



Connected
Society

Closing the coverage gap
Digital inclusion in Latin America



The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

For more information, please visit the GSMA corporate website at www.gsma.com

Follow the GSMA on Twitter: [@GSMA](https://twitter.com/GSMA)



Connected Society

Supporting the mobile industry to increase the adoption of the internet for the underserved by tackling key barriers: network coverage, affordability, digital skills and locally relevant content.

For more information, please visit www.gsma.com/mobilefordevelopment/programmes/connected-society

connectedsociety@gsma.com



GSMA Intelligence

GSMA Intelligence is the definitive source of mobile operator data, analysis and forecasts, delivering the most accurate and complete set of industry metrics available.

Relied on by a customer base of over 800 of the world's leading mobile operators, device vendors, equipment manufacturers and financial and consultancy firms, the data set is the most scrutinised in the industry.

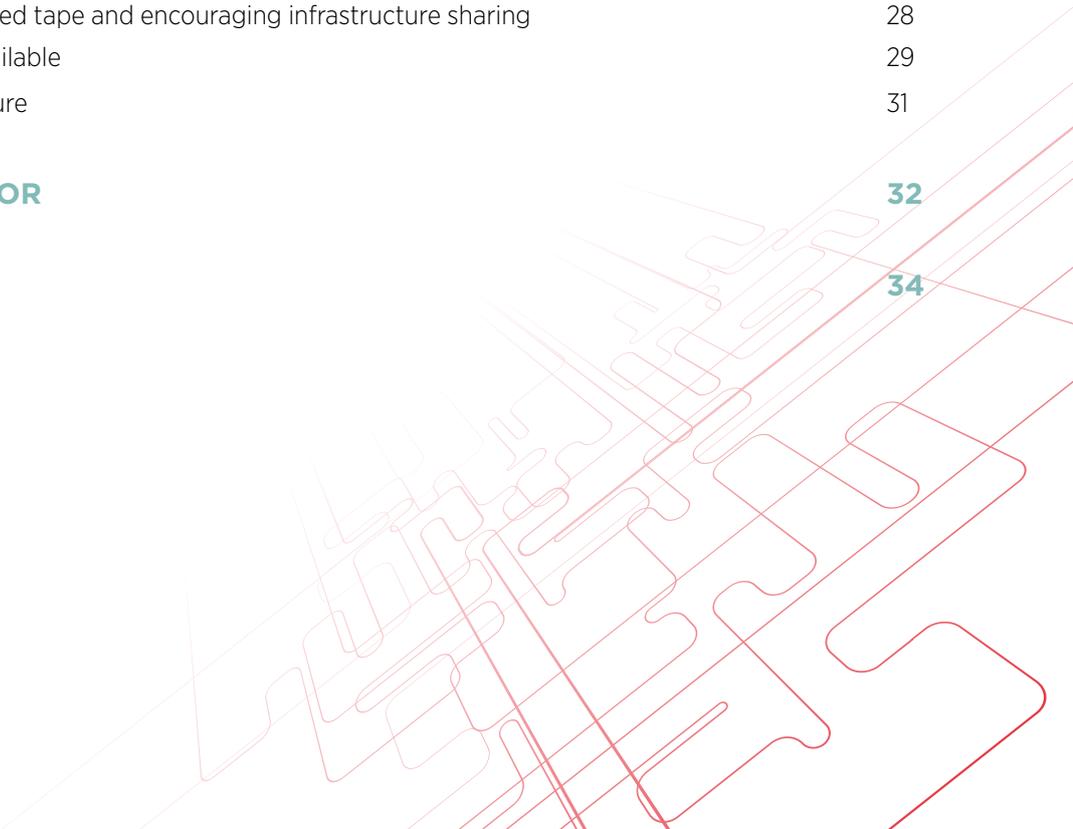
With over 25 million individual data points (updated daily), the service provides coverage of the performance of all 1,400+ operators and 1,200+ MVNOs across 4,400+ networks, 65 groups and 237 countries worldwide.

www.gsmaintelligence.com

info@gsmaintelligence.com

CONTENTS

1. EXECUTIVE SUMMARY	2
2. MOBILE BROADBAND COVERAGE: A KEY BARRIER TO DIGITAL INCLUSION	4
2.1 The coverage gap is 10%	6
2.2 Challenges in reaching the unconnected	9
2.2.1 The unconnected population	9
2.2.2 Pressure to spend wisely	11
2.2.3 Efficient use of the 700 MHz band	11
2.2.4 Regulation overload	13
3. CLOSING THE COVERAGE GAP: OPERATOR-LED INITIATIVES	16
3.1 Direct investment	17
3.2 Infrastructure sharing	19
3.3 Partnering with other ecosystem players	21
4. THE ROLE OF GOVERNMENTS	24
4.1 Financial support	26
4.2 Reducing municipal red tape and encouraging infrastructure sharing	28
4.3 Making spectrum available	29
4.4 Access to infrastructure	31
CASE STUDY: EL SALVADOR	32
CASE STUDY: PERU	34





Executive Summary

Digital inclusion – defined as the expansion of global connectivity and mobile internet adoption – can deliver broad economic and social benefits by bringing communications services to previously unconnected populations. This in turn can help reduce poverty, improve infrastructure and services, and further increase internet access and usage. Unconnected and underserved communities risk falling further behind, widening the digital divide, if the barriers to digital inclusion remain unaddressed. Aside from coverage (the focus of this report), these barriers include affordability, digital skills and local content.

Despite considerable progress in building out mobile broadband networks over recent years, 10% of the population still has no access to a mobile broadband network in Latin America. This means 64 million people across the region are digitally excluded and unable to enjoy the socio-economic benefits that mobile broadband can bring. Although this is a relatively small number compared to other developing regions, the coverage gap will not close without a significant rethink in approach, regulation and policy.

For mobile operators, the market-led business model has so far proven effective in expanding coverage to current levels. However, moving further into remote areas (where the majority of the unconnected lives) through traditional network deployment is a much greater challenge, owing to the sparsely populated unconnected areas, the difficult economic situation in many countries, the high cost of investment with limited potential for return, and a challenging market environment that often makes coverage expansion uneconomical. As a result, mobile operators are increasingly adopting alternative methods, notably infrastructure sharing and partnerships with other ecosystem players, to complement traditional network deployments.

Governments in the region want to make access to and use of mobile broadband universal, a goal shared by mobile operators. This requires a multi-dimensional approach and collaboration between governments

and the mobile industry, with the former supporting industry-led initiatives with policies and programmes that create the right incentives and an enabling environment for extending connectivity to underserved areas. In many cases, mobile operators' efforts to improve coverage are hampered by inefficient and arduous regulation from governments and policy-makers, including onerous coverage obligations, strict quality-of-service (QoS) expectations, and restrictive planning laws around new infrastructure deployment which, together, make for a tough regulatory environment.

To realise the goal of universal access to mobile broadband, governments need to move away from mandatory regulations on coverage and QoS, and allow competition in a free and open market to guide mobile operators' investment decisions. Governments also need to provide incentives to complement mobile operators' efforts; for example, offering financial support (such as subsidies and tax incentives), reducing municipal red tape, creating an enabling environment for infrastructure sharing, making harmonised spectrum available and simplifying access to infrastructure. Government policies should be designed to encourage, rather than curb, investment in mobile broadband infrastructure. Underpinned by unrestrictive regulation, cross-industry collaboration can help close the coverage gap and address one of the key barriers to digital inclusion in Latin America.

KEY FINDINGS

The coverage challenge

The coverage gap is **10%**

64m

people across Latin America without access to a mobile broadband network

Who/where are the unconnected?



Rural



Widely dispersed



Limited purchasing power



Underdeveloped infrastructure (roads, electricity etc)

Challenges to coverage expansion



Limited return on investment potential



Inefficient use of spectrum



Overload of regulation

Closing the coverage gap

Capex by mobile operators in Latin America is increasing

Total capex per person



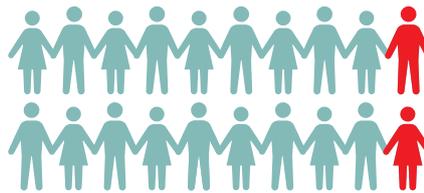
2009-2014
\$129



2015-2020
\$191

Capex per person in Latin America is higher than in any other developing region

Coverage



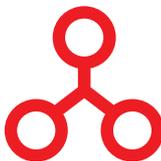
90% coverage achieved by network competition and mobile operator investments

But this alone will not lead to coverage ubiquity

Infrastructure sharing, ecosystem partnerships and government support will help connect the remaining **10%**

Infrastructure sharing

enables mobile operators to deploy networks more efficiently, optimise asset utilisation and reduce running costs



42%

Independent tower companies own and operate around 42% of the total towers in Latin America

Partnerships with other ecosystem players

The business case for satellites and other aerial technologies is improving



Community networks are emerging but need operator support to scale

Governments have a role to play

Governments need to use incentives that improve the economics of providing services in less viable areas



Provide financial support



Reduce municipal red tape for antenna deployment and encourage infrastructure sharing



Make spectrum available



Simplify access to infrastructure



2

Mobile broadband coverage: a key barrier to digital inclusion

Mobile technology has already had a profound impact on the way people live in Latin America. In 2013, the mobile industry contributed 4.1% to the total gross domestic product (GDP) of the region, and supported – both directly and indirectly – approximately 2.2 million jobs.¹

Digital inclusion – defined as the expansion of global connectivity and mobile Internet adoption – can extend these economic and social benefits to previously unconnected populations, fuelling a virtuous circle that reduces poverty, improves infrastructure and services,

and further increases internet access and usage. By extension, unconnected and underserved communities risk falling further behind, widening the digital divide, if the barriers to digital inclusion remain unaddressed.

The GSMA has identified four barriers to digital inclusion:

- infrastructure economics: expanding rural network coverage of the mobile internet by promoting regulatory and technical best practice
- affordability: reducing the total cost of ownership of the mobile internet
- digital skills: increasing adoption and usage by addressing literacy and internet awareness barriers
- local content: promoting locally relevant content to attract people to use the mobile internet.

The first of these barriers is the focus of this report. We highlight the extent of the coverage gap in Latin America, discuss the challenges in closing this gap, and outline the ways the mobile ecosystem can address this barrier to digital inclusion with the help of innovative government policy and regulation.

Local content will be the subject of a subsequent report published in January 2016. A regional Digital Inclusion deep dive – to be published in February 2016 – will bring together all four barriers, with a particular focus on affordability and consumer issues.

1. Source: The Mobile Economy Latin America 2014, GSMA, November 2014

2.1 The coverage gap is 10%

Broadband penetration rates across Latin America have grown rapidly in recent years, driven primarily by mobile, given the relative lack of fixed line infrastructure and costly fixed connections.

The International Telecommunication Union (ITU) reports that fixed broadband penetration in the region on average stands at less than 20% of the population. Even in those markets that have higher than average fixed line penetration, such as Brazil and Argentina, fixed line services tend only to be accessible to higher income households.² Consequently, mobile technology, particularly mobile broadband (3G and 4G), is key in helping connect the unconnected throughout Latin America, allowing millions of people access to the internet for the first time via a mobile device, resulting in social and economic transformation. A major goal for governments in the region therefore is to make access to and usage of mobile broadband universal to all.

