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In-kind obligations for IMT spectrum in Latin America:

Challenges and case studies

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Index


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1. Introduction

In the early days of the mobile industry, spectrum assignment processes were governed by the traditional award formats of each country, usually through a public auction. In-kind obligations have been part of assignments since the beginning, initially to extend mobile service coverage (including transport corridors), and were an additional cost on top of the price paid for spectrum.

Technological evolution in recent years has led to a vibrant, constantly changing mobile market. Mobile services are now a fundamental tool enabling access to job opportunities and essential services such as education and healthcare. In this new context, more flexible and timely spectrum assignment and renewal processes were needed.

Governments in Latin America have updated and adjusted regulatory frameworks to improve assignments and renewals. New approaches include direct assignments and renewals, lower spectrum prices, longer licence extensions, improved licence renewal procedures, voluntary sharing of network elements, more flexible licence use, public consultations and innovative payment methods.

Figure 1

In-kind obligations in Latin America

Digital Infrastructure	Service-focused (SMP/non-SMP)	Adoption / Demand	Auction-specific
• Coverage • New mobile infrastructure • Fibre availability • Highway/motorway coverage • Technology upgrades of legacy networks (2G/3G)	• Voice and data obligations • Public institutions connectivity • National roaming • Capacity for MVNOs	• Mobile plans for low-income users • Demand aggregation centres • Mobile device distribution • Wi-Fi zones • Community networks	• Reallocation • Clean-up and all obligations to provide incumbent service elsewhere • Public safety solutions / networks

Source: Based on information from a private consulting firm.

The new approach of using in-kind obligations as an alternative to upfront payments for IMT[1] spectrum is part of this evolution. Licence obligations are now viewed as a fundamental tool to close the connectivity gaps affecting Latin America.[2] Governments in the region[3] have decided to promote the use of obligations to accelerate new technology deployment, encourage uptake and promote digital transformation. Extending service to unserved areas is the obligation type most frequently adopted, but other options have been included too.

In-kind obligations are an effective mechanism to boost connectivity, as actions focus on specific goals designed to enhance socioeconomic wellbeing rather than raising public revenue. In Peru and Chile[4], the entire value of the spectrum auctioned was paid for through in-kind obligations. In Brazil and Costa Rica, investment commitments accounted for 90% of the final price. In Colombia, the investment commitments ranged from 20% to 50% of the total payment, depending on the process.[5]

Responsibility for the obligation falls mainly on operators, making compliance more effective because of the financial incentives to achieve the highest possible return on investment. In contrast, when operating expenses for providing the service are added, costs may be passed on to the end user.

Despite these benefits, as in-kind obligations reach saturation level, increasing complexity could discourage interested players if implementing obligations is likely to require unsustainable resources, with no long-term plan to move to a more sustainable scenario.

The existing framework is due in part to the diversity of experiences in the region. As the use of in-kind obligations is likely to continue in Latin America[6], recommendations and guidelines are needed to regulate them and ensure they are uniformly implemented within the institutional framework of each country.

This report identifies the challenges of the current approach in the region, proposes guidelines to address them, and outlines a roadmap for the future to establish in-kind obligations in collaboration with industry stakeholders. By doing so, obligations can continue to help bridge the connectivity gap in Latin America.

1. International Mobile Telecommunications (IMT) spectrum refers to the radiofrequency bands regulated by the International Telecommunication Union (ITU) that are designated for mobile broadband services, including 3G, 4G, 5G and future generations.
2. The connectivity gap affects 40% of the population in Latin America, meaning 260 million people do not access a mobile service. Some 40 million have no coverage (the coverage gap) and 220 million have coverage but do not use it (the usage gap).
3. In Chile in 2021, Colombia in 2019 and 2023, Brazil in 2021, Peru in 2023 and 2025, and Costa Rica in 2025.
4. In Chile, the initial bidding ended in a technical tie, resulting in a tiebreaker auction with cash bids.
5. As set out in Colombia's National Development Plan 2022-2026 (Law 2294/2023). The percentage varied depending on the auction and band type. The regulatory framework updated in 2023 allows up to 90% of spectrum value to be offset by in-kind obligations. According to local operators, this method would more accurately reflect reality, given that the real cost at the time of deployment is higher than the result of the theoretical valuation exercise.
6. In some cases, this is already occurring, such as in Peru, where – under the new regulatory framework – 5G has been directly assigned with 100% of the payment made through in-kind obligations.

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Challenges of the current approach and areas for improvement

The challenges governments face in implementing in-kind obligations can be grouped into three areas: eligibility and technical specifications, valuation of the obligations, and compliance and monitoring. This section analyses the challenges identified in each area and the proposed opportunities for improvement to encourage use of in-kind obligations and help close the connectivity gap in Latin America.

Figure 2

In-kind obligations: main challenges

Source: GSMA

2.1
Eligibility and technical specifications

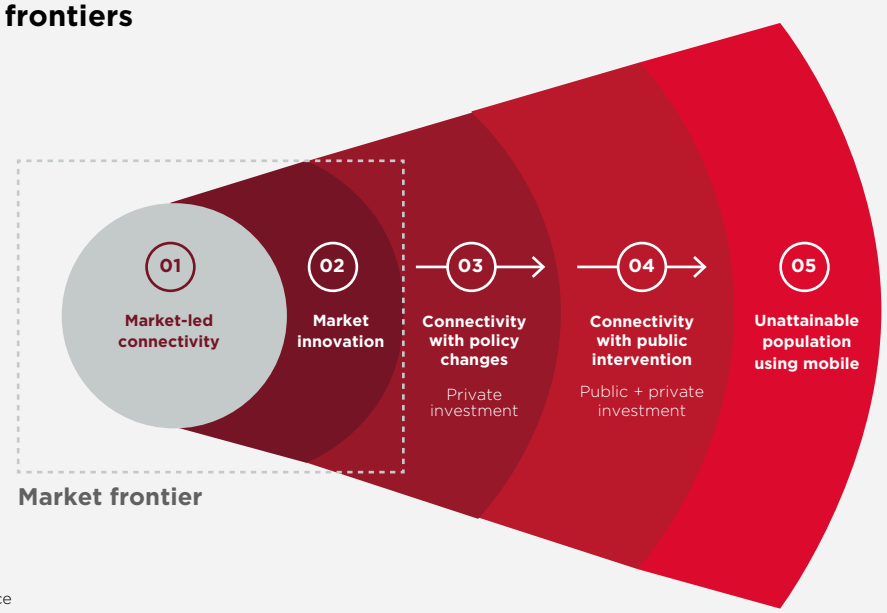
Long-term sustainability of in-kind obligations

The geographical areas analysed by governments are typically unserved and beyond the market frontier, as they are considered unprofitable under current market conditions.[7] However, technological innovations and regulatory changes could lower the cost of deploying infrastructure and doing business in these areas. In-kind obligations are an intervention tool governments can use to encourage deployment and mobile service uptake among unconnected populations.

7. However, some countries, such as Chile, traditionally because of the beauty contest format, have added flexibility by including obligations that do not necessarily entail a loss for licence holders.

Figure 3

Connectivity frontiers



Source: GSMA Intelligence

The purpose of in-kind obligations is not just to extend connectivity but ensure deployments last and that the service continues once the obligation has ended. It could therefore appear somewhat illogical to place in-kind obligations on areas beyond the market frontier, given that current market conditions in these areas are not favorable for assigning additional resources to deploy coverage or acquire new customers.

From a valuation perspective, in-kind obligations should factor in the net loss[8] that discourages operator investment, to provide financial balance to support the deployment. To minimise this loss, regulators could allow operators to use their entire spectrum holdings to meet obligations. Similarly, allowing the use of alternative technologies could ensure faster deployment at a lower cost, facilitating technology uptake.

To assure long-term sustainability, governments should have a medium- to long-term outlook based on implementing policies to build the skills needed to encourage service uptake[9] and expand the market to create the right incentives (through increased revenue).

8. The total incremental capex and opex costs are higher than the potential incremental revenue that the in-kind obligation will generate for the operator, from a discounted cashflow perspective.
9. Training to develop skills to use digital tools in production, education and commerce.

Infrastructure approach versus services approach

The approach adopted for in-kind obligations should be based on defining the primary objective of the obligations. Governments could opt for an immediate compliance target, such as the deployment of infrastructure. Alternatively, they could choose to require the provision of services over a longer period. The infrastructure deployment approach allows for a clearer identification of cost drivers, supporting the valuation process using internationally benchmarked reference prices while isolating operational risks and their associated costs.

This decision determines the key components of the cost structure and guides the technical specifications and design of monitoring and compliance mechanisms. In Latin America, both approaches have been observed. In 2021, Chile and Brazil required the deployment of infrastructure, such as the installation of rural network nodes and the rollout of fibre-optic networks. By contrast, in Colombia in 2019 and Peru in 2023, the delivery of services was required, through measures such as providing connectivity to schools and expanding mobile coverage in specific areas, subject to quality-of-service standards.[10]

Principle of relevance

Historically, in-kind obligations have not always been associated with mobile operators' core business. Providing computers or tablets, deploying sub-fluvial fibre or extending FTTH were not always compatible with the main activities of the players involved.

