

5G in Latin America

Unleashing the potential



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Contents

Executive summary	04
1 5G in a global context	07
2 5G in Latin America's connectivity landscape	16
3 Building the networks of the future	24
4 Driving customer uptake	33
5 Policies to realise the potential of 5G in Latin America	41
6 Country overviews	46
Argentina	47
Brazil	48
Chile	49
Colombia	50
Dominican Republic	51
Guatemala	52
Mexico	53
Peru	54
Uruguay	55

Executive summary



Executive summary

5G is set for take-off

As of March 2023, eight countries in Latin America had launched commercial 5G services. The number of 5G connections is forecast to grow steadily over the next couple of years, before accelerating in the second half of the decade as new 5G markets go live and existing networks expand to cover new areas. As such, 5G adoption will overtake 2G in 2024, 3G in 2026 and 4G in 2029. By 2030, 5G will account for nearly 60% of total mobile connections in Latin America.

The speed of adoption reflects the high levels of consumer interest in 5G. According to a GSMA Intelligence survey, nearly two thirds of consumers in Latin America intend to upgrade to 5G. Around 30% of those surveyed in the region are unsure about whether to upgrade, while only 7% of people claim they do not intend to upgrade to 5G (the lowest of any region worldwide).

There is also positive sentiment towards 5G among enterprises in Latin America. GSMA Intelligence research shows that enterprises in the region across all verticals find new technologies such as 5G, private networks, massive IoT, edge and slicing compelling to advance their digital transformation. Moreover, the level of interest in these technologies is in line with advanced 5G markets, such as the US.

5G is driving network investment priorities

Operators in Latin America have invested \$54 billion¹ in mobile capex over the last five years – mostly on deploying and expanding 4G networks. The rollout of 5G networks across the region is expected to drive a slight increase in capex levels, but a spike is unlikely. This reflects the modest growth in mobile revenues forecast over the next few years, with operators trying to keep their capex-to-revenue ratios below a certain threshold.

Key investment areas will include massive MIMO capabilities, cell site densification and fibre backhaul. Investments in sustainable technologies (renewables and energy-efficient equipment) are also high on the agenda, as operators look to guard against rising energy costs. Furthermore, operators in Latin America see the rollout of 5G as an opportunity to move forward with cloud and IT transformation projects in the core network. This will occur alongside security enhancements (a top-two 5G core investment priority for 30% of operators), which will be essential due to 5G's cloud-native design and distributed network architecture.

Moving to cloud-native infrastructure will be crucial to enable 5G standalone (5G SA) deployments. As is the case globally, most initial 5G deployments in Latin America have used a non-standalone (NSA) architecture. 5G networks in Brazil are a notable exception. 5G SA availability will increase in other parts of the region, however. GSMA Intelligence research shows that 55% of operators in Latin America with live 5G networks have announced plans to upgrade to 5G SA – in line with the global average. This will help operators deliver the true benefits of 5G in terms of latency, network slicing and IoT support, which will be crucial for new use cases.

¹ Throughout this report, \$ is used to refer to US dollars.

Operators search for the ‘wow’ factor

According to a GSMA Intelligence survey, 5G home broadband is an extremely or very appealing proposition for two thirds of Latin American consumers. 5G FWA will mainly be used to facilitate first-time home broadband adoption in the region, in addition to improving speeds for households reliant on cable/DSL connections with lower performance. There is likely to be a specific focus on the urban, middle-income segment. 5G also provides operators with new bundling opportunities, with 5G consumers showing higher levels of interest than 4G users in adding services and content to their contracts. Digital entertainment and remote health applications are among the services offered to consumers with 5G service plans in Latin America.

Most early 5G use cases are extensions of existing services. However, mobile operators are acutely aware of the need to develop further applications that leverage 5G’s unique capabilities to drive a ‘wow’ factor and justify higher prices. These will require certain partnerships, with a combination of capabilities key to creating value. As such, operators and equipment vendors in the region have invested in 5G labs dedicated to co-creating consumer and enterprise solutions with partners to address specific needs.

The enterprise sector will prove pivotal to the success of 5G

There is a consensus among operators that the business-to-business (B2B) segment represents the largest incremental revenue opportunity in the 5G era, considering the raft of digital transformation projects underway across a number of industries. Operators around the world typically see manufacturing as the largest B2B revenue opportunity. While manufacturing is widespread, the opportunity by industry can vary, reflecting different levels of importance to local economies (e.g. agriculture and mining represent significant opportunities in Latin America).

With the deployment of 5G networks, operators are reshaping their enterprise strategies to better serve customers. Besides connectivity speeds being upgraded over those of previous network generations, 5G provides benefits for IoT deployments and low-latency applications. There is also scope to scale private wireless solutions. Latin America has seen demand for private wireless networks in Brazil, Peru and Chile in particular. Most deployments so far have been private LTE solutions, but the number of 5G use cases in testing or live is growing. These include autonomous guided vehicles (AGVs) for transporting goods, drones for site survey and high-definition video streaming for safety and security applications.

Policy decisions are key to accelerating 5G development

Unlocking the potential of 5G requires policy measures to support network investment and improve the affordability of digital services for consumers. Ultimately, the speed of rollout, as well as the adoption, reach and quality of 5G services, will heavily depend on an appropriate policy environment being in place. Specifically, policymakers should take steps to do the following:

- Provide timely access to the right amount of spectrum for 5G, under the right conditions.
- Rebalance sector-specific taxes and regulatory fees to promote 5G investment, economic growth and fiscal stability.
- Remove obstacles to network deployment to encourage and incentivise 5G rollouts, especially around right-of-way approvals, small cell deployment and electromagnetic field rules.
- Evolve to smarter regulation that accomplishes its objectives in the most efficient manner, eliminating regulatory asymmetries so that similar services are subject to similar rules.
- Foster dialogue between the public and the private sector.
- Promote the benefits of security assurance frameworks that can help strengthen 5G security.

1 5G in a global context



1.1

Understanding 5G

The mobile industry has demonstrated its ability to connect and transform society through 2G, 3G and 4G networks over the last 30 years. Building on the success of previous generations, 5G delivers a platform that enhances existing services and enables new business models and use cases. The mobile industry has five main goals for the 5G era:²

- **Boundless connectivity for all:** 5G networks will coexist with 4G networks and alternative network technologies to deliver a high-speed, reliable and secure broadband experience, and support a plethora of use cases.
- **Network economics and innovation:** 5G networks will rely on a combination of established and innovative technologies across different spectrum bands to deliver better quality networks in a cost-effective way.
- **Enhanced mobile broadband:** 5G networks will enable an enhanced broadband experience with speeds of up to 1 Gbps. This will support growing demand for mobile data in dense urban and suburban areas, as well as specific use cases such as fixed wireless access (FWA).
- **Massive IoT and critical communications:** 5G networks will support the massive rollout of intelligent IoT connections for a multitude of scenarios and provide an enhanced platform to support widespread adoption of critical communication services.
- **Digital transformation of industry verticals:** The mobile industry will provide the networks and platforms to accelerate the digitisation and automation of industrial practices and processes (including supporting Industry 4.0 goals).

² The 5G era: Age of boundless connectivity and intelligent automation, GSMA, 2017

1.2

5G versus previous generations

Legacy mobile technologies (1G, 2G and 3G) were heavily voice-oriented with their primarily circuit-switched network architecture. 4G introduced the first fully packet-switched network and the foundation for data services. As an evolutionary technology, 5G performs all the functions of 4G but with the potential for more, and at a significantly larger scale: superfast download speeds, high levels of reliability and extremely low latency.

5G will provide much higher data throughput, enabling a significantly better customer experience. However, faster speeds are not the only determinant of overall customer experience. In particular, the reduction in latency (delay) for data transit across the 5G networks and to end users will play a major role in unlocking new use cases by enabling new capabilities and the flexibility for operators to better serve the specific needs of enterprise customers. This improved capability and performance will come from a more advanced core network, increased spectral efficiency and capacity, and further network densification.

Figure 1

The evolution of mobile networks

Source: GSMA Intelligence

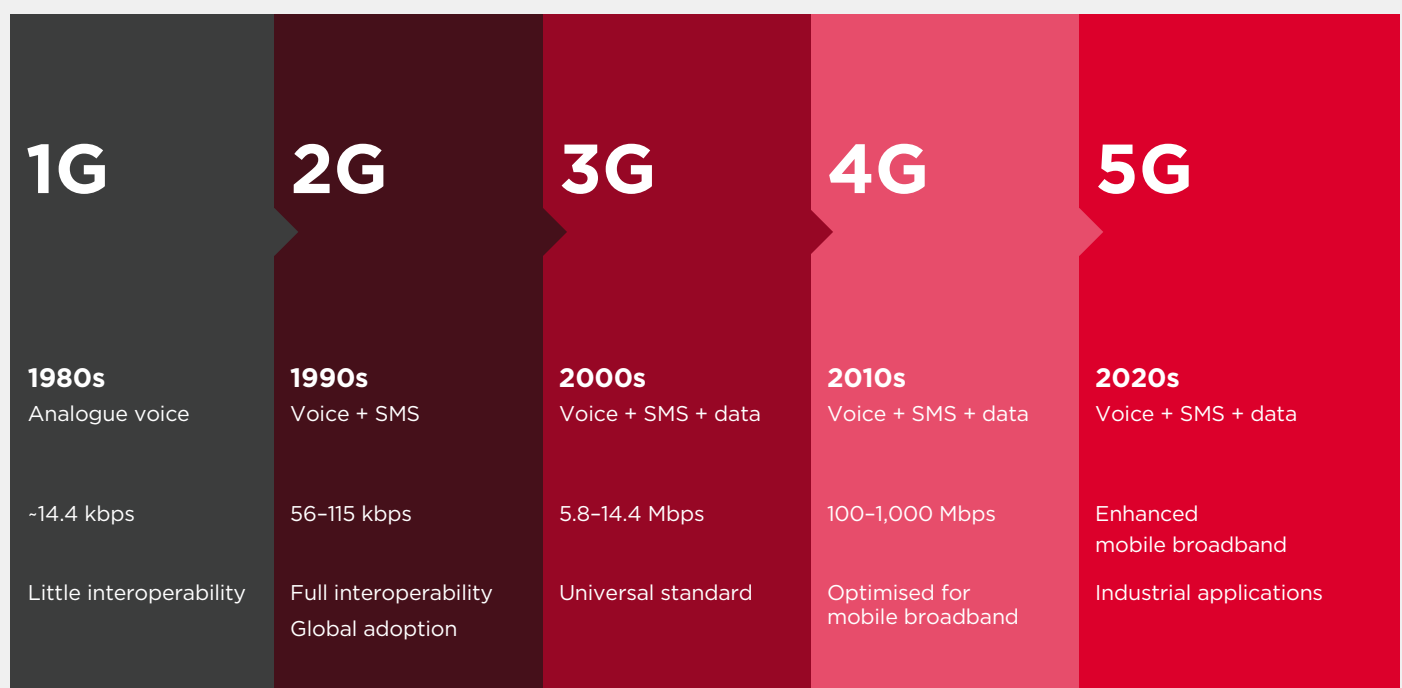


Figure 2

5G will support new and existing use cases

Source: GSMA Intelligence



1.3

5G availability spreading across the world

There have been extensive 5G deployments around the world. As of January 2023, 223 operators in 87 markets had launched 5G mobile services. Throughout 2023, some 30 new markets will launch 5G mobile services; many of these will be developing markets across Africa, Asia and Latin America, making 5G a truly global technology.

Many countries place 5G development at the centre of their digital transformation strategies, often setting goals at the national level and adopting policy reforms to support 5G development. For example, in Europe, the European Commission (EC) has set goals for uninterrupted 5G coverage in urban areas and along main transport routes by 2025, and 5G coverage to all populated areas by 2030. The EC has also made funds available to help boost the deployment of 5G in underserved areas,³ with 20% of the €672.5 billion Recovery and Resilience Facility devoted to digital projects.

In China, the 14th Five-Year Plan promotes the acceleration of 5G network deployment and adoption, setting specific targets. For example, the plan sets the ambition of reaching 26 5G sites per 10,000 people by 2025 and delivering 100 Mbps downlink and 5 Mbps uplink as standard. The objective is for 5G adoption to reach 56% by this point, aided by supportive policies on public funding and site infrastructure. In South Korea, the government established its 5G+ Strategy in 2019, with the objective to establish a world-leading 5G

ecosystem. The government also announced it would invest \$23 billion in collaboration with the private sector to support the early deployment of 5G and development of a strong ecosystem.

5G adoption rates will grow rapidly in the coming year, fuelled by factors including network coverage expansion and 5G marketing efforts. Progress on 5G smartphones is also a key factor. 5G was present in over two thirds of the smartphone models launched by the top 20 manufacturers in the first half of 2022, up from 40% in 2020. The average price of 5G-ready devices is now less than \$500, compared to nearly \$900 in 2019. Apple and Samsung occupy the mid and upper ground (\$500+), while a number of Chinese OEMs have positioned offerings primarily below that price point. Over the next couple of years, there is likely to be further movement towards the value end of the market, particularly sub-\$200 devices.

These factors will drive total 5G connections past the 2 billion mark by the end of 2025, reaching around 5.4 billion at the end of this decade. By this point, 5G connections will account for more than half the total number of mobile connections. However, 5G adoption will vary significantly around the world, ranging from over 85% in some markets to less than 20% in Sub-Saharan Africa. This highlights that 4G still has plenty of room to grow and will remain the dominant technology in many countries throughout the 2020s.