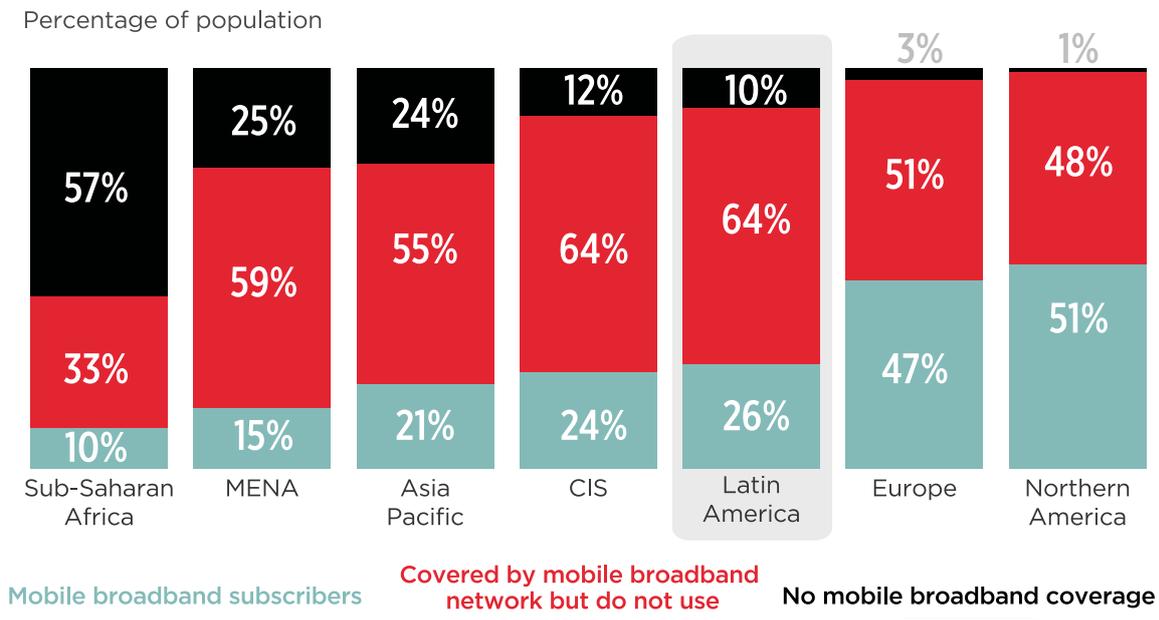
As of mid-2015, there were around 330 million unique subscribers in Latin America, or just over half the population. Of these, just over 160 million people, a quarter of the population, subscribed to higher speed mobile broadband services (see Figure 1). This means that three-quarters of the population do not currently subscribe to mobile broadband services. The majority

of these people, 64% of the total population, have access to a mobile broadband network but do not subscribe to mobile broadband services, primarily due to affordability and/or consumer challenges. This will be the topic of a future report. Here, we focus on the segment of the population that is not covered by a mobile broadband network. This group accounts for 10% of the total Latin American population.

Despite considerable progress in building out mobile broadband networks over recent years (particularly 3G, but more recently 4G), 10% of the population is still not covered by a mobile broadband (3G or 4G) network. Although less of a pressing concern in Latin America given that the region has the highest mobile broadband coverage and penetration rate of any developing region, this still equates to an unconnected population of 64 million. These are digitally excluded and unable to enjoy the socio-economic benefits that mobile broadband can bring.

Source: GSMA Intelligence

Figure 1: Latin America: mobile broadband in context, Q2 2015



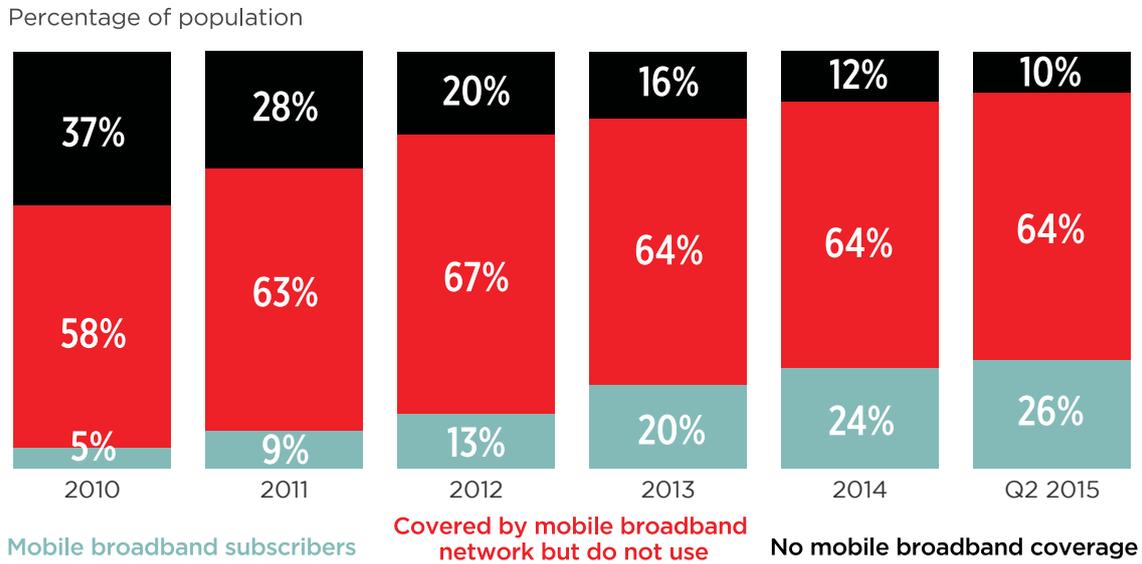
² Source: Mobile Broadband at the Bottom of the Pyramid In Latin America, GSMA, June 2013

Since 2010, mobile broadband coverage has increased from 63% to 90% across the region. An additional 190 million people – just under a third of the population –

now have access to a mobile broadband network (see Figure 2).

Source: GSMA Intelligence

Figure 2: Latin America: growth in mobile broadband coverage



Much of this has been achieved by privately owned network operators competing with each other (there are no monopolies in Latin America and only one duopoly in Nicaragua). This is the dominant model under which the industry in the region is organised.

Mexico, however, is proposing an alternative model – a single wholesale network (SWN) – for mobile broadband services in the 700 MHz band, to be

operational by 2018. This project aims to solve the problems of inadequate or slow coverage in rural areas and promote better incentives for the private sector to compete and invest. However, the fundamental question is whether this approach is preferable over a process to tender the 700MHz spectrum among competing mobile operators with conditions that incentivise them to achieve the SWN coverage targets.

Moving away from traditional mobile operator competition models towards SWNs can lead to economic inefficiencies in terms of forgone tax revenues and capital investments, stifle innovation, restrict take-up of mobile broadband services and ultimately work against consumer interests. Several arguments support this:

- An SWN may co-exist for a period with existing networks. As the SWN will be supported by the government, this will likely lead to a distortion of competition. Co-existence is also likely to increase uncertainty, which will have a dampening effect on investment in mobile broadband services.
- To achieve its objectives, the SWN would need to evolve into a regulated monopoly, leading to worse long-term outcomes for consumers. As a monopoly, an SWN will always have incentives to keep prices high and reduce expenditure, including network deployment to increase coverage. Although

regulation can attempt to ensure the SWN mimics the outcomes of a competitive market, it will not fully succeed.

- Although a publically funded SWN could deliver coverage in areas into which it would be uneconomical for privately funded competing networks to expand, the correct approach is to consider how public subsidies could be used to extend the benefits of network competition to those areas (see Section 4.1).
- The benefits of network competition go beyond coverage. Innovation is a key driver of consumer value at the national level, and this occurs in networks as well as services and devices. In practice, single networks have been much slower to expand coverage, perform upgrades and embrace new technologies such as 3G, and an SWN can be expected to prompt less innovation than network competition.

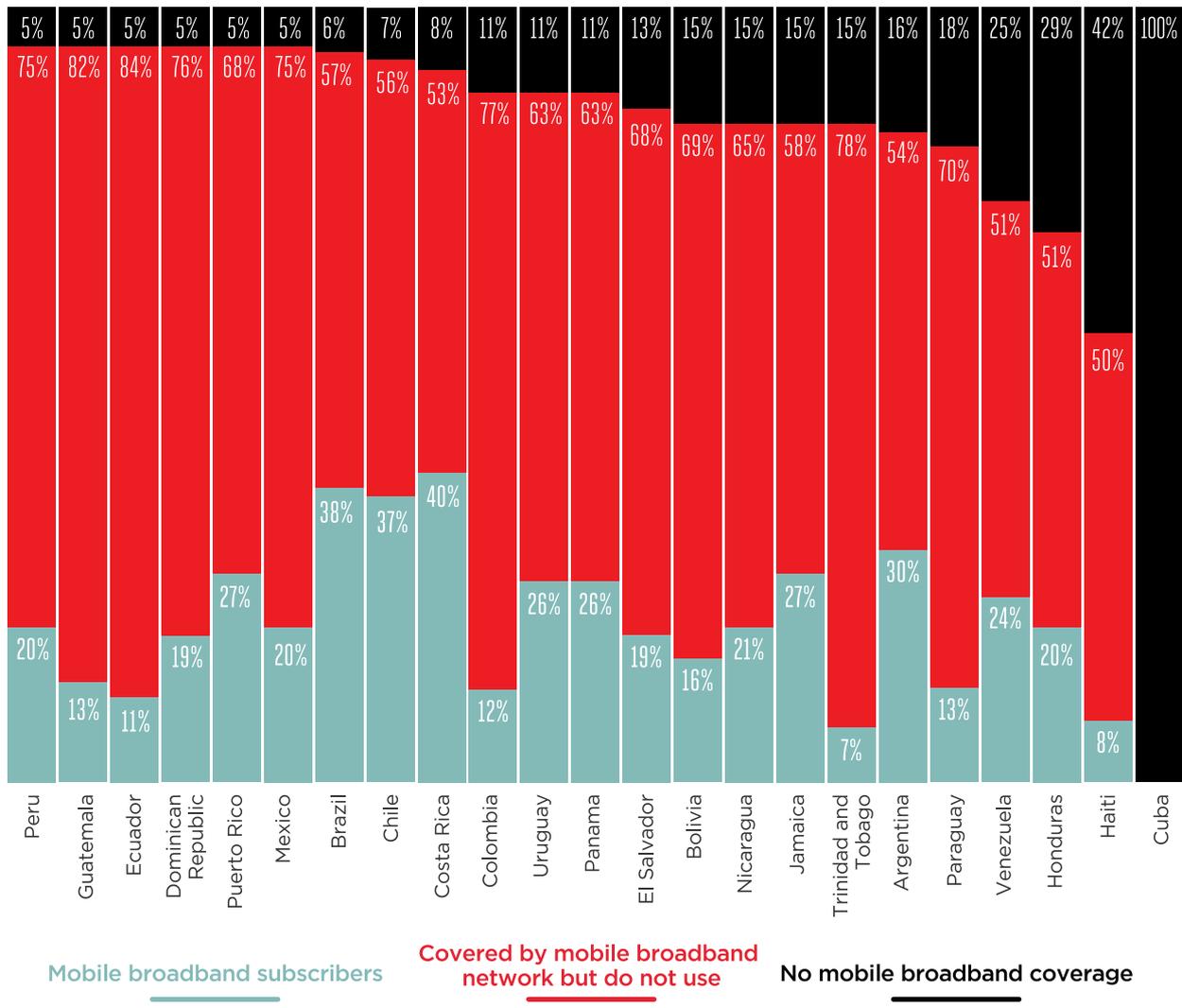
Traditional network competition could actually be more successful in meeting the government’s objective for improved coverage. A recent report commissioned by the GSMA³ found that 3G coverage is 36% higher, and overall coverage increased three times faster, in countries with competing networks compared to those served by a single network.

There is considerable diversity in mobile broadband coverage across the region. Some of the larger and richer countries, such as Brazil, Chile, Mexico and Peru, have coverage levels of more than 90%; some of the poorer and/or smaller countries, such as Haiti, Honduras and Venezuela, have coverage levels of 75% or less; and Cuba has no mobile broadband coverage at all (see Figure 3).

