Enabling Rural Coverage

Regulatory and policy recommendations to foster mobile broadband coverage in developing countries

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Executive Summary

In 2017, the number of unique mobile subscribers reached the symbolic mark of 5 billion, with 3.5 billion of them using mobile networks to access the internet. Despite this achievement, there are still 3.8 billion people who remain offline, out of which 1.2 billion are not covered by a broadband capable network – the vast majority of this uncovered population lives in the rural areas in developing countries. Acknowledging that the mobile industry cannot close this coverage gap without the government's support, this report invites policymakers to support mobile operators through the implementation of policies and regulations that enhance incentives to invest in rural networks. Such policies should eliminate unnecessary deployment costs, enhance operational flexibility, and increase investor confidence. Recognising that each regulatory framework is different, this report provides recommendations on a number of key regulatory areas with the aim of serving as a guideline for regulators to identify the shortcomings of their own framework as compared to international best practices.

To encourage investment, the regulatory framework should be based on clear policy objectives, extend a light touch, maintain neutrality with respect to different technologies, and evince certainty and predictability in enforcement. [Chapter 2]

Improved rural coverage requires regulators to release sufficient spectrum, grant spectrum licenses that allow flexible use of new and emerging technologies, permit operators to trade spectrum as needed, provide a clear roadmap for future releases of spectrum, and auction off spectrum with the aim of boosting connectivity rather than as a technique for maximising the government's revenue from the sale. [Chapter 3]

Sector-specific taxes reduce the capacity for operators to invest in infrastructure. Expanded rural coverage needs predictable, transparent and as low as possible taxes and fees, with charges based on operators' profits rather than revenues to encourage reinvestment, whereby the government refrains from imposing import duties or infrastructural taxes that could distort or impede necessary investment. [Chapter 4]

A specific area that the authorities should consider is how best to reduce red tape for infrastructure investment, as this reduces the costs of deployment of a network. This would require ensuring consistency of regulations across municipalities, eliminating unfounded local bans on site deployments, and streamlining procedures for approvals and access to land. [Chapter 5]

Infrastructure sharing is another area for the authorities to consider. In addition to voluntary passive sharing of infrastructure as a proven technique for lowering investment and operating costs, regulators should allow voluntary active infrastructure sharing, including spectrum sharing, so long as market assessments show no risk of collusive or anti-competitive practices in service delivery. [Chapter 6]

Governments should first explore regulatory mechanisms to ensure that operators expand coverage on a commercial, market-led basis. Only after exhausting these mechanisms, governments should consider market interventions. Governments should then choose the most cost-effective policy of intervention, preferring less intrusive options that are more likely to achieve their objectives (e.g. coverage obligations or targeted subsidies) over more intrusive and complex interventions that tend to fail at the implementation level (e.g. Universal Service funds or single wholesale networks). [Chapter 7]

1 Introduction

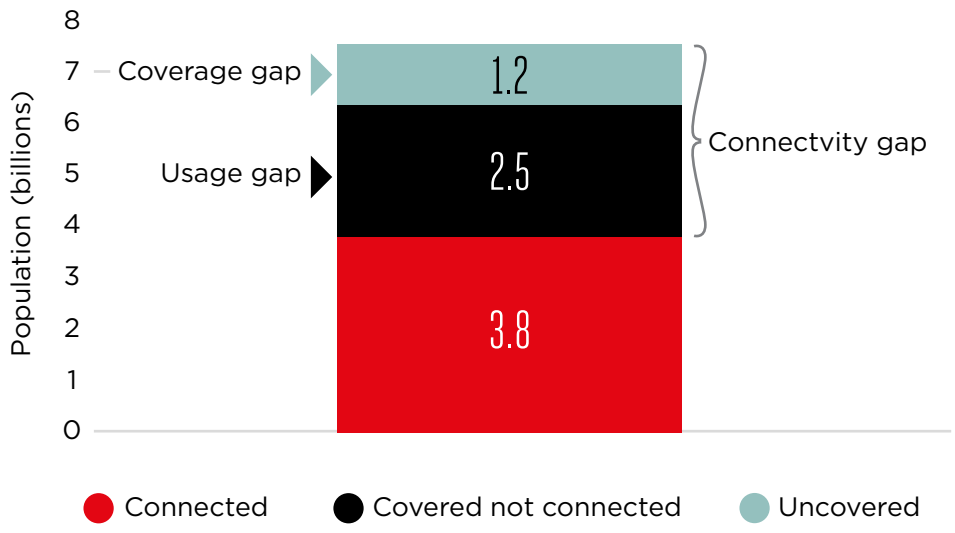
The connectivity gap

In 2017, the number of unique mobile subscribers reached the symbolic mark of 5 billion, with 3.5 billion of them using mobile networks to access the internet. Only last year, the GSMA recorded 350 million new mobile internet subscribers. This growth in mobile internet users is partly explained by the sustained infrastructure investments of mobile operators to upgrade and expand their networks: today half of the world's population is within the reach of a 4G network and 84% are covered by 3G.[1] Despite these achievements, there is a connectivity gap of 3.8 billion people who remain offline and excluded from participating in the digital economy and unreachable by e-government services.

The connectivity gap can be further categorised in two separate groups (see Figure 1). Those who are covered but not connected (usage gap: 2.6 billion) and those who are not covered at all (coverage gap: 1.2 billion). Closing the connectivity gap requires measures to enhance both the demand for mobile services to increase usage in areas where coverage is available, as well as measures to enhance supply to bring coverage to uncovered populations.

Figure 1

The mobile broadband coverage and usage gaps



Closing the coverage gap

The lack of coverage in rural areas is the consequence of a basic economic challenge: deploying infrastructure in remote areas can be twice as expensive, while revenue opportunities are as much as ten times lower, a combination that deeply affects the business case for MNOs to deploy infrastructure.[2] In other words, high prices of deploying infrastructure in rural areas, combined with a weak demand for mobile internet services in rural populations, result in a supply-demand equilibrium with low population coverage.

The challenge is not only to bring coverage to rural areas, but doing so in a commercially sustainable manner that ensures these networks are upgraded and maintained. Achieving commercial sustainability requires:

1. lowering the CapEx and OpEx of cell sites and infrastructure overall, thus increasing the RoI of extending coverage;
2. decreasing the risks of investing in mobile infrastructure (i.e. decrease cost of capital); and
3. enhancing demand for mobile services, therefore unlocking revenue opportunities that improve profitability and attractiveness of these investments.

This report focuses on the role that governments play in creating a favourable regulatory environment that enhances supply in order to close the coverage gap. However, the reader must keep in mind that supply and demand enhancing policies are complementary and mutually reinforcing.

Examples of governmental measures to enhance demand for MBB services include:

- Bring ICT into the school curriculum
- Literacy and digital skills education programmes in schools and public institutions
- Remove sector-specific consumer taxes on usage and handsets that affect affordability
- Connect schools to broadband to promote a better learning environment
- Support entrepreneurs and SMEs to develop local digital ecosystem
- Develop or strengthen e-government services.

MNOs are demonstrating the willingness of the industry to close the coverage gap by entering into active and passive infrastructure-sharing agreements that minimise the duplication of expensive infrastructure, thus reducing the risk and increasing the returns of investments in areas with low economic potential. Other initiatives include partnerships with technology providers to test innovative technologies that aim to reduce the upfront investments and operating costs of providing services in low- density areas.

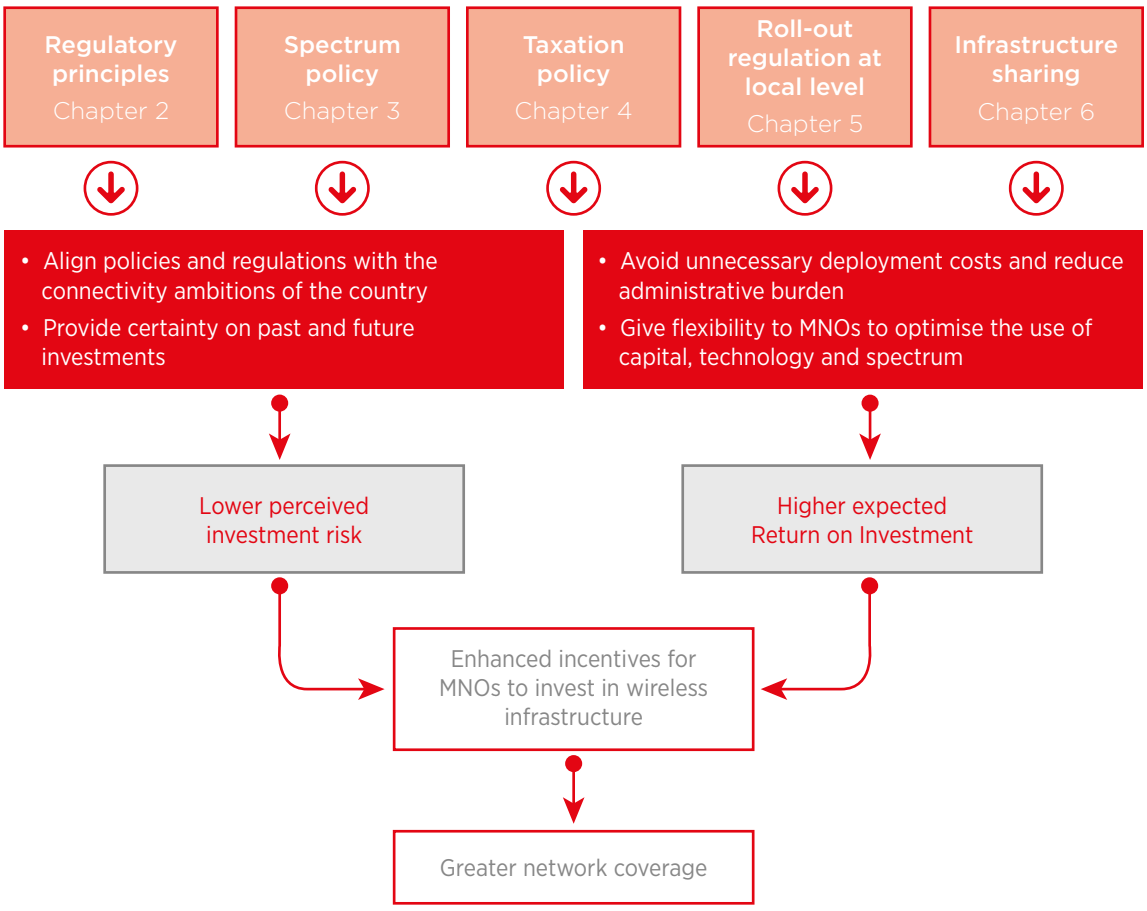
However, closing the coverage gap cannot be achieved by the industry alone. Governments should play their part by implementing policies and regulations that eliminate unnecessary costs, enhance flexibility, and increase investor confidence. Yet in many countries, the existing regulatory framework (i.e. the broad sets of regulations affecting the provision of telecommunications services) is inconsistent, outdated, and often misaligned with the objectives of the digital agenda.

