

Facilitating 5G Deployment in The Caribbean: Strategy for creating a regulatory environment that enables access to advanced connectivity

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Abstract

The deployment of 5G technology in the Caribbean presents both significant opportunities and regulatory challenges. To ensure successful implementation, Caribbean regulators must ensure that their respective regulatory frameworks are robust and enabling, providing for efficient spectrum allocation and management, streamlined infrastructure approval processes, fit-for-purpose license conditions and strong cybersecurity regulations, all tailored to the unique economic and geographic context of the Caribbean. The paper recommends a strategic approach for regulators, prioritizing the promotion of 5G and other advanced technologies while safeguarding national interests. Central to this strategy is multi-stakeholder collaboration among governments, regulators, service providers, consumers and other telecommunications industry participants. Drawing on respective case studies from India and Spain, this paper also demonstrates the effectiveness of multi-stakeholder collaboration in 5G deployment and its potential to transform the tourism product.

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1. Overview and Context

The proliferation of smart and connected devices, along with the increasing demand for applications requiring higher bandwidth and lower latency, are key drivers behind the development of the Fifth Generation of International Mobile Communications Technology (IMT-5G, hereinafter referred to as “5G”) and other advanced technologies¹. 5G is touted as a transformative technology that enables use cases across various sectors, including healthcare, business, manufacturing, education, and national security. In the Caribbean, where tourism makes a significant contribution to the national gross domestic product (GDP) of many countries², 5G deployment has the potential to improve the tourism sector by enhancing connectivity for tourists and those business serving them, while also enabling more immersive experiences such as augmented reality (AR) and virtual reality (VR).

Overall, the socio-economic impact of 5G in the Caribbean promises to be profound, unlocking new economic opportunities, improving social services, and driving operational efficiency and innovation across many sectors. By embracing 5G, Caribbean nations can position themselves to thrive in the global digital economy while addressing critical issues such as digital inclusion and economic diversification.³

According to the GSMA, as of January 2024, 261 operators in 101 countries have launched commercial 5G services, and more than 90 operators from 64 markets have committed to 5G deployments.⁴ By September 2024, 5G networks had been reportedly deployed in 5 Caribbean countries, - Bermuda⁵, the Cayman Islands⁶, the US Virgin Islands⁷, Puerto Rico⁸ and the Dominican Republic⁹. To avoid being left behind, it is imperative that all key Caribbean stakeholders enable the successful deployment of 5G and other advanced technologies within their respective countries.

Former CEO of General Electric, Jack Welch, famously remarked *“If the rate of change on the outside exceeds the rate of change on the inside, the end is near.”* In the context of 5G and other advanced technologies, Caribbean stakeholders must proactively adopt policies and strategies

¹ “Fast-evolving networks need higher capacity and lower latency”, available at

<https://www.itu.int/hub/2022/12/fast-evolving-networks-need-higher-capacity-and-lower-latency/>

² <https://www.statista.com/statistics/814155/caribbean-total-contribution-travel-tourism-gdp-country/#statisticContainer>

³ “5G: The Driver for the Next-Generation Digital Society in Latin America and the Caribbean” available at <https://publications.iadb.org/en/5g-driver-next-generation-digital-society-latin-america-and-caribbean>

⁴ <https://www.gsma.com/newsroom/press-release/5g-momentum-continues-with-1-6-billion-connections-worldwide-rising-to-5-5-billion-by-2030-according-to-gsma-intelligence/>

⁵ [https://onecomm.bm/introducing-](https://onecomm.bm/introducing-5g/#:~:text=Bermuda's%20first%205G%20mobile%20network,than%20the%20current%204G%20capabilities.)

[5g/#:~:text=Bermuda's%20first%205G%20mobile%20network,than%20the%20current%204G%20capabilities.](https://onecomm.bm/introducing-5g/#:~:text=Bermuda's%20first%205G%20mobile%20network,than%20the%20current%204G%20capabilities.)

⁶ <https://www.ofreg.ky/news/cayman-islands-is-regional-leader-in-5-g>

⁷ <https://www.wtjx.org/blogs/local-news/its-official-tmobile-is-now-in-the-usvi/>

⁸ <https://www.nprchamber.org/news/2022/6/14/t-mobile-quickly-deploying-ultra-capacity-5g-in-puerto-rico>

⁹ <https://www.gsma.com/about-us/regions/latin-america/wp-content/uploads/2023/08/290623-5G-in-Latam-ENG.pdf>

that facilitate such deployments to ensure that the region remains competitive, innovative and attractive for investment.