3 <https://5gobservatory.eu/public-initiatives/public-funding-of-5g-deployment/>

Figure 3

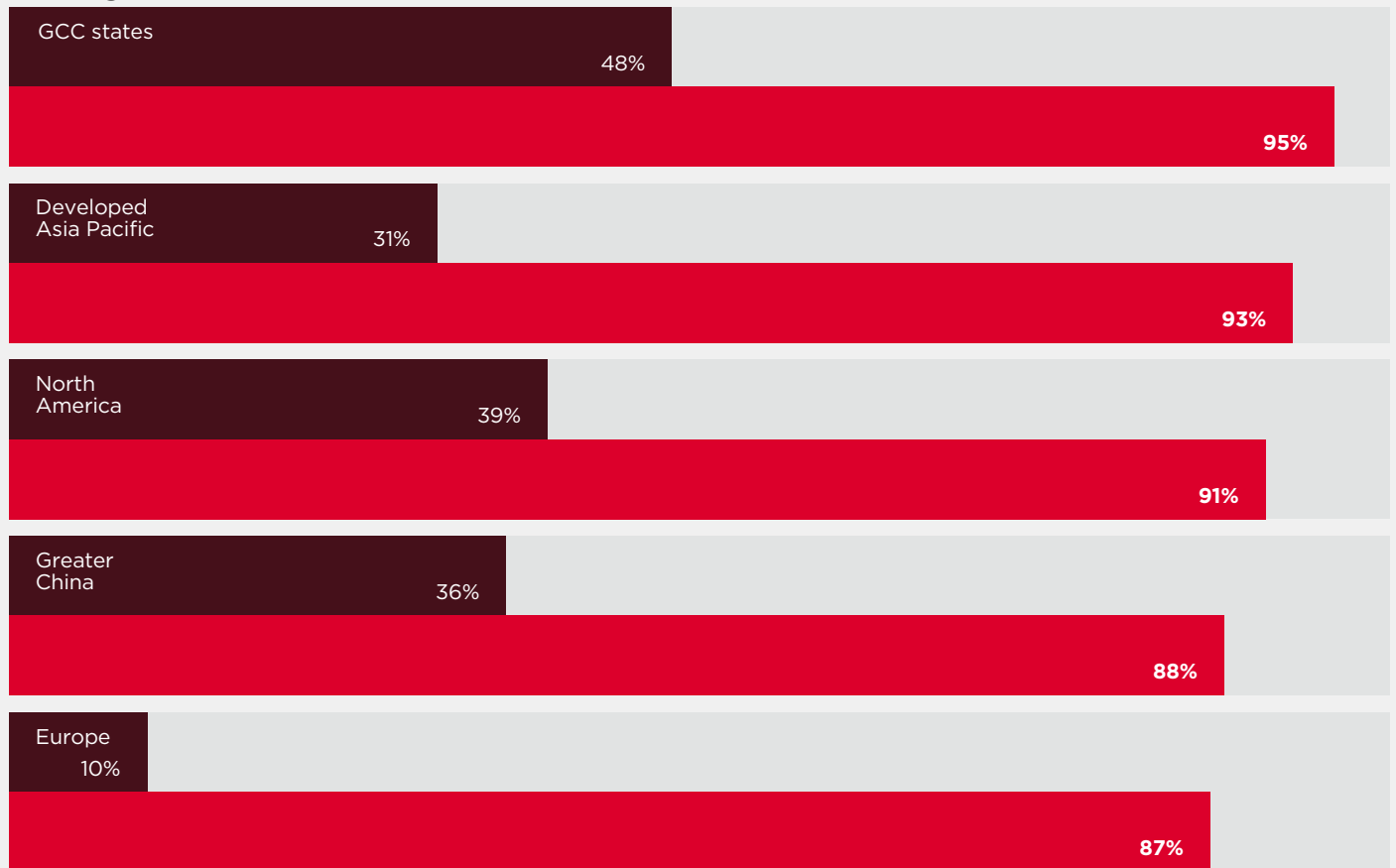
Over half of mobile connections will be on 5G by 2030

5G as a percentage of total connections

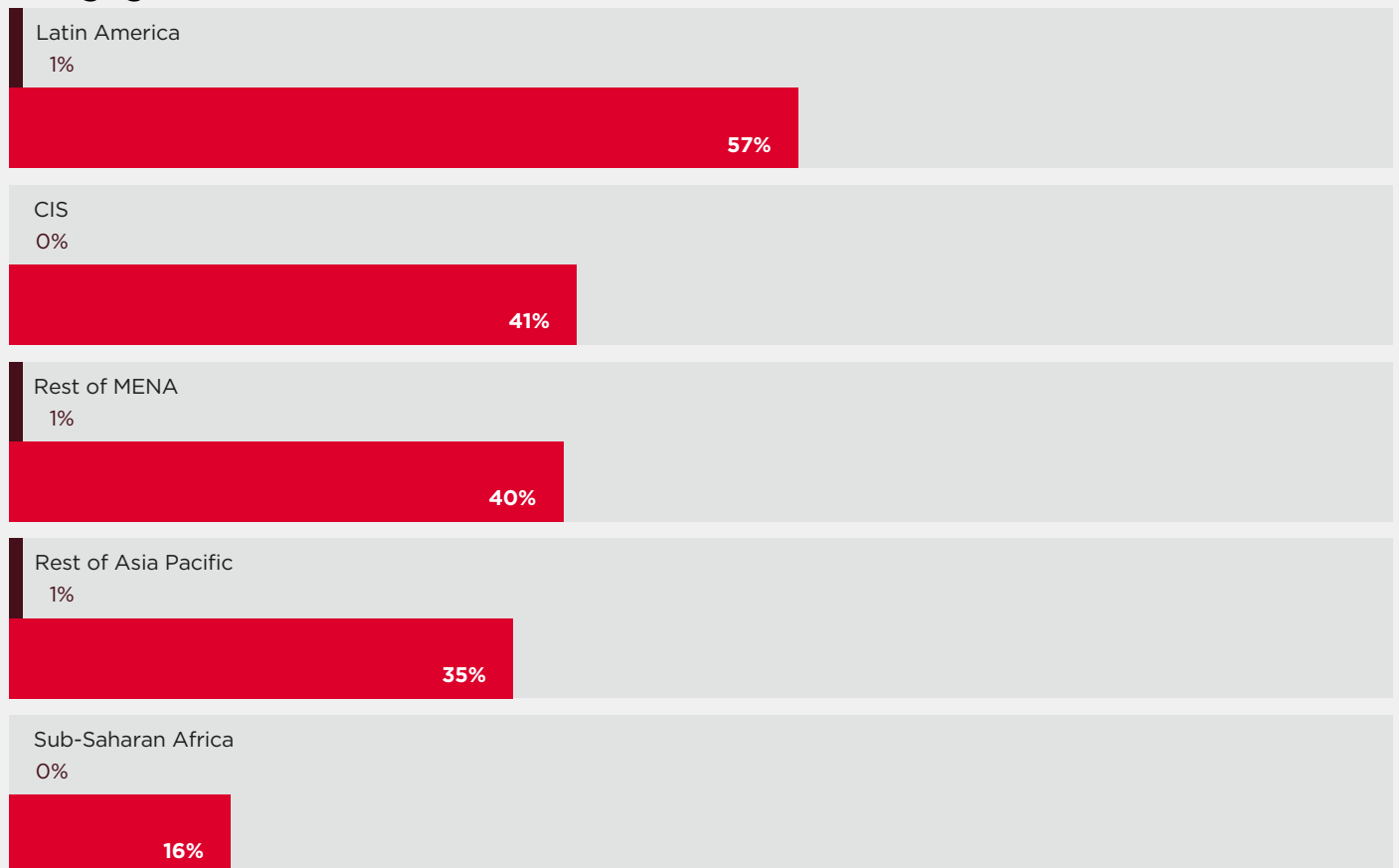
Source: GSMA Intelligence

■ 2022 ■ 2030

Leading 5G markets



Emerging 5G markets



1.4

Operators exploring new revenue opportunities

5G will continue the trend in mobile data pricing seen in the 4G era, where greater network capacity and improved network efficiency drive the convergence of the revenue/GB and cost/GB curves. This enables operators to offer larger data bundles, which can help increase profitability for the mobile industry if operators are able to successfully monetise excess capacity. Innovative tariff structures will be crucial to success. For example, Elisa reports a €3 per month average billing uplift when customers upgrade to 5G in Finland, supported by its speed-based service plans.

Delivering new services will also be a crucial part of 5G monetisation strategies. For example, Thailand's AIS reports a 10-15% ARPU uplift from 5G as a result of bundling AR/VR and live sports content with 5G service plans. AR/VR content was also a big part of operators' 5G marketing strategies in South Korea; following the launch of 5G in mid-2019, mobile ARPU returned to growth in 2020 and 2021 after several quarters of decline. The rollout of 5G networks has also supported revenue increases in Germany (e.g. O2 Germany and Vodafone), where operators have had some success with 'more for more' tariff structures.

FWA on the rise

With revenue growth front of mind, there has been renewed interest in FWA solutions as a key use case for 5G networks. As of January 2023, more than 90 fixed broadband service providers (the vast majority mobile operators) had launched commercial 5G-based FWA services across over 48 countries. This means that around 40% of 5G commercial mobile launches worldwide include an FWA offering. The percentage could rise further as operators take stock of pilots, demand and the return on investment.

5G FWA solutions provide an increase in speeds of over 10× compared to 4G FWA, along with substantial improvements in capacity, which enables FWA to target a broader market. In the US, for example, T-Mobile surpassed 2.5 million 5G FWA customers by the end of 2022. By 2025, it expects to have 7-8 million FWA subscribers, while Verizon is targeting 4-5 million FWA subscribers in the same period. This would give FWA a share of around 10% of the US fixed broadband market – an indication of the technology's underlying potential. Interest in 5G FWA is also strong in several GCC states, including Oman, where it accounts for 21% of fixed broadband subscriptions (while 4G FWA accounts for a further 18%).⁴

Looking ahead, 5G FWA penetration growth will likely be strongest in markets where the fixed broadband technology mix is skewed towards DSL (such as in Austria, the Nordic countries, Bahrain and Australia), as there is the clearest reason to switch. Countries with low fixed broadband penetration but rising incomes (such as the Philippines and South Africa) will also see faster-than-average growth.

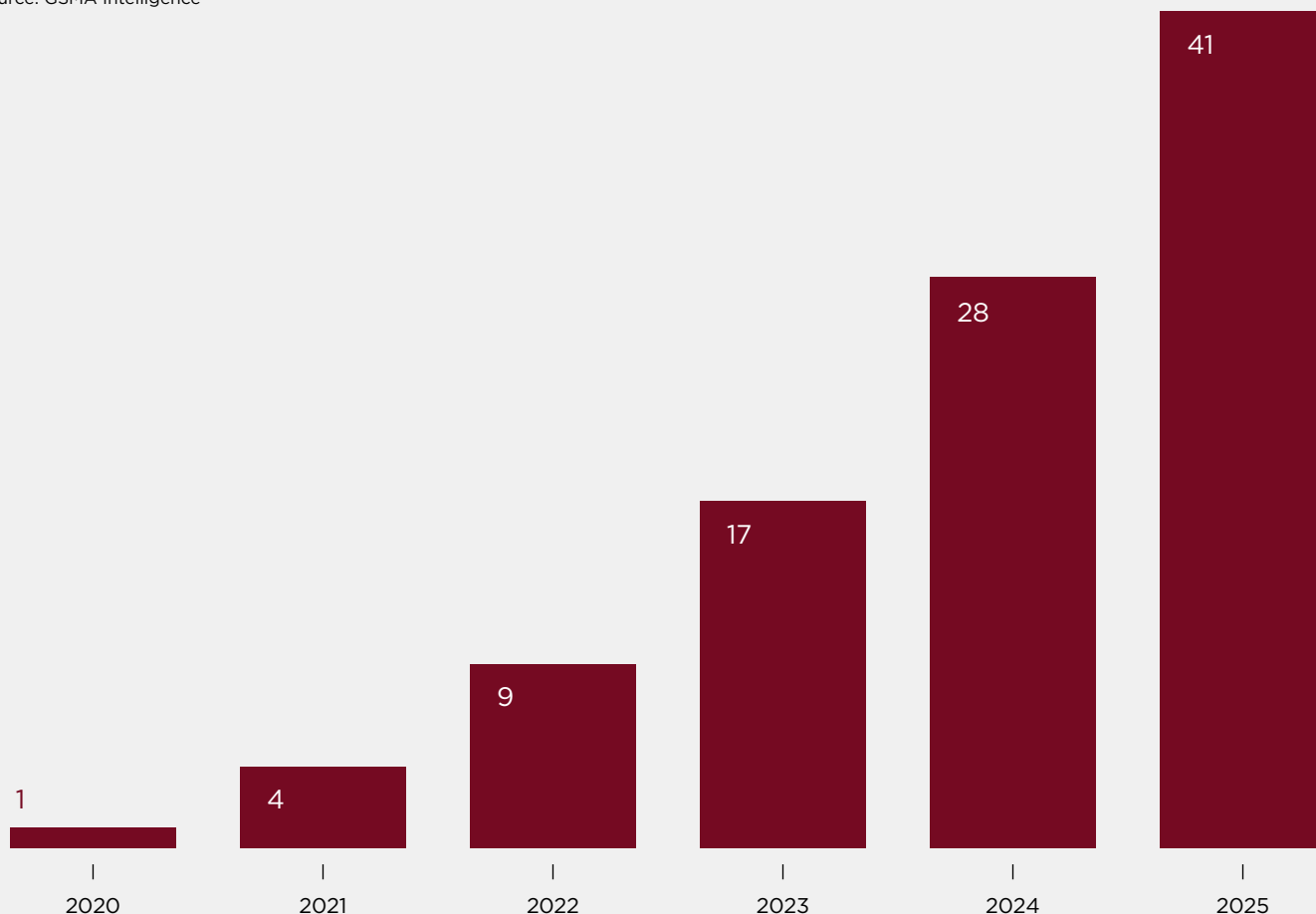
4 5G FWA in action, GSMA Intelligence, 2022

Figure 4

5G FWA connections will grow quickly under the right market conditions

Global 5G FWA connections (million)

Source: GSMA Intelligence



The enterprise opportunity for new revenue generation

Although FWA and emerging technologies such as AR/VR present potential pathways to incremental revenue growth, the greatest opportunity for generating new income in the 5G era lies in the enterprise sector. 5G will be able to facilitate a large network of IoT devices, supporting the creation of smart cities, smart infrastructure and, in the utility sector, smart grids capable of self-identifying issues on energy networks. Moreover, low latency and high reliability will enable new applications such as connected robots and drones in manufacturing, logistics, health and transportation.

As operators work to capitalise on these opportunities, they are investing in new 5G capabilities that require upgrades to existing 5G networks. Most operators around the world began their 5G deployment efforts with the non-standalone (NSA) version of the technology, which leverages the 5G New Radio (NR) equipment for connectivity and a 4G core for control function. This allowed operators to launch 5G commercial services more quickly than if they had to deploy a 5G core. However, with the first stage of 5G rollouts complete in many countries, the focus is now shifting to 5G standalone (5G SA). This requires operators to deploy a new, dedicated 5G core network that connects to 5G NR equipment. This is crucial to delivering the true benefits of 5G in terms of latency, network slicing and IoT support, which in turn will enable new use cases, particularly in the enterprise sector.

5G-Advanced is also rising up the agenda, as it enables 5G to support new market demand while waiting for 6G to arrive.⁵ Strong interest in 5G-Advanced in support of multicast services and satellite integration highlights a focus on the technology as a break-away from today's 5G. However, expectations that the technology will be critical for network slicing and edge compute success show that it is simultaneously seen as an evolution that will support today's 5G use cases.