Given these regulatory shortcomings, this report provides concrete recommendations to regulators and governments to create a regulatory framework that fosters the expansion of mobile broadband (MBB) networks to rural areas. Figure 2 summarises the policy areas covered in this report. The final chapter explores the alternatives to bring coverage beyond the point of commercial viability.

In the following chapters, the reader will find case studies that illustrate how countries around the world have enacted the regulatory and policy principles explored in this report. A combination of cases from developed and developing countries intend to provide a wide range of approaches that can serve as reference for countries who are currently facing the same challenge of connecting their rural populations.

Figure 2

Elements of a regulatory framework supporting investment in rural areas



2 Principles of an investment-friendly regulatory framework

Recommendation:

Regulation should be based on clearly defined policy objectives (including the promotion of competition, and a clear recognition of citizens' interests in investment in new and enhanced infrastructure), limited to the minimum necessary to attain those objectives, technology neutral, and should ensure regulatory predictability. These general principles should apply throughout and are especially important for policies that will lead to the expansion of rural mobile coverage.

An investment-friendly regulatory framework comprises both the adoption of regulation (e.g. laws, secondary legislation and guidelines) that complies with best practice, and the enforcement of such regulation by appropriate regulatory action by a responsible, well-funded, independent and competent authority cooperating well with other authorities that may have jurisdiction in overlapping areas (such as a competition authority).

Applying a consistent and stable regulatory approach to the enforcement of best practice regulation aimed at promoting investment over time is crucial to give investors the confidence needed to design sustainable business plans for new network roll-out in uncovered areas or upgrades in the existing coverage footprint.[3] This in turn also protects competition and consumers' interests by ensuring that consumers only pay for efficient investment that is required to deliver mobile broadband services.[4]

First, regulation should be based on **clear policy objectives.** These objectives should include (at a minimum) the promotion of

(a) sustainable competition;
(b) citizens' and consumers' interests; and
(c) investment and innovation in new and enhanced infrastructure.

These policy objectives should not just be declarations of good intention. The design of regulation should logically follow the objectives. For example, regulation should permit voluntary cooperative arrangements between network operators investing in new infrastructure and parties seeking access to it, in order to diversify the investment risks, whilst ensuring that competition in the market is preserved and the principle of non-discrimination is respected.[5] Good regulatory action should mean taking all reasonable measures (or reasonably abstaining from taking any measure) to ensure the achievement of these objectives.[6]

In other words, the pursuit of these objectives should be a key element of regulatory action and assessed using a balanced approach on a case by case basis.[7] For example, balancing the promotion of sustainable competition and investment means that if, in the context of regulation that permits infrastructure sharing on a voluntary basis, the regulator nevertheless intends to impose sharing obligations, it should only do so after taking appropriate account of the investment risks incurred by the network operators.

Second, regulatory action should be **"light handed"** – i.e. limited to the minimum necessary to meet its objectives. Intrusive sector specific regulatory action should indeed be an exception in an economic framework that is fundamentally based on the operation of market forces. A first application of this principle is the roll-back of ex ante obligations as market competition develops and ultimately for the sector to be subject only or mainly to ex post competition law.[8]

Third, in order to make regulation future proof in an environment that is characterised by constant and rapid technological change, regulation should be **technology neutral.**[9] Mobile technology deployment should be left to market forces, without mandating any particular network standard or restricting the use of a particular technology. Technology-specific regulation can have negative effects for both the industry and consumers. By contrast, technology-neutral regulation allows operators to offer a range of services with their choice of technologies, including multiple technologies side-by-side and a resulting higher mobile broadband penetration.[10] Regulatory action must also follow the principle of technology neutrality. The fact that, due to historical reasons, a regulator may only have jurisdiction to regulate a sector does not excuse that regulator from conducting a proper market assessment that takes into account all substitutable products and services. Failure to do so may result in regulatory action against a set of competitors, whilst another set of competitors can operate outside the regulatory framework.

Finally, certainty and predictability of regulatory action is a key issue in a sector requiring high investment in rolling-out new and enhanced infrastructure to provide mobile broadband services.[11] The approach to regulatory action and the terms and conditions imposed (e.g. for access to the infrastructure, spectrum, interconnection fees) should be consistent over appropriate review periods, in order to provide investors with the certainty needed to make the investments.

This does not mean inflexibility. Existing regulatory obligations should be subject to periodic review (e.g. every five years[12]) in order to keep them up-to-date with technological and market evolution and in order to ensure that they continue to be proportionate to the objectives to be achieved. In this way, regulatory action can take into account, on the one hand, the fact that amortisation of an investment in new infrastructure is spread out over a number of years and a longer period than other investments and, on the other hand, that changes in the marketplace can be properly factored in. The principle implies that, for example, even if the level of tariffs imposed upon a company with significant market power would not stay identical over a review period, the underlying approach to regulation would remain the same.

Best practices in ensuring predictability of regulatory action include the use of regulatory impact analysis (incorporating competition assessment), the systematic consideration of less intrusive alternatives (self-regulation or ex post intervention on competition law grounds), wide public consultation, and improved accountability arrangements in the review of existing regulations and development of new ones (see Box 1: Best Practices for Ensuring Predictability of Regulatory Action).

Box 1: Best practices for ensuring predictability of regulatory action[13]

- **Openness and transparency:** Regulation and regulatory measures should be proposed through an open and transparent process that, to the extent feasible, promotes accountability and participation of citizens and stakeholders, with adequate time, opportunity, and tools (including the Internet) for stakeholders' input and public comment at appropriate stages of the policy preparation process in advance of their final adoption.
- **Based on a cost-benefit analysis:** Regulatory measures should be proposed only after an impact assessment process of relevant alternatives. This impact assessment should include the assessment of non-regulatory options where feasible and applicable, including a "do-nothing" option. This impact assessment should be carried out in a transparent way prior to the adoption of a regulatory measure, should be based on the best available evidence, and the depth of the analysis should be commensurate with the significance of expected impacts. All factors (both quantitative and qualitative) should be considered, including potential economic, environmental, public health and safety, social, and distributive impacts, as well as the degree and nature of the risks involved.
- **Proportionality:** Regulatory measures should aim to avoid imposing unnecessary burdens on society, consistent with achieving regulatory objectives, and to minimise adverse impacts on citizens and business. These measures should aim to avoid unnecessarily divergent or duplicative requirements, where appropriate.
- **Periodic review:** Existing regulatory measures should be evaluated on a periodic basis through a transparent procedure and, to the extent feasible and appropriate, should be modified, expanded, simplified, or repealed in light of what has been learned in the evaluation, taking into account technological, market and legislative changes. Citizens and stakeholders should be able to provide input in these evaluations.

3 Coverage as a key driver of spectrum policy

Recommendation:

A spectrum policy that aims to improve coverage in rural areas should create incentives for MNOs to invest in network infrastructure by: 1) releasing sufficient spectrum; 2) following an established roadmap; 3) allowing for secondary spectrum trading; 4) using licences that are technology-neutral; and 5) setting auction reserve prices at modest levels.

To design a spectrum policy that supports a government's coverage ambitions, regulators need to understand the mechanisms through which spectrum policy affects the incentives of MNOs to invest in network infrastructure. This section explores five components of spectrum policy and illustrates how these mechanisms operate in each case. These five components are summarised in Figure 3.

Sufficient spectrum

The spectrum used for mobile communications can be grouped into two broad categories: the coverage bands for frequencies below 1GHz and the capacity bands for frequencies above 1GHz. This classification is based on the physical properties of these bands: lower frequencies suffer less attenuation and penetrate walls better, while a greater availability of frequencies above 1GHz allows regulators to license larger portions of spectrum and thus carry more capacity (see Figure 4).

Holding sufficient spectrum in coverage bands allows operators to improve network availability in rural areas because:

1. Operators can cover wider areas using fewer sites. For example, according to the ITU, using 900MHz allows operators to cover from 2 to 2.7 more area than using 1800MHz.[14] As a result, operators will be able to cover more population with a given amount of CAPEX.
2. A positive RoI (Return on Investment) of rural sites creates the incentive to deploy in rural areas. The RoI of deploying a new site increases with the number of people covered by that site. In rural areas where population density is low, low frequencies allows to cover enough potential customers to ensure the commercial viability of the site, creating a natural incentive to deploy in these areas.

