Connectivity Gaps in Latin America

A Roadmap for Argentina, Brazil, Colombia, Costa Rica and Ecuador

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Executive summary

Recent years have seen an internet connectivity revolution in Latin America. Between 2014 and 2021, the number of people in the region with mobile internet access[1] nearly doubled, from 220 million to almost 400 million.

Despite this spectacular growth, 230 million people remain without access to mobile internet. And in contrast to the fast pace of change seen over the last few years, further progress will be increasingly complex.

The gap in terms of internet provision (the 'coverage gap') across most of the countries studied is not wide relative to other parts of the world. At a regional average of 7% of the population (and even lower in some countries), the coverage gap is concentrated in remote areas or locations with complex terrain, making network deployments economically challenging.

Lack of demand (the 'usage gap') is the main driver of the mobile internet connectivity gap across Latin America. Some 190 million people across the region (of the 230 million unconnected), in both urban and rural areas, live in locations with mobile internet network coverage but do not access the internet. Despite a continued decline in service prices, this usage gap remains due to a lack of affordability. Low income levels in some population segments are an important factor, but regressive, short-termist tax policies also artificially raise the price of internet connectivity for low-income populations.

If the current framework is not changed significantly, the connectivity objectives set by most regional governments and international organisations such as the United Nations will not be achieved. By 2030, the International Telecommunication Union (ITU)'s targets are to reach universal internet coverage and for 100% of the adult population to be connected.

The main public policy instrument for bridging the connectivity gap in all five countries studied has traditionally been universal service funds (USFs). However, it is clear that these do not represent an effective mechanism for closing the gap. Aside from specific projects supported by USFs that may have been partially successful, econometric analysis[2] by the United Nations indicates that the average effect of USFs on internet connectivity is null or even counterproductive (that is, USFs reduce connectivity).

USFs in the region need to be reformed urgently, particularly in terms of funding models, the selection and disbursement of investments, and the lack of evaluations or monitoring of projects supported by fund resources. Over the last 10 years, changes in the value chain and the digital ecosystem landscape have led to significant variation in how much revenue is being generated – as a result of connectivity – by different players. While telecoms providers' revenues have remained largely flat, the revenues of digital service providers in the region, such as Meta, Netflix and YouTube, have grown rapidly.

USFs in all five countries studied are still exclusively financed by contributions from telecoms operators. If there are no changes to the contributions and efforts made by the different players in the ecosystem, the USF funding system will remain unfair and unsustainable. Such a system creates impacts that are at odds with the desired objectives and raises the cost of extending services to lower income users.

The inefficacy in the operation and use of USFs is clear. Disbursement rates over the last few years have been inadequate, with partially funded projects and inactive funds the norm rather than the exception in several countries. The efficiency and effectiveness of the use of funds is highly questionable. How many people have had access to the benefits of connectivity thanks to USF-supported programmes? What is the return on investment, measured in terms of people connected per dollar invested? Unfortunately, given the lack of any robust, ex-post evaluations by the institutions responsible, such questions remain unanswered.

1. Those subscribed to a 3G, 4G or 5G mobile internet service.
2. The Impact of Universal Service Funds on Fixed-Broadband Deployment and Internet Adoption in Asia and the Pacific, Asia-Pacific Information Superhighway (AP-IS) Working Paper Series, United Nations Economic and Social Commission for Asia and the Pacific, 2017

Fortunately, there are alternatives to USFs in the region that provide a potential roadmap for achieving connectivity objectives. In Peru, infrastructure sharing and a spectrum management model that facilitates sharing enable players from across the ecosystem to jointly invest in rural connectivity through a market mechanism called Internet for All *(Internet para Todos)*. In Chile, the state assumes its central role and leadership in enabling the benefits of connectivity by directly financing the USF. In North America, the US regulator was one of the first to acknowledge that the USF financing model is no longer sustainable and that expanding its contributor base is necessary to tackle the challenges related to closing the connectivity gap.

To assess the effectiveness of different models and the cost of closing the gap[3], we analysed the results of a detailed supply and demand economic model specifically developed for the five countries studied.

First, we analysed the effects of eliminating sector-specific taxes and levies on connectivity, including an alternative financing model for the USF. We find that these measures will boost demand and, as a whole, lead to a reduction in the connectivity gap of between 6 and 16 percentage points, depending on the country. This equates to an additional 50 million connected people across the five countries.

Once sector-specific taxes and other barriers to mobile internet connectivity are eliminated, we reach the coverage and adoption frontier that the market is capable of achieving under current technological and demand conditions. To completely close the gap beyond the market frontier, direct subsidies to boost internet supply and demand need to be considered.

The economic model shows that achieving 99% 4G population coverage would require between USD1,200 and USD3,500 per additional person covered beyond the market frontier, depending on the country. To achieve universal 4G connectivity, some markets will need to boost demand further through digital training programmes and subsidies to cover the entirety or a proportion of the cost of devices and services for low-income citizens. Such costs are estimated at between USD50 and USD360 per additional connected person, in present values.

The conclusion is clear.

To effectively bridge the internet connectivity gap, measures need to be taken to enable the expansion of both supply and demand. Without significant changes, connectivity objectives will not be achieved. The roadmap to universal internet connectivity varies from one country to another, but it must inevitably involve the expansion of demand and urgent reform of USF operation and financing. These funds are not only ineffective in connecting the unconnected; they are also often counterproductive.

3. For the purposes of this economic model, we define mobile internet as access to 4G services. In the medium term (by 2030), the minimum quality level expected by users and regulators in relation to internet access should be generated through 4G networks. For example, A4AI states that, even today, a 4G connection is the minimum standard necessary to enjoy an acceptable internet experience.

01.

The mobile connectivity gap in Latin America

Key barriers to digital inclusion in Argentina, Brazil, Colombia, Costa Rica and Ecuador.

01.

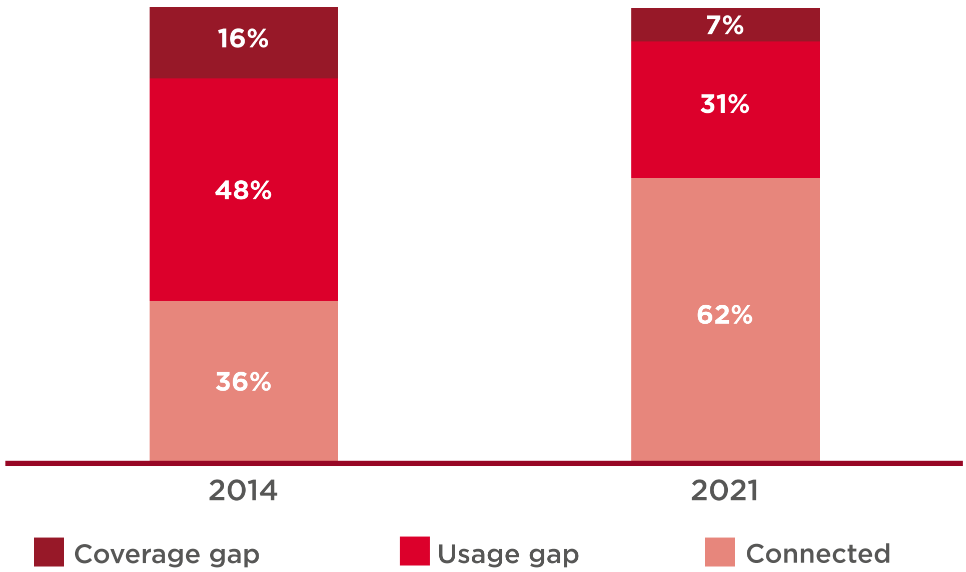
The mobile connectivity gap in Latin America

Recent years have seen significant growth in internet connectivity levels across Latin America. Between 2014 and 2021, the number of people in the region with mobile internet access nearly doubled, from 220 million in 2014 to almost 400 million by the end of 2021[4]. In just seven years, the number of new users added matched the total number of users in 2014.

Despite this spectacular growth, 230 million people remain without access to mobile internet. In contrast to the fast pace of change over the last few years, further progress going forward will be increasingly complex. Some countries are close to reaching their connectivity frontier under current market conditions.

FIGURE 1

Mobile internet connectivity in Latin America, 2014–2021
Percentage of population



Source: GSMA Intelligence

4. According to ITU data on the number of fixed connections in the region (104.4 million) and the average number of people per household in the region (3.53) as reported by the United Nations, 369 million people are estimated to have access to fixed internet connectivity, while there are almost 400 million citizens who have mobile internet connectivity subscriptions in the region. A larger number have access to the internet through shared mobile internet connections.

The 230 million people unconnected in the region represent the 'connectivity gap' and are the main reason for the development of this study. The research analyses the most effective options and measures to reduce and eliminate this gap over the next few years.

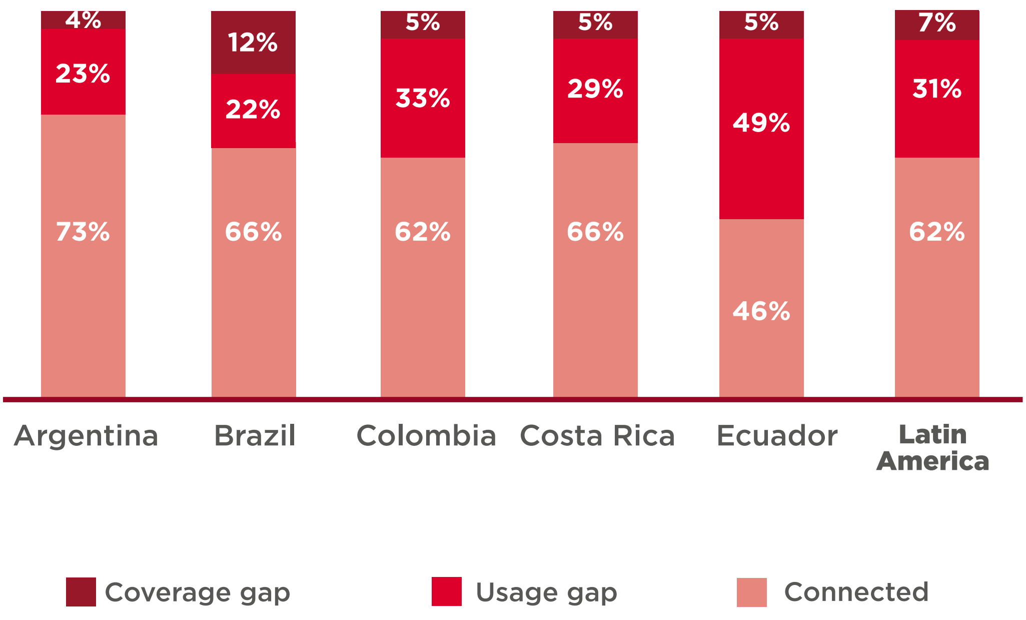
The connectivity gap comprises the coverage gap and usage gap. The coverage gap refers to those who live in areas where no mobile internet services are available. This gap is relatively small in Latin America, accounting for 7% of the population – around half of what it was in 2014. It accounts for almost 40 million people. The usage gap refers to those who live in areas with mobile internet coverage but do not access internet services. The usage gap is the main reason why there is a mobile internet connectivity gap in Latin America, accounting for 190 million of the 230 million unconnected.

The Covid-19 pandemic has highlighted the importance of internet access and the central role of mobile technology – the main internet access technology for most people across the region, thanks to widespread network deployment and flexibility in commercial supply. Mobile internet provides access to critical information at the personal and professional levels, enabling key services and opportunities for individuals while also driving economic growth. According to the International Telecommunication Union (ITU), a 10% increase in mobile broadband penetration would result in an additional 1.2% increase in GDP across the Latin American and Caribbean economies[5]. Despite progress achieved so far, urgent action needs to be taken to meet the digital inclusion objectives for the region and leave no one behind in an increasingly digitised and interconnected society.

This study focuses on five countries in the region (see Figure 2) whose geographic, economic and social diversity enables us to gain a broad view of the digital divide across the region, its causes and the potential for eliminating it over the next few years.

FIGURE 2

Mobile internet connectivity for the five countries studied, 2021
Percentage of population



Source: GSMA Intelligence

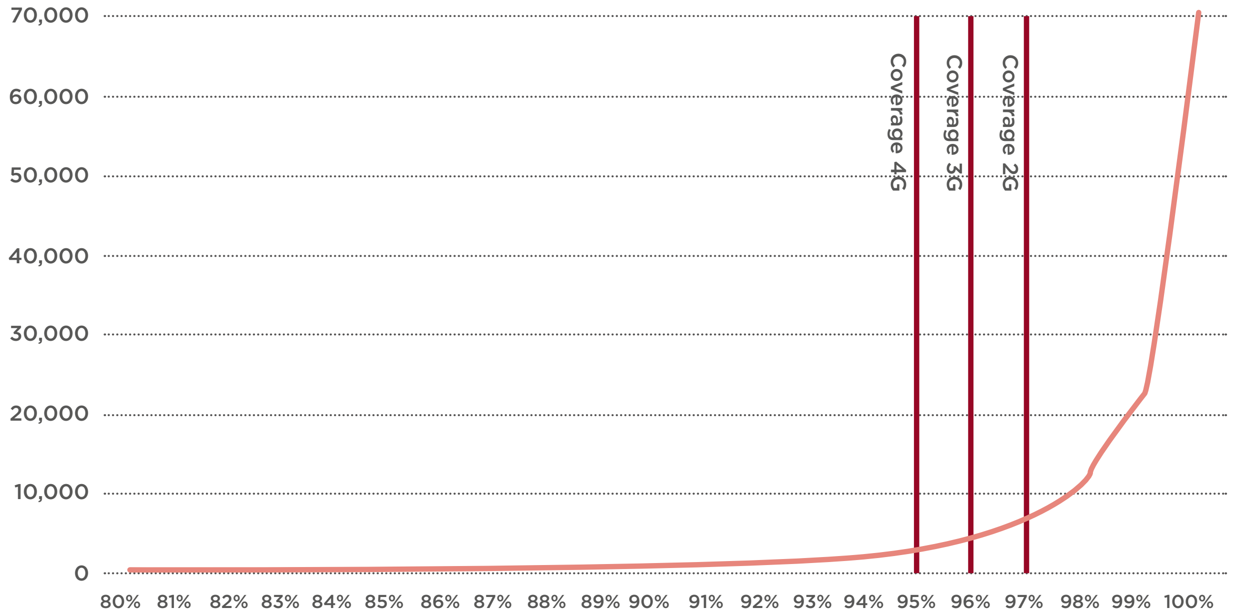
5. The economic contribution of broadband, digitization and ICT regulation, ITU, 2019. See "Econometric modelling for the Americas". These results are also in line with econometric analysis conducted by GSMA Intelligence, which estimates effects between 0.5% and 1.2% for each 10% increase in penetration.

The mobile internet connectivity gap is still a significant problem across Latin America – and will continue to be so for the whole of this decade if market conditions and regulations do not change. Despite spectacular growth, there are still 230 million people in the region who do not have access to mobile internet. Unlike the fast pace of change over the last few years, further progress will be increasingly complex, as some countries are close to reaching their connectivity frontiers under current market conditions[6].

Although the coverage gap in the countries studied varies, the regional average is 7%. This is currently concentrated in remote areas of the region, where network deployments are economically challenging. For example, according to GSMA estimates, providing coverage in Argentina to the last 1% of the population that does not have access to mobile internet would require more mobile sites than those required to take the coverage percentage from 0% to 99%. Such investments are not feasible based exclusively on a market-based approach. Making them possible will require creative and collaborative solutions by both the private and public sectors within an enabling regulatory framework.