Adding the principle of relevance means obligations must be directly associated with operators' business activity. Operators will manage resources more efficiently than anyone else,[11] as they have the financial incentive to achieve the best possible return on their investment.

Detailed conditions and rigid deployment models

Licence obligation deployment models were originally comprehensive and rigid, with little room for other options to provide operators with more flexibility. In recent years, in line with evolving market conditions, governments have aimed to create models that allow operators to more successfully meet their commitments.

In this sense, regulators have added various instruments, such as using entire spectrum holdings to guarantee coverage deployment (compliance was previously limited to providing the service using the band assigned in the process), or creating a collaborative environment for voluntary infrastructure sharing (active or passive) or leasing agreements to meet investment commitments.

10, In the case of Colombia, MINTIC established a more demanding quality system than in the general regulations (Decision CRC 5050/2016), creating, in practice, a system that makes it more costly to fulfill the obligations.

11. For example, direct performance of obligations by the state or a party other than the operators.

2.2

Valuation techniques

Investment plans not considered as in-kind obligations

Investments committed to comply with an expansion plan or a technical project are not recognised as part of the payment for IMT spectrum. Examples of this are the minimum expansion plans included in the Dominican Republic and Colombia, and technical projects in Peru. Because the investment commitments carry greater risk, operators need to assign more resources to use the licence. However, the incremental risks and resources are not recognised as part of the payment.

Including investment plans as part of the payment for IMT spectrum would broaden the scope of obligations by applying them to areas that are less complicated but require investment in infrastructure and service. It would also create incentives for sustainable market development and in-kind obligations, and increase objectivity in recognising the risk to operators in committing to long-term investments.

Classifying in-kind obligations

Calculating the cost of in-kind obligations is an essential step for operators ahead of an assignment or renewal process that includes obligations. However, oversimplification has occurred in classifying obligations (e.g. inclusion of only one type of rural area) due to a lack of touchpoints with key stakeholders and dialogue with interested players.

In-kind obligations are not one size fits all, as deployment areas are different. Classifications of in-kind obligations should ensure the valuation technique is accurate, reducing the gap between design and reality in the field to minimise estimation errors. The most typical in-kind obligation is coverage deployment for unserved or underserved populations, but these areas can have markedly different characteristics.

Coverage obligations can be classified according to three factors: type of access (e.g. road, trail, fluvial/aerial), type of accessible energy (electric, solar, wind, fossil fuel) and transport network available (e.g. terrestrial or satellite). Coverage on transport routes can be classified by the type of transport (road, railway or fluvial), considering the kilometres covered. This would broaden the scope of in-kind obligations, as the cost estimate would improve due to the lower margin of error for the case analysed.

Assessing operator profile under current market conditions

Governments should design obligations and estimate their associated costs in alignment with medium- and long-term public policy objectives. To do so, it is important to begin with a theoretical exercise that defines the profile of an operator capable of operating efficiently under prevailing market conditions – that is, an operator that manages its resources with the objective of maximising social and economic welfare, and that possesses an appropriate combination of operational scale, network coverage, infrastructure and technical capabilities.

This approach helps avoid the introduction of distortions into the design and valuation of obligations that can be associated with factors such as the scale of operations, existing infrastructure and deployed technologies, prior commercial agreements or the quality of business management, among other elements.

Although this exercise is fundamental to the process, there is evidence of limited coordination with relevant stakeholders and insufficient transparency regarding the profile of the operator selected. As a first step, introducing a structured consultative dialogue with operators can provide governments with greater visibility of the complexity and feasibility of the required deployments. This, in turn, can support more accurate cost determination and help define a competitive operator profile that meets appropriate technical and operational efficiency criteria, in line with the specific conditions of the market. Ultimately, this maximises binding investment commitments and contributes to effective achievement of public policy objectives.

Underestimated valuation of in-kind obligations

Governments typically apply two methods to value spectrum: benchmarking and discounted cashflow. However, in-kind obligations are valued only by the second method.

Discounted cashflow is used to estimate the current value of the future revenue and expenses of the investment commitment. For the calculation, a discount rate known as the weighted average cost of capital (WACC)[12] is applied to future cashflows (the same rate used to value spectrum under the discounted cashflow method). The cash value of the spectrum and the in-kind obligation are estimated and directly compared[13] to calculate the obligations needed to align the cash value of the commitments with the estimated value of the spectrum assigned.

Applying the same rate to value spectrum and obligations is debatable, as the decision drivers are different. Operators estimate the present value of spectrum based on the expected returns from their business. However, investment commitments are not valued based on a business goal, but on maximising the social wellbeing provided by investing in connectivity for unserved or unconnected populations.

Meeting in-kind obligations is a source of additional uncertainty for operators, as they are not part of operators' business decisions in the context of strictly commercial analysis. Several factors contribute, including delays to the deployment plan, variability in network and infrastructure costs, estimation errors, variability of expected demand, difficulty obtaining permits, and issues verifying compliance.

From a financial valuation standpoint, this uncertainty has an incremental cost that should be recognised for operators, beyond theoretical flows of capex, opex and revenues. However, the current valuation method does not reflect the extra cost to operators of having to include contingencies imposed by non-commercial obligations. For the purpose of this analysis, this condition of in-kind obligations is called the uncertainty risk premium.

12. WACC is normally estimated using the capital asset pricing model (CAPM) method.
13. This comparison is carried out directly as follows: if deploying a base station in a rural area and operating it for 20 years results in a net discounted cashflow of USD400,000, then USD400,000 is discounted from the spectrum debt.

To incorporate the public benefit created by these investments and add this premium to the valuation, a variant of the discounted cashflow method known as the social discount rate[14] could be applied. This rate would include all the impacts of the project on the players involved – not just the financial return but also the additional uncertainty created by the challenges involved and the positive social impact of the deployments. At the same time, it would help to offset potential biases that distort valuations.[15]

The discount rate for valuing in-kind obligations could therefore be different to the rate used by operators (WACC) to value spectrum based only on financial returns, in a process that would include other items for analysis and a range of expected outcomes. The value of the investment commitments could then be increased, as it would include not only business decisions but also projects with an economic and social impact involving challenges and benefits not typically included in investment projects associated with the industry.

Because the social discount rate allows long-term analysis of social investment projects by including the impact on the entire population of a country, one way to calculate the rate would be to link it to the nominal rate of sovereign bonds. This rate is used to appraise public sector projects and includes all the economic, social and political signals that countries send to financial markets. In methodological terms, it comprises the sum of a risk-free rate[16] and an increase associated with the country risk premium,[17] isolating the industry-specific risk, lowering the discount rate and increasing the final valuation of in-kind obligations.

Figure 4

Components of the social discount rate (equivalent to the nominal rate of sovereign bonds) and WACC – conceptual explanation (percentage)

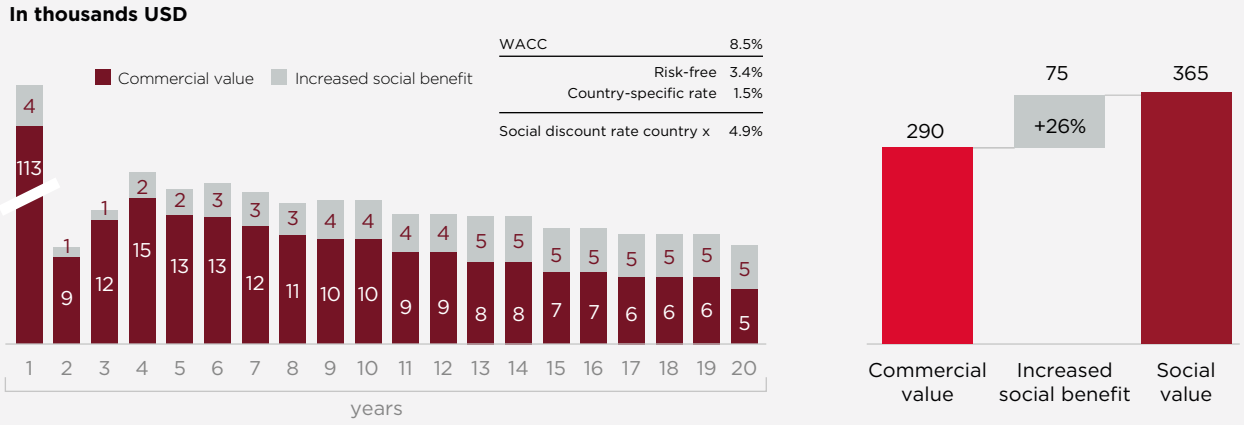
Source: Based on information from a private consulting firm.