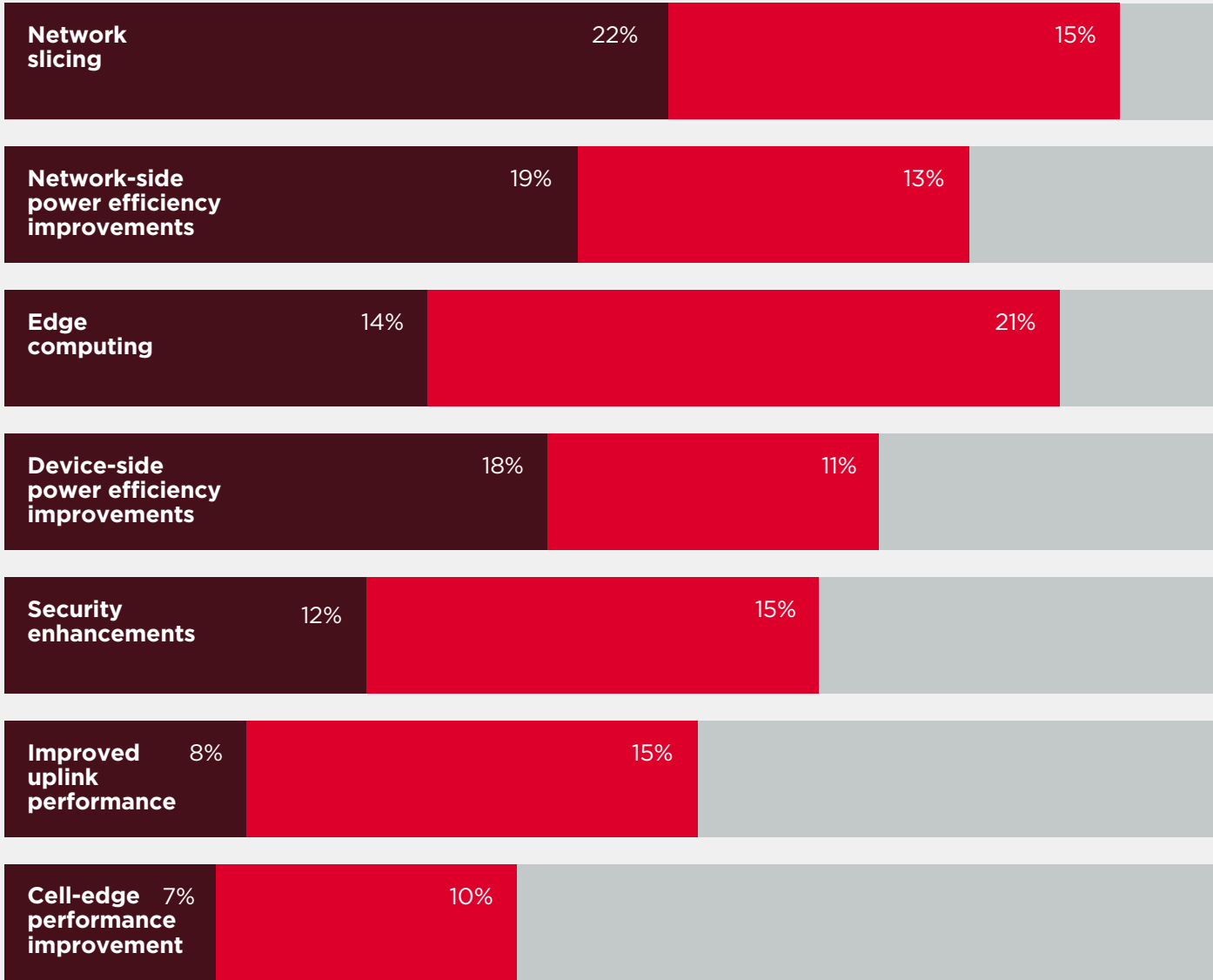
Mobile operators are collaborating with vendors to explore the potential of 5G SA and 5G-Advanced across several enterprise use cases. For instance, Singtel has deployed a 5G SA network and edge compute capacity to support a Gammon construction site on Sentosa Island in Singapore. 5G is used to connect drones and headsets for augmented reality services, as well as robots that can scan the site in 3D. Meanwhile, Zain Saudi Arabia and Huawei have signed a '5.5G City' MoU to explore how 5G-Advanced applications can support the delivery of the Saudi 2030 vision. The partnership aims to provide a gigabit experience in both indoor and outdoor scenarios through the deployment of Huawei's massive MIMO, carrier aggregation and indoor coverage solutions.

Figure 5
5G-Advanced will be additive

Which 5G-Advanced use cases and applications are most important to your network transformation priorities?
(Percentage of respondents)

Source: GSMA Intelligence Operators in Focus: Network Transformation Survey 2022

Ranked 1st Ranked 2nd



5 5G-Advanced is the 3GPP's branding for 5G technologies to be delivered by 3GPP Release 18 specifications and beyond. 5G-Advanced is expected to be deployed commercially from 2025 onwards.

2

5G in Latin America's connectivity landscape



2.1

The 5G era takes shape

5G continues to make inroads in Latin America. As of March 2023, commercial 5G services were available in eight countries in the region, with more markets expected to follow soon. 5G coverage in the region is still mostly limited to major cities, but there is

growing evidence that deployments are ramping up. 5G coverage is available in all state capitals in Brazil and in all districts of Chile and Dominican Republic. Furthermore, at the end of 2022, Telcel's (America Móvil) 5G network was live in 100 Mexican cities.

Figure 6

Around a third of countries in Latin America have launched commercial 5G services

Source: GSMA Intelligence



*5G FWA services available but not 5G mobile. 5G commercial mobile services are expected to become available in Colombia and Peru in 2024

**5G only available through dynamic spectrum sharing (DSS)

5G deployments can build on strong consumer interest in 5G. According to the GSMA Intelligence Consumers in Focus Survey 2020, nearly two thirds of consumers in Latin America intend to upgrade to 5G. Around 30% of people surveyed in Latin America are unsure about whether to upgrade, while only 7% of people claim they do not intend to upgrade to 5G (the lowest of any region worldwide). As operators extend 5G networks to new areas and increase 5G marketing activity, there is an opportunity to drive awareness of 5G's benefits to increase upgrade intent.

As is the case globally, consumer intent in Latin America to upgrade to 5G is higher than average among the 18-24 and 25-34 age groups and those living in urban areas. While these findings are expected, they emphasise the importance of customer segmentation when targeting the early addressable market for 5G networks and services.

There is also positive sentiment towards 5G among enterprises in Latin America. GSMA Intelligence research shows that enterprises in the region across all verticals find new technologies such as 5G, private networks, massive IoT, edge and slicing compelling to advance their digital transformation. The level of interest in these technologies is in line with more advanced 5G markets, such as the US.

Realising the full vision of digital industries will take many years, but 2023 will likely see important progress as operators turn 5G interest into larger-scale deployments. This can help enterprises address new external pressures such as disruption to supply chains, rising energy costs, and compliance with sustainability targets. Dedicated enterprise resources and budgets will be key to fulfilling this vision.

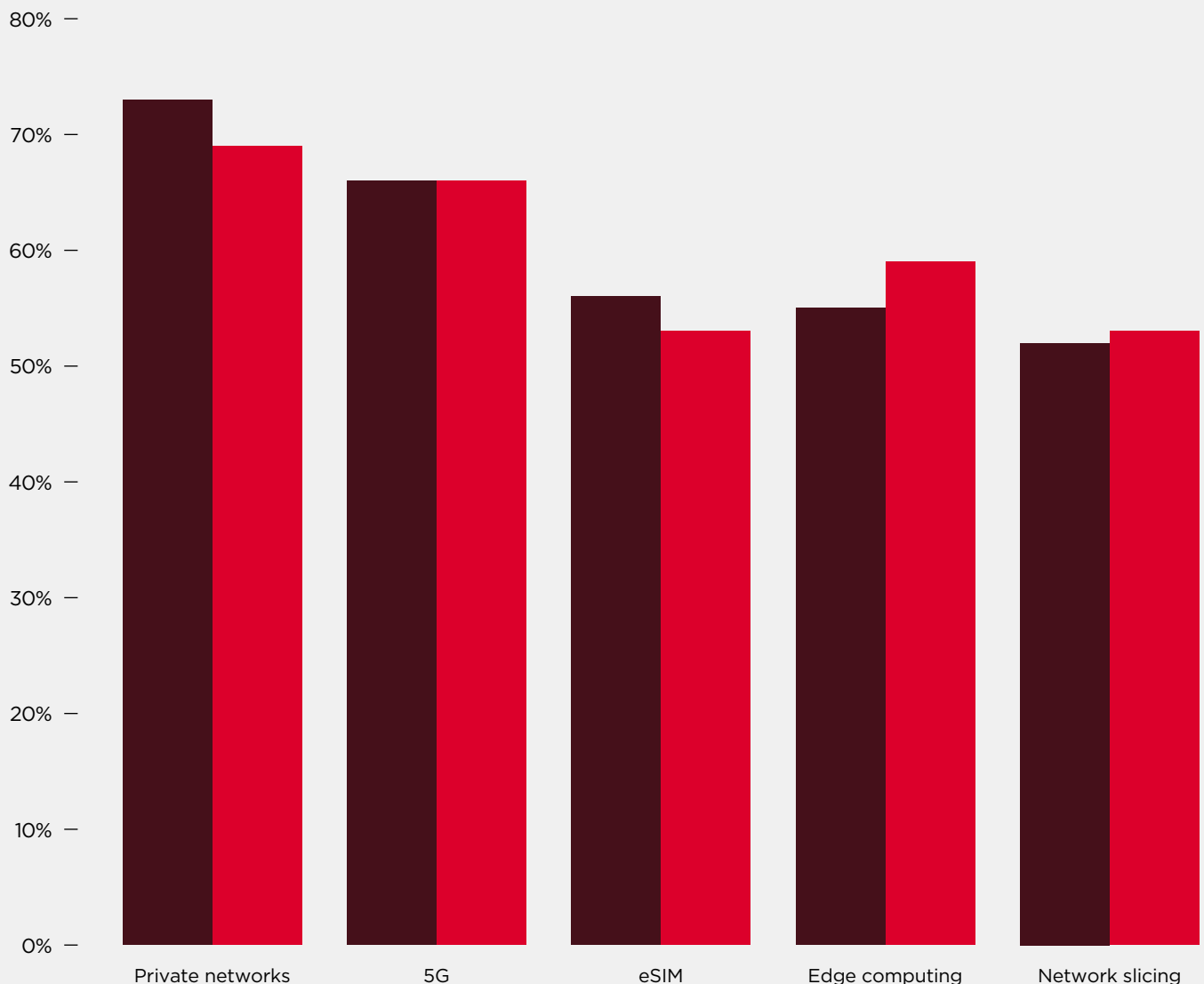
Figure 7

Demand for 5G among enterprises in Latin America is in line with more advanced 5G markets

Which of the following features or capabilities are very important for the success of your IoT deployment?

Source: GSMA Intelligence Enterprise in Focus Survey 2020

■ Latin America ■ US



2.2

Growing demand for high-quality connectivity drives 5G adoption

With 450 million 4G connections, 4G adoption in Latin America reached 65% of total connections at the end of 2022. 4G take-up is set to continue to rise until 2024, when it will peak at 72%. The increase will be fuelled by growing adoption in Colombia, Peru and Venezuela, as well as Central American countries, notably Dominican Republic and Guatemala.

5G is currently at a nascent stage in Latin America. The current adoption rate is around 2% of total connections; this is expected to grow to 11% by 2025. By that point, 5G will have a double-digit share of total connections in five countries in the region: Chile, Brazil, Mexico, Uruguay and Argentina. In the second half of the decade, 5G adoption will ramp up quickly as new 5G markets go live and existing 5G networks expand to new areas. 5G's share of total connections will therefore grow to 57% in 2030, meaning 5G will be the most widely adopted mobile network generation in Latin America.

Figure 8

5G adoption will grow quickly in Latin America over the next decade

Percentage of total connections (excluding licensed cellular IoT)

Source: GSMA Intelligence

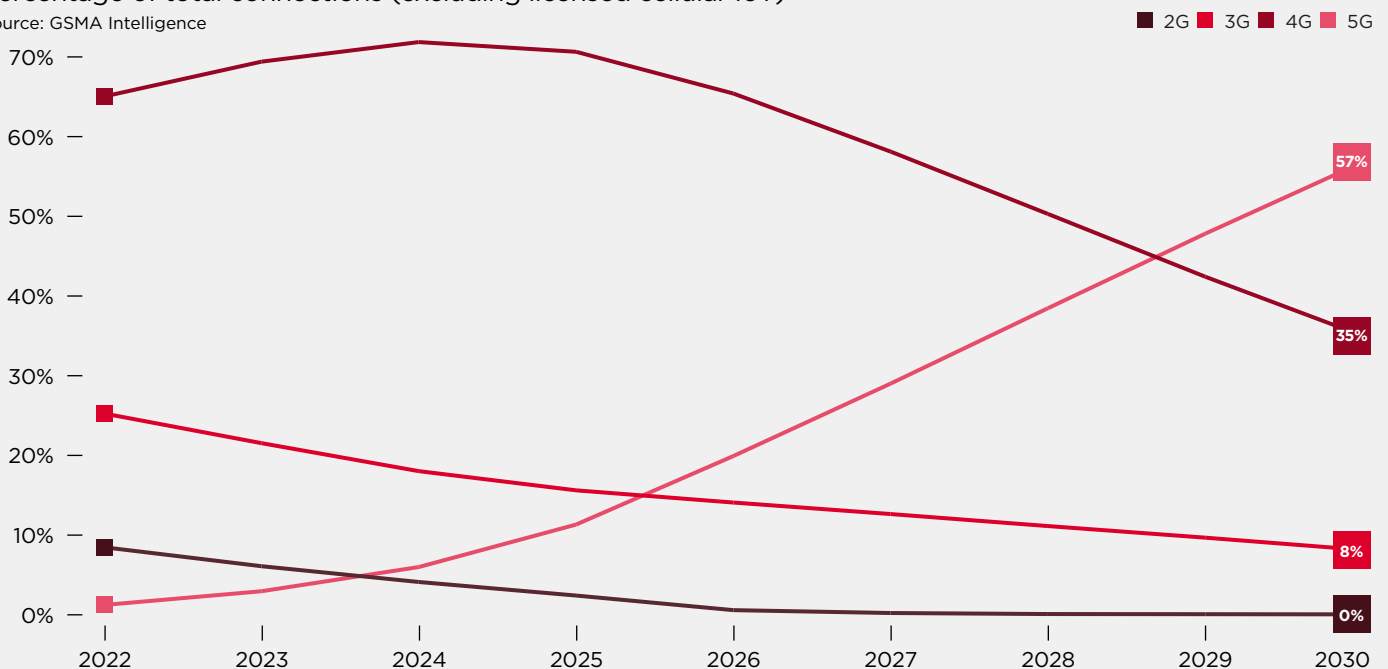
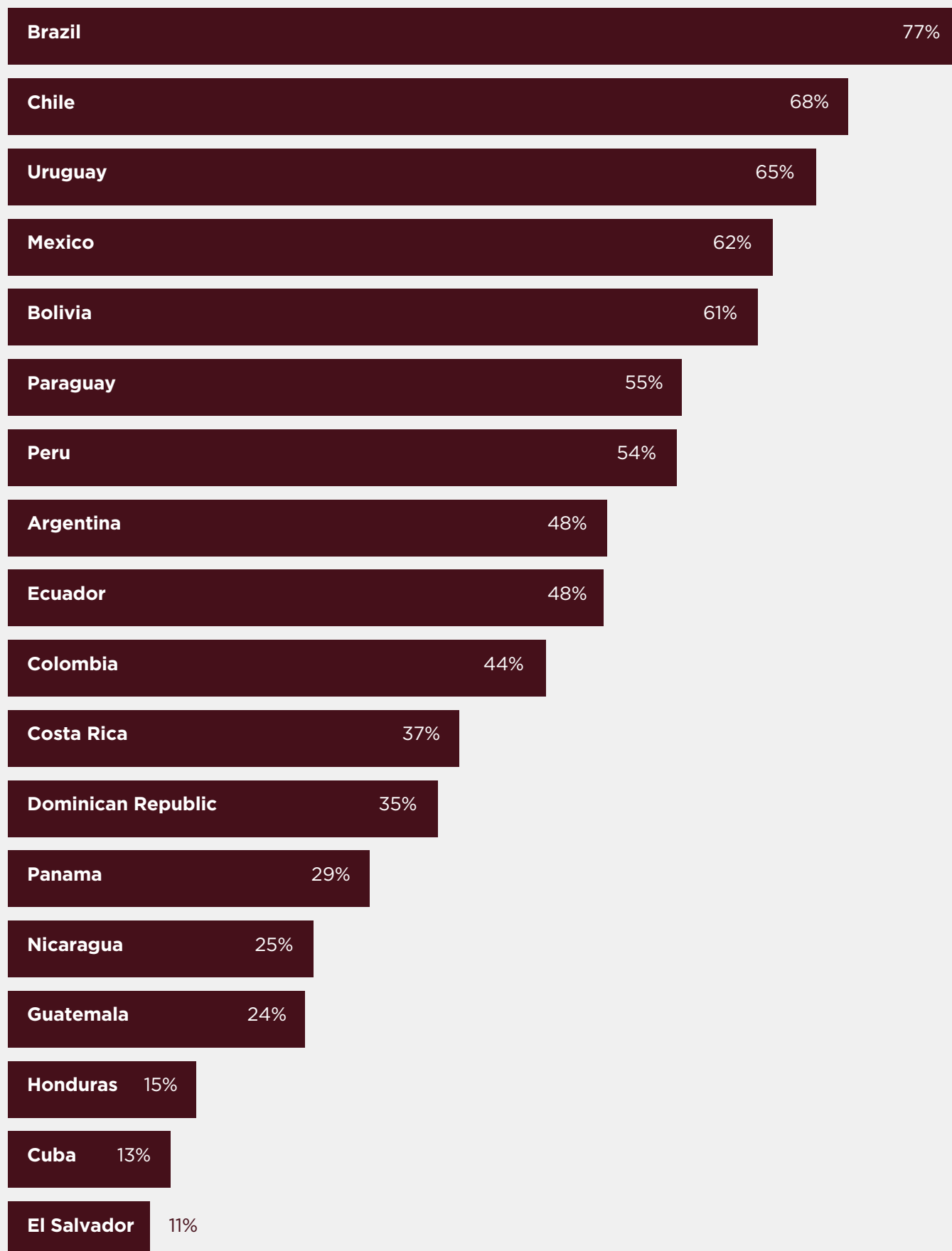


Figure 9

By 2030, 5G will account for more than 50% of total connections in seven Latin American countries

5G as a percentage of total connections in 2030

Source: GSMA Intelligence



2.3

Slow pace of spectrum assignment remains a challenge

Three countries in Latin America (Brazil, Chile and Dominican Republic) have assigned spectrum for 5G services to operators. However, 5G spectrum assignment is still underdeveloped when compared to Asia Pacific, Europe and North America. The situation should start to improve with several countries in Latin America set to auction 5G spectrum in 2023, including Costa Rica, Peru, Argentina, Uruguay, Mexico and Colombia.

