

Accelerating Access to Digital Services

Policy and Regulatory Initiatives to Incentivize Infrastructure Investments

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Abstract*

Economic theory tells us that there is a close relationship between price and demand. Moreover, these two variables may explain the rhythm of deployment and the technological solution that could provide broadband services most cost efficiently. The experience of the past decade has clearly shown that competition—in particular, facilities-based competition together with setting up independent regulatory authorities—is the most important driving force for accelerated and sustainable telecom market development. This paper discusses various ways to lower network deployment and operation costs to achieve greater efficiency and broaden coverage in providing digital services across the different social strata. In this regard, this paper provides specific recommendations related to: (i) tower sharing assuming mobile is the more extended and available technology in Latin America and the Caribbean (LAC) (ii) infrastructure sharing, and (iii) conditions for state aid.

JEL codes: D4, K2, L1, L22, L51, L96, H54

Keywords: broadband, digital economy, infrastructure, regulation, telecommunications

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1. Investment Requirements Based on Sociodemographic and Economic Conditions

The telecom sector is currently characterized by slowing growth and rising competition. Both factors increase the need to address issues related to the financial model applied to deploying infrastructure and, more importantly, network costs—the major cost for telecom operators. Table 1 summarizes the trends that explain the need of more cost-effective deployment of telecom infrastructure.

Table 1. Major Trends in the Telecom Sector

Slowing Growth	<ul style="list-style-type: none"> – Population penetration reaching saturation – Gross-adds driven by 2nd SIMs and churners
Declining Prices for Voice	<ul style="list-style-type: none"> – Voice ARPUs falling under competitive pressure – Usage elasticity does not fully compensate price declines
Declining Prices for Data	<ul style="list-style-type: none"> – Data competition focusing on transport – Price declines to incentivize customer usage
Increasing Competition	<ul style="list-style-type: none"> – Competitive intensity rising in saturated marketplace – New competitors (MVNOs, resellers) emerging
Increasing User Sophistication	<ul style="list-style-type: none"> – Majority of customers are experienced mobile users – Operator purchasing decision increasingly independent and informed

Source: Authors' elaboration.

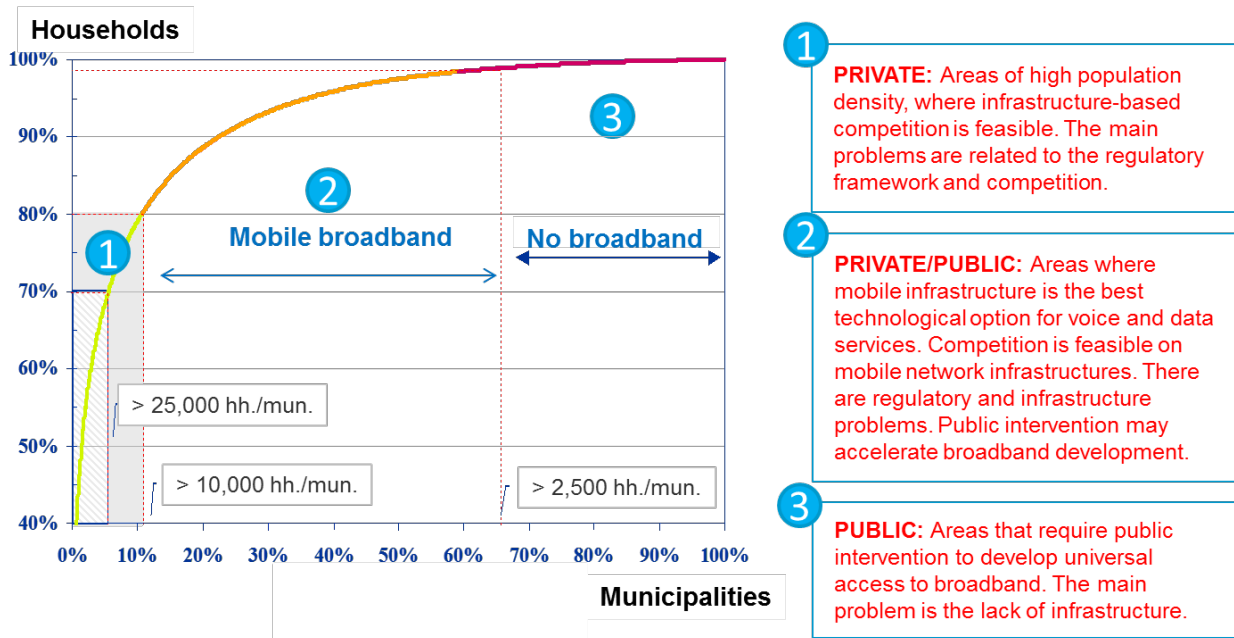
Note: ARPU = Average Revenue per User; MVNO = Mobile Virtual Network Operators

Considering these trends, infrastructure deployment strategies need to take into account sociodemographic and economic conditions. Figure 1 shows that there are urban areas where population density and the willingness to pay for service make deployment economically and financially attractive (area 1 in Figure 1); however, there are other areas (area 3 and in some circumstances area 2) where public intervention or a public–private partnership is the only way to reach the objective of universality and affordability.

Economic theory tells us that there is a close relationship between price and demand. Moreover, two variables may explain the rhythm of deployment and the technological solution that could provide broadband services most cost efficiently.

The experience of the past decade has clearly shown that competition—in particular, facilities-based competition together with setting up independent regulatory authorities—is the most important driving force for accelerated and sustainable telecom market development. According to estimates of cost distribution for the different layers of broadband infrastructure, the passive infrastructure layer accounts for 70 to 80 percent of all the investments and has a payback period of at least 15 years (Table 2). As a result, telecom operators increasingly look for opportunities to reduce network deployment costs, specifically for the infrastructure layer.

Figure 1. Investments Associated with Different Sociodemographic and Economic Conditions



Source: Authors' elaboration.