14. The social discount rate includes the social benefits of implementing a specific project, taking into account not only the operators seeking a financial return but all the players involved. This concept was developed by several international organisations, including IDB, World Bank, OECD, governments experienced in this area, and internationally recognised studies by the University of York and the London School of Economics (LSE). In the present case, using this rate allows the social impact of connectivity to be included in the valuation of obligations.
15. One of the most common biases is the "optimism bias", where appraisers systematically underestimate costs and overestimate benefits. In the present case, the cost of coverage deployment should be adjusted upwards to reflect this bias. This issue was addressed by the UK's HM Treasury in its project appraisal manual for all government departments.
16. Best practice in the financial appraisal of investment projects is to use the US treasury bond yield as the risk-free rate.
17. Estimated using the Emerging Market Bond Index (EMBI) from JPMorgan.

An example of this method is shown below, using an example of the most typical valuation of an in-kind obligation: deploying an antenna to cover a remote area with no return for the entire licence period (20 years).[18] The model uses illustrative infrastructure costs to present the methodology.

Figure 5

Estimate of the increased social benefit of in-kind obligations – conceptual explanation



Source: GSMA based on information from a private consulting firm.

In this exercise, by discounting cashflows at the market rate (WACC), the government would recognise an equivalent commercial value of USD290 thousand to the operator per antenna deployed. In contrast, using the social discount rate, the social value would be USD365 thousand, around USD75 thousand more than the strictly commercial approach.

When the impacts on all the stakeholders are included (both the financial return and the public benefit generated by the investment), the final valuation of the obligations increases by almost 30%. The amount of increase will vary depending on country-specific conditions, discount rates and potential future cashflow, but could range from 25% to 35%.

2.3

Compliance and enforcement

Harsh sanctions regime

The current monitoring approach includes harsh sanction regimes based on a scale of fines for non-performance, delays or changes to timelines. Sanctions start with fines and can include enforcement of guarantees and licence cancellation in more serious cases.

18. The estimate is for installing and operating a radiating system on a guyed tower, with microwave backbone. It includes only the network and traffic costs (variable and fixed) and excludes variable costs (e.g. customer service, collection).

Adopting a more open, collaborative approach to justifiable non-compliance is one approach to ease the impact and uncertainty in meeting in-kind obligations. This involves conducting risk analysis that includes unforeseen events, vandalism or force majeure[19] seen in previous cases or other countries. Commercial and proportionality grounds could also be considered, to allow the reprogramming of node installation (e.g. site costs beyond standard market prices).

A more collaborative approach is now part of best practice among leading regulators internationally, including Ofcom[20] in the UK, FCC[21] in the US, Bundesnetzagentur[22] in Germany, and ACMA[23] in Australia.

Such approaches mitigate risks and minimise the effective costs of deployments, boosting operator support for in-kind obligations and ensuring more efficient use of resources due to greater flexibility in addressing unforeseen barriers to new deployments.

Including cash payment as a last resort

In many cases, the definition of investment obligations includes deploying connectivity in areas where access is logistically complicated, available energy sources are limited, or civil unrest hinders the execution of works.

These unpredictable situations make it more difficult to estimate the associated costs by adding uncertainty to the valuation of obligations, and (in many cases) prevent fulfilment of the commitments undertaken in the assignment process.

Despite the frequency of these situations in this geographically and socially heterogeneous region, current schemes in Latin America do not include the option of cash payment in extreme cases that prevent performance of an in-kind obligation. In extraordinary situations, allowing cash payment as an exception could encourage operators to take on more complex obligations and provide greater certainty and more flexible options for unexpected scenarios.

19. A lack of commercial energy infrastructure and logistics infrastructure are two of the greatest impediments to deployment in remote areas in the region, and have considerably increased operator costs.
20. Ofcom includes a series of "reasonable conditions" that prevent compliance with a coverage plan, including: inability to obtain required planning permission, inability to secure relevant landlord agreements at reasonable prices, excessive costs (overall costs, including for power and backhaul for a site, significantly above typical rural costs and the costs of alternatives such as fibre and renewable energy), and inability to find alternative sites. See: 2020 Coverage Obligations – Notice of compliance verification methodology, Ofcom, 2020.
21. The FCC stipulates that extending the deployment period is included in regulations. Extensions are granted in the case of "involuntary" delay or for causes beyond the operator's control. The regulations classify specific cases not included in such extensions but allow the possibility of analysing cases that are not included. See: Title 47 CFR § 1.946 - Construction and coverage requirements, ECFR, FCC.
22. The German regulator, from a collaborative rather than a sanctioning perspective, allowed the original deployment periods that operators committed to in a spectrum auction to be reviewed. See: Review of mobile network operators' coverage reports complete, Bundesnetzagentur, 2020.
23. The aim of the regulator in reviewing compliance is to encourage compliance without imposing either economic or administrative fines, promoting a culture of compliance in the industry, imposing measures commensurate with the seriousness of the conduct, and allowing for different types of conduct (inadvertent or not, reckless or not, deliberate or casual; the nature of harm to third parties; seriousness and impact, among other aspects). See: Compliance and enforcement policy, ACMA.

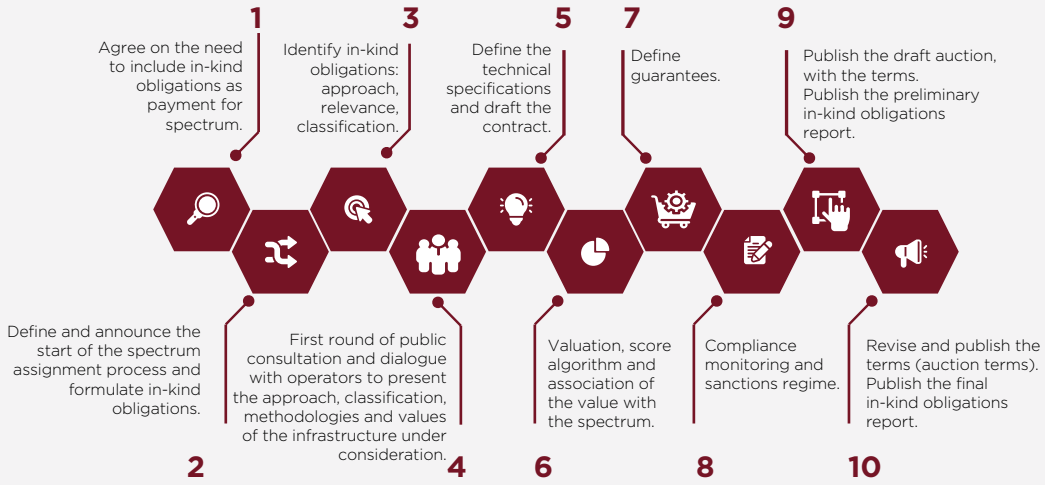
2.4

Lack of a roadmap for formulating in-kind obligations

The process described above includes the milestones for formulating in-kind obligations but omits others inherent to the spectrum assignment process, such as valuing the spectrum bands, designing the format of the process and drawing up the contract. It is estimated that the entire process, from initial concept to publication of the final in-kind obligations report, will comprise 10 stages, excluding activities not associated with formulating the obligations.[24] The duration of each stage will depend on regulators' approach and resources.

Figure 6

Roadmap for formulating in-kind obligations for IMT spectrum



Source: Based on information from a private consulting firm.

The dialogue and consultation stages have proven to be essential to the process. Two instances of consultation and dialogue between public agencies and operators are proposed. The first is to explain the principles and methodologies and discuss the benchmark costs and classification criteria for the in-kind obligations. The second is to publish a draft of the final terms (typically the specifications, in the case of a public auction, and the licence contract) and the in-kind obligations report.

When this roadmap has been followed, a report on the formulation of in-kind obligations can help create certainty. Rather than providing structured information about how in-kind obligations are formulated, governments typically issue general reports that mention them only briefly. A report solely about in-kind obligations, with information about the methodologies used, the criteria applied, benchmark values and outcomes, would be useful for the industry, to mitigate risks and allow operators to calculate the resources they need to comply.

24. Many of these activities can occur at the same time as activities associated with the obligations.

03

Case studies from Latin America

3.1

5G in Chile (2021)

Overview

The 5G auction in Chile was the region's first 3.5 GHz band auction. When the Under Secretariat of Telecommunications (Subtel) drew up the 2018–2022 Government Plan, it submitted the 5G National Plan for public consultation, mainly to define the priority spectrum frequency ranges. After the consultation, it was decided that the priority frequency bands in Chile for introducing services based on 5G were 3.4–3.8 GHz and 27.5–28.35 GHz.

In August 2020, Subtel published the terms of the auction to award the first licences in Latin America for telecoms services operating 5G networks in the 700 MHz, AWS, 3.5 GHz and 26 GHz bands. The public auction was held in 2021.

The spectrum was awarded for 30 years. With national coverage, the regulator offered 20 MHz in the 700 MHz band, 30 MHz in the AWS-3 band, 150 MHz in the 3500 MHz band (15 blocks of 10 MHz), and 1600 MHz in the 26 GHz band (in four 400 MHz blocks), with coverage in a list of specific municipalities.