Deploying 5G in the Caribbean presents challenges such as high costs associated with upgrading infrastructure and network expansion, navigating complex regulatory frameworks, and diverse economic and geographic conditions that limit accessibility and affordability in remote and uneconomic regions. Bearing this in mind, the successful deployment of 5G in the Caribbean requires the combined efforts of all key stakeholders, to overcome these challenges and create an environment conducive to widespread 5G deployment.

Governments, regulators, service providers, and consumers are key stakeholders in the successful deployment of 5G networks and services. It is crucial for regulatory bodies with oversight of electronic communications networks and services and radio spectrum (“the Regulator”) to engage with all key stakeholders - including government, relevant ministries and departments, other relevant regulatory bodies, service providers, consumers, and other industry participants to ensure that their respective regulatory frameworks are robust and supportive of 5G deployment. This paper proposes a roadmap and strategy to enable 5G deployment taking into account the roles and responsibilities of key stakeholders, key considerations for deployment and the importance of the public consultation process. It also presents case studies on India and Spain to respectively illustrate the effectiveness of multi-stakeholder collaboration and 5G’s potential to transform the tourism sector.

2. Key Stakeholders and Their Critical Roles in 5G Deployment

As highlighted, the successful deployment of 5G networks in the Caribbean hinges on multi-stakeholder collaboration, with each stakeholder group playing a critical role. For the Regulator to fulfill its mandate, it must have a thorough understanding of the key stakeholders and their respective roles to engage with them effectively. The key stakeholders and their responsibilities are outlined below.

Government – The Government is responsible for setting strategic economic, social, and technological goals for 5G deployment. Its duties include:

- *Policy Development* – creating policies that promote 5G deployment.
- *Investment Incentives* – offering incentives to stimulate investment in 5G networks and services.
- *Digital Inclusion* - adopting innovative policies and implementing strategies to ensure that 5G and other advanced connectivity solutions reach rural, underserved, uneconomic, and unserved areas, promoting both domestic and foreign investment in all regions.

The Regulator – The Regulator’s role is to establish a robust regulatory framework that aligns with the Government’s strategic goals and policy objectives. This framework should ensure¹⁰:

- Efficient Spectrum Allocation;
- Spectrum Pricing and Assignment;
- Streamlined Infrastructure Approval;
- Relevant Licence Conditions and Regulatory Measures;
- Infrastructure and Network sharing (where feasible);
- Network Security;
- Consumer Education; and
- Health and Safety Mitigation.

Service providers – Service providers are responsible for making strategic investments in network infrastructure to ensure the availability of high-quality 5G and other advanced internet technologies to meet the demands of their customers and any relevant regulatory obligations. Moreover, Service providers should:

- *Make Infrastructure Investments* – Building and upgrading their network infrastructure.
- *Improve Operational Efficiency* – Leveraging 5G investment for competitive advantages.¹¹
- *Be Transparent* – Engage with the Government and the Regulator on their needs in a clear and candid manner and provide useful feedback on how these entities can support 5G deployment.

Consumers – Consumers drive demand for 5G and other advanced internet technologies by providing valuable information that fosters improvement. In this context, Consumers should:

- *Provide Feedback on Service Quality* - Informing Service Providers and the Regulator about their needs for higher bandwidth and lower latency.
- *Demand Innovation* – Encouraging continuous improvement and innovation by creating new use cases for 5G technology.

¹⁰ Discussed further in section 3 of this paper.

¹¹ GSMA “5G-era Mobile Network Cost Evolution” available at https://www.gsma.com/solutions-and-impact/technologies/networks/gsma_resources/5g-era-mobile-network-cost-evolution/

3. Key Considerations for Successful 5G Deployment

The successful deployment of 5G networks in the Caribbean requires Regulators to identify all relevant matters and engage meaningfully with key stakeholders. By doing so, deployments can be efficient, secure, and aligned with national interests, international agreements and best practices. In this section, several key matters that should be addressed in the roadmap to enable 5G deployment will be discussed. It is important to note that Regulators should remain open to additional considerations raised by stakeholders.