FIGURE 3

Argentina: sites to achieve coverage



Source: GSMA Intelligence

The usage gap is significant in all the countries studied and constitutes the main barrier to achieving digitisation objectives.

It is fundamental to understand the factors that cause the connectivity gap, particularly the usage gap (the largest). To do this, the key barriers to connectivity were analysed using the latest data available.

6. 'Connectivity frontier' refers to the highest coverage and adoption points the market can reach under current supply and demand conditions.

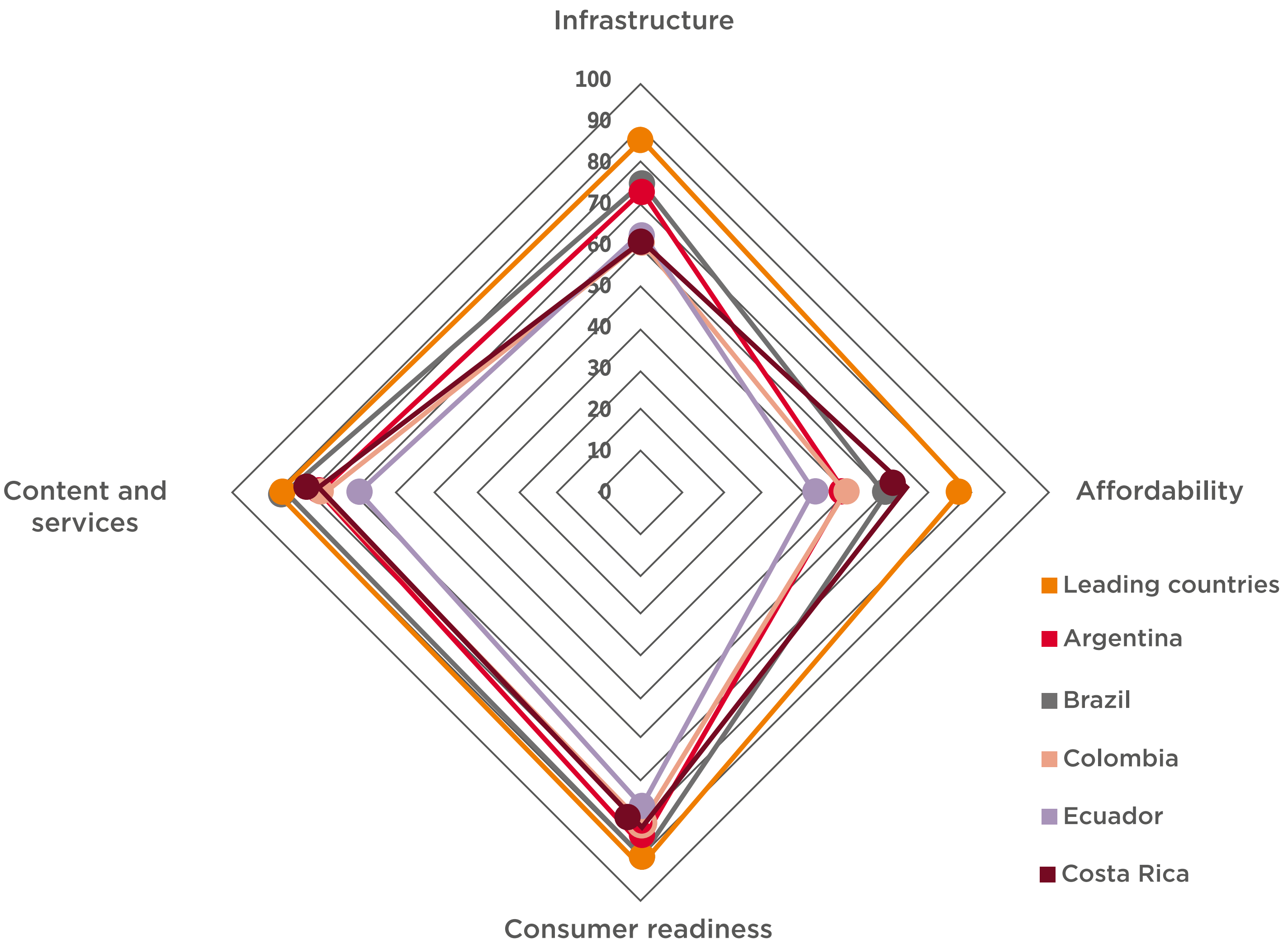
Key barriers

To assess the main factors causing the gap in each country, we analysed the key barriers to connectivity using the latest data available in all five countries studied. We then compared the data with the average figures for leading countries[7] globally in terms of mobile internet connectivity.

Figure 4 shows the result of the comparison. It uses data from the Mobile Connectivity Index (MCI)[8] – an index developed in line with guidelines from the OECD and the European Union Joint Research Centre (JRC). The MCI includes four enablers that capture the characteristics of the key barriers to mobile internet connectivity. The first is Infrastructure, which measures barriers to network deployment and thus the main barriers to closing the coverage gap in each country. The remaining three – Affordability, Consumer Readiness and Content & Services – measure the key barriers on the demand side so represent the main causes of the usage gap.

FIGURE 4

Top barriers to mobile internet connectivity: countries studied versus leading countries



Source: GSMA Intelligence

7. Leading countries are those with the highest scores in the Mobile Connectivity Index 2022
8. Mobile Connectivity Index Methodology

Figure 4 clearly shows that (lack of) affordability of mobile internet is where there is the biggest difference between the five countries studied and the leading countries globally, and is the main factor determining the usage gap. Lack of affordability is particularly severe in Ecuador, which has the widest usage gap of the five countries studied. Consumer skills and readiness and the availability of relevant content across the countries studied show similar values (though lower) to those of the leading countries. Finally, barriers to infrastructure deployment, which greatly affect the coverage gap, are more severe in Colombia, Ecuador and Costa Rica. Brazil and Argentina have values that are more in line with the leading countries.

Figure 5 shows a breakdown of the enablers, providing further insight into the underlying barriers in each country.

FIGURE 5

Assessment of barriers to mobile internet connectivity by country

		ARGENTINA	BRAZIL	COLOMBIA	COSTA RICA	ECUADOR
Infrastructure	Network coverage	88.69	89.50	79.49	83.39	82.77
	Network performance	65.63	76.68	48.14	51.52	65.10
	Other enabling infrastructure	74.72	69.06	68.46	74.60	62.53
	Spectrum	59.54	58.04	36.03	28.90	31.40
Affordability	Mobile tariffs	51.21	80.03	49.34	71.37	44.78
	Handset prices	51.73	62.32	60.83	70.31	44.47
	Taxation	45.18	73.58	65.44	85.50	40.72
	Inequality	49.50	10.00	23.75	27.75	37.75
Consumer readiness	Mobile ownership	79.86	78.79	79.90	87.43	79.32
	Basic skills	88.65	67.57	68.38	72.86	66.21
	Gender equality	92.03	93.16	90.91	91.48	85.86
Content and services	Local relevance	78.76	78.96	74.25	74.95	71.65
	Availability	91.44	91.21	91.69	90.19	90.69
	Online security	50.12	96.25	63.72	67.45	26.30

Lower values indicate a stronger barrier to mobile internet connectivity

Source: GSMA Intelligence

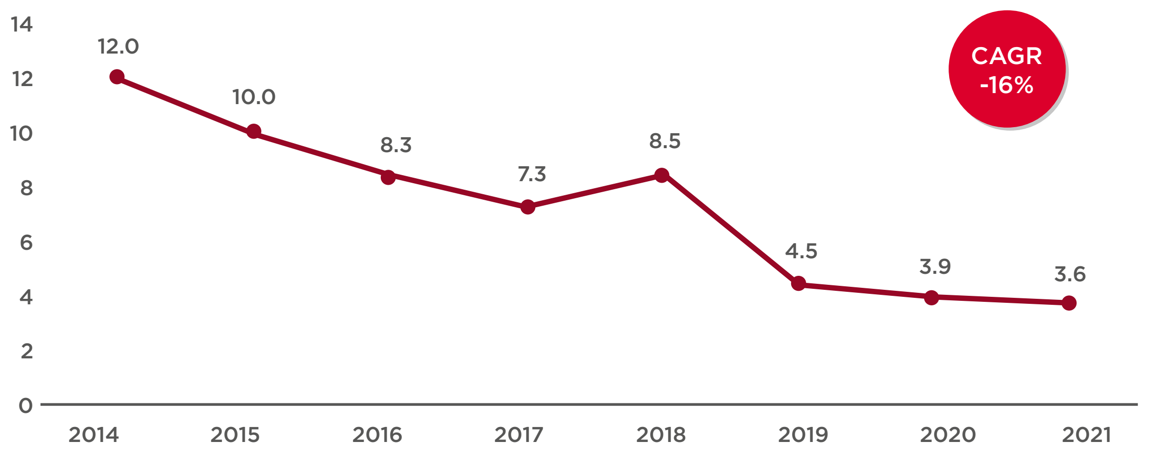
• Lack of affordability:
Despite strong reductions in mobile internet prices over the last few years (see Figure 6), several other aspects have converged to make affordability issues the top barrier to connectivity in most of the countries studied. In particular, economic inequalities are a significant barrier in most of the countries; the cost of internet connectivity is unaffordable for a significant proportion of the population with low incomes[9]. In addition, sector-specific taxes – particularly in Argentina and Ecuador – elevate final prices. Reforms introduced at the end of 2021[10] in Ecuador could lead to significant improvements so should be further developed. Brazil recently implemented tax reforms that could help increase demand and further bridge the usage gap.

• Online security:
Without online security there is no user trust, which can become a significant barrier to adoption. This is the case in Argentina and Ecuador[11], where the usage gap is partly explained by this factor.

• Supply barriers to infrastructure deployment:
In particular, spectrum availability and prices in Colombia and Ecuador and a lack of sufficient low-band spectrum in Costa Rica have been significant impediments to network deployment. It is no coincidence that these three countries are further behind in their deployment of 4G coverage than other countries studied.

FIGURE 6

Mobile internet prices (USD per GB, average of the five countries studied), 2014–2021[12]



Source: GSMA Intelligence

9. In the lowest quintile by income distribution, the impact of mobile broadband services on per-capita income was 8.5% for Argentina, 4.6% for Brazil, 7.5% for Colombia, 7.8% for Costa Rica and 11.5% for Ecuador. Source: GDP and income distribution data by quintile sourced from the World Bank. For plan prices, we considered the annual price of a standard 5 GB monthly data service.
10. Las 4 reformas fiscales que implementó Ecuador para favorecer la inclusión digital, GSMA
11. GSMA studies on the impact of spectrum prices in Latin America.
12. This shows the change in average prices per GB between 2014 and 2021 in all five countries studied. To calculate the average price, we considered the prices of 1 GB and 5 GB plans.

02.

Policies to bridge the connectivity gap: universal service funds

Regulatory objectives, USF usage and transparency. Disbursement and financing mechanisms.

02.

Policies to bridge the connectivity gap: universal service funds

Regulatory objectives, use of funds and transparency

Universal service funds (USFs) came about, in most cases, after markets were deregulated and opened up to competition. They were created in 2000 in Argentina (Universal Service Fiduciary Fund, FFSU), Brazil (Telecommunications Services Universal Fund, FUST) and Ecuador (Telecommunications Development Fund, FODETEL)[13]. The ICT Unified Fund in Colombia was a result of reform in 2019, when the ICT and TV funds were merged[14]. Costa Rica provides the most recent example, with the creation of FONATEL in 2008.

In all cases, USF contributors are exclusively telecoms operators. Contributions are between 1% and 3% of income, plus contributions from administrative fees (FISTEL, Brazil), fines and penalties (in Colombia), as well as contributions from spectrum use allowances and permits (in Brazil, Costa Rica and Colombia).

FIGURE 7

Contributions to universal service funds

ARGENTINA	**1% of net income from ICT licensees, with up to 30% potentially paying for projects – after approval and subject to conditions.**
BRAZIL	**1% of gross operating income from the provision of telecoms services.** • 50% of the Telecommunications Inspection Fund (FISTEL), with an upper limit of BRL700 million. • Revenue from telecoms service allowance, permit or authorisation transfer or radiofrequency use, payable by licensees. • Potential donations.
COLOMBIA	**1.9%[15] of gross income from all network and telecoms service providers.** • Economic compensation for radio spectrum use, of which 60% could be paid in financial obligations. • Fines and financial penalties imposed by the Ministry of ICTs, the CRC and ANE on network and communication service providers. • Potential allowance from national budget allocations[16]. • Fees, charges and tariffs from allowances, frequency use and compensation, paid by open broadcast TV service operators.

13. Argentina, Decree 746/2000; Brazil, Law 9998/2000; Colombia, Law 1978; Ecuador, Resolution CONATEL 394/2000; and Costa Rica, Law 8642/2008.
14. The Communications Fund was created in 1976 (Decree 129).
15. Res. 903, 2020.
16. Despite this regulation, no funds have been received for this item.

COSTA RICA	**Parafiscal tax between 1.5% and 3.0% of gross income of public network telecommunication operators and publicly available telecoms service providers.** • Resources from licensing • Fines payable to SUTEL. • Transfers and donations made by public and private institutions to FONATEL.
ECUADOR	**1% of the income of telecoms service providers.**

The objectives established in the original regulations were mostly aimed at closing the coverage gap, initially for telephony services and more recently for internet services. In some cases they focus on rural areas as the target population or supporting the broader work of Ministries (Colombia). In later reforms, some USFs included the concept of universal access[17] (Colombia, 2019 reform) and demand stimulation[18] (FUST, Brazil, 2021 reform).

In some regulations and legal frameworks that have created USFs and put them into operation, we can see elements that at first seem efficient or considered to be good practices. However, without mechanisms such as ex-post evaluations, accountability and public policy impact analysis, they are just unrealised intentions.

This is the case in Argentina, where the Argentina Digital Law[19] provides for a periodic programme review every two years *"in light of social needs and requirements, existing demand and technology evolution"* and allows the possibility to have *"up to 30% of disbursement in calculated investment"*[20]. These provisions could make it easier for contributing companies to strengthen their networks where needed, but in practice authorities have not traditionally promoted these approaches. Other factors that lead to inefficiencies in the management of the USF in Argentina include bureaucratic delays, which often impact the timely delivery of projects, and a challenging macroeconomic environment that makes the delivery of projects even more complex.

Until the implementation of Brazil's regulatory reform in 2021, FUST resources were used to close the primary deficit of the Union and to disburse USD250 million to subsidise diesel fuel during the fuel crisis of 2018, as specified by a presidential Provisional Measure[21]. Such use of the USF is far removed from meeting any of the goals related to universal internet connectivity.

In Colombia, Law 1,978 of 2019[22] describes the functions of the ICT Unified Fund. However, there is no established mechanism to fund projects with better expected returns in terms of connectivity[23].

Notably, in the objectives of FONATEL[24] in Costa Rica, and unlike in the other countries studied, *"FONATEL resources may not be used for purposes other than those established in the National Telecommunications Development Plan, in compliance with universal access objectives, universal service objectives and solidarity, as defined in Art. 32 of this Law, and they shall be allocated in full every year."* This is one of the key characteristics of the USF in Costa Rica; it has an

17. Colombia – its current objective is to *"finance plans, programs and projects to facilitate ICT universal access and universal service for all national inhabitants (...) ensure the strengthening of public television (...) as well as support activities carried out by the Information and Communications Technologies Ministry and the National Spectrum Agency, and the improvement of their administrative, technical and operational capacity to fulfill their functions."*
18. This rule was updated twice (in 2020 and 2021) under the premise of protecting the use of the funds "(...) *the objective is to promote the expansion, use and improvement of network and telecommunications services, reduce regional inequalities and drive the use and development of new connectivity technologies to boost economic and social development."*
19.Article 25, Argentina Digital Law N° 27,078, 2014
20. Article 7bis, Argentinian General Regulation on Universal Service, Enacom.
21. Provisional Measure No 839
22. Article 35.
23. This regulation (Art. 34, paragraph 2) provides for a consultative process to receive comments about the investment agenda, which must receive answers. However, it does not provide for an ex-ante analysis of the effectiveness of proposed projects in relation to the established goals.
24. Article 38 of this Law.

autonomous public policy agency that oversees and manages exclusive use of the funds for the purposes set by the National Development Plan.