Figure 3

Features of a spectrum policy conducive to network expansion

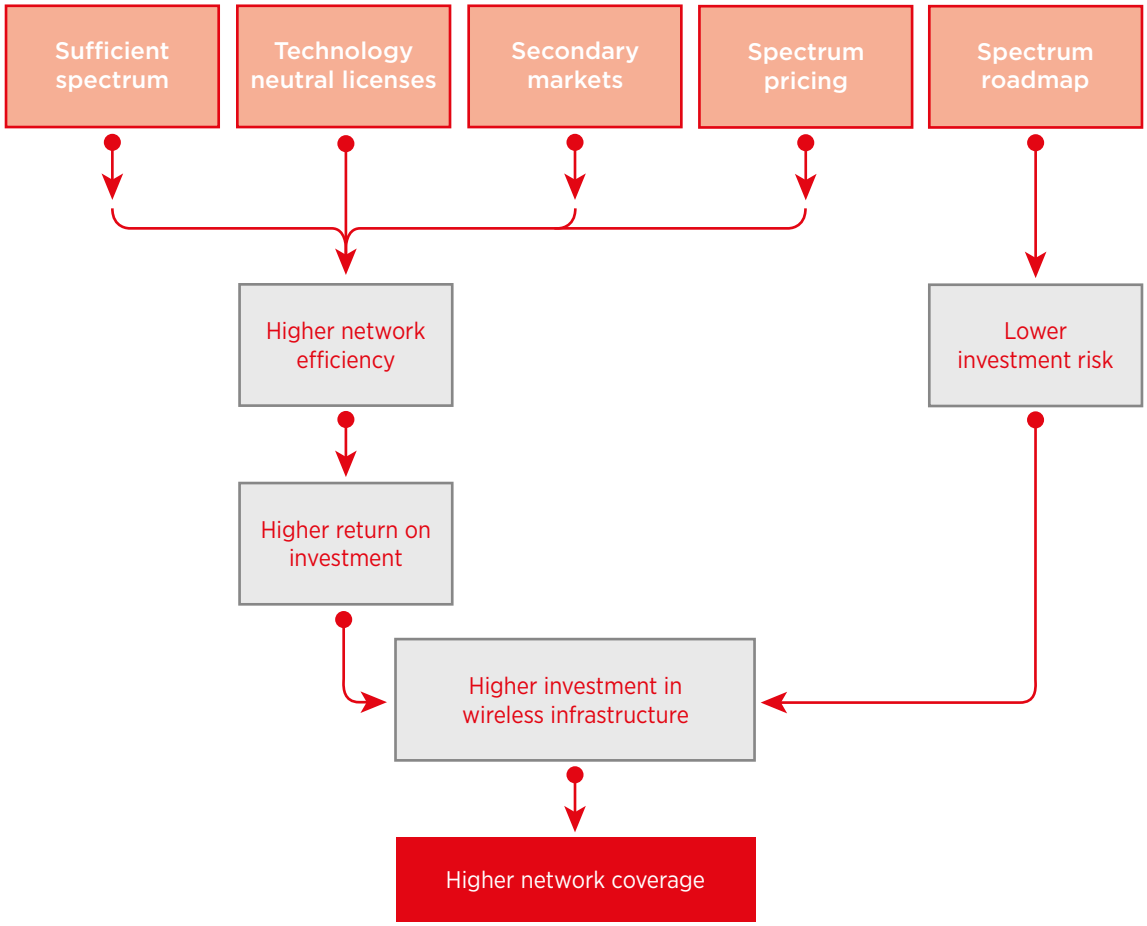
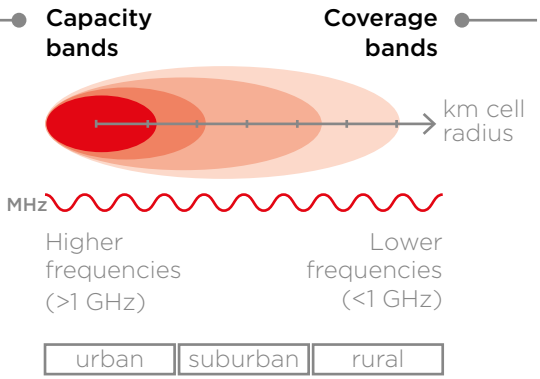


Figure 4

Characteristics of coverage and capacity spectrum bands

Higher frequencies (>1 GHz) are primarily used by mobile operators to cover urban and suburban areas where data traffic is dense and substancial network **capacity** is required.



Lower frequencies (<1 GHz) provided extended **coverage** at lower cost as fewer base stations are required to achieve greater geographic coverage.

These coverage bands are ideal for use in rural areas, while they also help to improve indoor coverage in urban areas.

The global trend (see Figure 5) of reallocating digital dividend spectrum (600, 700 and 800 MHz bands) for mobile services shows that regulators worldwide have acknowledged the importance of providing enough spectrum on coverage bands. The low frequencies of digital dividend spectrum are ideal for covering large areas with a low number of sites, and clearing and releasing this spectrum is crucial for MNOs to provide coverage in rural areas in an economically sustainable way.

Figure 5

Digital dividend spectrum assignment map

Unfortunately, a number of developing countries that most need to release spectrum fail to do so, perhaps in the misguided belief that hoarding the spectrum could increase its selling price at subsequent auctions. For example, Bangladesh uses only four of the ten spectrum bands, totalling just 309 MHz of 780 MHz, that the ITU has standardised for mobile applications in Asia Pacific.[15] Other countries in the region, such as Pakistan and Thailand, have also failed to release most of their assigned spectrum, which has resulted in lower levels of mobile development, compared to other countries (such as Singapore and Malaysia), which have double the amounts of spectrum available for mobile use. Unused spectrum and delayed release of spectrum represent a wasted resource to society.

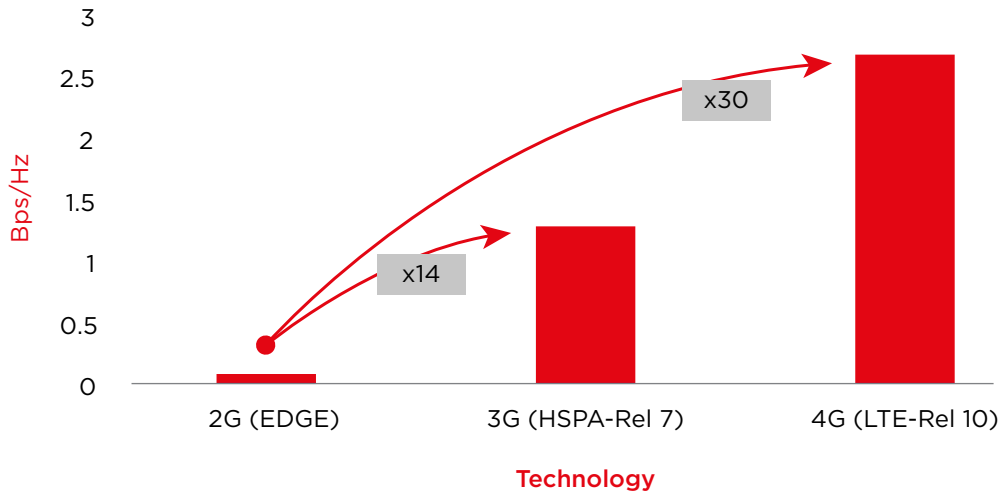
Technology-neutral licences

As mobile technologies evolve they become more spectrum efficient, enabling MNOs to make better use of spectrum. Technology-neutral licences give MNOs the flexibility to use the technology that best suits their needs and introduce new technologies that enable new and better services to their customers in urban and rural areas. The gain in spectrum efficiency achieved by introducing new technologies can be substantial (see Figure 6 on spectral efficiency), allowing operators to increase the capacity and coverage of existing and new cell sites. The benefits of technology neutrality were well illustrated in a declaration by the French regulator as it introduced technology neutrality in the 1800 Mhz band:

> "The lift of restrictions in the 1800MHz band will allow the reuse of already deployed sites to offer LTE services and contribute to the development of a more efficient investment. It will also allow all MNOs to offer better quality and coverage of MBB services."[16]

Figure 6

Spectral efficiency of mobile technologies[17]



Regulators often delay the migration towards technology-neutral licences with the aim of pushing MNOs to buy new licences, thus increasing the government's revenue. This short-term vision prevents MNOs from using spectrum efficiently, delaying investments, and effectively destroying value for consumers that could benefit from greater capacity and coverage.

However, regulators must be aware that introducing technology neutrality to existing licences can affect the competition dynamics in the market and create imbalances among operators. In this case, an adequate competition assessment and stakeholder consultation process are needed prior to changing the licence regime to ensure a positive long-term effect on the market.

Clear spectrum roadmap

As discussed throughout this section, the business plan of MNOs is closely linked to the availability of spectrum and the conditions under which it is made available. Therefore, lack of information regarding the government's intentions to release and renew spectrum creates an uncertain financial future for MNOs. Having a roadmap that describes the government's spectrum strategy reduces uncertainty by allowing MNOs to assess the long-term value of their infrastructure investments. By releasing this roadmap, governments can help to reduce risk for MNOs and have a positive impact on their network investment decisions.

A similar logic applies to licence renewals and the duration of licences. Short licence duration creates uncertainty on the long-term return of infrastructure investments, making these investments less attractive, especially towards the end of the licence term.[18]

A comprehensive spectrum roadmap should include a:[19]

- Assessment of the current use(s) of spectrum and identification of spectrum that could be reallocated;
- Schedule for future releases;
- Framework for spectrum allocation and pricing procedures;
- Timing and process for spectrum renewal decisions; and
- Plan for licence conditions changes, such as technology neutrality or secondary markets.

Spectrum pricing

Governments should avoid the temptation to use spectrum auctions to maximise revenue. Instead, governments should allocate spectrum with the aim of fulfilling their connectivity objectives. Whereas the spectrum is allocated by auction or beauty contest, spectrum should be allocated to the actor who values it the most (i.e. actor willing to make the necessary network investments to maximise the use of that spectrum). High spectrum prices and fees increase the costs of MNOs which are ultimately paid by consumers affecting primarily the affordability of mobile services in rural areas. Furthermore, using spectrum to maximise government's revenue can result in spectrum going unsold after an auction. In this case, the spectrum would remain unused, causing an irrecoverable loss of commercial and public value.

For spectrum auctions, regulators should set reserve prices below a conservative estimate of market value to ensure scope for competition and price discovery in the auctions. A reserve price at a modest, but non-trivial, level will deter frivolous entry of non-competitive firms while ensuring that winners pay at least the "opportunity cost" of having denied the next-best use for the spectrum, such as in TV broadcasting, for the 700 MHz band. Award rules for auction winners should also not put a competitor's enterprise value at risk in ways where an auction winner could foreclose future competition. Bidders compete for spectrum with an eye to their competitive position. A regulator, therefore, should not permit any auction result that, for example, enabled one competitor to take over spectrum bands that may be essential for others to compete for customers with newer 4G or 5G technologies. Pricing rules—whether by auction or beauty contest—should also offset any onerous coverage obligations with commensurate concessions via a discounted final price.[20]

Secondary markets

Secondary spectrum markets allow MNOs to buy or lease spectrum from each other via commercial arrangements. This added flexibility results in a more efficient use of spectrum, since spectrum can be transferred to the actors that value it most at any given time.[21] This gain in efficiency can have direct impact on coverage, by transferring the spectrum to actors willing make the necessary investments to make a better use of the available spectrum.

While the transaction costs for trading spectrum should be kept at a minimum, it is important to ensure oversight of the spectrum transactions to avoid spectrum concentration that could lead to spectrum hoarding and lead to anticompetitive behaviour.

