including both IT and intangible capital in a growth accounting framework.
- Regeneris' investigation, performed in 2012 for UK's largest communication services supplier BT also provides econometric evidence on the impact of increased broadband speed on welfare (measured by the gross value added) and employment due to enhanced business performance, new business creation and better home working opportunities.
- Mölleryd's[388] paper builds on a model used for estimation of the social and economic benefits from the development of an open, operator-neutral fibre network in Stockholm. It provides useful estimates of the benefits of high-speed broadband on economic growth and firms productivity. The study also finds evidence that high-speed broadband networks can potentially substitute some transport services, create employment opportunities and even provide more efficient home care services.

6.5.8.1 DSGE modelling

Seeking to account for more general macroeconomic effects from the reforms, related to the digital agenda of the EU, Lorenzani and Varga (2014)[389] augment the EC **dynamic general equilibrium model** QUEST III. The estimated policies include competition and investment-enhancing policies in the radio spectrum, enhancement of the professional e-skills, deepening of the e-Commerce and increased fixed broadband take-up. They find a positive impact of over 1% on long-term economic growth of the reforms that have already been implemented and potential for additional 2.1% in case the Digital Agenda for Europe targets are achieved.

6.5.8.2 CGE modelling

CGE models are less frequently used to study the economic, social and environmental impact of electronic communications but they present a number of advantages in case multiple countries or

[384] Czernich, N., O. Falck, T. Kretschmer and L.Woessmann (2009), "Broadband Infrastructure and Economic Growth", CESifoWorking Paper, No. 2861, Munich

[385] Spiezia V. (2012) "ICT investments and productivity: Measuring the contribution of ICTs to growth", OECD Journal: Economic Studies, vol. 2012/1.

[386] Oliner, S. D., D.E. Sichel and K.J. Stiroh (2007), "Explaining a Productive Decade", *Brookings Papers on Economic Activity*, 1, 81-151.

[387] Jorgenson, D. W., M.S. Ho and K.J. Stiroh (2008), "A Retrospective Look at the US Productivity Growth Resurgence", *Journal of Economic Perspectives*, 22(1), 3-24.

[388] Mölleryd G., 2015, "Development of High Speed Networks and the Role of Municipal Networks", *OECD Science, Technology and Innovation Policy Papers No. 26*, OECD.

[389] Lorenzani D. and J. Varga (2014) "The Economic Impact of Digital Structural Reforms", EC economic papers 529/September 014.

multiple sectors need to be incorporated. As a most recent example of this type of modelling, Christensen (2015)[390] presents a multi-country, multi sector dynamic computable general equilibrium model, where ICT and R&D are imbedded in the production function.

Khorshid and El-Sadek (2012)[391] also develop a CGE model with a focus on the ICT sector for Egypt, where they base their estimations on a social accounting matrix, which aim is to capture the impact of the ICT on the other economic sectors, as well as on the labour and capital demand and on the income distribution. As a result, they provide estimates of the impact from four policies – 1. Measures to increase ICT investment, 2. Policies, specifically targeted to achieve growth in the ICT sector, 3. National training, reorientation and capacity building program leading to an enhanced factor productivity and labour efficiency in the economy as a whole based on advanced ICT and 4. Foreign exchange policy to promote ICT exports to the outside world.

Finally, Moon et al. (2000)392 use the ORANI-F model, calibrated to the Korean economy, but rather than estimating the impact of ICT, they only make projections on the structure of the Korean economy by sectors and draw implications about the development of the ICT sector in terms of growth, export share, composition by subsectors, etc. However, this study has the merit of providing a reference classification of the ICT activities.

6.5.9 Elaboration of the methodology

6.5.9.1 Estimation of the production function with stochastic frontier analysis

If we take into account that the production function is defined as the function, which transforms given inputs into the maximum output quantity, then the actual output will be either at the production possibility frontier or below it. Therefore, the output can be estimated as a function of the production function, taking into account also possible inefficiency and stochastic shocks[393]:

$$\ln Y = \ln f(x) - u + \epsilon, \qquad u \geq 0$$
(SFA1)

where Y is the output, $f(x)$ is the production function, where the input x is an argument, $u \geq 0$ are inefficiencies and ϵ is the error term. The latter equation is equivalent to

$$Y = f(x).e^{-u}.e^{\epsilon}$$
(SFA2)

and allows us to define the following measure of output-oriented technical efficiency:

$$TE = \frac{Y}{f(x).e^{\epsilon}} = \frac{f(x).e^{-u}.e^{\epsilon}}{f(x).e^{\epsilon}} = e^{-u}$$
(SFA3)

We have estimated the above econometric model by maximum likelihood estimator with time-varying efficiencies, available in package 'frontier' under the R software. The error term follows a normal distribution with zero mean and constant variance and the inefficiencies u are assumed to be independently distributed according to a positive half-normal distribution:

$$\epsilon \sim N(0, \sigma_{\epsilon}^2)$$

[390] Christensen M.A. (2015), "A CGE Model with ICT and R&D-driven Endogenous Growth: A Detailed Model Description", *Joint Research Centre technical reports*, Report EUR 27548 EN.

[391] Khorshid M. and A. El-Sadek (2012) "A Multi-sector ICT Economy Interaction Model for Egypt: The Path to Information Society", International Conference on Policy Modeling 2012.

[392] Moon S-W, Y. Kim and D-P. Hong (2000), " The Economic Importance of the Information and Communications Technology (ICT) Industry in Korea: A CGE Approach", presented at the 3rd Annual Conference on Global Economic Analysis.

[393] Meeusen, W. and J. van den Broeck, 1977, "Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error", *International Economic Review* 18:435-444. Aigner, D., C. Lovell and P. Schmidt, 1977, "Formulation and Estimation of Stochastic Frontier Production Function Models", *Journal of Econometrics* 6:21-37.

$$u \sim N^{+}(\mu, \sigma_u^2)$$

These standard assumptions ensure that the distribution of $-u + \epsilon$ is skewed to the left so that the difference between actual and optimal production $\ln(Y) - \ln(f(x))$ stays negative.

Based on a dataset for the 28 EU economies[394], we have estimated a production function, relating GDP to capital and labour:

$$\ln(Y_{rt}) = \alpha_0 + \alpha_1.\ln(L_{rt}) + \alpha_2.\ln(K_{rt}) + \alpha_{3,r}.Country_r + \alpha_4.DCRISIS_t + t + \varepsilon_{rt}, \quad \text{(SFA4)}$$

where Y_t stands for GDP in constant 2010 prices of country r in period t ($t \in [2000,2015]$), L_{rt} is employment, $Country$ capture the fixed effects for each of the EU28 MS and $dCRISIS_t$ is added to account for the economic crisis, starting from 2008 onwards. The capital K_{rt} is defined as:

$$K_{rt} = 3.Y_{r1995}.\sum_{i=0}^{t-1995}(1-\nu)^i + \sum_{i=0}^{t-1-1995}(1-\nu)^i I_{ri}, \qquad t \in [1996,2015] \quad \text{(SFA5)}$$

Assuming a depreciation rate $\nu = 0.1$, the assumption of the capital-to-GDP ratio in the base 1995 year becomes irrelevant from 2005 onwards.

As a second step we then regress the derived efficiency terms against the Heritage Index of Economic Freedom and variables, related to the development of the e-communication services in the EU:

$$\ln(EFF_{rt}) = \beta_1.\ln(heritage_{rt}) + \beta_2.\ln(mbb_ltecov_{rt}) + \beta_3.\ln(DOWNSPEED_{rt}) + \beta_{4,r}.Country_r + \upsilon_{rt}, \quad \text{(SFA6)}$$

In the above formula, $heritage_{rt}$ stands for the Heritage Index[395], intended to measure the developments in terms of rule of law, size of the government, regulatory efficiency and openness of the economy as key contributors to total factor productivity. Among others it can also be used as a proxy to measure of the effectiveness and efficiency of the regulation.

The variable $DOWNSPEED_{rt}$ measures the average download speed. Finally, the impact of the 4G mobile broadband coverage (as % of all households) mbb_ltecov_{rt} also proved to be statistically significant.

In the estimation of the impact of e-communications on the total factor productivity we also tested specifications including other key variables from the Digital Agenda Database[396], such as the Herfindahl-Hirschman Index on broadband competition, investments in the telecom sector, market share of leading operator (in % of active SIM cards) and share of the individuals interacting online with public authorities in the past 12 months. They however proved either statistically insignificant, or had the wrong sign. These problems are largely due to the short time series available for most of the considered indicators, covering post-2008 crisis period, when unsteady GDP growth rates and, at the same time, significant improvements in digital agenda indicators were observed. Attempts to add other variables to control for the crisis were largely not very successful either.

6.5.9.2 C.2. Cluster analysis for the selection of representative economies

The model features a regional breakdown to allow for assessment of the impact of the proposed policy options not only for the EU as a whole, but also taking into account the differences between the EU MS in terms of digitalization, overall economic development and size of the economy.

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394 Eurostat, National Accounts (ESA2010) statistics.

395 http://www.heritage.org/index/

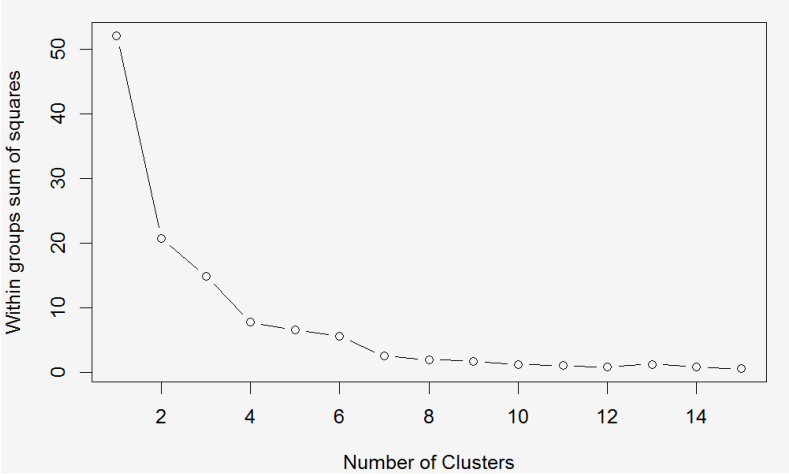
396 https://digital-agenda-data.eu/datasets/digital_agenda_scoreboard_key_indicators

As inclusion of all 28 EU MS economies increases exponentially the dimension of the model, we decided to cluster the EU countries according to the dimensions, mentioned in the previous paragraph and select a single representative economy from each of the identified clusters.

The variables, which were used to identify each cluster, are the following:

- The Digital Economy and Society Index (DESI), compiled by the EC
- Gross domestic product

The number of clusters was set to 6, based on the so called elbow method – number of clusters is plotted against the percentage of variance explained (see the figure below).



The number of clusters to be used is selected based on two criteria:

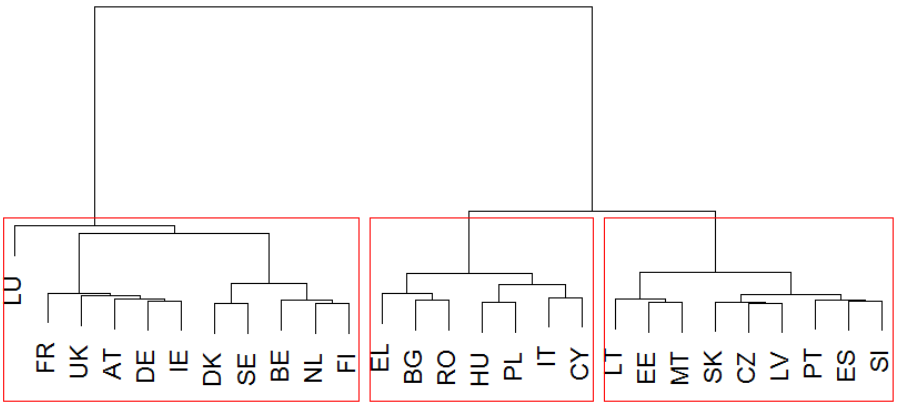
1. Keep the number of clusters as small as possible

2. Choose the number of clusters so that adding another cluster does not improve the explanation of the differences significantly.

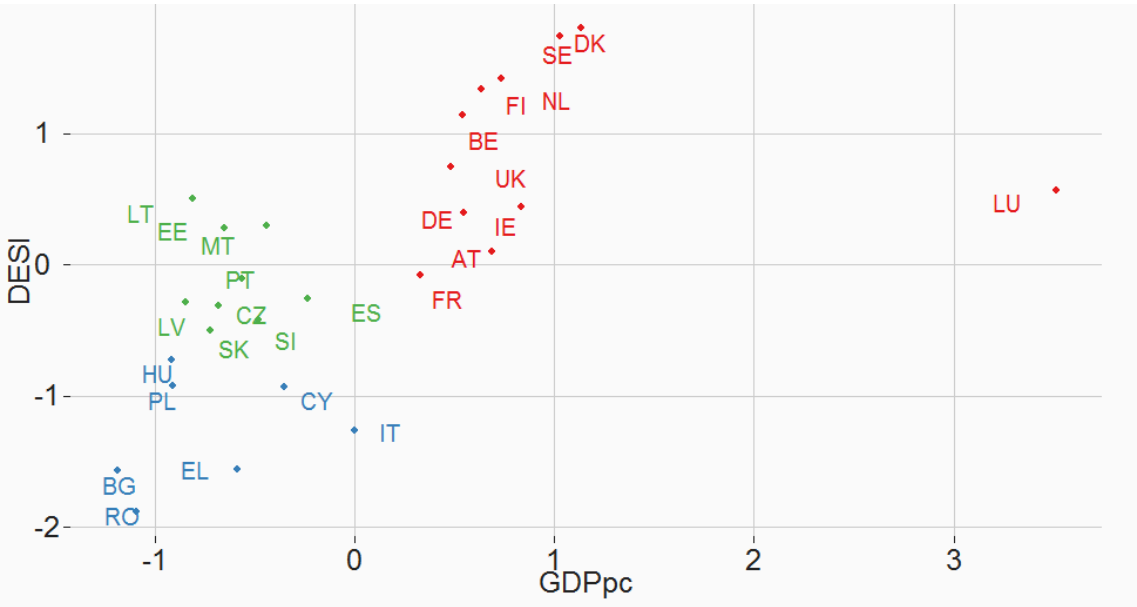
Based on the above figure, we had to select either 4 clusters, but the grouping of the countries into 4 distinctive clusters resulted in a separate group, consisting of Luxembourg alone. So, for efficiency reasons, we resorted to 3 clusters.

The clusters were selected with the Ward method for hierarchical cluster analysis, based on minimization of the within-cluster variances. As a result the following clusters were identified:

Cluster Dendrogram



To obtain a better idea of the groups of countries, employed in the model, we have depicted each of the countries along the clustering criteria, where colour codes were introduced to distinguish the six clusters.



Generally, one can identify a group of 11 countries (LU, DK, SE, FI, NL, BE, UK, DE, IE, AT, FR), which have very developed economies and rate very high in terms of digital development. The second cluster consists of the largest share of the countries, which joined the EU in 2004. They are slightly worse in terms of digitalization and economic development – LT, EE, MT, PT, CZ, LV, SK, SI. The group of the least developed countries in terms of economy and digitalization consists of Bulgaria, Romania, Greece, Cyprus, Italy, Hungary and Poland.

Based on the identified clusters of countries, we have selected the following three representative economies modelled in the CGE framework:

- Germany
- Czech Republic
- Bulgaria

They are viewed as 'typical' representatives of their groups, where no special economic or political circumstances have been observed in the past years.

6.5.9.3 C.3. Computable general equilibrium model: outline

We model an economy, which consists of the three representative regions/ countries, selected as a result of the cluster analysis, and rest-of-the-world, where eight types of products are being produced using private and public capital, unskilled and skilled labour.

Each **economic sector** operates under perfect competition, maximizing its profit, subject to its production technology. The sectorial production functions are defined as Constant elasticity of substitution (CES) production functions. They take as production factors private and public capital KPR and KPU, skilled labour H and unskilled labour N.

$$\max_{L_{jrt},H_{jrt},KPR_{jrt},KPU_{jrt}}\left(PVA_{jrt}.VA_{jrt} - PN_{rt}.N_{jrt} - PH_{rt}.H_{jrt} - PKPR_{rt}.KPR_{jrt} - PKPU_{rt}.KPU_{jrt}\right) \quad \text{(CGE1)}$$

s.t.

$$VA_{jrt} = \sigma_{jrt}^{VA}\left(\beta_{jr}^{VA}.L_{jrt}^{\nu_{jr}^{VA}} + \left(1-\beta_{jr}^{VA}\right).K_{jrt}^{\nu_{jr}^{VA}}\right)^{\frac{1}{\nu_{jr}^{VA}}} \qquad \text{(CGE2)}$$

$$N_{jrt} \geq 0, \qquad H_{jrt} \geq 0, \qquad KPR_{jrt} \geq 0, \qquad KPU_{jrt} \geq 0$$

where j, r and t represent respectively the j-th economic sector, r-th region and t-th time period. In other words, we have unconstrained maximization problem and a definition of the value added VA_{jrt}:

$$\max_{L_{jrt},H_{jrt},KPR_{jrt},KPU_{jrt}}\left(PVA_{jrt}.\sigma_{jrt}^{VA}\left(\beta_{jr}^{VA}.L_{jrt}^{\nu_{jr}^{VA}} + \left(1-\beta_{jr}^{VA}\right).K_{jrt}^{\nu_{jr}^{VA}}\right)^{\frac{1}{\nu_{jr}^{VA}}} - PN_{rt}.N_{jrt} - PH_{rt}.H_{jrt} - PKPR_{rt}.KPR_{jrt} - PKPU_{rt}.KPU_{jrt}\right)$$

(CGE3)

The **household** derives utility from final consumption C_{irt} and savings S_{rt} and disutility – from the two types of labour N_{jrt} and H_{jrt}. The introduction of labour as a control variable in the household problem (i.e. endogenous labour supply) allows for modelling the link between technological progress and labour supply.

$$\max_{C_{irt},N_{jrt},H_{jrt},S_{rt}}\left(\sum_i \theta_{ir}.\ln C_{irt} - \sum_j \xi_j \frac{N_{jrt}^{\rho+1}}{\rho+1} - \sum_j \pi_j \frac{H_{jrt}^{\rho+1}}{\rho+1} + \kappa.\ln S_{rt}\right)$$

(CGE4)

s.t.

$$\sum_i P_{irt}.C_{irt} = (1-td_r)\sum_j\left(PN_{jrt}.N_{jrt} + PH_{jrt}.H_{jrt} + PKPR_{jrt}.KPR_{jrt}\right) + ror * A_{rt} + tr_r - S_{rt}$$

(CGE5)

$$C_{irt} \geq 0, \qquad N_{jrt} \geq 0, \qquad H_{jrt} \geq 0,$$

The **government** revenues consist of receipts from direct and indirect taxes, interest on its assets[397] and income from public capital. It spends on government consumption, transfers to the households and capital expenditures. The difference between government revenues and expenditures constitutes the government budget balance:

$$BB_{rt} = R_{rt} - G_{rt} =$$

$$ttd_r.\sum_j\left(PN_{jrt}.N_{jrt} + PH_{jrt}.H_{jrt} + PKPR_{jrt}.KPR_{jrt}\right) + \sum_i \tau_{ir}.\frac{P_{irt}}{(1+\tau_{ir})}.Q_{irt} + \sum_j PKPU_{jrt}.KPU_{jrt} + ror * AG_{rt} - \left(\sum_i cg_{irt}.P_{irt} + tr_{rt} + KE_{rt}\right) \qquad \text{(CGE6)}$$

[397] Is government assets are positive, then it receives interest, if not – it pays interest on its debt.

For the **foreign sector**, we have adopted the Armington assumption, which contradicts the conventional Heckscher and Ohlin foreign trade theory, but provides explanation on the following facts:

- many commodities are imported and exported from a single country simultaneously;
- even at the most disaggregated level, most countries produce in all product categories and thus specialization in a single product, for which the country has comparative advantage, is not possible;
- the assumption takes into account the different substitution elasticities between the commodities, produced in the country and the imported ones and therefore allows for estimation of the changes in the relative prices of the imported goods and services.

To apply the Armington assumption, a composite product Q_{irt} is defined, which quantity is determined as a CES function of the quantity produced in the country for the domestic market QD_{irt} and imports QM_{idt}.

$$Q_{irt} = e_i\left(\beta_i . QM_{irt}^{-\sigma_i} + (1-\beta_i) . QD_{irt}^{-\sigma_i}\right)^{-1/\sigma_i} \qquad \text{(CGE7)}$$

where e_i is a scale parameter, β_i measures the share of imports and σ_i is an exponent, which is equal to $\frac{1}{elasticity\ of\ substitution} - 1$. It is constrained to satisfy $-1 < \sigma_i < \infty$ to ensure that the respective isoquant is convex, i.e. that we have a decreasing technical rate of substitution.

The domestic prices, respectively are determined by calculation of the optimal ratio between imported and domestically produced goods and services:

$$\frac{QM_{irt}}{QD_{irt}} = \left(\frac{PD_{irt}}{pm_{it}} . \frac{\beta_i}{1-\beta_i}\right)^{1/1+\sigma_i}$$

(CGE8)

In a similar manner the substitution between the products, produced for the domestic market and for exports is described through a constant elasticity of transformation function (CET). The CET is almost identical to the above CES function, defined for the combination of domestically produced and imported commodities, with the exception of the elasticities of substitution, which are no longer negative.

$$QP_i = f_i\left(\eta_i . QE_i^{\gamma_i} + (1-\eta_i) . QD_i^{\gamma_i}\right)^{1/\gamma_i}$$

(CGE9)

Here $-1 < \gamma_i < \infty$ to ensure a concave isoquant.

Again, the optimal relationship between exports and products for the domestic market is calculated:

$$\frac{QE_i}{QD_i} = \left(\frac{pe_i}{PD_i} . \frac{1-\eta_i}{\eta_i}\right)^{1/\gamma_i - 1} \qquad \text{(CGE10)}$$

To complete the external sector, foreign savings FS_{rt} are estimated as the difference between foreign sector revenues from imports and interest on its assets and incurred expenditures from exports, where p is an index for the respective external trade partners.

$$\sum_i \sum_p PE_{it} . QE_{iprt} + FS_{rt} = \sum_i \sum_p PM_{it} . QM_{iprt} + ror * AF_{rt} \qquad \text{(CGE11)}$$

We also specify the usual equalities between total quantity supplied and used, defining the link between the make and use tables in the national accounts:

$$Total\ quantity\ supplied = Q_{irt} =$$

$$Total\ quantity\ used \quad = \sum_j IC_{ijrt} + C_{irt} + cg_{irt} + ID_{irt} + QE_{irt} + QT_{irt} \quad \text{(CGE12)}$$

and savings equals investment:

$$\overline{PK}_{rt}.II_{jrt} = \frac{K_{jrt}}{\sum_j K_{jrt}}(S_{rt} + KE_{rt} + BB_{rt} + FS_{rt} - ror * (A_{rt} + AF_{rt} + AG_{rt}) - \sum_i P_{irt}.Z_{irt} - DUMMY_{rt}) \quad \text{(CGE13)}$$

where $DUMMY_{rt}$ is a dummy variable, added to ensure that the system of equations becomes functionally independent (which is not the case otherwise, due to Walras law). To close the model, an additional equation for each region is defined by normalizing the prices to the overall price level in the respective region:

$$plevel_{rt} = \sum_i w_{ir}.P_{irt} \quad \text{(CGE14)}$$

As specified, the model is static in its nature, as all agents optimize only in the current period t and not over the entire time horizon of the simulations. However, the model allows also for transitional analysis by incorporating a capital and asset accumulation equations and constant growth of total factor productivity to capture some of dynamic in changes to the "state of the world":

$$KKPU_{jrt+1} = (1 - \delta).KKPU_{jrt} + IPU_{jrt}$$

$$KKPR_{jrt+1} = (1 - \delta).KKPR_{jrt} + IPR_{jrt}$$

$$\sigma_{jrt+1}^{VA} = (1 + \gamma A_t).\sigma_{jrt}^{VA}$$

$$A_{rt+1} = (1 + \mathrm{ror_r}).+S_{rt}$$

$$AF_{rt+1} = (1 + \mathrm{ror_r}).+FS_{rt}$$

$$AG_{rt+1} = (1 + \mathrm{ror_r}).+BB_{rt}$$

6.5.9.4 C.3.1. Sectorial and skill breakdowns

Sectorial disaggregation

In the selection of the disaggregation by economic sectors, we largely follow Christensen (2015). The classification of the low-tech and high-tech manufacturing sectors is made following the Eurostat classification[398]. In addition to this division of the manufacturing activities, we also specify the telecom, energy, transport and other e-com activities separately due to their importance for the impact assessment. Thus the economic sectors covered include:

1. Agriculture
2. Low-tech manufacturing
3. High-tech manufacturing
4. Energy sector
5. Transport
6. Telecommunications
7. E-communication services
8. Other services.

Skill disaggregation of labour

As specified the sectors use labour with very different qualification. If we assume the ILO classification based on occupations[399] , where the occupations are mapped by skill, using the following transition key:

ISCO-08 major groups	Skill level (from 1 to 4, where 4 is the highest)
1 Managers	3 + 4
2 Professionals	4
3 Technicians and Associate Professionals	3
4 Clerical Support Workers	2
5 Services and Sales Workers	2
6 Skilled Agricultural, Forestry and Fishery Workers	2
7 Craft and Related Trades Workers	2
8 Plant and Machine Operators and Assemblers	2
9 Elementary Occupations	1
0 Armed Forces Occupations	1 + 2 + 4

For the modelling purposes, we have grouped skill levels 1 and 2 into unskilled labour and skill levels 3 and 4 into skilled labour. In this way over 4/5 of the labour employed in agriculture and transport are unskilled. The share of unskilled labour in low-tech manufacturing and services is

[398] http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:High-tech_classification_of_manufacturing_industries

[399] International Labour Office, 2012, "International Standard Classification of Occupations ISCO-08", Geneva, available at: http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_172572.pdf

respectively around 2/3 and 1/2 and for the telecommunications and other e-communication services – between 1/4 and 1/3.

6.5.9.5 C.3.2. Data sources and transformations

The inputs to the model consist of three major types: statistical data, estimates of some of the parameters for the model, based on identified relevant studies and information on the policy options considered, based on the input from the EC and a review of the development of the relevant legislative and institutional framework.

In order to perform simulations with the specified model, it is calibrated with some representative data about the groups of countries identified in the cluster analysis (described in the next section). The latter, together with the envisaged econometric estimations of particular parameters, also require detailed data about the e-communications services sector. Additionally, data on the main socio-economic variables has been collected.

Below, a list of all used sources of information is provided. Data for the econometric estimations was used in logarithms.

Data	Source	Used for
Supply-use tables for all EU MS economies	Eurostat, Supply, Use and Input-Output tables	Construction of the social accounting matrices for the CGE model.
Main revenues and expenditure aggregates for the government	Eurostat, Annual government finance statistics	Construction of the social accounting matrices for the CGE model.
GDP and components by final use, income and production accounts (including by economic sectors), employment population and per capita	Eurostat, National accounts	Econometric estimations of the impact of the KPIs SAM and parameters calibrations for the CGE model Cluster analysis
Employment by occupation and economic activity	Eurostat, Detailed annual LFS statistics on employment	Estimation of the skilled and unskilled labour supply in the CGE model
Exports and imports by trading partners and commodities	Eurostat, EU trade since 1988 by SITC	Construction of the social accounting matrices for the CGE model.
Data on KPIs, related to the e-communications	EC Digital Agenda Key indicators dataset	Econometric estimations of the impact of the KPIs.
Heritage index	Heritage foundation webpage: http://www.heritage.org/index/explore	Econometric estimations of the impact of the KPIs.
Data on DESI index		Cluster analysis for the identification of the regions in the CGE model

6.5.9.6 C.3.3. Calibration

The majority of the parameters are calculated from the social accounting matrices, constructed for the implementation of the computable general equilibrium model, respectively for Germany, Czech Republic and Bulgaria. They are computed backwards, so as to reproduce some of the equations in the model for the base year, taking the variable values as given.

Another big group of parameters are also calibrated based of historical data for the respective economies. Finally, there is also a group of parameters, which are set, based on economic literature review. The model proved robust with respect to most of them with the exception of the elasticities in the Armington and CET aggregation functions ($\boldsymbol{elQ_{jr}}$ and $\boldsymbol{elQP_{jr}}$). They were adjusted to achieve a better reproduction of the baseline trajectories.

Parameter	Setting of the value
$\boldsymbol{elVA_{jr}}$	0.99 (i.e. practically corresponds to Cobb-Douglas function)
$\boldsymbol{elL_{jr}}$	0.99 (i.e. practically corresponds to Cobb-Douglas function)
$\boldsymbol{elK_{jr}}$	0.99 (i.e. practically corresponds to Cobb-Douglas function)
$\boldsymbol{elQ_{jr}}$	0.20, adjusted to reproduce plausible economic development trajectory in the baseline
$\boldsymbol{elQP_{jr}}$	0.20, adjusted to reproduce plausible economic development trajectory in the baseline
$\boldsymbol{\beta^{VA}_{jrt}}$	Calculated values of the share of labour in gross value added (SAM)
$\boldsymbol{\beta^{L}_{jrt}}$	Calculated values of the share of unskilled labour is total labour (SAM)
$\boldsymbol{\beta^{K}_{jrt}}$	Calculated values of the share of public capital in total capital (SAM)
$\boldsymbol{\beta^{Q}_{jrt}}$	Calculated from equation (QMQD) in the base year (SAM)
$\boldsymbol{\beta^{QP}_{jrt}}$	Calculated from equation (QEQD) in the base year (SAM)
$\boldsymbol{\nu^{VA}_{jrt}}$	$\boldsymbol{(elVA_{jr}-1)/elVA_{jr}}$
$\boldsymbol{\nu^{L}_{jrt}}$	$\boldsymbol{(elL_{jr}-1)/elL_{jr}}$
$\boldsymbol{\nu^{K}_{jrt}}$	$\boldsymbol{(elK_{jr}-1)/elK_{jr}}$
$\boldsymbol{\nu^{Q}_{jrt}}$	$\boldsymbol{(elQ_{jr}-1)/elQ_{jr}}$
$\boldsymbol{\nu^{QP}_{jrt}}$	$\boldsymbol{(elQP_{jr}-1)/elQP_{jr}}$
$\boldsymbol{\sigma^{L}_{jrt}}$	Calculated from equation (LAGGR) in the base year (SAM)
$\boldsymbol{\sigma^{K}_{jrt}}$	Calculated from equation (KAGGR) in the base year (SAM)
$\boldsymbol{\sigma^{Q}_{jrt}}$	Calculated from equation (QAGGR) in the base year (SAM)
$\boldsymbol{\sigma^{QP}_{jrt}}$	Calculated from equation (QPAGGR) in the base year (SAM)

η^{L}_{jrt}	Calculated from data on employment by occupation and economic activity (from 2008 onwards, NACE Rev. 2) from Eurostat
η^{IC}_{ijrt}	Calculated from equation (ICSH) in the base year (SAM)
η^{VA}_{jrt}	Calculated from equation (VASH) in the base year (SAM)
η^{QP}_{jirt}	Calculated from equation (QPSH) in the base year (SAM)
η^{QT}_{ii1rt}	Calculated from equation (QTEQ) in the base year (SAM)
η^{KE}_{rt}	Calculated from equation (KEEQ) in the base year (SAM)
η^{ID}_{irt}	Calculated from equation (IDEM) in the base year (SAM)
η^{IPU}_{jrt}	Calculated from equation (IPUSH) in the base year (SAM)
η^{FS}_{rt}	Set as the share of current account in GDP in the base year
η^{BB}_{rt}	Set as the share of consolidated government budget balance in GDP in the base year
η^{S}_{rt}	Set as the share of savings in GDP in the base year, adjusted to reproduce plausible economic development trajectory in the baseline
utk_r	Calculated to reproduce a plausible economic development trajectory in the baseline
td_r	Calculated from the SAM as a ratio between revenues from direct taxes and the respective tax base
τ_{ir}	Calculated from the SAM as a ratio between revenues from indirect taxes and the respective tax base
δ_r	0.025
θ_{ir}	Calculated from equation (HCONS) in the base year (SAM)
w_{ir}	Calculated as the share of consumption of product I in total consumption in the base year (SAM)
ξ_{jr}	Calculated from equation (NSUP) in the base year (SAM)
π_{jr}	Calculated from equation (HSUP) in the base year (SAM)
ρ_r	2.3436, based on Mandelman and Zlate (2011)[400]
κ_r	1 (the parameter has a scaling effect and simulations with different values did not show impact on the results)
ι_r	Calculated from equation (IbarEQ) in the base year (SAM)
ror_r	Set at very low levels, in line with the current trend of very low interest rates
$plevel$	Calculated from equation (PNORM) in the base year (SAM)
zv_{ir}	Calculated from the respective use tables in the base year

6.5.10 List of abbreviations and equations in the CGE model

6.5.10.1 List of indices

Abbreviation	Definition
j	sectors
i	products

[400] Mandelman F. and A. Zlate (2011), " Immigration, Remittances and Business Cycles", Federal Reserve Bank of Atlanta.