Although Chile was known for assigning spectrum using the beauty contest format, the terms of the 2021 assignment process created significant competition that resulted in a technical tie between the bids received. A second round of the public auction[25] included upfront payment and subsequent cash bidding, which had historically been avoided in Chile and divided opinion among industry players.

Table 1

Mandatory and additional in-kind obligations

Frequency band assigned	Mandatory in-kind obligations	Additional in-kind obligations
700 MHz	• Coverage by municipality • Municipalities to cover: 710 • Transport routes to cover: 65 routes, 9,170 km	Additional coverage obligation in georeferenced polygons using the 700 MHz, AWS and 3500 MHz bands in the first year: • Airports and aerodromes: 17 • Places of scientific interest: 13 • Minimum coverage required: 90% o Regional capitals: 16 o Provincial capitals: 56 o Public hospitals: 199 o Ministries: 24 o Municipal administrations: 16
AWS-3	• Coverage by municipality • Municipalities to cover: 345	
3500 MHz	• Coverage by municipality • Municipalities to cover: 986	
26 GHz	Deployment of the service. Bidding by municipality rather than country-wide.	

Source: Subtel

25. First-price sealed bid combinatorial auction: simultaneous (stage 1) and sequential (stage 2).

The terms of the obligations established a 90% minimum coverage requirement by municipality and comprised 16 regional capitals, 56 provincial capitals, 199 public hospitals, 24 ministries and 16 municipal administrations. They also included additional coverage[26] in georeferenced polygons, comprising 17 airports and aerodromes, 13 places of scientific interest, 26 tertiary education institutions, 23 maritime ports and 9,170 km on 65 transport routes.

The bidding terms allowed the addition of 344 municipalities to the 366 mandatory municipalities associated with spectrum in the 700 MHz band. The AWS band included 345 municipalities and the 3500 MHz band included 986.

The maximum period for executing the technical projects was three years[27] from the date of publication of the decree awarding the licence.

Value of in-kind obligations

Using the outcome of the beauty contest process and the tie break, the Ministry of Transport and Telecommunications (MTT) awarded licences to operators based on the technical projects submitted, which included the commitments detailed above.

The public revenue raised was around USD454 million, excluding cash payment for frequencies in the 26 GHz band, as shown in Table 2.

Table 2

Values raised in the 5G auction

Band	Additional revenue raised (USD)	In-kind obligations
700 MHz	84 million	• 366 compulsory municipalities with a population of 322,000 • Coverage on 65 roads with total coverage of 9,170 km
AWS	23 million	• Airports and aerodromes: 17 • Places of scientific interest: 13 • Regional capitals: 16 • Provincial capitals: 56 in the first year • Public hospitals: 199 in the first year • Ministries: 24 • Municipal administrations: 16 • 79 polygons in various commercial, industrial, academic etc. categories
3500 MHz	347 million	

26. To provide service in the polygons, operators could use the band assigned or any other spectrum they held.
27. Coverage by municipality: 88% of coverage by municipality committed to in all bands will be in the first 18 months; main provincial or regional hospitals: 100% in the first year; mandatory municipalities: 100% in 18 months.

Band	Additional revenue raised (USD)	In-kind obligations
26 GHz	No payment	• Deployment in specific municipalities across the country, with a specific focus on large urban centres or commercial/industrial centres. The auction was not about maximising coverage or ensuring country-wide presence.
Total USD	454 million	

Source: Subtel

Entel bid USD139 million, Telefónica bid USD163 million for the same holdings and WOM bid USD151 million. In 2024, another auction was held in the 3.5 GHz band; Claro was awarded 50 MHz. The process was similar to the 2021 auction and a similar number of obligations were established.

3.2

5G in Brazil (2021)

Overview

The 5G auction in Brazil is considered by the industry to be an international success story. This is not just because of the format of the process, valuation of deployments and technical specifications, but also because of how it was prepared, the opportunities for dialogue, and regulatory changes introduced in earlier stages. The final outcome was the highest ever collection of investment commitments and cash payments in Brazil.

The assignment process took place in 2021 using the multiple-round ascending auction format for the technical tie. Spectrum licences were awarded for 20 years, renewable at the end of this period under the future regulations in force. Brazil awarded 20 MHz in the 700 MHz band,[28] 90 MHz in the 2300 MHz band,[29] 400 MHz in the 3500 MHz band[30] and 3200 MHz in the 26 GHz band.[31]

28. 1st round: national blocks of 10+10 MHz. 2nd round: regional blocks of 5+5 MHz and commitments in municipalities and roads without 4G.
29. 2nd round: one national block of 50 MHz and regional blocks of 40 MHz.
30. 3rd round: Four national blocks of 80 MHz and eight regional blocks of 10 MHz for municipalities with fewer than 30,000 inhabitants and small operators.
31. 1st round: 10 national blocks and six regional blocks of 200 MHz for 20 years. 2nd round: blocks unsold in the earlier round with a licence extension of 10 years.

Table 3

General guidelines and in-kind obligations by band

Frequency band assigned	General guidelines	In-kind obligations
700 MHz	4G coverage	• Coverage in 625 municipalities without 4G • Coverage for 2,349 transport routes without 4G, totalling 36,000 km - Mobile network limited to the territory of the Federal District to provide services for public security, rescue, emergency, disasters and other state competences (municipal offices connected: 391).
2300 MHz	4G coverage	• Coverage of 95% of the urban areas of municipalities without 4G • Coverage for 400 municipalities with fewer than 30,000 inhabitants • Coverage for 6,500 locations in rural areas
3500 MHz (national)	5G deployment (3GPP release 16)	• Capitals with more than 500,000 inhabitants • Cities with 30,000–500,000 inhabitants • Migration of TVRO systems to Ku band and free migration kits for users • Construction of eight fibre-optic transport networks in the North region • Construction of Programa Amazonia Integrada y Sostenible (PAIS – Integrated and Sustainable Amazonia Programme) fibre-optic network in 530 cities • Construction of Project Red Privada de Comunicación de la Administración Pública Federal (Federal Public Administration Private Communication Network) • Construction of fibre-optic transmission networks (backhaul) in 530 municipal offices
3500 MHz (Regional)	5G deployment (3GPP release 16)	• 4,396 cities with fewer than 30,000 inhabitants
26 GHz	Coverage in special municipalities	• School connectivity project (BRL3.1 billion)

Source: Anatel

The auction terms included obligations to provide 5G coverage from at least three operators to 1,174 municipalities with public offices and more than 30,000 inhabitants; to 4,396 municipalities with municipal offices and fewer than 30,000 inhabitants from one or more operators; and 1,700 additional municipalities without municipal offices. A further requirement was to provide at least 4G coverage to 7,430 municipalities and 2,349 transport routes (almost 36,000 km). The terms also required the deployment of fibre-optic backhaul in 530 municipal offices, and school connectivity projects totalling more than BRL3 billion.[32]

For the stage following the approval of the results, the terms specified participation of the Monitoring Group for School Connectivity Projects and the Monitoring Group for Implementation of Solutions to Interference Problems in the 3625 to 3700 MHz band. These working groups were responsible for defining projects and monitoring progress of the obligations included in the assignment process.

Value of in-kind obligations

The National Telecommunications Agency, Anatel, conducts regular diagnoses of telecoms networks in Brazil and identifies the connectivity needed to extend broadband access. The information is included in the Structural Plan for Telecommunications Networks (PERT), which also defines the actions, projects and sources of finance to reach the connectivity goals proposed. In the 2021 update, the regulator identified a need to extend fibre-optic transport networks, 3G and 4G services, and high-speed fixed access networks to municipalities not served by any type of infrastructure, and create essential public networks, such as public security and defence.

Based on this, the process to value in-kind obligations began with a comprehensive, individual analysis of every unserved and underserved population in more than 20,000 locations[33] across Brazil's 5,570 municipalities, including the coverage situation across more than 122,000 km of federal railways identified by the National Department of Transport Infrastructure (DNIT). The municipalities were grouped by number of inhabitants: 0–20,000, 20,000–50,000 and 50,000–100,000.

32. Compromissos de Abrangência do Leilão do 5G, Anatel.

33. This refers to the 21,525 locations recognised by the Brazilian Institute of Geography and Statistics. In addition, Anatel has a database of 29,259 further locations identified from data collected in the field or requests for coverage from inhabitants.

Table 4

Auction results and in-kind obligations valuation

Band	Value offered (BRL)	Value of in-kind obligations (BRL)	Type of in-kind obligations
700 MHz	1.3 billion	2.3 billion	2,349 transport routes totalling more than 36,000 km
3500 MHz (national)	145 million	22.7 billion	-5G in 1,174 municipalities of more than 30,000 inhabitants -5G in 4,396 municipalities of fewer than 30,000 inhabitants with at least one operator -530 municipal offices with fibre-optic backhaul
3500 MHz (regional)	1.8 billion	6.0 billion	
2300 MHz [block of 50]	1.1 billion	4.9 billion	Coverage in 7,430 municipalities with 4G or higher technology
2300 MHz [block of 40]	653.0 million	2.8 billion	
26 GHz band	8.0 million	3.4 billion	Connectivity in primary and secondary schools
Total R$	5.0 billion	42.1 billion	
Total USD	USD 1.0 billion	USD 8.1 billion	

Source: Anatel

Specific pricing was carried out based on this analysis, and the valuation was performed using the capex and opex cashflow forecast, deducting potential revenue. The spectrum and obligations were valued using a business model of an efficient new entrant.[34] To calculate network costs, the regulator estimated the average deployment cost of a base station at about USD185,000. The base value of the band was determined linearly from the sum of the estimated value of the in-kind obligations and a cash payment, estimated using the business model of a new entrant in the market.