3.1 Case Study: Sweden

Sweden has a reputation for being an early adopter of new communication technologies. One telling example is the launch of 4G: in 2009, Sweden and Norway were the first two countries to launch commercial LTE networks, roughly one year before any other country in the world. Today, 4G coverage in Sweden reaches 99% of the population[22] despite being one of the least dense countries in Europe and the world.

Part of this success can be attributed to a forward-looking spectrum policy that has provided a **transparent, flexible, and predictable** environment for investing in infrastructure. As the Swedish regulator's (PTS) General Manager stated, "with **transparent and predictable spectrum management, we can create good conditions for investment,** technological development and innovation, legal stability and the efficient use of spectrum."[23]

This transparency and predictability is embodied in the Spectrum Strategy published by PTS, which contains a short- to medium-term strategic plan for spectrum management[24] and a roadmap for future spectrum releases.[25] This Spectrum Strategy is structured around the guiding principles of PTS's spectrum policy. The first of these principles states that "PTS will enable the development of radio-based electronic communication services and other services based on radio communication through **sufficient availability of spectrum**."[26] As part of this principle, PTS states that it will "**increase the availability of useful spectrum** by setting the **least restrictive conditions**, working for international harmonisation, **assigning spectrum at a rate appropriate to meet demands**, and **promoting secondary trading**." These statements highlight the importance PTS places not only on timely release of spectrum, but the flexibility to allow spectrum to be used efficiently.

The licence conditions of the 800 MHz spectrum auction are a good example of how these principles are being applied. The spectrum was awarded in 2011 for a **period of 25 years** using **technology and service-neutral licences**, i.e. allowing licence holders to choose the service they want to offer and use their preferred technology (within certain restrictions). Moreover, licence holders could deploy different technologies across different geographical areas and could change them over time.[27] Another important feature of the auction was that only one of the five frequency blocks included coverage obligations. The reserve price of this block differed from the others in that it subtracted a fixed amount of capital from the final price, same amount that the licence holder committed to invest to cover the remote areas designated by the regulator. With this approach, PTS limited market distortion by only imposing coverage obligations on one licences and avoided costly duplication of infrastructure in remote areas, while **securing investment for coverage**.

3.2 Case Study: Myanmar

With assistance from the ITU, Myanmar has one of emerging Asia Pacific's most flexible and dynamic approaches to the licensing and management of spectrum to easily accommodate convergence. Myanmar has allocated spectrum by beauty contest rather than by auction and permits unified licensing, spectrum sharing, spectrum trading, and in-band migration.[28] It also has technology-neutral licenses and has followed the best practice of spectrum harmonisation.

As part of a process to liberalise its telecommunications sector, in June 2013, the Myanmar government awarded Telenor and Qatar's Ooredoo mobile licenses to compete with the majority-state-owned incumbent, the Myanmar Posts and Telecommunications (MPT). In early 2014, after the passage of a new telecommunications law, each new operator got its 15-year license, with 10-year renewal, to operate MPT's formerly controlled, 2 x 5MHz bands (at 900 MHz frequency) and 2 x 10MHz (at 2100 MHz frequency) for a modest fee of USD 500 million per operator.[29]

As a result of pricing spectrum to expand coverage rather than to maximise revenue from an auction, Myanmar has leapfrogged other emerging markets to deploy 4G services despite late liberalisation of the market. Mobile services rapidly expanded to reach most of its 54 million citizens from just 6% mobile coverage in 2012. To ensure future growth, in April 2016, the Myanmar government published its 5-year roadmap for unassigned portions of the 850/900 MHz and 2100 MHz bands, as well as the 700 MHz, 1800 MHz, 2300 MHz, and 2600 MHz bands.[30]

Although Myanmar did not refarm any of MPT's wide-coverage 450 or 800 MHz bands to new entrants Telenor and Oredoo, the competition in the coverage band of 900 MHz prompted MPT to broaden its services in the other coverage bands, as Telenor, in particular, rapidly approached market parity with the incumbent. The low upfront cost, guaranteed tenor of spectrum licenses, and a clear roadmap for future spectrum releases, gave Telenor and Oredoo the confidence to invest rapidly in the expectation of gaining market share in what became one of the world's fastest growing telecom markets.

4 A taxation policy that fosters investment in rural areas

Recommendation:

Implement a tax policy that maximises the capacity and incentives of MNOs to invest in network infrastructure. An investment-friendly tax policy should: 1) eliminate sector specific taxes that distort the market; 2) encourage reinvestment by estimating tax payments on profits and not revenues; 3) include direct incentives to invest in rural areas such as import duties exemptions; and 4) reduce complexity and uncertainty in tax levels as a way to increase investor confidence. It should also be enforced in a non-discriminatory manner.

In support of the goal of extending connectivity worldwide, reducing sector-specific tax and fee payments could have material impacts on connections. In competitive markets, a proportion of the tax and fee savings may be passed through to consumers through lower prices. Improving affordability may contribute to extending both the number of connections and the volume of mobile usage. Furthermore, more affordable services will enhance demand in low-income rural areas, which will improve the attractiveness for operators to extend coverage to these areas.

In addition, extending connectivity to empower those on lower incomes and reduce poverty has become an increasingly important global goal for the international community. Reducing the number of the unconnected may also have additional impacts across the economy in terms of social and economic development.

Extending connectivity has the potential to deliver economic and fiscal benefits. Multiple studies by the GSMA suggest that by expanding the user base and usage of services, tax and fee reductions could be achieved while maintaining tax neutrality in the medium-term. By reducing sector-specific taxes and fees on the mobile sector, governments can not only increase digital inclusion and economic growth, but also recover higher tax and fee revenues through more efficient and broad-based taxation in the long run.

The level of taxation directly affects mobile operators' financial ability to invest in infrastructure and coverage, while tax complexity and uncertainty may also affect future investment incentives and ease of doing business in the region:

- With frequent tax changes, returns on investment are less certain and investment may be deterred,

especially where significant upfront investments may need to be recovered over a long time period, as in the mobile sector.

- Fees on revenues rather than profits may discourage investment and innovation, as these fees require the same payment from an operator regardless of whether it retains its profit or uses it to invest in new infrastructure and services.
- Taxation on infrastructure and duties on importing network equipment can act as a significant barrier to investment in networks by directly increasing the cost of equipment. This can reduce the business case for upgrading and extending coverage through new infrastructure investment, which can be particularly detrimental for unconnected areas.

Based on the best practice principles set out, among others, by the IMF, and evidence from a series of studies, as well as on consultation with the GSMA and mobile operators, a number of areas for tax reform have been identified which could support the connectivity agenda of governments and international organisations:

1. Reduce sector-specific taxes and fees: Those taxes and fees that are charged exclusively to the sector over and above general taxation may create economic distortions, potentially affecting service prices and investment levels. Reducing these sector-specific taxes has the potential to lead to increases in coverage, penetration and usage. Figure 7 shows this negative correlation between sector specific taxes and the Mobile Connectivity Index score in Sub-Saharan African countries. By extending the user and tax base, reductions in taxation could have a neutral or positive impact on government revenues in the medium to long term. Phased reductions of sector-specific taxes and fees can represent an effective way for governments to signal their support to the connectivity agenda, to benefit from economic growth resulting from the reductions, and to limit short-term fiscal revenue losses.
2. Reduce complexity and uncertainty of taxes and fees on the mobile sector: Uncertainty over future taxation reduces investment as the risk of future tax rises is priced into investment decisions and can therefore reduce investment in the medium-term. In addition, numerous sector-specific fees, often levied on different tax bases, raise compliance costs for mobile operators. Governments could seek to limit unpredictable tax and fee changes and to streamline how tax and fees are calculated. A predictable and properly enforced tax environment is also key: tax concessions, denied deductions of genuine business expenses, and arbitrary assessments increase uncertainty.

Figure 7

Comparison of the rate of sector specific taxation and the connectivity level in Sub-Saharan countries[31]

5 Reducing red tape to deploy infrastructure

Recommendation:

National authorities should play an active role in reducing the complexity of regulations and administrative processes to deploy infrastructure. To achieve this, they should elaborate guidelines that ensure consistency, simplicity, and rapid implementation of regulations across local governments on: planning regulations, health and safety regulations, permits and approvals processes, and access to land and infrastructure.

Mobile networks are designed at the national level to provide a consistent service quality across a country's territory. However, these networks are built locally, which means MNOs must comply with the rules and regulations enforced at the local level (by regional, state or municipal authorities) when deploying, maintaining, and upgrading their network infrastructure. An overly strict set of rules that is not proportional to the objectives it is trying to achieve, as well as complex and lengthy permit approval process, limit the ability and increase the costs for MNOs to deploy new sites. This is especially the case when these rules are inconsistent across local governments, mainly because:

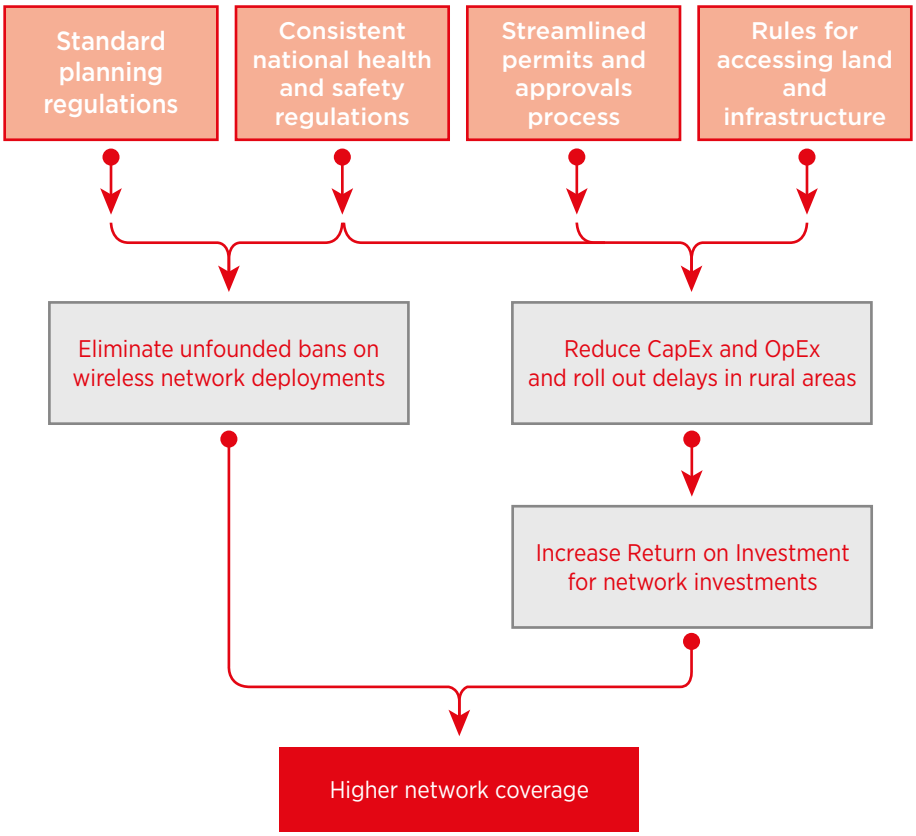
- Having heterogeneous regulations prevents MNOs from streamlining their deployment processes at the national level;
- Local governments often lack the technical expertise available at the national level to guide regulatory design, which may result in ill-conceived regulations;
- Local governments sometimes engage in rent-seeking or vote-seeking behaviour that produces regulations out of alignment with the national digital agenda;
- Local governments may impose arbitrary charges and levies for site approvals that increase the costs of building new sites.