Note: hh./mun. = households per municipality

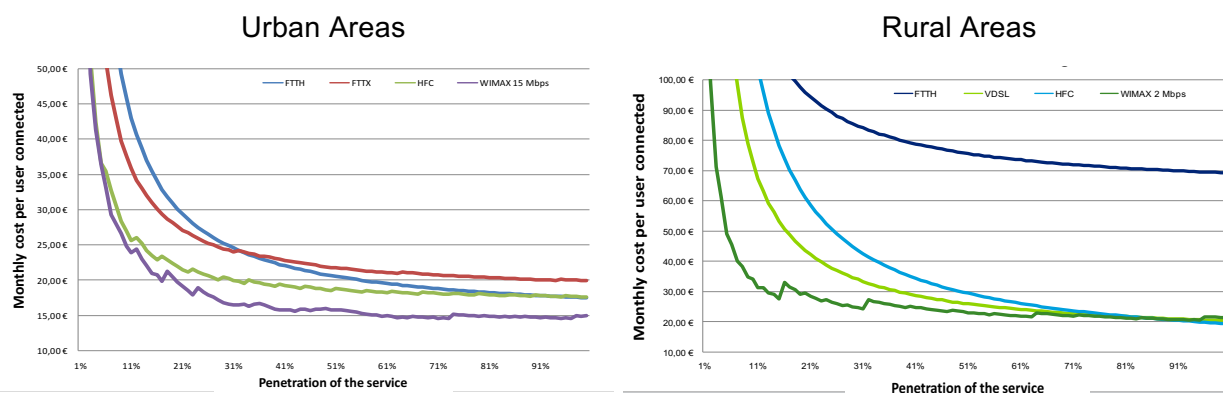
Table 2. Distribution of Costs Between Different Infrastructure Layers

Layer	% of Network Costs	Payback Period	Examples
Passive infrastructure	70–80	15 years	Trenches, ducts, dark fiber, etc.
Active infrastructure	20–30	5–7 years	Electronic equipment, Operational Support System (OSS), Business Support System (BSS)
Service	N/A	Few months–3 years	Content, services, and applications

Source: Broadband Commission (2012).

Considering this cost distribution, the structure of the industry and the costs associated with deployment are expected to vary greatly depending on variables such as: (i) population density, (ii) average return per user (ARPU), (iii) service take-up, (iv) user demand requirements, and (v) the availability of civil infrastructure. In fact, as shown in Figure 2, population density and user requirements will drive which technologies have the best cost position, thus allowing very different industry structures in different areas. Similarly, the higher the ARPU, the service take-up, and the availability of civil infrastructure that could be used to deploy the passive level of the telecom network, the more potentially competitive a marketplace becomes.

Figure 2. Monthly Costs Associated with Different Access Technologies



Source: Authors' elaboration.

Figure 2 shows that, depending on the financial indicators related to the infrastructure deployment, one or another type of infrastructure makes more or less sense. To choose, it is necessary to know how much money consumers are willing to pay. Then, taking into account the capex related to deployment, financial figures can be calculated to assess the attractiveness of the investment. Thus, if the objective is to reach penetration of 70 percent of the population having broadband service, in urban areas, the most inexpensive technology would be WiMAX.¹ However, it is important to note that the maximum speed in urban areas would be 15 Mbps; whereas, in rural areas the maximum speed would only be 2 Mbps. Similarly, if we define affordability at €25 (~US\$27) per month, then FTTx becomes economically feasible when penetration rates in urban areas reach 30 percent of households.

This paper discusses various alternatives to lower network deployment and operation costs to achieve greater efficiency and more coverage in providing digital services across different social strata. The authors provide specific recommendations related to: (i) tower sharing assuming that mobile is the more extended and available technology in LAC, (ii) infrastructure sharing, and (iii) conditions for state aid.

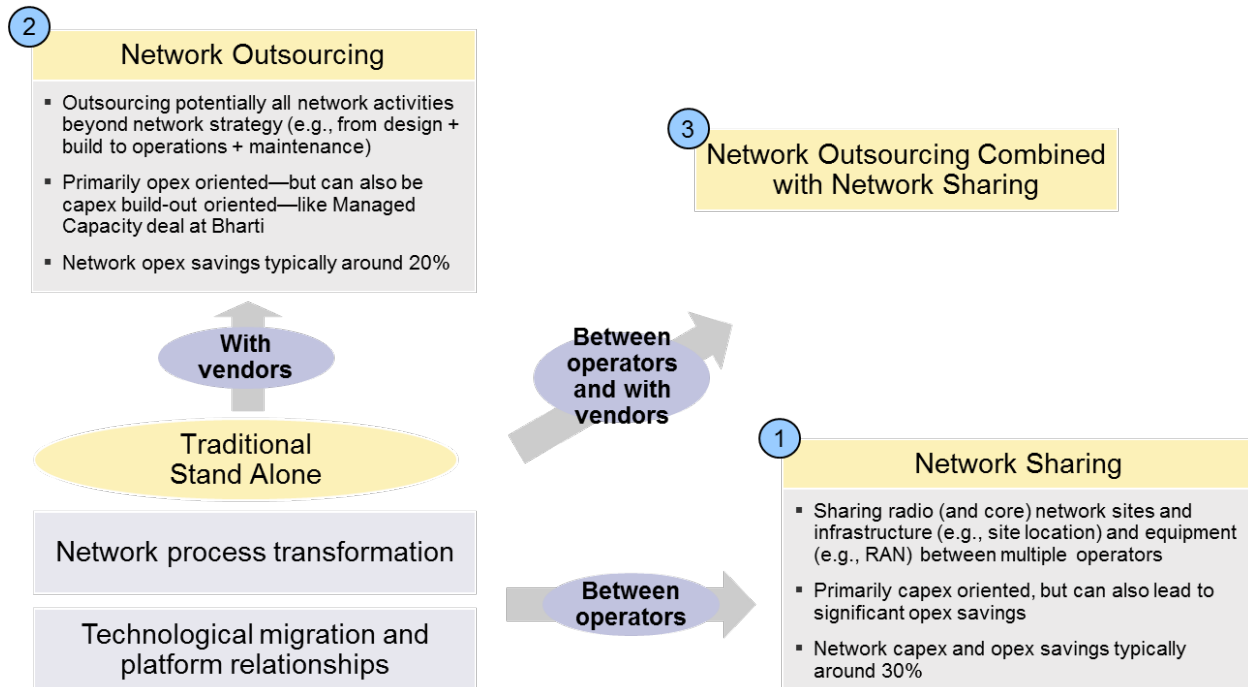
2. Infrastructure Sharing to Accelerate Deployment of Digital Infrastructure in LAC

Mobile network operators are pioneers in optimizing network costs. With penetration reaching saturation and margins reduced toward competitive levels, optimization solutions have already gone far beyond traditional infrastructure sharing on active (e.g., Radio Access Network [RAN]) or passive (e.g., towers and sites) levels. Now operators are creating outsourcing models with more advanced capacity. Figure 3 shows that, beyond more traditional network optimization

¹ The maximum speed offered by WiMAX cannot match the strategic connectivity objectives of most LAC countries.

approaches (one network–one operator), alternative network models (many operators–one network, many operators–outsourced network) promise new cost savings. In particular, mobile operators are exploring such models between themselves.