Abbreviation	Definition
r	regions
t	time periods

6.5.10.2 List of parameters

Abbreviation	Definition
$elVA_{jr}$	Elasticity of substitution in the CES production function
elL_{jr}	Elasticity of substitution in the labour aggregation function
elK_{jr}	Elasticity of substitution in the capital aggregation function
elQ_{jr}	Elasticity of import substitution (Armington)
$elQP_{jr}$	Elasticity of transformation
β_{jrt}^{VA}	Share of value-added to labour in activity j
β_{jrt}^{L}	Share parameter in the labour aggregation function
β_{jrt}^{K}	Share parameter in the capital aggregation function
β_{jrt}^{Q}	Share parameter in the composite supply Armington function for i
β_{jrt}^{QP}	Transformation function share parameter for i
ν_{jrt}^{VA}	Exponent parameter for the production function
ν_{jrt}^{L}	Exponent in the labour aggregation function
ν_{jrt}^{K}	Exponent in the capital aggregation function
ν_{jrt}^{Q}	Exponent in the composite supply Armington function for i
ν_{jrt}^{QP}	Transformation function exponent for i
σ_{jrt}^{L}	Shift parameter in the labour aggregation function
σ_{jrt}^{K}	Shift parameter in the capital aggregation function
σ_{jrt}^{Q}	Shift parameter in the composite supply Armington function for i
σ_{jrt}^{QP}	Transformation function shift parameter for i
η_{jrt}^{L}	Share of unskilled labour in total labour supply
η_{ijrt}^{IC}	Quantity of i as intermediate input per unit of output of j
η_{jrt}^{VA}	Value added per unit of output of j
η_{jirt}^{QP}	Yield of commodity i per unit of activity j
η_{ii1rt}^{QT}	Quantity of commodity i as trade input per unit of i1 produced and sold domestically
η_{rt}^{KE}	Share of public investments in GDP
η_{irt}^{ID}	Share of investment demand for product i in total investment
η_{jrt}^{IPU}	Share of public investment in sector j

η_{rt}^{FS}	Share of foreign savings to GDP
η_{rt}^{BB}	Share of budget balance to GDP
η_{rt}^{S}	Share of private savings to GDP
utk_r	Capital utilization rate
td_r	Implicit direct tax rate
τ_{ir}	Implicit indirect tax rate
δ_r	Depreciation of capital
θ_{ir}	Share of commodity i in the consumption of household
w_{ir}	Weight of commodity i in the CPI
ξ_{jr}	Weight to disutility from unskilled labour in hhd utility function
π_{jr}	Weight to disutility from skilled labour in hhd utility function
ρ_r	1 over Frisch elasticity of labour
κ_r	Weight of utility to savings in the hhd utility function
ι_r	Shift parameter in the investment aggregation function
ror_r	Rate of return
$plevel_r$	Consumer prices level in the base year
zv_{ir}	Change in stocks in value terms (for the base year calibration)

6.5.10.3 List of variables

Abbreviation	Definition
Endogenous variables	
σ_{jrt}^{VA}	Total factor productivity in the production function for activity *j*
VA_{jrt}	Value added in sector *j*
PVA_{jrt}	Value-added price of activity *j*
N_{jrt}	Quantity of unskilled labour demanded by activity *j*
H_{jrt}	Quantity of skilled labour demanded by activity *j*
L_{jrt}	Total labour employed in activity *j*
KPU_{jrt}	Quantity of public capital demanded by activity *j*
KPR_{jrt}	Quantity of private capital demanded by activity *j*
K_{jrt}	Quantity of capital demanded by activity *j*
PN_{jrt}	Price of non-skilled labour in activity *j*
PH_{jrt}	Price of skilled labour in activity *j*
$PKPU_{jrt}$	Price of public capital in sector *j*
$PKPR_{jrt}$	Price of private capital in sector *j*
IC_{ijrt}	Intermediate consumption of product i in activity *j*
QA_{jrt}	Gross output in activity *j*
PA_{jrt}	Price of gross output in activity *j*
QP_{jirt}	Quantity of product i produced domestically
QPT_{jirt}	Total quantity of commodity i produced domestically
PPT_{irt}	Price of total quantity of commodity i produced domestically

Abbreviation	Definition
QD_{irt}	Quantity sold domestically of domestic product i
PD_{irt}	Domestic price of domestic output i
PDD_{irt}	Domestic price of domestic output i including trade and transport margins
QT_{irt}	Quantity of commodity demanded as trade and transport margin
P_{irt}	Composite price of product i
Q_{irt}	Composite supply of product i at domestic market
QM_{irt}	Imports of product i
QE_{irt}	Exports of product i
C_{irt}	Consumption of commodity i by household
S_{rt}	Household savings
$\bar{I}_{rt}$	Total investment demand
ID_{irt}	Investment demand for product i
Z_{irt}	Change in stocks of product i
$\overline{PK}_{rt}$	Composite investment goods price
II_{jrt}	Sectoral investment
IPU_{jrt}	Public investment in activity j
IPR_{jrt}	Private investment in activity j
$KKPU_{jrt}$	Total public capital stock in sector j
$KKPR_{jrt}$	Total private capital stock in sector j
A_{rt}	Private cumulative assets
AF_{rt}	Foreign cumulative assets
AG_{rt}	Government cumulative assets
KE_{rt}	Government capital expenditures
R_{rt}	Government revenues
G_{rt}	Government expenditures
BB_{rt}	Budget balance
FS_{rt}	Foreign savings
$DUMMY_{rt}$	Walras variable (zero at equilibrium)
Exogenous variables	
tr_{rt}	Transfers from the government to the household
cg_{irt}	Government consumption of i
pm_{irt}	Import price of product i
pe_{irt}	Export price of product i

6.5.10.4 Complete list of model equations

Production function

$$VA_{jrt} = \sigma_{jrt}^{VA}\left(\beta_{jr}^{VA}.L_{jrt}^{\nu_{jr}^{VA}} + \left(1-\beta_{jr}^{VA}\right).K_{jrt}^{\nu_{jr}^{VA}}\right)^{\frac{1}{\nu_{jr}^{VA}}} \qquad \text{(PRODF)}$$

First-order conditions for the producer optimization problem

$$L_{jrt} = \sigma_{jrt}^{L}\left(\beta_{jr}^{L}.N_{jrt}^{\nu_{jr}^{L}} + \left(1-\beta_{jr}^{L}\right).H_{jrt}^{\nu_{jr}^{L}}\right)^{\frac{1}{\nu_{jr}^{L}}}$$

(LAGGR)

$$K_{jrt} = \sigma_{jrt}^{K}\left(\beta_{jr}^{K}.KPU_{jrt}^{\nu_{jr}^{K}} + \left(1-\beta_{jr}^{K}\right).KPR_{jrt}^{\nu_{jr}^{K}}\right)^{\frac{1}{\nu_{jr}^{K}}}$$

(KAGGR)

$$PN_{rt}.N_{jrt}^{1-\nu_{jr}^{L}} = \frac{\beta_{jr}^{VA}.\beta_{jr}^{L}.PVA_{jrt}.VA_{jrt}.L_{jrt}^{\nu_{jr}^{VA}}}{\left(\beta_{jr}^{VA}.L_{jrt}^{\nu_{jr}^{VA}} + \left(1-\beta_{jr}^{VA}\right).K_{jrt}^{\nu_{jr}^{VA}}\right).\left(\beta_{jr}^{L}.N_{jrt}^{\nu_{jr}^{L}} + \left(1-\beta_{jr}^{L}\right).H_{jrt}^{\nu_{jr}^{L}}\right)} \quad \text{(NDEM)}$$

$$PH_{rt}.H_{jrt}^{1-\nu_{jr}^{L}} = \frac{\beta_{jr}^{VA}.\left(1-\beta_{jr}^{L}\right).PVA_{jrt}.VA_{jrt}.L_{jrt}^{\nu_{jr}^{VA}}}{\left(\beta_{jr}^{VA}.L_{jrt}^{\nu_{jr}^{VA}} + \left(1-\beta_{jr}^{VA}\right).K_{jrt}^{\nu_{jr}^{VA}}\right).\left(\beta_{jr}^{L}.N_{jrt}^{\nu_{jr}^{L}} + \left(1-\beta_{jr}^{L}\right).H_{jrt}^{\nu_{jr}^{L}}\right)} \quad \text{(HDEM)}$$

$$PKPU_{rt}.KPU_{jrt}^{1-\nu_{jr}^{L}} = \frac{\left(1-\beta_{jr}^{VA}\right).\beta_{jr}^{K}.PVA_{jrt}.VA_{jrt}.K_{jrt}^{\nu_{jr}^{VA}}}{\left(\beta_{jr}^{VA}.L_{jrt}^{\nu_{jr}^{VA}} + \left(1-\beta_{jr}^{VA}\right).K_{jrt}^{\nu_{jr}^{VA}}\right).\left(\beta_{jr}^{K}.KPU_{jrt}^{\nu_{jr}^{K}} + \left(1-\beta_{jr}^{K}\right).KPR_{jrt}^{\nu_{jr}^{K}}\right)}$$

(KPUDEM)

$$PKPR_{rt}.KPR_{jrt}^{1-\nu_{jr}^{L}} = \frac{\left(1-\beta_{jr}^{VA}\right).\left(1-\beta_{jr}^{K}\right).PVA_{jrt}.VA_{jrt}.K_{jrt}^{\nu_{jr}^{VA}}}{\left(\beta_{jr}^{VA}.L_{jrt}^{\nu_{jr}^{VA}} + \left(1-\beta_{jr}^{VA}\right).K_{jrt}^{\nu_{jr}^{VA}}\right).\left(\beta_{jr}^{K}.KPU_{jrt}^{\nu_{jr}^{K}} + \left(1-\beta_{jr}^{K}\right).KPR_{jrt}^{\nu_{jr}^{K}}\right)}$$

(KPRDEM)

Leontief aggregation of intermediate consumption and value added

$$IC_{ijrt} = \eta_{ijr}^{IC}.QA_{jrt} \quad \text{(ICSH)}$$

$$VA_{jrt} = \eta_{jr}^{VA}.QA_{jrt}$$

(VASH)

$$PA_{jrt}.QA_{jrt} = \sum_i \frac{\eta_{ijrt}^{IC}}{\sum_i \eta_{ijrt}^{IC}}.P_{irt}.\sum_i IC_{ijrt} + PVA_{jrt}.VA_{jrt} \quad \text{(QAVAL)}$$

Transformation of activity into output

$$QP_{jirt} = \eta_{jir}^{QP}.QA_{jrt}$$

(QPSH)

$$PA_{jrt} = \sum_i \eta_{jir}^{QP}.PPT_{irt} \quad \text{(PAEQ)}$$

$$QPT_{irt} = \sum_j QP_{jirt}$$

(QPTEQ)

$$PDD_{irt} = PD_{irt} + \sum_{i'} \eta_{i'i}^{QT}.P_{i'rt}$$

$$PPT_{irt}.QPT_{irt} = PD_{irt}.QD_{irt} + PE_{it}.QE_{irt} \quad \text{(QPTVAL)}$$

$$\frac{P_{irt}.Q_{irt}}{(1+\tau_{ir})} = PDD_{irt}.QD_{irt} + PM_{it}.QM_{irt} \quad \text{(QVAL)}$$

$$QT_{irt} = \sum_{i'} \eta_{ii'}^{QT}.QD_{i'rt} \quad \text{(QTEQ)}$$

Armington function for domestic-import aggregation

$$Q_{irt} = \sigma^{Q}{}_{i}\left(\beta^{Q}{}_{i}.\overline{QM}_{irt}^{-\nu^{Q}{}_{i}} + \left(1-\beta^{Q}{}_{i}\right).QD_{irt}^{-\nu^{Q}{}_{i}}\right)^{-1/\nu^{Q}{}_{i}} \quad \text{(QAGGR)}$$

$$\frac{\overline{QM}_{irt}}{QD_{irt}} = \left(\frac{PDD_{irt}}{PM_{it}}.\frac{\beta^{Q}{}_{i}}{1-\beta^{Q}{}_{i}}\right)^{1/(1+\nu^{Q}{}_{i})} \quad \text{(QMQD)}$$

Constant elasticity of transformation function for the domestic-export aggregation

$$QPT_{irt} = \sigma^{QP}{}_{i}\left(\beta^{QP}{}_{i}.\overline{QE}_{irt}^{\nu^{QP}{}_{i}} + \left(1-\beta^{QP}{}_{i}\right).QD_{irt}^{\nu^{QP}{}_{i}}\right)^{1/\nu^{QP}{}_{i}} \quad \text{(QPAGGR)}$$

$$\frac{\overline{QE}_{irt}}{QD_{irt}} = \left(\frac{PE_{it}}{PD_{irt}}.\frac{1-\beta^{QP}{}_{i}}{\beta^{QP}{}_{i}}\right)^{1/(\nu^{QP}{}_{i}-1)}$$
(QEQD)

First-order conditions in the household optimization problem

$$\sum_i P_{irt}.C_{irt} = (1-td_r)\sum_j\left(PN_{jrt}.N_{jrt} + PH_{jrt}.H_{jrt} + PKPR_{jrt}.KPR_{jrt}\right) + ror * A_{rt} + tr_r - S_{rt} \quad \text{(HBUDG)}$$

$$C_{irt}.P_{irt}.\kappa = \theta_{ir}.S_{rt}$$
(HCONS)

$$\xi_j.N_{jrt}{}^{\rho}.S = \kappa.(1-td_r).PN_{jrt}$$
(NSUP)

$$\pi_j.H_{jrt}{}^{\rho}.S = \kappa.(1-td_r).PH_{jrt}$$
(HSUP)

Government equations

$$KE_{rt} = \eta_r^{KE}.\sum_j PVA_{jrt}.VA_{jrt} \quad \text{(KEEQ)}$$

$$R_{rt} = td_r.\sum_j\left(PN_{jrt}.N_{jrt} + PH_{jrt}.H_{jrt} + PKPR_{jrt}.KPR_{jrt}\right) + \sum_i \tau_{ir}.\frac{P_{irt}}{(1+\tau_{ir})}.Q_{irt} + \sum_j PKPU_{jrt}.KPU_{jrt} + ror * AG_{rt} \quad \text{(REQ)}$$

$$G_{rt} = \sum_i cg_{irt}.P_{irt} + tr_r + KE_{rt} \quad \text{(GEQ)}$$

$$BB_{rt} = R_{rt} - G_{rt}$$
(BBEQ)

Capital and investment equations

$$ID_{irt} = \eta_{ir}^{ID}.\bar{I}_{rt} \quad \text{(IDEM)}$$

$$\bar{I}_{rt} = \iota_r.\prod_i ID_{irt}{}^{\eta_{ir}^{ID}}$$
(IbarEQ)

$$\overline{PK}_{rt} = \sum_i \eta_{ir}^{ID}.P_{irt}$$
(PKEQ)

$$IPU_{jrt} = \eta_r^{IPU} * KE_{rt}$$
(IPUSH)

$$II_{jrt} = IPU_{jrt} + IPR_{jrt} \quad \text{(IPREQ)}$$

$$KPU_{jrt} = utk.KKPU_{jrt}$$
(KPUEQ)

$$KPR_{jrt} = utk.KKPR_{jrt}$$
(KPREQ)

Recursive dynamic equations

$KKPU_{jrt+1} = (1-\delta).KKPU_{jrt} + IPU_{jrt}$
(KKPUDYN)

$KKPR_{jrt+1} = (1-\delta).KKPR_{jrt} + IPR_{jrt}$
(KKPRDYN)

$\sigma_{jrt+1}^{VA} = (1+\gamma A_t).\sigma_{jrt}^{VA}$
(TFPDYN)

$A_{rt+1} = (1+\mathrm{ror_r}).+S_{rt}$
(ADYN)

$AF_{rt+1} = (1+\mathrm{ror_r}).+FS_{rt}$
(AFDYN)

$AG_{rt+1} = (1+\mathrm{ror_r}).+BB_{rt}$
(AGDYN)

Foreign sector balance

$\sum_i \sum_p PE_{it}.QE_{iprt} + FS_{rt} = \sum_i \sum_p PM_{it}.QM_{iprt} + ror * AF_{rt}$ (FSEQ)

Savings-investment balance

$\overline{PK}_{rt}.II_{jrt} = \frac{K_{jrt}}{\sum_j K_{jrt}}(S_{rt} + KE_{rt} + BB_{rt} + FS_{rt} - ror * (A_{rt} + AF_{rt} + AG_{rt}) - \sum_i P_{irt}.Z_{irt} - DUMMY_{rt})$ (IIEQ)

Product market clearance

$Q_{irt} = \sum_j IC_{ijrt} + C_{irt} + cg_{irt} + ID_{irt} + Z_{irt} + QT_{irt}$ (PRODMKT)

Additional equation due to Walras law of functional dependence

$plevel_{rt} = \sum_i w_{ir}.P_{irt}$ (PNORM)

6.6 ANNEX 6 - Data and problem evidence

6.6.1 Introduction

Europe's Digital Progress Report provides an overview of the progress made by MS in digitalisation. It also details the policy responses by MS to address the specific challenges that face them.

The Commission adopted the DSM Strategy for Europe[401] in May 2015, which identified that Europe has the potential to lead in the global digital economy, but that fragmentation and barriers that do not exist in the single market are holding back the EU. It estimated that bringing down these barriers could contribute an additional EUR 415 billion to European GDP. The digital economy could expand markets and provide better services at better prices, offer more choice and create employment. The DSM could create opportunities for new start-ups and provide an environment for businesses to grow and benefit from a market of over 500 million consumers.

The Commission therefore announced a series of measures to be taken at EU level to:

- improve access for consumers and businesses to online goods and services across Europe;
- create the right conditions for digital networks and services to flourish; and
- maximise the growth potential of the European digital economy.

The delivery rhythm of the announced measures has been brisk.

Already on 6 May 2015, the Commission launched a competition sector inquiry into eCommerce relating to the online trade of goods and the online provision of services. More than 1300 companies responded before the end of 2015. A first set of very preliminary results has been published on 18 March 2016, showing that geo-blocking is widespread in the EU. This is partly due to unilateral decisions by companies not to sell abroad but also contractual barriers set up by companies preventing consumers from shopping online across EU borders.

On 9 December 2015, the Commission presented a proposal for Directive on contracts for the supply of digital content[402] as well as a proposal for a Directive on certain aspects concerning contracts for the online and other distance sales of goods[403]. The aim of these proposals is to remove barriers due to contract law differences. In addition, for the supply of digital content, once adopted, the Directive should set out clear and specific rights for consumers. Indeed, there is currently a clear gap in EU legislation in the area of defective digital content, as most MS do not have any legislation in place to protect consumers in the case of defective digital content.

On the same day, the Commission proposed a Regulation on the cross-border portability of online content services in the internal market[404] to allow people to travel with their online content. In other words, this Regulation should ensure that Europeans who have purchased films, series, sports broadcasts, games or e-books online can access them when they travel within the EU.

At the same time, the Commission published an action plan to modernise EU copyright rules,[405] which should make EU copyright rules fit for the digital age. This 'political preview' will be translated into legislative proposals and policy initiatives that take into account responses to several public consultations.

A set of measures to support and link up national initiatives for the digitisation of industry and related services across all sectors and to boost investment through strategic partnerships and

[401] COM(2015) 192.
[402] COM(2015) 634.
[403] COM(2015) 635.
[404] COM(2015) 627.
[405] COM(2015) 626.

networks was adopted by the Commission on 19 April 2016.[406] This package also contains concrete measures to speed up the standard setting process for ICT and an updated e-government action plan to modernise digital public services.

In addition to action at the European level, the DSM strategy recognised that such action needs to be complemented by actions taken at MS level, since a major part of policies which are essential for the development of the digital economy are formulated a national level. Moreover, MS are at very different stages in the development of the digital economy; some, for example, the Nordic countries, are among the most advanced in the world, while others still have a lot of catching up to do. Therefore, both policy priorities and the impact of the DSM will differ significantly from Member State to Member State.

This report combines the quantitative evidence from the **Digital Economy and Society index (DESI)** with country-specific policy insights. It keeps track of the progress made in digitalisation in the MS and provides important feedback for policy-making at EU level. To enable a better comparison between MS, this report also develops a cross-country analysis for the main dimensions of DESI. This report will feed into the analysis of MS' economic and social challenges and the monitoring of national reform efforts carried out under the European Semester.

The report is structured in thematic chapters that examine one issue across all MS. The first section starts with connectivity, followed by human capital, before moving on to internet usage, the digitisation of industry and digital public service and finally R&D in ICT. This is followed by country chapters, each of which looks in the same order at the same issues, except for R&D, which is not covered at the level of MS.

6.6.2 The state of play on connectivity and the telecom sector

The Connectivity dimension of DESI looks at both the demand and the supply side of fixed and mobile broadband. Under fixed broadband it assesses the availability as well as the take-up of basic and high-speed NGA broadband and also considers the affordability of retail offers. On mobile broadband, the availability of radio spectrum and the take-up of mobile broadband are included.

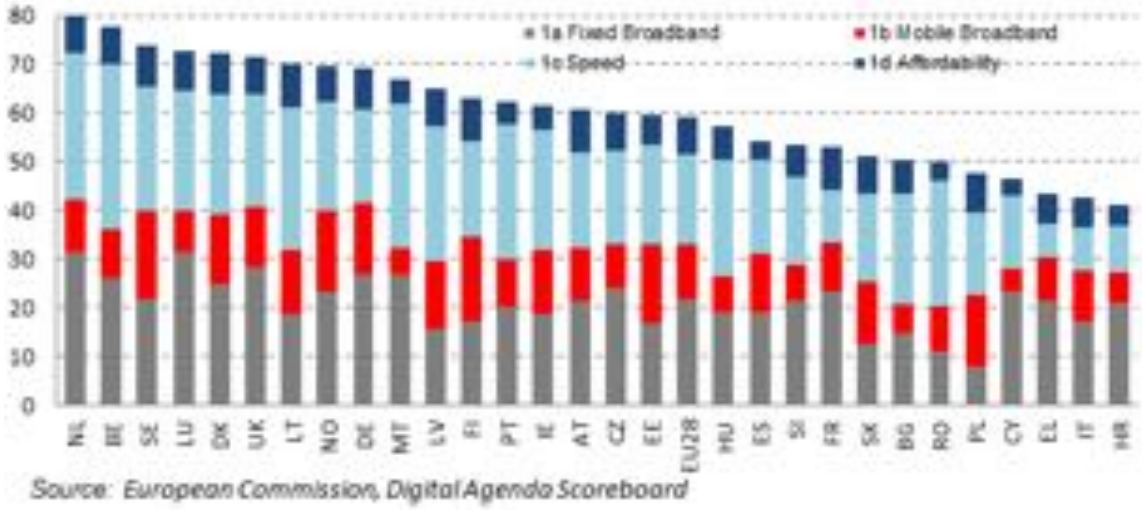
On the fixed side, Luxembourg, the Netherlands and the UK are the strongest, and Poland, Romania, Slovakia and Bulgaria the weakest. NGA subscriptions are particularly advanced in Belgium, Romania, the Netherlands and Lithuania. As for mobile broadband, The Nordic countries (Finland, Sweden and Denmark) lead along with Estonia, while lowest figures were registered by Hungary, Greece and Portugal.

Table 32 - EU average of Connectivity Indicators in DESI 2016

DESI - Connectivity	
Fixed broadband coverage (% of homes)	97%
Fixed broadband take-up (% of homes)	72%
Mobile broadband take-up (subs per 100 people)	75
Spectrum (% of spectrum harmonised)	69%
NGA coverage (% of homes)	71%
Subscriptions to fast broadband (% of subscriptions)	30%
Fixed broadband price (as a % of income)	1.3%

[406] COM(2016) 176, (COM(2016) 178, COM(2016) 179, COM(2016) 180.

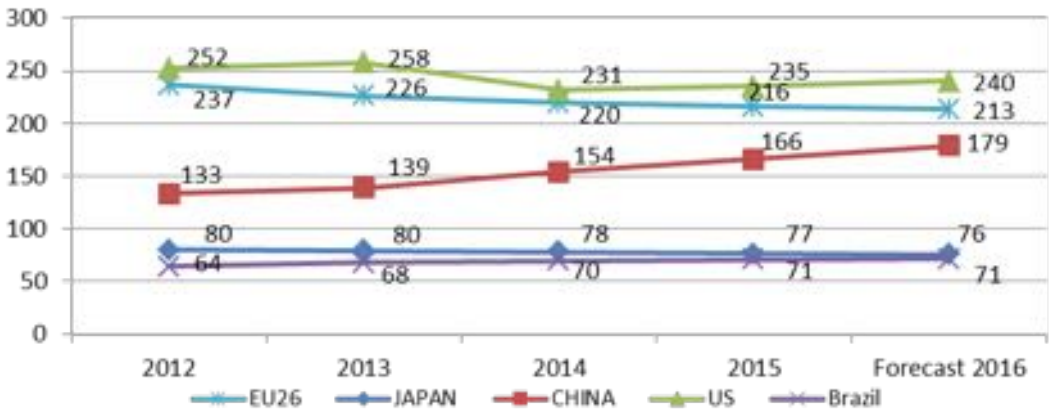
Figure 37 - Digital Economy and Society Index (DESI), Connectivity, 2016



Total telecom services revenues have declined by 10 % in Europe since 2012. EU telecom CAPEX has slightly increased in the same period.

Telecom operators in Europe generated less revenue than US operators. Revenues went down from EUR 237 bn in 2012 to EUR 213 bn in 2016 (forecasted) in Europe. At the same time, the US also reduced its figures from EUR 252 bn to EUR 240 bn, surpassing Europe despite its smaller population. There have been large increases in emerging markets, especially in China, where there is still relatively low take-up of telecom services[407].

Figure 38 - Total telecommunication services revenues per region, billion EUR, 2012-2016

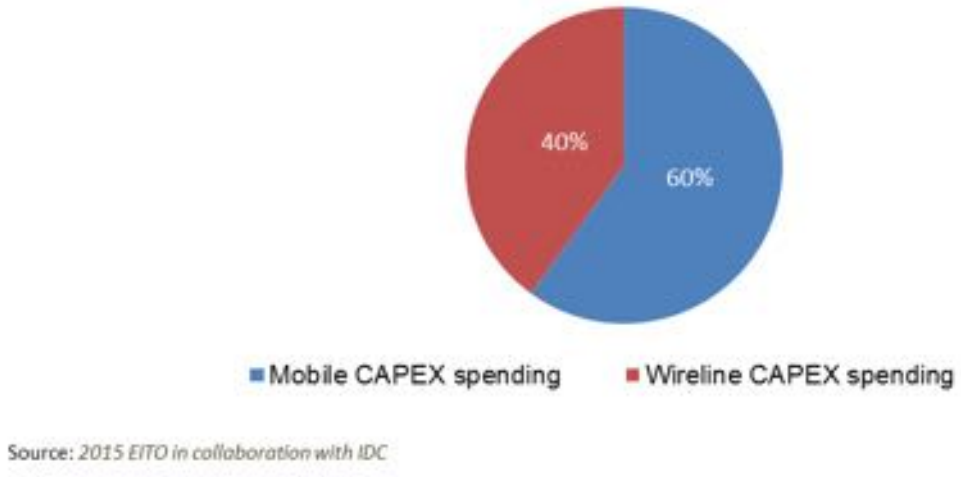


Source: *2015 EITO in collaboration with IDC*

CAPEX figures remained stable over the last four years even though NGA coverage increased from 54 % to 71 %. Mobile CAPEX spending represented 60 % of total spending.

[407] *Note: this analysis is based on detailed figures from 26 MS, which covered about 98 % of the total EU market (total telecom carrier services).*

Figure 39 - Share of fixed and mobile CAPEX in Europe, 2015



Mobile voice and fixed voice revenues have decreased by over 25 % since 2012. Mobile data grew by 10 %, and will represent over a quarter of total telecom revenues at EU level in 2016.

The revenues of the telecommunications sector went down by 10 % between 2012 and 2016 (forecasted figure).

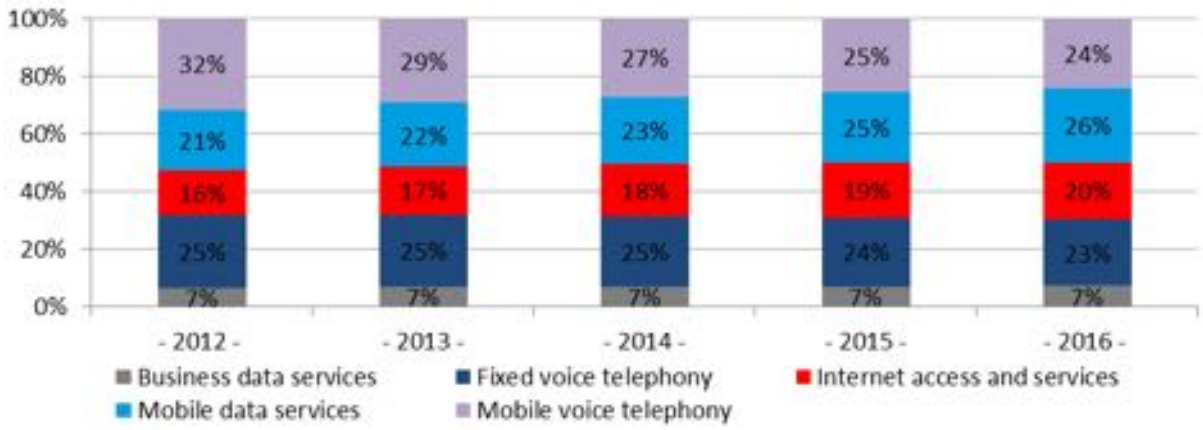
Telecommunications revenues (carrier services) by segment showed, how voice services (both fixed and mobile) lost importance. Fixed voice decreased by 17.2 %, while mobile by 30.8 %. Fixed and mobile voice services made up 57 % of total telecom revenues in 2012, but will only represent 47 % in 2016.

Table 33 - . Revenue growth rates, 2012-2016

Revenue growth rates 2012-2016	
Telecom carrier services	-10.0 %
Business data services	-0.8 %
Fixed voice telephony	-17.2 %
Internet access and services	13.1 %
Mobile data services	9.9 %
Mobile voice telephony	-30.8 %

By contrast, the growth in mobile data services (9.9 % between 2012 and 2016) is remarkable. Mobile data will represent over one quarter of total market revenue (26 %) in 2016. The growth in mobile data services could not, however, compensate for the major decline in voice. Revenue from fixed internet access went up by 13.1 % since 2012, whereas business data services decreased by almost 1 % between 2012 and the forecasted figure for 2016, representing solely 7 % of total telecom revenue.

Figure 40 - Total telecom carrier services revenues by segment, 2012-2016



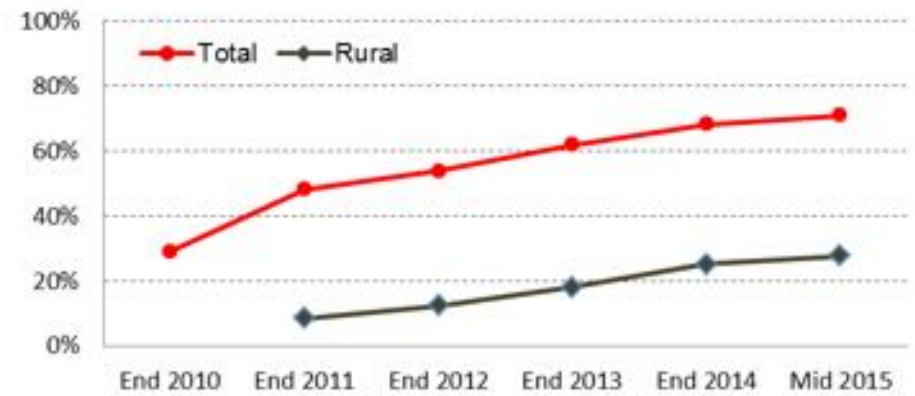
Source: 2015 EITO in collaboration with IDC

Coverage of next generation access (NGA) technologies continued to increase and reached 71 %. NGA deployments still focus mainly on urban areas, while only 28 % of rural homes are covered.

For the purpose of this report, next generation access includes VDSL, Cable Docsis 3.0 and FTTP. By mid-2015, Cable Docsis 3.0 had the largest NGA coverage at 44 %, followed by VDSL (41 %) and FTTP (21 %). Most of the upgrades in European cable networks had taken place by 2011, while VDSL coverage doubled in the last four years. There was remarkable progress also in FTTP growing from 10 % in 2011 to 21 % in 2015, but FTTP coverage is still low.

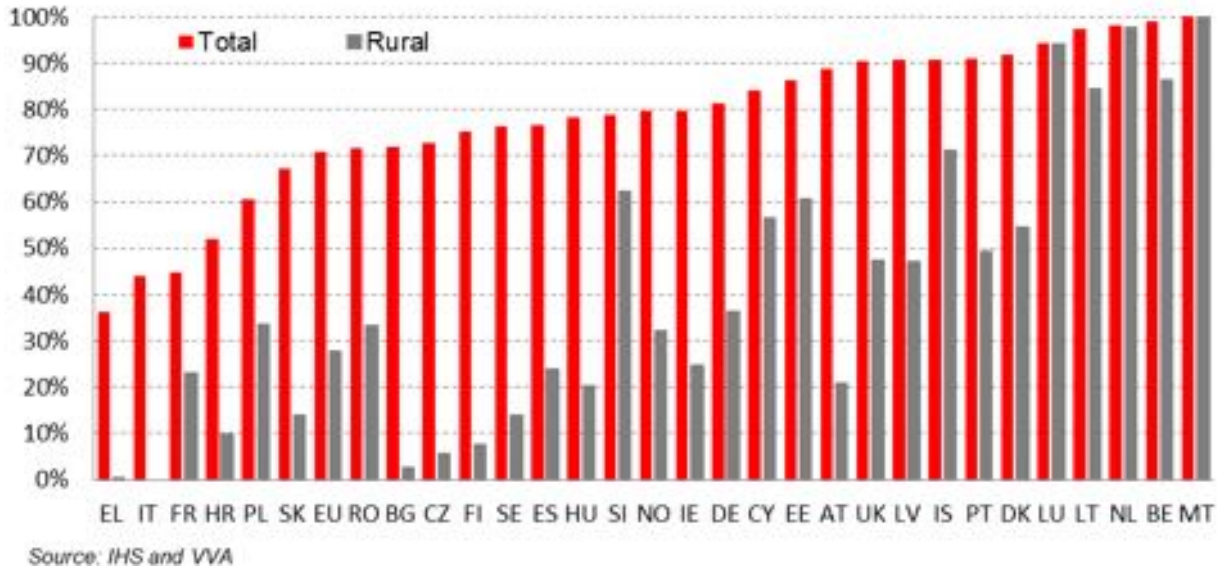
NGA networks are still very much limited to urban areas: only 28 % of rural homes are covered, mainly by VDSL.

Figure 41 - NGA broadband coverage in the EU, **2010-2015**



Source: IHS, VVA and Point Topic

Figure 42 - Next generation access (FTTP, VDSL and Docsis 3.0 cable) coverage, June 2015



Coverage of Fibre to the Premises (FTTP) grew from 10 % in 2011 to 21 % in 2015, while it remains a primarily urban technology. Lithuania, Latvia, Portugal and Estonia are the leaders in FTTP in Europe.

FTTP is catching up in Europe, as coverage for homes more than doubled since 2011. However, the FTTP footprint is still significantly lower than that of cable Docsis 3.0 and VDSL. In Estonia, Portugal, Latvia and Lithuania more than two thirds of homes can already subscribe to FTTP services, while in Greece, the UK, Ireland, Germany, Austria and Poland only less than 10 % can do so. FTTP services are available mainly in urban areas with the exception of Lithuania, Latvia, Estonia, Denmark and Luxembourg, where more than one in three rural homes can also have access to it.

Figure 43 - Fibre to the premises (FTTP) coverage in the EU, 2011-2015

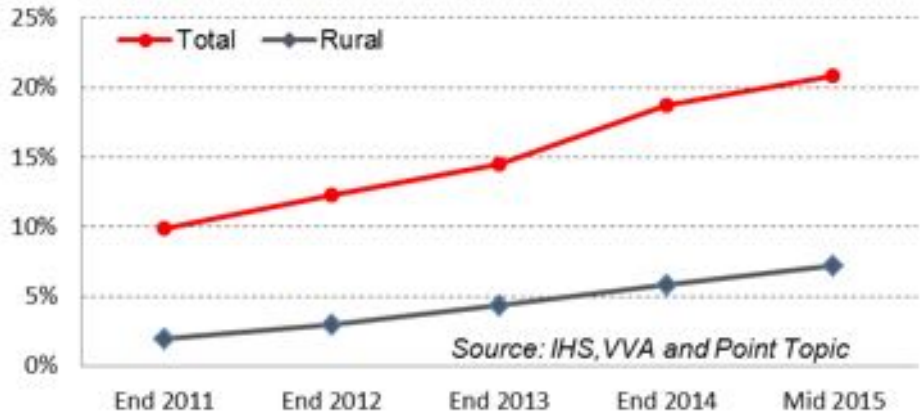
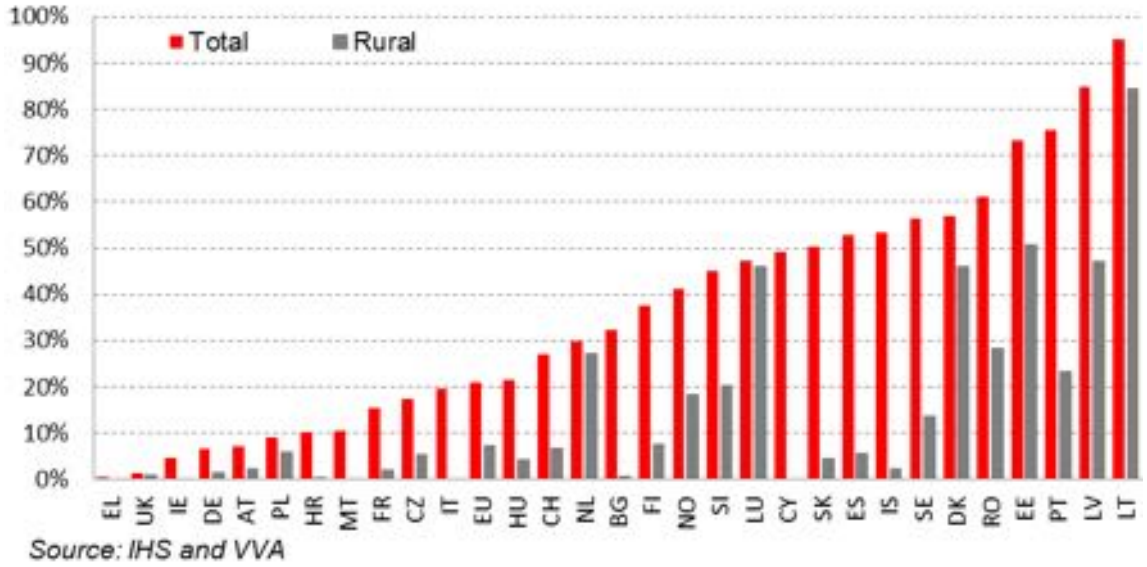


Figure 44 - Fibre to the premises (FTTP) coverage, June 2015



4G mobile broadband availability reached 86%, up from 27% three years ago. 4G has been commercially launched in all MS.

In 2015, deployments of 4G (LTE) continued: coverage went up from 79% of homes to 86% in six months. Nevertheless, 4G coverage is still substantially below that of 3G (HSPA). As of October 2015, 80% of Mobile Network Operators in the EU offered 4G services on LTE networks.

LTE is most widely developed in the Netherlands, Sweden and Denmark, while commercial 4G services were launched only last year in Bulgaria.

LTE deployments have focused so far mainly in urban areas, as only 36% of rural homes are covered. However, in sixteen MS, LTE is already available also in the majority of rural homes, with very high rates in Denmark, Sweden, Slovenia, Luxembourg and the Netherlands.

Figure 45 - Mobile broadband coverage in the EU, 2011-2015

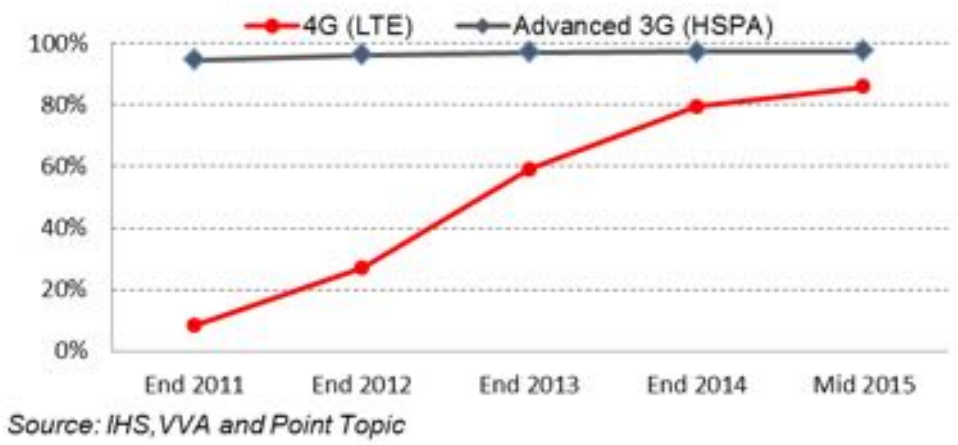
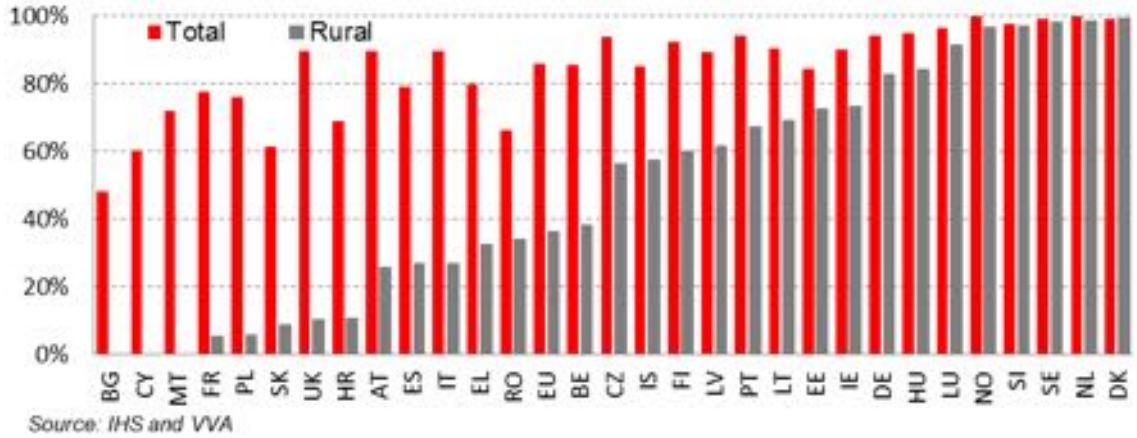


Figure 46 - 4G (LTE) coverage, June 2015



An estimated 8 % of European homes subscribe to ultrafast broadband (at least 100Mbps), up from 0.3 % five years ago. Romania, Sweden and Latvia are the most advanced in ultrafast broadband adoption.