Standardising rules does not mean that local governments should be excluded from regulating the deployment of infrastructure within their territory, rather, it means there should be a common national framework for them to follow. Failing to provide a consistent framework increases the costs of deploying and operating cell sites in areas with overly strict regulations. These extra costs can offset the revenues in rural areas where profit margins are low, preventing MNOs from providing services in those areas (Figure 8 illustrates the impacts of administrative policies on network coverage).

When standardising deployment regulations, central authorities should not limit their focus to producing recommendations and best practices. Ensuring implementation of those best practices requires mechanisms to incentivise local governments to adopt those guidelines. Failing to create these adoption incentives will severely limit the positive effects of these guidelines.

Figure 8

Measures to reduce red tape at the local level



Eliminating unfounded bans on wireless network deployments

Health and safety or visual concerns of local communities sometimes create opposition to the deployment of new cell sites. This opposition often results in local authorities imposing stricter regulations than those recommended at the national or international level, increasing the costs of providing coverage in those areas, and in extreme cases, banning the deployment of new sites. In some countries, these overly strict regulations might come from the national authorities themselves.

Research on the impact of wireless networks on human health has resulted in a set of precautionary measures and guidelines to limit exposure to radiofrequency (RF) radiation.[32] It is the responsibility of central authorities, which are normally better equipped to evaluate these technical guidelines, to establish national rules for RF exposure limits and compliance mechanisms.[33] Local governments (or the pertinent approving body) should refer to these guidelines to ensure the safety of cell sites when processing deployment permits.

Reducing the costs of deploying wireless network infrastructure

There are two main ways to reduce administrative costs of deploying new sites: 1) improve the efficiency for granting permits; and 2) improve coordination across infrastructure sectors to avoid duplicating costs.

Delays in obtaining construction permits represent a cost for MNOs in terms of lost revenue. In Latin America, for example, the average permit approval process exceeds six months, and can reach to more than two years for certain countries or municipalities.

National authorities can improve the efficiency of permit approvals by setting a:

- clear set of building regulations;
- standardised process for permit approval that includes a list of information requirements and a mandatory decision period;
- simplified approval procedure for upgrading or sharing infrastructure;
- single information point for permit granting, Transparency, rights of way, and dispute resolution for infrastructure deployment; and
- clear criteria on low impact facilities that can be installed without the need to obtain local planning approval.

Promoting coordination across the different infrastructure sectors reduces costs by avoiding the duplication of expensive passive infrastructure. Improving coordination can be achieved by:

- Pursuing mapping initiatives of relevant infrastructure including existing fibre and ducting infrastructure and make this data available through a single information point. To support inclusive mobile broadband coverage, reliable and valid information on existing infrastructure and broadband services is crucial and enables operators to optimise their investment in passive infrastructure;[34]
- Imposing a general obligation to make advance notifications of planned civil works. This allows mobile operators to share the work of deploying infrastructure with other public or private players and reduce their costs.

Reducing the ongoing costs of providing mobile services

The ongoing costs of operating a cell site include renting land, securing the premises, and powering the equipment, among others. Some of these costs can be especially high in rural and remote areas where there is little existing infrastructure. Governments can play an active role in reducing these costs by elaborating national rules and guidelines that:

- promote access to public buildings and public land;
- provide a standardised set of procedures and requirements to access that land;
- ensure that rental prices are based on the administrative costs incurred; and
- facilitate access to energy sources when available.

The cost of building a classic macro-cell in rural areas is usually above USD 150,000, as it requires significant work to build a foundation to support large towers that can cover a wide area. Moving these towers can be extremely expensive, which weakens the position of MNOs when renegotiating a land tenancy agreement and can lead to opportunistic behaviour on the part of the landlord, which is usually the municipality itself. By providing a clear set of rules to facilitate access to public land at fair prices, national governments can reduce this opportunistic behaviour.

Box 2: Best practices in reducing red tape in the deployment of wireless network infrastructure[35]

Central authorities

- Provide standardised national procedures for antenna permits.
- Define a simplified process for modifications to existing sites, site sharing and co-location, and small cells.
- Define national notification and consultation requirements.
- Define national requirements to assure compliance with relevant health and safety regulations and separate health and safety compliance from town planning.
- Provide an independent appeal process.
- Provide national guidance on visual integration for infrastructure.
- Provide consistent content for public information materials on health and safety considerations of mobile network antennas.
- Prohibit the unfounded imposition of zones that exclude mobile network antenna sites.
- Facilitate access to land and infrastructure (public buildings, electricity, backhaul, and backbone) for MNOs.
- Pursue mapping initiatives of relevant infrastructure and make this data available through a single information point.
- Imposing a general obligation to make advance notifications of planned civil works.

Local authorities

- Implement efficient processes for handling construction permits for mobile network antenna sites, consistent with the national framework.
- Defer to national agencies on expertise, policies, and technical requirements.
- Follow national health and safety policies for approving permits.
- Where community members express concern, support local engagement between stakeholders.

5.1 Case Study: Colombia

In Colombia, as in most countries in Latin America, municipal governments enjoy a high degree of legal autonomy over land use, rights of way, urban planning, and even tributary regimes. Municipalities have control over the issuing of permits to deploy mobile network infrastructure, as well as defining the legal requirements and application processes operators must follow to apply for permits.

Colombia has 1,122 municipalities, many of which have their own set of regulations. In some municipalities, the regulations for deploying infrastructure are so stringent that operators are unable to deploy more sites to cope with the growing demand. These stringent regulations have created uneven coverage and service quality across different municipalities, despite the efforts of operators to deploy new infrastructure in these areas.

In response to these challenges, and in line with its digital agenda, Colombia's government has taken several steps to standardise regulations for obtaining permits and eliminate the barriers to deploying infrastructure:

- In 2009, the government created a law that obliges regional and local governments to take all necessary measures to facilitate the deployment of infrastructure.[36]
- In 2012, the Communications Regulations Commission (CRC) and the National Spectrum Agency (ANE) issued a set of guidelines that described best practices in visual integration, health and safety, and listed the requirements and processes for issuing new permits.[37]
- The National Development Plan 2014–2018 obliges municipalities to identify the barriers to deploy infrastructure and adopt measures to remove them.
- In 2015, the ICT ministry and attorney general's office issued a joint memorandum to remind municipalities of their legal duties to comply with the law on the National Development Plan 2014–2018.

Despite the goodwill of central agencies, progress has been slower than expected, with a limited number of municipalities that have adopted the recommendations and complied with these laws. This lack of compliance suggests that the problem is not solely a lack of technical capacity at the local level, but that municipalities lack incentives to comply with the regulations.

Given the constitutional autonomy of municipalities, it seems unlikely that any legal procedure would be effective in forcing them to adopt the regulations elaborated by the central government. Instead, central agencies are exploring other approaches to create incentives for municipalities to voluntarily comply with the new regulations.

The case in Colombia shows that, while elaborating guidelines and best regulatory practices is an essential first step, central agencies need to think further into how to implement them. Achieving homogeneous regulatory practices across municipalities will require the central agencies to create incentives that generate high levels of voluntary compliance.

Similar cases can be found in other parts of the world. One example is the Philippines, which has one of the lowest- cell-site densities in Asia, resulting in a lack of rural infrastructure and LTE download speeds that are barely half the global average and among the slowest in Asia.[38] This is in part explained by the difficulties that operators face to deploy infrastructure, where in some areas operators need to secure more than 25 permits to deploy a cell-site, leading to operators having hundreds of sites waiting for approval at any given time.[39] Recognising this problem, the government is working on a new law that would establish a one-stop, business-facilitation service for electronic submission of forms and automatic approvals when delays due to local governments' inaction exceed one month.[40]

5.2 Case Study: OECD Report on Red Tape in Greece

The case for reducing red tape in telecommunications is well established. In 2014 the OECD published a detailed analysis [41] of measures that Greece could take to reduce red tape in 13 economic sectors (including telecommunications). In the report, the OECD considered the measures for implementation in the telecommunications sector to be of "intermediate priority."

Table 1 below lists these recommendations in the telecommunications sector, together with the reduction in administrative burdens for MNOs that the OECD estimates will follow implementation. The cumulated savings from implementing these reforms are equivalent to 5.1% of the 2013 CAPEX for all the MNOs in Greece.

The case shows the importance of being specific when considering red tape measures: governments should carry out a preliminary assessment of the hurdles that affect operators seeking permits to expand connectivity. Once these have been identified, the

solutions will depend on the available systems for centralisation and e-Government communications, as well as modifications of the relevant regulations. The OECD report explains in detail the calculations of the reductions in administrative costs and burdens. In addition, a reduction in red tape has the potential to boost the economy. Since telecommunications infrastructure underpins the economy and is the bedrock of a digital economy, the advantages of undertaking a thorough analysis and identifying options become clear.