Figure 3. Alternative Network Models to Achieve Cost Savings



Source: Authors' elaboration.

Notes: opex = operating expenses; capex = capital expenses.






Network Sharing: A partnership between telecom operators aiming to decrease capital investment in infrastructure and lower operating costs by rolling out and operating shared network infrastructure. This model is increasingly popular for 3G/4G network rollouts. Separate networks of participating operators are transformed into a single network infrastructure that is shared by all participants. For new deployments, each operator may be responsible for covering a certain geographic area.

Network Outsourcing: A partnership between a telecom operator and an equipment vendor whereby the equipment vendor builds and operates the network infrastructure and the telecom operator purchases the capacity it needs to provide its services. This kind of partnership—also known as a managed capacity agreement—is well established.

Network Outsourcing Combined with Network Sharing: A partnership between a number of telecom operators and an equipment vendor whereby an equipment vendor builds and operates network infrastructure that is shared by multiple operators.

For instance, the expected cost savings from network sharing are always in both capital expenditures and operating expenses and can reach up to 40 percent. Table 3 shows that similarly interesting savings can be achieved using alternative models.

Table 3. Savings in Capital and Operating Expenses Associated with Different Network Deployment Models

	Capex Savings	Opex Savings	Savings***
 Site Sharing 1	<ul style="list-style-type: none"> • Site acquisition costs • Site preparation costs (civil works, tower/pole, room/container) 	<ul style="list-style-type: none"> • Site rental costs • Site administration costs • Basic site maintenance costs (e.g., tower checks, cleaning) 	~10%
 Infrastructure Sharing 2	1 plus <ul style="list-style-type: none"> • Infrastructure costs (power, air conditioning, alarms, antennas, feeders) 	<ul style="list-style-type: none"> • Electricity costs (e.g., air conditioning) • Further site maintenance costs (infrastructure) 	~15–20%
 Telecom Equipment Sharing 3	1 plus 2 plus <ul style="list-style-type: none"> • Infrastructure costs (power, air conditioning, alarms, antennas, feeders) 	<ul style="list-style-type: none"> • Electricity and maintenance costs (telecom equip) • Transmission costs (microwave/local loop fees) • Operating costs 	~25%
 National Roaming** 4	1 plus 2 plus 3 plus <ul style="list-style-type: none"> • Further telecom equipment costs • Optimization costs 	<ul style="list-style-type: none"> • Electricity and maintenance costs (telecom equip) • Operations costs • Possibly radio licence costs 	~30%
 Full Sharing 5	1 plus 2 plus 3 plus 4 plus <ul style="list-style-type: none"> • Further telecom equipment costs (core network, core transmission network) 	<ul style="list-style-type: none"> • Related rental, electricity, maintenance costs • Operating costs 	~40%

Source: Authors' elaboration.

*Refers to individual mobile network codes.

**Equal to telecom equipment sharing with one common mobile network code.

***Scaled with reach of sharing. For example, small (geographical) areas/selected sites vs. entire country/all sites.

Similarly, for fixed telephony, telecom regulators could foster investment by designing regulatory measures that level the playing field and promote investment. Table 4 presents regulatory measures that could be undertaken depending on existing competition problems related to deployment (Gelvanovska, Rogy, and Rossotto, 2014).

Table 4. Possible Legal and Regulatory Measures

Bottleneck/Barrier	Legal/Regulatory Measure Should Establish at Least:
Limited transparency concerning existing physical infrastructure suitable for broadband rollout	<ul style="list-style-type: none"> – Right to access/obligation to provide information about existing physical infrastructure suitable for broadband rollout – Mechanisms to ensure availability of such information (e.g., establishing nationwide inventory or facilitating and centralizing access to existing information)
Lack of appropriate legal basis/institutional framework	<ul style="list-style-type: none"> – Scope of entities obliged to share controlled infrastructure – Scope of infrastructure to be mandated for sharing – Governance model distributing relevant functions among public institutions (taking into account cross sector nature of the infrastructure sharing obligation)
Commercial issues (lack of business interest) or anti-competitive behavior	<ul style="list-style-type: none"> – Principles for pricing of infrastructure sharing (commercial, regulated, or mixed approach; e.g., in case of public and private infrastructures) – Dispute resolution mechanism (courts of general competence, arbitrages, or specialized dispute resolution procedures at national regulatory agencies)
Technical infeasibility	<ul style="list-style-type: none"> – List of reasons to refuse sharing – Definition of technical infeasibility (e.g., establishing methodology for technical feasibility assessment)

Source: Authors' elaboration.

3. Tower Sharing

According to GSMA, in 2020 there will be 5.7 billion mobile telephone subscribers globally, of which 4.43 billion will be in developing countries. GSMA estimates that by 2020 the LAC region alone will host 521 million unique subscribers.² Mobile access thus provides solid grounds to empower the population in LAC with digital services. However, investments are needed to match these estimates. In this context, tower sharing will be instrumental in decreasing the investments required by cutting down the costs to construct the passive level of infrastructure. If efficiently prompted by the governments, subscribers could pay lower prices for services.

In advanced economies, tower sharing is occurring on a commercial basis using mutually beneficial arrangements among mobile operators, thus policy and regulatory intervention are not necessarily required (see the appendix for examples of infrastructure sharing practices in different

² <https://www.gsma.com/mobileeconomy/>

countries). Mobile operators that are uncertain of the potential value of tower sharing should consider three questions and their relevant value implications:

- Do I want someone else on my towers?
- Do I manage my towers by myself?
- Do I sell my towers?

These questions arise in relation to two potential threats: (i) risk of market share loss if they facilitate the expedited entry of a new competitor and (ii) loss of network control and related quality issues. Table 5 provides an example that showcases the potential benefits of infrastructure sharing and the implications of not getting into this new business.