The economic value of the auction was almost USD9 billion, 90% of which had to be invested in coverage commitments to 2030, while the remaining 10% was an upfront payment used as revenue for federal government. Some of the commitments will be implemented directly by operators (e.g. deploying 4G and 5G in populated areas and on roads), while others will be paid to the 3500 MHz Spectrum Management Entity, which is responsible for deploying some of the obligations of the 5G auction (e.g. migration of the TVRO service to the Ku band).

34. Consideration of a new entrant is by order of the *Tribunal de Cuentas de la Unión* (TCU – Federal Court of Accounts), to ensure all interested parties have unrestricted access. The value of spectrum for a new entrant, mainly because of its scale, will be less than for an incumbent, and compliance with the in-kind obligations (especially obligations to cover remote areas) will be higher for a new entrant than for an incumbent. Numerous factors determine this, such as the incremental costs to a new entrant for compliance with in-kind obligations due to the lack of a legacy access network (2G/3G), greater barriers to access the transport network, lack of local knowledge of the mobile business, and the need to implement wholesale agreements.

3.3

Peru (2023 and 2025)

2023: AWS-3 and 2300 MHz

Overview

The 2023 assignment in Peru was the second round of the 2021 auction, in which no spectrum was assigned. After a review of the technical specifications, valuation techniques and compliance terms, three of the four operators in the market submitted bids and all the spectrum put up for auction was awarded.

The licence extension was for 20 years, and the assignment format was the simultaneous first-price sealed auction. The assignment process offered 60 MHz in AWS-3 (nationally, two blocks of 2×15 MHz) and 30 MHz in the 2300 MHz band.

Regulations allowed operators to use all their spectrum holdings, or third-party spectrum, to comply with the Mandatory Investment Commitments (MICs). The base station infrastructure for MIC compliance could be the operator's own or that of a third party, through co-location or leasing. The terms and conditions of the assignment process stated that the payment alternative was solely by deployment of the MIC.

The obligations included in the auction required operators to provide mobile services using 4G LTE-A or higher access technology to users in unserved municipalities, or upgrade services to 4G in municipalities with existing 2G or 3G coverage.

The measures benefitted 3,825 locations[35] (2,057 with no existing service and 1,768 where technology was updated to 4G), reaching around 1 million people. Deployment was almost entirely confined to the first two years, with more than 85% of municipalities to be covered in the first year and the remaining 15% in the second year. Final completion was required no later than four years after the spectrum assignment.

Value of in-kind obligations

Government authorities have acknowledged that requirements for investing in and operating mobile infrastructure vary considerably depending on the terms of each in-kind obligation, or each population in this case, and various approaches are needed. Municipalities were classified based on the state of mobile coverage indicated in the latest reports that operators submitted to the regulator (2G, 3G or no coverage) and the access conditions in each area (the existence of roads or trails, and their state of repair). Following that methodology, eight categories were identified.

The annual capex (initial and recurring) and opex required to provide 4G services in each type of location were estimated using a comprehensive costing of the physical infrastructure, equipment, services and activities needed to deploy and operate the infrastructure in question.[36] Lastly, the regulator estimated the net present value for each location type using a discounted cashflow analysis, including the potential revenue[37] for the operator that could be generated with the infrastructure.

35. The Ministry of Transport and Communications (MTC) had previously identified 7,449 unserved locations. After the assignment process, 3,624 locations remained unserved.
36. Active base station and radiating system equipment; type of support infrastructure; types of backhaul link required; availability of electric energy; and the services associated with site deployment and operation (land, permits, installation, initial tuning, supervision, maintenance, management, etc.).
37. Estimated from the average population in each location type and the ARPU in rural areas of Peru.

Table 5

Types and number of locations for in-kind obligations

Band	AWS-3
Expected revenue USD	214,200,145
MHz	60
Blocks	2
Revenue per block USD	107,100,073
Minimum score required per block	8,833
Value of each point in USD	12,125

Band	2300 MHz
Expected revenue USD	77,189,242
MHz	30
Blocks	1
Revenue per block USD	77,189,242
Minimum score required per block	5,257
Value of each point in USD	14,682

Type	Description	Locations included	Score by location	Value by location in AWS-3 (USD)	Value by location in 2300 MHz (USD)	Average value by location (USD)	Average value weighted by location (USD)
Type 1	Unserved (greenfield) and terrestrial access in good state of repair	691	18.8898	229,037	277,343	253,190	249,270
Type 2	Unserved (greenfield) and terrestrial access in poor state of repair	2,005	21.5972	261,863	317,093	289,478	284,996
Type 3	Unserved (greenfield) and terrestrial access by special transport (e.g. by mule)	1,376	29.3312	355,637	430,645	393,141	387,054
Type 4	Unserved (greenfield) without land access (fluvial or aerial)	745	45.5740	552,579	669,124	610,852	613,940

Type	Description	Locations included	Score by location	Value by location in AWS-3 (USD)	Value by location in 2300 MHz (USD)	Average value by location (USD)	Average value weighted by location (USD)
Type 5	Existing coverage (upgrade) and terrestrial access in good state of repair	650	6.8838	83,465	101,069	92,267	90,839
Type 6	Existing coverage (upgrade) and terrestrial access in poor state of repair	1.392	7.7912	94,467	114,392	104,429	102,813
Type 7	Existing coverage (upgrade) and terrestrial access by special transport (e.g. by mule)	429	11.1418	135,093	163,586	149,339	147,027
Type 8	Existing coverage (upgrade) with	161	16.1037	195,255	236,437	215,846	212,504

Source: ProInversion

Using this criteria, the terms and conditions of the auction published by the Agency for the Promotion of Private Investment (ProInversion) established a minimum score for each spectrum block on which operators could increase the number of locations, in addition to a score for each location type.

With this format, the total estimated investment was USD640 million – almost twice the amount of the expected revenue indicated by ProInversion in its promotional campaign. In the AWS-3 band, investment commitments totalling USD450 million were made to cover 2,640 locations. In the 2300 MHz band, commitments totalling USD190 million were made to deploy 4G in 1,185 locations. The total value of the spectrum was paid with in-kind obligations.

In 2018, Peru published a regulatory framework[38] that encouraged infrastructure expansion and recognised operator investments as part of the recurrent spectrum usage fees. MTC defined the amounts to be recognised for deploying new 4G infrastructure or upgrading 2G or 3G networks in rural areas. The amounts vary depending on the type of infrastructure (macro cell or small cell) and backhaul link (microwave, fibre or satellite); they increase when additional hops are needed using microwave or photovoltaic systems. The value recognised for capex and two years of opex[39] for a base station is approximately USD179,000 for a macro cell (covering at least two locations) and USD120,000 for a small cell; for a technology upgrade, the amount is USD75,200.

38. Supreme decree 001-2024-MTC.
39. Exchange rate: USD1 = PEN3.6

2025: 5G in Peru

Overview

MTC offered 500 MHz in the 3500 MHz band, to be assigned in a beauty contest format, in which operators bid for blocks by offering a combination of deployment obligations to provide service to a list of municipalities, transport routes and government institutions, and reallocate existing spectrum holders in this band.

MTC grouped the bandwidth offered into five 100 MHz blocks, with a valuation estimated at USD126 million per block. The block would be assigned to each operator after the second round of bidding, and the value of the block would be paid in full with in-kind obligations.

The auction comprised two rounds of bidding. In the first round, operators had to bid for each lot, indicating the number of additional obligations above the stipulated minimum. MTC would then choose the best offer for each lot (i.e. the bid that included the highest number of municipalities to cover).

Table 6

Minimum investment commitments per lot

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Municipalities	446	380	403	382	443
Transport routes (in km)	552	654	706	599	481

Source: MTC

The second round of bidding was held to determine the sequence for operators to select their preferred spectrum blocks. The sequence depended on the combination of additional investment commitments initially submitted by operators to provide outdoor 5G coverage at universities, Pan American Games venues, hospitals and education centres.

With regard to the deployment timeline, the terms stipulated that at least 25% of the commitments had to be completed within one year of the assignment, and all commitments had to be completed within four years. For Pan American Games venues, the deadline was 18 months; for health and education facilities, it was two years.

Value of in-kind obligations

The valuation mechanism in this process was different from the one used in the 2023 auction. MTC defined 36 types of deployment, based on cell type, access type, energy supply and type of link, among others.

Then, each type of deployment was valued by the capex, opex and potential revenue. Operators had to determine their combination of municipalities and specify one of the 36 types for each location.