Source: GSMA Intelligence

Figure 3: Latin America: mobile broadband by country, Q2 2015

Percentage of population



Looking forward, mobile broadband has the potential to match 2G population coverage, which stands at around 98% in many markets across the region, and may in fact exceed this through the use of lower frequencies such as 700 MHz. However, the coverage gap will not close without a major change

in current market trends. Until now, mobile operators have shouldered the burden of coverage expansion themselves, but this approach will not succeed in connecting the remaining 10% without a significant rethink in support, regulation and policy.

3. Source: "Assessing the case for Single Wholesale Networks in mobile communications", Frontier Economics, 2014

2.2 Challenges in reaching the unconnected

2.2.1 The unconnected population

Latin America is characterised by densely populated and sprawling cities, but also by vast, sparsely populated areas, mountain ranges, rainforests and islands. Although most people live in urban or suburban areas, it is the small proportion of people living in rural areas (20% of the population⁴) that are most likely to be without access to mobile broadband.

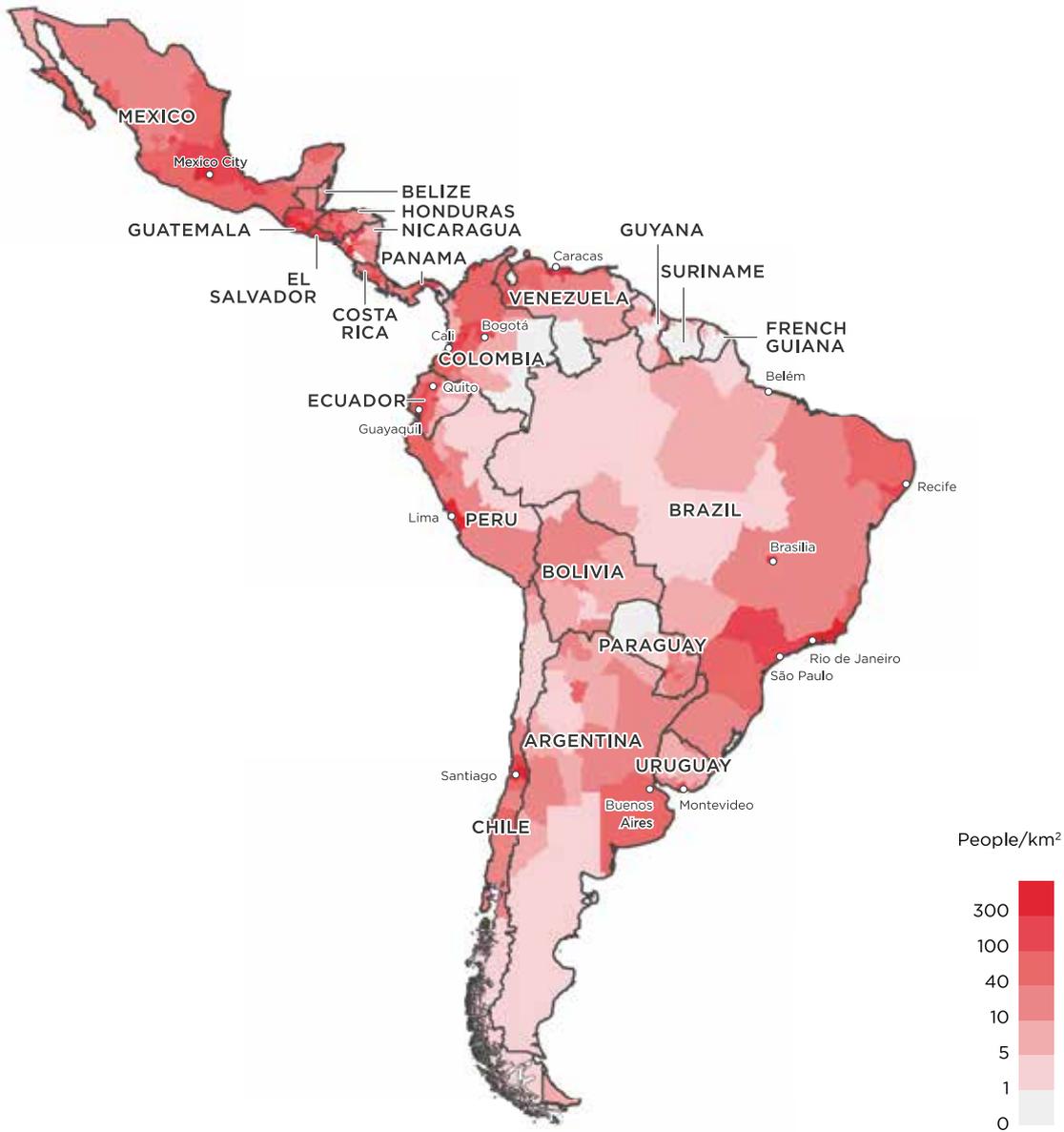
Overall population density in Latin America is 31 people per square kilometre, much less than the world average of 56 people per square kilometre. However, population density varies greatly between countries: less than 10 people per square kilometre in Bolivia to just under 300 people per square kilometre in El Salvador. Internal population distribution within a given

country also varies greatly. The Brazilian Amazon, for example, has fewer than two inhabitants per square kilometre, while the Brazilian states of Rio de Janeiro and São Paulo have population densities of 376 people per square kilometre and 177 people per square kilometre respectively. Similarly, the Amazonas State in Venezuela, which accounts for around 20% of the total land area, has a population of around 146,000 – a population density of 0.8 people per square kilometre, while the Distrito Capital (home to the capital Caracas) has a population of just over 2 million in an area just 433 square kilometres, equating to a population density of 4,844 people per square kilometre (see Figure 4).

4. Source: World Bank

Source: National databases, World Bank, GSMA Intelligence

Figure 4: Latin America: population density



In many countries, the rural populations (and therefore the unconnected) are also characterised by relatively high instances of poverty. In Honduras for example, 46% of the population live in rural areas, of which 69% live below the national poverty line. Similarly, in Panama, 50% of the 1.3 million people living in rural areas (over a third of the total) live below the national poverty line.⁵ Additionally, many rural areas have limited access to electricity. In Nicaragua, Honduras and Peru for example, 57%, 34% and 27% of the rural populations respectively have no access

to electricity. This makes it extremely difficult to roll out infrastructure that relies on an electricity grid to operate.

The unconnected populations are therefore widely dispersed, with low purchasing power and limited availability of electricity and other essential infrastructure. As a result, mobile operators are finding it increasingly difficult to justify investing in infrastructure deployments in these areas.

5. Source: World Bank

2.2.2 Pressure to spend wisely

The market-led business model has so far proven effective in expanding coverage to current levels. However, moving further into rural and remote areas is a much greater challenge and often proves uneconomical. This is due to three factors:

- Lower population density in remote areas, by definition, makes these areas more expensive to cover on a per-capita basis.
- The terrain in these areas makes it much more difficult and expensive to roll out physical infrastructure.
- Lower household income levels limit consumers' purchasing power and therefore demand for mobile handsets, service and commerce. The net result is a high cost of investment with limited potential for return.

Exacerbating this problem is the current economic situation in the region, with modest GDP growth (1.3% across Latin America in 2014⁶), high levels of inflation (as high as 49% and 28% in 2014 in Venezuela and Argentina respectively⁷) and some of the highest levels of income inequality in the world serving to depress consumer purchasing power. Many countries are also facing the possibility of recession, making it difficult for mobile operators and foreign investors to justify investing in coverage expansion.

Market trends are also having an impact. The decline in voice revenue continues, driven by growing competition between mobile operators, MVNOs and internet players, as well as increasing regulatory intervention. Growth in data revenue is unlikely to offset this entirely, and will place further pressure on mobile operators' top lines and margins, which in aggregate are the lowest of any developing region. Coupled with ongoing pressure from governments to improve networks to alleviate capacity constraints and address quality-of-service issues (discussed more in Section 2.2.3), mobile operators in Latin America are being ever-more careful with their precious resources.

2.2.3 Efficient use of the 700 MHz band

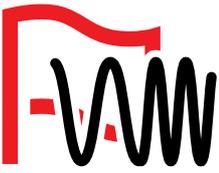
Several countries in Latin America have assigned the 700 MHz band for mobile broadband services – in particular 4G LTE. The 700 MHz band, or Digital Dividend, has better signal propagation than higher frequencies, such as AWS (1700/2100 MHz) or 2.6 GHz bands, allowing coverage of a larger geographical area with fewer cell sites. This makes it ideal for

expanding mobile broadband coverage in remote and sparsely populated areas with more efficient network deployments.

However, two areas where there has been a lack of progress and therefore inefficient use of the 700 MHz band are clearing and harmonisation.

6. Source: World Bank

7. Source: World Bank



Clearing:

In most countries in Latin America, this portion of the spectrum is currently allocated to broadcasting services. As a result of the transition from analogue to digital television, this spectrum is being vacated, and could be reassigned to offer mobile broadband services in underserved areas. Unless it is cleared, mobile broadband services may experience interference from other services on the same band, severely hindering quality of service. However, governments across the region have generally been slow to migrate the existing services out of the way, in part

due to the digital switchover being as much as a decade away. In Argentina, Bolivia, Brazil, Chile, Ecuador, Jamaica, Panama and Paraguay, spectrum in the 700 MHz band has been assigned to mobile operators (see Figure 5), but in most of these countries is not yet available for use. In Brazil for example, mobile operators acquired spectrum in the 700 MHz band in 2014 but will not be able to fully deploy services in the band until 2018. Meanwhile, Colombia has almost concluded the clearing of the band and plans to auction it in 2016.



Harmonization:

Harmonization is key in the 700 MHz band. Coordination along country borders alleviates difficulties that arise from the differences between the US and APT band plans. Different plans might raise interference in border areas, such as on the border between Mexico and the US,

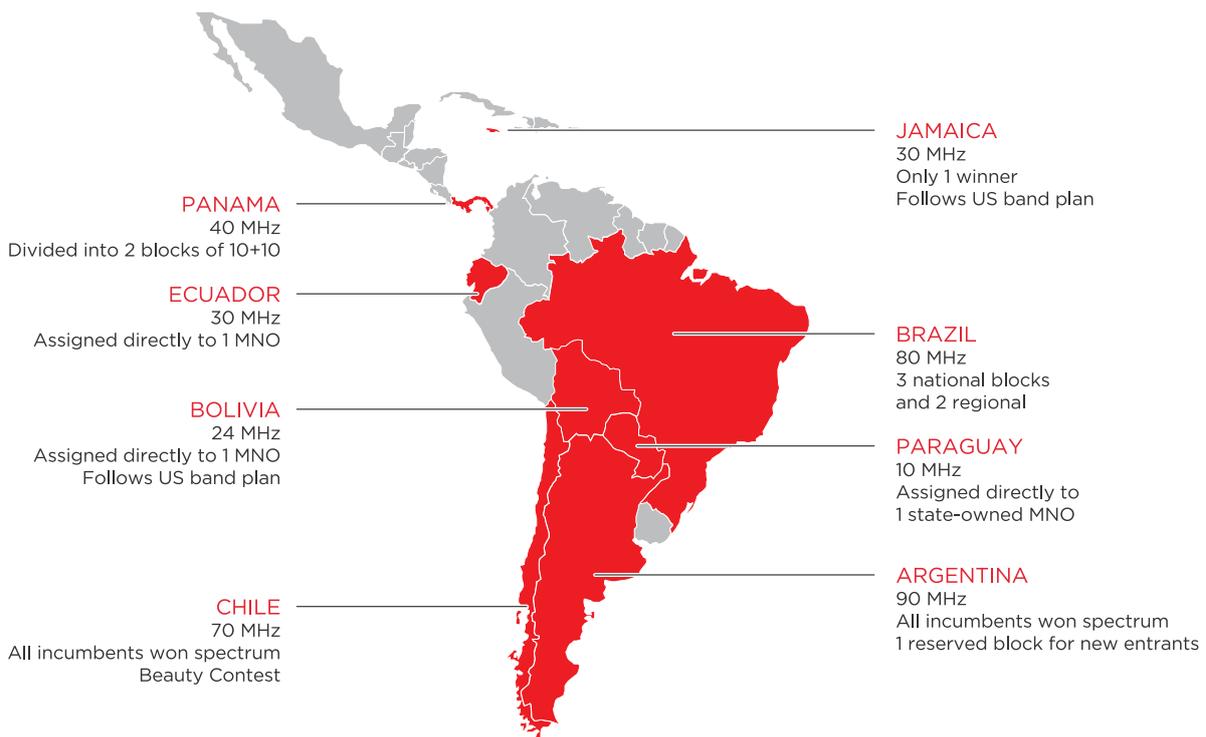
or even the borders within Latin America. For example, Bolivia uses the US plan while Argentina, Brazil, Chile, Peru and Uruguay have chosen APT.