In Ecuador, since the creation of the USF, there have been no allocation mechanisms enabling the use of the funds for the objectives set. Toward the end of 2021, reform[25] was passed to promote digital inclusion by enabling payments of 50% of contribution obligations to the USF for projects intended to improve connectivity in rural or marginalised urban areas, with prior authorisation from the relevant authorities and after eliminating a specific tax imposed on consumers (ICE). Despite the reform, traditional financial and fund disbursement models have not succeeded in meeting their original objectives. As of November 2022, the reforms adopted in Ecuador to close the usage gap are at risk of being repealed together with the Economic Development Law. This would only expand the already significant gap in Ecuador. At the same time, the Ministry for the sector issued the 2022–2023 Universal Service Plan, but there is still no regulation enabling the fulfillment of the objectives set by the National Development Plan.

With the exception of Costa Rica (where SUTEL – through FONATEL's website – describes the disbursement, allocated amount for each project and updated results), in the countries studied it is difficult to access detailed information about the level of disbursement and scope of all the implemented projects that use USF resources, since their creation. Accessing information is even more difficult when it comes to disbursed budgets or an assessment of additional people benefiting from connectivity, acquired digital skills or infrastructure deployed/improved.

Almost none of the countries studied has a publicly available historical registry to learn about the impact of the programmes implemented over the last 20 years and a comparison with the objectives set.

In most cases, there are recent reforms, but these are yet to result in a measurable impact. However, every review highlights the fact that current instruments and their execution and control mechanisms are not useful in closing the connectivity gap.

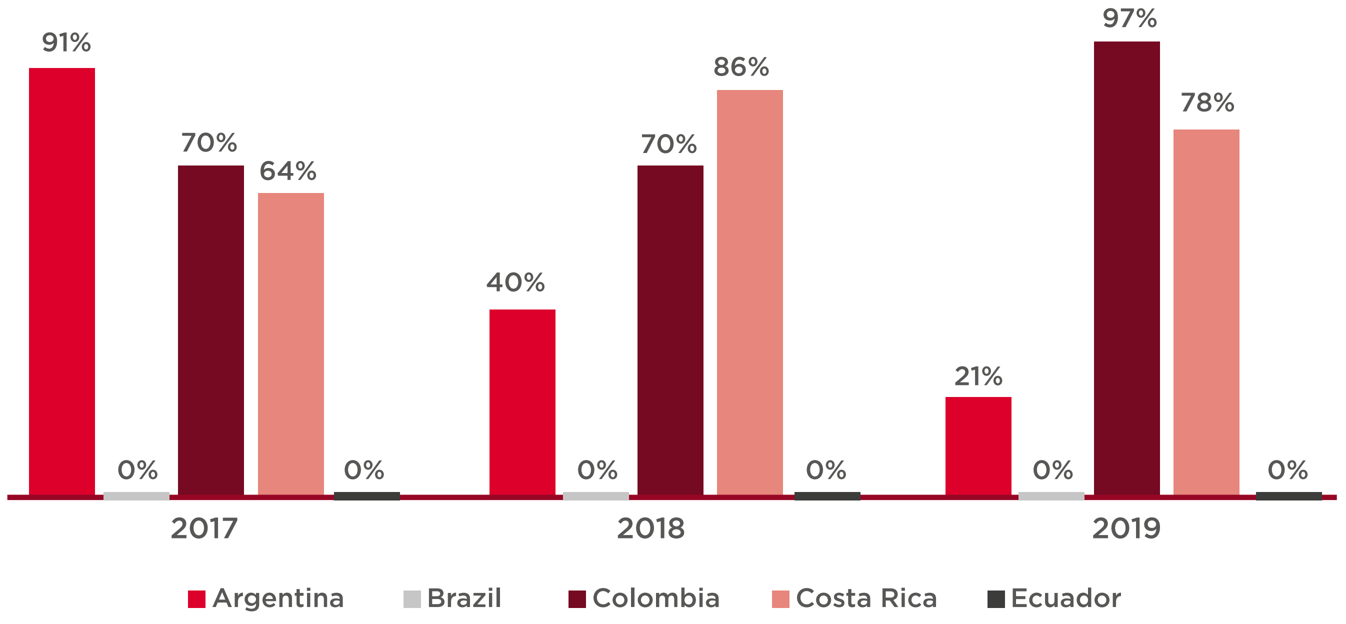
25. For more information on the tax reform in Ecuador, see "Las 4 reformas fiscales que implementó Ecuador para favorecer la inclusión digital", GSMA, March 2022

Fund disbursement

The insufficient disbursement of USFs is clear – not only in the countries studied in this analysis but across the region. A study conducted by A4AI[26] shows how the disbursement rates of funds are not at acceptable levels.

FIGURE 8

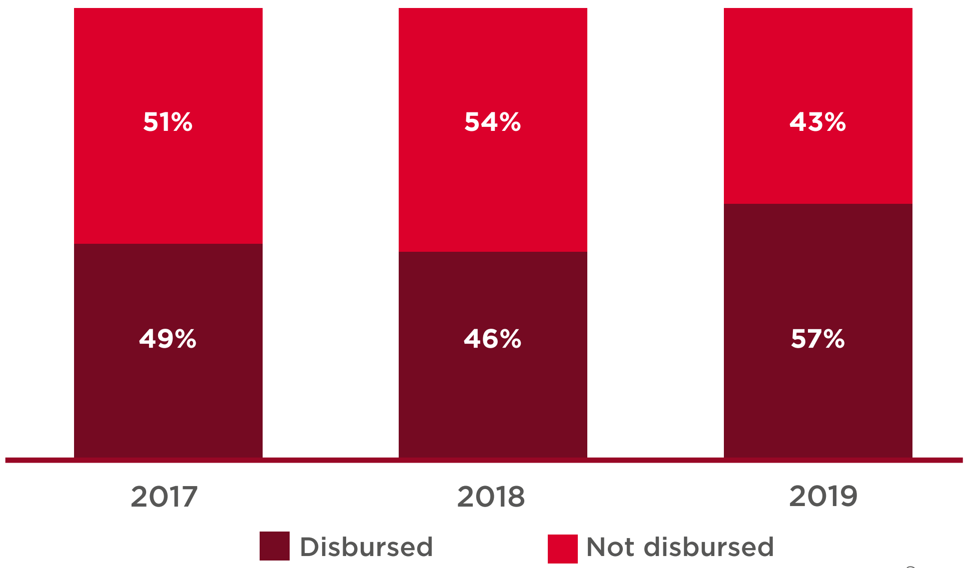
Level of USF disbursement by country, 2017–2019



Source: GSMA Intelligence, A4AI

FIGURE 9

Aggregate level of USF disbursement for the five countries studied, 2017–2019



Source: GSMA Intelligence, A4AI

26. Universal Service and Access Funds in Latin America & the Caribbean, A4AI, 2021

Apart from a lack of disbursement, the efficiency and effectiveness in the use of funds measured against the objective to close the connectivity gap remains open to question. How many new people have had access to the benefits provided by connectivity thanks to the programmes implemented? What is the return on investment in terms of people connected per sum invested? Are there more efficient ways to help close the gaps?

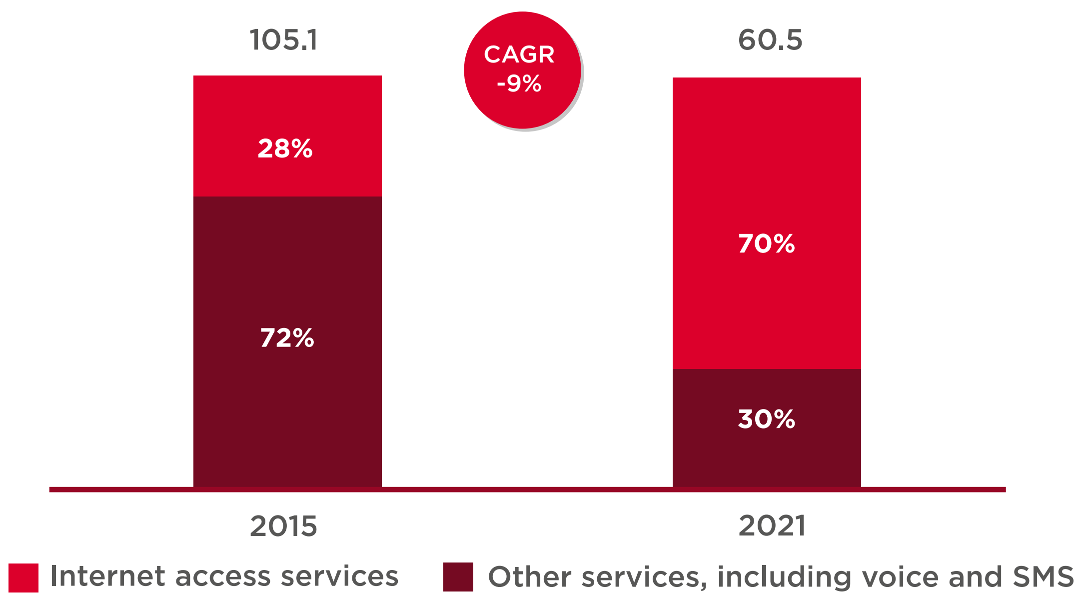
Funding model

When the focus of universal service programmes was telephony services, funds were financed exclusively through contributions from telecoms operators. This caused distortions in investment, with potential undesired impacts on service universality objectives, but at least some kind of balance was struck between connectivity beneficiaries (telecoms operators) and fund contributors (also telecoms operators).

Now, however, the balanced structure of fund beneficiaries and contributors has completely broken down. Connectivity objectives established for the funds have changed and currently focus on broadband internet – a service with a much larger ecosystem. In addition, the balance of revenues between players in the internet ecosystem has changed dramatically in the region. Operators' share of internet access services revenues has decreased significantly despite being focused mainly on the monetisation of internet connectivity services (Figure 10).

FIGURE 10

Mobile operator revenues in Latin America (USD billion, constant 2021 prices)

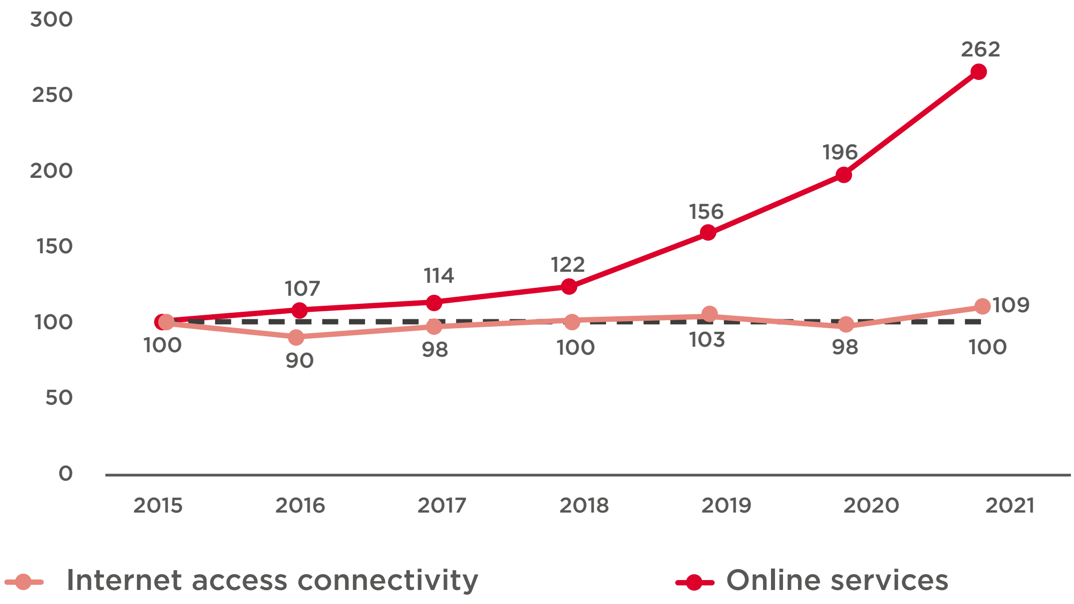


Source: GSMA Intelligence analysis

These changes in the ecosystem are clearly seen in the capacity of different players to capture benefit (revenues) from connectivity. As shown in Figure 11, while operators' revenues in the region stagnated, digital service providers' such as Meta, Netflix and YouTube saw their revenues grow rapidly. Since 2015, while revenues related to internet connectivity provision have been stable, digital service providers' revenues in the region have increased more than 250%.

FIGURE 11

Change in revenue: internet access connectivity versus online services (index base 2015 = 100)



Source: GSMA Intelligence analysis

A lack of transparency from most digital service providers hinders the possibility of accurately estimating revenues from this segment in the region. At the global level, it is estimated that digital service revenues were three times higher than revenues from the provision of internet connectivity[27]. A similar ratio in the region would mean 2021 revenues among digital service providers in the region would be around USD600 billion, compared to USD150 billion for internet access providers (including fixed and mobile).

Regardless of the exact figure, it is clear that at present the main beneficiaries in terms of additional revenues from connectivity are not telecoms operators.

The current USF funding model is an anachronism and requires urgent reform. Currently, basic best-practice principles for the funding of a connectivity programme are not being adhered to. Failure to reform the model leads to several consequences:

1 Given the evolution of revenues in the market, the current funding model is neither sustainable nor fair.

Connectivity programmes should be consistent with the principles of efficiency, justice and fairness. Those who benefit from investments should contribute to paying for such investments[28]. The funding model is also inconsistent with the principle of the ability to pay. Contributions should be made according to the ability to pay or potential revenues.

2 The current model creates investment distortions, leading to undesired consequences.

The concept of tax neutrality outlines how an objective of tax collection should be to minimise distortions related to investment and market players' decisions. With the funding of the USFs falling exclusively on connectivity providers, distortions are substantial, leading to negative impacts on the incentive to reduce the coverage gap. Currently, a percentage of the additional revenues an operator can obtain from internet access among new users must be contributed to the USFs, reducing the amount of new users that can be profitably provided with connectivity from a market viewpoint.

27. The Internet Value Chain 2022, Kearney/GSMA, 2022
28. This is the beneficiary principle, also known as the quid pro quo principle.

3 The current funding model has regressive effects.

The notion that internet access is essential implies that it should be affordable. For example, the UN Broadband Commission has established a target that internet tariffs should not exceed 2% of monthly income per capita. However, when USF funding relies solely on connectivity providers, some of the additional cost impacts the final cost of connectivity access. This is regressive in effect, given that it has a particular impact on low- and middle-income citizens, who need to spend a larger percentage of their income to obtain the service.

03.

Alternative mechanisms to bridge the connectivity gap

Telecommunication Development Fund in Chile. Internet for all Peru. Reform of the universal service concept in the US.

03.

Alternative mechanisms to bridge the connectivity gap

USFs in all five countries studied are financed exclusively from contributions by telecoms operators. Evidently, this funding model is unsustainable and requires urgent reform. Below are two examples of alternatives of connectivity projects with very different funding models. We have also analysed the current process in the US; the country is the first to acknowledge that the current USF funding model is no longer sustainable to meet the challenges of closing the connectivity gap.