Table 5. Implications, Value Drivers, and Value Breakdown of Infrastructure Sharing

		Implications	Value Drivers	Value Breakdown
Do I want someone else on my towers?	Yes	<ul style="list-style-type: none"> – Increased tenancy ratios – Higher operational efficiency on existing assets 	– (High margin) rental income	25–35%
	No	– Competitors are likely to share and become more cost efficient, translating into higher competitive capacity for commercial business	N/A	—
Do I manage my towers by myself?	Yes	<ul style="list-style-type: none"> – Sub-optimal management focus on core business (i.e., serving customers) – Competitors will likely become more cost efficient if they outsource 	N/A	—
	No	<ul style="list-style-type: none"> – Improved operational efficiency by outsourcing to experienced third party – Increased focus on core business 	– Lower opex as outsourcer leverages economies of scale and best practices	5–20%
Do I sell my towers?	Yes	<ul style="list-style-type: none"> – Increased funds available to enhance commercial business – Increased independence of the tower business, leading to higher tenancy ratios and valuations 	<ul style="list-style-type: none"> – Capital gains – Tax benefits from conversion of capex to opex – Repatriated cash (where an issue) 	40–60%
	No	– Likely divestment by competition could render tower assets less valuable	N/A	—

Source: Authors' elaboration.

In urban markets, coverage is already extensive and thus infrastructure sharing is not particularly helpful in reducing capex. Consequently, operators need to reduce opex by sharing towers thus gaining rental income. In rural markets, operators need to expand coverage and drive uptake of services. In this scenario, operators can benefit from divesting tower infrastructure into a joint venture company with other incumbents, thus transferring capex to opex while simultaneously lowering each operator's financial risks by sharing costs and improving tenancy.

A market is attractive for a tower business when operators expect new licenses will be issued and/or there will be network expansions. A market is even more attractive when tenancy ratios are increasing, rental prices are relatively constant, and there are constraints in building new towers. Table 6 shows the variables that affect supply and demand of infrastructure sharing.³

Table 6. Variables that Affect Supply and Demand for Infrastructure Sharing

Addressable Demand		Accessible Supply
Positive	Negative	
New or recent licensees who have considerable roll-out left to get national coverage	Lower capex budgets due to pressure on margins	Cost of capital
Data-driven network roll-out (3G, WiMAX, and LTE in the future)	Software upgrades which increase BTS/Node B capacity	Restrictions to build towers
Increased price competition leading to increase in Minutes of Use (MOU) and resultant network capacity requirements	Deployment of tri-band/quad-band antennas	Financial pressure on operators
Regulatory bodies encouraging and in some cases forcing passive element sharing	Market consolidation of license holders	Highly competitive markets

Source: Authors' elaboration.

4. Assessment of Disbursement Mechanisms for State Aid Funds

Having access to the internet is becoming a human right; however, there are still regions where the population, small and medium enterprises, and public institutions are not connected either because of a lack of financial or economic interest from the private sector or because the people do not have the digital literacy required to take advantage of the benefits that digital services could bring. In these scenarios, public intervention is needed to guarantee that everybody has access to digital infrastructure and services. This section analyses public intervention in Europe and provides specific recommendations for the LAC Region.

4.1. The European Union

The main economic rationale for state aid is to correct market failures (e.g., market power, information asymmetries, inefficient allocation of resources, public services), whereas the main political rationale is that it helps to achieve common policy objectives (e.g., social and regional cohesion, employment, research and development, and sustainable development) (World Bank, 2017). The European Commission (EC) is mandated to assess the compatibility of state aid and

³ See toolkit on infrastructure sharing from The World Bank at https://ppiaf.org/documents/4709?ref_site=ppiaf.

enforce the European Union's (EU) state aid policy. In exercising its discretionary power to assess the compatibility of state aid, the EC has found a balance between the necessity, proportionality, and ability of state aid to contribute to achieving common EU objectives versus the distortion of competition that the aid may cause (EC, 2013a). In this regard, a measure will constitute state aid if four cumulative conditions are met: (i) the intervention is made by the state or using state resources; (ii) the intervention is likely to affect trade between member states; (iii) the intervention confers a selective advantage to the recipient; and (iv) the intervention distorts or threatens to distort competition (EU, 2013). In summary, if a measure meets all four criteria above, it has to be treated as state aid. Examples of state aid are extensive and include direct state grants and subsidies, tax exemptions, loans at preferential interest rates, guarantees, and disposal of land or buildings at lower than market price.

The framework is frequently reviewed and improved. In past decades, the EC has attempted to shape state aid policy to better target common EU policy objectives and thus the EU's state aid policy has undergone several reforms. In 2000, the EC asked member states to reduce the level of state aid as percentage of GDP⁴ and to promote horizontal aid instead of benefiting individual companies or sectors.⁵ The EC was seeking to shape state aid policy to more effectively target the goals of the *Lisbon Strategy*—"to become the most competitive and dynamic knowledge-based economy in the world" (European Parliament, 2000). In 2005, the state aid action plan was launched. It covered the period 2005–09 and brought about further changes in line with the mid-term review of the *Lisbon Strategy*. Finally, in 2012, a state aid modernization initiative was issued primarily to support the EU's growth strategy for 2020 (EC, 2012a). The summary of the latest modernization and its implications are provided in Box and Box . Figure 4 summarizes the main criteria for state aid and notification requirements.

⁴ Historically, state aid has been used by member states explicitly and extensively in defense of their national industries. For more detail see Ganoulis and Martin (2001).

⁵ Sectorial and individual aid is considered to have potentially the strongest distortive effects on the allocation of resources and competition or trade. For more detail see Ganoulis and Martin (2001).

Box 1. State Aid Modernization

In May 2012, the EC issued a Communication on State Aid Modernization. It set out an ambitious state aid reform program with three main objectives: (i) to foster sustainable, smart, and inclusive growth in a competitive internal market; (ii) to focus EC *ex ante* scrutiny on cases with the biggest impact on the internal market; and (iii) to streamline the rules and provide for faster decisions.