Only a few operators in different countries in the region have launched services in the 700 MHz band. This is either because spectrum has not been assigned to mobile operators or, in many cases, other users (mostly broadcasters) occupy the frequency bands. In some countries, mobile operators have won 700 MHz

spectrum through auctions, but cannot yet launch services because the spectrum is not available for use. In Brazil for example, the regulator auctioned the 700 MHz band for mobile services in September 2014, but mobile operators can only launch services 12 months after the digital switchover, which will be completed in 2018.

Source: GSMA

Figure 5: Latin America: 700 MHz band assignments for mobile





2.2.4 Regulation overload

There is often a conflict of interest and mixed messaging between mobile operators and governments in Latin America. The priority of many governments is to increase mobile broadband coverage to ubiquitous levels, while mobile operators want to improve the capacity of their networks to meet the growing data demand resulting from the increasing use of smartphones and mobile broadband services. This is the case in most countries worldwide, but here

mobile operators are faced with regulation from all angles. Governments and regulators attach onerous coverage obligations to new licence purchases but also frequently fine mobile operators for failing to adhere to strict QoS expectations. There are also restrictive planning laws on the deployment of new infrastructure, both in rural areas (to improve coverage) and in cities (to improve capacity and QoS).

Restrictive tower laws

In many countries across Latin America, mobile operators face restrictive or excessive regulation on infrastructure deployment. This can be a result of having to deal with individual municipalities as opposed to a nationwide government, or having to follow strict guidelines regarding tower placement.

In Brazil, for example, authorisation is granted at a municipal level, and mobile operators need to obtain approvals from individual municipalities for each tower site. Since there are 5,570 municipalities in Brazil, as well as over 300 municipal laws that hinder and delay the deployment of antennas, this puts a heavy bureaucratic and administrative burden on mobile operators trying to deploy new base stations in remote areas. As a result, area coverage in Brazil is sporadic, and inconsistent across different regions.

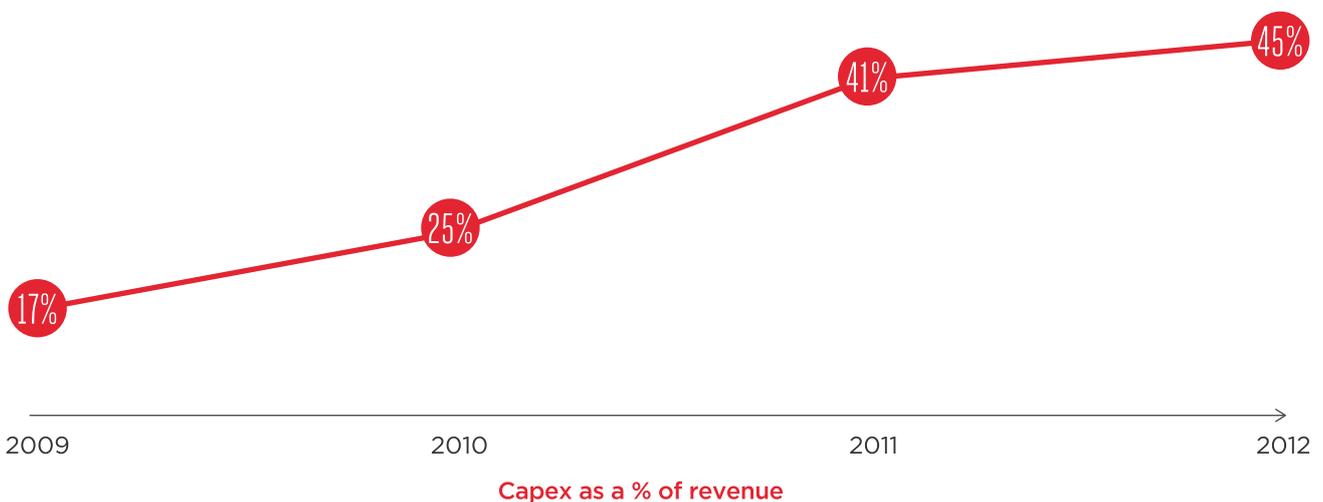
In April 2015, a new Antenna Law was passed in Brazil that aims to speed up licence issuing for new antenna installations, which in many cases takes more than a year. The law simplifies the procedures by requiring that licence applications are addressed to a single municipal agency, and exempts from licensing the deployment of small antennas in urban areas, as well as antennas with technical features that are equivalent to those previously deployed in that area. The law also establishes that payments for right of way on public roads and other public goods of common use will not be required in new contracts, including those operated under concession, such as roads and railways. This contributes to the deployment of mobile services in locations that currently lack the infrastructure because they are not covered by federal incentive programs and are less economically attractive. Although this is a step

in the right direction, it is too early to see the outcome of this new law. Since there are 5,570 municipalities in Brazil that will all have to adjust to accommodate the new law, and since no implementation deadlines were issued, it may take some time for it to have a positive effect.

In Chile, the Towers Law restricts tower deployment in sensitive and congested areas, where towers must not be over 12m high, must not be within 50m of a school or hospital, and must not be within 100m of each other. Any existing towers exceeding these specifications must be decommissioned, or compensation must be paid of up to 30% of the value of the tower. This law restricts mobile operators' ability to deploy new sites and is leading to more infrastructure sharing (see Section 3). However, if a mobile operator chooses not to share its infrastructure with other mobile operators, it would be forced to pay the equivalent of 50% of the replacement value of the tower, or 20% if the tower is camouflaged. This adds an extra financial burden on mobile operators in deploying new infrastructure. As an example, Figure 6 shows how capex as a percentage of revenue for Movistar Chile reached 45% in 2012 as a result of the tower law. This led to increasing pressure on margins, which dropped from 45% in 2010 to 35% in 2012.

Source: GSMA Intelligence

Figure 6: Towers law: increased financial burden on Movistar Chile



Challenging coverage and QoS obligations

Considering the challenging investment climate and difficulties in rolling out new infrastructure, the mandatory coverage obligations that have been attached to new 4G licences in many Latin American countries, along with quality-of-service expectations, appear onerous compared with those imposed in other regions. Examples include the following:

- **Argentina:** The 4G auction in 2014 included several bands, including AWS and 700 MHz, but also featured stringent coverage obligations; all main motorways and cities with fewer than 50,000 inhabitants are required to be covered within 27 months, and all localities of more than 500 inhabitants within five years.
- **Brazil:** Mobile operators that were successful in the 2012 auction of 2.6 GHz licences are obligated to cover all municipalities with more than 30,000

inhabitants by June 2016, and all remaining cities by 2019. This poses a significant investment challenge; in September 2013 an Ofcom study estimated that the relative cost of deploying 4G solely in the 2.6 GHz band could be almost double that of deployment in the 1800 MHz band.

- **Peru:** Licence obligations for spectrum in the 1900 MHz band auctioned in 2013 stated that operators were expected to deploy 4G networks and provide coverage to 409 district capitals within 36 months, and to an additional 1,918 localities within 48 months. In addition, licence winners have been mandated to offer broadband services to public schools, health centres and police stations across the country at no charge for 10 years. They are also required to provide a 'social tariff' for lower income users and satellite connectivity for remote areas.

In parallel to the coverage obligations, there is a rising trend towards the regulation of quality of service (QoS) in the region. This is despite there being little consensus on its definition, the need for regulation, the responsibility of each player across the supply chain and appropriate measurement methodology. There is, however, consensus on the fact that mobile data growth in the region has exceeded all forecasts made by the players involved, placing enormous pressure on mobile operators to respond to the demand for mobile broadband services.

In this regard, QoS is always a priority for mobile operators, yet expectations often appear overly strict. Some examples include requirements for 0% dropped calls, or the obligation to only offer unlimited data plans. Some countries have even imposed compensation mechanisms for dropped

calls. In December 2014 for example, Colombian mobile operators were fined nearly \$20 million for not meeting customer service expectations, in addition to reparations totalling \$4 million to replace minutes lost by their customers.

These obligations restrict the mobile operators' market-led business model that has seen success in expanding coverage to current levels. A competitive environment drives mobile operators to expand and improve their networks, which benefits the mobile ecosystem and the region as a whole. However, stringent regulation reduces mobile operator participation in a free and open market where competition guides investment decisions. This can have a negative effect on coverage expansion where the economics of infrastructure deployment are no longer viable.



3

Closing the coverage gap: operator-led initiatives



Closing the coverage gap requires a multi-dimensional approach and collaboration between the mobile industry and governments. Mobile operators' direct investment in infrastructure deployment to underserved areas continues to play a major role in coverage expansion, albeit stretched thin by the growing need to meet capacity and QoS expectations. However, deploying and maintaining traditional, standalone mobile broadband networks in difficult terrains and sparsely populated areas is at variance with operator network economics, which relies on scale and assumes that high infrastructure investments

and running costs are spread across many potential customers to make a return that can be re-invested. This has led operators to adopt unconventional mechanisms to improve the economics of providing services to remote communities. Meanwhile, governments have a key role to play in supporting these mechanisms and other industry-led initiatives with policies and programmes that create an enabling environment and provide the right incentives for further investment in coverage expansion. This government role is discussed further in Section 4.