In Greece, as in many other countries around the world, a recurrent issue faced be operators is the relationship between central government and localised institutions (at the city level or, in a federal state, between the federal government and the state government). Australia provides an interesting example of centralised legislation that allows for operators to install certain facilities without the need to obtain local planning approval. The OECD report on Greece quotes this example and adopts it as a recommendation for Greece:

> "... under Australian Government legislation carriers are permitted to install "low-impact facilities" without the need to obtain local government planning approval. Low-impact facilities are those that are considered essential to maintaining telecommunications networks, but are of low visual impact and unlikely to cause significant disruption to the community during installation or operation. They include, but are not limited to, telecommunication towers less than 5 metres high attached to buildings, underground cabling and in-building subscriber connections."[42]

Table 1

Administrative costs savings from implementing OECD recommendations

Recommendation	Yearly savings on administrative burdens for MNOs	As a % of 2013 CAPEX of MNOs in Greece**
"Centralisation" of the application process for mobile base stations and fixed network permissions*	EUR 2 079 277	0.8%
Connection of all competent authorities to the electronic application system (SILYA)*	EUR 606 563	0.2%
Reduction of the need for modification of base station permits and certifications of completeness	EUR 1 826 305	0.7%
Establishment of an 'electronic one-stop-shop' for right of way application process*	EUR 2 085 703	0.8%
Setting of Accepted Technical Standards in order to reduce required documentation for fixed telephony network expansion projects	EUR 2 498 877	0.9%
Identification of "low-impact projects" requiring simpler approval process or no approval for right of way	EUR 4 600 113	1.7%
Total	**EUR 13 696 838**	**5.1%**

* The overall reduction obtained depends on the sequencing of recommendations. Those recommendations marked with * should be implemented first for maximum impact.

** CAPEX estimated using GSMAi data.

6 Infrastructure sharing

Recommendation:

Active and passive infrastructure sharing should be allowed under primary legislation and encouraged by regulators on a voluntary basis. There should be no regulatory bias against active sharing, subject to safeguards under competition rules supported by evidence-based market assessments.

Network sharing can be broadly classified into four categories (see Figure 9):[43]

- **Passive (mast or tower) sharing** – the sharing of the physical mast. Each operator provides separate backhaul equipment, antennas, etc. It can also include the sharing of the energy equipment.
- **RAN sharing** – the sharing of the entire Radio Access Network (RAN), including the site, mast, antenna, base transceiver station (BTS or NodeB), backhaul and base station controllers (BSC or RNC).
- **RAN sharing with spectrum pooling** – the sharing of the RAN plus the sharing of the spectrum held by each operator.
- **National roaming** – when a mobile customer uses a network not provided by their operator.

Mast and site sharing are known as passive sharing. RAN sharing, spectrum sharing or national roaming are known as active sharing. National roaming allows two operators providing services in the same country to share the load of covering a geographical area by allowing their customers to roam between networks, even if there is no co-ownership of infrastructure.

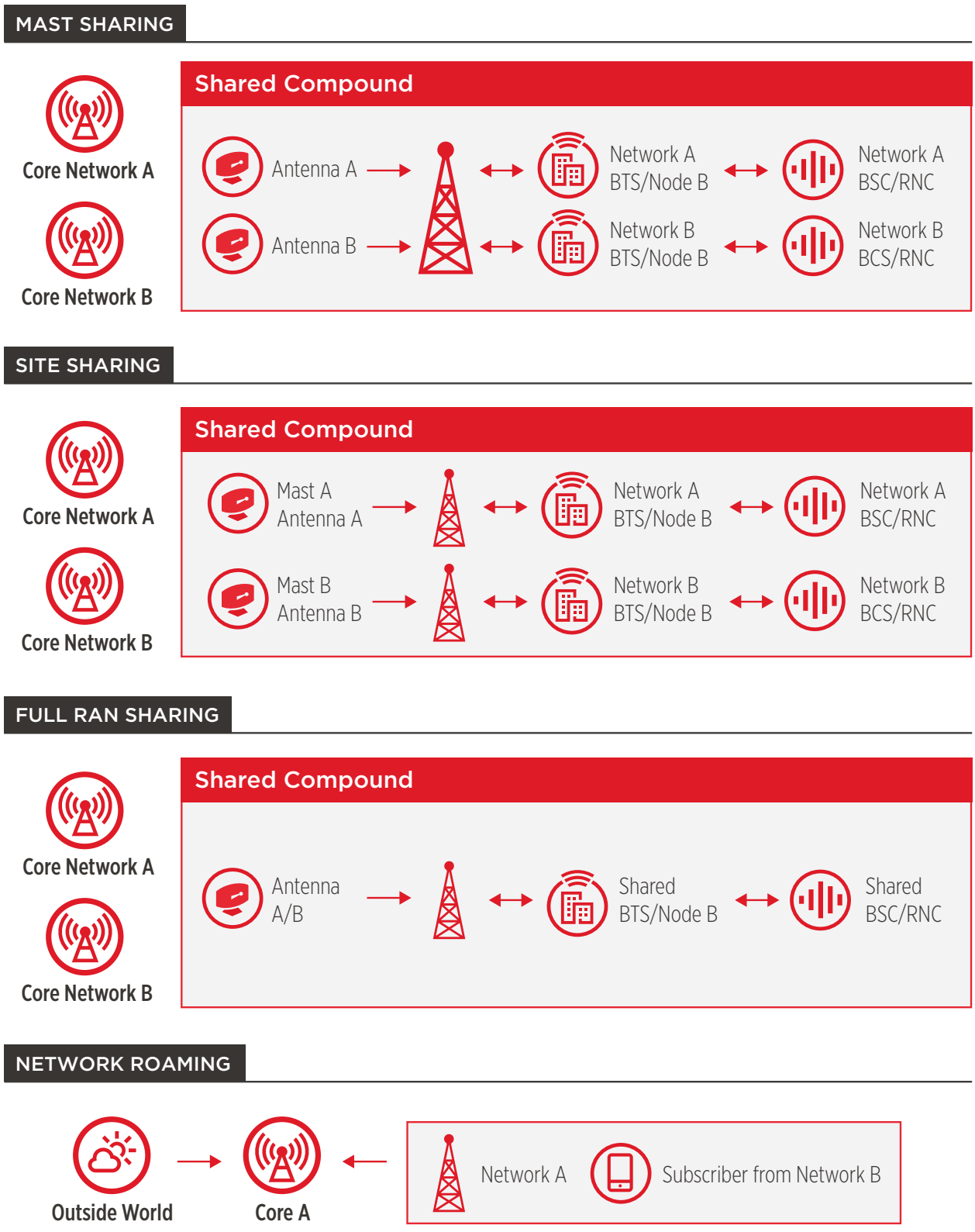
Entering a shared infrastructure deal has important strategic and financial implications for MNOs. The benefits of a sharing deal are:

- Lower costs due to more efficient use of infrastructure;
- Lower risk due to co-investment; and
- Growth opportunities from expanding coverage to new areas.

By lowering the risk and costs of investing in network expansion, sharing deals can have a positive effect on network coverage, especially in rural areas. Regulators should seize this opportunity by enacting regulations that allow for active and passive infrastructure sharing. In some cases, network sharing can be less appealing to an MNO that considers coverage as a competitive advantage and prefers to pursue an infrastructure-based competition strategy. If this is the case, forcing an MNO to share its infrastructure might reduce its incentives to invest and expand to new uncovered areas. Regulation that encourages voluntary network sharing opens the door for MNOs willing to co-invest, while avoiding discouraging MNOs that want to invest on their own.

Figure 9

Infrastructure sharing[44]



Subscriber from Network B has roamed into coverage of operator A and is being serviced by their network

From the perspective of the regulator, the potential positive outcomes of infrastructure sharing include:[45]

- Optimising scarce resources and positive environmental impacts;
- Less duplication of investment;
- Positive incentives to expand coverage into underserved areas;
- Better service quality in areas where deployment of new masts is difficult;
- Product and technological innovation as operators compete on service differentiation; and
- Greater consumer choice as entry and expansion become easier.

In addition to these potential positive outcomes, infrastructure sharing may potentially reduce infrastructure-based competition, a major concern for regulators and competition authorities. The overall long-term impact of a network-sharing deal will depend on market dynamics and the characteristics of the deal. An approach that allows network-sharing deals through ex-ante regulation, but keeps its veto power through competition law, can offer the best of both worlds.

A common trend is to allow and encourage passive infrastructure deals, which pose few competition concerns. For example, recognising the public and environmental benefits of site and mast sharing, the EU[46] and the US[47] have actively encouraged passive sharing through primary legislation.

This report argues that active and passive sharing should be conducted on a voluntary basis and should be encouraged by regulators where it is considered useful to achieving one of the efficiencies listed above. Furthermore, there should be no bias against active sharing, subject to safeguards under competition rules. This is discussed in the next section.

6.1 Addressing competition policy concerns of infrastructure sharing

There are three main concerns about anti-competitive behaviours associated with network sharing deals:

- loss of infrastructure-based competition;
- risk of exchange of sensitive information; and
- collusion at the service level.

In terms of the potential loss of infrastructure competition, although approaches around the world vary considerably, sharing passive network elements is generally permitted, while the sharing of active network components or frequencies may need to be assessed on a case-by-case basis, but should not be prohibited per se.

For example, in the US, the FCC encourages network sharing of masts, antennae and towers,[48] whilst the sharing of core aspects of a network is subject to a "rule of reason"[49] competition law assessment. Similarly, the European Commission found that site and RAN sharing, excluding the sharing of an MNO's core networks, frequencies or network controllers, does not infringe EU competition rules. Moreover, the European Commission concluded that any restrictions that may have occurred in relation to infrastructure competition would be outweighed by the benefits consumers would derive from new 3G services competition.[50] Finally, there are also positive examples of core network sharing arrangements that have not been challenged on competition law grounds. There is therefore no bias against any form of network sharing under best practices in competition policy.[51]

In terms of the risk of excluding competitors seeking access to the networks being shared and the exchange of competitively sensitive information and collusion at the downstream service level — so-called "spill-over effects" — the GSMA (2016) and ITU (2016) have noted it is not uncommon for the parties or regulators to put safeguards in place to mitigate concerns about these effects. The nature of the safeguards depends on the type of infrastructure being advocated and the extent to which sharing is permitted or encouraged rather than mandated.

Examples of safeguards include:

- Creating "clean teams" that separate the staff dealing with the network-sharing partners and the staff dealing with downstream customers;
- Requiring operators to log all infrastructure-sharing activities and making the logs available to the regulator, if requested;
- The regulator acting as a arbitrator to move commercial negotiations along and/or resolve disputes; and
- Permitting infrastructure and encouraging commercial negotiations, but mandating access and conditions should negotiations fail.