The Digital Agenda for Europe set the objective that at least 50 % of homes should subscribe to ultrafast broadband by 2020. From June 2015, 49 % of homes are covered by networks capable of providing 100Mbps. As service offerings are emerging, take-up is growing sharply. The penetration is the highest in Romania, Sweden and Latvia. These three MS have a high coverage of FTTP. In Greece, Italy and Croatia take-up is low mainly due to the lack of superfast infrastructure, while in Cyprus and Malta, where the infrastructure is available for many homes, still mainly lower speed offers are purchased.

Figure 47 - Percentage of households with a fast broadband (at least 30Mbps) subscription at EU level, 2010-2015

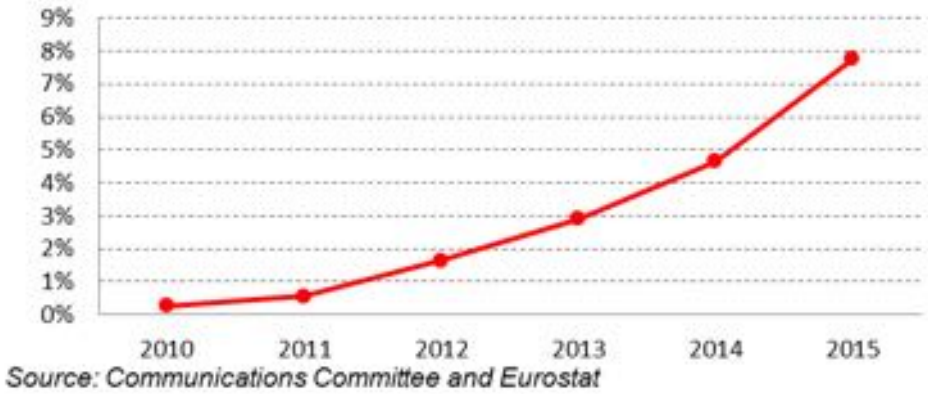
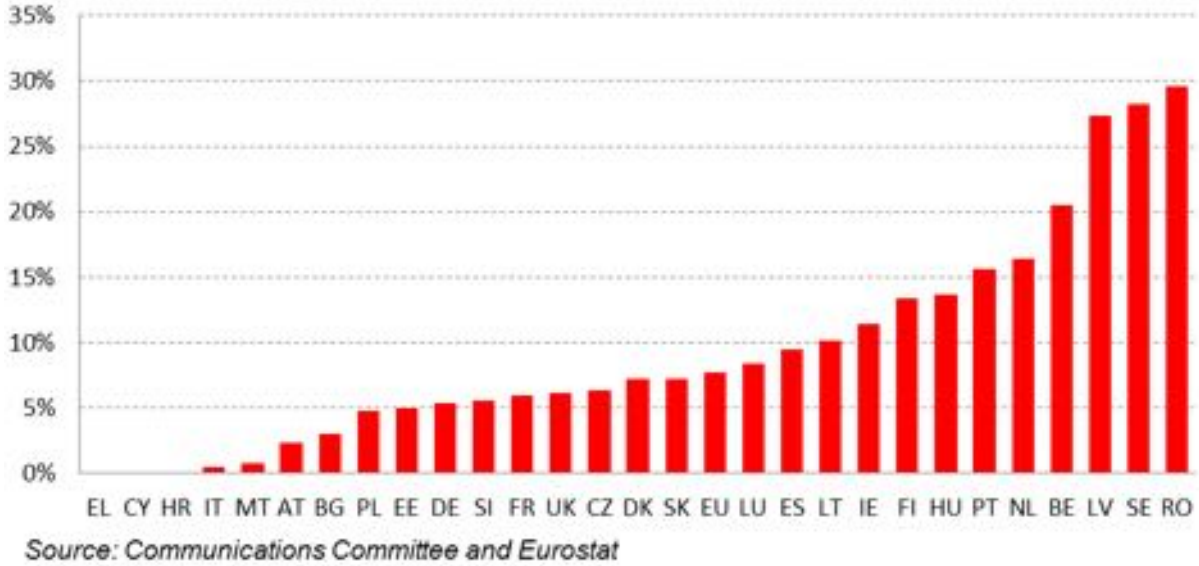
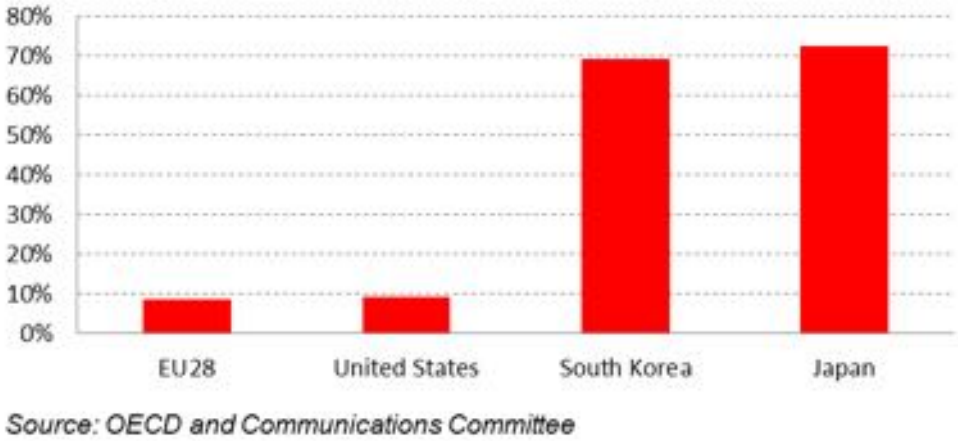


Figure 48 - Percentage of households with an ultrafast broadband (at least 100Mbps) subscription, July 2015



FTTH and FTTB together represent 9 % of EU broadband subscriptions up from 7 % a year ago. In these technologies, Europe is still very much lagging behind South Korea and Japan.

Figure 49- Share of fibre connections in total fixed broadband, July 2015



Fast and ultrafast broadband subscriptions grew by 36 % in 12 months. In Belgium, Latvia and Romania, the majority of subscriptions are at least 30 Mbps. Ultrafast (at least 100 Mbps) is most widespread in Belgium and Romania.

Despite the growth in fast and ultrafast subscriptions, they are still rare in the EU. In January 2015, only slightly more than one in four subscriptions were at least 30 Mbps and only 9 % were at least 100Mbps.

In Belgium, Romania, Malta, Latvia, Portugal, Lithuania, Ireland, the Netherlands and Sweden, more than 50 % are already at least 30Mbps, while the same ratio is less than 10 % in Italy, Greece, Cyprus and Croatia. In ultrafast (at least 100 Mbps), Sweden, Latvia and Romania are the most advanced with more than 40 % of subscriptions.

Figure 50 - Fixed broadband subscriptions by headline speed at EU level, 2008-2015

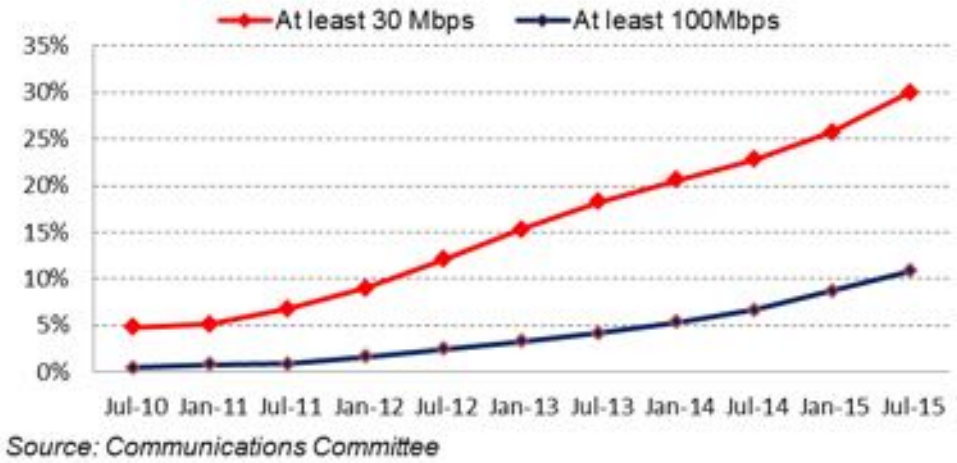
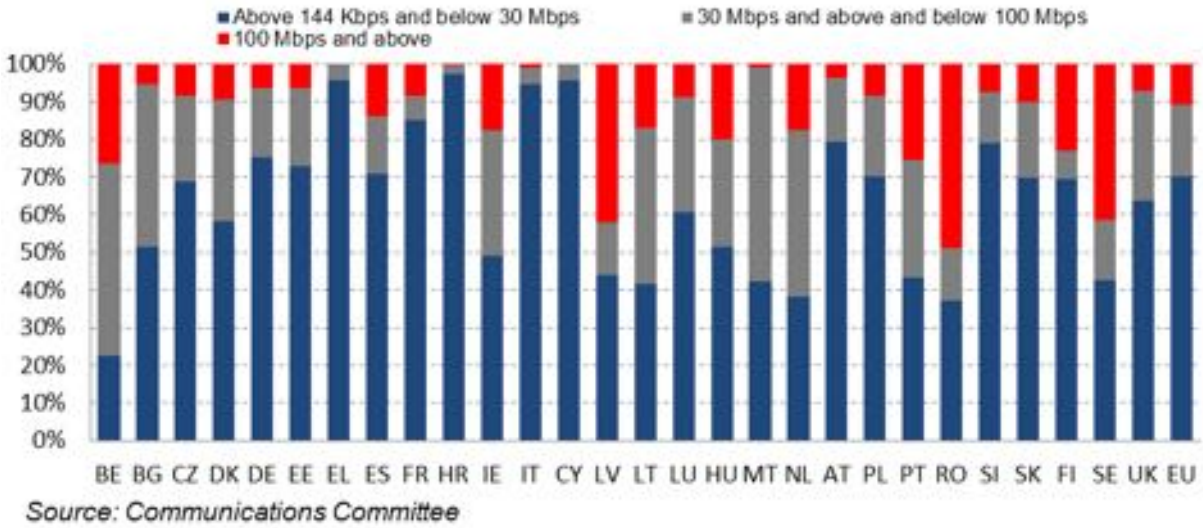


Figure 51 - Fixed broadband subscriptions by headline speed, July 2015



There are 75 active mobile broadband SIM cards per 100 people in the EU, up from 34 four years ago. The growth was linear over the last three years with over 40 million new subscriptions added every year.

Mobile broadband represents a fast growing segment of the broadband market. More than 60% of all active mobile SIM cards use mobile broadband.

In the Nordic countries and Estonia, there are already more than 100 subscriptions per 100 people, while in Hungary, Greece, Portugal and Slovenia the take-up rate is still below 50%. Most of the mobile broadband subscriptions are used on smartphones rather than in tablets or notebooks.

Figure 52 - Mobile broadband penetration at EU level, January 2009 - July 2015

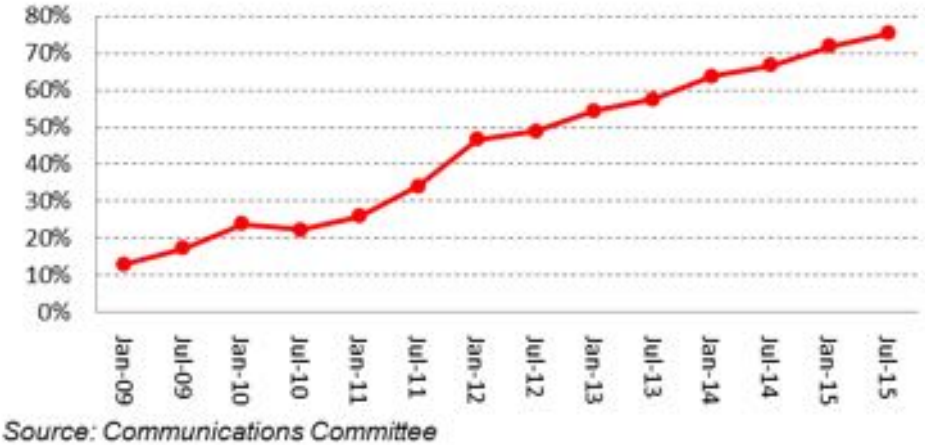


Figure 53 - Mobile broadband penetration at EU level, January 2009 - July 2015

Mobile broadband traffic: Tablets are expected to be the touchstone for mobile data traffic in 2020, exceeding smartphones and laptops in average usage. Mobile data traffic in 2020 is expected to be 6-fold higher than in 2015.

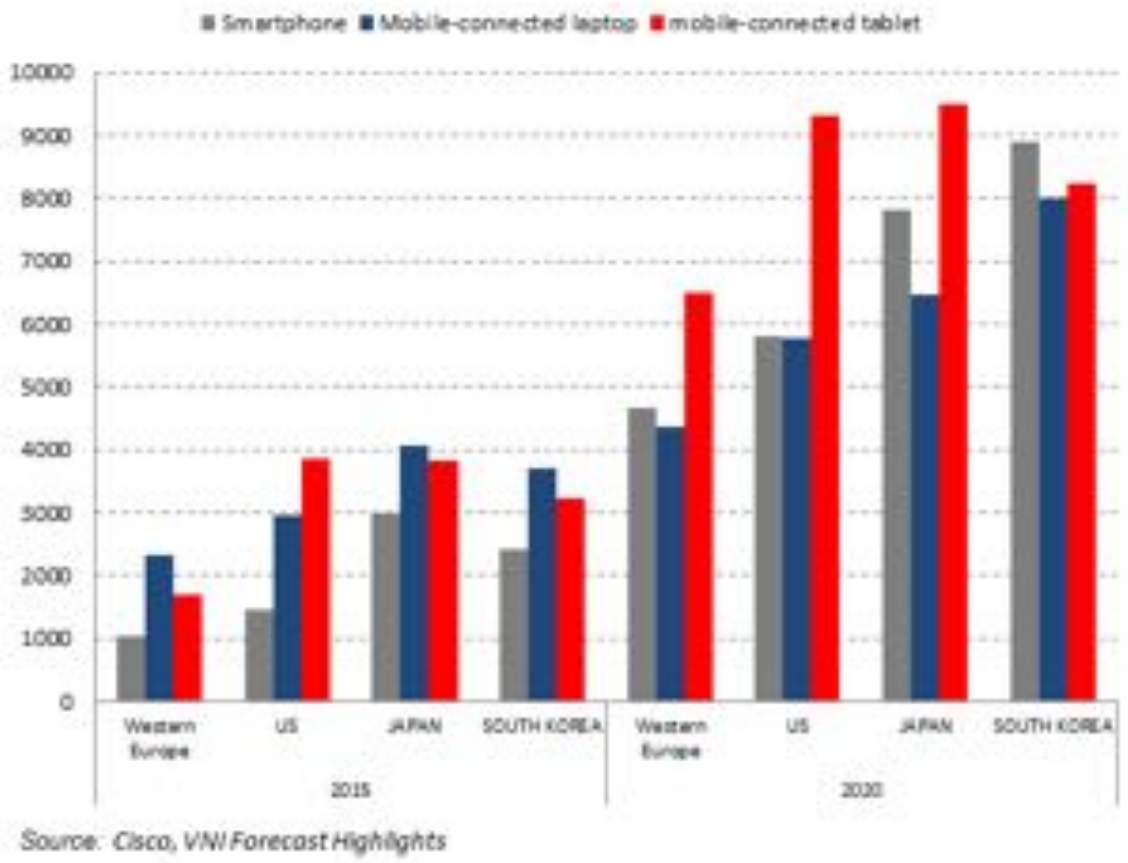
Mobile data traffic in Western Europe is expected to grow by 6-fold from 2015 until 2020, which represents a higher growth compared to the US (x6), South-Korea (x5) and Japan (x4). Indeed, mobile data traffic will grow 2 times faster than fixed IP traffic from 2015 to 2020.

The average smartphone user in Western Europe will generate 4.6 Gb of mobile data traffic per month in 2020, up by 353% from 2015. Laptop users will generate 4.4 Gb and tablets user more than 6GB.

Tablet devices in Europe will overtake mobile-connected laptops and smartphones in total data traffic. Currently, in Western Europe, tablets represent 33% of total mobile traffic. In 2020, their share will be 42%, while in South-Korea and Japan tablets will weigh less than 40% of total mobile traffic.

As for the US, tablets will represent 44% of total mobile traffic by 2020, with 9Gb per month per user, as opposed to 6Gb in the EU.

Figure 54 - Mobile data traffic per type of device and region, Megabytes per month, 2015 - 2020

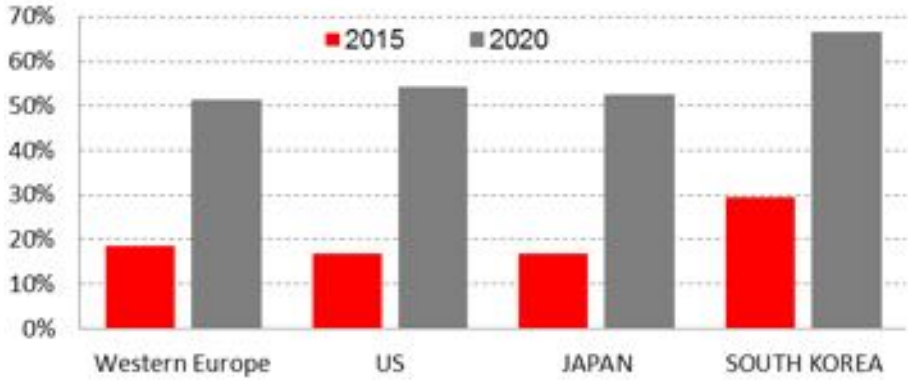


Machine-to-Machine communications: In Western Europe, M2M modules currently generate 3% of total mobile data traffic. By 2020, this figure will go up to 11.6%, while M2M modules will represent more than half of the total connected mobile devices in Western Europe.

Machine-to-Machine communications on mobile networks will continue to increase rapidly both in terms of traffic and the number of devices. M2M currently represents 19% of all connected mobile devices; this ratio is forecasted to go up to 51% by 2020 in Western Europe. M2M traffic will also expand, but will still take a relatively low share of total traffic on mobile networks (12%).

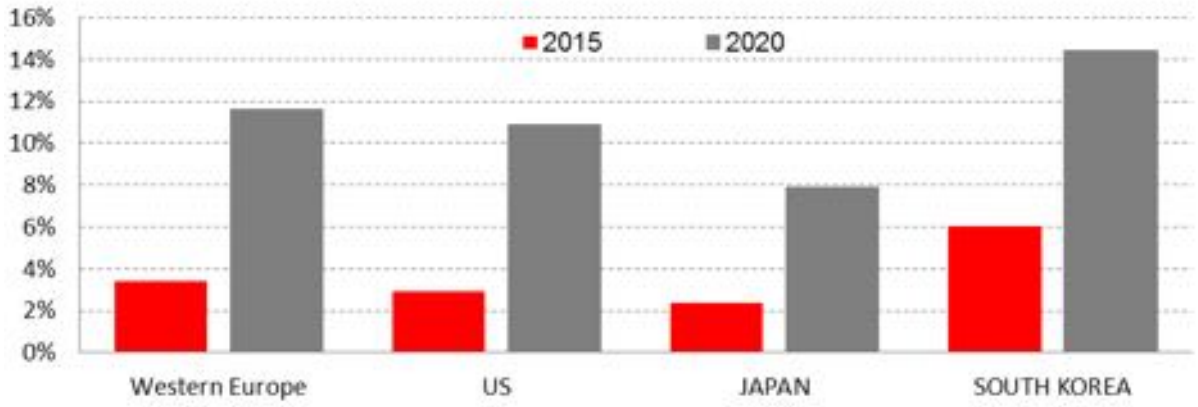
The US and Japan will show similar figures, while in South Korea both traffic and number of M2M devices will be significantly higher proportionally.

Figure 55 - Percentage of M2M modules of device connections by region, 2015 - 2020



Source: Cisco, VNI Forecast Highlights

Figure 56 - M2M traffic as a percentage of total mobile data traffic by region, 2015 - 2020



Source: Cisco, VNI Forecast Highlights

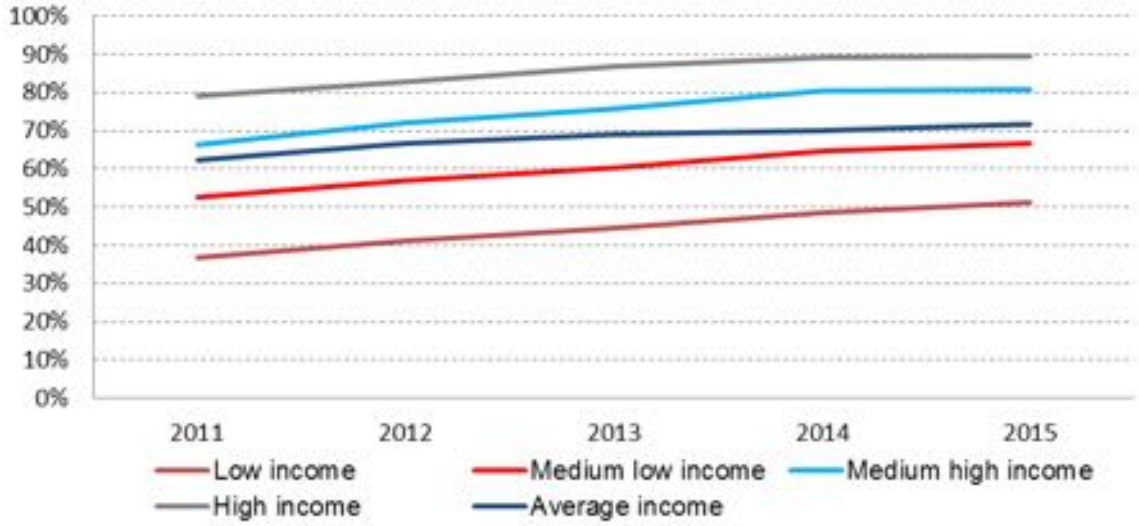
Broadband take-up tends to be lower in MS where the cost of broadband access accounts for a higher share of income, but the correlation is not strong. The lowest income quartile of the EU population has a significantly lower take-up rate.

Considering overall take-up, European average is 72 % of homes with Luxembourg, the Netherlands at the highest positions and Italy, Bulgaria and Poland lagging behind.

Statistics show that income plays an important role in subscription rates. The lowest income quartile has only 51 % take-up of fixed broadband as opposed to 89 % in the highest income quartile.

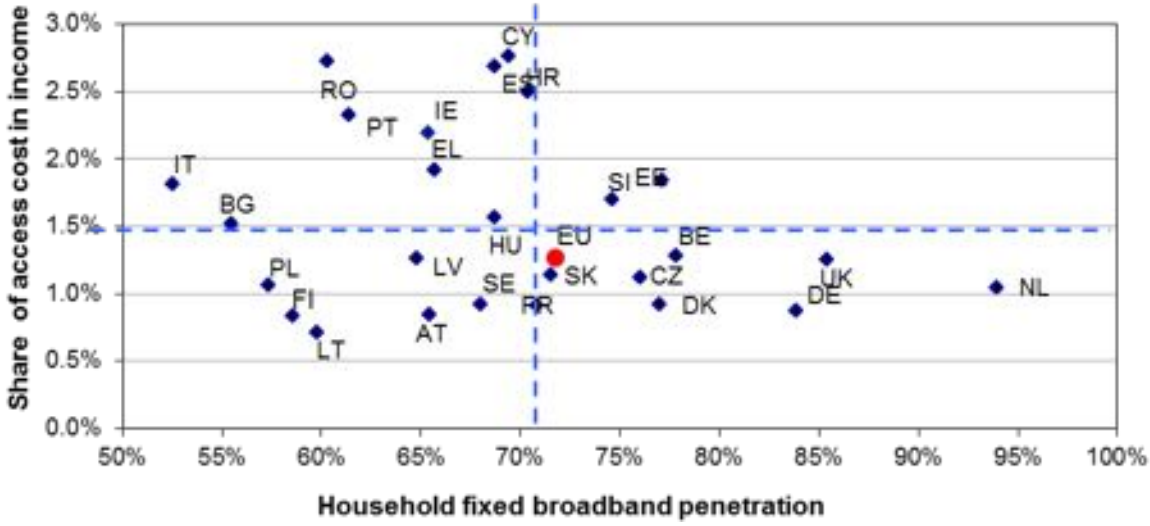
The lag in the lowest income quartile when compared with the national average is evident in Bulgaria, Romania, Hungary, Slovenia, Lithuania, Czech Republic, Croatia, Spain and Slovakia.

Figure 57 - Fixed broadband household penetration by income quartiles at EU level, 2011-2015



Source: Eurostat

Figure 58 - Household fixed broadband penetration and share of broadband access cost (standalone 12-30Mbps download) in disposable income, 2015[408]



Source: Commission services based on Eurostat and Van Dijk

Half of all EU households subscribed to bundled communications services in 2015. 80 % of bundles include internet access. Fixed telephony + internet is the most popular type of bundle.

50 % of all EU households purchase bundled communications services, up from 38 % six years ago. The most popular bundle is fixed telephony + internet followed by 'triple play': fixed telephony + internet + TV. Internet access (either fixed or mobile) is present in 80 % of all service bundles, fixed telephony in 64 %, TV in 54 % and mobile telephony in 46 %.

[408] Data not available for Luxembourg and Malta.

Figure 59 - Percentage of households subscribing to bundled services at EU level, 2009-2015

Figure 60 - Popularity of different services in bundles at EU level, 2015

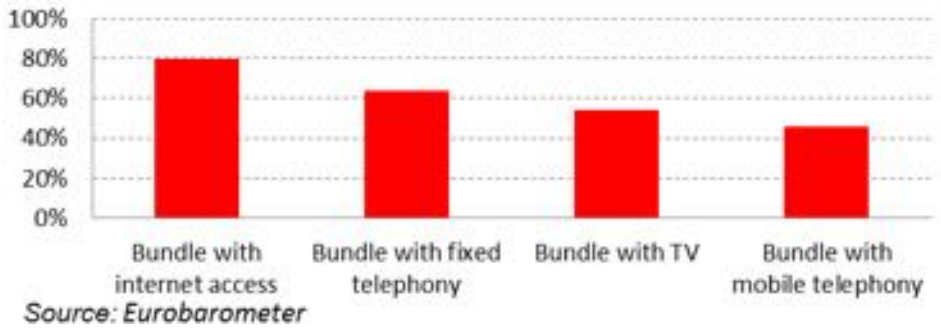
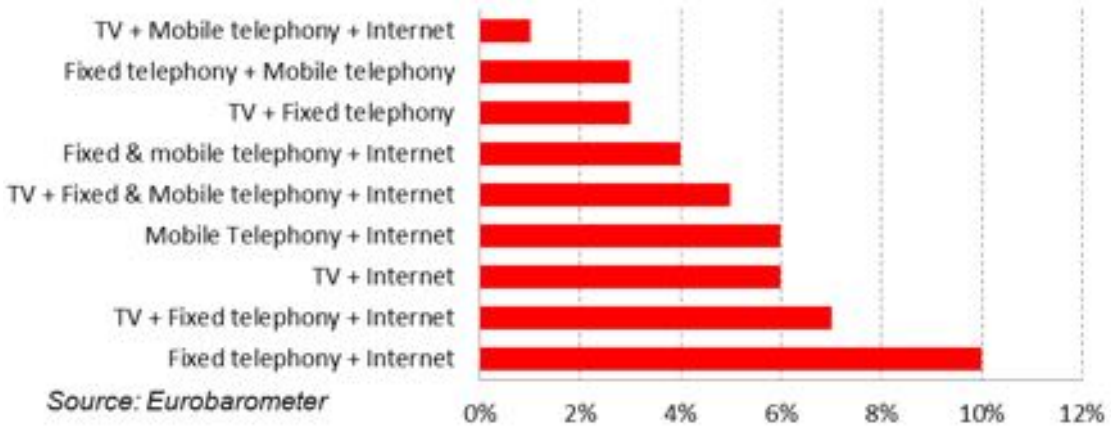


Figure 61 - Popularity of different bundles (% homes with subscriptions) at EU level, 2015



Prices of mobile voice+data plans vary greatly across Europe. In comparison with the US, the EU is cheaper for lower usage baskets, and more expensive for high-end packages.

Looking at the usage basket of 300 voice calls and 1GB data usage on handset, minimum prices range between €13 and €73 with an EU average of €31.

The cheapest countries are Estonia, Lithuania, Denmark and the UK with minimum prices below €15. At the same time, prices are very high (>€60) in Hungary, Malta and Greece.

The EU on average has much lower prices than the US for the 0.1GB+30 calls and the 0.5GB+100 calls baskets, however, on the 2GB+900 calls basket, the US is by close to 30% cheaper than the EU[409].

Figure 62 - Mobile broadband prices (EUR PPP) - handset use in the EU and the US, 2015

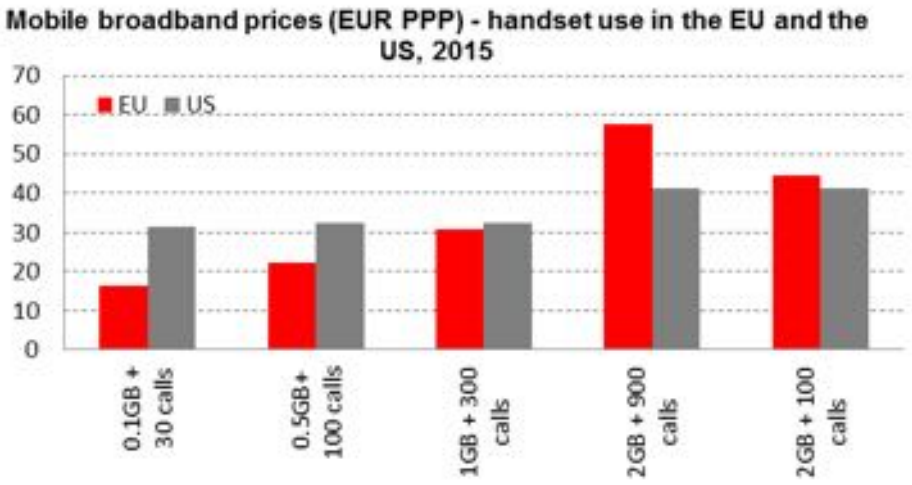


Figure 63 - Mobile broadband prices (EUR PPP) - handset use, 1GB + 300 calls, 2015

[409] Source: SMART 2014/0049 - Mobile Broadband prices (February 2015) https://ec.europa.eu/digital-single-market/en/news/mobile-broadband-prices-february-2015. This study was carried out for the European Commission by Van Dijk.

Prices of mobile broadband plans for laptops also show large differences across Europe. In comparison with the US, the EU is cheaper for all usage baskets.

Looking at 5GB data-only plans for laptops, minimum prices range between €10 and €46. The EU average (€19) is below the price of fixed standalone offers of 12-30Mbps.

The cheapest countries are Austria, Italy, Finland, Denmark and Poland with prices below €12. At the same time, prices are very high (>€30) in Cyprus, Spain, Czech Republic and Croatia.

The EU on average has much lower prices than the US for all the laptop baskets[410].

Figure 64 - Mobile broadband prices (EUR PPP) - laptop use in the EU and the US, 2015

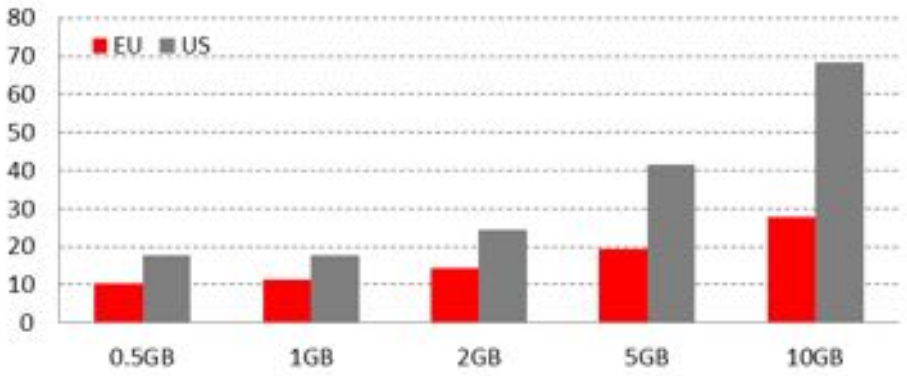


Figure 65 - Mobile broadband prices (EUR PPP) - laptop use, 5GB, 2015

[410] Source: SMART 2014/0049 - Mobile Broadband prices (February 2015) https://ec.europa.eu/digital-single-market/en/news/mobile-broadband-prices-february-2015. This study was carried out for the European Commission by Van Dijk.

6.6.3 Technical annex on technologies and medium

In the context of constantly increasing IP traffic, resources such as numbering or spectrum become more and more scarce. In spite of industrial development of more sophisticated and optimised solutions of spectrum usage for wireless data transmissions or of other transport media like copper or fibre, the laws of physics as currently understood are showing a clear unused capacity potential for certain technologies. Just comparing the fundamental properties of physical media available for future technologies which could appear over the air, copper or fibre, electrical signal speed is just two thirds of the speed of light. Fibre has an efficiency range of dozen of kilometres while copper G.fast is effective only over 250 m or so. More significantly, fibre theoretical capacity of frequency bandwidth is 50 000 GHz against 0.2 GHz for twisted copper.

Concerning broadband technologies we are observing on the one hand a tendency of boosting equipment around a copper pair or wireless path in order to use higher and higher spectrum in the fixed line or over the air over shorter and shorter distances; and on the other hand, evolution of optical devices in order to consume more and more of the unused already available spectrum of the fibre while keeping or improving the efficiency range.

As suggested by the SMART 2015/0005 support study, the continuous reliance on the existing copper-based infrastructure may hinder the development and take-up of certain applications if the most demanding scenario in terms of bandwidth needs materialises. The new concept of VHC takes into consideration a number of parameters in terms of quality of transmission (speeds, latency, jitter, etc.), that will define performance in a broader sense than understood today (with a current focus almost exclusively on download speeds).