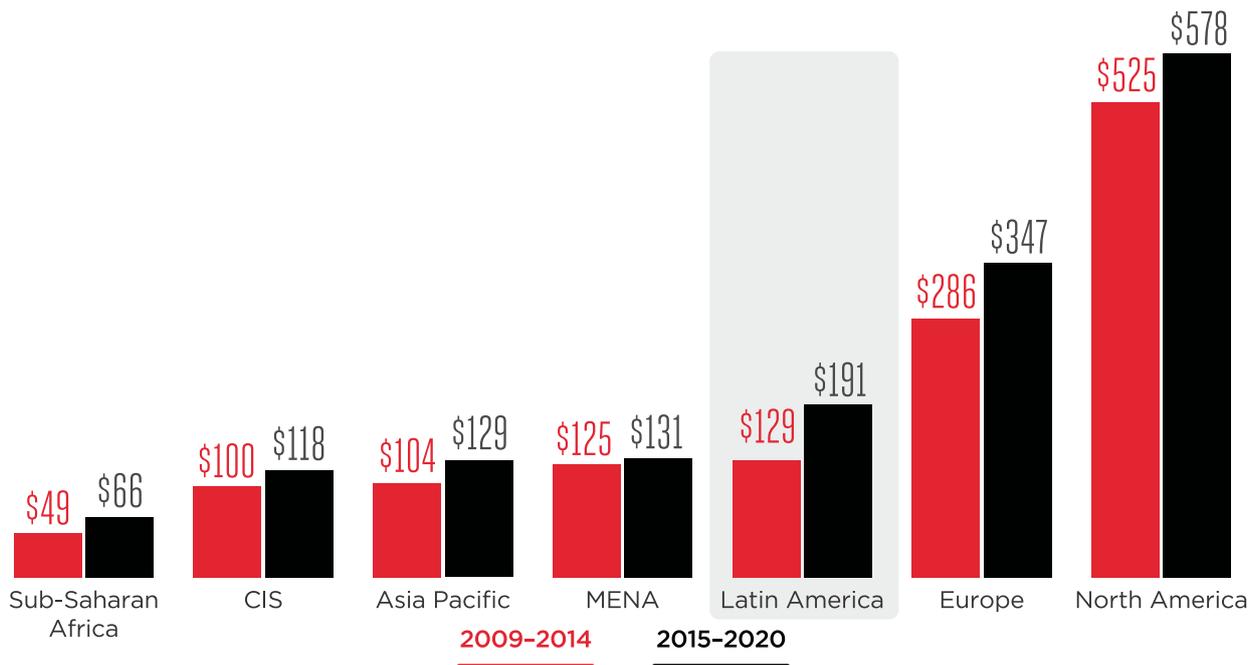
3.1 Direct investment

Capital expenditure by mobile operators in Latin America is increasing significantly and is forecast to reach a cumulative \$116 billion between 2015 and 2020. Between 2009 and 2014, the total capex per person in the region, at \$129, was higher than any other developing region, and will rise to \$191 over the

six years to 2020 (see Figure 7). Spectrum and licence fees account for a significant proportion of capex. Latin American operators invested almost \$8 billion in spectrum licences between 2012 and 2015, primarily to support 4G deployments.

Source: GSMA Intelligence

Figure 7: Average capex per person: Latin America the highest of all developing regions, and growing



Argentina, Brazil and Mexico jointly account for the majority of capex in the region, partly due to their geographical and population sizes. Mobile operators in these countries have largely committed to further investments despite significant macroeconomic headwinds in recent years, particularly currency depreciation, which directly affects equipment and services procurement costs. For example, in September 2015, TIM Brasil announced that it will stick to its investment plan, despite a drop in Brazil's currency of more than 30% since the start of the year. The operator expects to stay within its target of around BRL14 billion (\$3.7 billion) in capital spending from 2015 to 2017 by renegotiating the terms on imported equipment. In Mexico, America Movil plans to invest \$6 billion in its mobile network between 2015 and 2018, while AT&T plans to invest \$3 billion over the same period. Mobile

operators' commitment to sustain or, in some cases, increase capex despite a challenging macroeconomic environment highlights the potential for market competition to stimulate investment for optimum network coverage, capacity and performance.

Capital budgets are not entirely spent on coverage expansion projects; mobile operators also allocate capex to areas such as IT services, network management equipment and network capacity expansion projects. While the proportion of capex allocated to coverage expansion projects has been decreasing in recent years because network coverage has become more widespread, mobile operators in the region commit around 10–20% of total annual capex to infrastructure deployment in underserved areas⁸.

Examples of Movistar's coverage expansion projects in Latin America

Country	Details
Mexico	Movistar plans to deploy 1,200 antennas under its rural franchise programme for between \$20,000 and \$50,000 per site, equivalent to a total spend of \$24–60 million (by Movistar and other investors). The project involves extending 2G and 3G services to remote areas with a population of between 5,000 and 10,000 inhabitants. Movistar is deploying 150 antennas across the country as of August 2015 under the rural expansion scheme, which sees the operator share the costs of deployment with local franchise operators.
Peru	In September 2014, Movistar said it will invest PEN277 million (\$95.5 million) to roll out mobile services to 2,327 rural locations by 2017, extending its network to an additional 2 million Peruvians (see Case study). The operator is also jointly implementing a project with equipment vendor Ericsson to provide 4G-based connectivity in the Peruvian Amazon, covering more than 500,000 square kilometres, during 2015.
Argentina	Movistar is rolling out mobile broadband services along 2,500 kilometres of roads, which will expand coverage to remote communities and sparsely populated areas.
Colombia	Movistar has expanded coverage to 914 municipalities, investing more than COP9.2 billion (\$3.1 billion) to connect local communities between 2006 and 2014.

Despite these investments, traditional infrastructure deployment has its limitations; it is uneconomical for extending coverage to areas where the potential returns on investment do not justify the attendant risks. Mobile operators have adopted several unconventional

mechanisms to address this challenge, some of which also have the potential to improve QoS levels amid growing network traffic. Two such methods – infrastructure sharing and partnerships with other ecosystem players – are highlighted below.

⁸. Source: GSMA Intelligence estimate based on mobile operator interviews

3.2 Infrastructure sharing

Infrastructure sharing enables mobile operators to deploy networks more efficiently, optimise asset utilisation and reduce running costs compared with standalone deployment. It also minimises duplication of infrastructure, which has come under the spotlight in many countries due to growing environmental and public safety concerns. There are two broad forms of infrastructure sharing: passive and active. With passive infrastructure sharing, operators share physical components of a cell site (e.g. installing multiple antennas on a single tower). With active infrastructure sharing, operators share the radio access network (RAN) or, at a more advanced level, the core network.

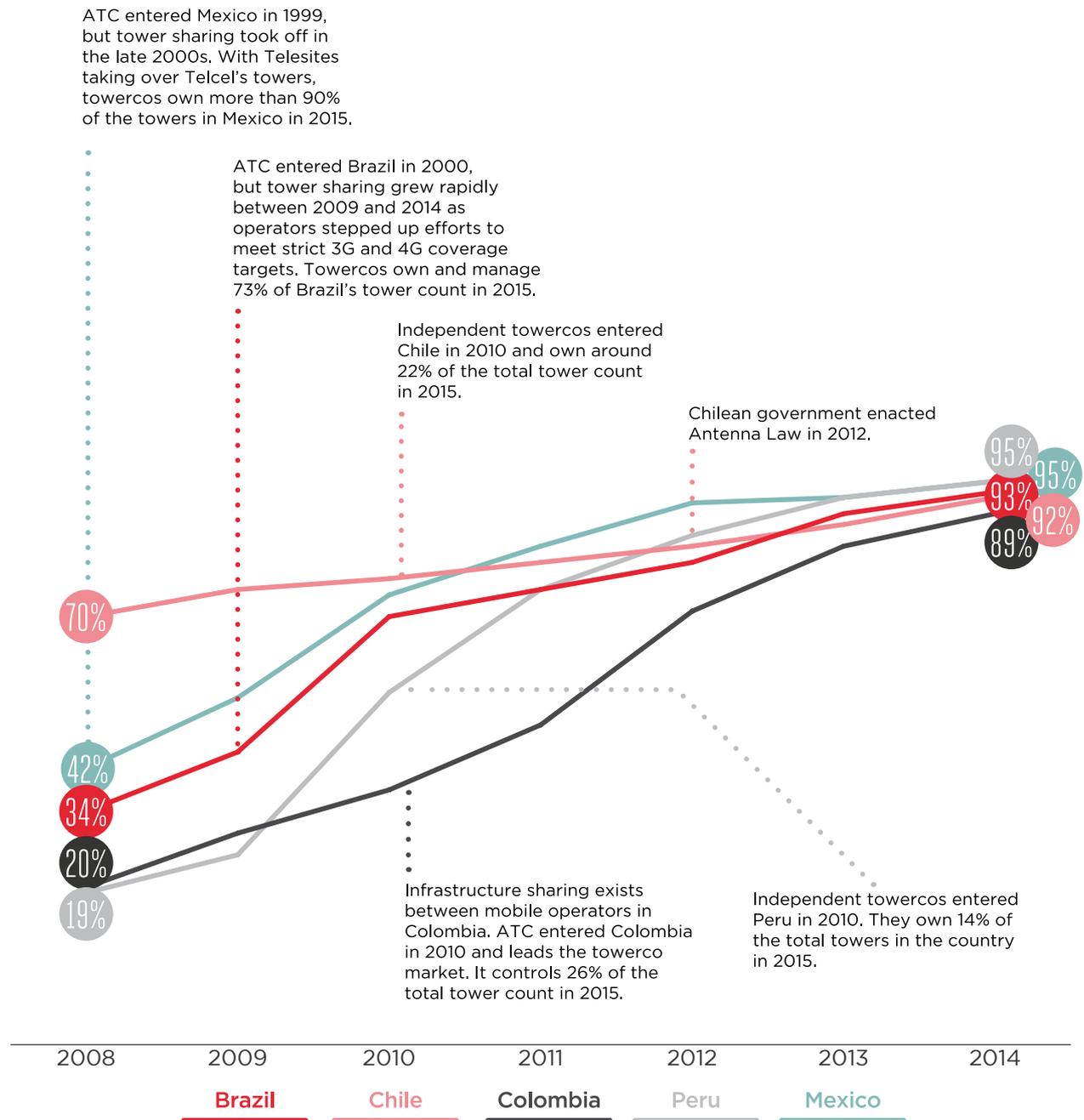
In Latin America, voluntary passive sharing has been the preferred approach, with independent tower companies (towercos), led by US firms American Tower Corporation (ATC), SBA Communications and Grupo TorreSur (GTS), playing a major role. The region is currently the third largest independent tower market (behind the US and Asia) in terms of number of towers owned by towercos. Towercos own and operate around 42% of the estimated total tower count of 160,000 in the region.⁹ Around 73% of the towers in Brazil are now owned and operated by towercos while, in Mexico, America Movil's spinoff of Telesites in 2015 has taken the proportion of towers controlled by towercos in the country to around 91%. Infrastructure sharing has helped drive 3G coverage in Latin America. Figure 8 illustrates major developments in the tower market in selected countries and the corresponding rise in 3G coverage.

In some countries where independent tower services are yet to take off, such as Venezuela, operators have implemented one-to-one passive sharing agreements to boost coverage. In October 2014, mobile operators in Venezuela – Movilnet, Movistar and Digitel – started the construction of shared sites in locations where there is no existing mobile service via a three-way shared investment programme to accelerate coverage expansion. The first shared site, located in the Paraguaná Peninsula, in Falcon state, provides coverage to more than 30 companies and 63,000 people in surrounding communities. The first phase of the project includes the construction of 30 sites, with each of the three operators taking responsibility for construction of 10 sites.

9. Source: TowerXchange

Source: GSMA Intelligence, TowerXChange, American Tower Corporation

Figure 8: Mobile broadband coverage (percentage of population) and key developments in infrastructure sharing



For mobile operators, increasing the tenancy ratio of cell sites, particularly in sparsely populated regions, makes coverage expansion more economical by spreading the investment, return risk and running costs over multiple operators. It also aids in mobile operators' compliance with coverage obligations considering the cost and complexity of deploying standalone networks.

Active infrastructure sharing is starting to gain traction, driven mainly by the high level of investment required to deploy LTE and meet government-imposed coverage obligations. Examples of active

infrastructure sharing in the region include Oi and TIM in Brazil forming a 15-year RAN sharing agreement in 2013 to deploy LTE using the 2.5 GHz band in 12 cities, and Movistar and Tigo in Colombia forming a RAN sharing agreement in 2013 to jointly deploy LTE using the AWS (1.7/2.1 GHz) band. Sharing part, or all, of the RAN can address the network densification requirements in urban areas while offering substantial savings for operators. It also boosts spectral efficiency, accelerates time to market, and gives operators the flexibility to redeploy infrastructure to more remote and underserved areas.