Efficient and Fair Spectrum Allocation and Management

Spectrum is a finite resource that is paramount to the deployment of 5G. Service providers need access to adequate spectrum, primarily in the low¹² and mid bands¹³ and in some cases the high band¹⁴ to deliver 5G services. In recognition of this need and in alignment with industry best practices¹⁵, the Regulator must ensure sufficient spectrum allocation, allowing Service providers to meet growing demands. Furthermore, Regulators should consider whether spectrum should be allocated to accommodate specialized use cases, including Private 5G Networks¹⁶, in line with international agreements¹⁷ and the Government's policy objectives.

Appropriate Spectrum Pricing and Assignment Methods

The Regulator must balance 5G spectrum pricing with the economic, social and technological policy objectives of the Government. Spectrum can either be priced to maximize revenue through auctions¹⁸ or to promote social benefits, such as digital inclusion in rural and uneconomic areas, by setting lower prices¹⁹. Administrative assignments²⁰ or beauty contests²¹ (i.e., comparative selections) may be employed to encourage deployment in rural and uneconomic regions.

¹² Less than 1GHz

¹³ 1GHz–6GHz

¹⁴ 24GHz–40GHz

¹⁵ GSMA “Spectrum Policy Trends 2023” available at <https://www.gsma.com/connectivity-for-good/spectrum/wp-content/uploads/2023/02/Spectrum-Policy-Trends-2023-1.pdf>

¹⁶ <https://www.nokia.com/about-us/news/releases/2024/07/01/nokia-and-telefonica-collaborate-to-develop-the-private-network-market/>

¹⁷ Such as the Final Acts of the World Radiocommunications Conference 2023

¹⁸ In October 2021, the Dominican Republic raised over \$73 million from 5G spectrum auctions. <https://developingtelecoms.com/telecom-technology/wireless-networks/12422-altice-dominicana-commences-5g-deployment.html>

¹⁹ In India, the TRAI recommended that spectrum prices for 5G be lowered. <https://www.fierce-network.com/5g/indian-government-modestly-reduces-5g-spectrum-reserve-prices>

²⁰ Regulator should consider the amount of available spectrum and the amount of service providers seeking to acquire such spectrum to determine whether this method is feasible

²¹ Applicants should be evaluated on qualitative criteria beyond the financial bid

Streamlined Infrastructure Approval Processes

Regulators should review and amend regulatory measures regarding cell/tower site approval processes to minimize barriers that may delay 5G deployment. Coordination with Government ministries responsible for public works and town planning is essential to streamline infrastructure approval processes.

License Conditions and Regulations

Regulators must ensure that licenses and regulatory measures impose coverage obligations, quality of service requirements, performance bonds and any other requirement necessary to create a conducive regulatory environment for successful 5G deployment. Any regulatory gaps should be addressed to align with the Government's policy objectives.

Infrastructure sharing²² and Network Sharing

Infrastructure sharing can significantly reduce deployment costs, particularly in rural and uneconomic regions. Regulators should consider mandating infrastructure sharing where technically and economically feasible to accelerate deployment and mitigate any adverse impact of 5G network deployment on the environment. Network sharing among Service providers²³ can also reduce the financial burden of infrastructure deployment in uneconomic and rural areas, where it is appropriate to do so²⁴.

Vendor Selection and Network Security

Given that electronic communications networks and services are critical infrastructure, vendor selection and network security are paramount. Regulators should promote the use of trustworthy vendors, considering geopolitical and national security implications. As 5G enables the use of more smart and connected devices, the network surface areas of Service providers will increase, leading to more points of vulnerability²⁵. Consequently, robust cybersecurity frameworks are necessary to ensure network confidentiality, integrity and availability, requiring Service providers to report cyber incidents and implement safeguarding measures in line with international best practices²⁶.

²² (i.e., sharing of passive infrastructure such as towers, ducts, and site facilities)

²³ (i.e., sharing of active network elements such as RAN, and antennas)

²⁴ The regulator should bear in mind collusion concerns and loss of redundancy in the event of disaster and outages.