There is no one-size-fits-all solution; the situation for each country is unique. However, it is important to outline alternatives that have been successfully implemented to close the coverage gap, with a view to promoting the adoption of mobile internet services and boosting demand.

The Telecommunications Development Fund in Chile

The Telecommunications Development Fund (FDT) is a governmental financial instrument in Chile, with a goal to *"promote the expansion of telecommunications service coverage in rural and low-income urban areas where there is low or no service availability due to economic infeasibility of the national telecommunications industry."*[29]

The FDT was created in 1994[30] and is part of the National Budget Law legal framework. It is managed by the Telecommunications Development Council[31]. The Council allocates resources through public tenders to companies and institutions that meet the conditions defined and designed by the Council.

Priorities are based on feedback received by the Office of Information, Complaints and Suggestions (OIRS). A project portfolio is created and then evaluated by the FDT Management Division of the Telecommunications Undersecretariat (Subtel). After analysing the information, proposals are outlined and sent to the Telecommunications Development Council (CDT). Upon approval, they become projects eligible for subsidy and are put out to tender.

Projects[32] currently being focused on include bringing coverage to remote areas (e.g. mobile service in routes along Tierra del Fuego), promoting digital skills through mobile internet access (e.g. "*Conectividad para la educación*" – internet at no cost for users who attend educational institutions), granting equipment subsidies (e.g. digital TV broadcast systems), and deploying fibre (e.g. the provision of intermediate service for infrastructure at borders).

As of September 2022, four projects were ongoing to expand fibre to remote areas, four were to expand mobile coverage, and at least two projects were to promote the development of digital skills through internet use and equipment subsidy.

29. For more information, see https://www.subtel.gob.cl/quienes-somos/divisiones-2/fondo-de-desarrollo-de-las-telecomunicaciones/proyectos-fdt/
30. Laws N° 18,168 and 20,522.
31. The Telecommunications Development Council comprises the Minister of Transport and Telecommunications, who serves as Chair; Deputy Minister of Telecommunications, who serves as Executive Secretary; Minister of Economy or their designee; Minister of Finance or their designee; Minister of Planning or their designee and counsellors from the north, south and central areas of the country.
32. For more information on FDT projects, see here

FIGURE 12

Who benefits from the programmes?[33]

FIBRE EXTENSION

1. FIBRA ÓPTICA AUSTRAL PROJECT. INTERMEDIATE INFRASTRUCTURE SERVICE (2017–2039/41)
2. NATIONAL FIBRE (2020–2043)
3. FIBRE AT BORDERS (2021, 20-YEAR PROJECT)
4. FIBRE IN TARAPACÁ (2021, 20-YEAR PROJECT)

MOBILE COVERAGE EXTENSION

1. MOBILE PHONE SERVICE ON ROUTES ALONG TIERRA DEL FUEGO, 2011–2023
2. TODO CHILE COMUNICADO IDCI, 2009–2023
3. TELECOMMUNICATIONS SERVICES IN WI-FI AREAS
4. TELECOMMUNICATIONS SERVICES IN WI-FI AREAS 2.0

BOOSTING DEMAND

1. CONECTIVIDAD PARA LA EDUCACIÓN. EDUCATIONAL INSTITUTIONS. 2011–2022
2. CONECTIVIDAD PARA LA EDUCACIÓN 2030. EDUCATIONAL INSTITUTIONS. 2021–2029
3. DIGITAL TV BROADCAST SYSTEMS (EQUIPMENT SUBSIDY) 2024–2026

Source: Cerrando la brecha de conectividad digital. Políticas públicas para el servicio universal en América Latina y el Caribe, IDB, 2021

Chile's FDT overview

- The objective is to understand the nature of the market, and for the state to help bring the benefits of connectivity to areas where it is economically unfeasible for companies to do so.

- Society is the main beneficiary of connectivity, so the state contributes to funding by using parts of the national budget.

- A portal of information is available so citizens have access to information about how funds are being used.

- Closing the connectivity gap is a state policy. Ongoing projects have defined terms of 10–20 years, reflecting the importance of long-term state policy that goes beyond political context and short-termism.

- Complex bureaucratic processes are still barriers to the swift execution of projects to bridge the gap. Digitisation policy/decision-making should also consider mechanisms to make project approval and execution processes more efficient.

33. For more information on these programmes and their rollout, please visit the Subtel portal.

Internet para Todos in Peru

The 'Internet para Todos' (IPT) or 'Internet for All' project was implemented in 2019 as a private initiative by Telefónica and Facebook (now Meta) with the purpose of finding a solution for connectivity in areas of Peru where telecoms service coverage was not available due to market frontiers or geographic challenges hindering expansion and growth. With the support of the Inter-American Development Bank (IDB Invest) and the CAF Development Bank, an initiative to connect the unconnected was developed. This was a private initiative with a view to becoming a financially sustainable approach over the medium term.

One of the enablers of IPT is the regulatory function of the rural mobile infrastructure operator (OIMR)[34] which, despite not having many regulatory reliefs or exemptions, facilitates use by the OIMR of operator spectrum. In this way, IPT can develop passive infrastructure and transport, and deploy an access network that provides service to mobile operators who have the relationship with end users in remote areas with no coverage.

All components of IPT play a clear role[35]. Telefónica contributed 2G and 3G infrastructure in rural areas (3,150 base stations) to drive rural 4G network development. Facebook contributed financial and technical resources as well as its expertise in the use of new technology (open RAN, AI, etc.). IDB Invest and CAF contributed financial resources and deep knowledge of strategies for development and digital inclusion.

Using a model of voluntary agreements, mobile operators can assign the use of the spectrum allocated to the IPT so that it develops networks in rural areas and shapes a wholesale business model that is economically feasible. The role of the regulator (Osiptel and the Ministry of Transport and Communications) is to guarantee fair conditions between the mobile companies to which IPT provides its services.

By the end of 2021, the IPT had been able to extend coverage using 4G networks in areas with a total population of more than 2.1 million people. Mobile internet access is, in many cases, the only way these communities can gain online access.

Despite this impact in remote and isolated areas, IPT has a significant challenge ahead in the development of a financially sustainable business model that allows for 100% coverage of the Peruvian population.

The project shows how implementing regulatory mechanisms and enabling policy as well as facilitating the development of innovative business models can expand current market frontiers. However, it also shows how reaching 100% of the population calls for financial resources that cannot come exclusively from private initiatives.

Peru's IPT overview

- The IPT generates incentives to develop innovative business models to close the supply gap beyond the market frontier.

- Regulation enables innovation through the OIMR and the formulation of more flexible spectrum management policy, allowing spectrum leasing under voluntary agreements.

- More flexible regulation (or even the temporary elimination of all regulation under models such as regulatory sandboxes) helps promote innovation to expand market frontiers.

- The promotion of cooperation between players is an innovative lever, with entities with complementary objectives coming together to find an alternative to achieve goals.

- Developing a financially sustainable business model that enables provision of services to 100% of the population continues to be a challenge, even when market frontiers are expanded by regulatory and public policy reform.

34. In 2013, Law 30,083 created the rural mobile infrastructure operator (OIMR) with the purpose of facilitating alternatives for areas where the telecoms market was unable to expand.
35. For more information, see Internet Para Todos.

Reform of the universal service concept in the US

Universal service was created together with the regulator in 1934 to bring telephony services to the masses in the US. Funds are contributed by telecoms service companies and managed by the Federal Communications Commission (FCC) with the governance of the Universal Service Administrative Company (USAC). Financing is covered by fixed and wireless phone service companies and interconnected voice-over-IP (VoIP) providers, including cable companies that provide voice services.

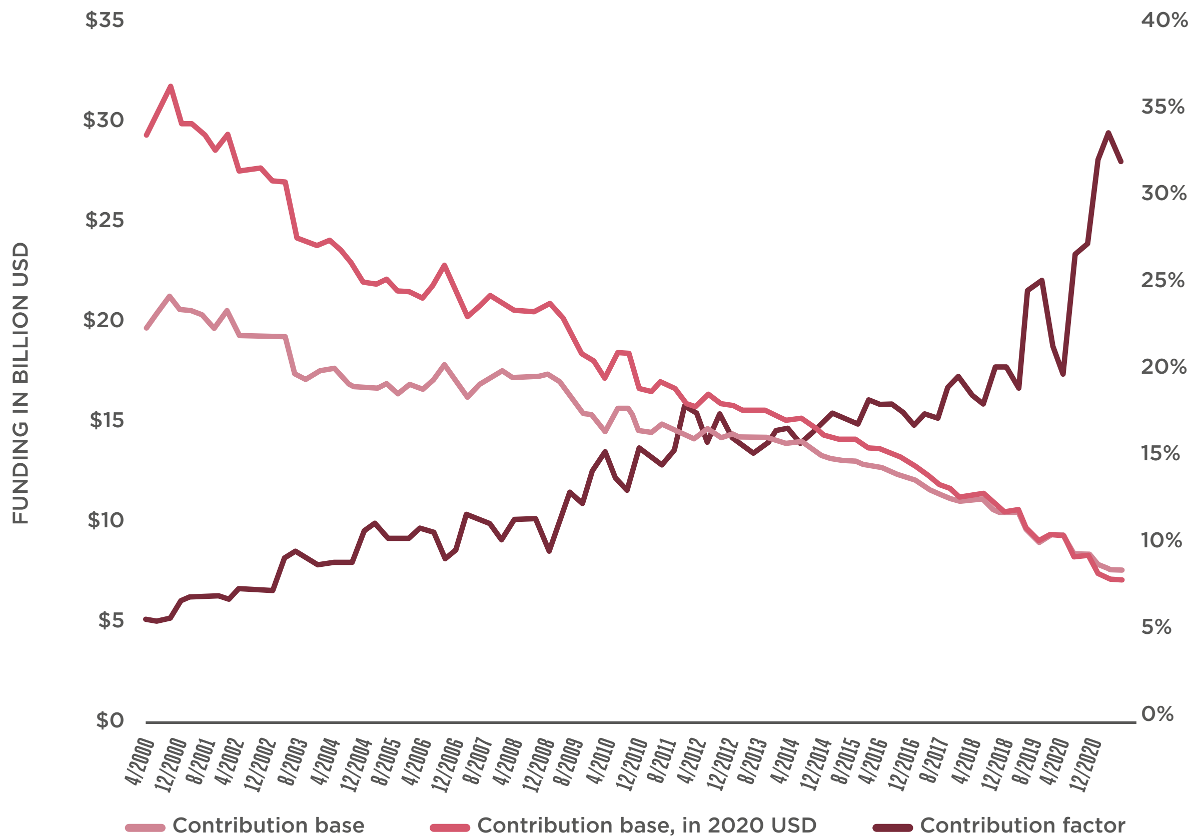
Currently, the FCC – through the USAC – has implemented four programmes. Lifeline[36] is specifically aimed at boosting demand, and consists of disbursement of partial subsidies for the cost of connectivity for low-income citizens. The remaining three programmes focus on financing infrastructure in unprofitable areas: E-rate[37], Rural Health Care[38] and High Cost, known as Connect Americas Fund, in which the FCC identifies uncovered or underserved rural communities where the market by itself is unable to afford network infrastructure deployment to provide connectivity, making them eligible for support.

Revisions and alternatives proposed by the US

There is a consensus on the need for change. The current model is unsustainable, mainly as the revenues of the companies contributing are decreasing steadily, which means their contributions to the fund represent an increasingly higher percentage of their revenues. It is only a matter of time before these contributions are unsustainable for both the fund and the contributors.

FIGURE 13

Quarterly USF contribution base and contribution factor, 2001–2021



Source: FCC contribution factor and quarterly filings[39]

36. For more information, see Lifeline
37. For more information, see E-Rate
38. For more information, see Rural Health Care
39. Subsidizing Universal Broadband Through a Digital Advertising Services Fee: An Alignment of Incentives, Hal J. Singer and Ted Tatos, 2021

At the end of 2021, US President Joe Biden signed the Infrastructure Act[40], directing the FCC to submit to Congress a report to improve its effectiveness in achieving the universal service goals. The FCC *"may make recommendations for Congress on further actions the Commission and Congress could take to improve the ability of the Commission to achieve the universal service goals for broadband."* After other intermediate steps, the FCC started a consultative process to receive comments for the future of the Universal Service Fund[41].

As of October 2022, two main proposals had been brought to the table: reform of the fund contributor base, and reform of fund distribution. Expanding the fund contributor base by adding the main data traffic generators is one proposal in the US. The internet value chain continues to grow strongly, but benefits and returns are captured mainly by players in the online service segment. A global study by the GSMA demonstrates there has been exponential growth of network traffic – mostly caused by high demand for digital services provided over mobile networks. The aggravating factor in Latin America, in particular, is that internet access is primarily mobile. Traditional telecoms companies are exposed to pressure to respond to the exponential growth of network traffic, which is made worse by the significant contributions they make through taxes and fees (sector-specific and general) and disbursements such as USF contributions.

Analysing how the funds are disbursed and where the bottlenecks are in the US can help inform USF reforms in Latin America. These reforms can include a more transparent management of the fund resources, better impact evaluation, and the consideration of alternative funding options.

40. Regulatory reference: Sec. 60104. Report on future of Universal Service Fund, H.R.3684 – Infrastructure Investment and Jobs Act, Public Law N°: 117-58.
41. Many contributions to this debate are available. See "Before the FCC, In the Matter of Report on the Future of the Universal Service Fund, reply comments of Roslyn Layton, PhD."

04.

How to effectively bridge the connectivity gap beyond the market frontier

Expected connectivity by 2030 under current market conditions. Expected connectivity after improvements in market conditions. Additional funding needs.

04.

How to effectively bridge the connectivity gap beyond the market frontier

What does it take to close the connectivity gap in Latin America? Despite the lack of individual assessments on the impact of USFs since their creation, all the indications are that they have not had the desired effects. An econometric analysis by the United Nations shows that, at the global level, the average effect of the USFs on internet connectivity is null or even counterproductive (that is, USFs reduce connectivity). These empirical results are aligned with the analysis for Latin America in Chapter 2, which highlights the deterrents that the USFs create in terms of investment in coverage, as well as the regressive effect on demand from low-income groups.

It is fundamental to understand what can be done to achieve real progress in the connectivity agenda for the region and meet the objectives set for 2030. First, it is important to determine where the market frontier is under current conditions. If there are no significant changes to market conditions, can we expect network coverage to expand? Can we expect mobile internet demand to continue growing? To answer this, we analysed the results of a detailed supply-demand economic model developed for the five countries studied.

The model calculates the cost effectiveness of investments in mobile internet coverage[42], taking into account the expected cost of network deployment in uncovered areas as well as demand conditions. Additionally, the economic model allows us to determine the levels of mobile internet adoption in each of the five countries. The Methodology details the workings of the model and the main technical assumptions.

Based on these calculations, we estimated the market frontier for each country. For example, in the case of Colombia, results show that, under current market conditions, it is profitable to expand 4G network coverage to 91% of the population. Similarly, 4G mobile internet adoption can reach around 62% of the population by 2030 under current conditions (or approximately 71% of the population aged 10 and above). These percentages are far from meeting the connectivity goal set by the ITU of 100% of the adult population by 2030. If there are no reforms or additional funding from other ecosystem players, we cannot expect current market dynamics to achieve significantly better network coverage or adoption.