Table 34 - Table of mediums and technologies

Medium	Technologies	Down/Upstream Rate[1]	Efficiency range[1]	Typical latency [5]	Shared medium for lastmile?	Frequency bandwidth [6]	Infrastructure architecture	Suitability	Future of the technology
copper	Wired								
	ADSL, ADSL2, ADSL2+	24/1 Mbps	5 km	15-40 ms	no	0,0022 GHz	internet access by transmitting digital data over the wires of a local telephone network copper line terminates at telephone exchange (ADSL) or street cabinet (VDSL) · Vectoring: Elimination of cross talks for higher bandwidths · G.Fast: Frequency increase up to 212 MHz to achieve higher bandwidth	· use of existing telephone infrastructure · fast to install · small efficiency range due to the line resistance of copper connection lines	· further speed and range improvements by enhancing and combining new DSL-based technologies (phantom mode, bonding, vectoring) · bridge technology towards complete fibre optic cable infrastructure
	VDSL, VDSL2, Vectoring	100 /40 Mbps	1 km	15-40 ms	no	0,017 GHz			
	G.Fast	500/500 Mbps	250 m	15-40 ms	no	0,212 GHz			
	CATV	200/100 Mbps[4]	2-100 km[2]	15-40 ms	yes	1 GHz	· coaxial cable in streets and buildings; fibre at the feeder segments · network extensions to provide backward channel functionality	· use of existing cable television infrastructure · fast to install · high transmission rates	· Further implementation of new standards (DOCSIS 3.1) will allow to provide higher bandwidth to end-users
fiber	Optical								
	p2p	1/1 Gbps (and more)	10-60 km	0.3 ms (5 µs per km)	no	50000 GHz	· signal transmission via fibre · distribution of signals by electrically powered network equipment or unpowered optical splitters	· highest bandwidth capacities · high efficiency range · high investment costs · bandwidth depends on the transformation of the optical into electronic signals at the curb (FTTC), building (FTTB) or home (FTTH)	· next generation technology to meet future bandwidth demands
	p2mp				yes				
air	Wireless								
	LTE(Advanced)	100/30 (1000/30) Mbps[3]	3-6 km	5-10 ms	yes	0.1 GHz	· mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas · sites connected to a cabled communication network and switching system	· highly suitable for coverage of remote areas (esp. 800 MHz) · quickly and easily implementable · shared medium · limited frequencies	· commercial deployment of new standards with additional features (5G) and provision of more frequency spectrum blocks (490 - 700 MHz) · meets future needs of mobility and bandwidth accessing NGA-Services
	HSPA	42,2 / 5,76 Mbps	3 km	30-70 ms	yes	0.005 GHz			
	Satellite	20/6 Mbps	High	500-700 ms	yes	10 GHz		· highly suitable for coverage of remote areas · quickly and easily implementable · run time latency · asymmetrically	· 30 Mbps by 2020 based on next generation of high-throughput satellites
	Wi-Fi	300/300 Mbps	300 m	100 - 1000 ms	yes	0.005-0.160 GHz(7)		· inexpensive and proven · quickly and easily implementable · small efficiency range · shared medium	· increased use of hotspots at central places
	WiMAX	4/4 Mbps	60 km	50 ms	yes	0.01 GHz			· gets continually replaced by Wi-Fi and LTE

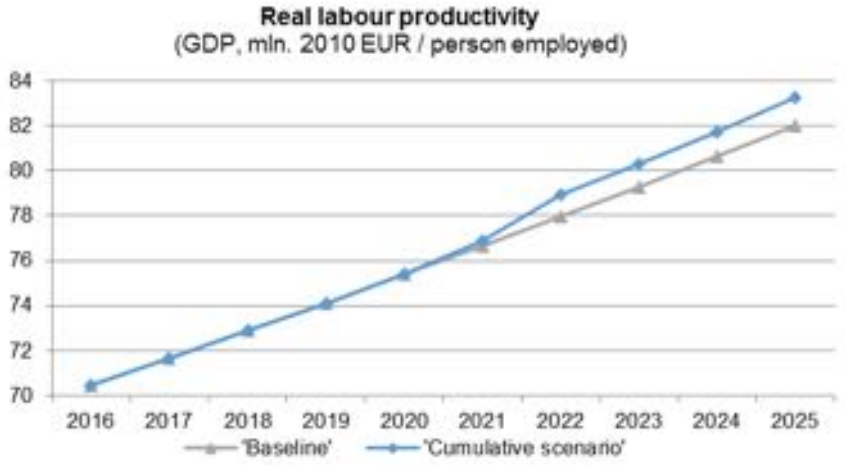
Legend:
1 Technical standard max.
2 Depends on amplification
3 Depends on the frequency spectrum used
4 EuroDOCSIS
5 Usual practical values depending on distance
6 difference between the upper and lower usable frequencies for signals transmission

6.7 ANNEX 7 - Impact on competitiveness and innovation

6.7.1 Impact on competitiveness

The results of the CGE modelling also provide some indications as regards the implications of changes to the framework on labour productivity – one measure of EU competitiveness. In the cumulative scenario case, where preferred policy options are implemented in all areas, real labour productivity will exceed the baseline by an average of 1% for the period 2020-2025. This is equivalent to an average of 0.3 percentage points higher growth rate of productivity in the simulation scenario as compared to the baseline.

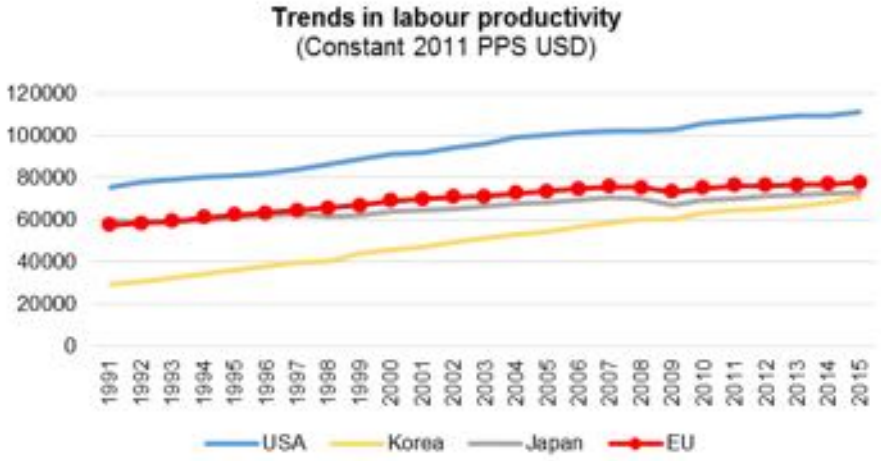
Figure 66 - Real labour productivity (preferred options vs status quo)



Source: Eurostat, own calculations

Viewed in international perspective, historically over the past quarter century labour productivity growth in EU has been lagging by an average of 0.4 percentage points as compared to the US and by 2.4 percentage points as compared to Korea (due its lower base). One can realistically expect productivity growth acceleration in the US and Korea in the forthcoming years as well. Despite this, the implementation of the considered policy changes should make a significant contribution towards boosting EU productivity, and potentially closing the gap.

Figure 67 - Trends in labour productivity – international comparisons



Source: World Bank, World Development Indicators database

6.7.2 *Potential for disruptive change through innovation*

The assumption underlying the CGE model is that clearer regulation of communication services and better connectivity will allow all sectors of the economy to operate more efficiently and realise higher total factor productivity rates.

In addition, the implementation of the preferred policy options might give a significant boost to innovation. Such innovation effects are particularly relevant in view of the fact that the review of the electronic communications framework could support the development and use of the 'Internet of Things' (IoT)[411] and digitalization of industry inter alia by fostering:

- More regulatory certainty for all players throughout the IoT value chain contributing to a better investment climate;
- Levelling barriers for scaling up in Europe (by reducing regulatory heterogeneity) to the benefit of start-ups entering as new players shaping the IoT value chain.
- Improving connectivity for SIM based M2M services;
- End-users confidence about security, privacy and confidentiality[412].
- Faster adoption of 5G; and
- A more ubiquitous roll-out of fibre networks to homes and lamp posts as to provide a backbone with the stability and low latency that is required by many IoT applications.

In turn, IoT implies an increased role for communication services in (and increased dependency on connectivity by) various industries, including automotive, agriculture, health, transport, etc. As such, policies which unlock the full potential of IoT and the digitization of industry could trigger a so-called "disruptive growth path".[413]

It is not possible to estimate ex ante the impact of such structural economic changes on the basis of CGE modelling. Therefore, the CGE estimates should be treated as a lower bound. Assessing the impact of disruptive structure changes would require a case study approach examining how precisely production processes would change as a consequence of a progressing IoT. Such analysis has been done by McKinsey (2015) "The internet of things: mapping the value beyond the hype" which analyses a number of IoT use cases [414] involving sectors that are key for EU competitiveness.

- IoT will particularly increase **productivity and innovation** in sectors that are considered essential for Europe's **global competitiveness** (such as automotive[415] and electrical

[411] BEREC (2016) and McKinsey (2015) identify a number of key enablers that contribute to unlocking the full potential of the IoT. Key enablers are optimal fixed and mobile connectivity (which is realised through policy measures with regards to access, spectrum and numbering), regulatory security for new players in the IoT value chain (which is realised by clarifying the scope of the RF) as well as end-users confidence about security, privacy and confidentiality.

[412] The reason, as explained by BEREC and McKinsey, is that new categories of risks are introduced by the Internet of Things. McKinsey argues that more devices means more opportunities for potential breaches and BEREC argues that "*[d]ue to limited resources in terms of energy and computing power, [...] IoT devices may be vulnerable to cyber-attacks*". Furthermore, McKinsey argues that the impact of a data breach is much larger in the context of the IoT. "*when IoT is used to control physical assets, whether water treatment plants or automobiles, the consequences associated with a breach in security extend beyond the unauthorized release of information—they could potentially cause physical harm*". BEREC concludes that *"If users do not trust that their data is being handled appropriately there is a risk that they might restrict or completely opt out of its use and sharing, which could impede the successful development of IoT*."

[413] See: "Information Technologies and Labour Market Disruptions - A Cross-Atlantic Dialogue" background document by the "interdisciplinary, cross-sector roundtable organised by the European Commission (DG Enterprise and Industry and DG Communication Networks, Content and Technology) in cooperation with The Conference Board and Cornell University ILR School" 3/11/2014, p. 11

[414] Outside, Home, Human, Cities, Factories, Worksites, Offices, Retail, environments, and Vehicles,

[415] BEREC BoR(16)39 as well as McKinsey (2015) identify automotive as key sector that will adopt IoT applications. At the same time, it considered a strategic sector of the EU economy http://ec.europa.eu/growth/sectors/automotive/index_en.htm

engineering[416]). Realising the full potential of the IoT in Europe contributes to maintaining/strengthening that position. Not realising the full potential of the IoT in Europe may lead to other parts of the world overtaking that position.

- IoT will also increase **productivity and innovation** in as well as in agriculture[417] which is an essential sector for the **regional competitiveness** of Europe's peripheral areas[418].
- Furthermore, IoT contributes to **cost savings** in a wide variety of other sectors such as E-health, smart metering/grids, smart homes and cities, etc.

McKinsey estimates for the global economy that by 2025, the full potential of IoT amounts to approximately 3.9 to 11.1 trillion dollars per year (including consumer surplus). In terms of % of global GDP this amounts to 3.3% to 9.4% according to our own calculations.[419] If Europe could realise a similar gain by fostering key IoT enablers, this would amount to an additional GDP of 0.56 and 1.59 trillion euros in the year 2025.[420]

The contributions to European competitiveness that could be made from the proposed changes to the EU regulatory framework are summarised in the following table.

[416] Electrical engineering is a sector in which the EU is the global leader and which will benefit greatly from the ongoing growth in mobile devices see: http://ec.europa.eu/growth/sectors/electrical-engineering/index_en.htm

[417] BEREC BoR(16)39 as well as McKinsey (2015) identify agriculture as key sector that will adopt IoT applications.

[418] Thissen, van Oort, and Diodato (2013)

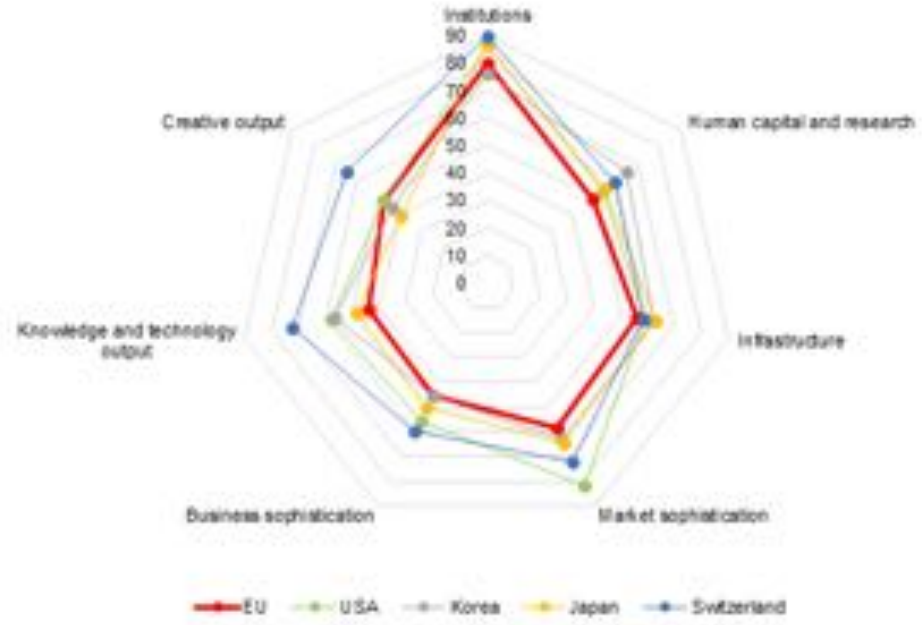
[419] On the basis of data and forecasts provided by the Conference board, global GDP may grow from 88 trillion dollars in 2015 to 117 trillion dollars in 2025, not accounting for a disruptive boost like the IoT. As such, the IoT may create up to 3.3% to 9.4% additional income at global level by 2025. See https://www.conference-board.org/data/economydatabase/index.cfm?id=27762 and https://www.conference-board.org/data/globaloutlook/index.cfm?id=27451

[420] Assuming the EU economy has grown to 16.58 trillion euros by 2025 (based on forecasts by the Conference board). 0.33% of 16.58 trillion euros = 0.56 trillion euros. 9.4% of of 16.58 trillion euros = 1.59 trillion euros

Table 35 - Overview of competitiveness impacts

	Access	Spectrum	Services
Cost competitiveness	High bandwidth connectivity supports the digitalisation of services, reducing cost and time to market. Standardising wholesale products used for business should also reduce costs and increase efficiency within cross-border organisations	The prevalence of general authorisations will make access to spectrum more affordable and lower administrative / regulatory costs. This is of particular benefit to smaller companies with more limited resources	The reduction of administrative burden and of regulatory heterogeneity realises cost savings for telecom operators.
International competitiveness	Access policies are likely to boost infrastructure deployment in Europe, closing the investment gap with other economies. Increased bandwidth is likely over time to support increased use of digital services and the attractiveness of the EU as a platform for technological and service development.	Device manufacturers will benefit from EU single market, offering significant scaling opportunities, and producing devices that are able to operate in "European" bands.	Less regulatory heterogeneity contributes to the realisation of a digital single market which facilitates a faster scale-up of European start-ups in the global digital economy.
Innovation competitiveness	The deployment of fibre to lampposts and homes supports 5G development, and new applications. A connected economy may also drive disruptive change in business processes	The prevalence of general authorisation will open up spectrum access to innovative services, faster roll-out of 4G/5G will foster development of new services based in Europe.	More clarity and equality throughout the value chain with regards to regulation reduces regulatory risk for new (small medium sized and large) players. This increases their willingness to invest and innovate

A key challenge however in realizing the benefits we have identified from innovations including those stemming from IoT is the capability of European businesses to leverage innovation. For example, comparing EU[421] innovation capacity and results against peer economies, according to the Global Innovation Index for 2015,[422] the EU seems to be lagging behind in terms of many aspects of innovation,[423] although some countries within Europe including Finland, Sweden, Luxembourg, Denmark and Germany are reported to be relatively strong in making use of innovations specifically in ICT.



Source: Global innovation index, own calculations

If benefits are to be fully realized, this highlights the need for levelling up within Europe, not only in terms of supply-side policies for electronic communications including the regulatory environment, but also – importantly – on initiatives to support the absorption of new technologies within businesses of all sizes.

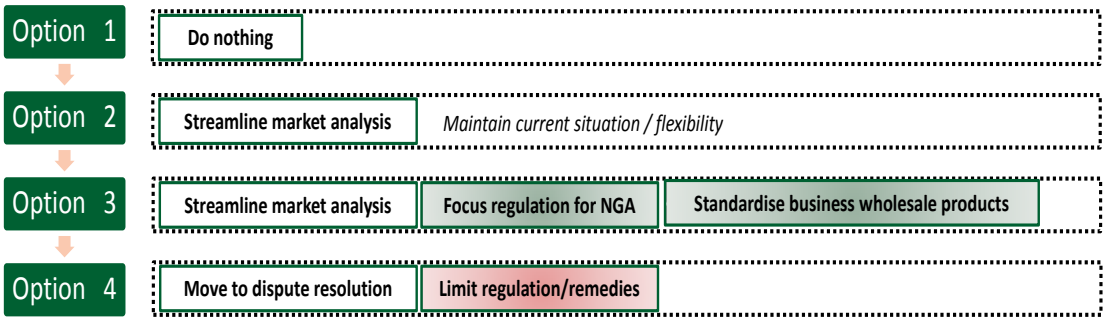
[421] EU figures are derived aggregating the member states scores, weighting them with the respective country population.

[422] The Global Innovation Index is an annual ranking of countries by their capacity for, and success in, innovation. It is published by INSEAD and the World Intellectual Property Organization, in partnership with other organisations and institutions. It is based on both subjective and objective data derived from several sources, including the International Telecommunication Union, the World Bank and the World Economic Forum.

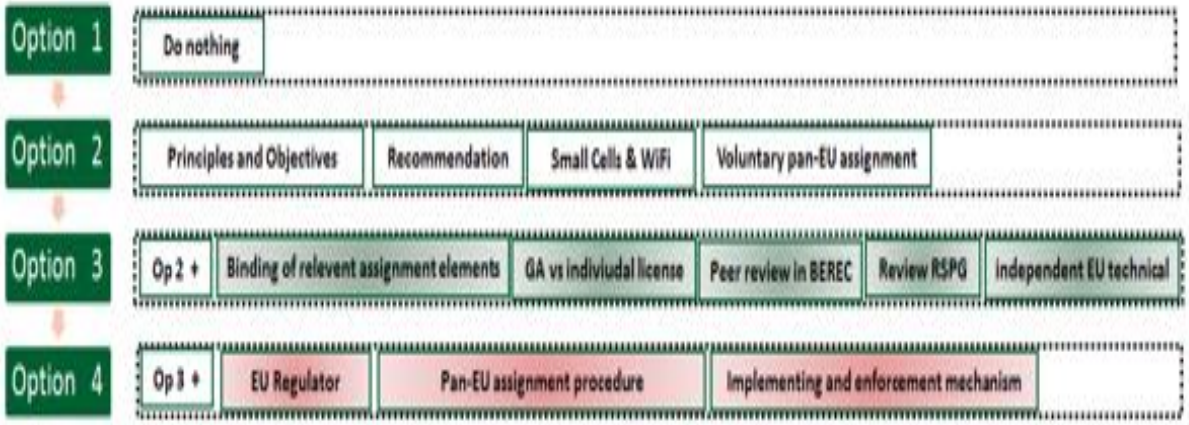
[423] There are clear differences for the business sophistication pillar of the index, which includes knowledge workers and R&D activities performed in the business sector, links between the business sector and the academia and means of knowledge absorption. Another aspect where EU is performing relatively worse concerns indicators for 'knowledge and technology' including knowledge creation, diffusion and impact.

6.8 ANNEX 8 – Options diagrams

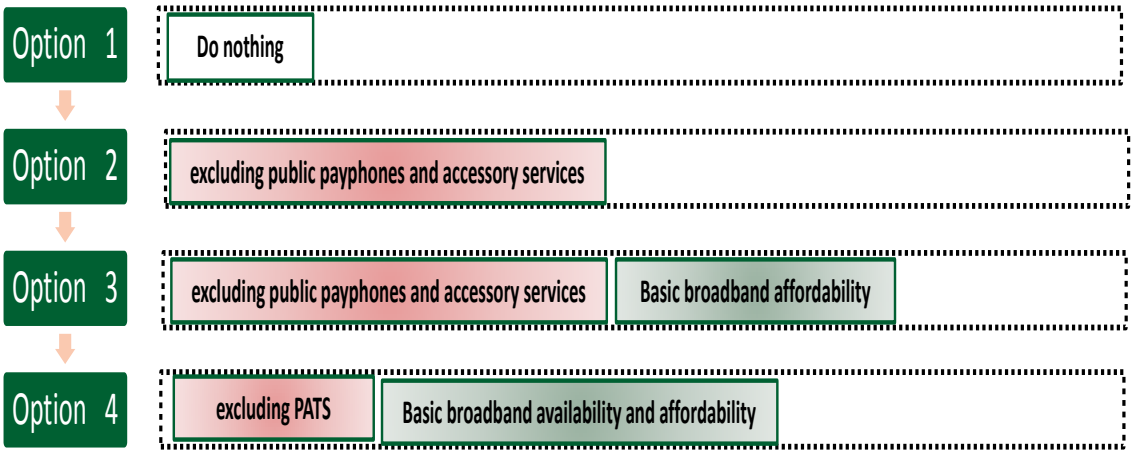
6.8.1 Access options



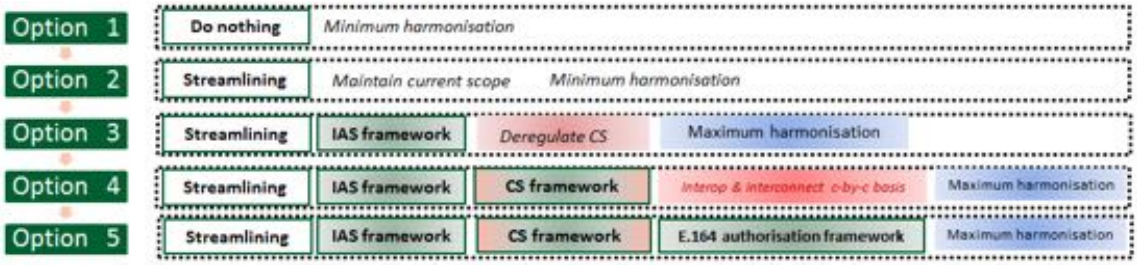
6.8.2 Spectrum options



6.8.3 USO options

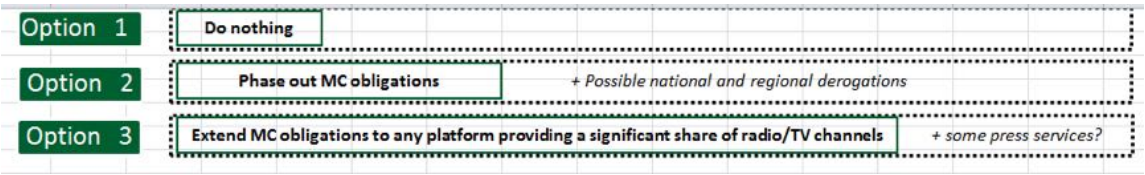


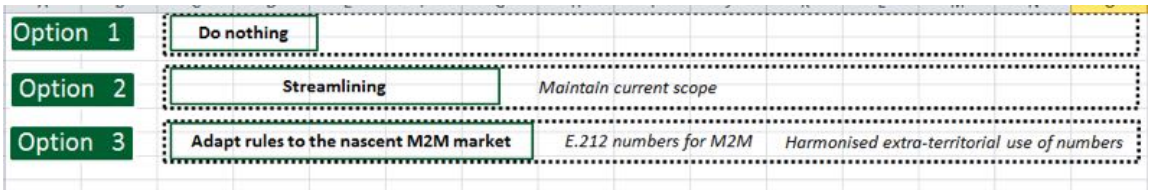
6.8.4 Services options



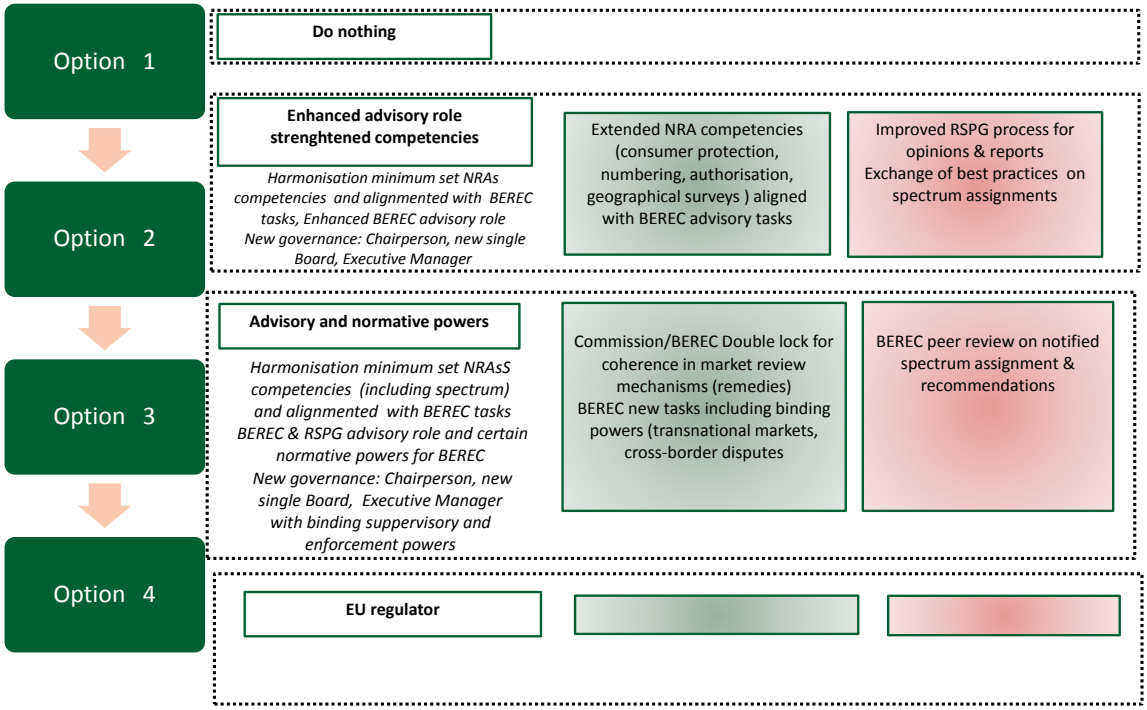
Costs

Green shaded: moderate enforcement, compliance and adjustment costs
Orange shaded: costs in terms of less privacy protection
Red shaded: high regulatory enforcement and compliance costs + increased regulatory risks
Blue shaded: costs of reduction in national flexibility (size of which depends on heterogeneity of preferences and degree of harmonisation of horizontal rules)





6.8.5 Governance



6.9 ANNEX 9 - The connectivity strategy: a European Gigabit Society

This annex spells out the rationale behind the connectivity strategy for a European Gigabit Society by 2025. The Communication accompanying the review of the telecoms framework will introduce the policy context and the ambitions for Europe in the coming years. In this annex we review the process followed and the evidence underpinning the need for a Gigabit society.

6.9.1 The public consultation on internet speeds and the new ambitions

Adequate connectivity is a prerequisite to achieve a genuine DSM. This is why the DSM Strategy announced that the review of the Telecom Framework's focus would include "*incentivising investment in high speed broadband networks*". This is also why President Juncker and VP Katainen have made of telecommunciations one of the prioritiy areas for strategic investment under the regulation setting up the European Fund for Strategic Investment. DG CONNECT has then, over the last year, gathered evidence on Internet connectivity needs beyond 2020:

- We have held bilateral meetings not just with the telecom operators but also with various user sectors' representatives.
- We have analysed connectivity facts and figures in available publications and forecasts.
- We have carried out and analysed a full public consultation which focused on speed and quality of internet services.

Overall, the results of these various actions converge: the use of Internet services and applications will substantially increase for both fixed and mobile connectivity and there is a need to prepare now for higher speed (upload and download) and other features of quality of service (latency, resilience, etc.) beyond 2020. The findings of these various steps illustrate the need to:

1. Show greater ambition in terms of both average and maximal speed and other quality parameters beyond 2020, considering expected future developments and the time horizon for investment.
2. Ensure that policy, regulatory and financing instruments support an investment-friendly environment in line with such ambition.

These conclusions echo the call for a definition of Europe's connectivity ambition beyond 2020 from the participants - representatives of the industry, users and local and national public authorities - in the broadband roundtables that Commissioner Oettinger chaired in early 2015. These stakeholders called for defining long-term connectivity ambitions and for better rules and instruments to further deploy broadband infrastructure.

On the need to show greater and longer-term ambition and in line with the mandate given to Commissioner Oettinger by President Juncker to "set clear long-term strategic goals to offer legal certainty to the sector and create the right regulatory environment to foster investment and innovative businesses", **Commissioner Oettinger announced in March his ambition of connectivity for a European gigabit society by 2025**, to be based on 3 pillars:

- Gigabit connectivity for socio-economic drivers, starting with schools, hospitals, libraries, public administration and business centres.
- Future-proof ubiquitous connectivity to support all forms of mobility.
- Improved connectivity in rural areas.

While the DAE targets should remain valid up to 2020, the expected uses' evolution and technological developments as well as the time horizon for investment (investment cycles

needed for such broadband infrastructure projects run over 5-10 years) call for setting up now longer term objectives for 2025. A study is currently being conducted by the Commission Services to assess the feasibility of the three pillars announced by Commissioner Oettinger and come up with a preliminary estimate of the cost entailed.[424]

6.9.2 Connectivity and its importance

As mentioned in the main report and in the support studies, there are numerous studies showing that improved Broadband access is beneficial for the society. The positive impact ranges from purely economic GDP growth and unemployment decrease, through battling digital divide and improvement in innovativeness for business and increased employees skills to entertainment possibilities and wellbeing generated by e-health. EGovernment solutions decrease the costs of the local administration and the citizens are more willing to participate in community life (e.g. voting participation).

Czernich et al (2011)[425] examined the wider effects of broadband on GDP per capita across the OECD countries, finding that a 10-percentage point increase in broadband penetration raises national annual per capita growth by 0.9-1.5 percentage points. EIB and IMIT[426] study proves that higher Broadband speed has positive impact on GDP and it is greater in countries with lower income than countries with higher income. Katz et al. (2010)[427] claims that Germany achieving both the broadband penetration and speed targets will create more than 960,000 additional jobs and output worth more than 170 billion euro. Rohman and Bohlin[428] (2012) show that increasing the Broadband speed in the OECD countries stimulates GDP growth. The impacts depend on the broadband speed and the existing economic growth in particular country.

Studies conducted by De Stefano et al. (2014)[429], Kandilov et al. (2011)[430], Kim and Orazem (2012)[431], Whitacre et al. (2014a)[432] show that Broadband can increase the number of businesses – either because it increases firm entry, or because it helps with firms' survival. Akerman et al. (2015)[433], Dettling (2013)[434], Kolko (2012)[435], Whitacre et al (2014b)[436] show that Broadband can positively impact on local employment. Employment effects can vary across different types of areas, industries, and workers, with urban areas, service industries and skilled workers possibly benefiting more than rural areas, manufacturing industries and unskilled workers.

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[424] See SMART 2015/0068

[425] Czernich N., Falck O., Kretschmer T., Woessmann L. (2011), Broadbnad Infrastructure and Economic Growth, The Economic Journal 121 (552) May 12, pp, 505-532

[426] http://institute.eib.org/wp-content/uploads/2014/04/EIB_broadband-speed_120914.pdf

[427] Katz, R. L., Vaterlaus, S., Zenhäusern, P. & Suter, S. (2010). The Impact of Broadband on Jobs and the German Economy. *Intereconomics*, 45 (1), 26-34

[428] Rohman, I. and E. Bohlin (2012), Does broadband speed really matter as a driver of economic growth? Investigating OECD countries. International Journal of Management and Network Economics, 2012, vol.2, issue 4, pages 336-356

[429] De Stefano, T., Kneller, R., Timmis, J., (2014), The (Fuzzy) Digital Divide: The Effect of Broadband Internet Use on UK Firm Performance. University of Nottingham Discussion Papers in Economics. Discussion Paper 14/06.

[430] Kandilov, AMG, Kandilov, IT, Liu, X, Renkow, M., (2011), The Impact of Broadband on U.S. Agriculture: An Evaluation of the USDA Broadband Loan Program. Selected paper Prepared for Presentation at the Agricultural and Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting. Pittsburgh, Pennsylvania, July 24-26

[431] Kim, Y., Orazem, P., (2012), Broadband Internet and Firm Entry: Evidence from Rural Iowa. Iowa State University Working Paper No. 12026

[432] Whitacre, B., Gallardo, R., Strover, S., (2014a), Broadband's Contribution to Economic Growth in Rural Areas: Moving Towards a Causal Relationship. Telecommunications Policy 38, 1011-1023.

433 Akerman, A., Gaarder, I., Mogstad, M., (2015), The Skill Complementarity of Broadband Internet. Quarterly Journal of Economics.

[434] Dettling, L.J., (2013), Broadband in the Labor Market: The Impact of Residential High Speed Internet on Married Women's Labor Force Participation. Finance and Economics Discussion Series Divisions of Research & Statistics and Monetary Affairs Federal Reserve Board, Washington, D.C.

[435] Kolko, J., (2012), Broadband and Local Growth. Journal of Urban Economics 71, 100–113.

[436] Whitacre, B., Gallardo, R., Strover, S., (2014b), Does Rural Broadband Impact Jobs and Income? Evidence from Spatial and First-Differenced Regressions. The Annals of Regional Science 53, 649-670.

Forzati and Mattsson (2012)[437] show that increasing in the ratio of the population that lives within 353 metres of a fibre-connected premise contributes positively to job employment from 0%-0.2% after two and a half years. Atkinson et al (2009)[438] proved that investment in broadband networks for USD 10 billion in one year generated about 498 thousand jobs in the USA.

Table 36 -Potential socio-economic impacts of broadband deployment in Rural, Remote and Sparsely populated areas

Domain	**Impacted aspect**	**Examples of benefits in RRS areas by stakeholders** **([B] business, [C] citizens)**
Community building	Quality of life Social inclusion	Participation in social life reducing geographical distances (including politics, leisure activities, etc.) [C]. Interaction among citizens allowing for the participation of a larger set of stakeholders (including elderly people, minorities, people living in remote areas, etc.) [C].
Crime and public safety	Quality of life	Reduction of crime due to the deterrent of remote surveillance (e.g. safer small villages) [C]. Control of strategic assets/infrastructures located in areas not easily accessible (e.g. increasing security and response capacities to man-made damages or natural disasters) [B].
Education and skills	Competiveness and innovation Employment Technological skills Social inclusion	Increase of productivity [B]. Increased contacts with research and innovation actors (i.e. universities and enterprises) allowing connections and technology transfer processes at distance [B]. Increase of competitiveness on the job market with skills alignment with those of the citizens of urban areas [C]. Creation of ICT professional competences as a side effect of deployment and management of broadband infrastructures [C]. Improvement in the ICT take-up (eServices, eCommerce, eGovernment) [C] [B]. Increase of education delivered in remote mode facilitating access to knowledge also by those having difficulties in accessing transport networks (from disabled people to people living in areas poorly covered by public transport services)[C]. |
Economy	Employment Growth Competiveness	Selection and employment of workers at distance, accessing competences not available locally or located in areas not attractive for business [B]. Opportunity for workers to contribute remotely to specific ICT-based jobs [C]. Creation of new ICT-based businesses [B]. Increase of the Total Factor Productivity of the areas [B]. Increased competitiveness of local firms in other sectors than ICT through the creation of new/innovative products and services [B].

[437] Forzati and Mattsson (2012), The economic impact of broadband speed: Comparing between higher and lower income countries

[438] Atkinson, R.T., Castro D., Ezell S.J. (2009), "The digital Road to Recovery: A Stimulus Plan to Create Jobs, Boost Productivity and Revitalize America", The Information Technology and Innovation Foundation (ITIF)

	and innovation Incremental cost saving Incremental revenues	Face-to-face communications worldwide, saving travels costs and time [B]. Access of remote technological services to increase firms' efficiency (i.e. cloud computing) while avoiding local physical installation of ICT equipment [B]. Implementation/adoption of logistic solutions addressed to increase firms' efficiency (i.e. monitoring of stocks) while avoiding traditional transport and logistics [B]. Direct access to global markets [B] and potential gaining of a market share through eCommerce solutions [B].
Environment	Incremental cost saving Quality of life	Use of smart grids with energy efficiency benefits [B] [C]. Less physical travels, implying reduced CO2 emission and use of fuels and time [B] [C]. Adoption of remote control systems to prevent and mitigate natural disasters [C].
Equality and well-being	Employment Technological skills Quality of life Social inclusion Incremental cost saving	Job opportunities for disabled people or people not served by public transport means [C]. Education opportunities for disabled people or people not served by public transport means [C]. Connection opportunities with families/relatives displaced in different areas [C]. Connection opportunities through smartphones and tablets [B] [C]. Connection opportunities for disabled people or people not served by public transport means [C]. Opportunities to access information and data worldwide [B] [C]. Opportunities to save money from traditional telecommunications means (i.e. fixed lines) [B] [C]. Opportunities to access eCommerce and eGovernment services [B] [C].
Finance and wealth	Wealth Incremental cost saving	Valorisation of the value of an area reflected in increased prices for housing/business location [B] [C]. Opportunities to access financial services for disabled people, people not served by public transport means, and remotely located businesses [B] [C].
Health care	Incremental cost saving Quality of life	Reduction of costs for health consultations (for less critical pathologies) [C]. Digitalisation and automation of administrative procedures within public and private health systems [B] [C]. Monitoring of basic health conditions through mobile apps [C]. Monitoring of patients at distance without requiring hospitalisation (for less critical pathologies) [C].

Source: Linking the Digital Agenda to rural and sparsely populated areas to boost their growth potential – Committee of the Region Report (2016)

SMART 2015/0005 demonstrates the impact of speed (and therefore quality) of networks. It estimates that an annual increase of broadband speeds of 21% (associated with a scenario whereby projected ADSL connections were all replaced with FTTC/VDSL connections by 2025), would result in cumulative growth in GDP of 1.5% by 2025. A 28% annual increase in speed (as would be associated with a replacement by all broadband connections with fibre) would result in cumulative growth in GDP by 2025 of 5.1%.

According to Vodafone and Arthur D. Little the number of fields which could benefit from the high-speed connectivity is substantial:

Better Healthcare: Fibre networks will be crucial for Digital Health such as Remote patient monitoring, Remote care & rehabilitation, Professional operative consultations and Research (e.g. Next Generation Genome Sequencing). Patient services are being improved, healthcare is delivered in a more efficient way, more patients can be reached and benefit from

specialists' attention and the cost of healthcare will ultimately be reduced. This sector still relies on antiquated infrastructure and many 'pre-Digital' working practices today.

Better Education: New educational tools and applications are being enabled by fibre networks such as immersive virtual reality training for professionals and remote interactive learning. Fibre networks will support increased digitalization within the classroom (e.g. to download content on tablets or laptops). This has allowed education to become more personalized, tailored to the need of each individual by student, increasing buy-in and motivation. Moreover, a larger network of students can be reached, teaching tasks distributed and education delivered in a more efficient way.

Increased Security: Monitoring public or private environments, recognizing suspicious activity and alerting security services can happen better and faster when fibre networks are in place. More and higher quality images can be captured (subject to privacy safeguards) and analysed whilst AI can recognize potentially dangerous situations and automatically trigger emergency response.

Positive Social impact: Fibre networks enable a range of new applications for entertainment, collaboration and social inclusion. Social relationships between people can be maintained regardless of distance, age or level of mobility, e.g. through high definition video streams or ambient presence.