²⁵ Trend Micro "The Telecoms Cyber Threat Landscape in 2021" available at

https://www.trendmicro.com/en_se/research/22/b/the-telecoms-cyber-threat-landscape-in-2021.html

²⁶ Such as ENISA and ISO/IEC 27001

Health Concerns and Aviation Safety Concerns

Concerns have been raised about increased exposure to electromagnetic fields in the context of 5G. Although The World Health Organization deems non-ionizing radiation²⁷, within recommended limits safe²⁸, the Regulator should consider mandating that all 5G deployments and other electronic communications networks adhere to the International Commission on Non-Ionizing Radiation Protection (“ICNIRP”) Guidelines for limiting exposure to electromagnetic fields (100 kHz to 300 GHz). Additionally, Regulators should consider conducting public awareness/education campaigns to help address health concerns.

Aviation authorities have raised concerns about potential harmful interference with radio altimeters from mid-band spectrum usage²⁹ for 5G³⁰. Regulators must collaborate with aviation authorities to devise measures that mitigate harmful interference and ensure compliance with international safety standards.

4. Engaging Stakeholders in the 5G Deployment Roadmap

To facilitate meaningful engagement with all key stakeholders, the Regulator should design a transparent, inclusive and collaborative consultation process, adhering to any relevant laws and the principles of natural justice. The stages of this proposed consultation process are detailed below.

Pre-consultation meetings

Pre-consultation meetings provide an opportunity for the Regulator to foster and maintain engagement with key stakeholders. Conducting these meetings early in the consultation allows for the identification and resolution of key matters. These meetings are also essential for building consensus and ensuring that the consultation is robust, comprehensive and effective. Bearing this in mind, the Regulator should hold pre-consultation meetings with the Government, Service providers, relevant ministries and departments, other relevant regulatory bodies and other relevant industry participants. A clear agenda should be set for these meetings, focusing on engaging in discussion on relevant matters, while gathering stakeholder feedback to inform the consultation document.

²⁷ 5G spectrum falls within the part of the electromagnetic spectrum that causes non-ionizing radiation

²⁸ ICNIRP Guidelines on Limiting Exposure to Electromagnetic Fields

²⁹ i.e., 3.7GHz to 4.2GHz

³⁰ ICAO “Potential Safety Concerns due to Interference from 5G to Aeronautical Radio Altimeters” available at https://www.icao.int/MID/Documents/2023/WRC-23%20and%20FSMP-SG17/FSMP-WG17-WRC23WrkShp41_Rev%20ICAO-%20Safety%20Concerns%20due%20to%20Interference%20from%205G_Radio%20Altimeters.pdf

Consumer Focus Group meetings

The Regulator should organize focus group meetings with consumers to gather qualitative insights about their perceptions, expectations, concerns, demands and use cases for 5G to inform the consultation document. These meetings should involve a diverse group of participants from different demographic backgrounds and key industries. The focus groups should be moderated by an experienced facilitator, with no more than 10 participants to encourage open and meaningful discussions. The insights gained will help shape the consultation document and ensure that it reflects the views and needs of the public.

Drafting and Issuing The Consultation Document

Following the pre-consultation meetings and consumer focus groups, the Regulator should develop a comprehensive consultation document. This document should include:

- the purpose and context of the consultation;
- the key considerations for 5G deployment;
- next steps in the process; and
- questions to solicit feedback from the public and interested parties.

The consultation document should be published in a manner that ensures that all stakeholders have a reasonable opportunity to submit their comments and, in any event, should adhere to relevant laws and the principles of natural justice.

Review of Responses

The Regulator must carefully review all responses to the consultation document, addressing any matters and concerns raised by stakeholders and making any accepted recommended adjustments to its proposed approach. This process helps build trust and transparency and increases the likelihood of successful implementation and broad acceptance of the Final Document.

Publishing Final Document on Roadmap to enable 5G

The Final Document should be published, clearly outlining key responses to the consultation document and the Regulator's replies. The Final Document must:

- address all key matters necessary for enabling the deployment of 5G networks; and

- set out the regulatory decisions informed by the pre-consultation meetings, consumer focus group meetings, responses to the consultation document and research.

The Final Document should serve as a comprehensive roadmap, providing clear direction to stakeholders involved in the 5G deployment process. It should also be aligned with the Government's economic, social, and technological objectives and adhere to international best practices. Ultimately, it should enable Service providers to deploy 5G networks efficiently, safely and equitably.