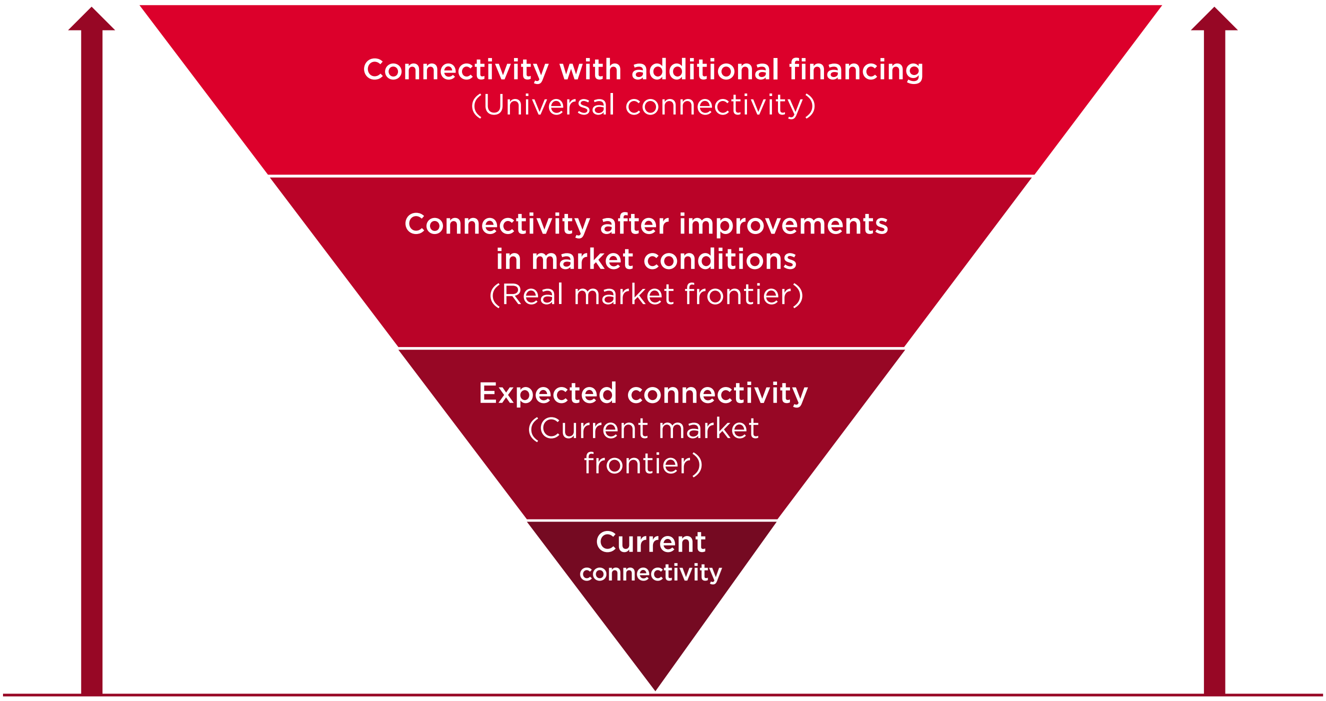
The analysis then takes into consideration potential expansion of mobile internet connectivity in the future under market conditions that boost demand beyond current frontiers. In this case, the economic model considers mobile internet connectivity expansion through 4G networks, as these ensure access to a broadband service capable of meeting consumers' needs, with demand growing considerably following the Covid-19 pandemic and continuing to do so in the short term. Options under consideration include reforming USF financing[43], eliminating special taxes imposed on users and internet providers, and providing low-income populations with VAT exemptions for mobile internet services.

42. For the purposes of this economic model, we defined mobile internet as access to 4G services. In the medium term, the minimum quality level expected by users and regulators in relation to internet access should be generated through 4G networks. For example, A4AI states that even today a 4G connection is the minimum necessary standard to enjoy an acceptable internet experience.
43. A measure to boost demand could include eliminating USF payments by mobile internet providers.

To drive supply and demand beyond these levels, options include reducing the cost of technology for the sector – for example, co-financing investment in remote areas; or boosting demand through digital training and subsidy programmes to cover the cost of devices and internet access for low-income segments.

FIGURE 14

Steps to universal connectivity



Source: GSMA Intelligence

Expected connectivity by 2030 under current market conditions

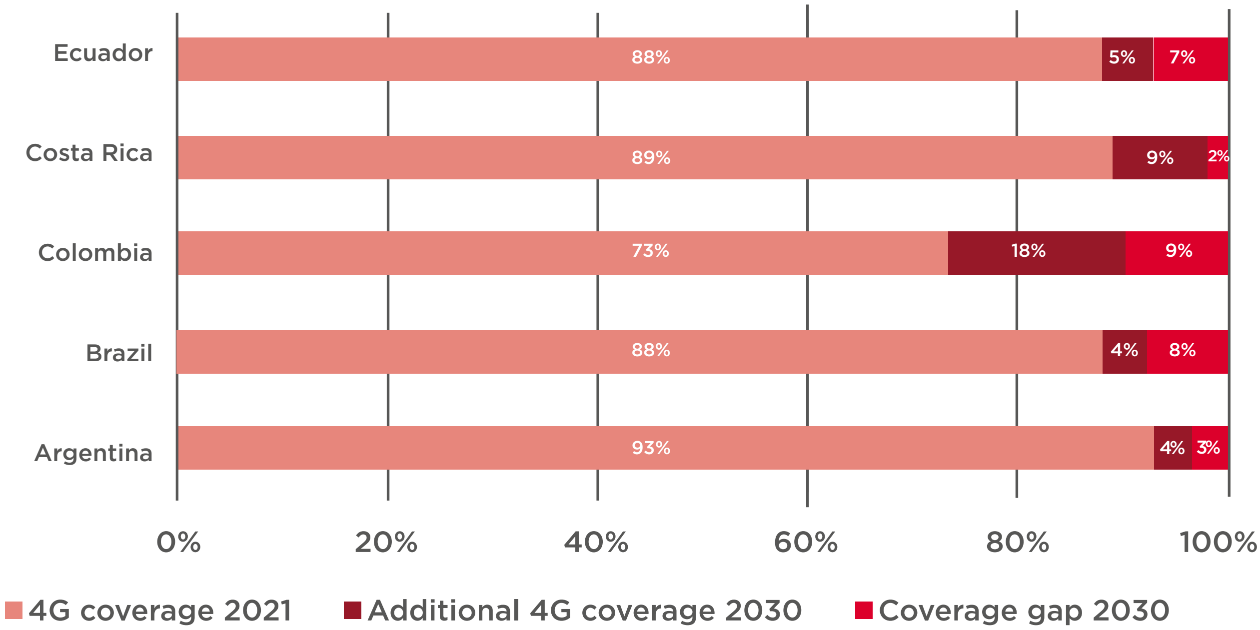
The results of this economic model show that in three of the five countries studied (Argentina, Brazil and Ecuador), 4G population coverage is currently close to the market frontier. In Costa Rica and Colombia, there is still significant room for 4G coverage to extend over the next few years, before reaching the frontier (Figure 15).

In all cases, current market conditions will not enable countries to reach universal 4G population coverage by 2030. Brazil and Colombia are those furthest from achieving such a goal. Without reforms or additional financing, we cannot expect 4G networks to expand in either of these countries beyond 92% and 91% population coverage, respectively.

FIGURE 15

Expected 4G coverage gap, 2030

Percentage of population



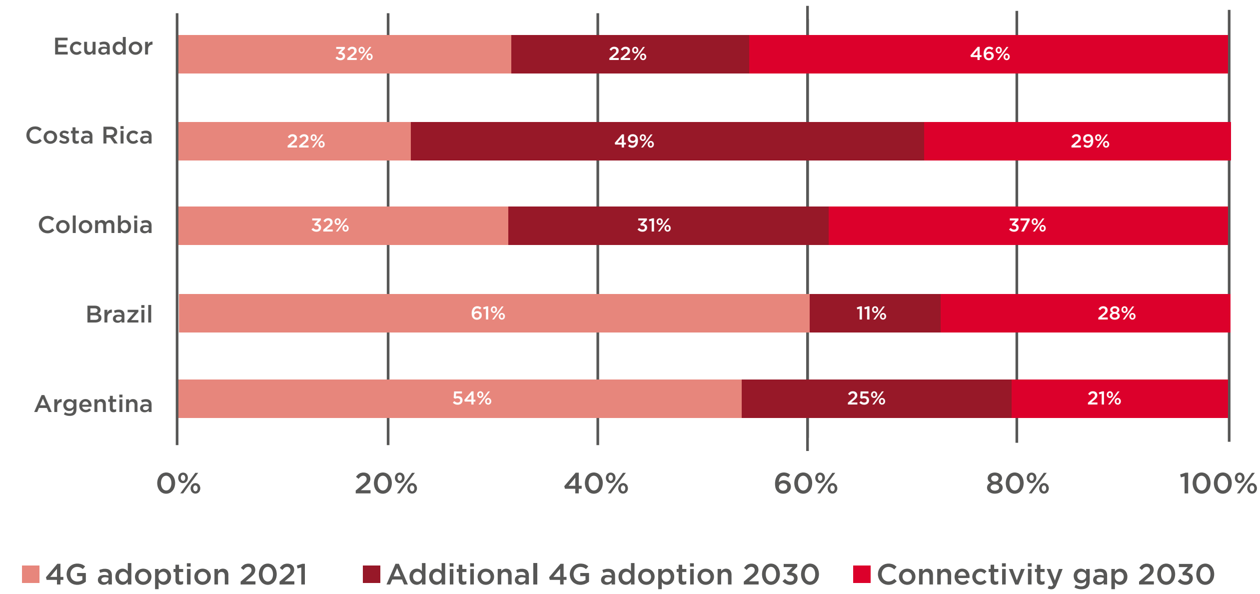
Source: GSMA Intelligence

Under current market conditions, none of the countries will be able to achieve the ITU's objective of connecting all the adult population to the internet by 2030. However, there are significant differences between countries. Argentina will have a 4G connectivity gap of less than 25%. Meanwhile, the connectivity gap in Colombia, Costa Rica and Brazil will be around or above 30%, partly due to their 4G coverage gaps but mainly because of their considerable 4G usage gaps. Lastly, Ecuador will have a connectivity gap of approximately 50% of the population in 2030. This gap is mainly due to demand factors (the usage gap).

FIGURE 16

Expected 4G connectivity gap, 2030

Percentage of population



Source: GSMA Intelligence

Expected connectivity after improvements in market conditions

Before considering additional mechanisms to bridge the gap, market frontiers could be expanded by promoting stronger demand.

Firstly, we considered the effects of alternative USF funding schemes, so that the burden does not exclusively fall on the revenues generated by mobile internet infrastructure providers. This model is currently under public consultation in the US. Alternative financing would mean an improvement in affordability for low-income population segments, which in turn would translate into greater adoption[44]. An alternative financing scheme could also improve the return on investment from expanding coverage. However, the model shows the effects would be small. There are also cases such as in Chile (see Chapter 3), where the state assumes its central role and leadership by using public funds to finance 100% of the projects aimed at closing the gap.

Secondly, we considered the effects of other reforms on service affordability and internet adoption, such as eliminating sector-specific taxation and exempting low-income people from VAT on devices and internet plans.

As shown in this detailed analysis for Latin America, eliminating sector-specific taxes would have a major effect on connectivity. At the same time, a neutral effect is expected on public funds in the medium term (see, for example, EY's analysis for Brazil). By receiving their financing through taxes on mobile operators' revenues, USFs also work as a special tax imposed on internet infrastructure providers that discourages investment.

Latin American users and providers are subject to a heavy tax burden, mainly due to special taxes on internet services and internet-enabled devices. Such taxes on both users and providers have an impact on the affordability of mobile internet services. The potential to expand demand in each of the countries studied depends on the possibility of balancing tax burdens so that consumers and internet providers can support a burden similar or equivalent to that of other services.

The five countries typically impose sector-specific taxes, which affects affordability. Sector-specific taxes in the countries studied include charges for end users. For example, in Argentina, there are additional charges of 20% when buying imported devices and an additional tax on mobile devices as they are considered luxury goods. Colombia imposes a special tax on the use of phone, data, internet and mobile browsing services, charging 4% plus VAT, which is then used to fund recreational and sports programmes.

Taxes also include sector-specific fees or charges that must be paid by connectivity providers, in countries such as Argentina (miscellaneous fees that add up to almost 6% of operators' revenues) and Brazil (FUST, FISTEL, Funntel, Condecine-Teles, CFRP and public price charges related to the right to use radiofrequencies).

In 2021, the Ecuadorian government, through the Ministry of Telecommunications and the Information Society, adopted four tax reforms[45] to promote investment and innovation. These included eliminating Special Consumption Taxes (10% on consumer plans and 15% on corporate plans) on mobile plans; eliminating market concentration payments[46]; offering the possibility of paying up to 50% of fees through connectivity projects; and offering the possibility of paying up to 50% of the universal service contribution through connectivity projects. Such reforms are decisions that help meet the objective of connecting the unconnected and should be sustained over time.

44. If the USF is not financed by charging operators, those savings would have an impact on users by lowering service prices, thus improving affordability.
45. For more information, see Las 4 reformas fiscales que implementó Ecuador para favorecer la inclusión digital, GSMA
46. This sector-specific payment was applied to operators' revenues with a market share of 30% or more. As fees increased proportionally to their market share, this tax discouraged the growth of companies. By lifting tax burdens, eliminating this payment increased operators' capacity to invest and improve mobile services and infrastructure.

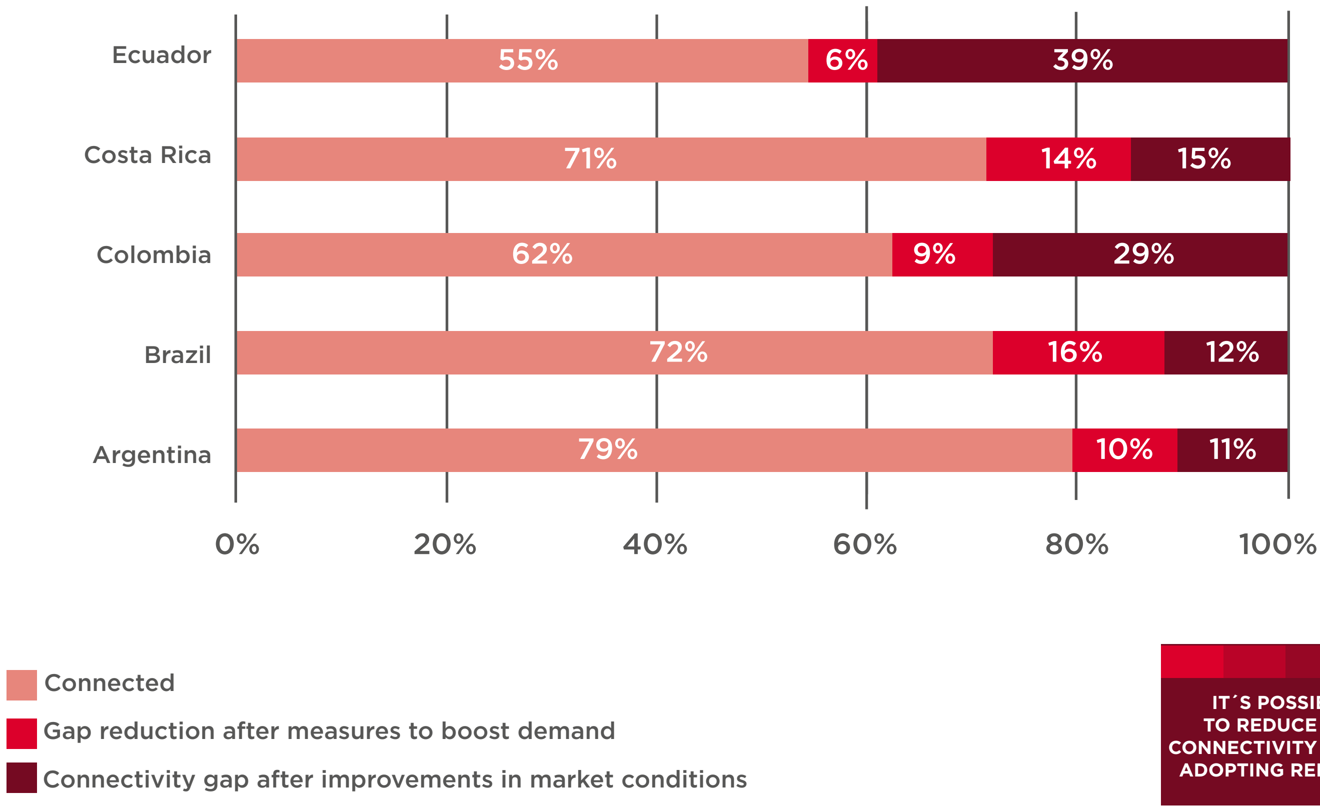
We also considered additional reform that eliminates VAT on internet plans and devices for low-income segments. In 2020, the Colombian administration decided to eliminate VAT on low-end smartphones (22 Tax Value Units – approximately USD8)[47] to lift the affordability barrier caused partly by heavy taxation.