3.3 Partnering with other ecosystem players

Latin America has a relatively low population density – the second lowest globally after North America. Many countries in the region, including Argentina, Brazil and Chile, have population densities of less than 30 people per square kilometre. Meanwhile, approximately 32 million¹⁰ people in the region have no access to commercial electricity grids, most of them living in difficult terrains deep in the Amazon rainforest, in mountainous regions or on remote islands. It is uneconomical to build conventional licence-based mobile networks in many of these areas given the high costs and lack of grid electricity. Mobile operators are therefore increasingly forming partnerships with other ecosystem players with alternative connectivity technologies, particularly aerial technologies such as satellites.

Satellites leverage the advantage of altitude to provide wider ground coverage, with low earth orbit (LEO) satellites cruising at 1,000 kilometres above sea level and geosynchronous earth orbit (GEO) satellites much higher at 40,000 kilometres. The technology is well established in serving commercial shipping companies

and other remote commercial installations, but the move to consumers has struggled to gain traction because of the high costs and integration complexities. Signal decay remains a problem, although rain fade¹¹ has been mitigated through recent advancements in the Ka-band.

Although a lot of broadband communication is currently carried via terrestrial links, satellites will play a greater role in the future, as recent improvements in the technology have the potential to improve service quality and solve the expensive ‘last-mile’ issue. For example, the high bandwidth available in the Ka-spectrum and frequency reuse capabilities across multiple beams enable the delivery of more capacity at faster speeds to smaller dishes, opening the door to upgraded services at lower costs for more users (see Table 1). European institutions and industry have made significant efforts to deploy satellite broadband solutions to offer ubiquitous broadband, especially in rural areas, with subscription prices and performance comparable to ADSL broadband.

Source: ISI European Technology Platform

Table 1: Advances in satellite broadband technologies

	2005	2010	2015	2020
Generation	Ku-band satellites	First generation multi-beam Ka-band satellites	Second-generation multi-beam Ka-band satellites	Third-generation multi-beam Ka-band satellites
Service capability	Internet broadband	High-speed internet broadband	Superfast internet broadband	Very high-speed internet broadband
Maximum service rate	2–3 Mbps	10–20 Mbps	30–50 Mbps	100 Mbps
Capacity per satellite	5 Gbps	50–100 Gbps	150–200 Gbps	>500 Gbps
Users per satellite	100,000	Several 100,000s	Up to 1 million	>1 million

10. Source: Inter-American Development Bank

11. Interruption of wireless communication signals by rain or snow droplets



As satellite communications can also be used with or as a complement to terrestrial infrastructures to enable universal broadband coverage, some mobile operators in Latin America have built partnerships with satellite technology providers as part of their rural coverage strategies. Israel-based Gilat Satellite Networks provides managed network and satellite-based services for rural telephony and internet access in Peru and Colombia, and has partnered with a number of mobile operators in the region, including Antel in Uruguay. In September 2015, O3b Networks announced the delivery of trunking services to Colombian ISP Skynet, which can be leveraged by mobile operators to provide broadband internet to users in the Amazon. With O3b expanding its capacity to connect islands and rural populations in far-flung areas of the world, there is scope for more partnerships with mobile operators, which already comprise 60–70% of its business.¹²

Aside from satellites, there is growing interest in the potential of other aerial connectivity solutions to improve network coverage in remote areas. With Google's Project Loon, a network of balloons roughly 20 kilometres above sea level uses unlicensed spectrum to provide internet connectivity to people in rural and remote areas. Project Loon was started in the Google X lab in 2011, and has seen significant improvements in the last two years to make it a more compelling alternative for mobile operators. In Latin America, Google has already run trials in Brazil and Chile, and plans to roll out the service more widely by the end of 2016 in partnership with mobile operators,

including Telefónica, in underserved markets in the region. Other tech giants, such as Facebook, are trialling similar technologies.

Beyond operator-led initiatives, several start-ups have established community networks targeted at remote settlements that are cut off from cellular connectivity and, in many cases, roads and grid electricity. Community networks often use micro base stations and a backhaul solution that links into the core network of mobile operators. Technically this functions by using custom software that re-encodes voice calls and data access onto the IP channel, which runs through a gateway onto the internet and interconnects with mobile networks around the world. In Mexico, a non-profit organisation Rhizomatica has established a community network in San Juan Yaeé, a remote community of about 500 residents. This was the first of up to nine networks running on software installed on open source base stations that it expects to install in the state of Oaxaca by the end of 2015.

The low set-up costs of these networks – Yaeé's network cost MXN 120,000 (\$7,500), a fraction of the potential cost of the deployment of a conventional network – make them an attractive proposition to local communities, which mostly finance the deployment. However, we believe that these networks will remain sub-scale indefinitely in the absence of partnerships with mobile operators given that most of the existing operations in this area run on experimental or unlicensed spectrum.

12. Source: "Before Google's Project Loon or SpaceX, O3b cites demand for its satellites", FierceWireless Tech, October 2015



4

The role of governments

Mobile operators in Latin America face a tough balancing act in allocating capital across multiple divergent needs: investing in network expansion projects to meet coverage obligations, or boosting network capacity in existing service areas to address QoS expectations (most countries in Latin America have more than 3,500 connections per base station, compared to around 1,000 or fewer in the US and other developed markets). This puts an additional burden on mobile operators and inadvertently weakens the business case for investment in coverage expansion. As private investment depends heavily on the regulatory climate, governments have a role to play in creating and sustaining an enabling environment for effective investment in infrastructure deployment.

In order to run commercially viable operations, mobile operators need to ensure that their networks have the right coverage, capacity, performance and business cases to keep up with the fast growth of mobile broadband. For this reason, it would be more productive for governments and regulatory authorities to allow competition in a free and open marketplace to guide the investment decisions of mobile operators rather than imposing mandatory regulations and obligations that potentially distort the optimum allocation of capital and other resources. The move by UK mobile operators to invest £5 billion (\$7.7 billion) to improve coverage in rural areas, after the government

withdrew plans to mandate a 'national roaming' agreement in 2014, shows the potential for supportive government policies to stimulate private investment in coverage expansion.

Beyond regulation, governments can use incentives that improve the economics of providing services in less viable areas to complement mobile operators' coverage expansion initiatives. These include financial support, an enabling environment for voluntary infrastructure sharing, spectrum and access to infrastructure.

4.1 Financial support

Financial support mechanisms are most effective for reaching remote areas where traditional rollout models would be uneconomical. They can take many different forms, but the most common examples are subsidies, public-private partnerships (PPPs), tax incentives and universal service funds (USFs).

Subsidies are directly financed from public funds to enhance and target investment into areas of need, as opposed to contributions from mobile operators (universal service funds). There are very few examples of subsidies in developing regions around the world, partly because the right mechanisms for implementation have not been established. There are, however, notable successes in developed countries; in 2015 Australia reserved \$76 million in subsidies for mobile operators to improve mobile coverage in remote areas following more than 10,000 requests for new towers in more than 6,000 locations nationwide. Some of the country's regional governments are moving in the same direction. Telstra has secured an \$8 million contract from the government of Western Australia to build the first 22 of 85 towers, which form part of a \$40 million Regional Telecommunications Project to reduce gaps in mobile voice and data coverage in small communities.

PPPs and tax incentives are offered to reduce the risks and financial burden of deploying infrastructure while providing incentives to investors. Conversely, USFs are generally funded through a contribution mechanism from mobile operators, either fixed or calculated as a percentage of gross revenues or as a portion of an overall regulatory or licensing fee, often with pre-defined exclusions.

However, the vast majority of existing funds are underperforming in terms of disbursement and project implementation, making USF a less viable form of financial support.

A GSMA study¹³ of 12 funds in Latin America revealed that approximately \$5.4 billion of undisbursed funds were held by the USFs by the end of 2011, highlighting inefficiencies in the utilisation of funds that could otherwise be used to extend network coverage or lower the cost of mobile ownership. That said, USFs remain an option in reaching underserved areas. Colombia's USF, known as FONTIC, serves as an example of an effective fund with a clear roadmap of planned projects, record of delivering projects in a timely manner and focus on financial transparency. However, we believe USFs should be at a lower priority to subsidies, PPPs and tax incentives until governance is improved to release funds systematically and much more in step with when they are actually collected. Governments in countries where existing laws preclude private mobile operators from accessing funds should suspend contributions by mobile operators until the laws are amended to establish a mechanism to disburse already collected funds for coverage expansion projects.

Table 2 shows examples of existing financial support measures in the region.

13. Source: Universal Service Fund Study, GSMA, 2013

Source: GSMA Intelligence

Table 2: Examples of government financial support in Latin America

Date + Country	Type of financial incentive	Key details
October 2015 - Brazil	Tax incentive	<p>The Ministry of Communications approved TIM's Special Tax Regime projects for the construction of mobile access networks and satellite services worth \$239 million and \$5.15 million, respectively, across the country.</p> <p>Star One, a subsidiary of Claro, won approval to construct satellite communication systems in the Ka-band and fibre-optic network valued at \$52.3 million.</p> <p>Oi won approval to build a fibre-optic network in Paraná for \$1.1 million.</p> <p>The Special Tax Regime of the National Broadband program for the implementation of telecommunications networks (REPNBL-Networks) granted an exemption to the PIS/Cofins tax on engineering and purchase of equipment to accelerate investment in broadband networks.</p>
January 2015 - Brazil	Tax incentive	<p>The governor of the state of Rio de Janeiro sanctioned Law 6962, which provides a tax break on mobile services as a compensatory measure for investment in network infrastructure in rural areas of the state.</p> <p>The tax reduction affects only the ICMS tax, a value-added tax on sales and services. As a state-level tax, it varies depending on the state and type of good. In Rio, the current ICMS rate for telecommunication services is 25%. The value of the tax reduction will be determined by the state government after the installation of the antennas, since the break is meant to be a compensatory measure to incentivise investment in rural coverage.</p> <p>The state government will participate in the process of choosing where the new antennas should be placed, and will prioritise the areas already covered by two existing rural area programs: Rio Rural and Vozes da Produção.</p>
December 2014 - Paraguay	Universal service fund	<p>The National Telecommunications Commission (Conatel) and Tigo signed a contract to expand mobile and fixed Internet connectivity to the Paraguayan areas of the sparsely populated Gran Chaco region, which also spans eastern Bolivia, northern Argentina and a portion of the Brazilian states of Mato Grosso and Mato Grosso do Sul.</p> <p>Tigo was the only company to lodge a bid in Conatel's USF tender. Tigo will receive PYG21.66 million (\$4.63 million) from the government to support the 24-month rollout.</p> <p>Deployment started in 2015 and is expected to conclude in 2017.</p>
August 2010 - Chile	Public-private partnership	<p>The government of Chile and Entel launched a PPP initiative called the Bicentennial Project to connect 1,474 rural communities to mobile broadband. The total investment for the project was \$100 million, with the government contributing 45% and Entel providing the remaining 55%.</p> <p>The project was divided into three phases and designed to benefit more than 3 million people and 800,000 households in 90% of rural communities in the country.</p>



4.2 Reducing municipal red tape and encouraging infrastructure sharing

For infrastructure deployment and antenna siting, mobile operators and tower companies need to obtain local approvals from municipalities for each antenna or tower site. The absence of a clear national policy can lead to each municipality adopting its own policy and procedures that are sometimes in conflict with the technical requirements of deploying mobile networks.

Governments therefore need to adopt national policies that support mobile infrastructure deployments and that are based on the recommendations of the World Health Organization (WHO). This will protect the public with clear criteria for assessment of site compliance with safety limits and provide clarity for mobile operators for site-planning purposes.