Positive impact on Environment: Next Generation Smart Grid and Smart Mobility applications can be enabled by fibre networks and will have a positive impact on Energy consumption and CO2 emissions. Applications like Automated Energy Demand Response reduce the production and consumption, enabling more efficient use of renewables. Smart highways, Autonomous transportation and Smart traffic management tools – with core fibre networks – will lead to more efficient Mobility.

Increased Employment: New jobs are created to construct and set up the new fibre infrastructure. But more importantly, new applications and business models enabled by fibre networks appear and create new job opportunities, and the wider availability of such connectivity nationwide also distributes economic benefits and promotes modern commerce outside urban centres.

The benefits from the network and especially high-speed network are well documented but the value of benefits varies with the speed and scope of adoption, and in turn speed and scope of adoption depends on the quality of networks. This circularity renders decisions difficult, in particular for public investment.

6.9.3 Towards the Digital Single Market and new connectivity ambitions

The DSM Strategy stresses the importance of connectivity and ICT networks: they "*provide the backbone for digital products and services which have the potential to support all aspects of our lives, and drive Europe's economic recovery*"; the DSM "*must be built on reliable, trustworthy, high-speed, affordable networks*".

Adequate connectivity is a prerequisite to achieve a genuine DSM. This is why the DSM Strategy announced that the review of the Telecom Framework's focus would include "*incentivising investment in high speed broadband networks*". This is also why President Juncker and VP Katainen have made of digital networks one of the prioritiy areas for strategic investment under the regulation setting up the European Fund for Strategic Investment.

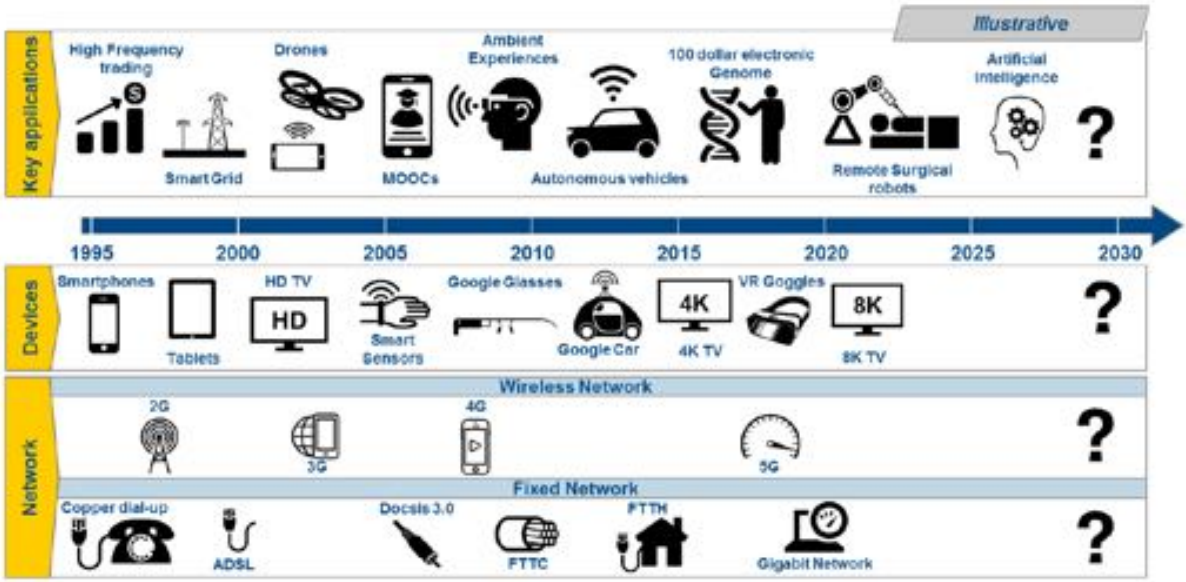
The lag between policy, investment and its impact on the society implies that in order to ensure connectivity beyond 2020 the decisions have already to be taken. Europe's future economic success will stem from innovation and new business models that will make the most of digital

networks – not just telecom infrastructure, but also cloud computing, Big Data, connected cars, the digitalisation of our industry, and so on. Hence, a supply driven approach would be in line with ensuring access to these new paradigms, even if demand may not follow immediately. Policy aiming at increasing European competitiveness and attractiveness for business will improve EU wealth and contribute to the well-being of all the citizens, stimulating jobs creation and decreasing unemployment.

6.9.4 Technological developments

Our review of global IP traffic, technological trends, user scenario forecasts and the infrastructure needs for key policy initiatives further reinforces the view that networks require a true generational shift in terms not only of download speed, but also in other quality aspects such as upload speed, low latency, reduced jitter and uninterrupted access. The figure below illustrates the technological development, which will require better networks.

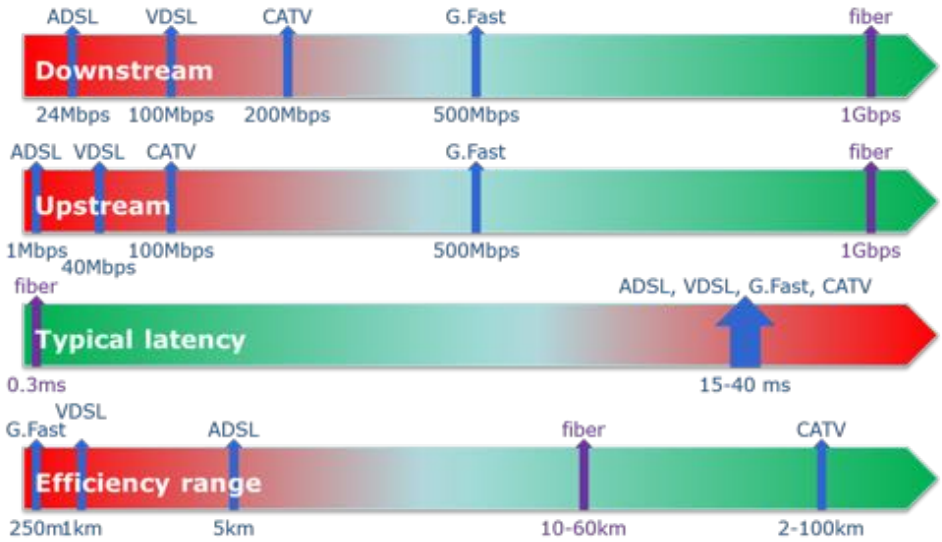
Figure 68 – Key applications and technological developments



Source: ADL

As mentioned in annex 6, section3, in the context of constantly increasing IP traffic, resources such as physical infrastructures, numbering or spectrum become more and more scarce. Furthermore, copper-based infrastructures tend to have a much higher number of nodes and equipment as well as require a higher amount of electricity. This implies higher maintenance costs and longer down periods which represent obstacles to the efficient and reliable running of these critical infrastructures. The figure below illustrates the differences between technologies.

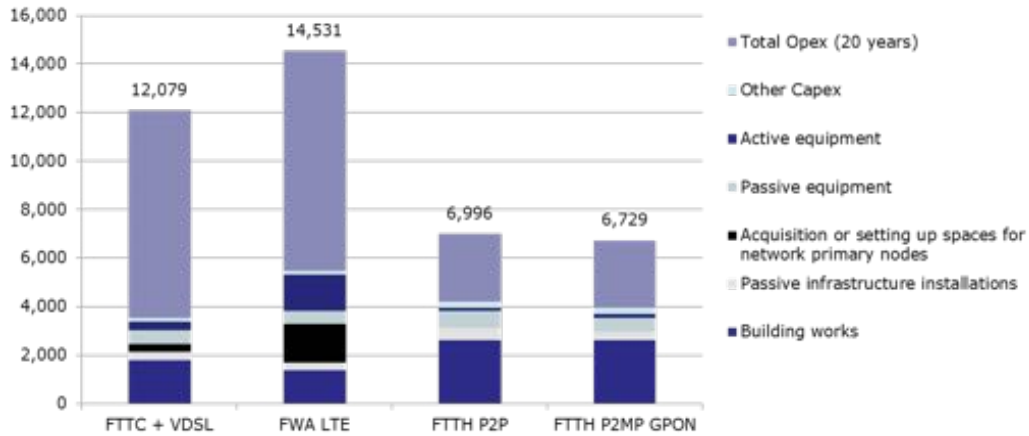
Figure 69 – Network features and speeds



Source: European Commission

Additionally, despite the higher initial expenditure in terms of CAPEX, the maintenance and operational costs OPEX are lower for fibre based technologies. The graph below is an example of a business case from OAN project Southern Primorska. The higher initial costs are offset after less than 3 years of operations assuming take-up of 50%.

Figure 70 – Cost scenarios for Southern Primorska region



Source; European Commission elaboration on data from project Southern Primorska

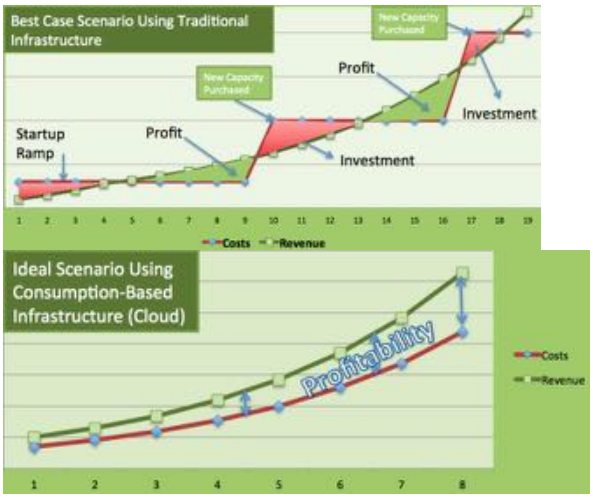
Hence, the physical characteristics of certain media make them inherently better than other media for communication tasks. Extended reliance on the existing copper-based infrastructure is already today showing inefficiencies in terms of quality of transmission (speeds, latency, range, etc.), capacity, maintenance costs, energy and suitability, inflexibility to easily accommodate Software Defined Networks and the service innovation that this brings with them.

6.9.5 Some future developments

The cloud technology, also referred to as XaaS being X as a service, where X might mean Infrastructure, Software, Security, etc. becomes more and more popular. Investment in IT is usually costly and might generate additional costs in order to satisfy peak demands. Companies,

which use cloud solutions only pay for capacity actually employed and do not need huge upfront investment (CAPEX). Below there are 2 graph illustrating the benefits from the cloud solutions – the left one represents a case, where a company invest in IT step by step and the right one the company, which benefits from the cloud.

Figure 71 – benefits from adopting a cloud solution



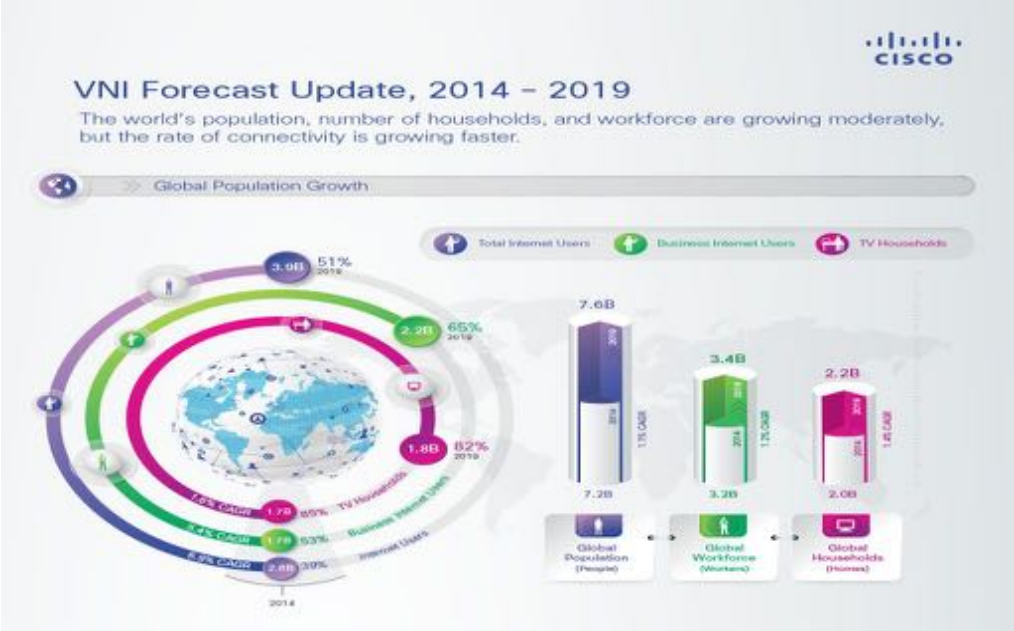
Source:medium.com

In order to benefit from the cloud the economic actors have to be connected – outsourcing IT capability requires excellent connectivity (both download and upload). Therefore for the connectivity is extremely important if Europe is supposed to get on the cutting edge of innovation by creating appropriate environment for the companies to optimize their costs. According to Cisco IP worldwide traffic will be growing very dynamically as the number of users and devices is fuelled by Internet of Things development.

Global IP traffic	2014	2019
Annual run rate	718.2 Exabytes	2.0 Zettabytes
Traffic per capita	8 GB	22 GB

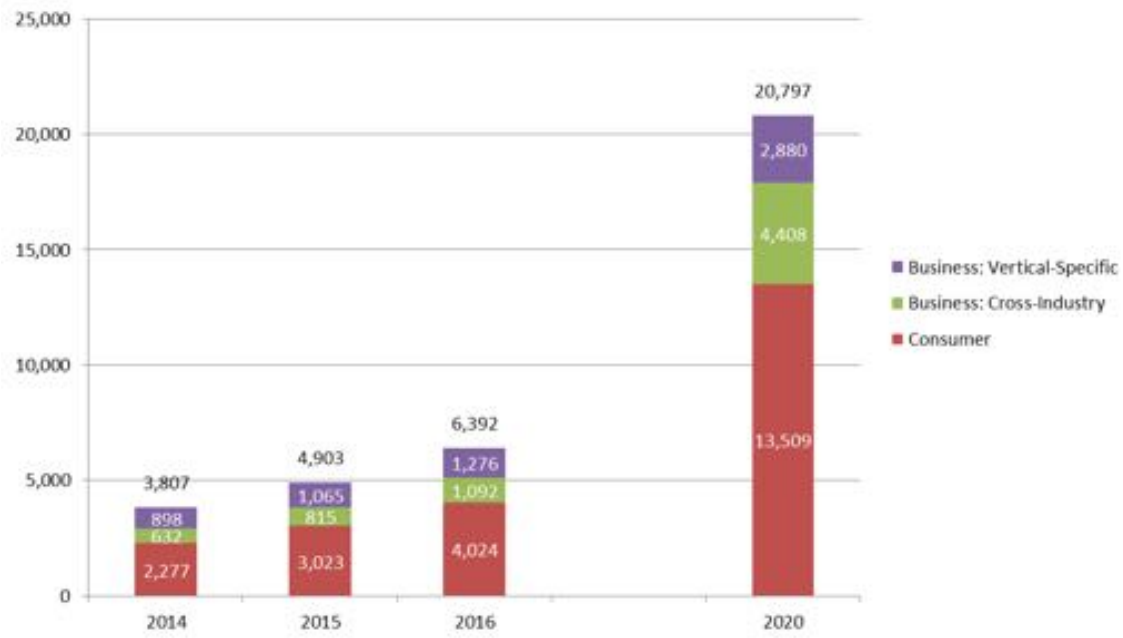
Globally, average IP traffic will reach 511 Tbps in 2019, and busy hour traffic will reach 1.7 Pbps. In 2019, the gigabyte equivalent of all movies ever made will cross Global IP networks every 2 minutes. Good connectivity will be key in order to ensure the wellbeing of the citizens.

Figure 72 – Cisco VNI forecasts



Penetration of Internet users, especially the business one will increase in the next 5 years and the trend will most likely continue till 2025.

Figure 73 - Internet of Things Units Installed Base by Category (Millions of Units)

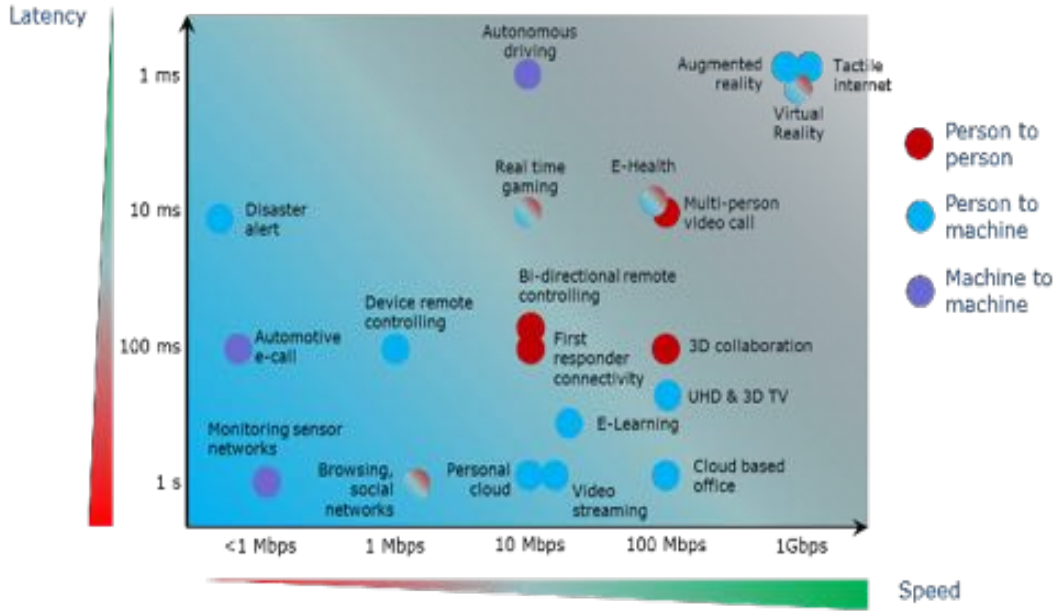


Source: Gartner (November 2015)

New applications requiring low latency and VHC internet access are emerging and will create the demand for better connectivity. **Error! Reference source not found.** illustrates that a number of applications will need latency around 1ms and bandwidth of 1Gbps by 2025. Of course, one has to consider that many of these application will be run in parallel, so that the bandwidth needed by households is cumulative.

Figure 74 – Latency and speed needed by applications and services

Need for speed and latency by applications and services



Source: Commission analysis based on GSMA and EIB

6.10 ANNEX 10 – Problem drivers

The present annex provides a more detailed description of the drivers included in section 1.3. and of the evidence supporting them.

6.10.1 The lack of incentives to deploy networks in the absence of infrastructure competition or in rural areas

The rules governing the sector fell short of providing sufficient incentives and opportunities for the market-funded roll-out of NGA and especially VHC fixed and mobile networks. Moreover the deployment of wireless infrastructure was hampered by insufficient availability of a key resource i.e. spectrum.

The need for upgrades to legacy networks described under section 1.2.1 raises questions of whether there are sufficient incentives to invest in the upgrade, and also which competitive model should be applied, as the unbundling of the copper local loop from the central office may become relatively less important because of the performance improvements on the basis of other technologies.[439]

The transition from copper-based networks towards fibre-based networks is gradually happening worldwide. In Europe, fibre is being deployed by a variety of operators in the access network to overlay or replace legacy copper lines or even parts of HFC co-axial networks. One of the main challenges for regulators today is to incentivise investment and support sustainable competitive models for newly constructed networks, at the same time guaranteeing the attained level of access to legacy networks until those become redundant. MS have followed different strategies with varying outcomes,[440] and new broadband gaps have emerged in terms of coverage and take-up of NGA and VHC networks between countries in Europe, between Europe and international competitors[441] and between urban and rural households, which projections suggest may persist.

Deployment of VHC networks can be comparatively more expensive in near-term Capex than incremental upgrades of legacy copper infrastructures and demand for - VHC connectivity is very closely related to experience, hence requiring a supply-led ("build it and they will come") approach. Traditional network operators managing depreciated legacy infrastructures do not necessarily see the benefit of rolling out VHC broadband networks under these conditions, which in turn renders perceived business cases uncertain, especially in challenge areas that in any case can only support one network, such as rural areas.

Certain elements of the current regulatory framework, in the light of the most recent market developments could be improved to **foster deployment of VHC networks**, such as:

(i) Incumbent operators fear that they will be most likely price regulated, potentially on cost oriented basis if and where they deploy VHC networks, lowering their return on investment.

(ii) Insufficient regulatory predictability regarding access obligations on NGA networks (in particular pricing); due to short market review cycles, lack of sufficient focus on retail markets and the difficulty of enforcing consistency on the basis of non-binding recommendations, impacting network roll-out. Conversely for regulated operators, obligations to share on a non-discriminatory basis any new assets may take away some of the incentives, especially for the riskiest investments.

(iii) The lack of incentives for incumbents to co-invest; experience has shown that this is relatively unlikely to happen in local markets, unless a credible threat of roll-out by competitors is present or where the incumbent has responded to a policy push.

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[439] Local Loop Unbundling has been the main tool facilitating competitive stimulus. LLU volumes are already starting to decline in countries such as Germany, with the migration to next generation fibre networks, and several countries such as the Netherlands and Sweden have focused on fibre access..

[440] See SMART 2015/0002 for a detailed analysis of regulatory strategies and outcomes

[441] Countries such as South Korea and Japan which placed significant emphasis early on FTTH are now clearly ahead of most (although not all) European countries as regards fast broadband as shown in section 1 above

(iv) Likewise in areas where no NGA infrastructure is present the emergence of new local operators may be discouraged by the commercial threat posed by existing operators that have (non NGA) infrastructure in place.

(v) Lack of sufficient measures to support NGA deployment by alternative investors. By focusing regulatory model on SMP finding, the system perpetuates a model built at a time where only one network was deployed. It fails to take account of other operators and investment models, which could benefit from greater support.

The implementation of basic competition safeguards which could help climb the ladder of investment (e.g., access to civil engineering of SMP operators) can be made difficult if access to civil engineering as a remedy is made ineffective by lack of information (mapping) or unclear or uncertain conditions[442].

Further, while access regulation is a necessary condition for newcomers to enter the market, gain scale and ultimately replicate the network infrastructure, on the other hand regulated access at low prices has lower risks than full network build-out and thus may result in lower incentives for alternative operators to invest or co-invest.

Ubiquitous connectivity also requires efficient investment in the roll-out of very high quality networks fit for 5G technology, expected to drive business in the years to come. The architecture of 5G networks will be much denser than previous wireless networks (i.e. 3G and 4G) and thus a key challenge will be to adapt the licensing model accordingly, including by promoting license-exempt spectrum or adaptations to the model of exclusive licensing. It has to be noted that in addition to spectrum needs the 5G deployment needs also substantial fixed assets at its disposal.

Poor auction design or renewals conditions and uncoordinated releases as well as timeframe between allocation and assignment of spectrum have severely hindered the level and the quality of the roll-out of 4G networks and this cannot be repeated. Rapid access to spectrum under appropriate conditions is key for early 5G network deployment.

6.10.2 Inefficient allocation mechanism for public funding

Investment needs remain considerable: as mentioned in annex 14, more than EUR 92 billion were needed in 2014 to bring our digital infrastructures up to the DAE 2020 broadband targets standard and more might be needed beyond that date to ensure that Europe's infrastructure remains competitive.

Where the market cannot deliver on its own, public funding can contribute to the wide deployment of VHC broadband networks. In particular the European Structural and Investment Funds (ESIF) the Connecting Europe Facility and the European Fund for Strategic Investment can help plugging the gap. These financing tools provide grants, financial instruments (equity, debt, guarantees) and can be cumulated to contribute funding a given project. While grants are mostly suited to plug gaps in market failure areas, financial instruments can reduce the risk profile in areas where a business case is present but remain underserved. However, one must be take into account that public support is a scarce resource and that it comes with significant constraints of legal, industrial and administrative nature; as an example OPEX is not included in grant funding, so the running costs fall on the network operator in any case.

However, the experience from the last programming period shows the trend that calls for tenders won by incumbents have typically resulted in copper enhancing solutions, while public support for VHC solutions has been more scarce.

[442] However, in France and Spain, as well as in Portugal, duct access was ultimately pursued as the main remedy for NGA under the SMP regime. Duct access SMP conditions were set in 2009 in France and Spain and complemented with symmetric obligations for in-building wiring and in the French case, access to fibre terminating segments outside areas in which the NRA considered that infrastructure competition could develop. The positive impacts of this policy aredescribed in chapter 5.

The size of the tenders was also a problem, as it is very difficult for a new entrant to bid for large regions, while they might have a chance in smaller areas. Finally, the lack of a homogeneous network, infrastructure, **investment and quality of service mapping** by NRAs generates very different outcomes in terms of granularity of assessment and sometimes underestimates the amount of infrastructure present on the ground, diverting grants to area where a business case is possible. Also, the way the call for tenders are designed often ends up favouring the incumbent operator (size of the call, choice of direct support to operators instead of PPPs). The Commission is committed to make the most of the public funding leverage effect with a view to promote and unlock both public and private investment across Europe. This is all the more important as the public resources assigned to broadband infrastructure are limited, (EUR 6.4 billion for 2014-2020 are devoted to broadband by Structural Funds) as explained in more details in Annex 14 (section **Error! Reference source not found.**)

The Commission and the MS should strive to work together to ensure a maximization of available resources for the financing of the broadband deployment including developing an appropriate funding mix between grants and financial instruments.

6.10.3 Fragmented regulated and commercial offers for businesses across the EU

Geographic market integration, leading to larger demand, more competition (allocative efficiency), lower costs (technical efficiency) and better product and services offers for customers (qualitative efficiency), is impeded by artificial barriers to the expansion of markets beyond borders. In the EU, the effects of various types of artificial barriers can be felt with regard to possibilities of access seekers to avail for consistently regulated access inputs, in particular with a view to serving business customers on cross-border basis, and with regard to non-harmonised end-user protection requirements.

Inconsistency of regulatory intervention in electronic communications markets, which acts as a barrier to market integration, is largely driven by three factors. First, national regulatory authorities have under the current regulatory framework not the appropriate incentives to opt for a DSM-compatible solution when choosing the appropriate regulatory remedy to a competition problem identified in a market. Indeed, NRAs exercise their discretion resulting in divergent approaches, for instance, in the regulation of fibre networks, symmetric regulation, pricing methodologies etc..

Although the current framework allows for flexibility in applying its general principles to national circumstances, this does not mean that all regulatory solutions can achieve the objectives of the framework or that they can all achieve them in the best way. Secondly, the technological complexity of networks, and in particular their local access parts, multiply this (inconsistency) problem by rendering the design of the technical details and requirements of comparable regulated access products more difficult. For example an international company purchasing communication services in different jurisdictions would not be able to receive a homogeneous offer on crucial elements such as activation or repair time. Thirdly, the current system does not allow identifying transnational demand nor as a consequence require NRAs to adopt remedies accordingly. This would enable the provision of connectivity for business users. Fourthly, the consistency check procedure (so called "Article 7 procedure") as well as the currently available "harmonisation procedures" (under Art.19 of the Framework Directive) would often not tackle the problem effectively, as such measures take too long to be implemented, leave too much room to national regulatory authorities to circumvent the outcome of the procedures and, thus, unnecessarily increase the lack of regulatory predictability.

Lack of consistency in regulatory responses to similar problems[443] does not just affect cross-border operators, which have to adapt to different regulatory regimes and thus face greater internal market barriers. It also results in different levels of effectiveness of national regulatory regimes in fostering the best possible connectivity at affordable prices for end users. For

[443] In about 11% of all draft decisions subject to Art.7 notification the Commission has indicated that it may create a barrier to a single market or is contrary to EU law, or even if no formal decision has been issued by the Commission, the notifying NRA has withdrawn its notification.

example the implementation of VULA reference offers in different MS has resulted not only in different design outcomes, but also in different levels of take-up of this type of access products, which may be due to the attractiveness to access seekers in terms of quality. In other words, regulatory choices such as those regarding access obligations and the pricing of legacy networks have an impact on the investment decisions of operators. In this way, end users pay the consequences of inconsistent and potentially sub-optimal regulatory decisions, affecting retail markets.

6.10.4 Minimum harmonisation, differentiated rules

Over the past years, it has become apparent that the lack of consistency of telecoms regulation is – to a degree at least – the result of the institutional set-up and the way the various institutional players (i.e. mainly NRAs, BEREC and the EC) interact and can influence the regulatory outcome.

Whilst the EU Regulatory Framework had been designed with flexibility in mind in order to allow NRAs to take account of national circumstances, many differences in the national regulatory approaches cannot be sufficiently explained with varying national circumstances. This reasoning led to, for example, the Commission's recommendations in relation to costing methodologies (termination rates and costing and non- discrimination recommendations). The inconsistency witnessed is exacerbated by the fact that the procedural and institutional set-up currently in place appears to be ill equipped to ensure a more consistent approach in similar circumstances.

For example, in the area of spectrum, while harmonization of technical conditions for spectrum use contribute to a great extent to the creation of economies of scale for device and network equipment manufacturers, the subsequent uncoordinated releases of spectrum to operators prevent these economies to be realized in full as network deployment only happens on a patchy manner, thereby increasing manufacturer´s development costs and the time to bring equipment to market. As investments decisions are increasingly made at global level, this phenomenon tends to discourage technology and equipment development in Europe to the advantage of other faster regions which will attract the investments.

Moreover, given that radio waves travel across national borders, the type of use of a frequency band in one MS has an impact on the type of use possible in neighbouring countries. In practice, if a MS uses a band for a specific type of application such as 5G before its neighbours who continue to emit with different technical parameters, interference problems could occur across borders[444] – for example in bands below 1 GHz (i.e. 700MHz band). This problem would hence be particularly relevant in smaller MS or in MS where a large proportion of the population lives within reach of signal transmissions from neighbouring countries. In addition, the very fact that there is only limited coordination of key determinants of market shaping inputs such as spectrum assignments across MS leads to more fragmented markets than necessary.

The current minimum harmonisation approach has also produced different outcomes and led to fragmentation in terms of consumer protection. In the field of contracts, for instance, this may be seen as a positive element, since NRAs can go beyond the minimum provisions of the Universal Service Directive where required. While the level of consumer protection - as measured by completeness of contracts, ease of comparing offers and extent of switching - is generally relatively high, the underlying measures are quite diverse. The diversity of national approaches creates a barrier to entry for pan-European operators active in multiple MS. The problem may be aggravated as MS may advance further and start developing their own measures in response to the previously identified problems.

[444] Spectrum allocation and cross-sectoral interference issues fall out of the scope of this review. In particular, the work on managing interference between GSM (mobile) and GSM-R (mobile communications for railways) is addressed in serveral bodies (CEPT and/or ERA) as well as at a national level. Some MS have introduced financing schemes to encourage the installation of filters and new radio modules in the railway cabin radios.

6.10.5 Differentiated rules leading to uncertainty on spectrum assignment

Spectrum rules do not support optimal spectrum availability and deployment of mobile networks in Europe (regulatory failure).

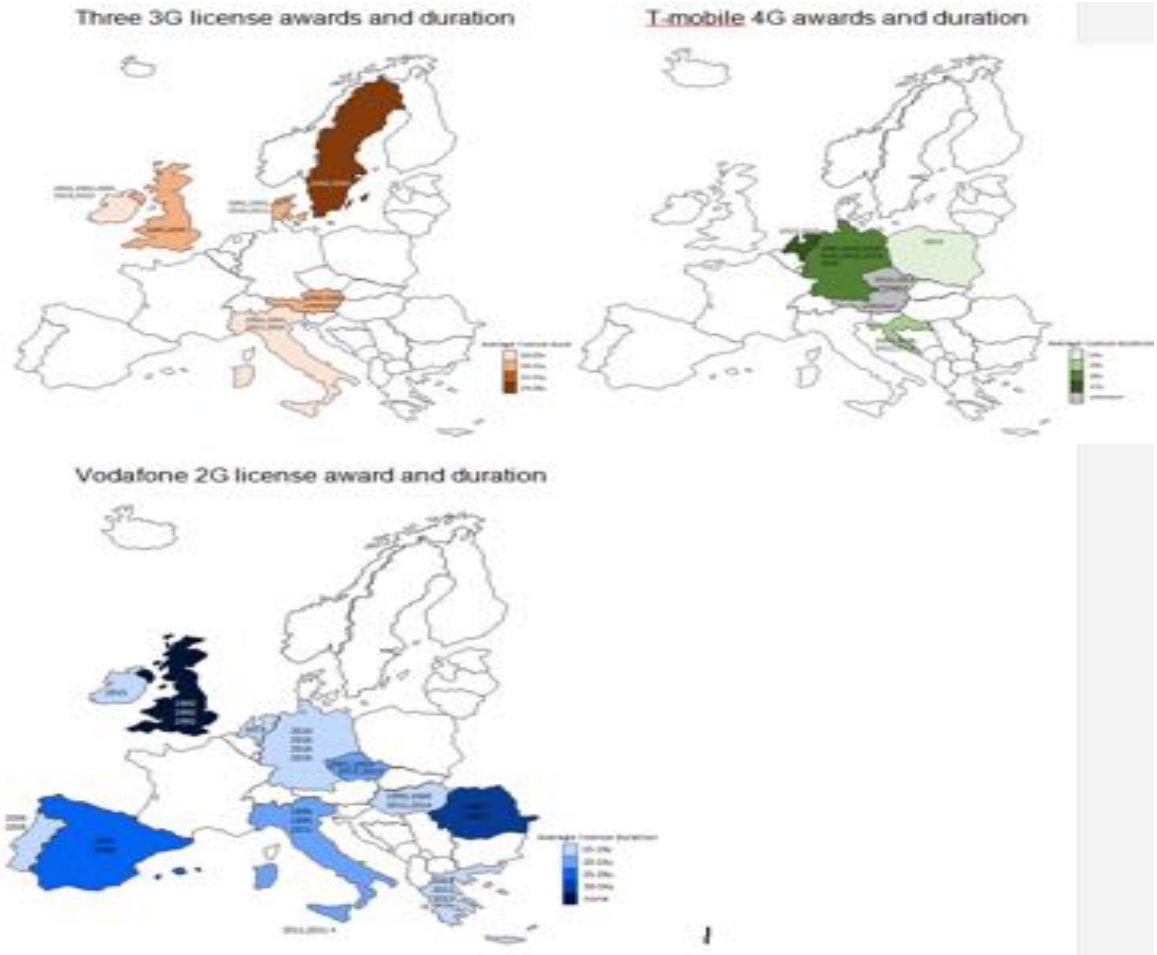
The timely availability of spectrum to the single market, is negatively influenced by

(i) the time gap between spectrum allocation (harmonised use and technical conditions) and actual assignment to operators, (ii) the uncoordinated timing of assignment of same bands throughout MS and (iii) the varying conditions which govern spectrum renewal.

The current regulatory framework has no mechanism in place to facilitate a more consistent approach let alone to enforce it and most attempts to coordinate the assignment of spectrum has been made on a piecemeal, limited and insufficiently efficient approach with the need to adopt a specific legislative measure each time a deadline has to be set for the assignment of a part of the spectrum (the 2012 Radio Spectrum Policy Programme for 800 MHz 4G, the 1998 UMTS decision for 3G, the pending proposal for a EP and Council Decision on 700 MHz). Moreover, spectrum policy is often guided by national policy objectives which often do not take sufficient account of common EU policy objectives such as the promotion of high quality communications networks and the single market.

The figures below show for three major operators the timing and duration of licenses awarded. The diagram clearly indicates that, even where licenses were awarded in neighbouring countries, these awards took place in different years and they cover different durations.

Figure 75 - Example of differences in timing and duration of licenses for major EU operators



Source: Wik Consult

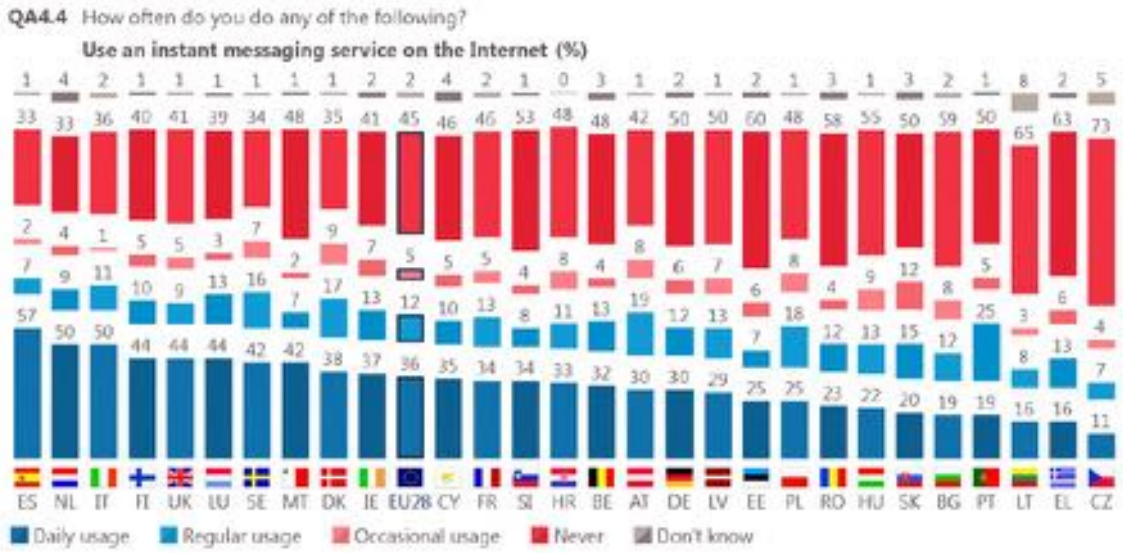
Furthermore, the existing spectrum governance structures focus on the harmonisation of technical parameters but may not allow for sufficient consistency of the timing of effective use of spectrum once allocated. Moreover, spectrum is assigned with varying conditions reflecting different (national) balances of the primary objectives underpinning the regulatory framework. This leads to disparate conditions where a national border bisects otherwise similar areas. The absence of consistent EU-wide objectives and criteria for spectrum assignment, as well as for changes to the conditions applicable to individual rights of use, at national level creates barriers to entry, hinders competition and reduces predictability for investors across Europe.