The opportunity to repurpose spectrum assigned for 2G and 3G could help facilitate 5G rollouts. 5G networks are more spectrally efficient than legacy networks and more energy efficient. This is driving a rise in the number of Latin American operators announcing plans to retire legacy networks.

Figure 10

The slow pace of 5G spectrum assignment remains a major barrier to 5G deployment

Countries that have been allocated new spectrum bands for 5G. Data correct as of March 2023.

Source: GSMA Intelligence

Country	Date	Bands	Bandwidth	Number of winners
Brazil	November 2021	700 MHz 2.3 GHz 3.5 GHz 26 GHz	20 MHz 90 MHz 400 MHz 3200 MHz	12 including Claro, Vivo, TIM
Dominican Republic	October 2021	3.5 GHz	140 MHz	2 Altice, Claro
Chile	February 2021	700 MHz 1700–2100 MHz (AWS) 3.5 GHz 26 GHz	20 MHz 30 MHz 150 MHz 1200 MHz	3 Entel, Movistar, WOM

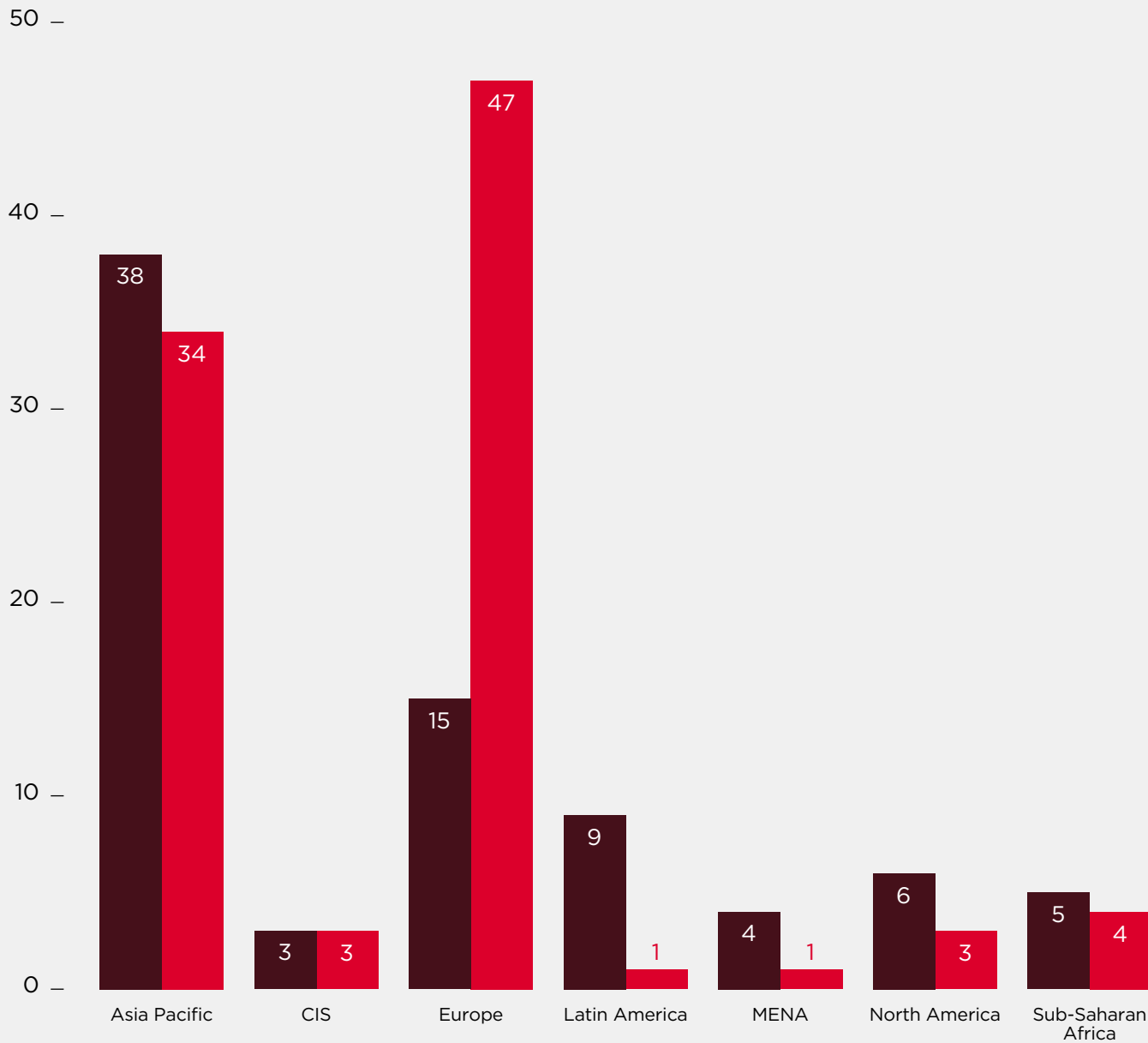
Figure 11

Latin American operators are beginning to formulate their network sunset plans to boost 4G and 5G services

Completed and planned sunsets, by region (2015–2025). Data correct as of January 2023.

Source: GSMA Intelligence

■ 2G ■ 3G



2.4

5G set to drive economic impact

5G is in its early stages of deployment in most countries of Latin America. However, as it is deployed, it will bring productivity and efficiency gains that will drive significant economic impact. These effects will reach more than \$60 billion in 2030, representing 0.9% of total GDP in the region.

The economic benefits of 5G will rapidly increase from 2025 as take-up of the technology increases. 5G will enable further digitisation, with a significant impact on economic growth. Benefits expected over previous technologies include improved access to healthcare and education, advanced manufacturing, increased public security and response times, safer driving conditions, and reduced pollution.

The benefits of 5G will spread across economic sectors depending on their ability to incorporate 5G use cases. In Latin America, around 43% of the benefits are expected to be generated from the services sector, and 29% from the manufacturing sector, driven by applications such as smart factories, smart cities and smart grids.

Figure 12

Latin America: annual 5G contribution by industry

Source: GSMA Intelligence

Billion

\$70 —

\$60 —

\$50 —

\$40 —

\$30 —

\$20 —

\$10 —

\$0 —

2022

2023

2024

2025

2026

2027

2028

2029

2030

- Services
- Manufacturing
- ICT
- Utilities management, construction, oil & gas, agriculture
- Retail
- Other

3

Building the networks of the future



3.1

5G brings new opportunities to drive opex savings

Mobile operators in Latin America have invested \$54 billion in capex over the last five years – mostly on deploying and expanding 4G networks. The rollout of 5G networks across the region is expected to drive a slight increase in capex levels, but a spike is unlikely. Operators are keen to keep their capex-to-revenue ratios below a certain threshold.

There will also be a strong focus on opex efficiencies. 5G is not intrinsically more opex-intensive than previous generations of technology, but there are many reasons to expect 5G to come with added opex burdens if operators do not take action. Unless an older network is decommissioned at the same time, 5G represents another network to operate. Further, based on the use of higher-frequency spectrum, 5G will likely require a denser network with more sites to deploy, monitor and service, suggesting the need for enhanced monitoring and troubleshooting.

Managed services contracts are an increasingly popular way to deal with the growing levels of complexity that come with managing newer networks and additional sites (see Figure 13). Many Latin American operators contract managed service providers to develop and manage parts of their network and IT operations. For example, Claro and Huawei have a managed services deal for AI-powered network operations in Peru. Through the agreement, Huawei provides an intelligent operations platform and service to improve network availability and quality, and drive operational efficiencies. Such agreements can be a quick win for operators in terms of opex reduction, which is driving their popularity.

In contrast, cloud and IT transformation (which rank second in Figure 13) represent a much longer journey, requiring a deeper level of organisational change, supported by enhanced internal expertise. Most operators are mid-way through this. For example, América Móvil revealed at its Investor Day in October 2021 that it had virtualised 36% of its network functions as part of its wider telco cloud initiative. 5G provides a chance to accelerate cloud and IT transformation of the network.

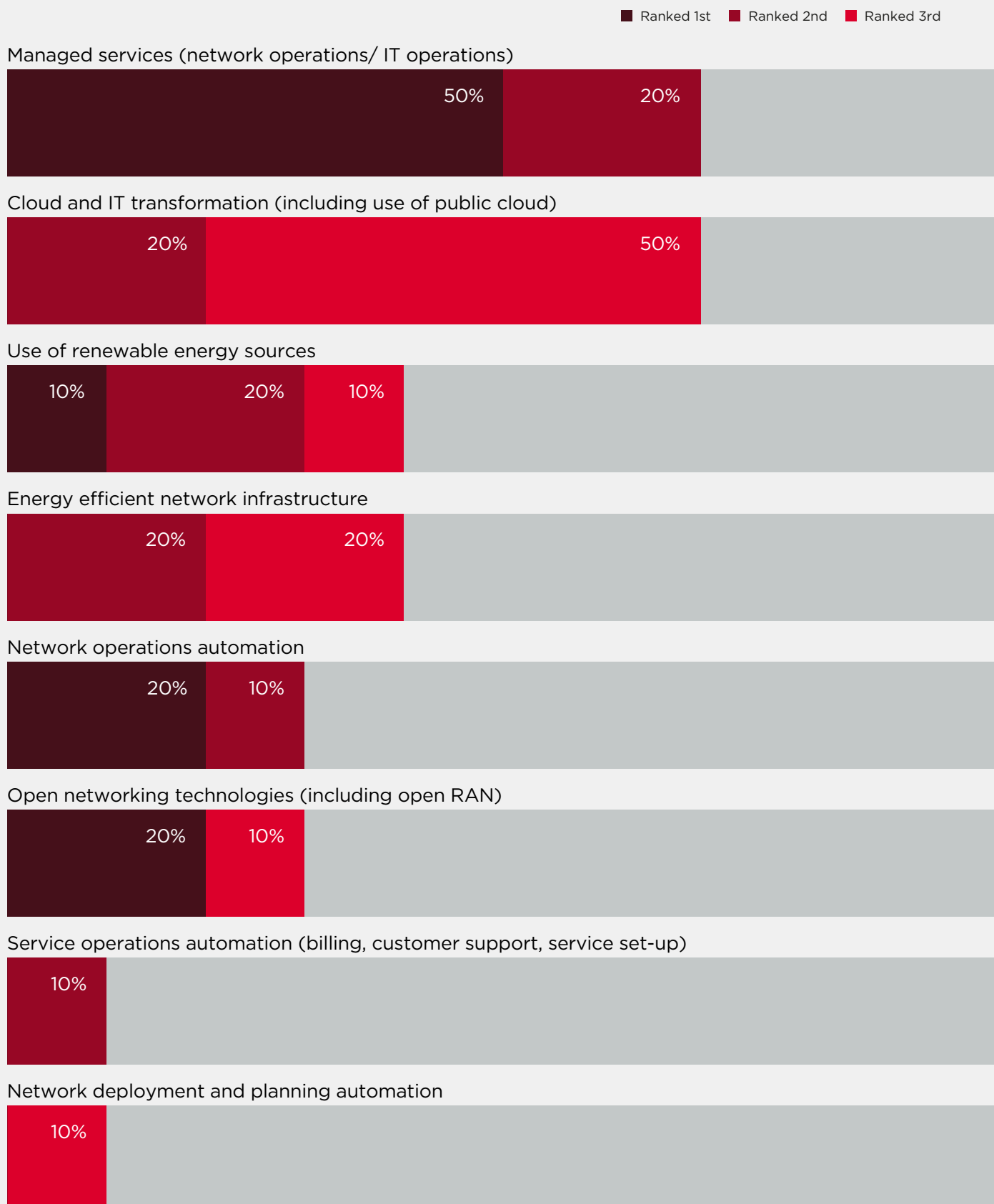
Latin American operators have relatively modest expectations when it comes to open RAN's ability to deliver opex savings. 5G deployments in Latin America have so far relied on traditional RAN solutions. Open RAN activity is currently limited to small trials. For example, Telefónica has engaged in open RAN proof-of-concepts in Argentina, Brazil and Peru. Yet, as trials and deployments move forward globally, it is increasingly clear that for now open RAN is not necessarily less expensive than competing solutions. Open RAN sites remain thin on the ground, both in Latin America and worldwide, while support from the biggest network infrastructure suppliers remains minimal at best.

Figure 13

Managed service providers and cloud & IT transformation programmes are seen as the best ways to deal with growing network complexity

Which technologies, in your company's view, hold the most promise of driving opex savings over the next 12 months in your network operations? (Rank importance)

Source: GSMA Intelligence Operators in Focus: Network Transformation Survey 2022 – Latin American operators



3.2

Operators look to 5G efficiencies and the green network

With energy costs accounting for 20–40% of network opex, investments in sustainable technologies (renewables and energy-efficient equipment) are seen as another important way of reducing opex. 5G trials and field test results from major equipment suppliers suggest the efficiency improvement versus 4G equipment is 50% or more. 5G can significantly improve the energy efficiency of mobile broadband, in a context of individual data consumption rises that will feed through to an increased strain on power usage without intervention. Over the next 10 years, mobile and digital technologies, deployed at scale, could amount to just under 40% of the required CO₂ reductions over the 10 years to 2030 within the top four emitting industries that account for 80% of global emissions – manufacturing, power and energy, transport, and buildings.⁶

Countries in Latin America are particularly well positioned for the use of renewable energy, especially solar – given the high sunshine duration ratio and the potential to serve cell sites in off-grid

and hard-to-reach locations. This can be achieved through solar panels within cell sites or by building large, centralised solar farms. In Brazil, 55% of Claro's cell sites already use renewable energy, with 38% from solar. Similar levels of progress can be seen in other Latin American countries. All major operators in the region have set ambitious green transformation plans.

Alongside the transition to renewables, operators are switching to more efficient network technologies to reduce energy costs. AI-driven network management applications will be central to this. The first dedicated large-scale deployments of AI-driven energy management solutions began in 2017. The main global equipment vendors were active by this time (for example, Huawei's PowerStar and Ericsson's Green Radio designs), but deployments were mostly in Europe and on a testing basis. Adoption has since grown worldwide, with 70% of mobile operators surveyed in Latin America using RAN energy efficiency sleep solutions (see Figure 14), albeit on a small scale.