6.2 Case Study: Brazil

In 2012, the Brazilian telecoms regulator (Anatel) auctioned 2 x 60 MHz in the 2.5 GHz band with the aim of developing 4G services nationwide. The licences included ambitious coverage obligations that required operators to cover specific locations to be used in the 2013 Confederations Cup and the 2014 World Cup. The obligations also included a calendar with coverage objectives extending to all 5570 municipalities in the country before December 2019. The 2.5 GHz licence included a regional licence on the 450 MHz band to be used for covering rural areas according to a regional split defined by the regulator (see Figure 10).

In 2013, the four largest mobile operators in the country entered into two separate network sharing agreements: Claro and Vivo on one side, and TIM and Oi on the other. Both agreements relied on sharing the Radio Access Network (RAN sharing) and were limited to rural areas (towns with populations less than 30,000 inhabitants). Anatel and Brazil's competition authority (CADE), who judged that these deals did not harm competition as long as commercial activities remained independent, cleared the deals.

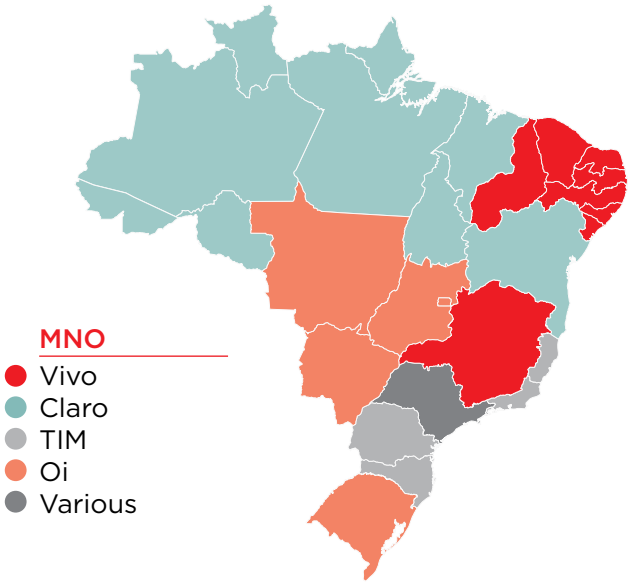
The agreement between Vivo and Claro, which initially included 186 cell sites, was gradually extended to 432 sites. Each operator deployed and operates half of the sites, following the regional split defined in the coverage obligations of the 450 MHz licence. This regional split allows MNOs to focus their building and maintenance efforts in smaller geographical areas, increasing their operational efficiency. Today, the shared network of Claro and Vivo covers 5.6 million people in rural areas.

From the government's perspective, the benefits were twofold: first, it accelerated the provision of mobile services, and second, it increased service-level competition. As highlighted by Anatel, the deal effectively increased competition by bringing two operators to areas where otherwise there would only be one[52] - the economic potential in these areas being too low for a second operator to enter the market deploying new infrastructure. From the operators' perspective, the agreement has allowed them to gain customers more quickly, and comply with their coverage obligations at a lesser cost. As of the writing of this report, 4G is present in 3039 Brazilian cities, which is almost three times the number cities required by the coverage obligations for the end of 2017.[53]

The Brazilian case is a good example of how infrastructure sharing is good both for the government and for mobile operators. It also demonstrates how competition law is a sufficient tool for the regulator and the competition authority to assess the benefits and of an active network sharing deal.

Figure 10

Geographical split of coverage obligations in Brazil



7 Policy alternatives to expanding mobile broadband coverage beyond the market frontier

Earlier sections of this report laid out policy recommendations to strengthen the business case for providing mobile services in areas with low economic potential, thus creating the incentives for MNOs to invest and expand coverage in rural areas. However, this market-driven approach reaches its limit in areas where mobile broadband cannot be provided at a profit and private actors would not find it in their commercial interest to invest (Figure 11 illustrates these different coverage areas). This section discusses common policy alternatives for the state to drive coverage beyond this market frontier.

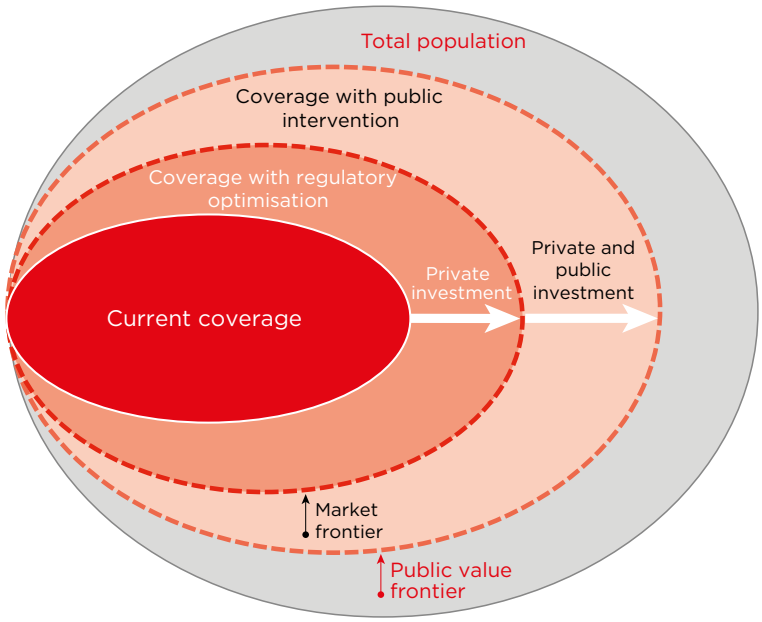
State intervention to extend coverage beyond the market frontier is motivated by the positive externalities mobile services have on the wider economy. However, the state should explore intervening only after exhausting all regulatory measures to maximise coverage through market-driven mechanisms. In other words, governments should focus first on creating a regulatory environment that maximizes MNOs incentives to increase coverage (as discussed in the previous chapters of this report) and, only after exhausting these options, they should start considering more direct interventions to bring coverage even further. Failing to take this two-step approach will generate unnecessary public intervention that will affect customers, who will end up paying for suboptimal services, and taxpayers who will pay for unnecessary expenditure of public funds.

Selecting the most cost-effective intervention is a case-by-case exercise that should rely on the cost-benefit analysis of the available alternatives. This analysis should include the “do-nothing” alternative, which should be the preferred scenario for areas where the total costs of the intervention outweigh the overall private and public benefits of extending coverage. Consulting MNOs as part of this analysis is key for the transparency of the process; furthermore, this allows MNOs to inform the authorities about their network expansion plans, thus avoiding public intervention in areas where operators are willing to invest in the medium-term.

In the past, regulators and policy makers have devised regulations to create incentives for, or sometimes force market players to invest in, unprofitable areas. Common solutions include coverage obligations, subsidies, Universal Service Funds (USFs), and, more recently, Single Wholesale Networks (SWN). The results obtained through this type of schemes are mixed, suggesting that while these schemes are theoretically appealing, the problem is often in their implementation. The following subsections discuss these four public intervention alternatives.

Figure 11

The market and public value frontiers



Single wholesale networks

In some countries, governments are turning to Single Wholesale Networks (SWN) to bring coverage to economically unviable areas. SWNs rely on scale to reduce costs and improve efficiency, for example by pooling large amounts of spectrum or avoiding duplication of RAN infrastructure. SWNs usually benefit from in-kind subsidies such as free spectrum or free access to public infrastructure and networks, which allows SWNs providers to artificially reduce their CapEx and/or OpEx, making the provision of mobile services profitable. There are two main issues with SWNs which can have long-term negative consequences:

1. A SWN is a monopoly that, even if strictly regulated, can create issues such as abuse of monopolistic position, lack of incentives for innovation, and inefficient use of resources.
2. The market frontier evolves with the economic development of rural areas, making new areas economically viable for MNOs to invest in. The existence of a wholesale network in these areas would discourage the deployment of new networks and crowd out private investment.

Beyond these theoretical issues with SWNs, a recent GSMA study points out the operational difficulties faced by several countries to implement SWNs, often leading abandoned projects or a failure to achieve the initial objectives. Table 2 summarises the findings of this study.[54]

Table 2

Main findings of a GSMA study of SWNs in five countries

	Kenya	Russia	Rwanda	Mexico	South Africa
SWN Implemented	Not implemented	Quasi-SWN plan initiated and failed	Implemented in 2014	Delayed, but in November 2016 it was announced the Altán consortium will build the network	White paper detailing approach published Oct 2016
Availability	⊗	Yota - the wholesale operator remained in urban areas only	4G coverage objectives not yet met, although progress has been made	Significant delays to roll out, which should have begun in 2014	?
Affordability	⊗	No visibility on pricing	Low take up, potentially due to high pricing, suggests affordability objectives yet to be met	?	?
Retail competition	⊗	Retail competition never materialised as carriers were unable to reach an agreement	No new MNVOs - competition in mobile remains unchanged at present	?	?
Efficiency	⊗	Failure of initiative meant operators rolled out their own overlapping 4G networks	At this time there is little evidence to suggest that SWNs have had an impact on efficiency	?	?

A preferable alternative to SWNs is to encourage infrastructure sharing agreements by existing MNOs, accompanied by public subsidies to achieve profitability in rural areas with very low economic potential. This approach allows for the same scale efficiency gains of a SWN by pooling the spectrum and deploying a single infrastructure. Yet, this approach reduces the likelihood of monopolistic behaviour

by the infrastructure provider, as MNOs themselves are the clients of their shared network. Furthermore, MNOs that operate in the market are the best placed to evaluate the complexities of building a network, reducing the likelihood of encountering unforeseen issues that might result in a failure to deploy the shared network.

Universal Service Funds

Universal Service Funds (USFs) work by collecting levies on MNOs and using those funds to finance connectivity initiatives determined by the government. The USF contributions are usually estimated as a percentage of revenues, collected by the regulator and transferred to the USF administrator. USFs are a good example of how implementation and administration issues can cause well-intentioned schemes to fail in achieving their initial objectives.