6.10.6 Technological and market changes

There have been significant changes in the telecommunications market since the last review that have affected the way in which end users communicate. The increasing coverage of wired and wireless broadband networks, coupled with the availability and affordability of consumer devices, have made consumers and businesses to rapidly adopt new communications services that rely on data and internet access services instead of traditional telephone services. The market has seen how in very few years new players have managed to compete with traditional telecom operators by offering a new set of communications applications over the internet.

Although there are still significant variations across Member States, overall European consumers have been very quick in adopting these new communications services. At the end of 2015, a significant number of citizens used instant messaging services, a relatively new service, several times per day compared to the users of e-mails or phone calls over a landline phone (30% vs. 27%). On average, 50% of Europeans use instant messaging services regularly, with 36% using them daily.

Figure 76 – Use of Instant Messaging in EU member States

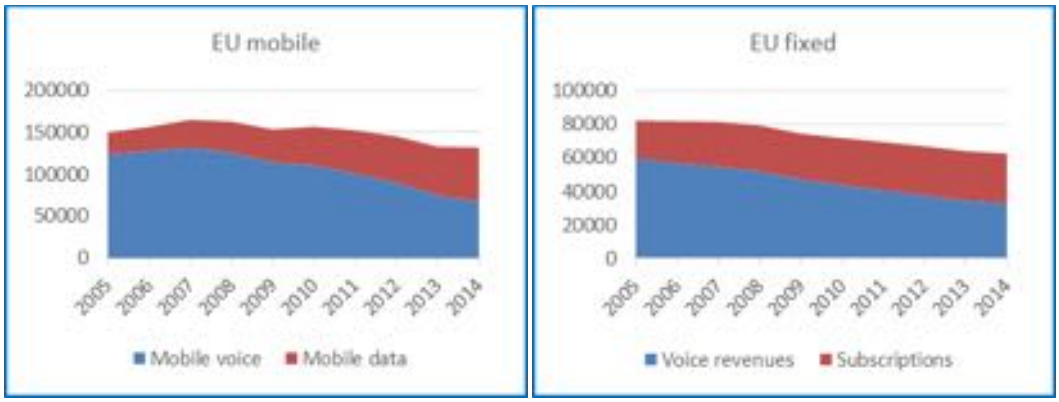


Projections on future take-up of instant messaging simply confirm current trends. The volume of IP messaging, which was still negligible in 2010, exceeded the SMS volume only three years later and it is expected to further increase its predominant share of overall messaging traffic in the future. In 2014 alone instant messaging services on mobile phones would have carried more than twice the volume (50 billion versus 21 billion per day) of messages sent via a short messaging service (SMS).

With regards to revenues, it is estimated that between 2008 and 2014 fixed and mobile revenues declined in the EU by 19%. In both markets there has been a drop in traffic-related revenues. Taking into account also factors that are largely independent of the rise of OTT, such as revenue decrease due to regulatory intervention (by NRAs or by the EC, such as a decline in termination and roaming rates) or due to the global economic downturn, the study SMART 2013/0019

concludes that the rise of OTTs had no impact on fixed revenues, but did negatively impact mobile revenues.

Figure 77 - Mobile and Fixed revenues in the EU (million Euros)



As regards to the provision of wireless connectivity, the upcoming 5G technology revolution requires a fit for purpose spectrum management chain including allocation and assignment, since the way airwaves are regulated depends partly on the technologies used and services offered. Future users of dense 5G networks will need greater flexibility on both, access and use of spectrum but today, in the current framework, there are insufficient incentives for holders of rights to use spectrum efficiently in terms of technology and capacity.

There is consensus on the need to develop spectrum sharing to enable the 5G revolution. Today there is much focus in the use of individual often exclusive licenses (which are justified for some uses, e.g. mobile, to avoid interferences) but no sufficient incentives for secondary market for spectrum. In addition, it becomes clear that commercial operators are also using license exempt spectrum, notably for distributing Wi-Fi based connectivity from fixed infrastructures**. Barriers to spectrum entry** need to be lowered to stimulate innovation and new services.

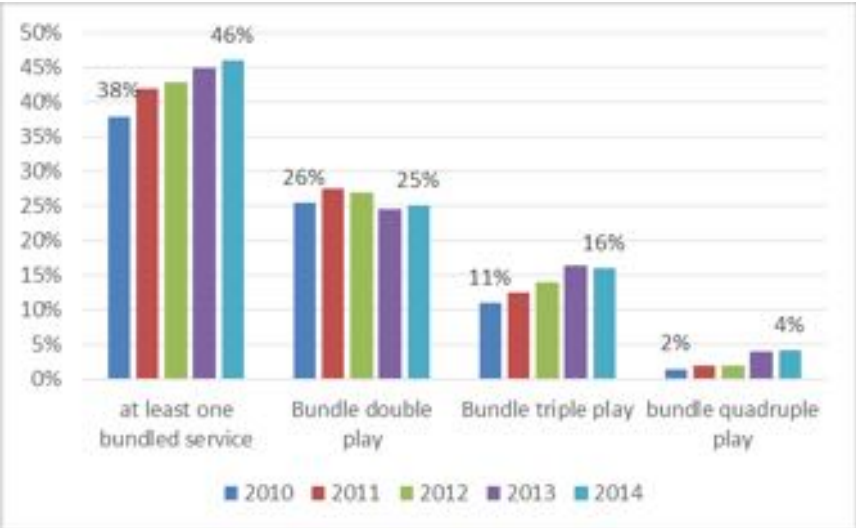
6.10.7 Increasing adoption of bundles

In response to network convergence and increased competition, telecom operators have started to bundle different services like TV and Voice telephony to the internet access service. Moreover, given the convergence of fixed and mobile services, also mobile services (voice and data) are increasingly added to the bundle.

A bundle refers to a package of several different services sold together as a single plan: landline calling, Internet access, mobile services, pay-tv. In 2014 take up of broadband bundled products per total population was 46%, five points higher than the previous year, with an ever increasing number of triple and quadruple play products.

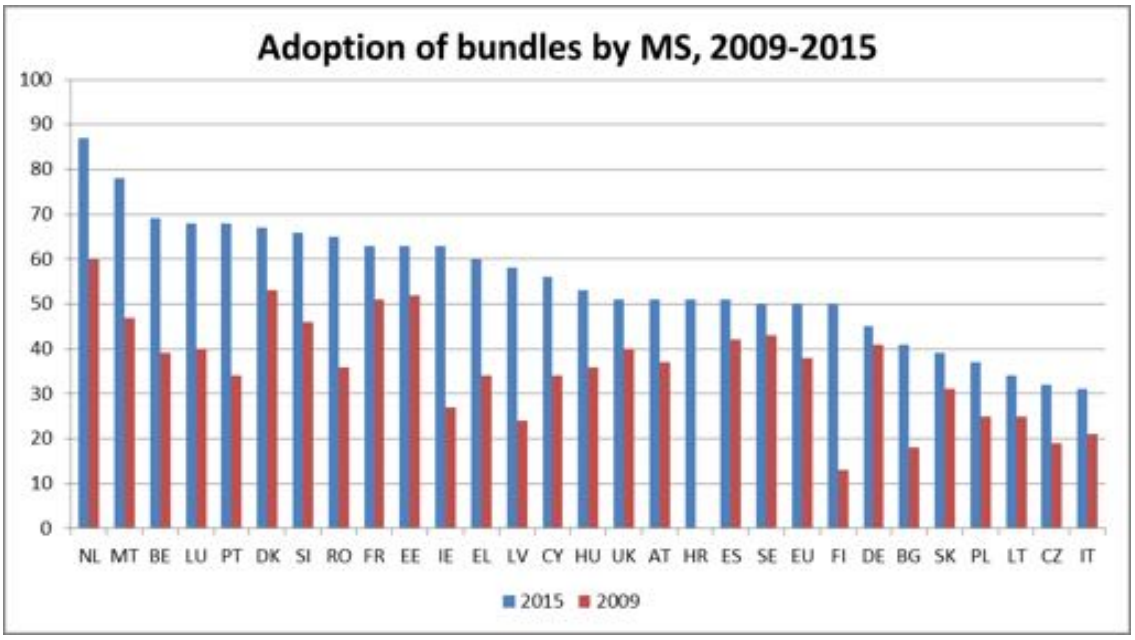
The growing take-up of bundled services can be seen in the figure below. Double play bundles are still most common, but triple and quadruple play bundles are gaining significance.

Figure 78 – Adoption of bundles in the EU, 2010-2014



At the end of 2015, 87% of households in the Netherlands and 78% in Malta had purchased bundles services, as had at least half of all households in 19 other Member States. Italy, the Czech Republic and in Lithuania were at the other end of the scale with 31%, 32% and 34% of households respectively. Since 2009 there has been an increase in the number of households subscribing to bundled products in all Member States, as shown in figure 68.

Figure 79 – Adoption of bundles per MS, 2009-2015



6.10.8 Suboptimal design of market review cycles and Inconsistent remedies under current rules (art.7)

This problem driver consists of insufficient legal certainty and regulatory predictability regarding access obligations on NGA networks due to short market review cycles, lack of sufficient focus on retail markets and the difficulty of enforcing consistency on the basis of non-binding recommendations, impacting network roll-out.

Provisions therefore need adjustments with a view to reducing the regulatory burden and make regulation more clear and certain. The current process of frequent market reviews and ex ante regulation has been reported in certain MS to cause little regulatory predictability and legal certainty, on top of being rather cumbersome. This is related on the one hand to the variety of (unranked) goals and remedies available to NGAs, but also to the relatively short regulatory cycles (every three years, significantly shorter than investment cycle), in particular when considered together with the associated appeals and court procedures. While regulation needs to move along with a fast changing sector, operators often stress the need for regulatory predictability.

It is also worth noting that the short cycle of market reviews, the lack of predictability and the litigation that may follow have a discouraging effect on institutional investors such as infrastructure funds, private equity and pension funds that may be willing to invest capital in the sector's network operators, especially on a long-term horizon. On the other hand, investors attracted by short-term gains and price arbitrage may be more attracted by a more volatile environment. The effects of this "adverse selection" problem may hamper infrastructure deployment which has is definition a long-term asset class, especially for operators which are smaller and more exposed to instability.

Whilst market fragmentation is not solely to blame on the regulatory set-up in the EU, it has become apparent over the past years, that the lack of consistency of telecoms regulation is – to a degree at least – the result of the institutional set-up and the way the various institutional players (i.e. mainly the NRAs, BEREC and the Commission) interact and can influence the regulatory outcome[445].

Whilst the EU Regulatory Framework had been designed with flexibility in mind in order to allow NRAs to take account of national circumstances, the Commission has repeatedly pointed out that many differences in the national regulatory approaches cannot be sufficiently explained with varying national circumstances. The inconsistency witnessed is exacerbated by the fact that the procedural and institutional set-up currently in place appears to be ill equipped to ensure a more consistent approach in similar circumstances[446].

In particular increased consistency in market regulation and management of scarce resources would contribute greatly to a true Single Market. With regard to both areas, of course, there may be various sub-themes[447], which would benefit more broadly from an institutional set-up that was geared more thoroughly towards ensuring consistency. Where the problem of inconsistency and fragmentation arises is exactly where the Commission does not have veto powers (and relies on the non-binding recommendations), i.e. on the remedy side.

First, concerning market regulation, one area, in relation to which a more consistent approach is particularly important, is the choice and design of access remedies. Unfortunately, it is especially in this area where there is the most notable divergence across the EU. Whilst competition still predominantly takes place at the national level, EU-wide consistency in designing access remedies is increasingly considered important.. In addition to access remedies, fragmentation of other regulatory conditions (e.g. authorisation conditions) may also represent an obstacle to market entry and cross-border provision of services[448].

6.10.9 Obsolete and redundant rules

A number of regulatory inefficiencies can be identified in the current regulatory setting, which are generating unnecessary compliance costs and discouraging investment. Given the technological and market changes described above, certain provisions of the framework might no longer be relevant or might have become superfluous.

This is the case for example for part of the Universal Service rules. The evolution of consumers' behaviour, the wide coverage and availability of mobile networks and services, and the provision by the market of comprehensive directories and directory enquiry services, which also experience strong competition from other (notably online) information sources, have eliminated or at least reduced the need for including certain universal service obligations, such as the phone directories and public pay telephones. These changes will require an adaptation of the Universal Service regime to remove outdated services. Moreover, with already nearly 100% standard fixed

[445] See, for example, the EP study on "How to Build a Ubiquitous EU Digital Society", p. 100 where it is stated that "[…] the fact that Heads of NRAs are considered primarily to be motivated by a desire for self-determination, has led to some criticisms that BEREC delivers verdicts based on a 'lowest common denominator', or prioritises flexibility over consistency in the Single Market."

[446] In particular, with regards to imposing remedies, the balance between achieving harmonisation in a flexible framework appears to have been tilted in favour of flexibility neglecting legitimate needs for consistency. For example, whilst remedies are imposed on operators by NRAs at the national level, the Commission and BEREC almost exclusively input through non-binding instruments in order to attempt to achieve EU-wide regulatory consistency on this level. In the past, this "soft law" approach has led to significant differences in some areas, clearly proving to be an obstacle for the development of a Single Market.

[447] For example, issues surrounding the independence and funding of NRAs, the constitutional set-up of BEREC, the design of the EU consolidation process under Article 7, the Commission's powers to adopt harmonisation measures under Article 19, standardisation, rights of way, numbering, spectrum management, naming and addressing to name but a few.

[448] The negative impact a fragmentation of conditions has on the provision of connectivity services has been widely reported by the BEREC consultation on the cross-border obstacles to business services, and in the EP study on the assessment of the EU Regulatory Framework (p. 42 and 107).

broadband coverage in the EU, universal service obligations regarding the availability of functional internet access and telephone service are likely to become redundant in many MS in the future.

Further provisions might have become superfluous due to legislative developments in other regulation areas. Some of the sector-specific consumer protection rules (e.g. Article 20 and 34 Universal Service Directive) are examples of provisions that need to be reviewed in those respects to avoid that overlapping rules contribute to the unnecessary administrative burden.

Overlaps in legal frameworks on consumer protection are just one of the issues to be addressed in this review. Sector-specific rules aimed at providing a particular level of protection to users of ECS in areas such as data protection, privacy and security, freedom of choice and prevention of lock-in effects, transparency, quality and affordability and access to emergency numbers. These rules only apply to providers of ECS.

While in some case these rules applicable to consumers can be complementary, there are may be instances where overlaps between the different set of rules can occur[449]. For example the information requirements in the Consumer Rights Directive overlap with certain general provisions of Article 20 Universal Service Directive, while Article 34 Universal Service Directive on out-of-court dispute resolution is covered by the Directive on alternative dispute resolution for consumer disputes.

A specific situation may fall within the scope of two Directives or within the scope of specific provisions of these directives and create a circular cross reference. One example may be the priority provisions in Article 1(4) USD "*The provisions of this Directive concerning end-users' rights shall apply without prejudice to Community rules on consumer protection, in particular Directive-s 93/13/EEC and 97/7/EC, and national rules in conformity with Community law*" and Recital 11 of the CRD: "*this Directive should be without prejudice to Union provisions relating to specific sectors, such as […] electronic communications*".

Another example is Art. 3 of ADR Directive, which states that "*if any provision of this Directive conflicts with a provision laid down in another Union legal act and relating to out-of-court redress procedures initiated by a consumer against a trader, the provision of this Directive shall prevail*".

This overlap results in a complex legal framework, with different consequences: the risk that it is not fully respected; penalties could be contradictory within MS; differences in implementation may also be due to an inconsistency among terminology; and these problems are compounded to the prejudice of the internal market when rules are based on minimum harmonisation.

[449] See for a detailed analysis the SMART 2015/005

6.11 ANNEX 11 - 5G spectrum requirements for connected car (use case)

In the study on 'Identification and quantification of key socio-economic data to support strategic planning for the introduction of 5G' SMART 2014/0008 spectrum estimates within each sub-range are calculated by multiplying the number of devices by their respective occupancy of the spectrum in bps according to the scenario and multiplied by the assumed spectral efficiency of the technology used for each device type.

The different approaches of 100 per cent sharing (fully shared) versus 0 per cent sharing (exclusive licensing) have a very high impact on the total demand to support either type of operation. In a fully shared (100 per cent sharing) environment, the spectrum needed is equal to the total use case driven demand estimate. In an exclusive licencing environment however, the spectrum needed is equal to the total use case driven demand estimate multiplied by the number of operators in the environment. This approach is taken to understand the minimum and maximum spectrum requirement figures.

In the connected car example illustrated below is based on two very high data rate use types within the transport and automotive verticals, once the theoretical total (user driven) demand estimates is calculated, the spectrum needs are analysed based on the five different spectrum sharing scenarios. In doing so, this use case is intended to drive the spectrum requirements to an extreme level to understand the impact on spectrum in a very challenging environment.

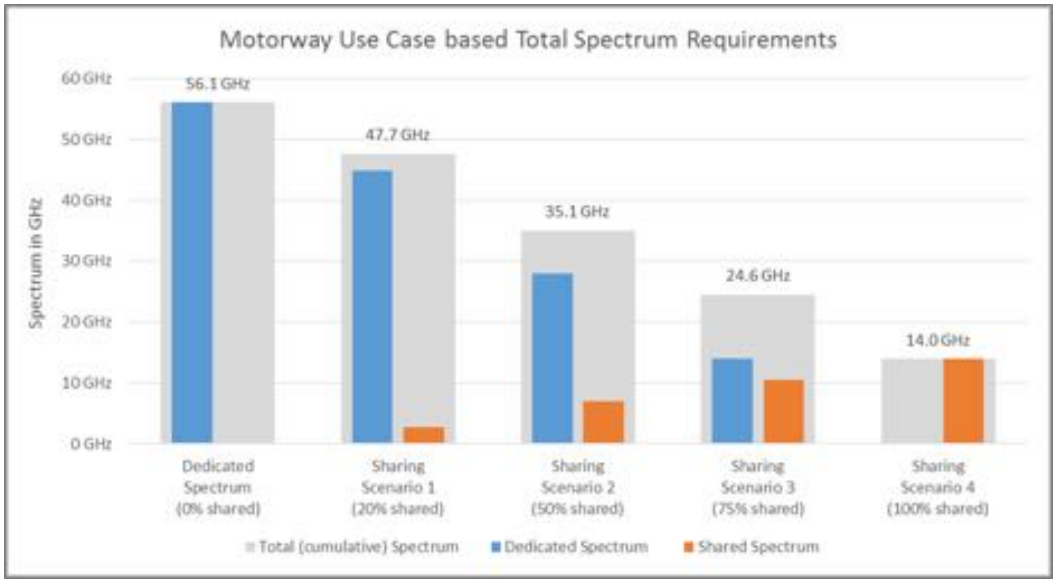
The table below shows how the total quantity of spectrum varies depending on the different sharing scenarios that may emerge by 2025.

Table 37 - Total spectrum requirements relative to percentage of spectrum sharing scenarios based on theoretical model

Spectrum sharing scenario	Total spectrum needed (GHz)
Scenario 1: 0% sharing	56.1
Scenario 2: 20% sharing	47.7
Scenario 3: 50% sharing	35.1
Scenario 4: 75% sharing	24.5
Scenario 5: 100% sharing	14.0

The figure shows the total spectrum requirements for each scenario split by the quantity of dedicated and shared spectrum in each case.

Figure 80 - Total spectrum requirements for motorway use case



All -exclusive case requires the largest quantity of spectrum (56.1 GHz) because each individual of the four-service provider (x4) requires approximately the same amount of spectrum estimated for the given scenario. The all (100 per cent) shared case has the lowest spectrum requirement with a total of 14.0 GHz of spectrum. If by 2025 full sharing is not possible then a mix of dedicated and MNO sharing with the 5G use cases (connected car, eHealth, transport and utilities) helps to minimise the total quantity of required spectrum compared to the all dedicated case.

The option of sharing spectrum becomes a benefit to service providers as the proportion of shared spectrum increases. Total required spectrum reduces however, for each frequency range where there is a limit to the quantity of available spectrum in each range. Therefore, this result shows that some sharing will be necessary in Sub-1 GHz band because MNOs will likely only have access to no more than 75 per cent of the spectrum in this sub-range by 2025 and therefore sharing with other operators and new MVNOs will be required to serve the users in this transport scenario below 1 GHz.

6.12 ANNEX 12 – Comparison of impacts by stakeholders

In this annex, we present the summary tables of impacts on different groups of stakeholders in; they were compiled under the supporting study to this IA on the basis of the public consultation, the interviews with stakeholders and workshops organised by the EC. As mentioned in section 4.8 we pay specific attention to positive and negative impacts, direct and indirect on specific categories of stakeholders, including SMEs, as required by the SME test under the better regulation principles and public administrations. Although the impacts on stakeholders are addressed for all the options considered under each policy area, a wider attention is paid to the preferred option for each policy area. A more complete and narrative version is provided in SMART 2015/0005, chapters 1 to 5.

6.12.1.1 Access regulation

Table 38 - Summary stakeholder impacts – access options

	Option 1: Status quo	Option 2: Continuity and simplification	Option 3: Fibre-ready	Option 4: Reduction in scope of regulation
Consumers	Mixed – some may be well-served but existing gaps may remain	As option 1	Substantial benefits arising from higher broadband quality of service due to increased deployment and competition in very high speed broadband. Some market consolidation also possible, which may have positive as well as negative impacts on innovation and price	Negative – significant reductions in competition could be expected impacting pricing and service quality, although some further investment might be made
SMEs	Mixed – some may be well-served but existing gaps may remain	As option 1	Substantial benefits arising from higher broadband quality of service due to increased deployment and competition in very high speed broadband.	Negative – significant reductions in competition could be expected impacting pricing and service quality, although some further investment might be made
Larger and multi-national businesses	Negative – fragmentation would continue to impact cross-border connectivity	As option 1	Benefits from greater fibre availability (also reaching smaller sites, homeworkers) and consistent wholesale specifications, if SMP approach maintained for business access	Highly negative – significant reductions in competition and further cross-border fragmentation
Incumbents	Negative – existing regulatory burden and constraints would remain	Some benefits compared with status quo – more certainty, higher burden of proof for intervention, but may also facilitate functional separation	Mixed. Some benefits – potential lifting of sectoral regulation, but also tighter regulation of ducts, pressure to invest	Highly positive – significant reduction in regulatory burden and constraints and lessening of competition
Entrants	Mixed – continuation of access regulation positive, but no emphasis on supporting more sustainable competition. Therefore, practical application varies by country. Entrants vulnerable to technological and regulatory change.	Some benefits compared with status quo – more certainty, greater potential for functional separation, but also higher burden of proof for intervention – may reduce regulation	Benefits for larger scale players able to invest and co-invest. Negative for smaller entrants relying on wholesale access	Highly negative – may undermine business viability

Alternative fibre investors	Neutral for existing players, but no additional support for further investment	As option 1	Positive – greater access to civil infrastructure, support for rural investments	Neutral if not reliant on incumbent SLU/duct access. Otherwise negative
Cable operators	Stability considered highly positive, although continued wholesale price regulation could undermine revenues	Benefits compared with status quo – more stability, higher burden of proof for intervention	Mixed - Some benefits from potential lifting of wholesale price regulation, but also greater infrastructure competition and pressure to invest	Positive – reduced competition
Content and application providers	Mixed – existing bandwidth gaps would remain, but competition would continue to support take-up and protect vs discriminatory conduct	As option 1	Positive – greater bandwidth availability, but risk in some markets of consolidation impacting competitive safeguards	Negative – likely to impede take-up of higher speed offers, and concentrate the market, raising risk of discriminatory conduct
Equipment manufacturers	Neutral to negative – no specific stimulus for investment by industry	Neutral to negative – no specific stimulus for investment by industry	Mixed – depending on business model/customer-base	Mixed – depending on business model/customer-base
NRAs	Mostly positive – retain existing flexibility. But several NRAs have raised concern over burden of 3 yearly review requirement + some NRAs raise concerns over independence and resourcing)	Positive – NRAs would benefit from continued flexibility, but with reduced market analysis administrative requirements and increased potential to implement functional separation. Under this option their resources and remit would also be strengthened	Mixed – NRAs would have more prescriptive requirements. Those not already pursuing mapping analysis and the operationalization of duct access may require additional resources to do so in the short term – although the admin burden may reduce longer term	Negative – NRAs would lose an important tool for the promotion of competition, while potentially facing an increased burden in dispute resolution
BEREC	Neutral	Positive – remit would be expanded and NRAs‘ competences would be aligned with BEREC‘s	This option would entail the strengthening of BEREC Governance as well as additional responsibilities. Although BEREC’s competence and influence would be expanded, NRAs would have less direct control over its Governance.	Highly negative. BEREC would lose a significant portion of its current remit (concerning market analysis).

6.12.1.2 Spectrum

Table 39 - Summary stakeholder impacts – spectrum options

	Option 1: Status quo	Option 2: voluntary	Option 3: binding	Option 4: spectrum agency
End-users (consumers and business)	Negative – late and uncoordinated deployment of 5G and lack of action on recent 700 MHz auctions means businesses are unable to develop new services (e.g. in transport, automotive, healthcare, utilities etc.) and consumers (including businesses) don't benefit from innovative services	Mixed – while this option could be in place fast, there is a high risk that voluntary measures would not be taken-up by many MS, leaving the same results as under option 1	Positive – this option delivers a coordinated approach to spectrum assignment and usage across the EU including for 5G (though it may come too late to influence 700 MHz assignments)	Mixed – while this option sets up a governance structure to address the problem, the complexity of negotiating this set-up means it will come too late to influence 700 MHz auctions and will delay 5G deployment
SMEs	Negative – the impacts would not differ from those for other end-users	Mixed – the impacts would not differ from those for other end-users	Positive - the impacts would not differ from those of other end-users. Swift implementation of 5G would create opportunities for innovation and entrepreneurship which would benefit SMEs in particular. General authorisations could provide greater opportunities for SMEs to gain access to spectrum which is now only accessible to large companies with the financial power to purchase exclusive rights (e.g. MNOs, etc.)	Mixed - the impacts would not differ from those of other end-users. Swift implementation of 5G would create opportunities for innovation and entrepreneurship which would benefit SMEs in particular
MNOs	Negative – this option risks repeating the 4G scenario where Europe lagged behind other regions for 5G with insufficient investment	Mixed – while this option could be in place fast, there is a high risk that voluntary measures would not be taken-up by many MS, leaving the same results as under option 1	Positive – this option delivers a coordinated approach to spectrum assignment and usage across the EU including for 5G (though it may come too late to influence 700 MHz assignments)	Mixed – while this option sets up a governance structure to address the problem, the complexity of negotiating might delay 5G deployment
Other spectrum users (e.g. broadcasters, PMSE, etc.)	Nil – this option would continue the current set-up which engenders significant local	Nil - This option would likely not differ significantly from option 1	Uncertain - This option provides a greater level of regulatory certainty and consistency across MS, impacts	Uncertain - This option provides the greatest level of regulatory certainty – impacts on other

	variability, continued erosion of spectrum for some users and uncertainty about future spectrum availability		on other spectrum users would depend on specific decisions taken by but the peer review mechanism could ensure that local needs of different spectrum users continue to be fully taken into account.	spectrum users would depend on specific decisions taken by the spectrum agency. There would be less scope for adaptation to local needs under this option.
Equipment manufacturers	Negative – this option repeats the 4G scenario (late & uncoordinated assignments) for 5G and therefore fails to provide legal certainty and it fails to capitalise on the size of the Single Market	Negative – this option risks repeating the 4G scenario for 5G and therefore fails to provide legal certainty and it fails to capitalise on the size of the Single Market	Positive – this option provides greater regulatory certainty and consistency to manufacturers proving them with incentives to invest now in order to serve the Single Market	Positive – this option provides greater regulatory certainty and consistency to manufacturers providing them with incentives to invest now in order to serve the Single Market

6.12.1.3 USO options

Table 40 - Summary of impacts on stakeholders – universal service options

	Option 1: Status quo (baseline)	Option 2: Light adjustment	Option 3: Broadband affordability	Option 4: Broadband availability
Consumers	Risk of social exclusion and of the deepening digital divide, support of redundant services	Risk of social exclusion and of the deepening digital divide	Connection of disadvantaged households, reduction of the risk of social exclusion, access to advanced services	As option 3, especially for rural and remote areas
SMEs	0	0	Support of self-employment and micro-organisation	As option 3
Larger and multi-national businesses	0	0	0	0
Incumbents	0	Alleviating the financial burden by narrowing the USO scope	Alleviating the financial and administrative burden by narrowing the scope and modernising the funding	As option 3; potentially increase or entrenchment of the market power
Entrants	Legal uncertainty with regard to financing	As option 1	More legal certainty with regard to financing	As option3; potentially increase or entrenchment of incumbent's market power; distortion of price levels; more difficult market entry
Alternative fibre investors	0	0	Alleviating the financial and administrative burden	As option 3; distortion of competition and price levels; crowding out investments
Cable operators	0	0	As above	As above
Mobile/ wireless providers	0	0	Alleviating the financial and administrative burden; more equitable cost-benefit relation in	As option 3

			the case affordable mobile broadband	
Content and application providers	0	0	Improved channels for advanced communications services and greater audience	As option 3
NRAs	0	Less flexibility in the adjustment of the USO to national circumstances	Flexibility with regard to the national USO; no choice with regard to financing	As option 3

6.12.1.4 Services options

Table 41 - Summary stakeholder impacts – services options.

	Option 1: Status quo	Option 2:	Option 3:	Option 4:	Option 5:
Consumers	A) Security and privacy issues remain. B) Looming risk to lock-in with multi-play bundles C) As OTT usage increases, there is an effective reduction of access to emergency numbers	A) 0 B) Lower risk C) 0	A) More issues B) Unclear (iii) C) -	A) Fewer issues B) Lower risk C) +	A) Fewer issues B) Lower risk C) +
Telco's	D) Unequal regulatory treatment vis-à-vis OTTs remains. E) Compliance costs F) duplication of costs when operating in multiple countries	D) 0 E) go down F) down (ii)	D) ++ E) down less than in option 2 (i) F) market entry i.s.o. regulatory barriers (iv)	D) + E) go down less than in option 3 (i) F) same as 2	D) ++ E) same as 4 (i) F) same as 2
OTTs	G) no compliance cost except some legal cases as to the scope of the RF	G) 0	G) reduced	G) new compliance costs	G1) New compliance costs G2) regulatory risk (vii) G3) impede innovations(vii)
IoT Start-ups and SMEs	I) Low confidence in future planning and investments due to unclear scope of RF	I) 0	I) More clarity but more market risks (v)	I) clarity about scope	I) clarity about scope
NRAs	L) Enforcement costs	K) 0 (i)	K) go up (vi)	K) 0 (i)	K) go up (vii)

(viii) Reduction in compliance costs due to cancelling redundant rules are significant. Reduction of enforcement costs by NRAs are zero. From option 2 to 3 the number of obligations for ECS reduce, but new obligations for ECN arise. From 2 to 4 and 5, the reduction in obligations for ECS remain the same, but the number of obligations for ECN go up. Additional measures that impact on OTTs do not impact on Telco's

(ix) Streamlining reduces the dimensions for regulatory heterogeneity. While lack of clarity about the scope of the RF may lead to evolution of interpretations by MS and create new heterogeneity of rules, this would not affect Telco's but rather OTTs and IoTs.

(x) Measures to reduce lock-in with multi-play service providers may be offset by relaxing obligations for interconnection and subsequent concentration of the market.

(xi) Relaxing obligations to interconnect may allow for the creation of market entry barriers as National Markets concentrate.

(xii) IoT start-ups will have less uncertainty about rights and obligations and experience less duplication of costs when operating in multiple countries, however, Option 3 may introduce competition issues for number-based m2m service providers vis-à-vis large telco's.

(xiii) Risk of more need for ex-post interventions in which NRAs may need to support CAs

(xiv) Interconnection on the basis of "reasonable limitations of technical feasibility as well as cost limitations" gives rise to enforcement/implementation costs, uncertainty and risks for innovation

6.12.1.5 Must carry and EPG obligations

Table 42 ---Summary stakeholder impacts – Must carry and EPG obligations

	Option 1: Status quo	Option 2: Phase out obligations	Option 3: Extend must carry obligations to OTT providers
Consumers	Positive, viewers continue to have access to PSB services via traditional TV networks	Negative, in some cases viewers may lose access to PSB services via traditional TV networks before OTT substitution is viable	Neutral compared to option 1: No impact on PSBs (neither small or large) or on the variety of content offered to (i.e. choice for) end-uses. The abundance of online content could make it more difficult for some smaller PSBs to build a significant audience
Larger and multi-national commercial content providers	Neutral – market entry might continue to focus on the OTT area which has less regulatory constraints	Positive - market entry could include traditional TV networks to the extent that transmission capacity becomes available subsequent to discontinuation of must carry obligations	Neutral. No change in the possibilities to make content available compared to status quo as OTT providers already include PSB content.
PSBs, including at regional and local level	Positive, existing privileges would remain in place	Negative, appropriate transmission on traditional TV networks would have to be negotiated under market conditions.	Negative as concepts for proportionate and appropriate intervention in the OTT area do not currently exist. Positive effects are possible in the long terms, if such intervention can finally be successfully conceived.
ECNs	Neutral/positive – existing regulatory burdens and constraints would remain, but with a perspective that they will be removed gradually over time subsequent to national reviews of obligations.	Strongly positive - existing regulatory burdens and constraints would disappear by 2020-2025	Neutral – no change of existing burdens and constraints
OTT service providers which are not themselves content providers	Neutral – existing obligations do not relate to OTTs	Neutral – existing obligations do not relate to OTTs	Negative as concepts for proportionate and appropriate intervention in the OTT area do not currently exist.

6.12.1.6 Numbering options

Table 43 - Summary stakeholder impacts – Numbers.

	Option 1: Status quo	Option 2:	Option 3:
Consumers	A) Higher prices for Iot services	A) same as option 1	A) Lower prices
IoT users (Industry 4.0)	B) Higher prices for Iot services C) Potential barriers for cross border use of applications D) Potential barrier for full integration into the IoT	B) same as option 1 C) same as option 1 D) same as option 1	D) Lower prices E) Less risk F) Less barriers
IoT service providers (including SMEs)	E) Potential lock-in with connectivity providers, leading to high prices and lower quality F) potential bottlenecks in delivering reliable always and everywhere connected services (domestic and cross border) G) Less room for innovations of IoT services	E) same as option 1 F) same as option 1 G) same as option 1	E) Less risk F) Less bottlenecks G) More room for innovations
Telco's	H) High prices and profits I) growing administrative costs related to extra-territorial use of numbers	H) same as option 1 I) same as option 1	H) lower prices, less profits I) Lower administrative costs
NRAs	J) growing administrative costs related to facilitating the extra-territorial use of numbers	J) same as option 1	J) Lower administrative costs

6.12.1.7 Governance

Table 44 - Costs of institutional options per stakeholder

	Baseline (option 1)	Preferred options access and spectrum (option 3) and services (option 4)		
Bodies	**Status quo (option 1)**	**Enhanced advisory role (option 2)**	**Advisory role + some normative powers (option 3)**	**EU regulator with implementation/enforcement powers (option 4)**
Commission	→	↑ (EU technical guidelines)	↑ Spectrum peer review	↑ Spectrum peer review
BEREC Agency	→	↑ (Additional advisory requirements + compliance with Common approach)	↑↑ (Enhanced technical guidance role + compliance with Common approach	↑↑↑ (substantial additional resourcing required)
NRAs	→	↑↑ (effective resourcing, additional advisory contribution to BEREC, mapping) ↓↓ Fewer market analyses, standardised specifications	↑↑ (effective resourcing, additional contribution to BEREC, mapping) ↓↓ Fewer market analyses, standardised specifications	↑ (additional contribution to BEREC) ↓↓ Fewer market analyses, some enforcement powers to EU
Spectrum authorities	→	↑ Increased contribution to RSPG	↑ Increased contribution to RSPG ↓ Greater EU guidance	↑ Increased contribution to RSPG ↓ ↓ Some enforcement powers to EU

A more analytical estimation of the costs is presented in SMART 2015/0005.