In 2013–14, the EC revised existing rules on state aid and adopted new ones in line with identified targets and principles. A number of documents were renewed, including:

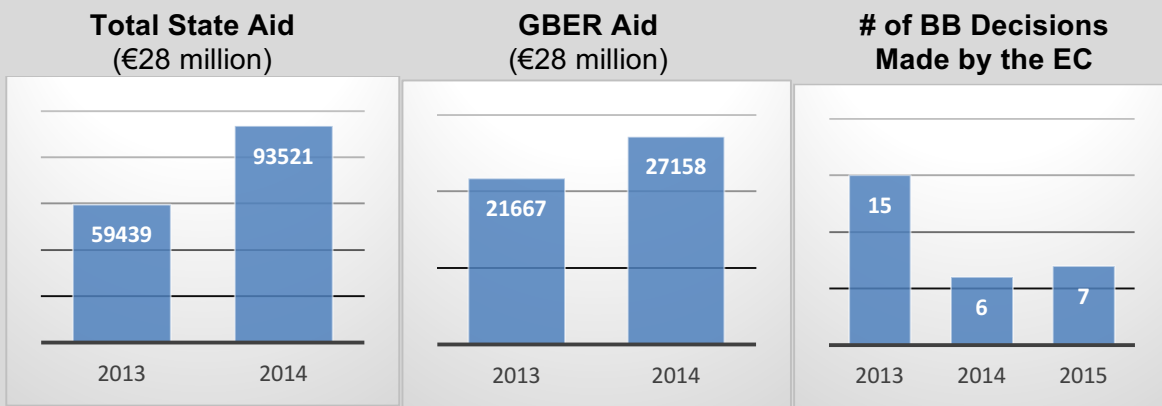
- **Guidelines on regional aid for 2014–20:** Key features of the new guidelines included increased coverage of regions where regional aid may be granted, more aid categories to be exempted from the notification procedure, and increased transparency of granted aid.
- **Broadband Guidelines:** The new guidelines focused more on principles of technological neutrality and availability of open access, added possible support for ultra-fast broadband networks, and stressed the importance of transparency.
- **General block exemption regulation:** The key improvements were increased thresholds, additional categories of aid, and simplified conditions to meet General Block Exemption Regulation (GBER) requirements.
- **De minimis regulation:** Though the exempted aid amounts of up to €200,000 per undertaking over a three-year period remain unchanged, the treatment of small aid measures were simplified. Companies having financial difficulties were no longer excluded from the scope of the regulation, the definition of what constitutes an “undertaking” were simplified and clarified.
- **Definition:** The notion of state aid was explained in detail for the first time.
- **Enabling regulation:** The EC introduced new categories of aid that it could decide to exempt from the obligation of prior notification, which allowed the EC to focus on the most important state aid cases.
- **Procedural regulation:** Handling of complaints was improved, leading to swifter, more predictable and more transparent investigation.

The reform also included revising guidelines on aid for research and development and innovation, guidelines on environmental aid, guidelines on risk finance aid, and aviation guidelines.

Source: EC (2012b).

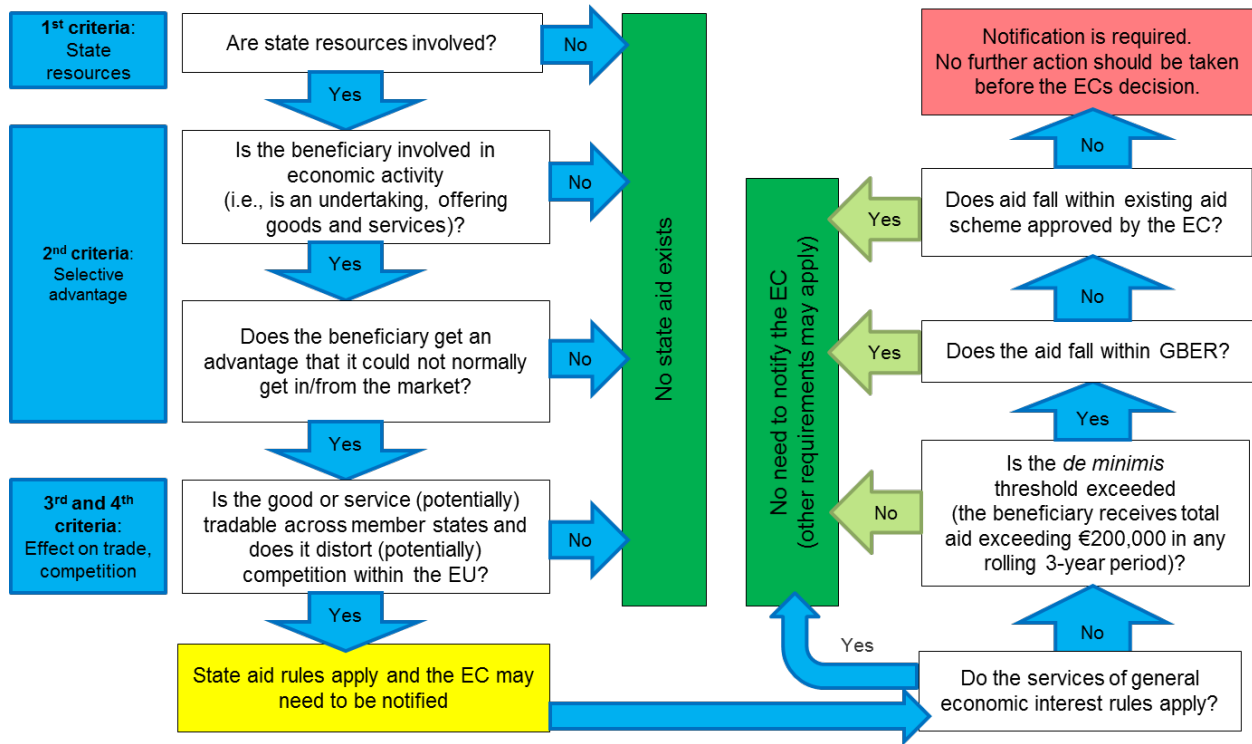
Box 2. Implications of Modernizing State Aid

One of the main objectives of modernizing state aid was to simplify procedures, especially those concerning aid with limited effect on the EU's internal market. In other words, the EC aimed to focus its enforcement on the cases with the biggest impact on the internal market, allowing the greater part of state aid decisions to be made by member states following the renewed regulations, in particular GBER and *de minimis* regulations. As modernizing state aid mainly took place in 2014, evaluating its implications is premature. However, the first data show the total amount of state aid has increased along with the amount of state aid granted under the GBER in 2014, although the number of state aid decisions made by the EC decreased (at least for broadband). This means that the reforms are showing positive results.



Source: EC (2016).

Figure 4. Main Criteria and Notification Requirements for State Aid



Source: Adopted from UK (2015).