The results of the analysis (see Figure 17) show that these measures collectively could boost demand significantly and have a considerable impact on closing the connectivity gap in all the countries studied. Total effects vary; the reduction of the connectivity gap can be between 6 and 16 percentage points.

FIGURE 17

Reduction of the connectivity gap by 2030, after reforms

Percentage of population



IT´S POSSIBLE TO REDUCE THE CONNECTIVITY GAP BY ADOPTING REFORMS

Source: GSMA Intelligence

Following reform, the connectivity gap remaining in countries such as Argentina and Brazil would be significantly reduced. However, in Ecuador, despite the important effects of reform (with connectivity growth of 6% of the population), the size of the connectivity gap would still be considerable.

To achieve better coverage and connectivity, additional funding mechanisms need to be considered to go beyond the market frontiers.

47. Number 6, Article 424, Colombian Tax Statute.

Additional funding needs

Once the main existing distortions of investment and consumption decisions are eliminated, we reach the limit of coverage and adoption that the market is capable of achieving under current technological and demand conditions.

To drive supply and demand beyond those levels, options include reducing the cost of technology for the sector (for example, by co-financing investment in remote areas) or boosting demand through digital training and subsidy programmes to cover the total or partial cost of devices and internet access for low-income segments.

There needs to be additional funding to close the coverage gap. For 4G networks to reach 99% of the population, approximately USD1,200 of additional financing would be needed per covered person in Argentina, Brazil and Colombia. In Costa Rica and Ecuador, the additional financing needed to reach 99% coverage is even higher, ranging from USD2,000 to USD3,500 per person covered[48].

Providing the last 1% of the population with coverage would require even more funding – more than USD4,000 per person covered in Brazil, around USD15,000 in Argentina and Colombia, and approximately USD20,000 in Costa Rica and Ecuador. Even taking into account the socioeconomic benefits this could bring to the unconnected population, such high costs raise serious doubts about the feasibility and rationale of investing in the most remote populations in each country. In this case and given the high costs, alternative technology solutions will be required, such as satellite.

Aside from driving universal coverage, connectivity objectives also include reaching higher internet adoption levels, reducing the usage gap. To reach 90% of the population with 4G mobile internet coverage and almost close the usage gap, the countries analysed will need to fund between USD50 and USD360 per additional person connected. The differences in funding needs between countries are primarily explained by differences in income levels of the unconnected target populations in each country.

48. Estimated financing includes investments in deployment (capex) and operational (opex) costs to ensure proper service operation after deployment. See the Methodology for a detailed explanation.

05.

Final recommendations: roadmap of public policies and regulatory reforms for universal connectivity

Roadmap: four steps towards universal connectivity.

05.

Final recommendations: roadmap of public policies and regulatory reforms for universal connectivity

The telecoms market has evolved towards ubiquitous network deployments and flexible commercial supply. We are no longer talking about calls or messaging services, but connected things, augmented reality, digitised production processes, e-government, smart cities and hundreds of other use cases related to digitisation.

The emergence of new technologies such as 5G confirm a paradigm shift in the digital ecosystem. This is why it is time to redefine the USFs to close the digital divide.

The balanced structure of fund beneficiaries and contributors has now completely broken down. Connectivity objectives for the funds originally focused on telephony services but now focus on broadband internet – a service with a much larger ecosystem.

Connectivity funds are still being financed by contributions exclusively from telecoms operators. In addition, the balance of revenues between providers of connectivity and online service providers has changed dramatically in the region; telecoms operators' revenues have remained largely flat while online service players have seen their revenues increase significantly. Moreover, the inefficacy in the operation and use of USFs is clear. Disbursement rates over the last few years have been inadequate, with partially funded projects and inactive funds the norm in several countries.

Achieving universal connectivity will require not only tax reform to help promote affordability for citizens, but also alternative funding mechanisms to help expand market frontiers.

USFs – the traditional policy instruments in the region – are obsolete and do not contribute to achieving universal connectivity goals. Urgent USF reform is needed.

If there are no significant changes, universal connectivity goals will not be achieved by the end of this decade.

Closing the connectivity gap is possible. It will require measures to allow for the expansion of supply and, most importantly, demand.

Roadmap: four steps towards universal connectivity

Plans to achieve universal internet connectivity will vary from country to country, but they should all do the following:

1 Boost demand by eliminating taxes on connectivity.

Redefine sector-specific taxation and consider the elimination of VAT and other taxes on devices and plans for low-income segments.

2 Consider alternative solutions to expanding connectivity.

Reach beyond what is currently possible in terms of coverage by adopting new business models such as "Internet para Todos" in Peru, by using resources financed by the state such as with the Telecommunications Development Fund in Chile, and by adopting other innovative solutions.

3 Expand the USF contribution base.

This must include players from the wider internet digital ecosystem, as well as an allocated budget directly from the public sector.

4 Maximise the effectiveness of USF investment.

Improve disbursement rates and select projects based on systematic investment evaluations – for example, people connected per amount of money invested. Measuring the efficiency of programmes is vital in order to adopt additional decision-making tools

ECONOMIC MODEL: METHODOLOGY

ECONOMIC MODEL: METHODOLOGY

Introduction

This model estimates the cost of reducing the coverage and usage gaps in five countries (Argentina, Brazil, Colombia, Costa Rica and Ecuador) by 2030, in line with connectivity goals set externally to the model, which are discussed further below.

The cost of reducing these gaps is analysed in four different scenarios of alternative public policies affecting the industry:

1. Baseline
2. Eliminating USF operator fees
3. Scenario 2, plus elimination of sector-specific taxes
4. Scenario 3, plus elimination of VAT.

Each of these scenarios has an impact on plan and device prices.

The model regulates cost pass-through of these impacts (reductions), from a complete appropriation by operators (pass-through = 0) to a complete price reduction (pass-through = 1)[49]. The baseline scenario for cost pass-through is 0.8, based on previous GSMA analysis (Mobile Taxation Studies – Methodology documentation).

Coverage gap

General considerations

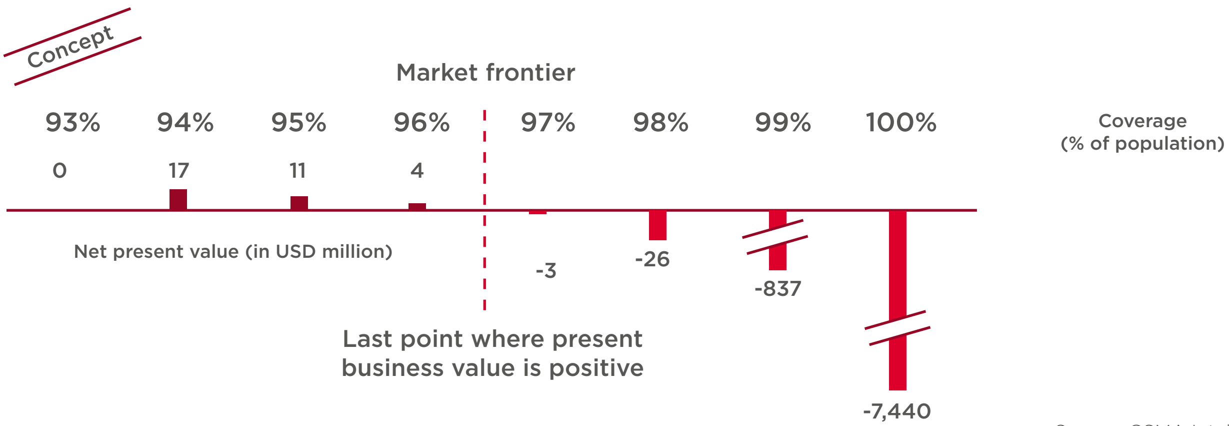
The model takes into consideration the current coverage figures and number of sites by technology (2G, 3G, 4G)[50]. Of the three technologies, the model picks the one with the highest number of sites. If this is 4G, the model estimates the deployment of new 4G sites. If the highest number is 2G or 3G, the difference between 2G/3G sites and 4G sites is the amount of sites available for technology upgrade.

Once all upgrades are made, the model deploys 4G sites until 99% of the population is covered.

The model then increases one percentage point of coverage until it reaches 100% in 2030. The calculation of the total cost required to cover 100% of the population takes into account the maximum coverage that is profitable for operators (market frontier[51]).

FIGURE 18

Market frontier – Argentina example

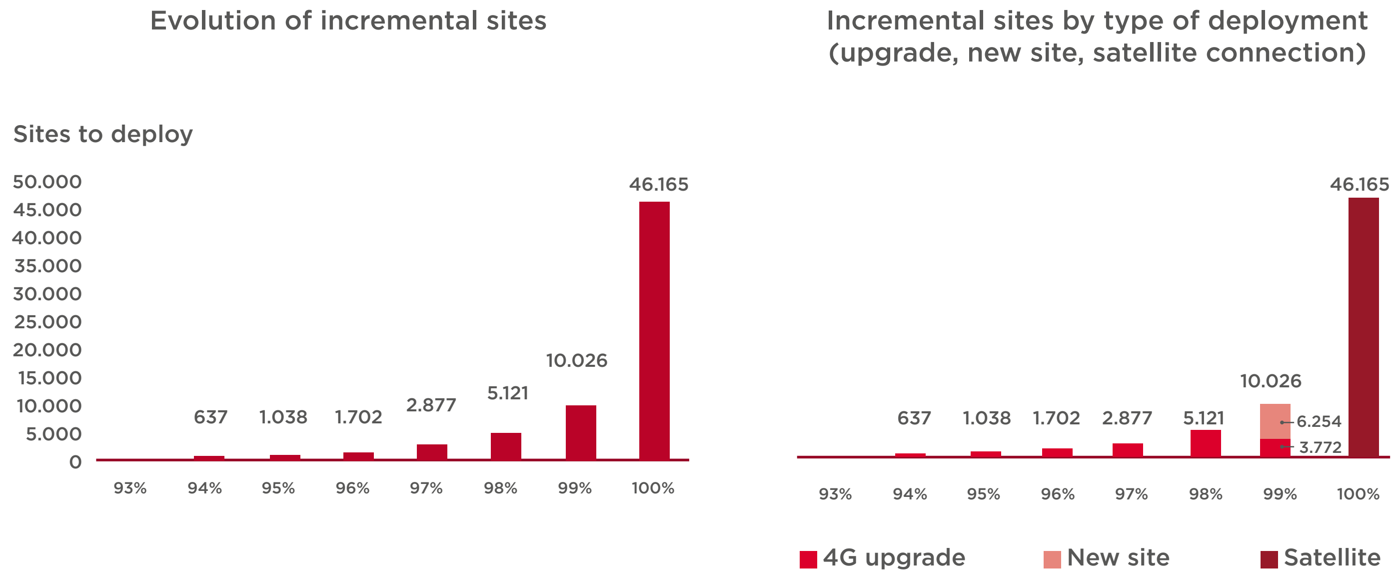


Source: GSMA Intelligence

49. Pass-through = 0 means that device and plan prices do not change in relation to the Baseline scenario. Pass-through = 1 means that all reductions caused by tax/fee reductions translate into an identical reduction in device and plan prices.
50. Data sources are public reports issued by regulators in each of the countries.
51. The market frontier is reached when the present value of adding one percentage point of coverage is below 0; that is, the market is losing money.

FIGURE 19

Argentina: target coverage and incremental sites (new sites by type of deployment)



Source: GSMA Intelligence

Given the incremental difficulty of the last percentile, this model considers that all countries cover their last 1% by deploying satellite-enabled backhaul.

Coverage extension model

The coverage extension model uses geographical data provided by the European Commission Joint Research Centre, using a 1-kilometre spatial resolution.

The data enables us to classify clusters according to rural/urban categories, as follows[52]:

- **Urban centre –** An urban centre consists of contiguous grid cells (4-connectivity cluster) with a density of at least 1,500 inhabitants per km2 of permanent land, and has at least 50,000 people in the cluster.

- **Dense, urban cluster –** A dense, urban cluster consists of contiguous cells (4-connectivity cluster) with a density of at least 1,500 people per km2 of permanent land and has between 5,000 and 50,000 people in the cluster.

- **Semi-dense, urban cluster –** A semi-dense, urban cluster consists of contiguous grid cells (8-connectivity cluster) with a density of at least 300 people per km2 of permanent land, has at least 5,000 people in the cluster and is at least 3 kilometres away from other urban clusters.

- **Rural cluster –** A rural cluster consists of contiguous cells (8-connectivity cluster) with a density of at least 300 people per km2 of permanent land and has between 500 and 5,000 people in the cluster.

- **Suburban or peri-urban grid cells –** These are all the other cells that belong to an urban cluster but are not part of an urban centre; a dense, urban cluster; or semi-dense, urban cluster.

52. GHSL Data Package 2022, European Commission Joint Research Centre.

• **Low-density, rural grid cells –** These are rural grid cells with a density of at least 50 people per km2 of permanent land and are not part of a rural cluster.

• **Very low-density, rural grid cells –** These are cells with a density of less than 50 people per km2 of permanent land.

• The GHSL SMOD classifies **water grid cells** as all cells with more than 0.5 share covered by permanent surface water that are not populated nor built on.

Using this classification and taking Colombia as an example, 56% of the Colombian population live in an urban centre and 20% live in dense, semi-dense or suburban areas. The remaining 24% of the population live in rural areas.