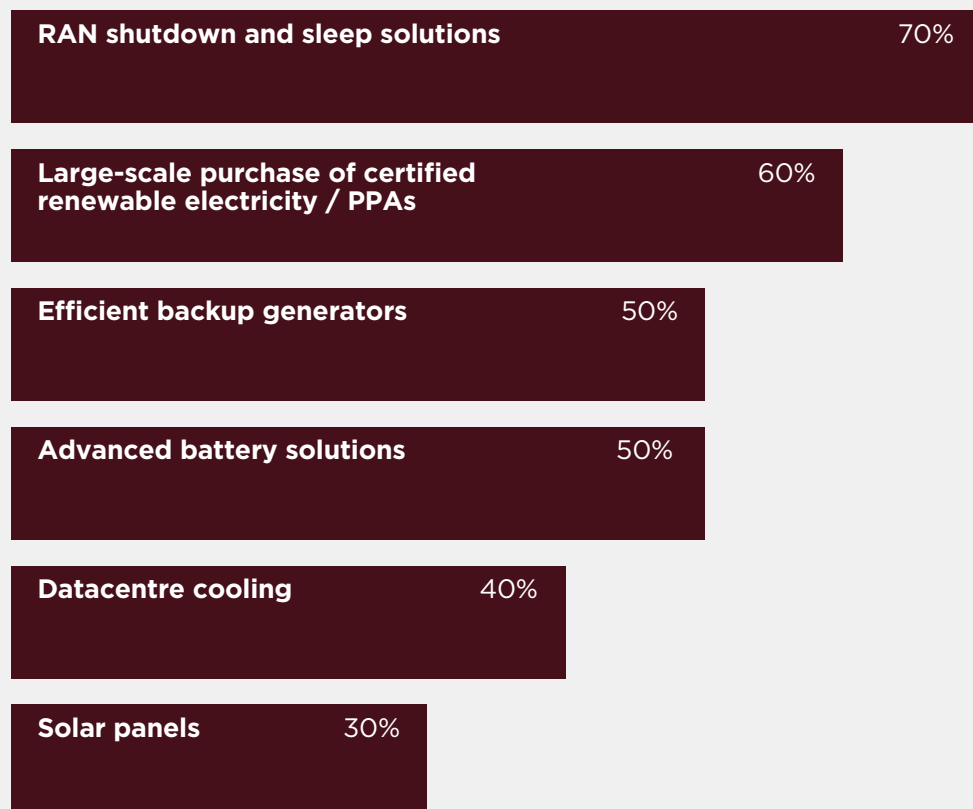
6 Mobile Net Zero: State of the Industry on Climate Action 2023, GSMA, 2023

Figure 14

Sustainable tech rollout follows the sustainability imperative

In order to improve the sustainability profile of your networks, which sustainability-focused technologies have you deployed?

Source: GSMA Intelligence Operators in Focus: Network Transformation Survey 2022 – Latin American operators



The need for additional cell sites to cope with rising data traffic in busy areas and extend coverage at the edge of the network is likely to drive further demand for energy-efficient solutions. The GSMA Intelligence Network Transformation Survey shows that network densification is a top-three 5G RAN investment priority for operators in Latin America. Operators are taking a balanced approach to early 5G site expansion. Telefónica has recently agreed RAN sharing deals in Brazil, Mexico and Peru, with the agreement in Mexico recently extended to include 5G services.⁷

Achieving wide-area 5G coverage is the second most important 5G RAN investment priority, according to the GSMA Intelligence Network Transformation Survey. As operators look to drive 5G service adoption, ensuring broad coverage is critical to make 5G available and attractive to as many potential users as possible. This must be balanced with delivering 5G within existing capex budgets, highlighting the importance of technologies such as massive MIMO that deliver improvements in spectral efficiency and range to enable operators to increase 5G coverage and capacity. Massive MIMO has been central to early 5G deployments in Brazil, with TIM and Huawei working to build the world's largest massive MIMO network.⁸

7 "Movistar activates 5G services in Mexico", RCR Wireless, December 2022

8 "TIM Brasil and Huawei Sign MoU to Transform Curitiba into the Country's First '5G City'", Huawei, March 2022

3.3

Virtualisation matters for 5G, in the core and beyond

Operators have been moving to virtualised core network functions for several years. From the start, it was clear that this would be a long-term journey. However, 5G represents another opportunity to accelerate virtualisation in the core network, more so than in the RAN, where vRAN investments were cited as a priority for only about a fifth of operators. For example, Personal (Telecom Argentina) plans to invest \$350 million in a project with Huawei to deploy an autonomous, cloud-based 5G core by 2024.⁹ Meanwhile, Entel Chile has chosen Huawei as the strategic partner for its 5G core solution, which runs on the vendor's NFV platform.¹⁰ 5G core upgrades will occur alongside security enhancements (a top-two 5G core investment priority for 30% of operators), which will be essential due to 5G's cloud-native design and distributed network architecture.

Virtualisation will also be central to OSS/BSS upgrades, highlighted by recent operator announcements.¹¹ OSS/BSS investment expectations correlate with an overall strategic focus on user experience and revenue generation, tying together service delivery, assurance and billing. These upgrades enable operators to expand into new markets and offer a broader range of digital services, which is vital to increase revenues from 5G deployments.

Transport/backhaul network upgrades ranked as the fifth-highest 5G core investment priority for operators in Latin America. Investments will be geared towards upgrading existing wireless backhaul links to support E-band (71–86 GHz) solutions, while replacing wireless backhaul with fibre in areas with the most significant capacity demand. Some regulators (such as Anatel in Brazil) have set operators targets for fibre backhaul,¹² which will accelerate investment timelines. Operators are exploring alternatives to wireless and fibre backhaul solutions for 5G sites in harder to reach areas. For example, Telefónica Global Solutions and Telesat completed Brazil's first LEO satellite 5G backhaul demonstration in May 2022.

9 "Telecom Argentina to finish 5G core deployment in 2024", BN Americas, November 2022

10 "Millicom Selects Affirmed Networks as the Strategic Partner to Deploy Its Cloud-Based, 5G-Ready Core Network", CommsUpdate, February 2020

11 See for example: "AT&T Mexico taps Oracle Cloud to run critical applications", Telecom Lead, March 2023

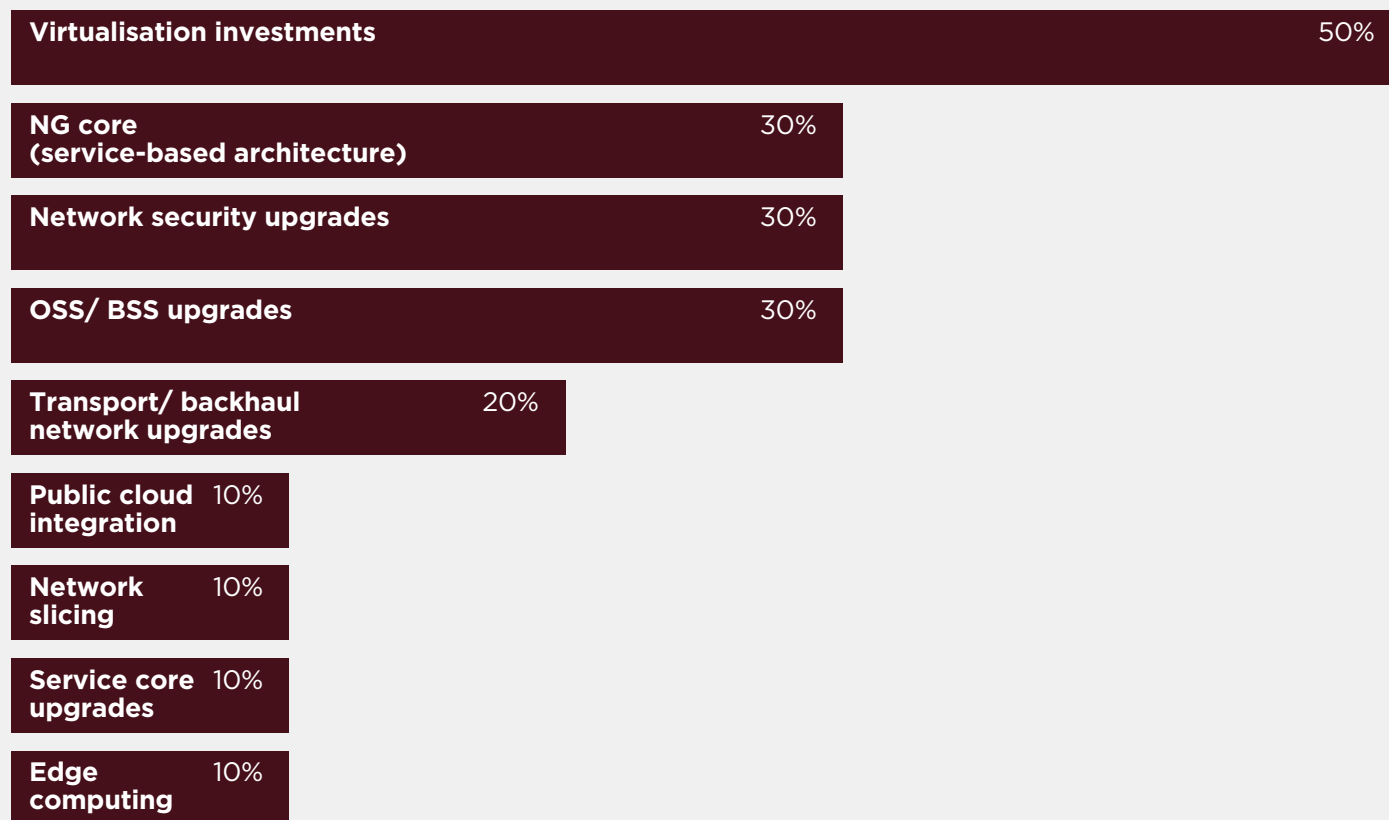
12 In its 'Strategic Plan 2023–2027', Anatel set the objective to expand fibre-optic backhaul connectivity in locations with more than 600 inhabitants from 13.63% to 50% by 2027.

Figure 15

The long road to virtualisation

Considering your 5G core and service network, which areas of investment are most important for delivering successful 5G services? Select top two

Source: GSMA Intelligence Operators in Focus: Network Transformation Survey 2022 – Latin American operators



3.4

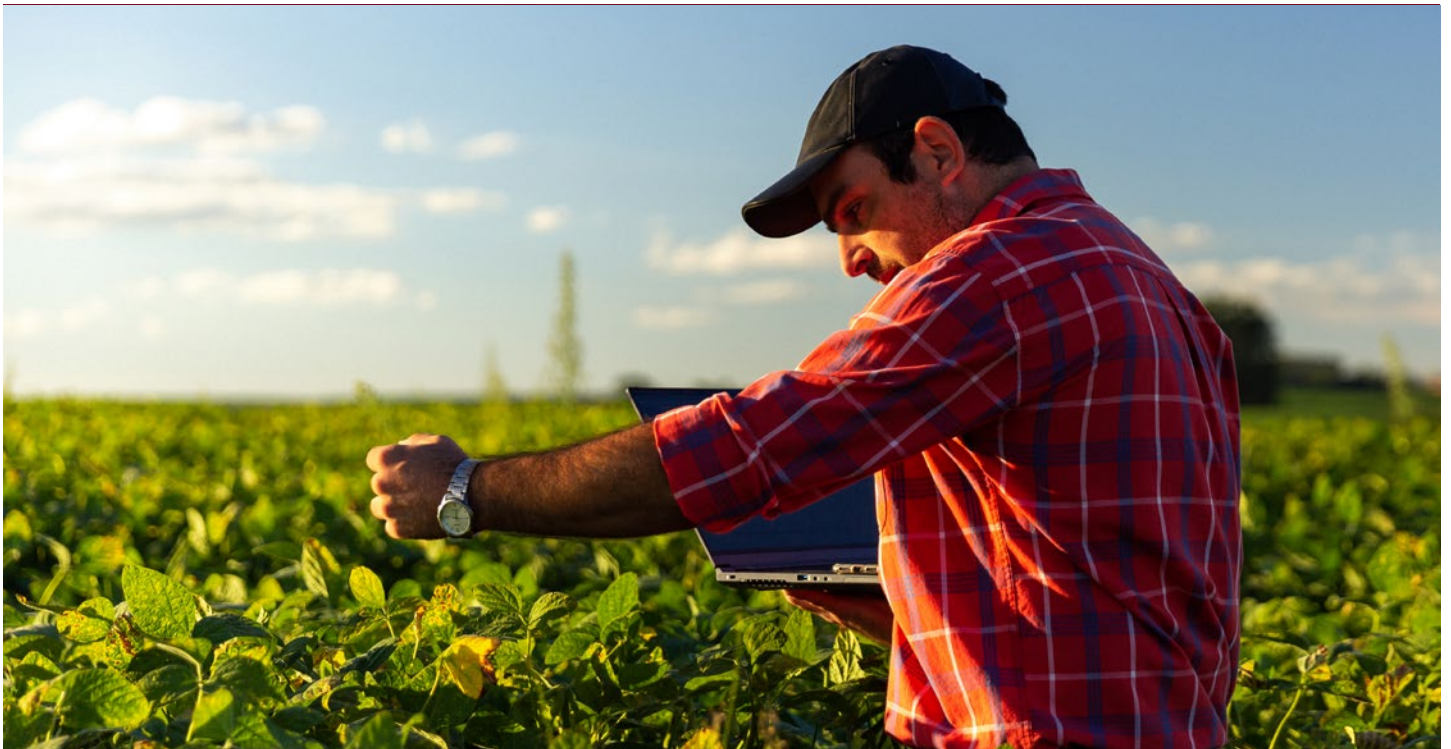
Focus set to shift to 5G standalone

As is the case globally, most initial 5G deployments in Latin America began with a non-standalone (NSA) architecture. This allowed operators to launch 5G services more quickly and cost-effectively, with greater levels of coverage than if they opted for the standalone (SA) alternative. To date, 5G SA is only available in Brazil and Colombia in the region, with the former home to a much larger rollout of 5G SA networks. All major operators have deployed 5G SA in Brazil after the telecoms regulator issued obligations for 5G SA rollout as part of the 5G spectrum auction. In Colombia, DirecTV remains the only operator with a 5G SA network, following its rollout of 5G SA to provide FWA services in Bogotá.¹³

Some 55% of operators in Latin America with live 5G networks have announced plans to upgrade to 5G SA, in line with the global average. The limited rollout of 5G SA so far reflects the cost and complexity involved in deploying cloud-native infrastructure, which is fundamental to many of the technical and commercial goals of 5G SA. The number of 5G SA networks in Latin America and other regions will rise as operators complete the first phase of 5G rollouts and shift their focus to enterprise use cases, driving interest in the customised network capabilities that network slicing can create (40% of Latin American operators rank network slicing capabilities as the top benefit of 5G SA).

“55% of operators in Latin America with live 5G networks plan to upgrade to 5G SA.”

¹³ “DirecTV launches fixed-wireless 5G in Bogota”, CommsUpdate, September 2020



CASE STUDY

5G SA helps Brazilian farms boost productivity



Country
Brazil



Mobile operators
Claro and Embratel



Customer
SLC Agrícola

For this pilot project, Claro and Embratel worked with Huawei and SLC Agrícola to focus on the development of 5G SA use cases to meet the needs of rural producers. The 5G SA network operated in the 3.5 GHz band, with 100 MHz bandwidth, using an experimental licence granted by Anatel.

The use of 5G SA architecture enabled the rapid transmission of hundreds of high-resolution images, which were collected in the field and processed in real time so producers could react quickly to combating pests and other threats. As part of the project, the companies also tested drone applications and integrated sensors into existing machinery to increase productivity. This helped improve sustainability by reducing energy, water usage and the amount of pesticide used.

The project demonstrated the feasibility of using new technologies such as drones and robotics to improve operational efficiency and productivity on farms.¹⁴ It highlighted 5G's advantages in terms of high bandwidth and low latency to enable use of AI and cloud technologies.