5. Practical Insight and Global Best Practices for 5G Deployment in the Caribbean

India Case Study: Multi-Stakeholder Collaboration in 5G Deployment

India is an example of effective use of multi-stakeholder collaboration among the Government, the Regulator, the Service providers, and other stakeholders in the deployment of 5G networks. By combining the expertise, resources and vision of the key stakeholders, India has become one of the fastest countries in deploying 5G with 448,709 base transceiver stations installed by June 2024, which has likely significantly advanced the country's digital landscape.³¹ Moreover, the GSMA's Mobile Economy Asia Pacific 2024 report forecasts that India has the potential to lead the world's second wave of 5G deployment, which will likely benefit the Indian economy and society.³² The following paragraphs outline how each of the Indian stakeholders fulfilled their responsibilities in enabling 5G deployment.

Government

In 2018, The Indian Government outlined a comprehensive vision for 5G in India, setting the foundation for its deployment. The Government recognized the transformative potential of 5G for sectors such as manufacturing, educational, healthcare, agriculture and finance. The Government's objective was to deploy 5G early and use it as a tool to promote digital inclusion, ensuring that the rural and economically weaker segments of society also benefitted from the technology. The Government also expressed its desire for India to emerge as a global leader in 5G technology."³³

³¹ <https://timesofindia.indiatimes.com/blogs/voices/collaboration-the-catalyst-for-5g-success-in-india/>

³² <https://www.gsma.com/newsroom/press-release/gsma-highlights-indias-5g-progress-ahead-of-increased-presence-at-india-mobile-congress/>

³³ Making India 5G Ready, India Department of Telecommunications, 2018 <https://www.bharatdigicom.in/wp-content/uploads/2023/01/5G-Steering-Committee-report-v-26.pdf>

The Telecom Regulatory Authority of India (TRAI)

The TRAI played a central role by conducting extensive stakeholder engagement with the Department of Telecommunications, Service providers, and consumers. The TRAI also issued regulatory decisions and recommendations on critical matters such as spectrum pricing and allocation, licensing requirements, infrastructure sharing, and streamlining infrastructure approval processes. To encourage 5G deployment in rural areas and underserved and unserved communities, the TRAI recommended lowering spectrum prices.³⁴

Service providers

India's major telecoms Service Providers, Bharti Airtel and Reliance Jio, have both played a pivotal role in advancing the deployment of 5G in India by making significant investments in 5G deployment.³⁵ These entities have submitted responses to TRAI consultation documents and worked to advance the Government's objective of deploying 5G in both rural and urban areas of India.³⁶

Spain Case Study: Impact of 5G Deployment on Tourism

New Immersive Experiences

The deployment of 5G technology is revolutionizing Spain's tourism sector by enabling more immersive and interactive tourist experiences. In 2020, Mediapro, Telefónica and Transports Metropolitans de Barcelona (TMB) collaborated on the 5G Augmented Tourism project, an innovative AR experience available on tourist buses. Passengers of TMB's Barcelona Tourist Bus were able to enjoy an AR tour of the Montjuïc mountain, providing them with real-time historical and cultural information³⁷.

In October 2023, Orange Spain partnered with León City Council to launch a mobile app, called 'Augmented City', which combines VR and AR to provide a unique experience for visitors to the city. This app offers thousands of tourists, who visit León daily, access to detailed cultural, artistic,

³⁴ <https://timesofindia.indiatimes.com/business/india-business/trai-suggests-39-cut-in-base-price-across-spectrum-bands-prime-5g-band-price-down-by-35/articleshow/90786055.cms>

³⁵ <https://economictimes.indiatimes.com/industry/telecom/telecom-news/reliance-jio-bharti-airtels-returns-on-investment-set-to-double-in-4-years/articleshow/110675915.cms?from=mdr>

³⁶ <https://www.ey.com/content/dam/ey-unified-site/ey-com/en-in/insights/telecommunications/documents/ey-report-role-of-cross-industry-collaboration-in-indias-5g-success.pdf>

³⁷ <https://www.intelligenttransport.com/transport-news/97639/5g-augmented-reality-bus-tour-trialled-in-barcelona/>

historical and architectural information. Tourists can tap on elements shown on their smartphones or tablets to discover in-depth information about the city's main attractions.³⁸

5G Coverage in Tourist Hotspots

In 2024, Telefónica significantly expanded its 5G network coverage in tourist hotspots and major event venues across Spain, enhancing connectivity for tourists and businesses serving them, and improving connectivity during major events.³⁹ By ensuring that key tourist areas and major event venues are equipped with 5G, Telefónica is helping to modernize Spain's tourism industry, enabling faster, more reliable connectivity and improving the overall tourism experience in Spain.