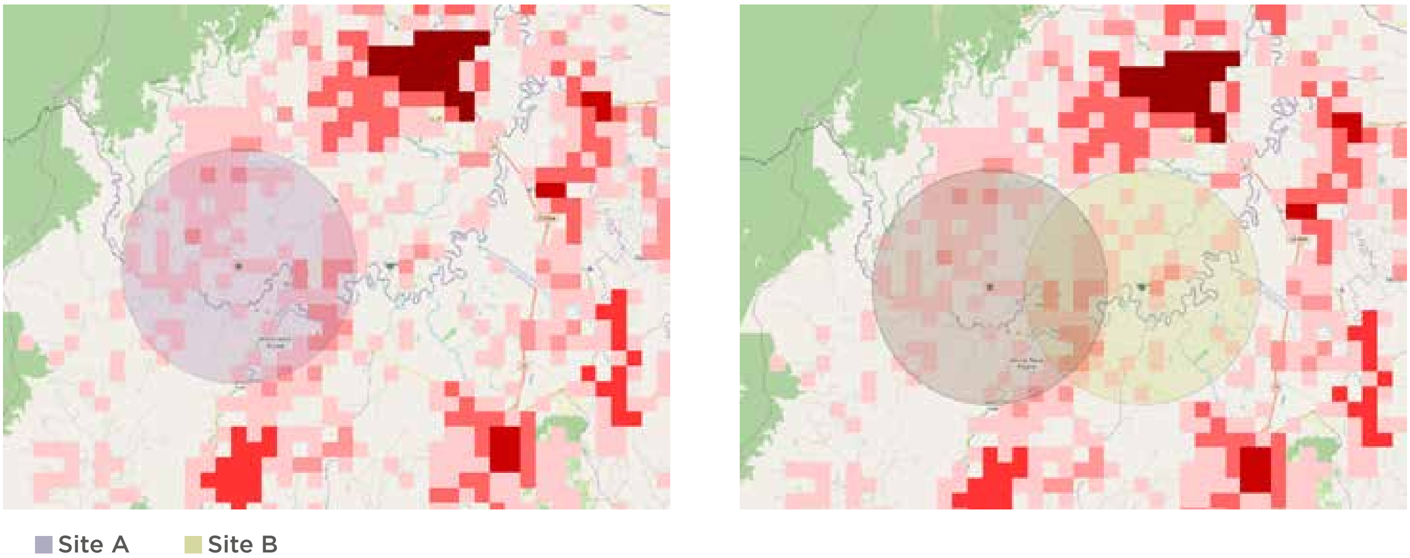
Site estimation

In this analysis, we estimated the number of sites needed to achieve universal coverage in each of the countries. Given the existing levels of 4G coverage, we assume that all urban areas are covered; the remaining uncovered areas are therefore rural.

A hypothetical network is then built and a mobile site is placed at the centre of each rural cluster (or each rural "network"). This means that the site has an 8.5 km reach, in line with access to 700 MHz spectrum[53].

FIGURE 20

Deployment of new sites in rural clusters



Source: GSMA Intelligence

Figure 20 shows the deployment of new sites in rural clusters. The installation of a site in the middle of a rural cluster is shown by the green dot in the left-hand image. The circled area reflects coverage. All population clusters inside the circle (in red) are therefore supposed to be covered. We then did the same for all population grids.

Several sites may overlap. Initially, the model deploys the one that would cover the highest number of people. In the image above, site A covers more people, so is the one that will be built first. Then, site B is deployed, with this one covering people in the green area but not in the overlapped area, as these populations are already covered by site A.

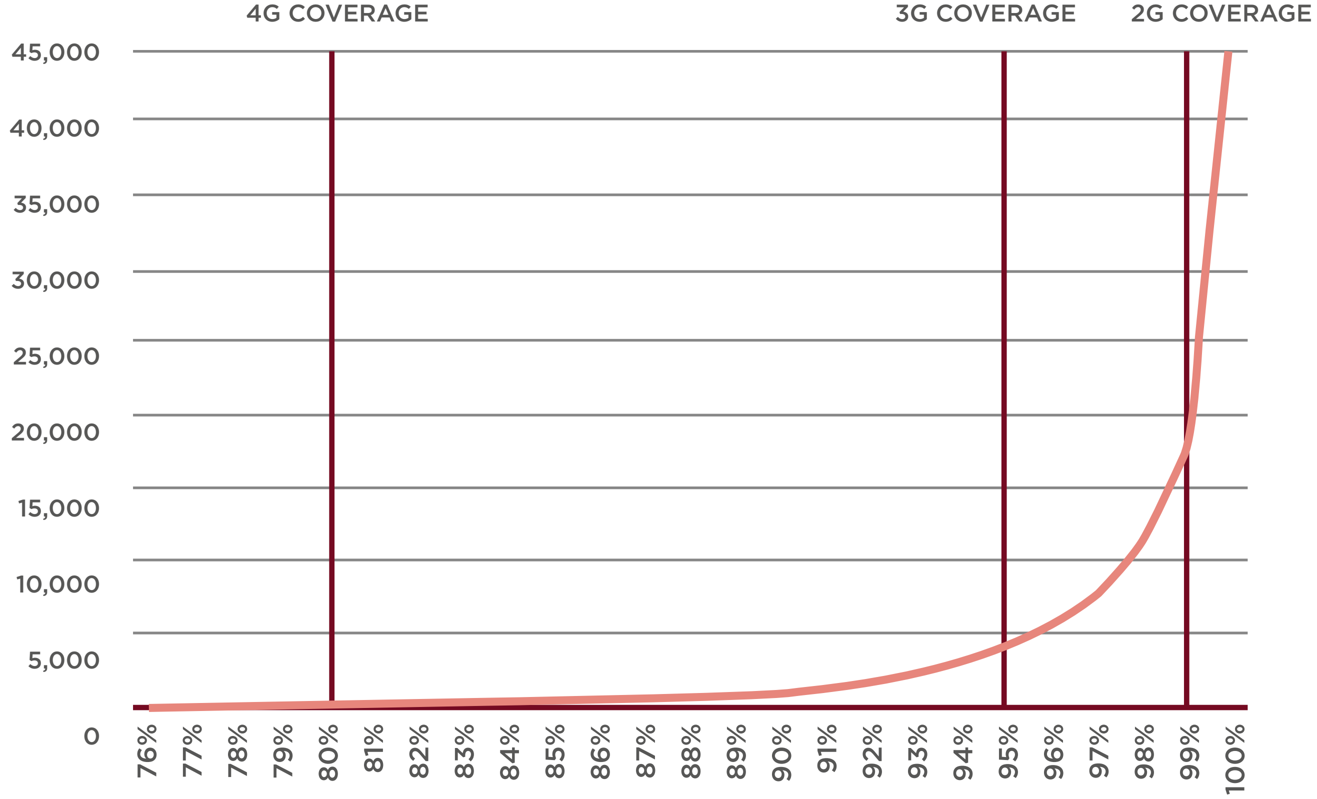
53. Uplink coverage comparison of typical scenarios – ZTE

Once all populations are covered by these sites, we classify them by number of people per site. It is stipulated that operators must implement sites in descending order, from the one with the most coverage to the one with the least coverage. The site with the most coverage is site 1. All populations covered by site 1 are then eliminated and population coverage is estimated again for each remaining site. This means that covered populations are eliminated to avoid counting them twice. The algorithm is used until we reach the last site, which should cover very few people. In this way, it is possible to calculate the number of sites needed to extend coverage to each incremental 1% of the population.

The number of required sites goes up with every increase, thus becoming exponential when population clusters are remote and scarce.

FIGURE 21

Modelled site deployment curve



Source: GSMA Intelligence

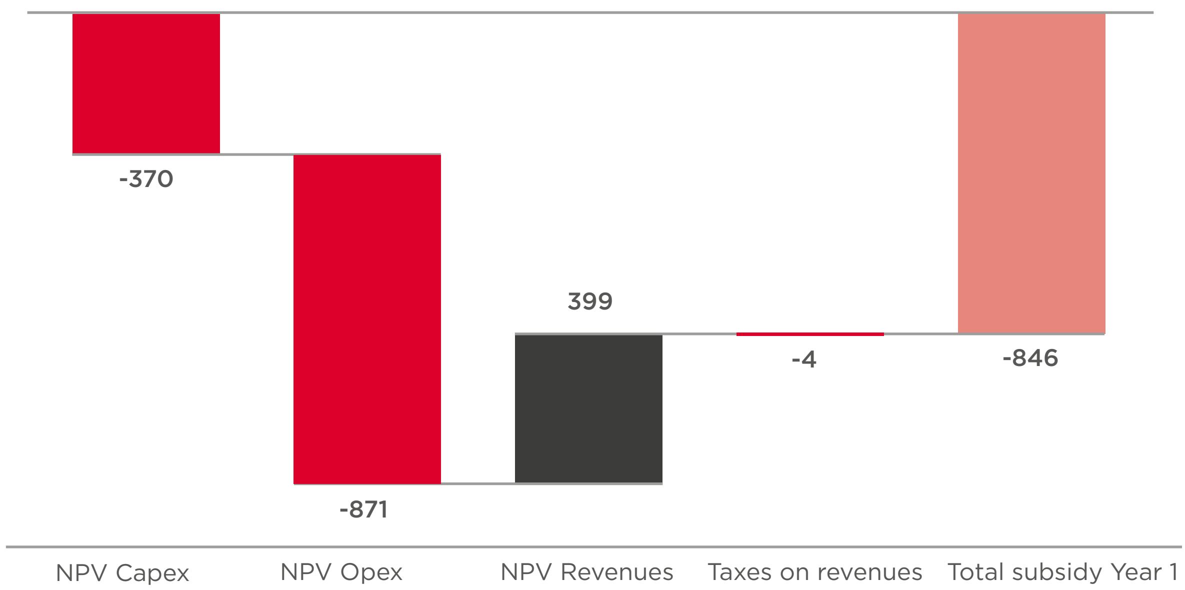
The increase in the number of 4G sites is based on the current number of 2G/3G sites, depending on the highest. In this way, if there are any sites that need upgrades, the model considers the first deployments as technology upgrades. This procedure continues until there are no sites left to upgrade. New physical sites then start to be deployed. For the last portion of population to cover, satellite backhaul is assumed needed after a certain point where physical deployments become too expensive or unfeasible, as locations are too remote.

Present value – supply-side subsidy estimate

For each percentage point of additional coverage, the model estimates the number of stations that need upgrades and the number of new sites that need to be deployed (4G or satellite). To do this, capex, opex and revenues are forecast.

FIGURE 22

Supply-side subsidy estimate – Brazil: year 1, 93% of target coverage level (USD million)



Source: GSMA Intelligence

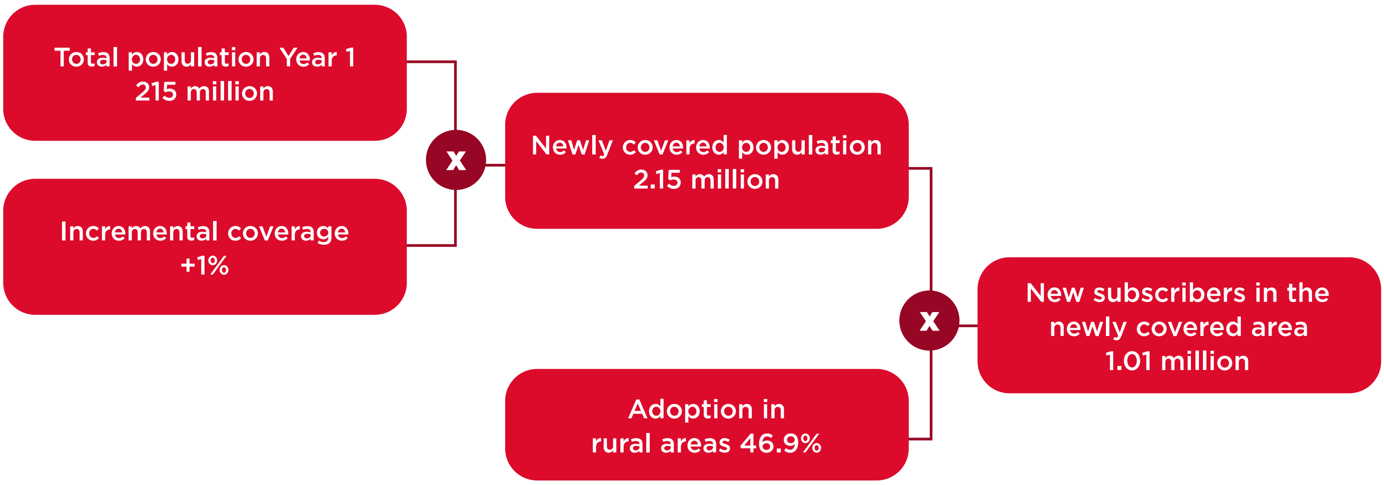
Subscribers are estimated based on the extension of coverage for each year, the newly covered population and the level of adoption[54] in newly covered areas (remote areas with low purchasing power). This figure varies from country to country and is affected by the impact on adoption from price changes[55].

To estimate adoption levels in remote areas – target populations of coverage extension – we used the report, "Rural Connectivity in Latin America and The Caribbean – A Bridge for Sustainable Development in a Time of Pandemic" by the Inter-American Institute for Cooperation on Agriculture (IICA), the IDB and Microsoft, as a source of information. This report created the Substantial Rural Connectivity Index, which was used as a proxy in this model to determine the level of adoption mobile broadband services will have in newly covered areas.

54. The Rural Significant Connectivity Index (RSCI) for Latin America and the Caribbean, IICA, IDB, Microsoft
55. An elasticity analysis for each specific country can be found in the Elasticity impact in Annex 1.

FIGURE 23

Estimate of adoption levels in rural areas – Brazil, year 1



Source: Rural connectivity in Latin America and the Caribbean. A bridge for sustainable development in a time of pandemic, Inter-American Institute for Cooperation on Agriculture, the IDB and Microsoft

The present value of final costs to increase coverage by 1 percentage point includes three elements. The first is the capex required to deploy all the sites. The second is the opex of deployed sites during their operation. The third is revenue, calculated by applying the ARPU to the number of new subscribers based on the estimated level of adoption, which is also measured considering the period of time a site has been operating for. This way, free cash flow is estimated for each year (free cash flow = revenue – capex – opex).

Finally, the free cash flow is deducted by applying a weighted average cost of capital (WACC), which varies between countries. This defines the present value of financing required to close the coverage gap and, in the process, identifies the market frontier for each different scenario.

Usage gap

General considerations

Estimating the usage gap begins with defining a goal to reach a certain number of total subscribers by 2030 (adoption goals). This model sets a goal to reach 90% of the total connected population, which is in line with two ITU objectives:

- **ITU aspirational targets**[56]**:** 100% of the connected adult population aged 18+
- **ITU connecting humanity**[57]**:** 90% of the connected population aged 10+.

With these targets for 2030, the deployment process initially requires analysis of subscriber evolution by that year, which would cushion the impact created by price changes in each scenario (country-specific elasticity analysis).

This subscriber evolution (shown in Figure 24) begins with data on 4G mobile internet unique subscribers. This number was developed through mobile internet unique subscriber data, split by 3G and 4G unique subscribers based on the share of connections by technology. After defining the number of 4G mobile internet unique subscribers, this is analysed according to the impact of elasticity in each scenario and with a coverage limit defined by market frontiers.