4.2. Broadband-Specific State Aid Rules in Europe: Lessons Learned

Although the EC first tends to rely on private investors, it recognizes that in some cases support from the public sector and public funds will be inevitable. However, the EC realizes that active governmental involvement in rolling out broadband could crowd out private investment, and thus a state aid control framework was put in place to prevent such crowding out. Until 2009, state aid for broadband development was assessed directly under the state aid rules of the Treaty on the Functioning of the European Union (1958) on a case-by-case basis (OECD, 2014). In 2009, the EC issued Broadband Guidelines based on its experience and case practice. The guidelines were revised in 2013 (and came into force in 2014) to better achieve the objectives of the Digital Agenda for Europe and to make granting state aid more transparent and effective (EC, 2013b).

It is also worth mentioning that the majority of state aid measures for broadband that are approved by the EC fall under 107(3)(c) of the Treaty, meaning they are usually considered to be compatible with the internal market because they aim to facilitate “the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest” (EU, 2008).

Understanding that state aid for broadband may help (i) to implement common EU objectives and (ii) to correct market failures, the EC allows (at the same time setting strict rules)

state intervention in the market. A guiding principle, however, is that any state intervention should be limited as much as possible to minimize the risk of crowding out or replacing private investments, of altering commercial investment incentives, and ultimately of distorting competition (Elixmann and Neumann, 2013).

After clarifying what constitutes state aid, the Broadband Guidelines set out the conditions under which aid can be declared compatible. The first step is complying with seven necessary conditions. “Failure to comply with one of the following conditions will result in declaring the aid incompatible with the internal market” (EC, 2013b). The conditions are provided in The second step is the balancing test. This test weighs the positive impact of the aid measure against its potential negative effects, such as distortion of competition or trade (OECD, 2014). If the negative effects outweigh the benefits, the EC may not approve it or may ask for remedial action (EC, 2013b). The balancing test is performed for every suggested state aid measure. Examples of such evaluation may therefore be found in every EC decision on state aid for broadband (for examples, see EC [2017]).

The third step details the assessment of state aid for broadband. For the purposes of the assessment, the EC distinguishes between basic and next-generation access (NGA) networks and identifies three types of areas that might be targeted based on their existing level of connectivity. The distinction is important because different requirements for state aid measures will apply in each case (see Table 7).

Basic and NGA networks: Asymmetric digital subscriber lines (up to ADSL2+ networks), non-enhanced cable (e.g., Data Over Cable Service Interface Specification 2.0, DOCSIS 2.0), third generation mobile networks (Universal Mobile Telecommunications System) and satellite systems are considered to be basic broadband. NGA networks are “(i) fibre-based access networks (FTTx); (ii) advanced upgraded cable networks (DOCSIS 3.0); and (iii) certain advanced wireless access networks capable of delivering reliable high speeds per subscriber” (EC, 2013b).

Types of areas that may be targeted, depending on the existing level of connectivity: Areas can be classified into white, grey, or black according to their current level of broadband provision: white indicates no network (currently and in the near future), grey indicates one existing network, and black indicates more than one network. Different requirements apply to each type of area. In white areas, it is easier to satisfy requirements than in grey or black areas where the market already provides a service and the potential for distortion of competition is greater. In general, black areas do not require state intervention, with the possible exception of ultra-fast (well above 100 Mbps) broadband networks.

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⁶ According to the Broadband Guidelines, near future is a 3-year period.

Table 7. Mandatory Requirements for Broadband State Aid Measures

	Requirement	Compliance
1	Contribution to achieving objectives of common interest	The EC assesses to what extent the planned aid would contribute to achieving objectives of the Digital Agenda.
2	Absence of market delivery due to market failures or important inequalities	Market failure occurs when, by itself (without state intervention), the market fails to provide demanded services. Governments may decide to intervene to deal with social or regional inequalities. In both cases, it must be clear that the market failed to deliver expected results.
3	Appropriateness of state aid as a policy instrument	To address the identified market failures, the proposed measure must be an appropriate instrument and be the least distortive to competition. The chosen measure must be duly assessed and justified ex ante. The EC stresses the importance of avoiding duplications or incoherence between different schemes and coordination between different authorities, such as the national regulatory agency and the competition authority.
4	Existence of incentive effect	Member states must demonstrate that broadband investments would not be made without state intervention.
5	Aid limited to the minimum necessary	Suggested measure should be proportional.
6	Limited negative effects	Suggested measure must be the least distortive to competition and competitors.
7	Transparency	Aid will be awarded transparently. Requirements for transparency are specified in the Broadband Guidelines.

Source: Authors based on Broadband Guidelines.

The Broadband Guidelines then set down a number of design features required in all measures in order to limit distortions of competition. Features include a detailed mapping and coverage analysis, public consultations, an open tender process, acceptance of the most economically advantageous offer, technology neutrality, use of existing infrastructure where possible, and wholesale access to third parties for at least seven years at prices estimated using benchmarks and a clawback mechanism to avoid over-compensation.⁷ Additionally, the guidelines set obligations that apply when state aid is granted for NGA networks. The EC specifies that, in the case of support for NGA deployment, a state aid measure should not only comply with the seven general requirements (Part I in Table 8) and the features to limit possible distortions (Part II in Table 8), but also must have stricter wholesale access and non-discrimination requirements (Part III in Table 8). The guidelines also cover the exceptional circumstances in which state aid to ultra-fast broadband networks might be permitted (Part IV in Table 8).

⁷ Clawback refers to repaying any excess aid that may have been granted to a beneficiary.