6. Final Thoughts and Implications

The deployment of 5G networks and services marks a pivotal milestone in the Caribbean's digital transformation, with the potential to boost the region's growing digital economy. However, the challenges and opportunities posed by 5G require a careful and strategic approach, including comprehensive reviews of existing regulatory frameworks, effective multi-stakeholder engagement, and consideration of all matters and potential risks relevant to 5G deployment.

It is essential that each Caribbean Regulator develop a comprehensive roadmap to enable 5G deployment, one that aligns with the Government's social, economic, and technological objectives, as well as industry best practices and international agreements. The 5G roadmap strategy proposed in this paper advocates for multi-stakeholder collaboration, promoting technological advancement and innovation, while safeguarding public interests, such as health and security concerns. By adopting this tactical approach, Caribbean Regulators can facilitate the deployment of high-quality, resilient and inclusive 5G networks and services throughout the region. As demonstrated in the India case study, a collaborative approach between key stakeholders can accelerate deployment and overcome challenges, ensuring that both urban and rural areas benefit from 5G technology.

Spain's use of 5G to enhance its tourism sector provides a clear example of how 5G can drive economic growth and improve service offerings in a key sector in many Caribbean economies. Failing to take proactive and thorough action on 5G deployment could place the Caribbean at a significant competitive disadvantage, hampering the region's ability to keep pace with global technological advancements. Ultimately, this could limit opportunities to attract both domestic and foreign investment, encourage creativity, reduce the digital divide and drive economic growth.

³⁸ <https://www.telecompaper.com/news/orange-spain-launches-5g-sa-and-ar-tourist-app-in-leon--1480046>

³⁹ <https://telecomtalk.info/telefonica-enhances-5g-over-400tourist-destinations-spain/978872/>

7. References

Department of Telecommunications, Government of India. (2018). Making India 5G ready. Retrieved from <https://www.bharatdigicom.in/wp-content/uploads/2023/01/5G-Steering-Committee-report-v-26.pdf>

Developing Telecoms. (2021, October). Altice Dominicana commences 5G deployment. Retrieved from <https://developingtelecoms.com/telecom-technology/wireless-networks/12422-altice-dominicana-commences-5g-deployment.html>

Economic Times. (2023). Reliance Jio, Bharti Airtel's returns on investment set to double in 4 years. Retrieved from <https://economictimes.indiatimes.com/industry/telecom/telecom-news/reliance-jio-bharti-airtels-returns-on-investment-set-to-double-in-4-years/articleshow/110675915.cms?from=mdr>

EY. (n.d.). Role of cross-industry collaboration in India's 5G success. Retrieved from <https://www.ey.com/content/dam/ey-unified-site/ey-com/en-in/insights/telecommunications/documents/ey-report-role-of-cross-industry-collaboration-in-indias-5g-success.pdf>

Fierce Wireless. (n.d.). Indian government modestly reduces 5G spectrum reserve prices. Retrieved from <https://www.fierce-network.com/5g/indian-government-modestly-reduces-5g-spectrum-reserve-prices>

GSMA. (2023). 5G in Latin America. Retrieved from <https://www.gsma.com/about-us/regions/latin-america/wp-content/uploads/2023/08/290623-5G-in-Latam-ENG.pdf>

GSMA. (2023). Spectrum policy trends 2023. Retrieved from <https://www.gsma.com/connectivity-for-good/spectrum/wp-content/uploads/2023/02/Spectrum-Policy-Trends-2023-1.pdf>

GSMA. (n.d.). 5G-era mobile network cost evolution. Retrieved from https://www.gsma.com/solutions-and-impact/technologies/networks/gsma_resources/5g-era-mobile-network-cost-evolution/

