

Output Report on ITU-D Question 1/1 **Strategies and policies for the deployment of broadband in developing countries**

Study period 2022-2025



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ISBN 978-92-61-40861-9 (Electronic version)

ISBN 978-92-61-40871-8 (EPUB version)

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International Telecommunication Union, Place des Nations, CH-1211 Geneva, Switzerland

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Acknowledgments

The study groups of the ITU Telecommunication Development Sector (ITU-D) provide a neutral platform where experts from governments, industry, telecommunication organizations and academia from around the world gather to produce practical tools and resources to address development issues. To that end, the two ITU-D study groups are responsible for developing reports, guidelines and recommendations based on input received from the membership. Questions for study are decided every four years at the World Telecommunication Development Conference (WTDC). The ITU membership, assembled at WTDC-22 in Kigali in June 2022, agreed that for the period 2022-2025, Study Group 1 would deal with seven Questions within the overall scope of “Enabling an environment for meaningful connectivity.”

This report was prepared in response to Question 1/1: Strategies and policies for the deployment of broadband in developing countries under the overall guidance and coordination of the management team of ITU-D Study Group 1 led by Ms Regina Fleur Assoumou-Bessou (Republic of Côte d'Ivoire), as Chair, supported by the following Vice-Chairs: Mr Ali Rasheed Hamad Al-Hamad (State of Kuwait), Mr Amah Vinyo Capo (Togolese Republic), Mr George Anthony Giannoumis (Norway), Mr Roberto Mitsuke Hirayama (Federative Republic of Brazil), Mr Sangwon Ko (Republic of Korea), Ms Umida Musaeva (Republic of Uzbekistan), Ms Caecilia Nyamutswa (Republic of Zimbabwe), Ms Memiko Otsuki (Japan), Ms Khayala Pashazade (Republic of Azerbaijan), Mr Sunil Singhal (Republic of India), and Mr Mehmet Alper Tekin (Republic of Türkiye).

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Special thanks go to the chapter lead authors Mr Christopher Hemmerlein (Amazon) (Chapter 1), Ms Uliana Stoliarova (Russian Federation) (Chapter 2), Ms Nataša Kuzmanovic (Bosnia and Herzegovina) (Chapter 3), Mr Turhan Muluk (Intel Corporation) (Chapter 4), Mr Juan Peirano (Internet Society) (Chapter 5), and to active contributors Mr Teddy Woodhouse (United Kingdom of Great Britain and Northern Ireland), Ms Natalia Vicente (GSOA) and Dr Shiv Bakhshi (Ericsson) for their dedication, support and expertise. This report has been prepared with the support of the ITU-D Question 1/1 focal points, the editors as well as the publication production team and ITU-D Study Group 1 secretariat.

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Executive summary

This report is the culmination of the work completed under Question 1/1 entrusted to Study Group 1 of the ITU Telecommunication Development Sector (ITU-D), which examines strategies and policies for the deployment of broadband in developing countries.

The report includes country experiences and best-practice guidelines to promote affordable broadband networks; strategies to stimulate investment in broadband networks; information on methods of broadband infrastructure deployment; an overview of basic principles of transition from narrowband to high-speed, high-quality broadband networks; case studies associated with operational and technical issues of deploying broadband networks; examples of removing practical and regulatory barriers to broadband infrastructure deployment; an overview of national experiences in the transition from IPv4 to IPv6; and other indirect aspects of broadband deployment.

Chapter 1 of the report reviews trends in broadband access technologies and deployment and regulatory considerations, including trends in standards for broadband access technologies; trends in national plans for fixed and mobile broadband development; trends in regulation, investment procedures and public-private partnerships; and trends in capacity building and supporting decisions in the process of broadband deployment.

Chapter 2 explores broadband strategies and policies in the post-COVID era, including analysis of the impact of the expected delay in the deployment of advanced telecommunication infrastructures, caused by the COVID-19 pandemic; economic downturn and technological alternatives complementary to the existing network to accommodate increased data traffic; national digital policies, strategies and plans to accelerate the deployment of advanced networks along with the promotion of e-education, e-health and telework after the COVID-19 pandemic.