Table 7

Greenfield base station configurations

Type	Deployment value year 1 (USD without VAT)	Deployment value year 2 (USD without VAT)	Deployment value year 3 (USD without VAT)	Deployment value year 4 (USD without VAT)
Macrocell – Easy (road) – Microwave – Commercial	288,924	265,664	243,825	223,292
Macrocell – Easy (road) – Fibre – Commercial	318,892	293,120	268,937	246,219
Macrocell – Easy (road) – Satellite – Commercial	428,559	399,763	372,526	347,206
Macrocell – Easy (road) – Fibre – Photovoltaic	361,873	332,823	305,584	280,015
Macrocell – Easy (road) – Microwave – Photovoltaic	331,906	305,368	280,472	257,088
Macrocell – Easy (road) – Satellite – Photovoltaic	471,541	439,467	409,173	381,002
Macrocell – Medium (terrestrial–animal traction) – Microwave – Commercial	356,993	327,783	300,394	274,686
Macrocell – Medium (terrestrial–animal traction) – Microwave – Photovoltaic	399,974	367,487	337,041	308,482
Macrocell – Medium (terrestrial–animal traction) – Satellite – Commercial	496,628	461,882	429,096	398,601
Macrocell – Medium (terrestrial–animal traction) – Satellite – Photovoltaic	539,609	501,586	465,743	432,397
Macrocell – Medium (terrestrial–animal traction) – Fibre – Commercial	386,960	355,238	325,507	297,614
Macrocell – Medium (terrestrial–animal traction) – Fibre – Photovoltaic	429,942	394,942	362,154	331,410
Macrocell – Difficult (aerial/fluvial) – Microwave – Commercial	536,091	493,523	453,676	416,349
Macrocell – Difficult (aerial/fluvial) – Microwave – Photovoltaic	579,073	533,227	490,323	450,145
Macrocell – Difficult (aerial/fluvial) – Satellite – Commercial	675,726	627,622	582,378	540,264

40. General sales tax, levied at a rate of 18% on the final consumption of goods, services, construction contracts and imports.

Type	Deployment value year 1 (USD without VAT)	Deployment value year 2 (USD without VAT)	Deployment value year 3 (USD without VAT)	Deployment value year 4 (USD without VAT)
Macrocell – Difficult (aerial/fluvial) – Satellite – Photovoltaic	718,708	667,326	619,025	574,060
Macrocell – Difficult (aerial/fluvial) – Fluvial – Commercial	683,326	634,710	588,988	546,429
Macrocell – Difficult (aerial/fluvial) – Fluvial – Photovoltaic	726,308	674,414	625,635	580,225
Small cell – Easy (road) – Fibre – Commercial	238,414	219,053	200,850	183,709
Small cell – Easy (road) – Microwave – Commercial	208,446	191,598	175,737	160,781
Small cell – Easy (road) – Satellite – Commercial	348,081	325,696	304,439	284,696
Small cell – Easy (road) – Fibre – Photovoltaic	281,395	258,757	237,497	217,505
Small cell – Easy (road) – Microwave – Photovoltaic	251,428	231,301	212,384	194,577
Small cell – Easy (road) – Satellite – Photovoltaic	391,063	365,400	341,086	318,492
Small cell - Medium (terrestrial-animal traction) – Fibre – Commercial	287,637	263,959	241,728	220,831
Small cell – Medium (terrestrial-animal traction) – Microwave - Commercial	257,670	236,503	216,616	197,904
Small cell – Medium (terrestrial–animal traction) – Microwave – Photovoltaic	300,651	276,207	253,263	231,699
Small cell – Medium (terrestrial–animal traction) – Satellite – Commercial	397,305	370,602	345,317	321,818
Small cell – Medium (terrestrial–animal traction) – Satellite – Photovoltaic	440,286	410,306	381,964	355,614
Small cell – Difficult (aerial/fluvial) – Microwave – Commercial	413,568	380,295	349,118	319,876
Small cell – Difficult (aerial/fluvial) – Microwave – Photovoltaic	456,550	419,999	385,765	353,672
Small cell – Difficult (aerial/fluvial) – Satellite – Commercial	553,203	514,394	477,819	443,790
Small cell – Difficult (aerial/fluvial) – Satellite – Photovoltaic	596,185	554,098	514,466	477,586
Small cell – Difficult (aerial/fluvial) – Fluvial – Commercial	560,803	521,482	484,430	449,955
Small cell – Difficult (aerial/fluvial) – Fluvial – Photovoltaic	603,785	561,186	521,077	483,751

Source: Bases del Concurso, MTC

Table 8

Upgraded base station configurations

Type	Deployment value year 1 (USD without VAT)	Deployment value year 2 (USD without VAT)	Deployment value Year 3 (USD without VAT)	Deployment value year 4 (USD without VAT)
Macrocell – Easy (road) – Microwave – Commercial	103,028	95,500	88,376	81,619
Macrocell – Easy (road) – Fibre – Commercial	158,289	146,058	134,549	123,701
Macrocell – Easy (road) – Satellite – Commercial	267,957	252,702	238,138	224,688
Macrocell – Easy (road) – Fibre – Photovoltaic	220,144	203,014	186,935	171,826
Macrocell – Easy (road) – Microwave – Photovoltaic	164,882	152,455	140,763	129,744
Macrocell – Easy (road) – Satellite – Photovoltaic	329,811	309,657	290,524	272,813
Macrocell – Medium (terrestrial–animal traction) – Microwave – Commercial	124,854	115,585	106,837	98,565
Macrocell – Medium (terrestrial–animal traction) – Microwave – Photovoltaic	186,709	172,540	159,223	146,690
Macrocell – Medium (terrestrial–animal traction) – Satellite – Commercial	289,783	272,786	256,598	241,634
Macrocell – Medium (terrestrial–animal traction) – Satellite – Photovoltaic	351,638	329,742	308,985	289,758
Macrocell - Medium (terrestrial–animal traction) – Fibre – Commercial	180,115	166,143	153,009	140,647
Macrocell - Medium (terrestrial–animal traction) – Fibre –Photovoltaic	241,970	223,099	205,396	188,772
Macrocell – Difficult (aerial/fluvial) – Microwave – Commercial	160,868	149,055	137,935	127,450
Macrocell – Difficult (aerial/fluvial) – Microwave – Photovoltaic	222,723	206,010	190,321	175,575
Macrocell – Difficult (aerial/fluvial) – Satellite – Commercial	325,797	306,257	287,696	270,519
Macrocell – Difficult (aerial/fluvial) – Satellite – Photovoltaic	387,652	363,212	340,082	318,644
Macrocell – Difficult (aerial/fluvial) – Fluvial – Commercial	333,397	313,345	294,307	276,684
Macrocell – Difficult (aerial/fluvial) – Fluvial – Photovoltaic	395,252	370,300	346,693	324,809
Small cell – Easy (road) – Fibre – Commercial	134,144	123,748	113,948	104,696
Small cell – Easy (road) – Microwave – Commercial	78,883	73,189	67,776	62,614

Type	Deployment value year 1 (USD without VAT)	Deployment value year 2 (USD without VAT)	Deployment value Year 3 (USD without VAT)	Deployment value year 4 (USD without VAT)
Small cell – Easy (road) – Satellite – Commercial	243,812	230,391	217,537	205,683
Small cell – Easy (road) – Fibre – Photovoltaic	195,999	180,703	166,335	152,821
Small cell – Easy (road) – Microwave – Photovoltaic	140,738	130,145	120,162	110,739
Small cell – Easy (road) – Satellite – Photovoltaic	305,667	287,346	269,924	253,808
Small cell – Medium (terrestrial-animal traction) – Fibre –Commercial	152,148	140,293	129,133	118,612
Small cell – Medium (terrestrial-animal traction) – Microwave – Commercial	96,887	89,734	82,961	76,530
Small cell – Medium (terrestrial–animal traction) – Microwave – Photovoltaic	158,742	146,690	135,347	124,655
Small cell – Medium (terrestrial–animal traction) – Satellite –Commercial	261,816	246,936	232,722	219,599
Small cell – Medium (terrestrial–animal traction) – Satellite – Photovoltaic	323,670	303,892	285,109	267,724
Small cell – Difficult (aerial/fluvial) – Microwave – Commercial	129,099	119,678	110,788	102,384
Small cell – Difficult (aerial/fluvial) – Microwave – Photovoltaic	190,954	176,633	163,174	150,509
Small cell – Difficult (aerial/fluvial) – Satellite – Commercial	294,028	276,879	260,549	245,453
Small cell – Difficult (aerial/fluvial) – Satellite – Photovoltaic	355,883	333,835	312,936	293,577
Small cell – Difficult (aerial/fluvial) – Fluvial – Commercial	301,628	283,967	267,160	251,618
Small cell – Difficult (aerial/fluvial) – Fluvial – Photovoltaic	363,483	340,923	319,546	299,743

With this configuration, four of the five predefined lots were assigned, leaving one unassigned. As a result, coverage was extended to 1,651 mandatory municipalities, plus 305 additional municipalities that were included as part of the bidding process. Coverage was also extended to more than 2,200 km of transport routes and 1,664 additional deployments (venues for the Pan American Games and education/health centres).