Table 8. Broadband Guidelines at a Glance

<p>Part I. Necessary conditions that every measure must comply with: (i) Contribute to achieving objectives of common interest; (ii) Absence of market delivery as a result of market failures or important inequalities; (iii) Appropriateness of state aid as a policy instrument; (iv) Existence of incentive effect; (v) Aid limited to the minimum necessary; (vi) Limited negative effects; (vii) Transparency.</p>	
<p>Part II. State aid design features to limit possible distortions (in addition to Part I):</p> <ul style="list-style-type: none"> – Detailed mapping and analysis of coverage: geographic areas covered by the measure should be clearly identified and justified. – Public consultation. – Competitive selection process: choosing a third-party operator to deploy a network must be done in line with principles of the EU Public Procurement Directives. – Most economically advantageous offer: qualitative criteria should be established on which tender offers will be evaluated. – Technological neutrality: tender should not favor or exclude any technology. – Use of existing Infrastructure: tender should encourage the reusability of existing resources. – Wholesale access: required of subsidized network provider for at least 7 years (and with a wide range of wholesale products). – Wholesale pricing: should be based on benchmarking principles. – Monitoring and claw-back mechanism: authorities should closely monitor implementation of the project and ensure repayment of excess aid. – Transparency: information on the approved aid scheme and its implementing provisions, name of the aid beneficiary, aid amount, aid intensity, and technology used should be available publicly for at least 10 years. – Reporting: periodic reports should be provided to the EC by the granting authority. 	<p>Part III. State aid design features for NGA (in addition to Parts I and II):</p> <ul style="list-style-type: none"> – Wholesale access: third-party operators must have access to both passive and active network infrastructure. Wholesale access should be granted for at least 7 years and the right of access to ducts or poles should not be time limited. – Fair and non-discriminatory treatment: where the network operator is vertically integrated, adequate safeguards must be put in place to prevent any conflict of interest or discriminatory practices.
<p>Part IV. State aid for ultra-fast (well above 100Mbps) broadband (in addition to Parts I, II, and III):</p> <ul style="list-style-type: none"> – On exceptional basis in urban, black NGA areas, when fibre networks do not reach the end-user's premises, the market situation is not evolving toward achieving 100 Mbps, and, above broadband services, expected demand for such services exists. – Demonstration of a "step change" (significant new investments are taking place and the infrastructure brings significant new capabilities in terms of broadband availability, capacity, speeds, and competition) is required. – Demonstration of enhanced technological characteristics and performance of the subsidized network. – Subsidized networks must be based on an open architecture and wholesale only networks. – The aid should not excessively distort competition with other NGA technologies in the target areas. 	

Source: Authors based on Broadband Guidelines.

Note: Part I, II, and III apply both to white and grey areas; however, for grey areas to be eligible, they must prove that (i) no affordable or adequate services are offered to satisfy the needs of citizens or business users and (ii) there are no less distortive measures available to reach the same goals.

5. Other Related Measures to Stimulate Infrastructure Investments

Beyond the measures discussed above, this paper would not be complete without mentioning additional related measures that governments in developed countries introduce to create better investment environments for infrastructure investments. For instance, in 2014, the EU adopted a specific directive to tackle the costs of infrastructure rollout and optimize the construction processes across the EU member states (EC, 2014). Table 9 summarizes existing good practices, beyond those discussed in this paper, that could be considered.

Table 9. Additional Policy and Regulatory Instruments to Facilitate Infrastructure Investments

Area of Intervention	Definition	Activities
Co-deployment of new infrastructure, coordination of civil works	Sharing the cost of excavation between operators and (or) utility companies	<ul style="list-style-type: none"> – Mandating coordination of civil works (development of primary and secondary legislation). – Developing a database where all planned civil works should be published. – Developing recommendations for possible cost sharing models and reference agreements for co-deployment. – Ensuring effective resolution of disputes regarding coordination of civil works. – Promoting coordination of civil works.
Pre-conditions for cheaper deployment of infrastructure in the future	Specific requirements for newly deployed infrastructure aiming to ensure sharing of such infrastructure in the future	<ul style="list-style-type: none"> – Mandating deployment of empty duct(s) whenever possible while constructing roads, water supply networks, etc. – Mandating specific diameter of empty ducts in regions with potentially high future demand for sharing. – Mandating technical requirements for poles and antenna masts to ensure possible sharing in the future.
Effective construction process	Streamlining and making more transparent processes of granting the rights of way and construction permissions	<ul style="list-style-type: none"> – Reviewing and simplifying the process of granting rights of way when infrastructure is deployed over, on, or under the public and private property. – Building awareness and capacity about the rights of way framework for property owners, operators, and relevant public (national and local) authorities, including courts. – Reviewing, simplifying, and bringing transparency to permission granting and associated administrative procedures.

Source: Authors' elaboration.

6. Conclusion and Recommendations

To summarize, infrastructure sharing and public co-financing are two policy instruments that have significant impact in supporting universal digital access nationally. This discussion paper outlined that infrastructure sharing, particularly tower sharing among mobile network operators, is expected to be important in terms of network expansion in LAC and will therefore likely be promoted by governments.

At the same time, promoting facilities-based competition should lead to developing broadband infrastructure in commercially attractive areas of each country. In the remaining underserved areas, an approach to infrastructure development that leverages public resources should be considered to avoid a digital divide. However, specific criteria for government intervention will need to be established to prevent crowding out private sector investment.

Governments should therefore proactively foster initiatives that will contribute to expanding the frontier of commercial viability, new modes of infrastructure supply, and decreasing deployment costs beyond those discussed. For example, innovative models for public-private partnerships between municipalities or utility companies and operators could address deployment of FTTx access networks in urban areas or backbone deployment to connect more isolated areas. Similarly, a more effective construction process could save time and financial resources whenever infrastructure deployment is taking place where civil works are also being completed.

We conclude that, in the current environment, accelerating the rollout of infrastructure and promoting affordable broadband access for citizens, businesses, and organizations is a significant investment challenge for telecom operators. For them to succeed—to incentivize infrastructure investments—governments need to adopt a holistic approach, combining policy and regulatory instruments: (i) infrastructure sharing, including tower sharing; (ii) public (co)financing in justified instances; (iii) co-deployment of new infrastructure and co-ordination of civil works; (iv) pre-conditions for cheaper deployment of infrastructure in the future; and (v) effective construction processes.

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7. Appendix. Mobile Network Infrastructure Sharing: A Regulatory Review

Country	Operator	Sharing Agreement	Regulatory Conditions	Type of Sharing
Australia	Telstra and H3G	<ul style="list-style-type: none"> – Commercially negotiated 3G site and RAN sharing. Regulator approved sharing of 3G RAN. – Telstra purchased 50% of H3G network assets. – 3GIS, an administrative group, established to own and operate H3G's existing RAN and fund future network rollout plans as agreed with Telstra and H3G. 	<ul style="list-style-type: none"> – Regulator approved sharing of 3G RAN. 	Towers and RAN
Brazil (GTB, 2012;	Several operators	<ul style="list-style-type: none"> – Country split into 11 licensing areas with 4 operators. Sharing permitted provided standalone rollout obligations licensed in each. Operators encouraged to share passive and active infrastructure, particularly in rural areas, where service may be uneconomic. 	<ul style="list-style-type: none"> – Sharing permitted provided standalone rollout obligations are met. 	Towers and RAN
Channel Island	All	<ul style="list-style-type: none"> – Arqiva owns sites and towers and rents access to any 2G or 3G operator who requests access. 	<ul style="list-style-type: none"> – Passive sharing permitted but not mandated. Reduction in number of sites to be built recognized as positive. 	Towers
Cyprus	Vodafone and Areeba	<ul style="list-style-type: none"> – Site sharing and national roaming arrangements. 	<ul style="list-style-type: none"> – Mandated co-location and national roaming. 	Sites and towers
Germany	T-Mobile and O2	<ul style="list-style-type: none"> – Site sharing of 3G networks. – O2 uses T-Mobile network for national roaming. 	<ul style="list-style-type: none"> – Site sharing permitted because it encourages faster rollout and expansion into rural areas and does not restrict competition because it is limited to basic infrastructure. National roaming exempted from competition rules. 	Towers, sites, RAN, and roaming
Hungary			<ul style="list-style-type: none"> – Mobile network operators (MNOs) have no access-related obligations because the national competition authorities did not find operators with significant market power in the mobile access market in 2005. – There are no MVNOs established in Hungary. 	Not applicable