A GSMA study of 64 USFs found that most of them remain inefficient and ineffective. In fact, more than one third of these funds have not yet disburse any of the levies collected from operators (see Figure 12A), and yet they continue to collect USF levies and cumulate a significant amount of capital (see Figure 12B).[55]

Figure 12A

Classification of USF funds by activity levels

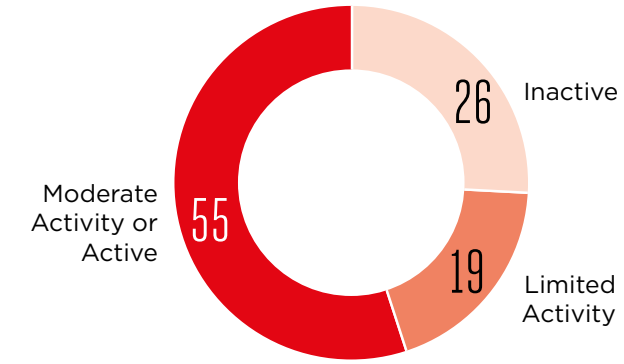
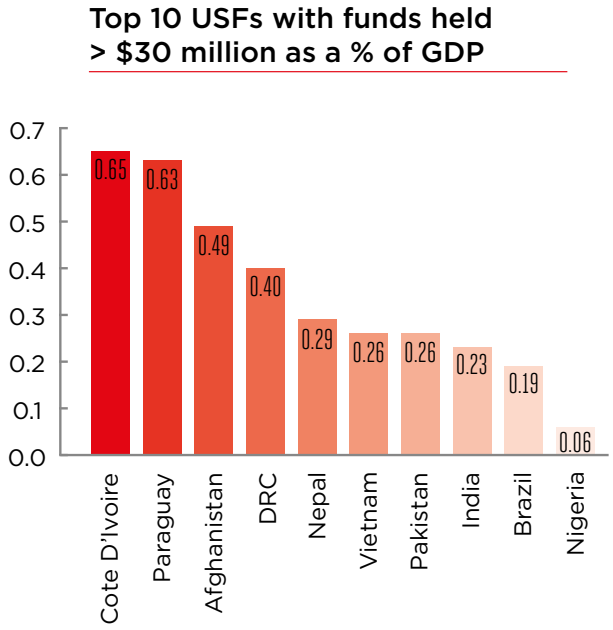


Figure 12B

Top 10 funds as % of GDP



The study identifies the following reasons behind the lack of effectiveness of USFs:

- Inadequate governance in the form of excessive bureaucracy, insufficient oversight and lack of transparency;
- Lack of independence of the USF administrators, making it susceptible to political intervention;
- Ill-conceived objectives that fail to take into account the reality of the market (i.e. roll-out of telecenters in places without taking into account education, maintenance, power sources, etc).
- Lack of defined targets (as many as half of the funds in the GSMA study lacked of pre-defined targets).

USFs that do not disburse any funds are effectively a sector-specific tax for the telecom sector. Contrary to improving connectivity, this tax negatively affects not only the capacity of operators to reinvest, but also increases the overall costs of operators, thus weakening the business case of improving coverage "on the margin". Governments should phase out USFs and discontinue collecting levies, or at a minima, adopt best practices to ensure the good operation of USFs. Box 3 offers a summary of the characteristics of a successful USF.

Box 3: Characteristics of a successful USF[56]

- Autonomous/independent fund structure along with a fund administrator who is accountable to an impartial party/authority, not subject to political interference and with a clear-defined governance.
- Based on a legal and regulatory framework that is flexible, technology and service neutral, highly flexible with respect to effecting policy, allows use of funds for ancillary/complementary purposes (but still ICT related) and has the ability to easily adjust levies (in consultation with stakeholders).
- Clearly specified and measurable objectives prepared in consultation with stakeholders, including coverage and service delivery targets.
- Highly transparent from a financial reporting perspective, along with fair allocation of funds through competitive bidding processes.
- Has guidelines and procedures for working with other funding sources (e.g. Development Banks).
- Consider providing incentives for efficient deployment and innovations for cost minimisation, with a focus on the ongoing sustainability of the solutions proposed.
- Adopt a 'pay or play' approach where operators can choose if they want to pay a contribution to the fund or use those funds to directly invest in areas aligned with the fund's objectives.

Subsidies

In contrast to USFs, subsidies that are lighter touch, targeted, and rely on the operator's capacity to deploy infrastructure, are more likely to have a tangible impact on coverage. Subsidies can take many forms, from direct monetary grants to indirect incentives, such as tax rebates. For subsidies to have an impact they must align the interests of MNOs and the government. This requires an allocation method that is:[57]

- **Targeted:** The impact on the outcome (extending coverage) will depend on the design of the subsidy allocation scheme. There needs to be a strong link between the incentives of MNOs to obtain the funds and the extension of coverage in the areas of interest.
- **Transparent:** The allocation scheme needs to be clear for all stakeholders, allowing MNOs to incorporate these funds in their deployment strategy and avoid disputes. In the case of grants, a transparent public tendering process is necessary to allocate funds fairly and efficiently.
- **Efficient:** The overhead costs of administering the allocation scheme should be as low as possible. A design too complex to administer or monitor will result in inflated costs and delays that can offset the expected benefits of the scheme.

An example of a well targeted subsidy was the tax rebate system introduced in Malaysia in 2014, which gave corporate income tax rebates (up to 70%) on capital investment in rural areas, and exemptions on import duties for last mile connectivity equipment, giving a direct incentive for operators to increase their investments in rural coverage.

Coverage obligations

While coverage obligations is in theory an effective mechanisms to ensure coverage of rural areas, the main challenge is identifying the right population or territory to target. Coverage obligations that are too ambitious and disregard the realities of the market will be impossible to attain, leading to a vicious cycle where MNOs are sanctioned for being unable to comply, further affecting their capacity to do so, and without creating any incentive to expand coverage. On the other hand, if coverage obligations objectives are reasonable, they can be an effective vehicle to drive coverage. When setting coverage obligations, regulators should consider:

- Coverage obligations in rural areas should only be considered for low frequency spectrum (below 1 GHz), which are the frequency bands suitable to provide wide coverage. Covering rural areas with high frequency spectrum (above 1 GHz) results in expensive and commercially unsustainable networks;
- Including coverage obligations in the initial licence conditions, along with the enforcing mechanisms and sanctions, allowing MNOs to integrate these obligations in their business plan when bidding for newly released spectrum;
- Setting realistic coverage obligations in terms of targets and timelines, giving MNOs a real opportunity to comply;
- If spectrum is released through an auction, the reserve price of licences that include coverage obligations must take compliance costs into account; and
- Avoiding duplication of infrastructure in areas with low economic potential by limiting the number of frequency blocks that include coverage obligations and allowing infrastructure sharing to facilitate compliance.

8 Summary of recommendations

Area	Recommendation	Implementation details
Principles of an investment-friendly regulatory framework	Regulation should be based on clearly defined policy objectives (including the promotion of competition, citizens' interests and investment in new and enhanced infrastructure), limited to the minimum necessary to attain those objectives, technology neutral, and should ensure regulatory predictability.	• To ensure regulatory predictability, the regulatory process should: • Be open and transparent • Be based on a cost-benefit analysis • Ensure regulations are proportional to the issue being addressed • Allow for periodic review of regulations.
Spectrum policy	A spectrum policy that aims to improve coverage in rural areas should create incentives for MNOs to invest in network infrastructure.	An investment-friendly spectrum policy should: • Release sufficient spectrum; • Follow an established roadmap; • Facilitate secondary spectrum markets • Use technology-neutral licences; and • Price spectrum fairly.
Tax policy	Implement a tax policy that maximises the capacity and incentives of MNOs to invest in network infrastructure.	An investment-friendly tax policy should: • eliminate sector specific taxes that distort the market; • encourage reinvestment by estimating tax payments on profits and not revenues; • include direct incentives to invest in rural areas such as import duties exemptions; and • reduce complexity and uncertainty in tax levels as a way to increase investor confidence.

Area	Recommendation	Implementation details
Reducing red tape in local governments	National authorities need to play an active role in reducing the complexity and heterogeneity of regulations required to deploy wireless network infrastructure at the local level. To achieve this, national authorities should elaborate and help to implement clear rules and guidelines for: planning regulations, health and safety regulations, permits and approvals processes, and access to land and infrastructure.	To reduce red tape, central authorities should: • Define standardised permit procedures and requirements for notification, health and safety, and visual integration; • Creating a single point of information for granting permits; • Provide an independent appeal process and prohibit unfounded bans of mobile network antennas; • Facilitate access to land and infrastructure (public buildings, electricity, backhaul, and backbone) for MNOs; • Enforce advance notification of civil works for infrastructure deployment (roads, sanitation, energy, telecom); and • Promoting initiatives to map infrastructure. In turn, local authorities should: • Implement permit procedures consistent with the national framework; • Defer to national agencies on expertise, policies, and technical requirements; and • Follow national health and safety policies for approving permits.
Infrastructure sharing	Active and passive infrastructure sharing should be allowed under primary legislation and encouraged by regulators on a voluntary basis.	There should be no regulatory bias against active sharing, which should be subject to safeguards under competition rules supported by evidence-based market assessments
Policy alternatives to expand mobile broadband coverage beyond the market frontier	Public intervention should only be considered after exhausting all measures to facilitate coverage expansion through market mechanisms.	Considerations for four common public interventions: • Coverage obligations: Set realistic obligations in terms of targets and timelines, and include these obligations in the spectrum licences. • USF: many USFs fail to achieve their targets due to complexities to administer and disburse the funds effectively. Prefer other alternatives or ensure appropriate governance and administration of the fund. • Subsidies: Subsidies can be a cost-efficient way of driving coverage. Design outcome-oriented subsidies that are targeted, transparent, and efficient. • Single wholesale networks: SWNs can lead to negative long-term outcomes due to their monopolistic nature. Prefer alternatives such as infrastructure sharing where multi-MNO ownership avoids creating monopolistic conditions.

LIST OF ACRONYMS

ANE	Colombian national spectrum agency
ARPU	Average Revenue Per User
BSC	Base Station Controller
BTS	Base Transceiver Station
CADE	Brazilian competition authority
CAPEX	Capital Expenditure
CRC	Colombian communications regulation commission
EDGE	Enhanced Data rates for GSM Evolution
EU	European Union
FCC	Federal Communications Comission
GSMA	GSM Association
HSPA	High Speed Packet Access
ICT	Information and Communication Technology
IMF	International Monetary Fund
ITU	International Telecommunication Union
LTE	Long Term Evolution
MBB	Mobile BroadBand
MNO	Mobile Network Operator
OPEX	Operation Expenditure
PTS	Swedish telecoms regulator
RAN	Radio Access Network
RF	Radio Frequency
RNC	Radio Network Controller
ROI	Return On Investment
SME	Small and Medium size Enterprises
SSA	Sub-Saharan Africa
UKRN	United Kingdom Regulators Network
US	United States of America
USF	Universal Service Fund

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