Based on the valuation and the combination of obligations, the estimated minimum investment was USD500 million and coverage expansion that would take the service to 140,000 new users across the country.

3.4

Colombia (2019 and 2023)

The 2023 assignment process consolidated the payment of licences with in-kind obligations. It was a considerable improvement on the 2019 auction in terms of technical specifications, valuation techniques, overall format and requests for guarantees. However, barriers remained and the outcome was mixed, with good assignment of the 3.5 GHz band but only a few low bids for the remaining spectrum.

2019: 700 MHz, 2500 MHz and remaining spectrum in 1900 MHz

Overview

The 2019 process awarded spectrum licences for 20 years, using a simultaneous multiple-round ascending auction format. The Ministry of Information and Communications Technologies (MINTIC) offered up to 90 MHz in the 700 MHz band, 5 MHz in the 1900 MHz band and up to 80 MHz in the 2500 MHz band. All frequencies were with national coverage.

In the terms of the auction, the regulator listed 5,766 municipalities eligible for assignment of the 700 MHz band, and 3,658 unserved areas were chosen from the list. Technology upgrade was included as an additional obligation in areas covered by legacy technologies. Licence holders also had to meet mandatory obligations to deploy connectivity in 312 education centres and provide more than 560,000 tablets for underprivileged students.

Value of in-kind obligations

The 5,766 municipalities eligible for assignment of the 700 MHz band were grouped into three types (1, 2 and 3). Operators had to indicate the municipalities chosen and a deployment deadline of up to five years in each case. Using this combination of location type and timelines, the regulator applied a formula to evaluate the bundle of obligations and cash payment each operator had bid. The terms of the auction did not stipulate a valuation for the site[41] but indicated a weighting[42] by the type, where type 1 had the highest valuation and type 3 had the lowest. In addition, the index valued the number of municipalities to cover rather than the number of sites to deploy. The challenge of this method for operators was to obtain the highest number of municipalities per site and thus achieve the highest possible score with the lowest possible investment.[43]

41. Each operator had to define their pricing based on their trading conditions, scale, network architecture in operation, and coverage achieved with the guarantee.
42. The parameter Zj was the weighting factor in question. The value for type 1 municipalities was 1,459; for type 2 it was 1,167; and for type 3 it was 292.
43. Although the municipalities were grouped by level of complexity, all municipalities in a single level were assigned the same value.

Figure 7

Bid evaluation formula

$$Index = A * [Value\ bid_{700\ MHz}] + B * \left[\sum_{i=1}^{5}\sum_{j=1}^{3} z_j * \frac{Locations_{ji}}{Locations_{j\ total}} * \frac{1}{(1+x\%)^{i-1}}\right]$$

Source: MINTIC

The assignment process also included mandatory investment obligations to deploy connectivity services in 312 schools.

The auction resulted in assignment of 80 MHz of the 90 MHz offered in the 700 MHz band, extending coverage to 3,658 of the 5,766 municipal administrations listed (slightly more than 60%). The total economic value of the 700 MHz band was approximately USD1.3 billion, with investment commitments accounting for just over USD670 million (52%).

Table 9

Coverage obligations by frequency band

Band	MHz assigned	Value offered (USD)	Total value payable in obligations (USD)	Obligation as a percentage of the value offered	In-kind obligations
700 MHz	80	1.3 billion	673 million	52%	3,658 municipal administrations
2.500 MHz	50	331 million		0%	No obligations
Total	130	1.6 billion	673 million	31%	

Source: MINTIC

In the 2500 MHz band, the 50 MHz put up for auction was assigned, with bids reaching USD330 million.[44] No bids were received for the 1900 MHz band.

44. This does not include WOM´s bid for a 10 MHz spectrum block. The operator asked to withdraw from this block due to a typographical error when entering the figure for the cash bid. No judgment has been rendered so far.

2023: 5G in Colombia and remaining spectrum in 700, 1900 and 2500 MHz

Overview

At the end of 2023, the terms of the auction in the 700, 1900, 2500 and 3500 MHz bands were published. The auction was held on 20 December.

The licence extension was for 20 years. The assignment process combined two auction formats: the simple clock auction with reserve price and a simultaneous multiple round auction.

The spectrum up for auction comprised one 10 MHz block in 700 MHz, one 10 MHz block in 1900 MHz, three 10 MHz blocks in AWS Extended, three 10 MHz blocks in 2500 MHz, and up to four 80 MHz blocks in 3500 MHz.

The process included IMT coverage obligations in unserved municipalities, using any spectrum band for which operators held a licence in the municipalities assigned. It also included IMT coverage commitments on 61 primary roads and 41 secondary roads within an 18-month deadline. Obligations were added in 2,326 education centres for licence holders with blocks in the 1900 and 2500 MHz bands, while other operators were offered deployment of fibre-optic infrastructure in rural areas.[45] In 3500 MHz, each operator was required to deploy a minimum number of base stations, providing 5G coverage in department capitals and municipalities with populations of more than 200,000.

Value of in-kind obligations

Since 2023, all in-kind obligations associated with 4G technology that are included in MINTIC auctions[46] must follow the procedure set in MINTIC Decision 3617/2023. The methodology includes an efficient cost model that reflects the maximum values of operators' capex and opex, and other inputs and technical, macroeconomic and financial parameters used to determine the discounted cashflow resulting from performing the obligations.

The size of the beneficiary population is quantified using georeferenced data of the population, area or institution to benefit from the service. The sociodemographic and economic information available is used to confirm whether the population, area or location has a commercial electrical energy service, either from an electrical power plant or alternative energy sources. The beneficiaries are then grouped by department and municipality and classified into three types of difficulty of access (easy, difficult and complicated).

The new infrastructure solutions have six technical components (civil works, commercial energy supply, radiofrequency sectors, solar energy supply, electrical energy supply, and transmission by microwave, optical fibre or satellite), but omit various elements that operators need to reach remote areas.[47] The

45. The licensed operator will have to deploy fibre-optic networks to provide internet service to specific education centres, allow third parties to use the available fibre infrastructure, and maintain and operate the solutions implemented for the duration of the licence (20 years). The project reflects the operator's capex for the fibre-optic sections, estimated based on the costs of a 10-km backbone. The five-year opex for the sections includes oversight and management. The project also reflects the value of the internet access service in education centres and possible commercial use of the fibre deployed for other services in communities near the proposed solution.

46. MINTIC Decision 3617/2023 is the legislation that establishes the methodology, procedure and requirements for defining, submitting, authorising, executing, quantifying, verifying and recognising in-kind obligations with 4G technology, primarily to benefit poor, vulnerable populations in the remotest parts of Colombia.

47. The types do not include extension/renewal of the transmission network from the optimum point to the new node under the obligation or other costs such as easements, transport and other unforeseen circumstances occurring in rural areas.

result is nine types of new base station deployment on land sites and roads.[48] For upgrades, three types of deployment are included.[49] MINTIC allows the use of an indexing factor to consider the temporal evolution of the costs of the various mobile infrastructure solutions associated with the in-kind obligations.[50]

Despite progress recognising in-kind obligations as payment for spectrum, MINTIC regulations still include detailed review criteria that hamper and delay effective recognition of the investments made.

Apart from the costs reflected in MINTIC Decision 3617/2023, the spectrum valuation includes the capex and opex of projects for fibre deployment to education centres for five years (despite the 20-year obligation), the monthly value of the internet service to education centres, and the possibility of commercially operating the fibre network deployed.[51]

Table 10

Capex and opex by type of solution

Infrastructure solutions with microwave transmission					
Solution number	**Infrastructure**	**Type of access**	**Type of energy**	**Capex (USD)**	**Annual opex (USD)**
1	Tower 30m or taller	Type 1, easy access	Commercial	169,354	4,311
2	Tower 30m or taller	Type 1, easy access	Diesel	177,472	6,942
3	Tower 30m or taller	Type 1, easy access	Solar panel	181,917	5,474
4	Tower 42m or taller	Type 2, difficult access	Commercial	271,301	8,152
5	Tower 42m or taller	Type 2, difficult access	Diesel	292,687	15,043
6	Tower 42m or taller	Type 2, difficult access	Solar panel	288,556	12,392
7	Tower 60m or taller	Type 3, complicated access	Commercial	451,304	18,446
8	Tower 60m or taller	Type 3, complicated access	Diesel	451,304	49,544
9	Tower 60m or taller	Type 3, complicated access	Solar panel	560,929	27,669

48. The valuation of deployments on roads does not include opex.
49. As with roads, the valuation of upgrades does not include opex. Investments in civil works and transmission to adapt a tower to the new technology are not included either.
50. Currently stipulated in MINTIC Decision 3227/2023. It should be noted that the indexing schemes vary with the licences, creating distortions and asymmetries between licences.
51. This is becoming unlikely, especially in the case of deployment in sparsely populated areas with low purchasing power and minimal uptake of technology.