Table 45 – Summary of governance costs by option

	Option 1		Option 2		Option 3		Option 4	
Body	Status quo	Assumptions	Enhanced advisory role	Assumptions2	Synergy + some normative powers	Assumptions3	Synergy + some normative and supervision powers	Assumptions4
Commission	€ 7.328.400	60FTE @€118,640pa (blended rate) + €210,000 missions	€ 7.921.600	Status quo + 5FTE to reflect additional implementation duties	€ 7.921.600	Status quo + 5FTE for spectrum article 7 process	€ 7.921.600	As option 3
BEREC Agency	€ 4.061.000	28FTE €137,714pa (= blended rate of €107,714 + additional est €30,000 pp overheads to reflect small scale) + €205,000 missions	€ 5.713.571	40FTE as opposed to 28FTE, assumptions as before	€ 8.467.857	60FTE as opposed to 28FTE, assumptions as before	€ 31.000.000	EBA cost
NRAs (excl spectrum)	€ 107.309.530	41FTE per NRA, blended cost for FTE €66,768pa, 40% mark-up for overheads	€ 103.103.146	Status quo + 5*10FTE for under-resourced NRAs + 10FTE for extra BEREC contribution. Cost savings on extended market review periods (est 15%). Cost increase associated with mapping assumed balanced by cost reductions through standardisation + reduced regulatory burden	€ 104.037.898	As option 2, but with additional contribution to BEREC.	€ 90.951.370	As option 3 but with reduction of 5FTE per NRA due to greater EU level rule-making and supervision
(of which BEREC contribution excl spectrum)	€ 4.580.285	49FTE based on BEREC estimate	€ 5.515.037	status quo +10FTE reflecting four additional guidance requirements per year	€ 6.449.789	Status quo + 20FTE reflecting additional contributions to draft Implementing guidelines	€ 6.449.789	As option 3
RSPG support/office	€ 556.600	Based on 2.5 Cion FTE + €260,000 expenses	€ 556.600	Status quo	€ 556.600	Status quo	€ 0	Spectrum activities incorporated within BEREC
SMA	€ 83.753.779	32FTE per SMA blended cost €66,768pa, 40% mark-up	€ 83.886.802	Status quo + increased RSPG contribution (see below)	€ 81.269.496	Option 2 with saving of 1 FTE per SMA due to more standardised auction format	€ 73.417.579	As option 3 but with further reduction of 3FTE per SMA due to greater EU level rule-making and supervision (SMA in NRA)
(of which contribution to RSPG)	€ 266.045	Based on 14 WG mtgs per year, 10 participants and 5 days prep	€ 399.067	Status quo +50% to reflect increased advisory requirements	€ 399.067	As option 2	€ 399.067	As option 2
Total costs with synergies (best case)	€ 203.009.309		€ 201.181.719		€ 202.253.451		€ 203.290.549	
Total costs (EU co-ordination)	€ 16.792.330		€ 20.105.875		€ 23.794.913		€ 45.770.456	
Co-ordination as % total cost	8%		10%		12%		23%	
Total costs (no synergies)	€ 203.009.309		€ 210.996.615		€ 214.685.652		€ 234.043.890	
Total costs (average)	€ 203.009.309		€ 206.089.167		€ 208.469.552		€ 218.667.219	

6.13 ANNEX 13 - Report from the Expert Group meeting

On 30 May 2016, WIK-Consult GmbH, Ecorys Brussels N.V. and VVA Europe organised a high-level academic expert panel to support the Commission in the preparation of the Impact Assessment for the Review of the electronic communications framework.

The purpose of the expert panel was to provide feedback on the provisional conclusions reached by the consultants concerning the impact of planned changes to the e-communications framework. Prior to the meeting, the experts were provided with a programme for discussion, slide presentation and draft 'overview' of the consultant's research findings.

This Annex presents details on participating experts, the agenda of the day with points for discussion, and the report as reviewed by the members of the expert group.

PARTICIPATING EXPERTS:

The members of the academic panel were selected in consultation with the Commission by virtue of their in-depth experience in issues relevant to the electronic communications sector, innovation and governance.

Joan Calzada is Associate Professor at the Department of Political Economy, Universitat de Barcelona, with expertise in theoretical and empirical industrial organization. His main research interests are the economic regulation of network industries, especially telecommunications, transportation, and water.

Brett Frischmann is Professor and co-Director of the Intellectual Property and Information Law program at Cardozo Law School in New York City. His expertise lies in intellectual property and Internet law, and in particular the relationships between infrastructural resources, property rights, commons, and spillovers. Professor Frischmann is a prolific author, whose articles have appeared in numerous leading academic journals. He has published important books, including the award winning 'Infrastructure: The Social Value of Shared Resources' (Oxford University Press, 2012).

Frederic Jenny is Professor of Economics at ESSEC Business School in Paris and a Chairman of the OECD Competition Committee. He has written extensively about trade, competition and economic development and his research areas concern the relationship between structure and performance in European countries and antitrust legislation in Europe.

Eli Noam is Professor of Economics and Finance at the Columbia Business School. His research focuses on strategy, management, and policy issues in telecommunications, computing, and electronic mass media. Noam has written numerous articles and books on subjects such as communications, information, public choice, public finance, and general regulation.

Dr **Brigitte Preissl** is Head of Knowledge Transfer in Economics at the German National Library of Economics in Hamburg. She has an extensive research record in the regulation of telecommunication markets, the economics of service innovation and national research systems.

Luc Soete is Professor of International Economic Relations at the School of Business and Economics, Maastricht University. His research covers a broad multi-disciplinary field which focuses on the nature, origin and determinants of innovation. Soete's publications include topics on governance and institutions, ICT-enabled innovation as well as societal transformation.

Reza Tadayoni is Associate Professor at the Faculty of Engineering and Science, Aalborg University. His research field is media convergence. He has been contributed to a number of consultancy reports and studies for the Danish telecom and broadcast administration, EU and the World Bank. He has been actively involved in European COST networks, including COST A20 on `The impact of the Internet on the mass media in Europe' and COST A16 on `ICT and transnational communities'.

Professor **William Webb** is a Director at Webb Search Consulting and an expert on wireless technology and regulatory matters. As a former director of Ofcom, he performed a research across all areas of Ofcom's regulatory remit and led major reviews conducted by Ofcom including the Spectrum Framework Review, the development of Spectrum Usage Rights and most recently cognitive or white space policy.

The expert panel was introduced by Anthony Whelan, Director for Electronic Communications at the EC, DG Connect, and Chaired by Dr Iris Henseler-Unger, Managing Director of WIK. Each subject was briefly introduced by a member of the study team on the basis of the circulated slides. Pertinent questions were raised by the Chair, and the remainder of the session was devoted to comments from experts.

AGENDA: EXPERT PANEL
IMPACT ASSESSMENT FOR THE REVIEW OF THE FRAMEWORK FOR ELECTRONIC COMMUNICATIONS

30 May 2016

Berlaymont, Room 07/062, Rondpoint Schumann, Brussels

The EC is currently undertaking a review of the legislative framework applying to electronic communications. The impact of the review could be significant. Electronic communications is a strategic sector which directly constitutes €168.62bln of European value added and 1.06 million jobs (around 1.3% GDP and 0.47% of total employment in 2012), with a labour productivity per person of more than 144 thousand euros (the highest rate within the ICT sector)[1]. The sector supports a wide range of other high-tech manufacturing and digital services (the ICT sector constitutes 4% GDP and 2.76% of EU jobs, with a labour productivity rate 44.45% higher than total labour productivity) as well as the economy as a whole.

The review comes at a crucial time for the digital economy. Consumer and business demand for bandwidth continues to expand, driven by the growth of connected devices, digital content services and cloud computing, as well as connected ‚things', we are mid-way through an important cycle of investment in fixed infrastructure with the prospect of 5G to come, and business models in the telecom sector are changing to adapt to a con-verged, data-driven environment.

These developments highlight a new **ambition for ubiquitous and Very High Capacity connectivity.** At the same time, they have revealed shortcomings in the framework, highlighting the need for the Framework to be adapted to meet market and technological change in order to protect **consumer interests and enable competition to flourish across the single market.** Finally the review provides an opportunity to **achieve efficiencies** and see whether the complex processes and institutional framework in place today can be streamlined to reduce costs and bureaucracy.

In order to ensure that the changes to the framework are fit-for-purpose, in according the Better Regulation Guidelines, the Commission is conducting an Impact Assessment to gauge the economic, social and environmental effects of different options and assess how effective and efficient they would be in achieving the objectives we have identified above. The Commission has engaged WIK-Consult, Ecorys and VVA Europe to support them in this exercise. **The purpose of the expert panel is to provide feedback on the provisional conclusions reached by**

the consultants concerning the impact of planned changes to the e-communications framework. Details of the programme are shown overleaf.

Programme

Participants

Experts:	Prof. Joan Calzada, Dr. Frédéric Jenny, Prof. Brigitte Preissl Prof. Luc Soete Prof. Reza Tadayoni Prof. William Webb, Prof. Brett Frischmann, Prof. Eli Noam
Commission	Anthony Whelan, Reinald Krueger, Vesa Terava
Consultants	Dr Iris Henseler-Unger, Ilsa Godlovitch (WIK), Nicolai van Gorp (Ecorys), Pierre Hausemer (VVA), Iglika Vassileva (Ecorys), Tseveen Gantumur (WIK)

Format	**Roundtable.** The session is introduced by Anthony Whelan, Director for Electronic Communications at the EC, DG Connect, and Chaired by Dr Iris Henseler-Unger, Managing Director of WIK. Each subject is briefly introduced by a member of the study team on the basis of the circulated slides. Pertinent questions are raised by the Chair, and the remainder of the session is devoted to comments from experts.
Record	**Minutes** will be taken of the panel proceedings and circulated following the workshop for comment and approval. The approved workshop minutes will be annexed to the final report under preparation by WIK, Ecorys and VVA.

09.30-10.00 Morning Coffee

10.00-10.30 Introduction and problem definition

Anthony Whelan EC

The context for the review
Identifying the core problems:
- Gaps in high speed broadband deployment
- Delays in LTE roll-out, perspective for 5G
- The impact of market and technological developments
- Redundant regulation

What should we seek to achieve?

10.30-12.40 Achieving ubiquitous high speed connectivity

Introduction by study team, debate

Approaches to access regulation to foster high speed broadband in urban and rural areas

Approaches to spectrum policy to accelerate deployment

12.40-13.40 Lunch

13.40-14.40 Protecting consumers and promoting competition and innovation in the single market

Introduction by study team, debate

Approaches to services policy

Need to adapt the concept of 'electronic communications services'?

Relevance of the use of public resources (e.g. numbering resources) for sector-specific rights and obligations?

Which rules should apply to which communications services?

The role of universal service in securing access to connectivity

14.40-15.00 Break

15.00-16.00 Implications for institutional governance, jobs and growth

Introduction by study team, debate

Implications for institutional balance, role of NRAs, EC, BEREC and RSPG

How will achieving the objectives impact jobs and growth?

16.00-16.20 Concluding remarks and next steps

Anthony Whelan, EC

Draft report

The report included below needs approval by the expert group, which will be granted by the end of June 2016.

Access

The connectivity imperative is not an immediate short term problem (except in rural areas)…

The experts agreed concerning the need to foster better infrastructure in rural areas, where a potential digital divide still looms. There was some discussion over what the review of the framework should aim towards as regards objectives for connectivity overall and whether or not there should be an emphasis on very high speeds potentially delivered via fibre connections. One view was expressed that FTTH may not be necessary to fulfil many of today's domestic needs; even when considering multiscreen 4K TV content, copper is also able to realise sufficient speeds. Moreover, the maximum capacity of In-house Wi-Fi may act as a bottleneck, limiting the effectiveness of Very High speed Connectivity (VHC) unless this additional performance barrier is addressed. It follows that, from a short term perspective, the added value of VHC may not be so high in the eyes of consumers and this gives rise to uncertainty as to whether they would be willing to pay more for it. The impact of different technological solutions on cost and price should also be analysed.

…but it is a problem in a forward looking perspective and the Framework should be forward looking and supportive of innovation.

It was agreed that this short term perspective should be taken into consideration. However, some experts noted that the Framework should have a more forward looking perspective. Market demand for VHC may not be there today, but you still might want to have infrastructures in place so that the market can evolve. In this sense, one could say there are market failures related to connectivity in the form of externalities and spill overs (innovations) that are not incorporated in the current willingness to pay by consumers. As such, VHC is a legitimate objective in a forward looking perspective but probably it will not be feasible to roll out FTTH re all the way up to the homes across the entire Union by 2025; e.g. in some areas it may already suffice to roll out fibre to the lamppost (in order to operationalise 5G). However, when considering Europe's global competitiveness vis-à-vis other parts of the world, we may want to set even higher targets as it may not be enough to 'catch up' but rather to aim to 'leapfrog'.

Solutions might not always be regulatory and may have to involve public support

The experts noted the need to be clear about what were the market failures involved in the new context and highlighted that there may also be other market failures involved than market power, such as innovation externalities, resulting in social demand for infrastructure not being reflected in current private demand. It follows that regulatory tools to promote competition may not be sufficient and that public investments (eg by municipalities or via state aid) may be needed to complement regulatory tools. Other solutions discussed included as initiatives for aggregating local demand (as in Sweden) and/or to enable the cost of the (network) connection to be defrayed over a longer period than the current contract duration (24 month) while maintaining the current rules for contract duration for service contractst

Mapping is considered an important initiative. the role of sunk costs in different areas can be considered a market failure

The experts indicated that the impact assessment should clearly specify where infrastructure competition alone does not work to stimulate connectivity and choice, and where accordingly additional solutions are needed. One important market failure is the presence of sunk costs giving rise to economies of scale and market power. Regions differ in the scalability of investments and this problem may be more pressing in white areas than in black areas. However, black areas may experience other sources of market failure. Mapping is therefore important to clearly describe the size of these problems: what is the magnitude of white areas? What are the potential problems in black areas? What are options to improve existing infrastructure? What is the interaction between electronic communication framework and state aid framework in these different settings?

The trade-off between harmonization/standardisation and regulatory/commercial innovation should be considered

With respect to the proposal to standardize of wholesale products for business communications, one of the experts questioned whether product innovation may be negatively impacted as a result of harmonization of specifications. However, it was noted that the wholesale products such as bitstream were often the result of regulatory intervention from the NRA to mandate access, and therefore such products may be less likely to be subject to commercial innovation.

On the other hand, one of the experts noted that market failures may result from a lack of harmonization. An analogy was made that once national networks have formed (e.g. in the banking sector) which largely serve national demand, none of them will spontaneously embrace pan-EU network solutions that serve transnational demand but that may have some short-term costs. This argumentation would call for more harmonization and the consideration of options which are more radical such as moving to EU regulators.

Spectrum

Agreement on the preferred option

There was broad agreement among the experts that the spectrum analysis indeed shows that the preferred option would constitute a significant improvement over the status quo.

Need a definition of 5G

Several comments were made for the research team to consider in the final report. First of all, the experts agreed that the successful, fast and joint deployment of 5G is the key opportunity to be seized and the key challenge for spectrum policy to tackle. While it is not yet clear precisely what 5G actually entails, the experts suggested that an attempt should be made in the report to define what is meant by 5G and to identify its key components (i.e. securing pioneer 5G bands) that will generate the impacts that are described in the impact assessment. Not all aspects of 5G technology will materialize at the same time: some aspects such as e.g. mmWave technology are currently still very much "research projects" that are likely to generate impact only in the longer term. At the same time, other aspects, such as enhanced mobile broadband are likely to be available much earlier.

Facilitating scaling up is one of the key impacts to consider

Second, the experts agreed with the research team that the analysis should clearly highlight how scale (and the speed of scaling up) is becoming an ever more important imperative for economic operators, especially in network industries. The experts pointed out that a true digital single market across the EU, for which spectrum is an important input, is a key element to facilitate such scaling up in Europe, experts mentioned 862-870MHz that is particularly suitable for IoT applications. It is such scale economies that lead investors (e.g. device manufacturers) to consider Europe as a significant player on the global stage, in comparison with other large markets such as the US or China. For instance, device manufacturers need to consider which spectrum bands their technology should be able to operate in. For Europe to ensure that it drives such decisions, it needs to present itself as a single market that is as economically attractive as other major markets.

Distinguish between market structuring and policy aspects of assignments

Third, the panel discussed the difference between market structuring and public policy elements of spectrum assignments which should be acknowledged in the report. Market structuring elements include e.g. license duration, spectrum caps and other such elements. Public policy aspects refer to issues such as coverage obligations. It was noted that EU level intervention is likely to be most valuable in the coordination of market structuring aspects, and in higher level framing of overall policy objectives.

Option 3 should be a stepping stone to a future more ambitious move toward a more consistent management of spectrum and possibly an EU regulator

Lastly, it was generally acknowledged that the preferred option would make a significant difference in terms of coordinating spectrum assignments in Europe. For the experts, the more far reaching Option 4 (an EU regulator) which is likely to lead to the biggest economic gains, is at the same time possibly less agile and efficient in adapting to local constraints and likely to meet opposition from Member States . A suggestion was made that the impact assessment should be used to show the cost of such opposition by Member States (i.e. the difference in

impact between Option 4 and Option 3). There was consensus that Option 3 could eventually be seen as a stepping stone to a future gradual move towards a sustainable and more consistent management of spectrum in the EU, and possibly to the creation of an EU regulator.

Services

Is numbering a practical distinguishing feature?

It was noted that the description of the preferred option should more clearly specify that the reference to "numbers" means E.164 numbers and no other numbering resources such as IPV6 addresses. Furthermore, it may need to be further analysed whether making use of numbering resources is a relevant distinguishing feature for applying sectorial obligations to services and whether this distinction is practically applicable, although they did not elaborate on this point.

Regulatory heterogeneity is not a bad thing per se

Some experts noted that the analysis on regulatory heterogeneity and on the impacts from harmonisation focuses on the gains of harmonisation but not so much on the possible costs for consumers. They agreed that regulatory heterogeneity with regards to consumer protection leads to duplication costs, but questioned whether there are benefits to regulatory heterogeneity if consumer preferences differ. At the same time they agreed that certainty will be needed for the development of the M2M market. They agreed on the need to be transparent about the pros and cons of harmonisation.

What exactly do the measures with regards to bundles entail?

Questions were raised as to what exactly the option with regards to bundles entailed. There were some doubts about the effectiveness and practicality of offering consumers the ability to buy services separately. The issue is rather about the need to be clear on which rules apply to what services when a bundle contains services that fall within the scope of the regulatory framework and services that do not. Once this is solved one should look at how services should be provided and what protections are needed. Consequently there is a need for some reasoning as to how sector specific rules apply to the bundle.

While consumers may clearly benefit from bundling, there are also risks involved

Some experts recognised that bundling may create transparency problems as consumers may find it more difficult to compare bundles to stand-alone products. They noted that it is not always clear what is in the fine print and, in the end, a consumer may have chosen a product in which he/she is actually not better off and it is not clear what the costs of getting out of the bundle are. Another potential concern, due to the popularity of bundles among end-users, was that some operators may be hindered in replicating bundles because they do not have access to relevant wholesale products (e.g. in Spain some operators have trouble getting wholesale access to mobile). However, other experts stressed that bundles may have positive attributes, not least to promote competition, and are no longer considered negative for consumers. Consumers also gain from bundles in the form of reduced transaction cost and a reduction of occasions at which a choice has to be made (consumers don't like to make choices). Thus there is a need to go case by case rather than taking a single approach on this area and improve transparency through comparison tools.

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The RF may not be the right framework for dealing with privacy and security issues

One expert noted that the basis for extending privacy and security obligations to a wider set of communication services is not strong if it is only based on the observation that one third of respondents to a survey find it an issue (referring to a survey held in the context of SMART 2013/0019). Another expert recognised that privacy and security issues are important in relation to communication services (notably IoT services), but argued that the problem also applies to other types of OTTs and not just to OTTs providing communications services. He suggested that in the future IPv6 addresses will replace E.164 numbers and that privacy and security issues should be dealt with under horizontal rules.

Universal service

Flexibility of regulation at the national level

While acknowledging the benefits of allowing Member States flexibility, experts were interested to understand how a universal service (US) obligation for basic broadband would be defined if included, e.g. who determines what is the minimum

bandwidth that should be guaranteed. They also inquired about the appropriateness of including mobile connection in the options in this day and age where mobile technologies are becoming much more important. It was explained that there is minimum harmonisation at the EU level so that Member states have options to define their understanding of US pursuant to the national circumstances (e.g. with regards to a minimum required bandwidth) and that mobile technologies are currently included as a technology that can potentially be used to realise broadband services at a fixed location. However, nomadic services as such are not currently included as a US.

Underline the distinction between the measures for affordability and availability of broadband

Experts noted that the problem analysis could make a clearer distinction between affordability and availability. While the preferred option aims at *affordability* (e.g. ensuring affordable prices for all end users, in particular for the most vulnerable), it was argued that *availability* is the real issue to be considered by the RF in general, including possibly by US. Affordability can be realized through social income related policies or subsidies. It was explained that under the preferred option broadband availability would be further promoted through other instruments (such as regulation, state aid or spectrum policy).

Differences between Member States may create complexity, but not necessarily create uncertainty

The analysis refers to "uncertainty" resulting from the fact that Member States have their own approach to assessing costs and unfair burden. It was questioned whether this causes "uncertainty", or just "complexity"? It was explained that differences between Member States in the calculation of net cost and the notion of unfair burden makes it not always clear to operators entering the market what will be the net cost of US provision, whether it will be considered an unfair burden and whether they get any compensation, which may result in an uncertain market entry.

Governance

Centralisation is important for scaling up and spillovers to be generated

On the topic of governance, the expert panel reaffirmed some of the policy specific elements discussed on access, spectrum and services. There was agreement that localised governance may prevent cross-border markets from emerging. If this is the case, then it significantly strengthens the case for co-ordination at EU level

Administrative costs related to a particular set-up might not be easily reduced

Second, the experts pointed out that in estimating the costs of governance reform, it should be borne in mind that institutional costs are sticky and that any savings from reform (e.g. administrative costs) might take a long time to materialize. One expert observed that institutions often end up maintaining the problem they were created to solve.

Subsidiarity needs to be considered in light of the benefits of greater coordination

Third, one panel member challenged the team to consider subsidiarity in a different light (finding the most appropriate geographic level of intervention rather than one that necessarily places responsibility at the most local level). He posited that, in the context of a digital single market, there is a need to justify why a centralized, coordinated model of governance for electronic communications is not the right way forward. The European Research Cooperation (ERC) is an example where centralisation of the allocation of research grants has resulted in a much more efficient allocation of national research funds across EU researchers and also a more effective search for talent, since there are strong arguments for a larger scale when trying to identify high level expertise. It is a prime example of how the subsidiarity arguments (scale economies and spill-overs) are at play and where centralisation leads to more efficient outcomes. A similar centralized model of governance could be beneficial in the case of e.g. spectrum.

The institutional set up needs to be open to innovation

Finally, one panel member suggested that it is important to understand how the governance model facilitates (rather than acts as a block to) innovation. How can innovation (technological or regulatory) be introduced under a new institutional set-up, what are the key steps for new ideas to be introduced,

for their merits to be considered, for them to be decided and then implemented and how open is this process. For example one of the benefits the preferred spectrum option is that it is open to this idea discovery process but puts in fewer blocking factors than other options.

Macroeconomic modelling

The analysis reflects existing production functions but not disruptive changes of production processes

The existing CGE analysis is a welcomed and well developed addition given the necessity to estimate future impact scenarios in a strongly quantitative way. But there are some limitations derived from the deterministic inclination of these models that should be noted.

The model is based on current productivity parameters, while structural changes might be expected as a result of the implementation of the preferred policy options together with a variety of factors. It should be noted that, ideally, the impacts should be analysed from a dynamic perspective, estimating the impact of changes in productivity as a result of both infrastructural and socio-economic factors, including organizational changes. This would require, among other things, that the analysis does not focus only on the horizontal comparison of industries, but also on the specifics of the production process throughout value chains and at the firm level. It is really important to understand how processes of production will change if policy strategies are to be rightly implemented.

Impacts may materialize with a lag

The analysis should account for the fact that it takes time to adopt changes, implement them and, finally, for them to have impact on the production process. Moreover, the analysis should recognize limits in the absorptive capacity of firms. Not all firms are instantly ready to jump to another production function. This has nothing to do with regulation, but with the potential to harvest the benefits of digitalization by industries. Such potential follows from the strategies that different industries and organizations might adopt e.g. regarding cloud computing. The consultants confirmed that such lags have been accounted for in the model.

CGE modelling is limited in assessing the impact on comparative advantages vis-à-vis the ROW

The CGE model seems to assume that the European economy is operating independently of what happens in the rest of the world. While the current policy options take the broadband situation in the most innovative economies as a benchmark, we have to go beyond that and have a vision to be more innovative than others. For example, the model suggests that exports growth will exceed that of imports. If you want to keep comparative advantage or achieve it, then you have to go beyond the benchmark of access policy, spectrum policy and service policy. It was recognized that this is a general but accepted shortcoming of CGE modelling.

Regional models: potentially very promising but not achievable under the current IA

It would be interesting to see a disaggregated model at regional level, similar to the RHOMOLO model for example. Such models allow for analysing what would happen on the ground in different industrial hubs around Europe. It is recognised that such models are indeed very interesting but also require an extensive amount of resources and development time when done properly.

Materializing of impacts depends on complementary policies in the area of innovation and digital services

Finally, the experts note that the Regulatory Framework alone would not be enough to realise the preferred outcomes in terms of competitiveness of the EU economy. Infrastructure policies should be complemented with innovation policies and policy of digital services (in broader sense than just communication services). All these different policy fields should go together.

6.14 ANNEX 14 – The state of play and the EU dimension of connectivity

This annex integrates the problem definition section by describing in more detail (i) the obstacles to unconstrained connectivity identified in section 1.2.1, (ii) the EU dimension of the problem and (iii) including more elements of the baseline, to complement the ones included in section 1.5.

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6.14.1 Costing the gap and the financial endowment of current initiatives

Some studies have tried to estimate the NGA broadband gap in Europe and to provide estimates about the cost to fill it. The best known of these studies is probably the one performed by the European Investment Bank in 2011. The study considers four scenarios for broadband deployment in Europe. The most **ambitious scenario foresees FTTH/B** roll-out throughout Europe and the gap was estimated at €221 billion[450]. The same scenario of 100% FTTH/B coverage was analysed by Analysis Mason in a study for DG CONNECT in 2012[451]. The amount foreseen is similar (€250 billion, for deployment of FTTP-only, across Europe). The amount is reduced to €154 billion in case of high duct re-use. Analysis Mason also estimated the costs associated to a 100% FTTC deployment which are in the area of €50 billion. In case of high duct re-use, the cost would go down to €31 billion.

An internal estimate on the basis of the Analysis Mason study was also carried out by DG CONNECT in 2014 according to which Europe needed an additional EUR 34 billion in investment to reach the target of 100% coverage at 30 Mbps, and an additional EUR 92 billion to credibly enable reaching the 50% take-up target at 100 Mbps[452]. These figures are already taking account of the amount that the private sector could be expected to invest[453]. and would leave part of the network unfit to serve a Gigabit society if substantial copper-based parts of the networks were to be durably maintained thereafter.

The **financial resources available** at the European level are certainly not sufficient to meet the challenge presented above. The allocation of **European Structural and Investment Funds** for high speed broadband networks experienced a sharp increase from EUR 2.7 billion in 2007-2013 to around EUR 6.4 billion for 2014-2020 (about EUR 5 billion ERDF and an estimated EUR 1.4 billion EAFRD)[454]. However, most of this investment is expected to be made in the form of grants rather than financial instruments so the leverage effect on public (national and/or regional co-funding) and private co-funding will not reach more than EUR 9-10 billion – falling far short from the needs to reach the EU targets for broadband coverage and take-up.

The **Connecting Europe Facility** (CEF) in the digital area is endowed with a limited budget of EUR 1 billion for the period 2014-2020 after the severe cuts it suffered in the Multiannual Financial Framework (MFF) negotiations from a proposed EUR 9.2 billion. EUR 150 million are allocated to broadband infrastructure, based on the provision of financial instruments via the

[450] http://www.eib.europa.eu/attachments/efs/eibpapers/eibpapers_2011_v16_n02_en.pdf
[451] Analysis Mason, The socio-economic impact of bandwidth (2013).
[452] Based on a 75% coverage assumption.
[453] According to the Digital Agenda Scoreboard, telecom (including fixed, integrated and mobile-only) CAPEX in Europe was € 43 bn in 2013. CAPEX figures remained relatively stable over the 2011-2014 years despite the fact that in the same period NGA coverage increased from 29% to 68%. In 2014, Mobile CAPEX spending represented 59% of total spending. However, this CAPEX is not only directed at modernising the network so that it is difficult to say how much private operators will invest in increasing coverage in the coming years.
[454] An estimate as the Commission cannot differentiate between allocations foreseen in EAFRD for ICT and Broadband as this type of information is not requested by the regulation. However, additional information is requested and will be provided in the context of monitoring activities (in particular, monitoring will be done for "N° of operations", "Population benefiting from new or improved IT infrastructure" differentiating here between "Broadband" and "Other than broadband").

European Investment Bank (EIB). The broadband part of CEF is expected to mobilise around EUR 1 billion[455].

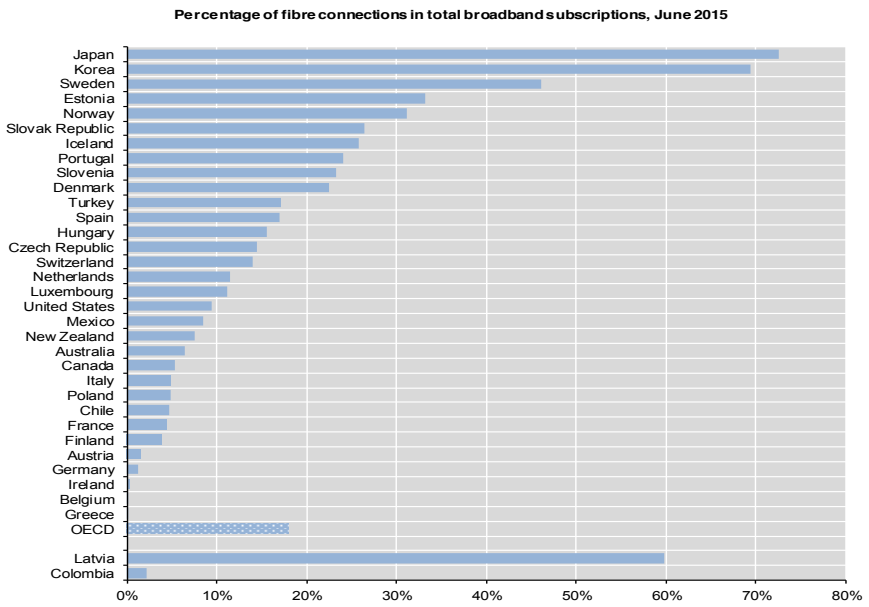
Finally, the European Fund for Strategic Investment (EFSI) does not have sectorial earmarking hence it is difficult to anticipate how much budget will be allocated to broadband infrastrcuture.

6.14.2 International comparisons

Affordable Gigabit connectivity has already been available as a consumer service in Japan,[456] Singapore and Korea for some years, while in 2014 Korea's SK Telecom announced trials of 10Gbit/s.[457] In Korea, the National Broadband Plan (Ultra Broadband Convergence Network[458]), already launched a 1 Gbps target in 2010.

Gigabit connectivity is also available to households and small businesses in US cities served by Google Fibre,[459] and recent reports suggest that AT&T is responding to the competitive challenge with more widespread urban Gigabit deployments of its own.[460] However, it is certainly not the case that all European countries are falling behind in a Gigabit society. As shown in the analysis carried out in SMART 2015/0002, Sweden or Estonia already today compare well with Japan on a range of NGA metrics (although Swedish fixed rural coverage remains relatively limited).

Figure 81 - % of FTTB connections on total subscriptions (OECD)



Several other EU countries, including Portugal, Spain, France, Romania and other MS, which benefit from an expanding FTTH/B footprint, albeit at different pace of deployment, may become

[455] Under the pilot phase of the Europe 2020 Project Bond Initiative, the EIB and the Commission closed in July 2014 the first deal on a broadband project bond (in France – Axione is the beneficiary). The leverage factor foreseen for the broadband part of CEF is around 7x, so it is expected to mobilise around EUR 1 billion. This leverage was exceeded by the Axione deal which had a leverage factor of 14x.

[456] KDDI launches GBit/s service 2008 http://www.japantoday.com/category/technology/view/kddi-to-launch-1gbps-fiber-optic-service-in-oct

[457] SK Telecom showcases 10Gbit/s service http://www.businesskorea.co.kr/english/news/ict/6789-100x-faster-internet-sk-broadband-offer-10-gbps-internet

[458] See: http://www.unescap.org/sites/default/files/4.1%20Korean%20Broadband%20Policies%20and%20Recommendations.pdf

[459] https://fiber.google.com/cities/kansascity/plans/

[460] See for example http://www.latinpost.com/articles/101338/20151210/google-fiber-vs-att-gigapower-likely-to-win-gigabit-race-thanks-to-google.htm

Europe's leading countries for VHC connectivity in the years to come[461]. However, large European countries which have so far been experiencing limited or incremental NGA deployment may lag behind European and global leaders on VHC broadband. illustrates the state of transition from copper to fibre, which is much more advanced in other large economies than in several large EU countries[462]. Although the picture does not take into account the effect of cable subscriptions, it gives an idea of the different pace of this transition. Furthermore, rural NGA coverage has been increasing slowly in several countries such as Germany, France, Italy, Austria and Finland, raising the risk of a growing urban/rural digital divide as can be seen in .

Figure 82 – Next generation access (FTTP, VDSL and Docsis 3.0 cable) coverage, June 2015

Source: *IHS and VVA* - Digital Scoreboard – Connectivity section[463]

Challenges to the regulatory framework[464]

The evaluation has confirmed that the access-related provisions of the EU Framework have delivered in most Member States competition and market entry at least in standard broadband and other copper-based telecom services, resulting in greater choice and value for consumers, as also confirmed by the consultation[465]. The market shares of incumbents have fallen steadily on average across the EU reaching 41% of total subscriptions by July 2015 and average prices for broadband services in the EU have been historically low in comparison with international benchmarks such as the US or Canada for low data consumptions patterns.[466]

Access of all citizens and businesses to high-quality networks at affordable price has become a prerequisite for Europe to reap the full benefits of the emerging digital economy. The existing framework was not primarily designed for, and could have not foreseen, the scale of the need to ensure the widespread availability of modern infrastructure (in rural as well as urban areas), to enable access to emerging applications and services - and to ensure that competition is fostered in an environment of technological change.

[461] See SMART 2015/0005 and SMART 2015/0002

[462] Fibre subscriptions data includes FTTH, FTTP and FTTB and excludes FTTC. Some countries may have fibre but have not reported figures so they are not included in the chart.

[463] Source: : https://ec.europa.eu/digital-single-market/en/download-scoreboard-reports

[464] For further discussion regarding the contribution of the regulatory framework to network investment and service take up, please refer to the Evaluation of the regulatory framework for electronic communications SWD, in particular to the sections concerning the effectiveness of access regulation and spectrum regulation.

[465] 86% of respondents to the Commission's consultation felt that the EU framework (and the access-related provisions specifically) have contributed either moderately or significantly to achieving the objective of competition. Consultation Q4b, Q19a

[466] Source: Mobile Broadband prices (February 2015) https://ec.europa.eu/digital-single-market/en/news/mobile-broadband-prices-february-2015. This study was carried out for the European Commission by Van Dijk.

6.14.3 Towards a connectivity objective

The need for **Very High Capacity networks** stems by the analysis of the likely connectivity needs over the next ten years based on the current trends and comparing them with performance enhancements required from telecoms networks to meet these needs. While expressing an ambition for the future – especially in the fast changing and transformative digital sector – cannot be fully evidence based, the trends described below, as well as findings of the public consultation on "*needs for Internet speed and quality beyond 2020*", strongly support the conclusion that Europe needs unconstrained VHC connectivity for all. This growth will be underpinned by technological evolution (a comprehensive overview of the means and technological choices available for network deployment and their implication in terms of performance can be found in Annex 6.3., SMART 2015/0005 and SMART 2015/0002).

The evaluation clearly shows how regulatory choices under the framework can affect the connectivity outcome (section 7.2.3.). Moreover, work conducted for the Commission[467] in support of the evaluation and review of the framework illustrates the impact that national regulatory choices can have on the deployment and upgrade of higher performance networks. The study presents how Spain, France and Portugal's NRAs have focused on stimulating entrants to '**climb the ladder'** to FTTH through a focus on duct access and in-building wiring in the absence of downstream remedies as well as by promoting co-investment models. These countries have seen developments in FTTH **infrastructure competition**, but these are largely limited to very dense areas. Market structures in these countries have tended to consolidate towards fewer fixed mobile integrated players. FTTH coverage has grown strongly in **Spain and Portugal, but more hesitantly until recently in France**. The feasibility of this model has depended on the characteristics of the existing networks, including the availability of ducts.

The main reason for both persistent capacity and coverage constraints, in particular outside urban areas, lies in the huge investments required to roll out very-high-capacity networks. While the 30 Mbps target for 2020 is likely to be largely reached on the basis of current trends, the uncertainty of adoption dynamics remains a key constraint to investment in VHC connectivity.

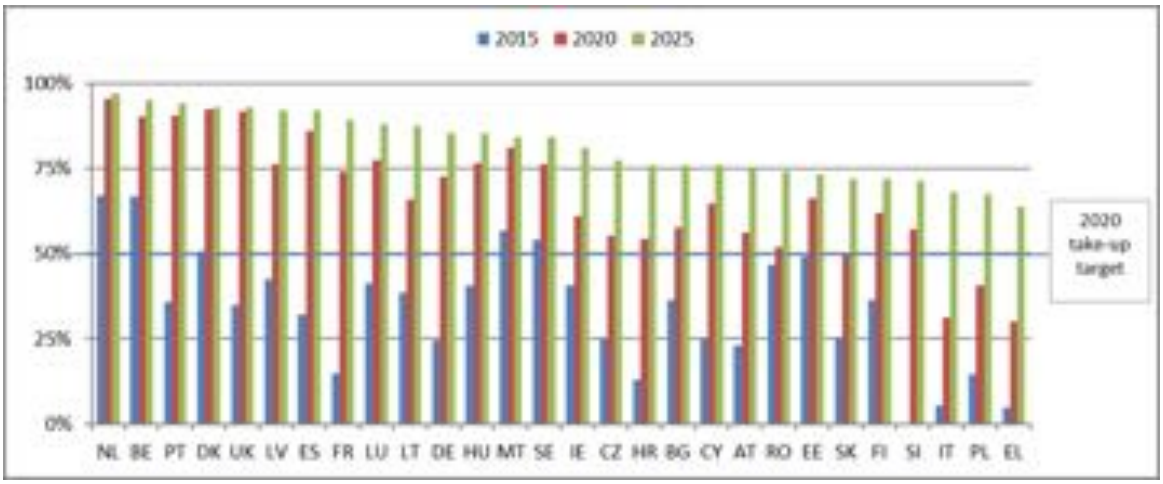
Despite progress in roll-out of NGA (> 30 Mbps), in the EU significantly fewer households, 49%, have access to networks of at least 100 Mbps, in contrast with Japan and South Korea where according to latest data, 73% and 69% of total broadband connections are fibre. In addition, connectivity in Europe is still overwhelmingly asymmetric, while upload speeds are increasingly important for services, such as cloud computing.