14 "5G Experience at SLC Agrícola's Farm is featured in Folha de São Paulo", SLC Agrícola

4

Driving customer uptake



4.1

5G FWA builds momentum

According to the GSMA Intelligence Consumers in Focus Survey, 5G FWA is an extremely or very appealing proposition for two thirds of consumers in Latin America, making it the most attractive 5G use case (see Figure 16). The technology will mainly be used to facilitate first-time home broadband adoption, in addition to improving speeds for households that are reliant on cable/DSL connections with lower performance. There is likely to be a specific focus on the urban, middle-income segment. Compared to FTTH, 5G FWA has a shorter time-to-market and can be cost-effective in several scenarios, as revealed by GSMA Intelligence

research.¹⁵ This is especially true in situations where new fibre infrastructure needs to be built, making it an appropriate and timely solution for bridging the digital divide in emerging markets.

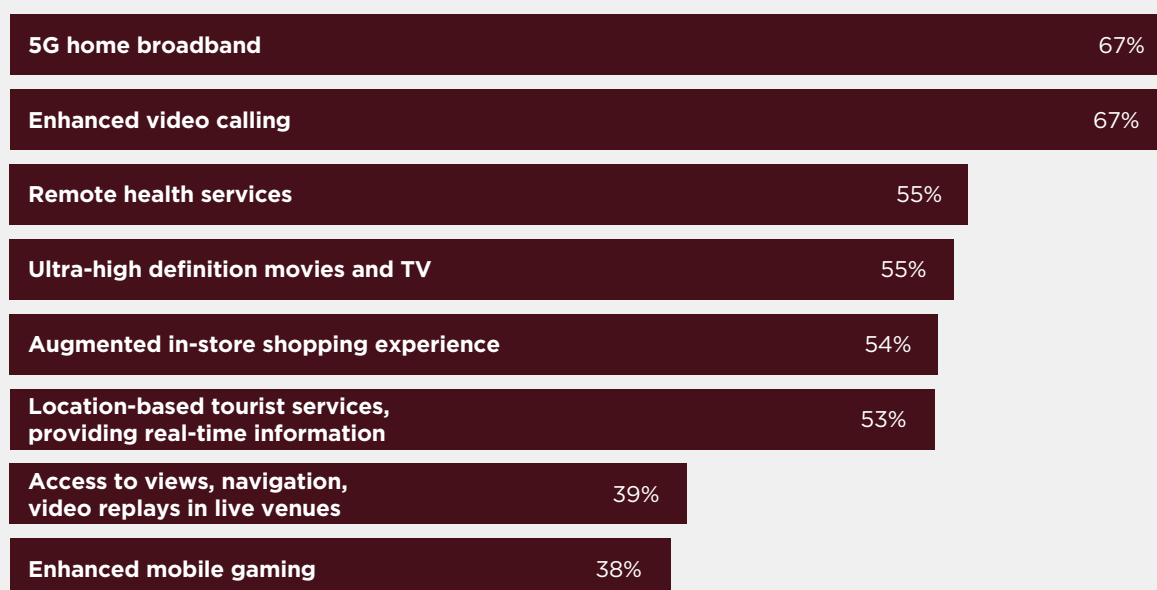
Over the next four years, 5G FWA connections are anticipated to grow by approximately 90% per year, on average, across the 52 countries that have either launched or announced a 5G FWA service.¹⁶ Although this figure is boosted by the small size of the current 5G FWA base, it still reveals significant momentum behind the technology. Around a fifth of the 52 markets, including Brazil, are expected to have more than 1 million 5G FWA subscribers by 2025.

Figure 16

Strong interest in 5G home broadband suggests an untapped opportunity for mobile operators

Percentage of smartphone users in Latin America who find the following 5G use cases or 5G-enhanced services extremely or very appealing

Source: GSMA Intelligence Consumers in Focus Survey 2020



15 The 5G FWA opportunity: a TCO model for a 5G mmWave FWA network, GSMA Intelligence, 2022

16 5G FWA: assessing trends, rollout and adoption, GSMA Intelligence, 2022

4.2

Operators look to drive a ‘wow’ factor for 5G

Beyond FWA, the GSMA Intelligence Consumers in Focus Survey shows consumers in Latin America have a strong interest in many other 5G use cases. In the wake of the pandemic, mobile solutions are playing a growing role in delivering healthcare. For example, Vivo has partnered with telemedicine provider Teladoc Health to offer a digital health and wellness platform in Brazil.¹⁷ The service, Vida V Powered by Teladoc, includes medical consultations, wellness and health programmes, pharmacy discounts and other benefits. 5G can play an important role here. Firstly, it has the advantage of mobility over in-home connectivity solutions such as Wi-Fi, enabling medical consultations to take place at more convenient times. Secondly, the higher bandwidth of 5G versus previous network generations enables better quality video consultations, which can support better diagnoses.

Digital entertainment is another key 5G use case. Video streaming services have seen a significant increase in demand in Latin America over the past few years thanks to a large and growing middle class, which has access to reliable internet and smartphones. 5G’s enhanced capabilities enable consumers to download ultra-high-definition movies and TV in a matter of seconds, rather than minutes. 5G also paves the way for more impromptu streaming while on the move.

These examples show that most early 5G use cases are extensions of existing services. These are important in the context of growing consumer demand for faster speeds and better quality networks. However, mobile operators are acutely aware of the need to develop further applications that leverage 5G’s unique capabilities to drive a ‘wow’ factor. These will require certain partnerships, with a combination of capabilities key to creating value. As such, operators and equipment vendors have invested in 5G labs dedicated to co-creating consumer and enterprise solutions with partners to address specific needs. Recent examples include the following:

- **September 2022:** Costa Rica’s telecoms development plan will include the creation of 5G laboratories. Universities, operators and other private companies have all signalled their interest in the initiative.
- **July 2022:** Nokia and AT&T Mexico announced that they are collaborating to accelerate the development of the 5G ecosystem in Mexico. As part of this, Nokia has been selected as a strategic partner for AT&T Mexico’s recently inaugurated 5G Innovation Lab.
- **June 2022:** Movistar Chile, Huawei and Universidad de Chile announced a partnership to develop a 5G lab in the Carén campus. The initiative is part of the Movistar inter-regional circuit, which comprises 10 technological laboratories in five regions of Chile.

17 “Teladoc Health partners with Vivo to improve access to quality healthcare in Brazil”, Teladoc Health, May 2021



CASE STUDY

5G enables new immersive experience to support remote learning



Country
Peru



Mobile operator
Entel



Customer
UTEC - Universidad de Ingeniería y Tecnología (Engineering and Technology University)

During Covid-19 lockdowns, remote education was a reality for thousands of Peruvians who could not go to school or university due to social distancing measures. The challenge for educators at the time was how to motivate students given the difficulties of remote learning. That's when new technologies, such as virtual reality and 5G, can make a difference.

Entel and UTEC launched an innovative distance education pilot programme, using tools such as AR and VR to create new educational experiences. For example, teachers can use the technology to conduct history lessons where students walk through Machu Picchu and other important historical sites. 5G's enhanced capabilities in terms of speeds and capacity play an important role in facilitating these types of experience.

Immersive reality applications can provide a learning experience that is more stimulating and interactive than traditional methods. It also provides an ideal solution for teacher training, with trainee teachers able to see how experienced colleagues conduct lessons.

4.3

Consumer 5G monetisation becomes an imperative

Despite strong interest in 5G use cases, some consumers still do not see a reason to pay a premium to upgrade from previous generations. Demonstrations of 5G's enhanced capabilities will therefore be crucial in helping operators generate additional revenues. Live sports events are a prime opportunity to do this, especially in regions such as Latin America where football is popular. TIM Brasil recently partnered with Rio de Janeiro's Maracanã stadium to install 5G connectivity, making it the first stadium in Brazil to have this feature. With stadia attracting large crowds wanting to stream video replays and share their experiences on social media, 5G's improved speeds and capacity can significantly improve the spectator experience. Operators can further showcase 5G's potential by creating similar demonstrations in places such as retail stores and tourist hotspots.

Understanding interest among 5G consumers in adding digital services, digital content and non-smartphone device plans to mobile contracts can also help operators grow revenues from 5G. Compared to 4G users, 5G consumers are more interested in adding services and content to their contracts.¹⁸ Gaming is a notable example: 36% of 5G consumers are interested in adding gaming services to their mobile contract, compared to 23% of 4G consumers. The prevalent business model for offering bundles involves a commercial partnership with a service/content provider. However, some operators have also launched their own non-connectivity services to strengthen revenue diversification, such as the TIM Cloud Gaming by AWG service from TIM Brasil.

The above highlights 5G's importance in generating additional revenues. However, 5G can also help operators reduce their total cost of ownership, delivering a lower cost per bit.

“Compared to 4G users, 5G consumers are more interested in adding services and content to their contracts.”

18 Analysing the behaviour of early 5G users: 10 things to know when planning consumer 5G strategies, GSMA Intelligence, 2021

4.4

The B2B opportunity expands

There is a consensus among operators that B2B is the largest incremental revenue opportunity in the 5G era, considering the raft of digital transformation projects underway across several industries. IoT was the initial effort by operators to advance vertical-focused strategies, but with the emergence of 5G, the B2B opportunity will expand considerably. This provides operators with a chance to increase B2B revenues, which currently account for anything between 15% and 40% of total revenues.

Operators around the world typically see manufacturing as the largest B2B revenue opportunity. While manufacturing is widespread, the B2B opportunity varies by industry, reflecting different levels of importance to local economies (agriculture and mining are significant opportunities in Latin America). In Brazil, for example, Claro, Embratel and SLC Agricola have partnered to deploy

5G SA systems from Huawei across a number of farm locations. SLC Agricola will use the technology to transmit high-resolution images, which can be collected in the field and processed in real time.

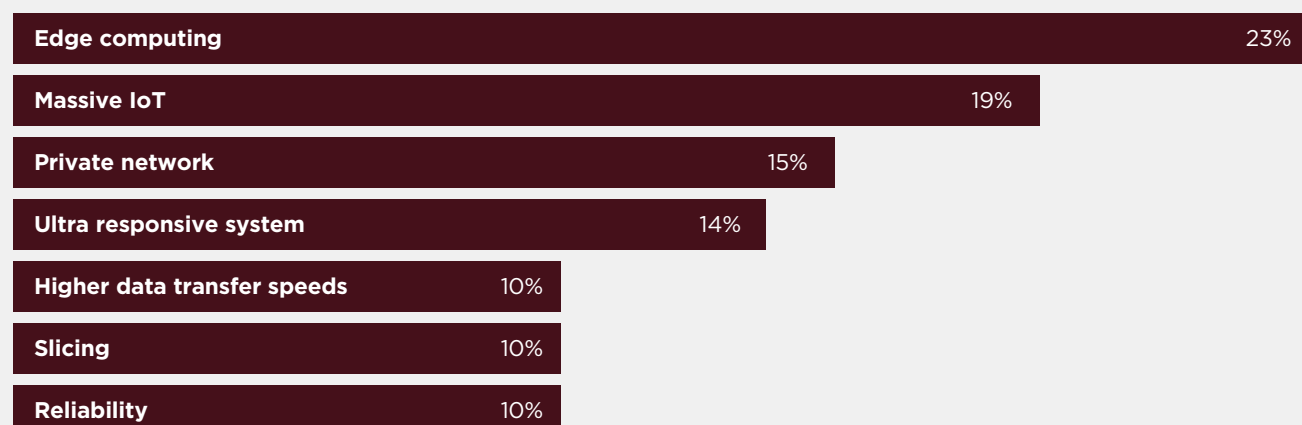
With the deployment of 5G networks, operators are reshaping their enterprise strategies to better serve customers. Besides connectivity speeds being upgraded over those of previous network generations, 5G provides benefits for IoT deployments as well as low-latency applications. Consequently, when GSMA Intelligence asked Latin America operators about the primary 5G value proposition they are marketing to enterprises, there is a shift in promoting edge computing and massive IoT over higher data speeds (see Figure 17). The transition to 5G SA will play a crucial role in supporting the 5G value proposition, offering advanced functionality and cloud-native functions.

Figure 17

The 5G enterprise value proposition is about much more than higher speeds

What is the primary 5G value proposition you expect to market to enterprises in 2023?

Source: GSMA Intelligence Operators in Focus: Enterprise Opportunity Survey 2021 – Latin American operators



4.5

Private 5G gathers pace

5G promises to flexibly serve consumer and enterprise customers. However, specific vertical requirements may be best served by custom network builds. In this way, enterprises can effectively control who can access the network and the data flowing within it, while also ensuring reliability, privacy and resilience.

Most private network deployments have taken place in high-income countries. However, there has also been strong demand for private wireless solutions in Latin America, particularly in Brazil, Peru and Chile. Most deployments so far have been private LTE solutions, typically in the mining sector. Mining operations take place in remote and specific locations, often in harsh conditions. These characteristics make the value proposition of private wireless (typically around coverage, reliability and security) very appealing.

Successful deployments of private 4G/LTE solutions will increase the appetite of enterprises to upgrade to private 5G, which will become easier once the equipment becomes more widely available. In the meantime, operators can engage with enterprises on use case and business model discovery, gain deeper expertise in vertical industries and use this experience to position themselves for success with private 5G over the next few years.

The arrival of 5G will give renewed impetus to private networks, with many performance advantages over LTE, including faster data transmission, lower latency and more precise positioning. In Latin America, multiple use cases involving private 5G are currently in testing or live. These include AGVs (for transporting goods), drones (for site survey) and high-definition video streaming (for safety and security applications). AR-based software is also being considered because of its latency demands (sub-20 ms).

“The arrival of 5G will give renewed impetus to private networks.”

Figure 18

Private LTE still has room to grow while private 5G gains momentum

Where are you in the process of offering private wireless networks?