National governments can support municipalities with a policy that:

- specifies clear information, consultation and visual integration requirements
- provides for a mandatory decision period for site applications
- allows for simplified procedures for small antennas, low power sites and modifications.

There should also be consistent procedures throughout the country rather than differing infrastructure permit norms for each municipality. Argentina and Peru have recently taken positive steps in this regard, announcing laws and policies that could facilitate infrastructure deployment. In August 2014, the Ministries of Communications and Municipal Affairs of Argentina signed an agreement aimed at streamlining the deployment of mobile phone network infrastructure and improving coverage in the country. The framework agreement provides guidelines for local governments to follow when installing new mobile phone towers and covers all aspects of the installation of mobile phone towers, including technical specifications as well as health, safety and environmental considerations. Although it is still early to assess the impact of this development, Innovattel/Torresec, a build-to-suit towerco with 350 towers across Puerto Rico, Ecuador, Peru, and Colombia, secured a contract in August 2015, making it the first independent towerco in the country.

In Peru, which requires an additional 4,000–6,000 towers by 2017 to improve coverage and capacity,

the National Congress approved a bill in June 2014¹⁴ that recognises the importance of mobile network infrastructure and establishes a special regime for 10 years across the country for the expansion of telecoms services, particularly in rural and underserved areas. Notably, the law provides for automatic approval by municipalities of antenna-siting applications that satisfy the provisions of the act and requires that fees correspond with the actual administrative costs.

There are approximately 160,000 towers in Latin America, but the region requires considerably more for optimum coverage. Infrastructure sharing has the potential to enable the efficient deployment of new towers and ensure the best use of existing ones. For example, the Mexican telecommunications regulator (IFT) claims 80,000 base stations are needed in Mexico. Although this is nearly four times the current tower count, it could potentially be served by 40,000 towers or fewer if tower sharing was implemented with an average tenancy ratio of two or more.

14. Law No 3139 approved on 11 June 2014

In view of the benefits of infrastructure sharing and mobile operators' positive disposition towards it, governments need to issue policies that allow all types of infrastructure sharing based on commercial private negotiation and collaborate with municipalities to support and facilitate the deployment of shared infrastructure. Although many infrastructure sharing agreements in the region are based on efficiency

considerations, there are cases of regulatory mandates, such as imposing infrastructure sharing on the incumbent where competitors lack viable alternatives. For example, Ecuador introduced mandatory site sharing in December 2009. Infrastructure sharing agreements should also be governed under commercial law and, as such, be subject to assessment under general competition law.

4.3 Making spectrum available

Sub-1 GHz spectrum bands are well suited to rural coverage given their significant capacity to propagate signals. The availability (suitable, affordable and free from interference or other use) of spectrum in these bands is essential for the efficient and timely deployment of mobile broadband services in sparsely populated areas. In a positive step, several countries in Latin America have allocated the 700 MHz spectrum band for mobile services, particularly 4G LTE, following the ITU's World Radiocommunication Conference in 2007, which confirmed the allocation of spectrum from 698 MHz to 806 MHz for mobile services in the Americas (Region 2). However, governments need to do more to assign harmonised spectrum to mobile operators and to clear the band of existing services.

A number of licences are due for renewal in several countries over the next five years (Table 3). Governments can use a transparent renewal process that reflects international best practice for spectrum valuation, coverage and quality-of-service obligations,

spectrum holdings, licence duration and technology neutrality to incentivise operators to prioritise coverage expansion. For example, in valuing licence renewal fees, governments should take into account the potential cost of building and maintaining network infrastructure in difficult locations, while the licence duration should be sufficient to stimulate investment in coverage expansion. Shorter licence terms can discourage new investment, especially in areas with potentially low returns on investment. Governments should also remove uncertainty around licence renewal, particularly with regards to renewal terms, timings and changes in original conditions, as this could impact negatively on operators investments; a previous GSMA report found that within 24 months of licence expiry, and with no certainty regarding the renewal process and/or its results, the potential loss of investments is 67%, compared to the investment level observed 60 months before expiration in the event of certainty regarding continuity of spectrum use.¹⁵

15. Licence Renewal in Latin America, GSMA, February 2014

Source: GSMA

Table 3: Latin America: upcoming licence renewals

Country	Operator	Date	Band
Brazil	TIM and Oi Claro and Oi	2016 2017	1800 MHz 1800 MHz
Panama	Telefónica Cable & Wireless	2016 2017	900 MHz 900 MHz
Bolivia	Tigo	2016	850 MHz
Ecuador	CNT	2018	850/1900 MHz
Colombia	Tigo	2018	1900 MHz
Mexico	Telcel, Telefónica and Lusacell (now AT&T)	2018	1900 MHz
Mexico	Telcel	2019	1900 MHz
Mexico	Telcel	2020	850 MHz
Mexico	Telcel	2020	450 MHz

4.4 Access to infrastructure

The majority of existing infrastructure in remote areas, including buildings, open spaces such as parks and squares, legacy fixed-line telecoms infrastructure and public utilities, is owned by governments and public institutions. This infrastructure should be made available for the installation of new sites and the provision of mobile services, significantly boosting coverage in underserved areas by reducing the cost and complexity of network deployment while guaranteeing security for network equipment in remote locations. There are two notable examples in Latin America of governments allowing mobile operators to access public infrastructure for coverage

expansion. In Mexico, the Telecommunications and Broadcasting Law, which came into effect in August 2014, allows private mobile operators access to various public infrastructure, including electrical transmission and radio towers, broadcasting infrastructure and other real estate, on a non-discriminatory basis. It also mandates the federal government to recommend the same measure to state and municipal governments. In 2014, the Argentinean government allowed mobile operators Claro, Movistar and Personal to rent part of the public infrastructure to expand coverage and improve their services in the mountainous area from Cacheuta to Las Cuevas.

Meanwhile, some governments in Latin America are investing in extensive fibre infrastructure as part of their national broadband plans. Some examples are highlighted below:

- Argentina: the government established ARSAT as part of the Argentina Connected Program with the aim of installing more than 50,000 kilometres of federal fibre-optic network in the country
- Ecuador: the Ministry of Telecommunications and Information Society claims that the country has 35,111 kilometres of fibre installed and is expecting it to reach 45,000 kilometres by the end of 2017
- Mexico: fibre-optic network infrastructure is being extended to rural areas
- Chile: the proposed Proyecto Fibra Óptica Austral in Chile is expected to connect Southern Patagonia.

As universal connectivity to high-speed Internet will require the integration of multiple technologies, including 3G and 4G, governments can support coverage expansion by establishing a framework to grant mobile operators fair and non-discriminatory access to fibre networks to support their backhaul requirements in remote areas. This is demonstrated in Peru, where a government-backed project to bring

fibre-optic connectivity to 1,344 villages has a provision for mobile operators to access the infrastructure for much-needed capacity and backhaul transmission. Peru's national telecoms investment fund, Fondo de Inversión en Telecomunicaciones, FITEL, will finance the project, for which Gilat consortium will deploy fibre-optic infrastructure in Apurímac, Ayacucho and Huancavelica, and Movistar in Lambayeque.

Case study:

El Salvador

The challenge

El Salvador is the smallest country in Central America¹⁶ but has the third largest population (after Guatemala and Honduras), making it the most densely populated country in the sub-region. It suffers from several social challenges, including poverty and income inequality, as well as poor infrastructure. Despite this, the country has a relatively developed mobile industry, with subscriber penetration at 65%.

However, the mobile broadband market is underdeveloped, with only 19% of the population subscribing to higher speed services. This is the second lowest in Central America, and well behind the Latin America average of 26%. The socio-economic difficulties, along with challenging geography (two parallel mountain ranges and a central plateau cover 85% of the land area), have hampered deployment of mobile broadband in underserved areas.

Market structure

El Salvador's unique mobile subscriber base reached 4.2 million by the middle of 2015, a penetration of 65%. The market is served by five active mobile operators, and a liberal regulatory environment encourages maximum competition between them. Tigo (part of Millicom) is the largest with 33% of connections (excluding M2M) as of June 2015; Claro

(owned by América Móvil) is second with 30%; and Movistar (Telefónica) is third with 23%. Digicel has 12% of connections, and Red (Intelfon) has just over 1%. Unique mobile broadband subscriber penetration is 16%, and mobile broadband population coverage is around 84%.

¹⁶ Central America consists of seven countries: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama

Strategy and players

In March 2014, Movistar reported investment of more than \$100 million over a three-year period, focussed on modernising base stations and upgrading the transmission network. In July 2015, Tigo reported investment of \$300 million since 2012, focused on data services, including its 3G mobile broadband networks,

as well as mobile financial services and satellite phones. In September 2015, Digicel reported that it had invested \$60 million in the upgrade and expansion of its network infrastructure to all 14 departments, and now provides 100% coverage of Greater San Salvador.

Impact and learning

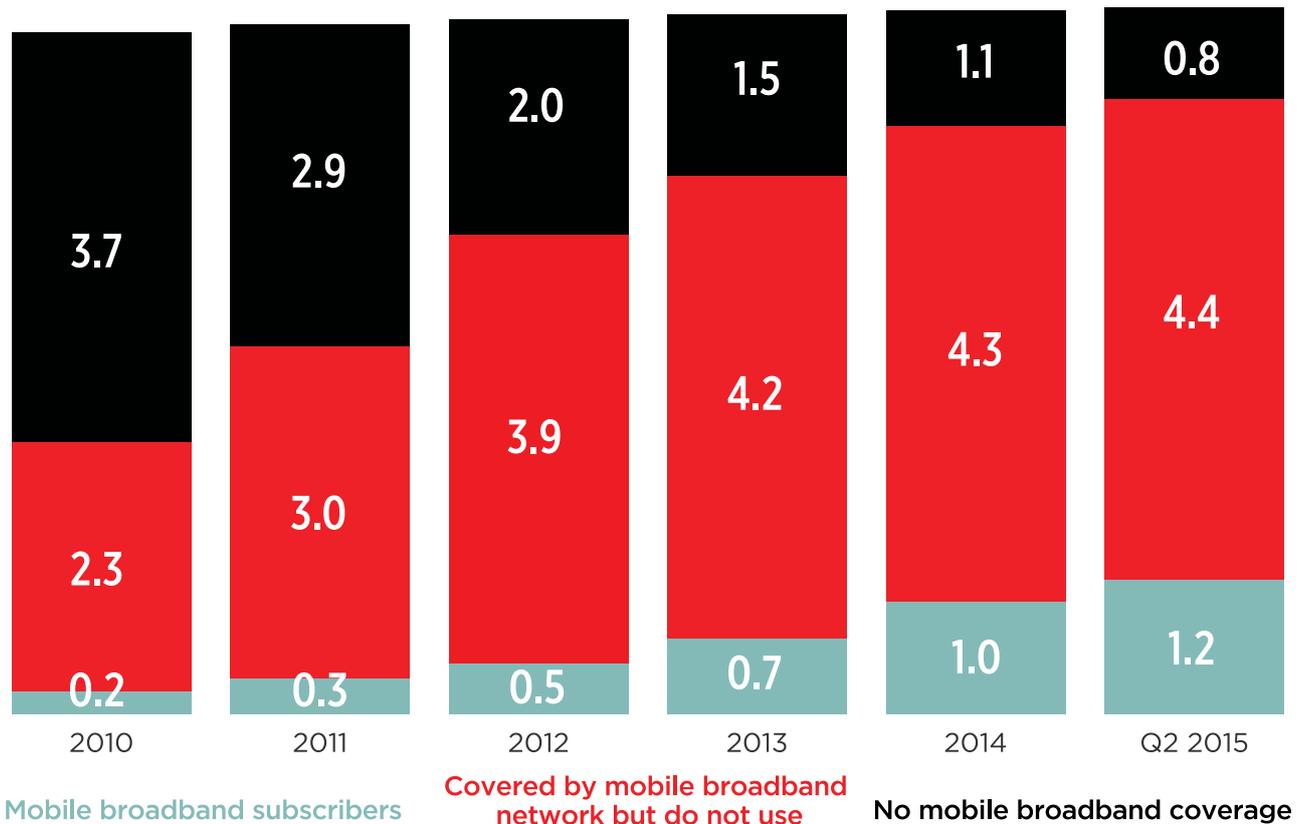
The liberal regulatory environment, strong competition and high levels of investment have led to rapid expansion of mobile broadband coverage in El Salvador, with an additional 2 million people, or

two-thirds of the population, covered by a mobile broadband network between 2010 and 2014 (see Figure 9).