As of July 2015, 70% of European households have basic broadband subscriptions; only 30% of the households are subscribed to NGA above 30Mbps. The trend however, shows that Europeans are rapidly replacing their basic broadband connections with NGA: in 2013 the only 15% of European subscribed to NGA above 30Mbps, while 85% of subscriptions was to a basic broadband connections[468]. Figure 13 showed how dramatically the take-up rate of connection above 100 Mbps is progressing in countries where fibre networks are widely available. Take-up projections of NGA in a 5-10 year timeframe vary, and show significant differences across countries and technologies. For example, taking into account evolving coverage and propensity to take-up NGA, IDATE preliminarily projects that nearly half of households across the EU will take NGA technologies (FTTC, FTTH/B or Docsis 3.0 and successors) by 2020, and nearly two thirds by 2025. However, there are significant differences between countries as shown in the figure below.

Figure 83 - Projections for NGA (>30Mbps) take-up 2015-2025

[467] Regulatory, in particular access, regimes for network investment models in Europe (SMART 2015/0002)

[468] Source; Digital Scoreboard: https://ec.europa.eu/digital-single-market/en/connectivity



Source: IDATE

As today not all NGA networks can deliver 100 Mbps, the picture above implies that without appropriate investment incentives, **Europe is likely to miss the target of having 50% take-up of 100 Mbps services by 2020.**

As reported in the evaluation on **stakeholders' views** (section 7.1.1.) some Member States, the European Telecommunications Network Operators' Association (ETNO) and the large majority of the incumbents go as far as suggesting, via the public consultation conducted in light of the review, that investment should be made an explicit objective, next to competition, given the significant network rollout and upgrade needs in the coming years. This would imply amending the framework; among others access regulation, to favour dynamic efficiency gains over static ones. In areas where infrastructure competition is not viable, competition would be "for the market" rather than "in the market". Many other stakeholders including alternative operators and consumer associations stress, on the other hand that competition would not survive outside the regulatory framework and that the latter should not favour investment at the expense of competition (and thereby also at the expense of the consumer outcomes that go along with competition).

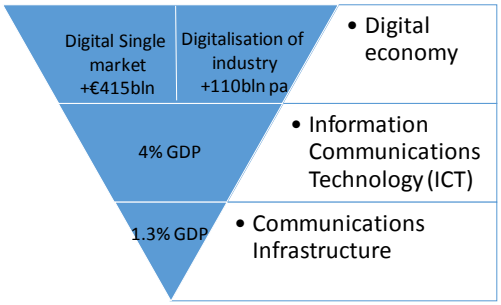
However, the findings of the access study and the forecast summarised in section 1.5 seem to show the legitimacy of the connectivity objective in the medium run.

6.14.4 What is the EU dimension of the problem?

The state of play and the European dimension of the connectivity problem There is a particularly strong rationale for EU action in the context of the challenges of the DSM. Digital services (including calls, messaging and entertainment) are increasingly offered on a pan-European or even global basis. In turn, digital services for consumers and businesses rely on ubiquitous connectivity, in some cases requiring VHC and/or reliability. Connectivity is a vital enabler for the DSM[469] and warrants an EU-wide response, even if network deployments are mainly local in nature. The figure[470] below gives an idea of the spillovers that are determined by communication infrastructures on the wider European economy.

Figure 84 – GDP contributions from the Digital economy

[469] See EC Digital Single Market Communication May 2015 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52015DC0192
[470] Source: SMART 2015/0005,.



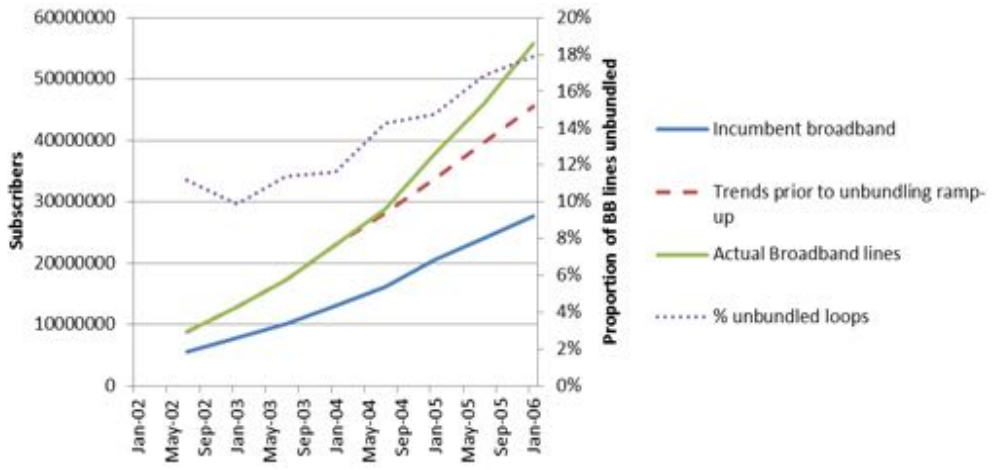
The limited connectivity available in Europe already today negatively affects EU citizens', businesses' and public authorities' capacity to produce, share and benefit from innovative digital products and services. Moreover, the competitiveness of the wider economy, not least of multinational companies based in the EU, is affected as high speed, high quality communications services and networks have an economic effect across all business sectors in Europe. As mentioned in section 1.2.1, it is important to take into account that **albeit networks are local in nature,** (and will probably get even more local in the future with the proliferation of small fibre operators such as in Sweden) the problem of **suboptimal investment is a European problem,** as even local networks are financed from international and cross-border capital markets. So despite the local nature of the networks, connectivity and investment have a clear internal market dimension and the review should strive to induce policies which are more favourable to investment without jeopardising the existing objectives.

According to the macroeconomic model elaborated for this study (see Section 4.11 and Annex 5), if all the preferred options are pursued as a result of the review of the electronic communications framework, we expect expanded market-driven investment and consumption and a cumulative effect on growth of 1.45% and on employment of 0.18% in 2025, assuming that the reforms are implemented by 2020.

In general, digital technologies and ICT have been in the last twenty years an enabler for the emergence and the expansion of new business models such as the sharing economy, crowd-sourcing of ideas and solutions for large companies, mutualisation of software (SaaS), including in the cloud. Experience from the **harmonisation of approaches** to previous generation technologies and solutions, notably from the GSM Directive,[471] LLU Regulation,[472] and the Leased Line Directive[473] suggests that clear and co-ordinated action at EU level to implement best practice in relation to connectivity can provide an important stimulus for deployment and take-up, raising the performance of the EU as a whole, compared with action that could be taken by MS individually. This is illustrated by **Error! Reference source not found.**, which shows how broadband take-up in Europe expanded in the years following the adoption of the LLU Regulation in 2000, which applied best practice methods for broadband promotion (until then applied only in a few countries such as Germany) more widely across the EU.

Figure 85 - Broadband trends in Europe following the LLU Regulation (2000)

[471]Council Directive 87/372/EEC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31987L0372:en:HTML
[472]Regulation EC 2887/2000 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32000R2887
[473] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31992L0044



Source: WIK based on Cocom data (except 2002 – OECD) and extrapolations

The 2002 Framework generally enhanced the flexibility of market regulation to deal with different economic circumstances in the MS (via market definition and SMP identification), and the 2009 review enhanced technological and service neutrality in spectrum bands (in contrast to the approach of the GSM directive).

This has allowed for a much more flexible and sophisticated approach to regulation, which can take economically-based decisions on a case-by-case basis. Nevertheless there is still is a clear need for a degree of EU-level steering to define bottlenecks and ultimately to meet common needs . This is recognised in the current framework through a level of flexibility which allows coping with new technological and market circumstances.

Several of the issues raised by the stakeholders and in the implementation experience involve cross-border challenges, such as numbering needs and roaming issues in relation to IoT, spectrum coordination and consumer protection, or businesses' need for seamless connectivity across multiple sites and countries. For example, the lack of European cross border coordination on the timing of allocation and assignment creates cross border interference problems and prevents services developing across the whole EU territory.

The heterogeneity in the implementation at national level of consumer protection as a result of different national legislation brought about by the current minimum harmonisation approach has impacted the effectiveness and efficiency of the rules and reflects the need for a coherent approach at EU level. Consistency in consumer protection standards across borders would avert further fragmentation along national lines and facilitate compliance for multi-territorial operations. Further harmonisation of end-user rights in the EU, coupled with deregulation where warranted, should thus result in a modernised set of consumer protections rules, providing higher confidence among end-users and making it easier for providers of communications services to comply with legislation and reducing unnecessary compliance costs.

6.14.5 Baseline analysis: how would the problem evolve without intervention

This section complements and deepens the analysis of the baseline presented in section 1.5.

As mentioned therein, the existing framework has delivered more competition, better prices and choice for consumers, and spurred operators to invest in upgrading their networks at least in some areas. Today virtually all EU citizens have access to basic broadband networks (97% fixed broadband connections according to the DESI index 2016[474]) and increasing numbers of citizens

[474] The Digital Economy and Society Index (DESI) is a composite index developed by the European Commission (DG CNECT) to assess the development of EU countries towards a digital economy and society. It aggregates a set of relevant indicators structured around 5 dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services. For more information about the DESI please refer to http://ec.europa.eu/digital-agenda/en/digital-agenda-scoreboard

and businesses have access to networks (Next Generation Access – NGA- connectivity) allowing at least 30 Mbps download speed (70.9% NGA general coverage[475] in EU according to DESI 2016 – see section 1.4.1 for more data). Only some countries, such as Malta, Lithuania, Belgium and the Netherlands, already enjoy nearly comprehensive coverage of NGA networks, in most of those cases probably mainly thanks to the competitive impulse provided by legacy cable networks, which could be upgraded at relatively low cost[476]. NGA coverage in countries which lack extensive cable has been slow to develop in many cases (Italy or Greece being emblematic). Moreover, a large part of the NGA coverage beyond the cable footprint in many countries (UK or Germany, for instance) has been achieved through only partial upgrades of the legacy copper loop (FTTC), rather than full upgrades (FTTH/B). As investigated in study SMART 2015/0002, the former approach may not be sufficient to cope with the data consumptions under the most ambitious scenario forecast.

A key development since the framework was originally conceived is that legacy telephone and cable (coaxial) networks, including the copper 'local loops', are in the process of being upgraded with fibre and other solutions which improve broadband performance.

In terms of demand, these enhancements are needed to enable customers to enjoy better quality in online services including online video and cloud applications, as well as enabling multi-screen viewing, which is becoming increasingly prevalent in European households with the proliferation of devices as illustrated in Figure 11 below.

Figure 86 - Europe IP Traffic and Service Adoption Drivers

Source: Cisco VNI Global IP Traffic forecast 2014-2019 – Europe includes Western Europe + CEE, excluding Russia

According to CISCO, Global IP traffic will increase threefold over the next 5 years. Overall, IP traffic will grow at a compound annual growth rate (CAGR) of 21 percent from 2013 to 2018[477]. The widespread adoption of cloud services, the number of connected devices (IoT), the booming M2M industry, contribute to further increase the traffic load on communications networks. In particular, as businesses and consumers exchange their data with the cloud, this will also lead to a **modified demand pattern for upload traffic**. Hence, while most of the traffic will still be in download, demand for upload will increase, as well as the need for lower latency for applications such as cloud computing and e-health, parameters included in the VHC concept.

The trends explained above increase the demand for capacity and certain quality characteristic of connectivity networks. There is an emerging consensus among industry players and investors that in the medium and long run connectivity providers, both fixed and mobile, will have to rely on

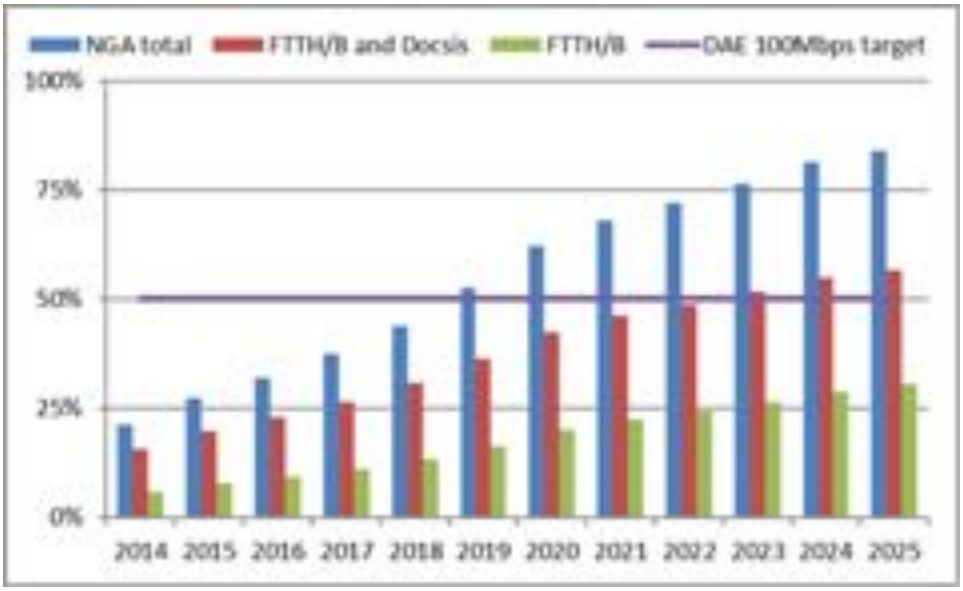
[475] NGA broadband coverage/availability (as a % of households) with Next Generation Access including the following technologies: FTTH, FTTB, Cable Docsis 3.0, VDSL and other superfast broadband (at least 30 Mbps download)
[476] Several studies highlight the role played by cable in stimulating NGA deployments including SMART 2015/0002, WIK-Consult (2015) for Ofcom 'Competition and Investment: analysing the drivers of superfast broadband', and the EP (2013) study 'Entertainment X.0 to boost broadband deployment'
[477] Source: CISCO VNI index, see:
http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html

(nearly) ubiquitous fibre infrastructures coming very close to users' premises, to support their business, especially considering the expected requirements of 5G.

Gigabit connectivity is also foreseen in projections by Deloitte[478] as a requirement to meet the aggregate demand from **dozens of connected devices in a home**. This is becoming the norm in European households where several users consumer bandwidth from several devices at once. Deloitte further notes that "*demand for connectivity has evolved symbiotically: as faster speeds have become available, the range of applications supported has increased and the viable number of devices per person has steadily risen*."

In terms of supply of NGA in commercially viable areas, forecasts from IDATE based on market intelligence (see figure below) suggest that upgrades to NGA and VHC networks will continue, but at a relatively gradual pace.

Figure 87 - Projected take-up of NGA by technology (to 2025)



Source: IDATE, SMART 2015/0002

IDATE projections suggest that by 2020 (see figure above), even under very optimistic assumptions (assuming FTTC/vDSL delivers 100Mbit/s in practice), around 16 countries may miss the DAE targets of 50% households taking up at least a 100 Mbps connection, and that within the 16 affected countries the target will be missed by around 25m households. Under a more conservative assumption, whereby only FTTH/B and cable are considered as reliably offering more than 100Mbit/s, the gap in meeting the target would amount to around **27m households**. In reality other advanced hybrid copper-based solutions may deliver the required speed provided the local loop is sufficiently short. Countries with limited historic cable competition such as Italy and Greece are included amongst those considered likely to miss the targets, while countries which have been characterised by strong FTTC, coverage could fail to meet targets under the stricter assessment[479].

This pace of development may be sufficient to meet the needs of some users, but is likely to limit the potential for more demanding users including small business and home office users and may not be sufficient to enable Europe to fully benefit from a connected economy and society. As explained in more detail in the support study SMART 2015/0005, chapter 1, the demand for data is booming and the scenarios considered are mostly rather conservative.

Concerning rural NGA deployment, existing regulatory practice and outcomes vary across the EU as shown in case studies for SMART 2015/0002. If the current varying practices remain, the

[478] Deloitte Technology, Media and Telecommunications Predictions 2016
[479] For additional deployment forecasts see , SMART 2015/0002.

current status of uneven rural deployment is likely to persist, resulting in patchy access in rural communities to broadband capable of reaping the benefits from the social and economic integration that digitisation may bring. This process is likely to have repercussions on public finances, especially if accompanied by ageing population. Challenge areas could in theory be addressed through public subsidies, but these are by no means sufficient. The costs of achieving DAE targets also in rural areas are exposed above in section **Error! Reference source not found.**.

An estimate of the connectivity problem in the future (2025 and beyond) can be inferred from asking (1) whether there is likely to be a gap between bandwidth demand and NGA deployed; (2) whether future demands can be met through incremental upgrades of existing copper and coax (cable) networks or only through FTTH/B; and (3) the extent to which future mobile technologies (5G) will be able to rely on fixed networks for backhaul and other data transmission needs. The size of Europe's bandwidth challenge can be seen most vividly by comparing where we are today with what would be needed to benefit from all aspects of a connected society in 2025 as assessed in more detail in SMART 2015/0002 and SMART 2015/005[480].

According to Samknows, average download speeds achieved in Europe in 2014 were 24Mbit/s.[481] If investment in NGA technologies continues at its current levels, IDATE has projected that average download speeds would reach around 200Mbit/s- by 2025,[482] while upload speeds would reach around 90Mbit/s. Based on trends in video and cloud usage under the 'status quo', IDATE has also estimated that bandwidth use in the EU may expand from 62GB per line per month in 2025 to 298GB per line.[483] This may seem significant, and for households used to experiencing restricted bandwidths,[484] it may be appear enough.

As mentioned in section 1.5, there is evidence suggesting that in the telecom sector **demand responds to supply**,[485] and that restricted download and upload speeds may limit the types of usage and applications that might otherwise emerge. In Sweden, following an early boost by the central government, one out of every two municipalities is involved in fibre to the business and fibre to the home deployments. This has led to very high take-up: as of July 2015, 68% of the broadband connections in Sweden are NGA[486], achieved predominantly through FTTH and FTTB connections. Where FTTH is widespread, the availability of fibre makes extending fibre to base stations far more feasible and efficient. This is well illustrated by the example of 4G in Stockholm where the world's first 4G deployment took place helped by the virtually 100% fibre coverage.[487]If bandwidth needs are calculated on the basis of what might be required to run certain applications, a case study of the German market providing a forecast for 2025 suggests that an average user might require 150-500Mbit/s downstream with more than 100Mbit/s up, while high-end users including those running small or home offices might require 1Gbit/s in

[480] In the context of the Expert Panel conducted under SMART 2015/005 – See Annex 13 for more detail, Prof. Brett Frischmann observed that current demand expressed by end-users may fail to reflect the innovation potential in the market, which could be unlocked through more performant infrastructure.

[481] Page 115 Samknows for EC Oct 2014 Quality of Broadband Services in the EU

[482] In the context of SMART 2015/0002 IDATE forecast likely uptake of NGA by technology to 2025 and based speeds and speed growth per technology on the basis of Samknows data. According to Akamai speed measurements, average speeds have been increasing by 16% per annum across a range of geographies. An alternative approach of extending this projection would result in speeds of around 150Mbit/s in 2025.

[483] SMART 2015/0002

[484] Many Internet users are already experiencing challenges with the bandwidth they have available. Almost four in ten respondents to the Eurobarometer survey of 2014 noted that they had experienced difficulties accessing online content or applications as a result of insufficient speed of download capacities.

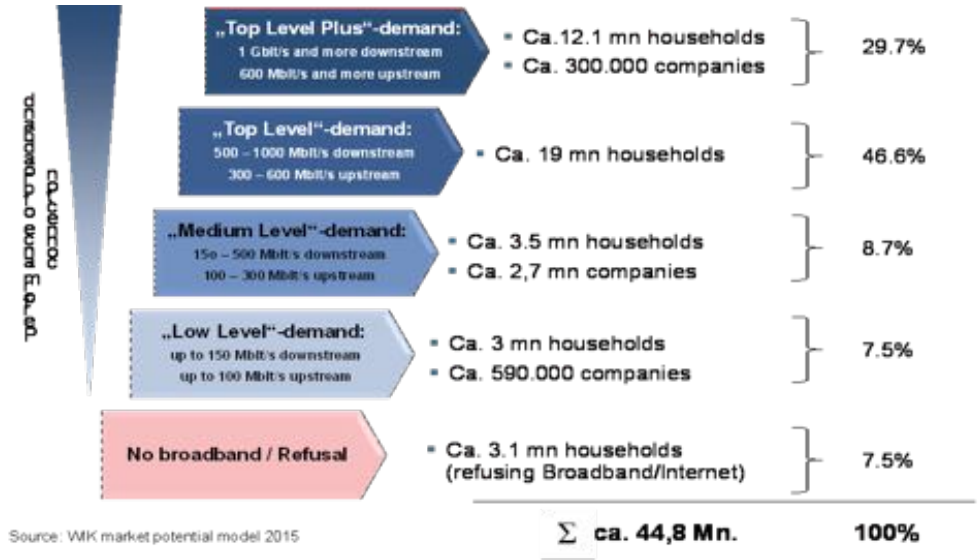
[485] Data from the UK regulator Ofcom for example suggests that download bandwidth consumption for NGA (FTTC and FTTP) networks was around two times higher than bandwidth consumption for non-NGA networks, with significantly higher use of upload capacity. This evidence of higher usage being associated with the availability of NGA is supported by the case study of Palaiseau in France, which has been the subject of a pilot trial for the switch-off of Orange copper customers and migration to FTTH networks. In this case it was observed that the average Internet traffic of Orange's broadband customers as well as their consumption of video-on-demand was multiplied by a factor of three. Importantly, this trial also resulted in fibre clients' usage of upload bandwidth being increased 8 times, due to changes in Internet usage and an increased usage of cloud-based services.

[486] See annex 6.

[487] Source: Vodafone's call for the Gigabit Society, Dec. 2015

download and more than 600 Mbps in upload (see SMART 2015/0005). This bandwidth would be used not only for multi-screen ultra HD video, but also for applications such as cloud and e-health as well as for home working and small business needs.

Figure 88 - Model of market potential – Germany 2025



As shown in Figure 14 data rates required by the most demanding users could reach 1 Gbit/s or more on the downstream link by 2025, while a significant proportion of households and offices could demand download speeds of 500-1000Mbit/s and 300-600Mbit/s upstream by 2025. This scenario therefore sets the upper bounds for potential users (including business user) demands in the medium term – though it is worth noting that even a less ambitious scenario will need the fibre rollout to reach far deeper into most of the present networks.

On the subject of inconsistency in the implementation of the framework, there is evidence that without further direction at EU level, this problem is likely to persist and may worsen, in part because when new technologies and services emerge they lack the harmonisation that was historically required through EU legislation, and may not achieve adequate levels of harmonisation through voluntary standardisation alone. Concerns over the impact of fragmentation on business users, in particular multi-national ones, provide an example of the enduring nature of these problems and difficulties in using current tools to address them. Concerns over fragmentation in the market for business communications were first raised in a survey conducted by the predecessor to BEREC, the European Regulators Group (ERG) in 2009,[488] validated in a further survey published in 2013,[489] and have subsequently been reaffirmed by business end-users in the context of studies for the EC in 2015[490] and 2016.[491] Yet in an interview conducted in 2016 for SMART 2015/0002, INTUG observed that it still had concerns over the ability of business issues to be effectively addressed under the existing institutional set-up.

Concerning future generations of wholesale access products for residential customers and small business, the experience of a new product designed as a partial replacement for LLU on NGA networks, such as 'VULA' (Virtual Unbundled Local Access) or a WDM (Wavelength Division Multiplexing) based access product provides a warning that without efforts to apply a European 'standard' (as was created with 'local loop unbundling' on copper networks) any future

[488] ERG report on the regulation of access products necessary to deliver business connectivity services ERG (09) 51 http://berec.europa.eu/doc/publications/2009/erg_09_51_business_services_paper_final.pdf
[489] WIK (2013) Business Communications, economic growth and the competitive challenge
[490] SMART 2014/0023 Access and Interoperability standards for the promotion of the internal market for electronic communications
[491] SMART 2015/0002 access and investment

technological upgrades in fixed access networks are likely to result in duplicate efforts to develop new wholesale access solutions and divergent implementations at national level. As seen with the past implementation of VULA, this may result in slow take-up of wholesale offers of future generations of fixed access infrastructure and therefore – especially in the early phase - reduced levels of choice for consumers in areas where competition cannot be delivered through infrastructure-based competition alone. In turn, this may dampen take-up of new technologies in the early deployment phase.[492]

Lastly, in view of the fact that the preparation by NRAs of market analysis often coincides with three year period between market reviews and results in delays of several years, the perpetuation of the existing three year market review cycle, is likely to result in insufficient time for the previous reviews to be confirmed and effectively implemented[493] and their effects to be known. Additionally, the continued re-evaluation and re-calibration of regulation conflicts with the aim of many regulators to provide longer-term certainty and potentially long-term remedies[494] in order to provide more durable solutions that offer greater certainty to operators and investors.

Overall we can state that **a no change scenario would lead to a persisting digital divide for citizens and SMEs,** sub-optimal economic development outcomes, sub-optimal allocation of capital, lack of consumer trust in digital services, lower take up of innovation and loss of competitiveness of EU industry. A review of studies on standard speed broadband suggests that an increase of 10% in standard broadband penetration could contribute between 0.25% to 1.38% to GDP growth.[495] There is also a small, but expanding body of literature highlighting how the effects of faster broadband through fibre connectivity could boost growth further and offer a new lease of life to rural communities[496].

Promotion of the interests of end-users, including the provision of a safety-net through the universal service obligations, is another principal objective of the regulatory framework, as it ensures that consumers can participate in the digital society and fully reap the benefits of a competitive market. Overall the framework has been successful in safeguarding consumer protection, even when this is not fully translated in increased consumer satisfaction. Given the increasing role of connectivity and electronic communications services in today's European economy, it is important to continue protecting end users' interest.

Current rules on contracts content, duration and termination, transparency on tariffs, quality of service and other conditions, potential minimum quality of service requirements, switching and number portability have enabled consumers to take advantage of a competitive market.

Regarding switching, the number of porting transactions has increased, in particular in relation to mobile numbers, with switching rates above other subscription-based industries, even if certain practical implementation difficulties still affect consumers (e.g. loss of service during switching).

National rules have ensured transparency of information on services and prices by providers, including in some cases the provision of online tools comparing prices and services; rules on

[492] Evidence from standard broadband suggests that unbundling played a role in accelerating take-up in the early deployment (but not later phase). It also had a positive impact on service quality. See unbundling the incumbent – evidence from UK broadband Nardotto, Valletti, Verboven (2015) http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2505035. SMART 2014/0024 also shows how NGA take-up could have been accelerated if customers of entrants had been converted to NGA at the same rate as those of incumbents

[493] This is especially true in the case of appealed decisions

[494] Long-term discounts exceeding 3 years have been negotiated for wholesale FTTC/VDSL bitstream access in NL and Germany. In France, one amongst a number of justifications provided by ARCEP in interview for SMART 2015/0002 for pursuing symmetric rather than asymmetric regulation to address fibre bottlenecks was the need to provide a framework for longer term solutions (in this case on the basis of IRU)..

[495] Among others: Crandall, R., Lehr, W., and Litan, R. (2007), The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data, *Issues in Economic Policy*, 6; Czernich, N., Falck, O., Kretschmer T., and Woessman, L. (2011), Broadband infrastructure and economic growth, *Economic Journal*, 121(552); Koutroumpis, P. (2009). The Economic Impact of Broadband on Growth: A Simultaneous Approach, *Telecommunications Policy*, 33; Qiang, C. Z., and Rossotto, C. M. (2009), Economic Impacts of Broadband, In *Information and Communications for Development 2009: Extending Reach and Increasing Impact*, 35–50.Washington, DC: World Bank.

[496] See for further studies SMART 005/2015

contract duration have been transposed so that the initial commitment period does not exceed 24 months, while also ensuring that providers offer users the possibility to subscribe to a contract with a maximum duration of 12 months; some Member States have adopted detailed rules regarding consumer protection safeguards in case of unilateral changes to contract conditions.

Despite the above, consumers still refer to issues related to transparency and quality of service, in particular with regards to the internet access service. This problem is especially acute when access to the internet service is bundled with other communications service, resulting in 24% of consumers not finding easy to compare prices of bundles, while evidence shows that an increasing number of consumers on most Member States opt for this service delivery mode.

The provisions on security and integrity of networks and services have contributed to strengthening the European telecom infrastructure's resilience and services availability across the EU. Yet effectiveness of the provisions is not complete and this would be related to the fact that security obligations cover only electronic communications providers.

As explained in the problem definition, only providers of traditional communication services have to comply with sector specific rules safeguarding end-user's interests. Providers of communications service over the internet (OTTs) are not subject to these sector-specific rights and obligations, even when their services are used by the end-users to cover the same or similar communications needs as the traditional electronic communications services.

Significant changes or further evolution of the problem are not foreseeable with regards to services and end-user protection, absent further intervention at EU level. Uncertainty about the scope of sector specific rights and obligations and gaps in consumer protection would persist, which would in turn lead to a further fragmentation of the internal market and impede adoption of new services.

Rules on universal service aim at providing a safety net ensuring that the most vulnerable in society as well as those in more remote areas can receive basic services. They cover both connectivity and service aspects, as well as the affordability of tariffs and accessibility for disabled users. The provisions permit financing of any 'net cost' of universal service obligations either through a levy on operators or through public funds, where such a net cost would otherwise constitute an unfair burden to the designated Universal Service Obligation (USO) operator.

In the absence of intervention at EU level, Member States would likely take increasingly different approaches in universal service obligations by removing outdated services from the scope. Consistency and coherence of the universal service regime across Member States would reduce without a common approach towards the inclusion of broadband in the universal service scope. The sectorial financing mechanism would continue being a possibility for financing. The costs of financing the universal service obligation in the Member States would likely remain the same, depending on possible national approaches. Looking towards future challenges which could not be addressed in the absence of more consistent and effective intervention, the most immediate and significant new technological development is the introduction of 5G (planned for the early 2020s). Indeed, as an ongoing Commission study[497] confirms, 5G is expected to deliver 1 gigabit per second simultaneously to, for instance, many workers on the same floor. In addition, it offers enhanced spectral efficiency, enhanced signalling efficiency and reduced latency compared to 4G. 5G is also expected to be a key enabler for M2M communications and the IoT.

The economic benefits of successful, fast and coordinated deployment of 5G across the EU are very significant and they have been estimated at 146bn EUR per year and the creation of 2.39m jobs[498]. These estimates only consider the most immediate impacts of a delay including the sectors that are most directly affected. It is likely that the full impacts of 5G would only materialise at a

[497] SMART 2015/0003, Substantive issues for review: market entry, management of scarce resources, and general end-user issues

[498] SMART 2014/0008, Identification and quantification of key socio-economic data to support strategic planning for the introduction of 5G in Europe

later stage and that they would affect many more sectors of the economy. Later deployment of 5G services would therefore also lead to delays in these ripple effects throughout the wider economy.

A failure to achieve a single market in electronic communications can in itself impose considerable costs. This is especially true for multi-national businesses, which require not only the availability of connections in disperse locations, but also uniform conditions for provisioning, repair and quality guarantees. In a 2013 study "Business communications, economic growth and the competitive challenge", WIK estimated that the creation of a single market enabling the seamless provision of business communications services could lead to efficiency gains and boost productivity providing economic benefits of up to €90bln per annum over time.[499]

Meanwhile, a 2011 study conducted for the EC – steps towards a truly Internal Market for e-communications[500] – identified substantial benefits from greater 'standardisation' of solutions within the EU, including: (i) Advantages for multinational corporations – making Europe a more attractive location for headquarters, branch offices and production facilities; (ii) economies of scale for manufacturers of telecoms systems, which could benefit from a lesser need for customisation (iii) improvements in e-Health, e-Learning and business to business services. The authors concluded that increased standardisation could provide annual gains of 0.3%-0.45% GDP (€35bln-€55bln) and cautioned that failing to reach standardised solutions would affect future pan-European roll-out as well as the development of premium over-the-top-services. The study also examined the impact of harmonised 'best practice' in the promotion of competition in telecoms, and concluded that a fully-harmonised European approach could provide gains of 0.22% and 0.44% of GDP (€27bln - 55bln) by delivering lower prices, higher quality and greater investments.

[499] The gains are associated with a welfare gain from lower prices, efficiency gains from an improvement in ICT processes and productivity gains through a reorganisation of business processes

[500] Ecorys/TNO/TU Delft (2011) 'Steps towards a truly internal market for electronic communications' https://ec.europa.eu/digital-agenda/en/news/steps-towards-truly-internal-market

6.15 ANNEX 15 - Glossary and Bibliography

ADR: Alternative Dispute Resolution

ADSL: Asymmetric Digital Subscriber Line

ARPU: Average Revenue Per User

ARCEP: Autorité de régulation des communications électroniques et des postes

ASQ – Assured Service Quality

BCG: Boston Consulting Group

BEREC: Body of European Regulators

BEUC: Bureau Européen des Unions de Consommateurs (The European Consumer Organisation)

CAGR: Compound Annual Growth Rate

CAP: Content and Applications Provider

CAPEX: Capital expenditure

CEPT: European Conference of Post and Telecom Administrations

COCOM: Communications Committee

CRM: Customer Relationship Management

DAE: Digital Agenda for Europe

DESI: Digital Economy and Society Index

DG CNECT: European Commission Directorate General for Communications Networks, Content and Technology

DNS: Domain Name System

DSM: Digital Single Market

ECHR: European Charter of Human Rights

EC: European Commission

ECN: Electronic Communication Networks

ECNS: Electronic Communication Networks and Services

ECS: Electronic Communication Services

ECTA: European Competitive Telecommunications Association

EFIS: ECO (European Communication Office) Frequency Information System

eMBB: enhanced mobile broadband

EP: European Parliament

EPG: Electronic Programme Guide

ERA: European Railway Agency

ERP: Enterprise Resource Planning

ERT: European Round Table for Industrialists

ESIF: European Structural and Investment Funds

ETNO: European Telecommunications Network Operators' Association

ETNS: European Telephone Numbering Space

ETSI: European Telecommunications Standards Institute

EU: European Union

EUR: euro (currency)

FCC: U.S. Federal Communications Commission

FTE: Full Time Equivalent

FTTB: Fibre to the Building

FTTC: Fibre to the Cabinet

FTTH: Fibre to the Home

FTTP: Fibre to the Premises

FTTx: Fibre to the x

FWA: Fixed Wireless Access

FWD: Framework directive

GDP: Gross Domestic Product

GHz: Gigahertz

GPS: Global Positioning System

GPT: General Purpose Technology

GSM: Global System for Mobile Communications

GSMA: GSM Association

HFC: Hybrid Fibre Coaxial technology

HSPA: High Speed Packet Access

IA: Impact Assessment

IAS: Internet Access Services

IASG: Impact Assessment Steering Group

ICT: Information and Communications Technology

INTUG: International Telecommunications Users Group

IoT: Internet of Things

IP: Internet Protocol

IPR: Intellectual Property Rights

IPTV: Internet Protocol Television

ISP: Internet Service Provider

IT: Information Technology

ITRE: European Parliament Committee on Industry, Research and Energy

LLU: Local Loop Unbundling

LTE: Long Term Evolution

M2M: Machine-to-Machine

MEP: Member of the European Parliament

MHz: Megahertz

MNC: Mobile network code

MNO: Mobile Network Operators

MS: Member States

MSC/MNC: multi-site/multi-national corporations

MVNO: Mobile Virtual Network Operators

NFV: Network Function Virtualisation

NGA: Next Generation Access

NIS: Network and Information Security

NRA: National Regulation Authority

ODR: Online Dispute Resolution

OECD: Organisation for Economic Co-operation and Development

OTA: over-the-air-provisioning

OTTs: Over The Top players

P2P: Peer-to-Peer

PATS: Public Access Telephony Services

PSAP: Public Safety Answering Point

PSB: Public Service Broadcaster

PSTN: Public Switched Telephone Network

QoS: Quality of Service

R&D: Research & Development

RSC: Radio Spectrum Committee

RSPP: Radio Spectrum Policy Programme

RSPG: Radio Spectrum Policy Group

SDN: Software Defined Networks

SIM: Subscriber Identity Module

SMA: Spectrum Management Authority

SME: Small and Medium Enterprises

SMP: Significant Market Power

SMS: Short Message Service

TFEU: Treaty on the Functioning of the European Union

TTE Council: The Transport, Telecommunications and Energy Council

US: United States of America

USD: Universal Service Directive

USO: Universal Service Obligation

VAT: Value Added Tax

VHC: Very High Capacity

VDSL: Very-high-bit-rate digital subscriber line

VoD: Video on Demand

VoIP: Voice over Internet Protocol

VP: Vice-President

VULA: Virtual Unbundled Local Access

WDM: Wavelength Division Multiplexing

WLR: Wholesale Line Rental

4G: Fourth generation of mobile phone mobile communication technology standards

5G: Fifth generation of mobile phone mobile communication technology standards