56. Achieving universal and meaningful digital connectivity in the decade of action: Aspirational targets for 2030, ITU
57. Connecting humanity. August 2020. Assessing investment needs of connecting humanity to the Internet by 2030, ITU

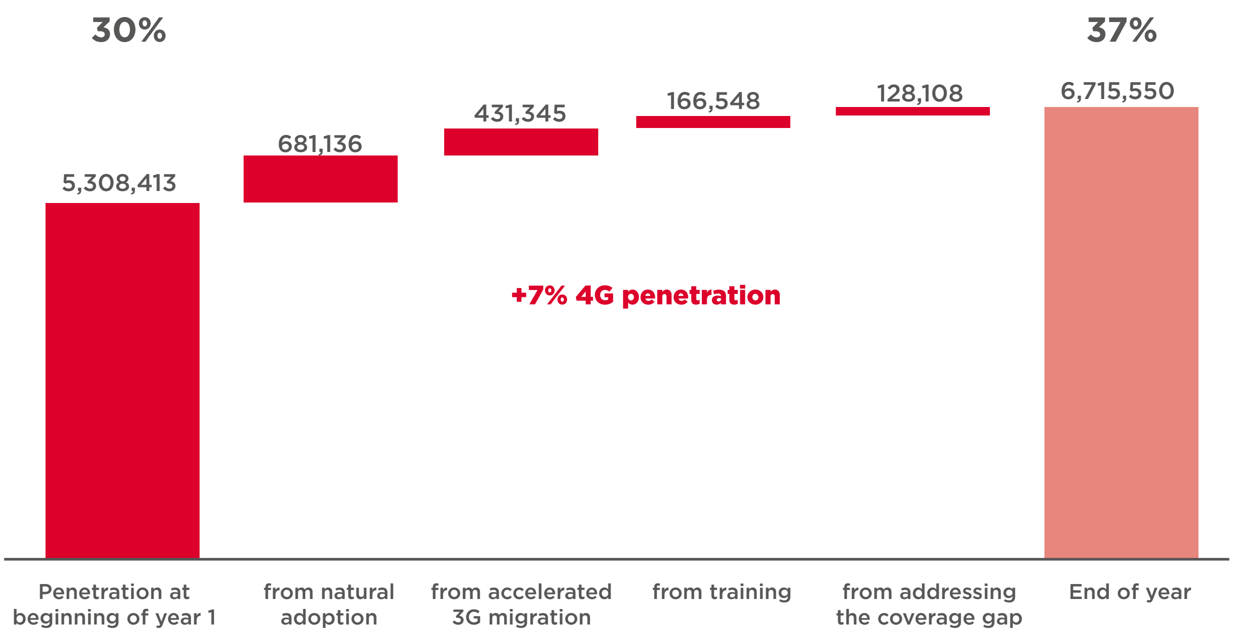
For each year, the 4G mobile data usage gap is estimated by comparing 4G coverage figures, 3G subscribers and 4G mobile internet adoption levels. The latter includes both 3G mobile data users[58] and people who live in covered areas but are not subscribed to any services. The end goal is to estimate the present value of total subsidies required to narrow the usage gap pursuant to the initial connectivity goals. Total subsidies include the required contributions to help purchase new handsets, make monthly plan payments and train new users. The incremental revenues generated by these new additions are then deducted for the duration of the service.

The first measure to narrow the usage gap is 4G adoption by users already subscribed to the service but using previous technologies (3G). For all countries, the model assumes that all mobile internet subscribers will have migrated to 4G by 2030. Based on this new migration rate, the model recalculates the usage gap. With this new figure in mind, the model defines a training and adoption rate to meet some of the ITU's objectives by 2030[59]. If a country reaches that figure naturally, the training rate should be minimal.

FIGURE 24

Breakdown of growth in 4G penetration, year 1 – Ecuador

Number of 4G subscribers and penetration (% of population)



Source: GSMA Intelligence

This provides a modelled subscriber evolution curve for 4G mobile internet service, taking into account the impact of narrowing the coverage gap, accelerated 3G user migration and the training of covered yet unconnected people to narrow the usage gap in line with predefined goals.

58. 3G to 4G user migration requires less investment, as users are already in the sector's customer base. Subsidies would therefore only include a portion of handsets and new plans. In addition, such customers are already subscribed to mobile services, so the sector does not need to train them.
59. 100% coverage of adult population or 90% coverage of population aged 10+ by 2030.

Present value – total required subsidy estimate

Given the existing adoption level in the countries studied, the model assumes that estimated new additions come from those in the third to fifth income quintiles[60], where purchasing power is a barrier to adoption and where certain subsidy levels may be needed to add new subscribers to the base.

Subsidy amounts for each quintile are estimated in the same manner, both for 3G migrated users and trained users. For the first year of adoption, subsidies are thought to be needed for both acquiring new handsets and paying for a full year of service. For subsequent years, subsidies need to cover service prices for each new year only.

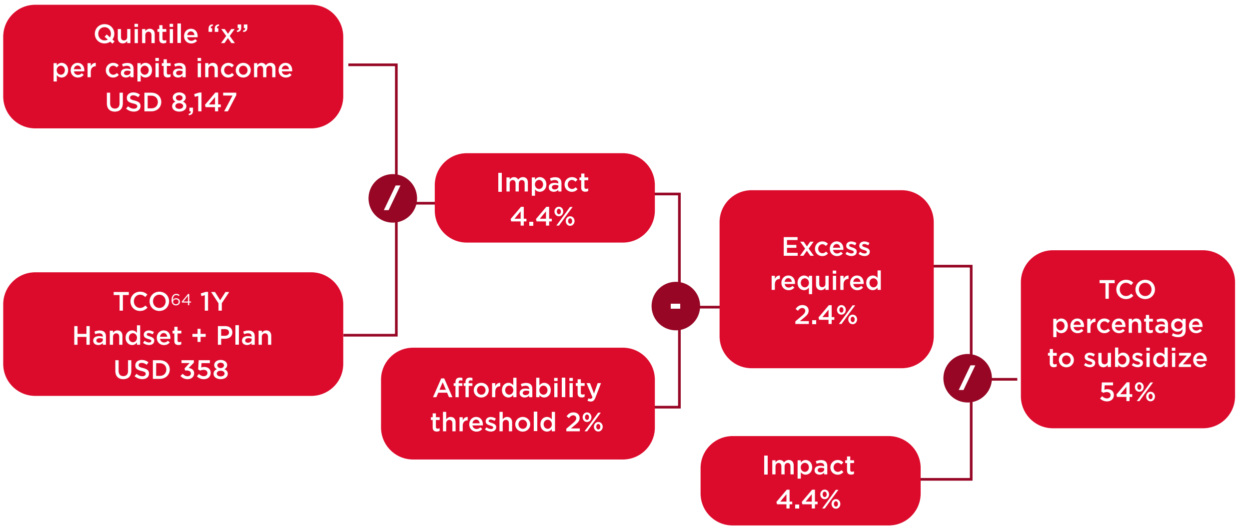
The starting point for calculating subsidy amounts is an affordability threshold of 2% of monthly gross national income per capita[61], as defined by the Broadband Commission for Sustainable Development.

To estimate the GDP per capita for each quintile, the starting point is the total GDP of each country, which is broken down into GDP contributions made by income quintiles. This information is sourced from the World Bank Database[62].

Comparing the required costs (in the first and subsequent years by groups of new additions) with income levels by quintile, the result is the impact of a service on income. This last factor is compared to the affordability threshold. The subsidy percentage is the remainder of the 2% threshold in relation to quintile income.

FIGURE 25

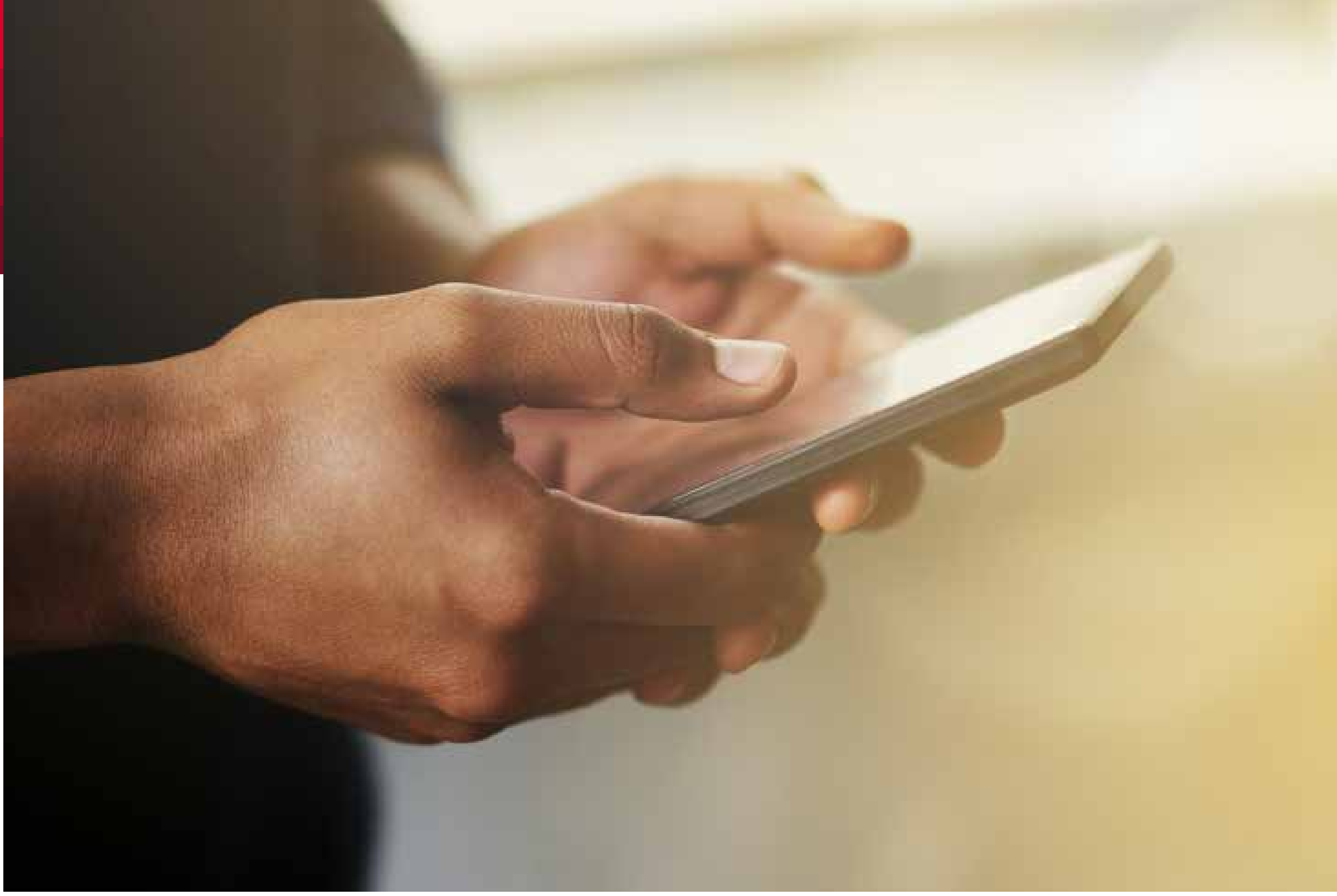
The dynamics of subsidy estimates by quintile[63]



Source: GSMA Intelligence

This model allows us to determine the subsidy percentage needed, ranging from 0% to 100%. Additionally, for trained users[64], it considers investments in training programmes only during the first year of adoption by new users. With accelerated user migration, such an amount is not included, as industry best practices recommend subsidising handsets when they are purchased, which is already provided for in our model.

60. This was classified by using Gallup's internet access survey for 2019, which classifies respondents into income quintiles and then provides a detailed breakdown of their answers.
61. Broadband Targets 2025: "Connecting the Other Half", Broadband Commission for Sustainable Development
62. World Bank Open Data
63. TCO = total cost of ownership. In this specific case, it means the cost of purchasing a 4G-enabled handset plus the annual cost of a data plan.
64. Connecting Africa Through Broadband, Broadband Commission for Sustainable Development, 2019



Regarding revenues, the assessment considered the incremental revenue generated by the migration from 3G ARPU to 4G ARPU due to the technology upgrade[65]. For trained users, incremental revenues are the total amount of 4G ARPU, as new additions come from a pool of potential users who were not subscribed to other mobile services.

Having determined those figures, the model estimates the total subsidy needed to narrow the usage gap in each year, applying the following formula:

$$\textit{Total subsidy needed}_{\textit{year } i} = \textit{revenues}_{\textit{year } i} - \textit{device subsidies}_{\textit{year } i} - \textit{plan subsidies}_{\textit{year } i} - \textit{training cost}_{\textit{year } i}$$

Based on that, it builds subsidy cash flows to 2030, which are later discounted by applying each country's discounted rate. Using this methodology, the model estimates the present value of the total subsidy needed to narrow the usage gap in line with the selected connectivity goals.

65. 4G ARPU is assumed to increase 5% when compared to 3G ARPU. Source: "South Korea's high-speed 5G mobile revolution gives way to evolution", euronews.com, May 2022

ANNEX 1
Elasticity analysis

Elasticity analysis plays a fundamental role in the impact of alternative public policy implementations to stimulate the adoption of mobile broadband services. Given that different scenarios introduce measures affecting the prices of services and devices, this translates into cost reductions that produce new levels of service adoption by the population, as they improve affordability conditions.

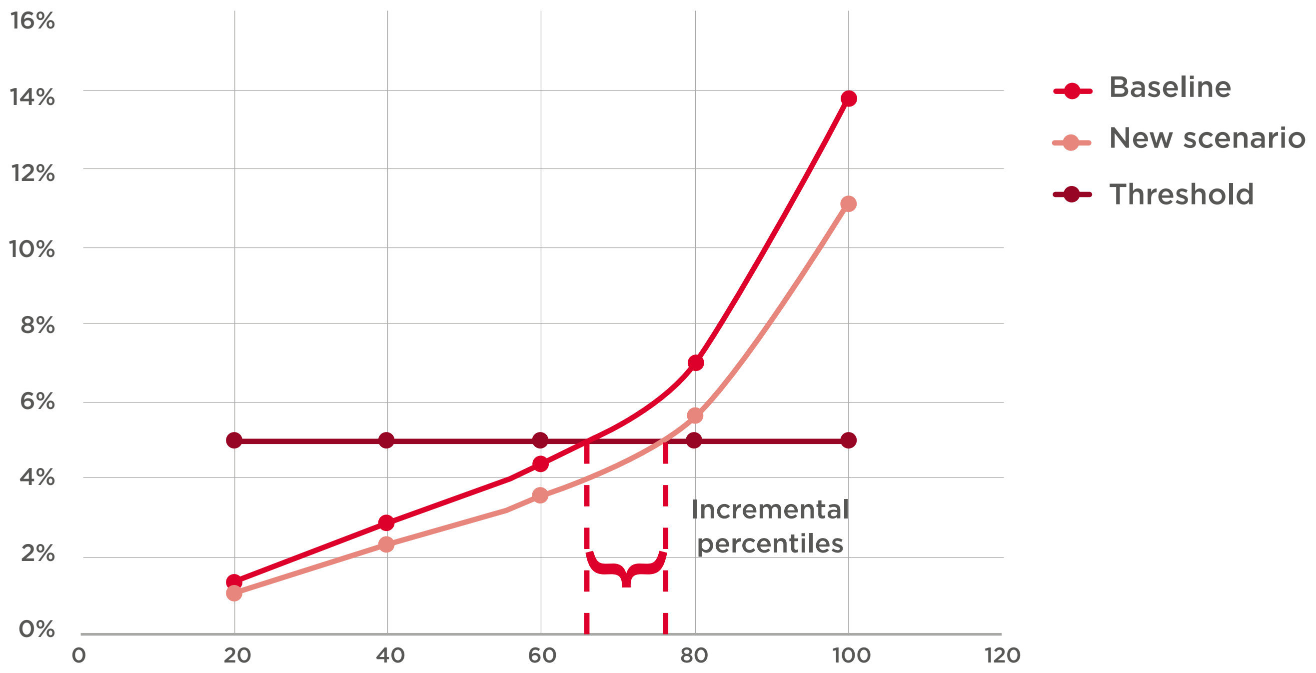
The analysis establishes an affordability threshold of 5% for all countries studied. Its objective is to show a greater incentive for users when services become more affordable, in order to increase adoption among the population.

For each country, we take the impact of service cost on income levels per capita to create a linear regression. Based on this, we calculate population percentiles where impacts are below this new affordability threshold.

For each scenario, the curve of linear regression is then re-calculated, taking into account public policy impacts on handset and plan prices. Finally, we re-calculate population percentiles where impacts are below this new affordability threshold.

FIGURE 26

Elasticity analysis



Source: GSMA Intelligence

The difference between the first and second linear regressions enables us to quantify incremental percentiles that would be added to the service if new policy was implemented, which allows us to estimate the number of new additions, elasticity and demand prices for each scenario.

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