Country	Operator	Sharing Agreement	Regulatory Conditions	Type of Sharing
India	All operators	<ul style="list-style-type: none"> - Commercially negotiated agreements. Regulators approved 30–40% of sharing cells sites. - Sites generally shared on 1-for-1 basis, except those funded by the Universal Service Fund. Bharti Infratel owns >20,000 sites and holds approximately 42% stake in Indus Towers, the recently announced joint venture between Bharti, Vodafone, and Idea that has over 70,000 sites. - Bharti Infratel and Indus Towers will provide site and mast services to all wireless telecom operators in India on a non-discriminatory basis. 	<ul style="list-style-type: none"> - Regulator approved sharing of cell sites and consulted on sharing RAN and other network elements. - Site and mast sharing, which is mandated in Delhi and Mumbai, was opposed by the MNOs. 	Sites and towers, and evaluating RAN
Italy		<ul style="list-style-type: none"> - First commercially negotiated wholesale access agreement recently signed by one mobile operator with a large distribution company. - Other agreements currently under negotiation. 	<ul style="list-style-type: none"> - No obligation for MNOs to sign wholesale access agreements. 	Towers, sites, RAN, and roaming
Latvia			<ul style="list-style-type: none"> - Access and origination market notified to EC in November 2006. No national roaming obligations imposed on two leading operators because new entrant was obliged by license conditions to affect certain levels of network investment. 	Not applicable
Luxembourg	Three mobile operators	<ul style="list-style-type: none"> - Strict security and health rules imposed would make it difficult to carry out facility-sharing and co-location. Seems to have delayed development of 3G mobile networks. 	<ul style="list-style-type: none"> - 3G network rollout delayed, partly due to procedures to obtain planning permissions for mobile masts and antennas. - National regulation came into force in January 2006, setting out procedures to apply for permissions and imposing legal time limits for each step of the three-step procedure. Three-month time limits imposed under the law do not seem to be observed in practice, and the procedure therefore can be long. 	Not applicable

Country	Operator	Sharing Agreement	Regulatory Conditions	Type of Sharing
Norway	Telenor (single dominance) and TeliaSonera's NetCom, plus a small number of MVNOs	<ul style="list-style-type: none"> – A number of commercially negotiated and regulated agreements between the main operators and MVNOs. – Commercial agreements between Telcor and TeliaSonera. 	<ul style="list-style-type: none"> – Telenor obliged to provide national roaming and MVNO access, publish tariffs and reference offers, and implement accounting separation, and subject to price and accounting controls for national roaming. – Telenor obliged to co-locate. All operators can share sites and masts, Radio Network Controllers can be shared physically, but operators must retain logical control over networks and spectrum. All transmission routes (i.e., optic fibre, cables, P-P radio lines) may be shared. For core networks, mobile Switching Centre cannot be shared. – Ministry of Transport and Communications may, subject to individual consideration, allow fulfilment of coverage requirements through roaming in networks based on technologies other than Universal Mobile Telecommunications System (W-CDMA) provided such networks can offer sufficient capacity and the arrangement is without substantial disadvantage to subscribers. 	Roaming
Pakistan	Telenor, Ufone, and Warid	<ul style="list-style-type: none"> – Telenor and Ufone announced commercial agreement to share sites and towers in 2006. Cited aim: to reduce network rollout costs and make rural network rollout more viable. – Warid later joined the sharing agreement. – Mobitel, largest operator by coverage and subscribers, opted not to join the consortium. 	<ul style="list-style-type: none"> – National telecoms policy encourages infrastructure sharing. – Currently, licensees not obliged to share infrastructure with competitors. – Each licensee expected to build or lease required infrastructure, although the license they own allows them to share their infrastructure on commercial arrangements. – So far, PTA (the regulator) has not issued guidelines. 	Sites and towers
Spain ⁹	Orange and Yoigo (Telia Sonera) Yoigo and Vodafone Spain	<ul style="list-style-type: none"> – January 2008, commercial agreement to share transmission infrastructure and sites for 5-year period. – Yoigo, 4th licensed operator using W-CDMA, has commercially negotiated roaming agreement to use Vodafone's network, which provides national coverage despite its own network being limited principally to urban areas. 	<ul style="list-style-type: none"> – All MNOs facing obligatory MVNO access arrangements. 	Towers, sites, RAN, and roaming

⁹ Spain follows directives and recommendations mentioned for Germany.

Country	Operator	Sharing Agreement	Regulatory Conditions	Type of Sharing
Sweden (MobileSociety, 2010; Mölleryd, 2010)	All licensed operators	<ul style="list-style-type: none"> - 5 operators - 4 have formed 2 separate consortiums of 2 operators. - Each consortium has built out a joint network. 	<ul style="list-style-type: none"> - Regulator permitted this level of sharing but required each operator to maintain 30% of its network separately. 	Towers, sites, RAN, and roaming
United Kingdom ¹⁰	Vodafone and Orange H3G and O2	<ul style="list-style-type: none"> - Radio access network sharing and commercially negotiated national roaming already in place. 	<ul style="list-style-type: none"> - EC approved all sharing models. - No mandated infrastructure sharing 	Roaming
United States	Various, including AT&T Wireless and Cingular	<ul style="list-style-type: none"> - Various operators share passive and active infrastructure, including joint network sharing deal between AT&T Wireless and Cingular. 	<ul style="list-style-type: none"> - FCC has assessed various infrastructure cases and has taken non-interventionist approach. 	Sites and towers, but no regulatory intervention

¹⁰ As in other EU countries, the United Kingdom follows the EC Directives and Recommendations. See Best (2012) for information on sharing 4G.