Infrastructure solutions with fibre-optic transmission					
Solution number	Infrastructure	Type of access	Type of energy	Capex (USD)	Annual opex (USD)
1	Tower 30m or taller	Type 1, easy access	Commercial	144,512	3,579
2	Tower 30m or taller	Type 1, easy access	Diesel	152,724	6,313
3	Tower 30m or taller	Type 1, easy access	Solar panel	157,565	4,788
4	Tower 42m or taller	Type 2, difficult access	Commercial	279,374	8,879
5	Tower 42m or taller	Type 2, difficult access	Diesel	301,597	14,321
6	Tower 42m or taller	Type 2, difficult access	Solar panel	284,754	10,268
7	Tower 60m or taller	Type 3, complicated access	Commercial	536,661	25,655
8	Tower 60m or taller	Type 3, complicated access	Diesel	536,661	57,967
9	Tower 60m or taller	Type 3, complicated access	Solar panel	650,561	35,239

Infrastructure solutions with satellite transmission					
Solution number	Infrastructure	Type of access	Type of energy	Capex (USD)	Annual opex (USD)
1	Tower 30m or taller	Type 1, easy access	Commercial	147,084	23,021
2	Tower 30m or taller	Type 1, easy access	Diesel	155,519	20,426
3	Tower 30m or taller	Type 1, easy access	Solar panel	160,137	24,230
4	Tower 42m or taller	Type 2, difficult access	Commercial	253,976	44,104
5	Tower 42m or taller	Type 2, difficult access	Diesel	276,190	40,486
6	Tower 42m or taller	Type 2, difficult access	Solar panel	266,951	45,294
7	Tower 60m or taller	Type 3, complicated access	Commercial	441,506	60,892
8	Tower 60m or taller	Type 3, complicated access	Diesel	441,506	123,073
9	Tower 60m or taller	Type 3, complicated access	Solar panel	555,406	116,598

Infrastructure solutions involving technology upgrade			
Solution number	Infrastructure	Type of access	Capex (USD)
1	Tower 30m or taller	Type 1, easy access	53,861
2	Tower 42m or taller	Type 2, difficult access	54,103
3	Tower 60m or taller	Type 3, complicated access	56,076

Infrastructure solutions on roads				
Solution number	Infrastructure	Transmission	Type of energy	Capex (USD)
1	Tower 42m or taller	Microwaves	Commercial	158,574
2	Tower 42m or taller	Microwaves	Diesel	167,008
3	Tower 42m or taller	Microwaves	Solar panel	171,627
4	Tower 42m or taller	Fibre optic	Commercial	261,342
5	Tower 42m or taller	Fibre optic	Diesel	283,562
6	Tower 42m or taller	Fibre optic	Solar panel	279,270
7	Tower 42m or taller	Satellite	Commercial	420,060
8	Tower 42m or taller	Satellite	Diesel	420,058
9	Tower 42m or taller	Satellite	Solar panel	533,958

Source: MINTIC Decision 3617/2023

With this configuration, 320 MHz in 3500 MHz was assigned for almost USD400 million, with investment commitments for more than USD100 million. In addition, a 10 MHz block in 2500 MHz was assigned for nearly USD46 million, with obligations for nearly USD9 million.

Table 11

Results of the 3500 MHz and 2500 MHz auction

Band	MHz assigned	Value offered (USD)	Total payable in obligations (USD)	Obligations as a percentage of the value offered
3500 MHz	320	396,633,574	104,221,856	26%
2500 MHz	10	45,591,164	8,905,277	20%
Total	330	442,224,738	113,127,132	26%

Source: MINTIC

With the inclusion of in-kind obligations as a method of payment in the assignment process, operators will invest nearly USD115 million to take 5G coverage to Colombia's main cities, increase mobile broadband coverage on more than 100 roads, install optical fibre in nearly 1,100 schools with 75,000 students, and improve connectivity in places near deployments where demand for service was detected.

3.5

5G in Costa Rica (2025)

Overview

In 2024 and 2025, Costa Rica's Ministry of Science, Innovation, Technology and Telecommunications (MICITT), through the Superintendence of Telecommunications (Sutel), implemented the assignment process for IMT spectrum, entitled "Multi-stage auction to award the use and exploitation of spectrum to provide telecommunications services by implementation of International Mobile Telecommunications (IMT) systems, including 5G".

The assignment process comprised 90 MHz in 700 MHz, 100 MHz in 2300 MHz, 300 MHz in 3500 MHz and 3250 MHz in 26 GHz and 28 GHz, with spectrum caps by band.[52] The terms of the auction allowed for part of the agreed amount to be paid through investment commitments consisting exclusively of the deployment of access infrastructure units (AIUs). AIUs would bring 4G connectivity to 134 remote districts[53] and improve quality[54] in a further 354, requiring deployments and upgrades at around 3,500 base stations.

Licences were awarded for 15 years and could be extended once, for 10 years, at no extra cost. Operators bid for generic blocks in a simultaneous, multiple round ascending auction. Numerous bands were included and auctioned at the same time, though the closing rule was verified by band rather than all bands combined. This created a significant risk of exposure for operators, as when they bid for a specific band, there was no certainty about which other bands they would acquire, and they could end up with a licence for a sub-optimal package.

The assignment process was structured in two stages: a first stage for national licences and a second stage for regional licences with no IMT spectrum holdings. Each stage included two sub-stages: one for pre-selection and another for final selection, in which additional bids for assignments were made in the form of AIU.

The compliance terms of the auction allowed delays for up to 5% of the total commitment for AIU and an extension of up to three months to complete the project. After this time, a financial penalty applies, although before a sanction is imposed, the operator may file a submission to explain the delay or non-performance.[55] For cases of force majeure or inability to deploy, the operator may choose other districts from the list (i.e. districts with less than 80% mobile coverage).

52. The cap was defined as 35% of the total spectrum assigned plus the spectrum put up for auction. For the 3500 MHz band, a minimum of 100 MHz was established.
53. Most of these districts already have 3G coverage.
54. Field tests carried out by operators appeared to indicate a high requirement for average upload speed in 2300 MHz (8 Mbps). Therefore, to avoid sanctions, operators had to reduce the coverage footprint, going against the aim of extending connectivity. Sutel could revise this requirement to bring measuring systems in line with public policy goals.
55. Section 77.4.1.5.2.3 of the terms of the assignment process.

Value of in-kind obligations

The AIUs to deploy were defined by the operators following a pre-selected list of districts with less than 80% mobile coverage.[56] The aim was to cover areas that were underserved at the time of the auction, including areas with no commercial value.

To value the AIUs, Sutel conducted an appraisal using its own research and benchmark values received from operators, which included only capex elements (equipment and civil infrastructure). In addition, Sutel recognised districts with no radio base stations (3G or 4G) and districts with existing antennas requiring additional equipment to support the new bands to be assigned in this process.

One aspect that created uncertainty in the process was that the base price and number of AIUs to deploy were not disclosed until 15 days before the auction, at which point operators were notified.

Table 12

Base price per block and minimum number of AIU to deploy per block in stage 1 by national operators

Frequency band	Duplexing	Blocks put up for auction	Bandwidth per block	Base price (USD) per block	Minimum AIU to deploy per block
700 MHz	FDD	1	2x5 MHz	1,596,488	152
700 MHz	FDD	4	2x10 MHz	3,192,977	305
2300 MHz	TDD	2	50 MHz	3,064,350	293
3500 MHz	TDD	12	25 MHz	2,402,299	229
26 GHz	TDD	1	400 MHz	393,447	38
26 GHz	TDD	1	50 MHz	49,181	5
28 GHz	TDD	5	400 MHz	393,447	38

Source: Sutel

The outcome resulted in a total price of USD34 million, of which USD32.5 million was contributed by national operators[57] (Claro and Liberty Latin America), while the remaining USD1.5 million was contributed by the four regional operators that participated in stage 2. The estimated average cost per AIU was just above USD94,000.

56. Except for 700 MHz, where the list mainly focused on rural areas. The cap of 80% was defined by taking into account the minimum coverage with 3G and 4G.

57. ICE did not take part in the process because it has spectrum in 3500 MHz, with which it is already offering the technology. It exceeded the caps established.

Despite that, less than 30% of all the spectrum put up for auction with national coverage was assigned: less than half the bandwidth in 700 MHz, all the 2300 MHz band (despite the significant compliance conditions), 70% of 3500 MHz and barely 30% of the mmWave bands. This outcome was attributed to the rigorous auction structure, uncertainty caused by the last-minute publication of the prices, and strict coverage obligations.

However, national operators committed to deploying 3,104 radio base stations, and regional operators bid to invest in 200 additional stations, to be fully deployed in four years in the case of 4G and six years for obligations in 3500 MHz. Payments made through in-kind obligations accounted for 90% of the total spectrum cost, while the remaining 10% was required to be paid upfront to the National Telecommunications Fund.

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