Source: GSMA Intelligence

Figure 9: Mobile broadband coverage in El Salvador

Population (millions)



This rapid growth in coverage highlights how effective flexible and open regulation can be in fostering a market-led environment, allowing natural competition to help the market grow. Despite difficult social and

economic conditions, mobile operators have been willing to invest in a market when they see strong potential for growth.

Case study:

Peru

The challenge

Approximately 1.6 million people in Peru (8% of the population) are not covered by a mobile broadband network. In their attempts to connect this last segment of the population, mobile operators find themselves caught between regulatory requirements at a national level and infrastructure barriers imposed by local municipalities.

The Peruvian regulator, Osiptel, has imposed strict regulations on coverage and quality of service. For example, in June 2013, Movistar renewed its operating licences with obligations to extend mobile broadband coverage to 1,842 remote villages by the end of 2015, and must also provide more than 12,000 free mobile broadband connections aimed at improving the performance of essential state services in areas such as education, healthcare and security.

To meet these obligations, further network infrastructure deployment is necessary. However, local municipalities have imposed restrictions on the deployment of base stations, making it difficult for mobile operators to invest in network expansion to meet coverage and quality-of-service (QoS) criteria. As a result, base station density per capita in Peru is one of the lowest compared to not only other Latin American countries but also Asia, Europe and the US. At the end of 2013, there were about 8,000 antennas in the country, and the Ministry of Communications estimated that 14,000 more would be needed by 2017 to meet coverage and QoS expectations.

Source: Osiptel

Figure 10: Base station density per capita



Market structure

Peru's unique mobile subscriber base reached 15.8 million by mid-2015, a penetration of 51%. The market is served by four active mobile operators, but two dominate the market. Movistar (Telefónica) is the largest with 53% of connections (excluding M2M) as

of June 2015, and Claro, owned by América Móvil, has 39%. The other two mobile operators, Entel and Bitel, have 6% and 2% of connections respectively. Unique mobile broadband subscriber penetration is 20% and mobile broadband population coverage is just over 91%.

Strategy and players

In recent years, most of the expansion of mobile broadband coverage has been as a result of direct investment by mobile operators. In 2012, Osiptel announced that investment in the sector reached \$964 million, an increase of 10% compared to 2011. The majority of this – \$636 million, or 65% of the total – was spent on mobile network infrastructure. Movistar invested the largest sum, \$530 million (just under half of which was on mobile network improvements), and Claro and Entel invested \$297 million and \$81 million respectively in their mobile networks.

This significant investment is primarily an effort to meet the strict coverage and QoS obligations as outlined above. Although this has arguably been good for the mobile industry as a whole in Peru, resulting in mobile broadband coverage levels passing 90%, the government has recently recognised the considerable pressure this, as well as municipal infrastructure restrictions, puts on mobile operators.

In April 2015, Peru's Ministry of Transport and Communications published new legislation governing the installation of telecoms infrastructure aimed at

speeding up and streamlining the process. The new law for the Strengthening of Telecommunications Infrastructure Expansion (Ley para el Fortalecimiento de la Expansión de Infraestructura en Telecomunicaciones No. 29022) sets out a standardised process and requirements for automatic approval to install mobile towers. This includes a single administrative process to roll out aerials, poles, masts and cables, with fewer obstacles for acquiring permits to deploy infrastructure, as well as a simplified procedure for environmental certification and methods of camouflaging infrastructure, and a provision that fees correspond with actual administrative costs.

The new regulation will help mobile operators deploy infrastructure in rural regions of the country, and will be particularly effective in helping the smaller mobile operators (Entel and Bitel) compete more effectively with the larger players.

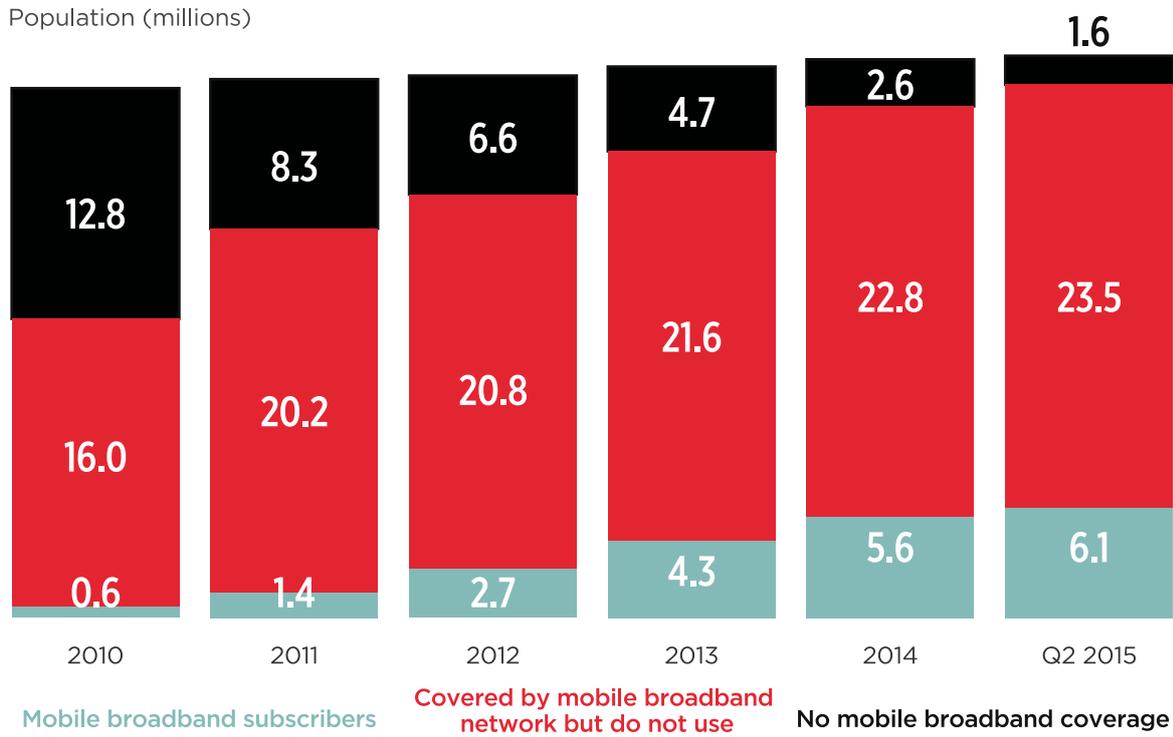
Impact and learning

Following years of investment and network rollouts, an additional 11 million people were covered by a mobile broadband network between 2010 and mid-2015 (see Figure 11). However, as the coverage gap gets smaller, it is increasingly more difficult to reach the unconnected, in this case the remaining 1.6 million people without

mobile broadband coverage. The new simplified regulation will make it considerably easier for mobile operators to roll out new infrastructure, allowing mobile broadband networks to reach previously unconnected areas.

Source: GSMA Intelligence

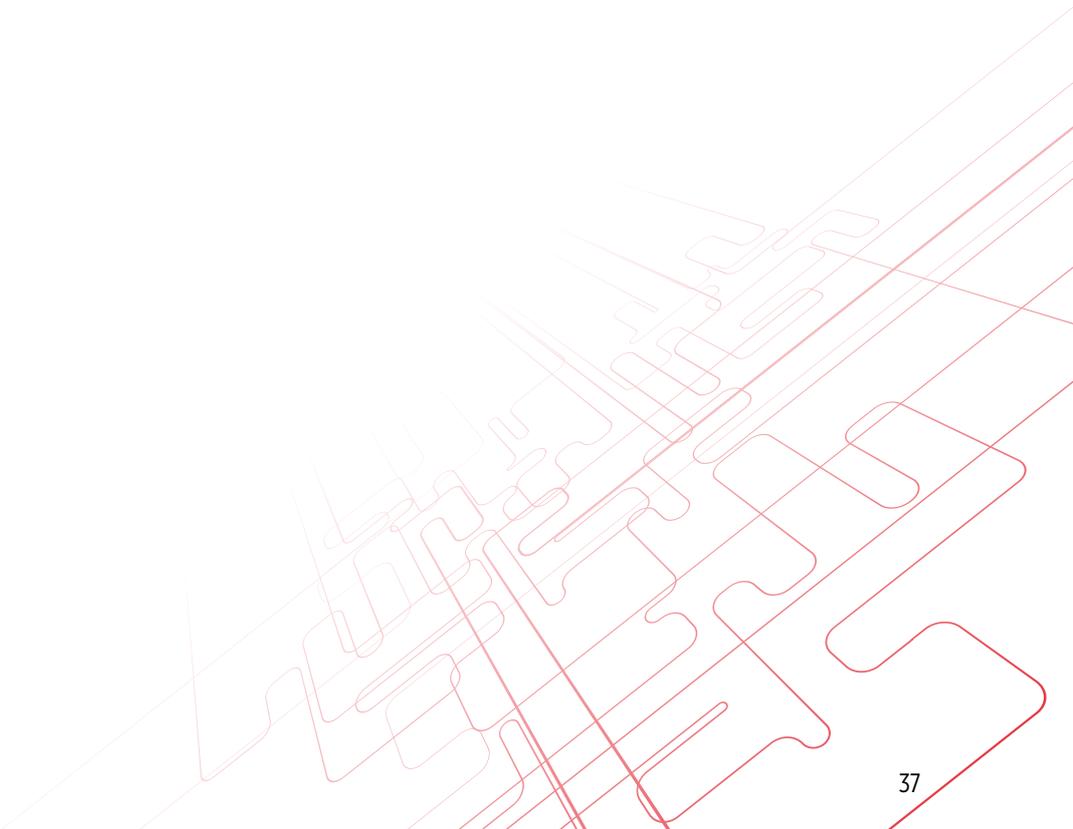
Figure 11: Mobile broadband coverage in Peru



To this end, Movistar plans to invest \$2 billion over the next two years to expand its infrastructure in Peru, \$95 million of which will be used to provide mobile connectivity to 2,327 rural locations. Meanwhile, Claro is planning to invest \$987 million over the next three years to expand coverage, increase network capacity and develop new value-added services. Entel is planning to invest as much as \$260 million to cover the entire national territory by the end of 2015. The plan includes expansion into six uncovered regions and an increase in sites from 1,590 (Q4 2014) to 2,400

by Q4 2015. Meanwhile, Bitel is spending \$400 million on the installation of 2,000 towers and laying 15,000 kilometres of fibre to ensure national coverage of 80% for its 3G services.

Towercos are also seeing Peru as an improving market for investment: American Tower reported that it had constructed 43 new towers in Peru during Q4 2014, bringing its total to 571, which represented the largest percentage increase across all of its operational markets, at 8.1%.





Please visit the GSMA website at: www.gsma.com

GSMA HEAD OFFICE

Floor 2
The Walbrook Building
25 Walbrook
London EC4N 8AF
United Kingdom
Tel: +44 (0)20 7356 0600
Fax: +44 (0)20 7356 0601