GSMA. (n.d.). GSMA highlights India's 5G progress ahead of increased presence at India Mobile Congress. Retrieved from <https://www.gsma.com/newsroom/press-release/gsma-highlights-indias-5g-progress-ahead-of-increased-presence-at-india-mobile-congress/>

GSMA Intelligence. (2023). 5G momentum continues with 1.6 billion connections worldwide, rising to 5.5 billion by 2030, according to GSMA Intelligence. Retrieved from

<https://www.gsma.com/newsroom/press-release/5g-momentum-continues-with-1-6-billion-connections-worldwide-rising-to-5-5-billion-by-2030-according-to-gsma-intelligence/>

Intelligent Transport. (2020). 5G augmented reality bus tour trialed in Barcelona. Retrieved from <https://www.intelligenttransport.com/transport-news/97639/5g-augmented-reality-bus-tour-trialled-in-barcelona/>

Inter-American Development Bank (IDB). (n.d.). 5G: The driver for the next-generation digital society in Latin America and the Caribbean. Retrieved from <https://publications.iadb.org/en/5g-driver-next-generation-digital-society-latin-america-and-caribbean>

International Civil Aviation Organization (ICAO). (2023). Potential safety concerns due to interference from 5G to aeronautical radio altimeters. Retrieved from https://www.icao.int/MID/Documents/2023/WRC-23%20and%20FSMP-SG17/FSMP-WG17-WRC23WrkShp41_Rev%20ICAO-%20Safety%20Concerns%20due%20to%20Interference%20from%205G_Radio%20Altimeters.pdf

International Telecommunication Union (ITU). (2022, December). Fast-evolving networks need higher capacity and lower latency. Retrieved from <https://www.itu.int/hub/2022/12/fast-evolving-networks-need-higher-capacity-and-lower-latency/>

Nokia. (2024, July 1). Nokia and Telefónica collaborate to develop the private network market. Retrieved from <https://www.nokia.com/about-us/news/releases/2024/07/01/nokia-and-telefonica-collaborate-to-develop-the-private-network-market/>

NPR Chamber. (2022, June 14). T-Mobile quickly deploying ultra-capacity 5G in Puerto Rico. Retrieved from <https://www.nprchamber.org/news/2022/6/14/t-mobile-quickly-deploying-ultra-capacity-5g-in-puerto-rico>

Office of Utility Regulation (OfReg). (n.d.). Cayman Islands is regional leader in 5G. Retrieved from <https://www.ofreg.ky/news/cayman-islands-is-regional-leader-in-5-g>

OneComm Bermuda. (n.d.). Introducing 5G. Retrieved from <https://onecomm.bm/introducing-5g/#:~:text=Bermuda's%20first%205G%20mobile%20network,than%20the%20current%204G%20capabilities>

Statista. (n.d.). Total contribution of travel and tourism to GDP in the Caribbean by country. Retrieved from <https://www.statista.com/statistics/814155/caribbean-total-contribution-travel-tourism-gdp-country/#statisticContainer>

Telecompaper. (2023). Orange Spain launches 5G SA and AR tourist app in León. Retrieved from <https://www.telecompaper.com/news/orange-spain-launches-5g-sa-and-ar-tourist-app-in-leon--1480046>

Telecom Talk. (2023). Telefónica enhances 5G over 400 tourist destinations in Spain. Retrieved from <https://telecomtalk.info/telefonica-enhances-5g-over-400tourist-destinations-spain/978872/>

Times of India. (2021). Collaboration: The catalyst for 5G success in India. Retrieved from <https://timesofindia.indiatimes.com/blogs/voices/collaboration-the-catalyst-for-5g-success-in-india/>

Times of India. (2022). TRAI suggests 39% cut in base price across spectrum bands, prime 5G band price down by 35%. Retrieved from <https://timesofindia.indiatimes.com/business/india-business/traai-suggests-39-cut-in-base-price-across-spectrum-bands-prime-5g-band-price-down-by-35/articleshow/90786055.cms>

Trend Micro. (2021). The telecoms cyber threat landscape in 2021. Retrieved from https://www.trendmicro.com/en_se/research/22/b/the-telecoms-cyber-threat-landscape-in-2021.html

WTJX. (n.d.). It's official: T-Mobile is now in the USVI. WTJX. Retrieved from <https://www.wtjx.org/blogs/local-news/its-official-tmobile-is-now-in-the-usvi/>