Chapter 3 examines strategies, policies and regulations for broadband, including regulatory interventions, deployment strategies and financing mechanisms. It contains an overview of responsive regulatory frameworks, competitive markets, principles of allocation of spectrum resources, implementation infrastructure co-deployment and sharing guidelines, price regulation, as well as information about the development and implementation of broadband plans.

Chapter 4 concentrates on the transition to high-speed and high-quality broadband networks, including an overview of basic principles for mobile-broadband networks (5G), other wireless broadband networks and fixed-broadband networks. It also contains best-practice guidelines and an overview of country and regional examples.

Chapter 5 contains information on the indirect aspects of broadband deployment, including transition from IPv4 to IPv6, as well as the development of Internet exchange points (IXPs).

Chapter 6 contains key findings.

i Introduction and background

The digital revolution has conclusively transformed societies, with broadband connectivity emerging as a critical driver of economic growth, social development, and innovation. While developed nations have largely harnessed the power of broadband, a stark digital divide persists between them and developing countries. This gap hinders economic progress, exacerbates social inequalities, and limits access to essential services for billions of people. According to the International Telecommunication Union (ITU), approximately 2.6 billion¹ people worldwide still lack Internet access, with the most significant disparities evident in developing regions. To bridge this gap and unlock the full potential of broadband for these nations, concerted and strategic efforts are imperative.

The widespread availability and use of broadband has both economic and social benefits, and broadband is an increasingly important factor in the development strategies of countries around the world. Demand for high-speed and reliable broadband has been growing worldwide, and that growth has been accelerated by the COVID-19 pandemic, which has made the public, businesses, and governments increasingly reliant on Internet connectivity.

A corresponding increase in the supply of broadband connectivity to meet rising demand requires robust investment in communications infrastructure. Broadband connectivity is not only important in its own right; it provides a platform for the growth of digital services including online communication tools, e-commerce, digital financial services, and e-government services, which together make up the foundation of a digital economy.

Digital services are the enablers of a digital economy, and the success of digital economy initiatives largely depends on a robust, reliable, resilient, low-latency, and high-speed broadband infrastructure. Broadband services will support economic growth, innovation, and development and enrich the quality of life.

Broadband connectivity is no longer a luxury but a necessity for modern societies. However, the benefits of broadband remain disproportionately distributed, with developing countries facing substantial challenges in achieving universal access. Infrastructure limitations, including a lack of robust telecommunications networks, geographical disparities, and high deployment costs, pose significant obstacles.

Economic constraints, such as low per capita income levels and limited private investment, further exacerbate the situation. Moreover, complex regulatory environments, spectrum scarcity, and the absence of supportive policies create an unfavourable climate for broadband development.

To compound these challenges, many developing countries grapple with low levels of digital literacy and skills among their populations, hindering the effective utilization of broadband services. Despite these formidable barriers, there is a growing recognition of the imperative to connect underserved communities. Governments, international organizations, and private sector entities are increasingly investing in broadband infrastructure and services.

This report aims to contribute to this critical endeavour by examining the strategies and policies essential for fostering broadband adoption in developing countries. Through a comprehensive analysis of the current landscape, identification of key challenges, and exploration of successful

¹ <https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>

case studies and best practices, this report seeks to provide actionable recommendations for policymakers, industry stakeholders, and international development partners. By understanding the complex relationship of factors influencing broadband deployment, this report aspires to inform the development of effective policies and initiatives that can accelerate its adoption and bridge the digital divide.

Ultimately, the goal is to create an environment where broadband connectivity becomes a catalyst for inclusive growth, social progress, and human development.

To achieve this ambitious objective, the report will explore a range of strategies, including public-private partnerships, infrastructure sharing, and innovative financing mechanisms. It will also examine the importance of digital skills development, policy reforms, and regulatory frameworks that foster competition and investment. By providing a comprehensive overview of the challenges and opportunities, this report aims to empower policymakers and stakeholders to make informed decisions and implement effective broadband deployment strategies.