Source: GSMA Intelligence Operators in Focus: Enterprise Opportunity Survey 2021 – Latin American operators

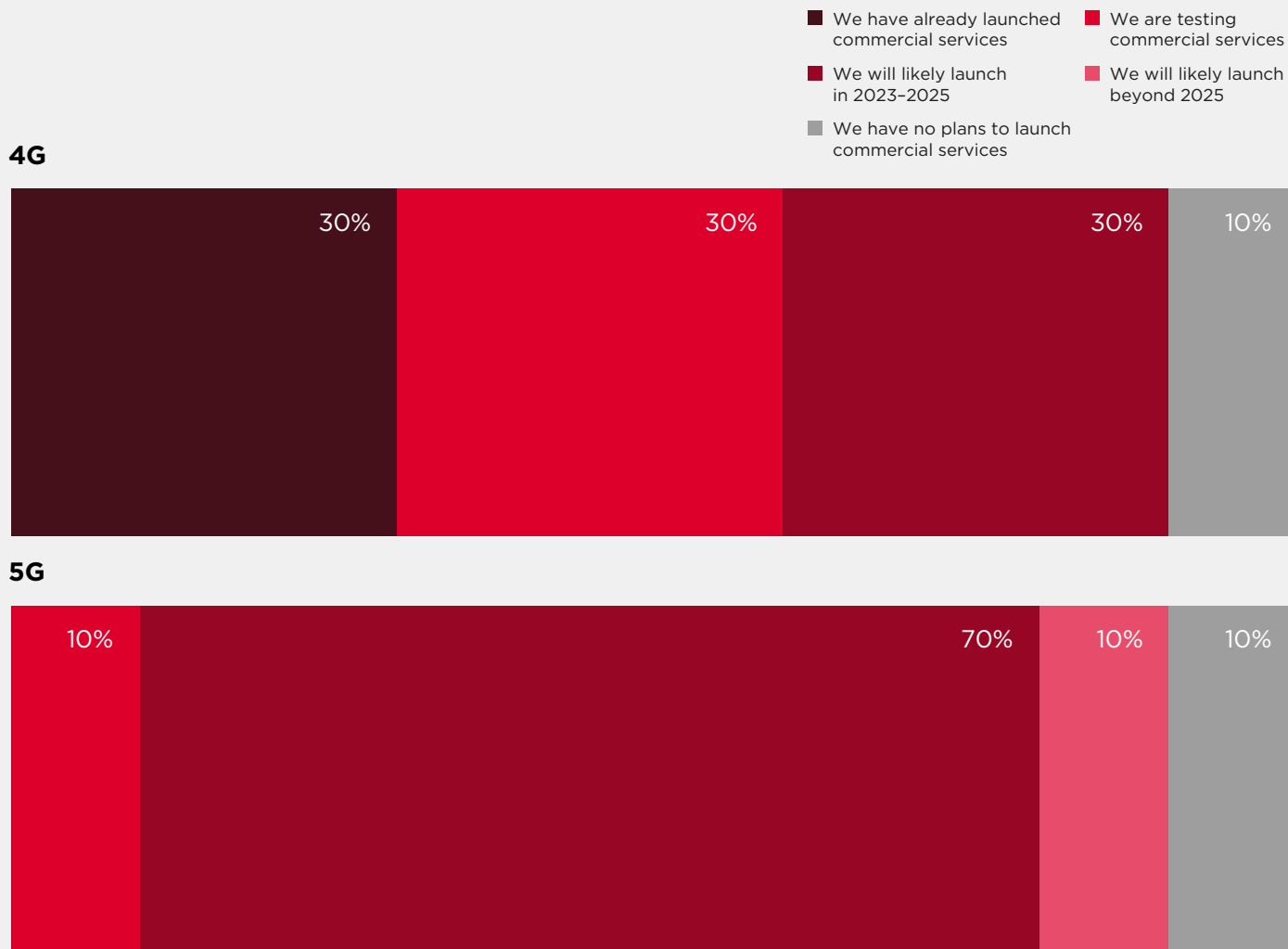


Figure 19

5G creates opportunities to deploy private networks in untapped industries such as manufacturing and ports

Selected private 5G announcements in Latin America

Source: GSMA Intelligence

Location	Sector	Customer	Companies involved	Primary use case(s)
Brazil	 Manufacturing	Nestlé	Claro, Embratel	AGVs
Brazil	 Ports	Brasil Terminal Portuário	TIM	Real-time remote monitoring of equipment (e.g. cranes)
Colombia	 Mining	AngloGold Ashanti	Tigo	Mission-critical communications, drones, high-definition cameras

5

Policies to realise the potential of 5G in Latin America



5G services require more spectrum across all bands

Most 5G launches globally (around 80%) have relied on 3.5 GHz spectrum. The 3.5 GHz range (3.3–4.2 GHz) has been adopted as the 5G launch band because it supports the required bandwidth and speeds for initial 5G services.

As adoption increases and more consumers and diverse services migrate to 5G networks, more spectrum across low, mid- and high bands will be needed to deliver widespread coverage and enough capacity to support the delivery of 5G:

- Low-band spectrum (sub-1 GHz) supports widespread coverage across urban, suburban and rural areas and helps support IoT services. Additional spectrum in low bands will help provide a 5G user experience in rural areas and indoors.¹⁹
- Mid-band spectrum (e.g. 3.5, 4.8 and 6 GHz) typically offers a good mix of coverage and capacity benefits. It is estimated that 2 GHz of mid-band spectrum per market will be needed on average for 5G in the period to 2030.²⁰
- mmWave bands (24 GHz and above) will meet peak traffic demand speeds to maintain the performance and quality requirements of 5G services. GSMA Intelligence estimates that 5 GHz of mmWave spectrum per market could be needed on average for 5G by 2030.²¹

5G has the potential to make an even greater impact than previous generations. But success hinges on effective spectrum licensing that benefits everyone.

In particular, governments in Latin America are making considered decisions on the most efficient use of the 6 GHz band. This represents the largest remaining single block of mid-band spectrum that can be assigned to licensed mobile for the foreseeable future. For countries that want to maximise the socioeconomic benefits delivered by 6 GHz and invest in the future of mobile, deployment of 5G in the upper part of the band is crucial, as GSMA Intelligence analysis shows.²²

In 2020, several countries in Latin America moved towards adopting the position (supported by the US tech sector) of allowing only Wi-Fi/RLAN technologies in 6 GHz. However, two years later this group has not grown, while support for licensed mobile – at least in the upper 6 GHz band – is now a global trend. In late 2022 one of those countries, Chile, reversed the earlier decision and opened the door to using 6 GHz for 5G. More recently, Mexico has joined a growing number of countries that are keeping their regulatory options open for the 6 GHz band – an important decision for the future of 5G.

The future of 6 GHz is one of the items up for discussion at WRC-23. While the WRC agenda discusses the entire 6425–7125 MHz band in only the EMEA region, there is support for using this spectrum for licensed mobile throughout the world.

¹⁹ Vision 2030: Low-Band Spectrum for 5G, GSMA, 2022

²⁰ Vision 2030: Insights for Mid-band Spectrum Needs, GSMA, 2021

²¹ Vision 2030: mmWave Spectrum Needs, GSMA, 2022

²² The socioeconomic benefits of the 6 GHz band: considering licensed and unlicensed options, GSMA Intelligence, 2022

5G spectrum licensing approaches will determine the success of digital transformation strategies

The delivery of socioeconomic benefits from 5G will require appropriate management of spectrum resources. This generally implies that sufficient spectrum across key bands, if possible in large contiguous blocks, is made available to the market. Crucially, it also requires that the conditions attached to licences are designed to promote investment in new networks and incentivise innovation at the service level.

As 5G develops and deployments progress, spectrum sharing and leasing could also become more attractive and widespread for several reasons, including spectrum supply (e.g. greater availability in mid- and high bands) and demand from different users who may want access to spectrum to provide the necessary local capability to realise an unaddressed business opportunity or to establish dedicated networks for industries.

Beyond this, upcoming 5G allocations represent both opportunities and risks for regulators, and will largely determine the success of digital transformation strategies in each country in the region. In particular, when spectrum costs are set above the true market value, there are clear consequences as investment incentives are distorted. Empirical evidence²³ shows that the total cost of spectrum impacts investment conditions in the market, innovation in network deployment, and ultimately the levels of connectivity that end users and consumers receive. Simulations of the impact of a reduction of the cost of spectrum in Mexico,²⁴ Ecuador,²⁵ Colombia²⁶ and Argentina²⁷ show that significant improvements in the quality of the network and the speed of deployment in the country would be possible if spectrum prices were better aligned to their true market value.

In most countries of the region, the main reason for the disconnect between the evolution of the cost of spectrum and revenues in the market is the design of public policies. While a short-term approach focused on maximising state revenue is a legitimate public policy choice, it is one that is associated with high risks. In Mexico, for example, the high cost

of annual fees set by the government has led to spectrum being returned by some operators, while in the latest spectrum auction most of the spectrum lots on offer were left unsold.

Despite the growing importance of fibre for backhaul, wireless backhaul will also remain central in the region for 5G for the foreseeable future. Regulators should continue to consider making spectrum bands available for backhaul, as well as formulae for backhaul fees that do not disincentivise the use of wider channels and new technologies.²⁸

Rebalancing sector-specific taxes and regulatory fees can promote 5G investment, economic growth and fiscal stability

The positive contribution of the mobile sector to the economy is well recognised. However, the tax treatment of the sector is not always aligned with best-practice principles of taxation, and may distort the continued development of the sector. Faced with considerable challenges in having to balance public sector budgets, some governments in Latin America apply additional, sector-specific taxes on consumers and mobile operators. This means operators in parts of the region are subject to a substantial tax burden, which reduces the likelihood of successful investments as Latin America approaches the next wave of mobile technologies.

Analysis shows that that there would be considerable economic benefits from tax reform in several countries in Latin America.²⁹ The removal of sector-specific taxes can result in increased demand for mobile services and more investment, but also overall growth in government tax revenues over the medium term. For example, mobile services in Mexico are subject to a 3% usage tax (IEPS). If this were eliminated, the analysis shows that, in the medium term, the number of connections would increase by 2.2 million, leading to a \$4.5 billion increase in GDP and \$1.1 billion increase in investment. Crucially, tax revenues would increase by \$589 million as a result of the larger taxable base.

23 The impact of spectrum assignment policies on consumer welfare, Telecommunications Policy, Volume 46, Issue 1, 2022

24 El impacto de los precios del espectro en México, GSMA Intelligence, 2022

25 Effective spectrum pricing in Ecuador, GSMA Intelligence, 2021

26 Effective spectrum pricing in Colombia, GSMA Intelligence, 2021

27 Costo del espectro en Argentina, GSMA Intelligence, 2022

28 Wireless Backhaul Evolution, GSMA, 2021

29 Taxing mobile connectivity in Latin America, GSMA, 2017

Removing obstacles to network deployment can incentivise 5G rollouts

The densification of networks to cope with urban capacity demand requires significant new investment in additional sites and supporting infrastructure, including fibre. Complex planning procedures involving multiple layers of approval in some countries can create an additional burden, significantly delaying 5G deployment. Policymakers must strive to ensure that deployment regulations at the local level are aligned with national digital ambitions and market realities.

To this end, policymakers are encouraged to implement flexible, light-touch regulation that creates an environment for continued mobile sector investment and innovation. For example, they should aim to simplify planning procedures and regulations for site acquisition, co-location and upgrades of base stations. It is also necessary to provide operators with access and rights of way (RoW) to public/government facilities for antenna siting and fibre deployment on reasonable terms and conditions. Policymakers should also offer a reasonable expectation of approval for voluntary network sharing deals while avoiding mandated sharing agreements that may amount to an access obligation.

Eliminating regulatory asymmetries and developing coordination between sectors is essential for 5G success

A future-proof regulatory framework should aim to accomplish its objectives in the most efficient manner. At the same time, it should be dynamic and able to adapt to constant changes based on ex-post performance. This includes analysing legacy frameworks and considering whether specific regulations are needed. Such frameworks will contribute to a reduction in existing regulatory asymmetries so that equivalent services are subject to the same rules. Additionally, they will promote competition and innovation by encouraging investment in key technologies such as 5G.

The relationship between government, policymakers and the private sector is fundamental to the creation and enforcement of consistent digital policies that contribute to the telecoms sector's long-term sustainability and encourage investment in next-generation networks. Policymakers need to fully understand network operators to formulate public policy that incentivises investment and benefits citizens. Intrusive policies that are formulated for short-term gains, without consulting sector authorities/experts or taking into account the current state of technology advancements, risk having a negative impact on industry sustainability and the capacity to invest in more and better services.

Further, it is important to share knowledge and experience with internal levels of government (province/state or municipal levels). This can make the difference between creating a comprehensive public policy that is consistent with the objective of connecting citizens and a collection of separate decisions preventing a country from enjoying the benefits of digitisation.

The development of national digital transformation strategies that put 5G at the centre can also help bring different parts of government and the private sector together. This has been the case in Europe, China and South Korea, where governments have set ambitions, provided funding and adopted policy reforms to support 5G development. In some cases, (e.g. in South Korea), users currently experience the fastest download speeds for 5G in the world (median speeds in excess of 500 Mbps).³⁰

30 "Stable and Expanding: The State of Worldwide 5G in 2022", Ookla, December 2022

Policymakers should establish uniform electromagnetic field rules that are no more restrictive than internationally agreed levels

The radio signals used by mobile technologies have been extensively researched for decades. The frequencies used by mobile operators comply with national or international EMF exposure guidelines, which cover all frequencies currently used by – and under consideration for – 5G.

The GSMA recommends that the basis for national RF-EMF exposure policies should be the international RF-EMF exposure guidelines developed by the International Commission for Non-Ionizing Radiation Protection (ICNIRP) that set the recommended human exposure limits on the basis of up-to-date scientific evidence.

In Latin America, certain false messages around the safety of 5G technology have gained some media traction. One of the concerns is the potential impact of 5G on cancer hazard. The WHO says that studies provide no indication that base station signals increase the risk of cancer or any other disease. Moreover, the International Agency for Research on Cancer (IARC), which reviews evidence for cancer hazards, classifies radio frequency signals in the same group as eating pickled vegetables (i.e. that there was limited evidence that they could cause cancer in humans). Eating processed meat falls under a higher classification than radio signals (i.e. there is stronger evidence that it might cause cancer in humans). ICNIRP says that trends in brain cancer incidence rates do not show any increase since mobile phones were introduced, and concludes that no effects of radio signals on cancer have been substantiated.³¹

The other main concern in public opinion is the impact of 5G on the environment. Chapter 3 highlights the initiatives taken by mobile operators in Latin America to invest in sustainable technologies. It is also important to mention that the same exposure limits that protect people also protect the environment. The German government agency, Bundesamt für Strahlenschutz, has stated that there is no scientifically reliable evidence of a risk to animals and plants exposed to radio signals at or below the limits in the international guidelines. In addition, the Antenna Bureau (Antennebureau) in the Netherlands has refuted conspiracy theorist claims that 5G tests harmed birds.

Security assurance frameworks can help strengthen 5G security

With 5G capabilities relied upon for sensitive services in sectors such as automotive, healthcare and logistics, it is clear that security breaches cannot be accepted and the ability to monetise effectively depends on users (businesses or individuals) being confident that communication and data are secure.

To facilitate improvements in network equipment security levels across the mobile industry, the GSMA has developed the Network Equipment Security Assurance Scheme (NESAS) to provide a universal and global security assurance framework, raising confidence and trust in mobile network equipment.³² The purpose of the scheme is to audit and test network equipment vendors, and the processes associated in the creation of those products, against a security baseline so they can demonstrate to network operators they conform to the desired standard. The scheme has been defined by industry experts through the GSMA and 3GPP. It therefore reflects the security needs of the entire ecosystem, including governments, mobile network operators and regulators.

NESAS audits involve internal and external assessments, both for product evaluation using 3GPP-defined security test cases and the processes used in the development of such products. Prior to audits and evaluations, the vendors are required to self-assess their processes and product security against defined security requirements. Supporting guidelines are available to help on request.

The NESAS has been adopted by the main global network equipment vendors. To date (April 2023), more than 20 processes have been audited and almost 40 products passed the evaluation since the launch of NESAS in 2020.

³¹ 5G, EMF Exposure and Safety, GSMA, 2020

³² www.gsma.com/security/network-equipment-security-assurance-scheme/

6

Country overviews



Argentina



	2025	2030
5G mobile connections	5.7 million	34.7 million
5G adoption (percentage of total connections)	9%	48%
5G economic contribution	\$1 billion (0.2% of GDP)	\$8 billion (1.1% of GDP)
5G population coverage	38%	84%

Source: GSMA Intelligence

The macroeconomic outlook for Argentina remains volatile, creating further challenges for operators who are exposed to rising equipment prices through foreign exchange depreciation. This has a direct impact on capex, making it more expensive to roll out new network infrastructure – either for 4G upgrades or 5G deployments.

Argentina has large amounts of spectrum (210 MHz) unassigned, equivalent to 50% of the total currently assigned. The main reason for the scarcity of spectrum available in the market is regulatory caps on the amount of spectrum each operator can have. In fact, one operator has returned spectrum since it exceeded the limit as a result of a series of company acquisitions. Additionally, there is 300 MHz available in the 3.5 GHz band, which is due to be assigned for the deployment of 5G networks. End users feel the greatest impact from this artificial scarcity, as it increases deployment costs and constrains network capacity, which in a context of strong data traffic growth leads to poorer network performance.³³

In the absence of new spectrum, Personal has used dynamic spectrum sharing (DSS) to introduce 5G services in February 2021.³⁴ It ended 2022 with DSS deployed across 180 active sites.³⁵ The operator has also started upgrading other parts of its network to meet 5G demand. For example, it has begun deploying an autonomous 5G core in partnership with Huawei – a project it expects to complete in 2024.

Operators in Argentina are working to develop new use cases that leverage 5G's unique capabilities. Movistar recently opened its first 5G testing lab in Buenos Aires, having launched similar spaces in Chile and Colombia in 2022. The lab will enable startups selected by Movistar's open innovation arm to test applications using spectrum in the 3.5 GHz band. Meanwhile, Personal is testing 5G use cases with companies in the automotive sector in partnership with Google.³⁶

³³ For more information, see Spectrum Pricing in Latin America, GSMA, 2023

³⁴ DSS allows mobile operators to use the same spectrum band for different radio access technologies such as 4G and 5G, to combat the absence of new 5G spectrum. It works by allocating spectrum to different technologies in real time, based on demand.

³⁵ "Personal ended 2022 with 180 5G DSS cell sites", CommsUpdate, March 2023

³⁶ "Telecom Argentina to finish 5G core deployment in 2024", BN Americas, September 2022

Brazil



	2025	2030
5G mobile connections	36.2 million	179 million
5G adoption (percentage of total connections)	16%	77%
5G economic contribution	\$5 billion (0.3% of GDP)	\$26 billion (1.2% of GDP)
5G population coverage	47%	84%

Source: GSMA Intelligence

5G commercial services arrived in Brazil in July 2020, with operators using DSS technology. Services have subsequently evolved following the November 2021 spectrum auction. For example, Claro, TIM and Vivo have deployed 5G SA using 2.3 and 3.5 GHz spectrum, delivering a significant performance improvement on previous networks. As of January 2023, 140 towns and cities had been approved to proceed with 3.5 GHz launches, equivalent to 38.5% of the population, according to regulator Anatel.³⁷

The growing coverage of 5G networks in Brazil should drive take-up of the service, which accounted for around 3% of connections at the end of 2022. 5G adoption will also be supported by the increased availability of 5G smartphones. For example, TIM claimed in September 2022 that 75% of devices on sale in its stores were 5G-ready.³⁸

Operators are also exploring options to deploy 5G FWA solutions. Over the next four years, 5G FWA connections are expected to grow by around 190% per year in Brazil. Although this figure is boosted by the current small 5G FWA base, it shows clear momentum behind 5G FWA. By 2025, the total number of 5G FWA connections in Brazil will exceed 1 million.

Gaming represents another important consumer 5G use case in Brazil, as cloud-based services require high-speed connectivity and low latencies. To capture this opportunity, TIM Brasil has launched its own cloud gaming proposition. Meanwhile, Claro Brasil, Ericsson and Niantic have conducted trials of AR gaming over 5G SA networks.

5G also brings new opportunities in the enterprise segment, as highlighted by growing demand for customised private 5G networks in Brazil. In September 2022, Nestlé announced it had commissioned Claro and Embratel to build a private 5G network at its factory in São Paulo. Meanwhile, state-owned petroleum company Petrobras plans to have 5G connectivity in 29 production platforms by 2024, building on its existing 4G private network deployments.

³⁷ "78 more locations approved for 3.5GHz 5G connectivity in Brazil", CommsUpdate, January 2023

³⁸ "5G carries 10% of data traffic in main cities, TIM Brasil says", CommsUpdate, September 2022

Chile



	2025	2030
5G mobile connections	11.6 million	22.7 million
5G adoption (percentage of total connections)	37%	68%
5G economic contribution	\$1 billion (0.3% of GDP)	\$2 billion (0.6% of GDP)
5G population coverage	57%	99%

Source: GSMA Intelligence

Historically, Chile has assigned spectrum with the main objective of promoting investment in network infrastructure to improve service and connectivity for end users. Along the same lines, the 2021 5G auction initially sought to make the maximum amount of spectrum available to the market. However, the tie-breaking criteria that Subtel opted for consisted of a first price bid with a sealed envelope – a format that can constrain price discovery and often leads to artificially high spectrum prices.

The total cost of spectrum can impact investment conditions in the market, innovation in network deployment and, eventually, the levels of connectivity users receive.³⁹ The high cost of 5G spectrum in Chile could be reflected in the speed of 5G rollouts, which is slower than that observed in the country with previous network technologies such as 3G and 4G.

Following the 2021 auction, operators moved to launch commercial 5G services. This began with Entel and Movistar in December 2021 and WOM in March 2022. The growing availability of 5G handsets provides a strong foundation for 5G adoption in the country. In mid-2022, Entel reported that 5G-compatible devices accounted for around 50% of its handset sales; as such, around 820,000 of its customers have devices capable of accessing the network, with approximately 620,000 users connecting to the 5G network each month.⁴⁰

With strong consumer take-up of 5G, the focus of operators in Chile is now increasingly shifting to 5G for the enterprise. For instance, the second phase of Entel's 5G rollout prioritises extending 5G coverage to enterprises and public sector organisations, including public hospitals, universities, government ministries, ports and airports. The operator has also partnered with Ericsson to roll out 5G SA and private wireless networks to advance industry 4.0 initiatives in Chile.

The rollout of future 5G services could be supported by additional spectrum allocations. Chile's Ministry of Transport and Telecommunications recently opened the door to using 6 GHz for 5G, reversing a decision made in 2020 to make the whole band (5925–7125 MHz) available for Wi-Fi. Instead of assigning the full 6 GHz band for licence-exempt use, only the lower part of the range (5925–6425 MHz) will now be set aside for RLAN technologies such as Wi-Fi 6E. The upper part will be considered for 5G. In the official documentation of the decision, the Chilean Ministry stated that the reason behind the reversal is the need to adapt to the realities of the market. It was further stated that Chile will await a potential decision on the band's future at ITU World Radiocommunication Conference 2023 (WRC-23).

³⁹ See Spectrum Pricing in Latin America, GSMA, 2023

⁴⁰ "Entel completes first phase of 5G rollout", CommsUpdate, August 2022

Colombia



	2025	2030
5G mobile connections	2.9 million	37.8 million
5G adoption (percentage of total connections)	4%	43%
5G economic contribution	\$0.3 billion (<0.1% of GDP)	\$4 billion (0.9% of GDP)
5G population coverage	30%	68%

Source: GSMA Intelligence

5G is driving renewed interest in FWA among operators in Colombia. In September 2020, DirecTV switched on its commercial 5G FWA service in select parts of Bogota, building on the 4G FWA proposition it launched in 2014. Furthermore, Claro initiated a six-month 5G FWA trial in mid-2020 using a block of 3.5 GHz spectrum that the regulator allocated on a temporary basis.

Commercial 5G mobile services have yet to launch in Colombia, but mobile operators are engaged in trials. Movistar staged the country's first 5G trial in May 2020. In conjunction with Huawei and the Ministry of Health, it used 5G to connect thermal cameras at the entrance of the Bogota District Health Secretariat and the Public Health Laboratory, allowing the real-time monitoring of body temperatures for more than 400 employees, to reduce the potential spread of Covid-19. Meanwhile, Tigo Colombia and Nokia have teamed up with AngloGold Ashanti Colombia to conduct the first 5G trial in mining in Jericó, Colombia. The trial highlighted it is possible to safely, sustainably and efficiently enable mining use cases for a private 5G SA network in a challenging underground environment.

Network modernisation efforts are also well underway in Colombia. Tigo switched off its 2G network in November 2022, while Claro aims to retire its 2G network in 2023. Such moves free up resources for the operators to upgrade their 4G networks and prepare for an eventual 5G launch once spectrum becomes available.

A 5G spectrum auction in Colombia is expected to take place later in 2023. Colombia's ICT ministry noted that nine companies had expressed an interest in securing 5G spectrum licences ahead of the December 2022 deadline. Spectrum in the 700 MHz, 1900 MHz, 2.5 GHz, 3.5 GHz and 26 GHz frequency bands is set to be included in the auction.

Dominican Republic



	2025	2030
5G mobile connections	0.6 million	4.3 million
5G adoption (percentage of total connections)	5%	35%
5G economic contribution	\$0.1 billion (<0.1% of GDP)	\$0.7 billion (0.5% of GDP)
5G population coverage	29%	55%

Source: GSMA Intelligence

The Dominican Telecommunications Institute completed an auction for 3.5 GHz spectrum in October 2021, with Altice and Claro both acquiring a 70 MHz block of spectrum. Frequencies in the 700 MHz band were also included in the same auction but failed to attract bids. The 700 MHz spectrum came with obligations to offer local roaming access for three years to other operators, which likely disincentivised operators from bidding. An auction with revised terms is likely in the near future.

In December 2021, Claro became the first operator in the Dominican Republic to launch commercial 5G services, while Altice's 5G network went live in Santo Domingo and Santiago de los Caballeros in March 2022. Its 5G rollout forms part of its plan to invest \$654 million (DOP35 billion) in the modernisation and expansion of its networks between 2019 and 2024. This figure is in line with the sum Altice invested in its network in the prior five-year period, signalling the operator's intention to incorporate 5G within its existing capex budget.

Guatemala



	2025	2030
5G mobile connections	1.1 million	6.9 million
5G adoption (percentage of total connections)	5%	24%
5G economic contribution	0	\$0.5 billion (0.4% of GDP)
5G population coverage	20%	41%

Source: GSMA Intelligence

5G commercialisation in Guatemala has been constrained by a lack of new spectrum bands available for 5G services. The country's telecoms regulator is moving forward with the release of spectrum in the 700 MHz and AWS bands,⁴¹ but it has suspended all procedures for the assignment of regulated frequencies in the 3.0–4.0 GHz range since 2006.⁴² This means 5G deployments have so far relied on existing spectrum allocations.

Claro launched Guatemala's first commercial 5G services in July 2022, offering a range of 5G-compatible Motorola and Samsung handsets. The operator's 5G network covers parts of each of Guatemala's 22 departments. Tigo Guatemala is also moving forward with its 5G launch plans. The operator recently launched three Guatemala City-based Experience Centres, which allow subscribers to test 5G applications at local shopping malls.

Further initiatives to boost the 5G ecosystem in Guatemala are likely over the next year. However, with 2G and 3G still accounting for more than half of total mobile connections in Guatemala, operators will balance plans to evolve their 5G propositions with increasing 4G uptake in the near term.

⁴¹ "SIT poised to auction 2.5 GHz band in Guatemala", CommsUpdate, September 2022

⁴² Regulated frequencies: those that are intended for commercial use. For more information, see [5G and the 3.3–3.8 GHz Range in Latin America](#), GSMA, 2020

Mexico



	2025	2030
5G mobile connections	16.9 million	87.0 million
5G adoption (percentage of total connections)	13%	62%
5G economic contribution	\$3 billion (0.2% of GDP)	\$13 billion (0.8% of GDP)
5G population coverage	54%	86%

Source: GSMA Intelligence

In Mexico, the annual rights for the use of spectrum are a major barrier to 5G deployment. The annual rights are quotas set each year by the legislature in the federal Rights Law and represent 85% of the total cost of spectrum. Annual royalty payments have generally risen above the country's inflation, while the sector's income has been either flat or declining. This led to two operators returning spectrum blocks between 2019 and 2023, while the latest spectrum auction in the country in 2021 resulted in spectrum remaining unsold in 38 of the 41 blocks offered. If there are no reforms and if the current trend continues, the cost for operators will continue to grow, thus limiting the ability and incentive to invest in the deployment of new technologies.⁴³

In this context, the Federal Institute of Telecommunications (IFT) approved the launch of a public consultation in January 2023 for the auction of 330 MHz of additional low- and mid-band spectrum for 5G networks. The auction will cover spectrum in the 600 MHz and 3.3 GHz frequency bands, as well as AWS and PCS spectrum. Mexico is also making progress on the allocation of mmWave spectrum. In December 2022, IFT announced that it had identified a total of 7,750 MHz in the 26 GHz, 38 GHz and 42 GHz bands suitable for 5G use from 2023.

In the meantime, operators have launched commercial 5G services using their existing spectrum allocations. Telcel launched commercial 5G mobile services in February 2021, after the telecoms regulator modified the licensing terms for its existing 3.5 GHz holdings (originally allocated for FWA only). By the end of 2022, the operator's 5G network covered around 100 cities in Mexico. AT&T and Movistar also offer commercial 5G services in Mexico, albeit over a more limited footprint.

With launches underway, operators and their partners are shifting their focus to developing 5G use cases. AT&T Mexico established a 5G Innovation Lab in 2022 to test new applications, while Mexico's telecoms regulator announced plans to launch a dedicated committee to drive the development of industrial use cases for 5G.

⁴³ See Spectrum Pricing in Latin America, GSMA, 2023

Peru



	2025	2030
5G mobile connections	3 million	25.6 million
5G adoption (percentage of total connections)	7%	54%
5G economic contribution	\$0.3 billion (0.1% of GDP)	\$3 billion (1% of GDP)
5G population coverage	40%	64%

Source: GSMA Intelligence

5G preparations have begun in Peru. The regulator has allocated 500 MHz (3.3–3.8 GHz) of mid-band spectrum to mobile services.⁴⁴ However, there is no specific date for the auction of unallocated spectrum within this range. Claro and Entel have received authorisation from the telecoms regulator to use their existing 3.5 GHz spectrum holdings for 5G FWA. Both operators subsequently launched 5G FWA services in March 2021, starting in select districts of Lima. Claro offers 5G FWA services for \$30 per month – a 30% uplift on the retail price of its 4G FWA proposition.

Commercial 5G mobile services are expected in 2024, driving the network investment decisions of operators. For example, in its Q1 2023 earnings presentation, Entel Peru noted it would invest \$162 million in capex in 2023 as part of its effort to prepare for 5G and improve 4G coverage and quality. 5G population coverage in Peru is expected to reach 40% by 2025, laying the foundation for 5G adoption, which is forecast to surpass 50% of total mobile connections by 2030.

44 5G and the 3.3–3.8 GHz Range in Latin America, GSMA, 2020

Uruguay



	2025	2030
5G mobile connections	0.9 million	4.0 million
5G adoption (percentage of total connections)	13%	65%
5G economic contribution	\$0.1 billion (0.1% of GDP)	\$0.5 billion (0.6% of GDP)
5G population coverage	25%	99%

Source: GSMA Intelligence

Mobile operators in Uruguay are yet to launch commercial 5G networks, reflecting a lack of new spectrum bands for 5G. However, policymakers are beginning to make progress, which should accelerate the timeline for 5G services. In February 2023, the regulator published its first draft of the bidding terms and conditions for the planned auction of 3.5 GHz spectrum, which is set to take place later in 2023. The document proposes that three 100 MHz lots of spectrum will be allocated: 3300–3400 MHz, 3600–3700 MHz (reserved for state-owned telco Antel) and 3700–3800 MHz. Each spectrum package has a minimum initial price of \$28 million and includes obligations such as a requirement to deploy a minimum of 70 base stations within one year and at least two base stations in each of Uruguay's 19 departments within three years.

While operators wait for new spectrum bands to be auctioned, they continue with 5G tests and trials. In April 2019, Antel launched a pre-commercial 5G network (i.e. commercial tariffs are not yet available from the operator) in Montevideo using spectrum in the 28 GHz band already assigned to the company for FWA services. Claro and Movistar were subsequently awarded temporary access to spectrum in the 28 GHz band to test 5G services, including FWA. The path to launching a commercial 5G FWA service using the spectrum is dependent on improvements in device availability and affordability. In any case, the scope to use 5G mmWave-based FWA services in Uruguay is likely to be limited due to the country's extensive FTTP network (FTTP services are available to more than 70% of homes). Operators are therefore likely to focus on other opportunities to drive incremental revenues from 5G.

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