Abbreviations and acronyms

This table contains abbreviations/acronyms relating to international, regional or supranational bodies, instruments or texts, as well as technical and other terms used in this report.

Abbreviations/acronyms of national bodies, instruments or texts are explained in the text relating to the country concerned, and are thus not included in this table.

Abbreviation / acronym	Extended form
2G/ 3G/ 4G/ 5G/ 6G	Second/Third/Fourth/Fifth/Sixth Generation mobile communications (see note 1 below)
AI	artificial intelligence
ARIN	American Registry for Internet Numbers
BDT	ITU Telecommunication Development Bureau
CIS	Commonwealth of Independent States
CN	community networks
D2D	direct-to-device
eSIM	embedded subscriber identity module
FCC	Federal Communications Commission
FTTH	Fibre-to-the-home
FWA	fixed wireless access
GSMA	Global System for Mobile Communications Association
GSOA	Global Satellite Operator's Association
IoT	Internet of things
ISP	Internet service provider
ITU-D	ITU Development Sector
ITU-R	ITU Radiocommunication Sector
ITU-T	ITU Telecommunication Standardization Sector
IXP	Internet exchange point
LEO	low earth orbit
LLDC	landlocked developing countries
LTE	long term evolution
MNO	mobile network operator

(continued)

Abbreviation / acronym	Extended form
MoU	memorandum of understanding
MTIT	Ministry of Telecommunications and IT (State of Palestine)
NGSO	non-geostationary satellite orbit
NTIA	National Telecommunications and Information Administration
NTN	non-terrestrial network
OECD	Organisation for Economic Co-operation and Development
ORAN	open radio access network
PPP	public-private partnership
QoS	quality of service
RAN	radio access network
RIR	regional Internet registry
RMIO	rural mobile infrastructure operator
SDG	sustainable development goal
USAC	universal service administrative company
USAID	United States Agency for International Development
USF	universal service fund
USOF	universal service obligation fund
VoWiFi	voice over Wi-Fi
WTDC	World Telecommunication Development Conference

Note:

1. While care was taken in this document to properly use and refer to the official definition of IMT-generations (see Resolution [ITU-R 56](#), "*Naming for International Mobile Telecommunications*"), The ITU Telecommunication Development Bureau (BDT) would like to note that parts of this document contains material provided by the the ITU membership which refers to the frequently used market name "xG": This material cannot necessarily be mapped to a specific IMT-generation, as the underlying criteria employed by the Membership is not known, but in general, IMT-2000, IMT-Advanced, IMT-2020 and IMT-2030 are known as 3G/4G/5G/6G, respectively. Furthermore, sometimes, earlier available technologies such as global system for mobile communications (GSM), EDGE and general packet radio services (GPRS) are referred to generally as 2G and could be considered as "pre-IMT" or "pre IMT-2000" technologies in ITU documentation and regulations.

Chapter 1 – Trends in broadband access technologies and deployment in non-rural and urban areas

1.1 Trends in standards for broadband access technologies

Broadband access technologies continue to evolve and expand their reach to consumers around the world, including in developing countries. Satellite systems, mobile networks, and Wi-Fi equipment in particular have undergone incredible innovation over the last several years, providing great promise for expanding broadband connectivity access in the underserved communities where it is needed most. While the innovation in these technologies offer consumers greater choice in access technology in their own right, they also present complementarities with the others in a manner that benefits the state of connectivity as a whole.

Satellite. A range of new solutions in satellite communications, such as direct-to-device (D2D) services, multi-orbit satellite networks, inter-satellite links, and software-defined satellites, are making satellite communications more versatile and cost-effective, meeting the increasing demand for seamless, reliable, and resilient connectivity. In particular, non-geostationary satellite orbit (NGSO) constellations of satellites in low earth orbit (LEO) offer underserved communities around the world the high-speed, high-quality broadband network connectivity they need to participate in the modern digital era. LEO satellite systems have been launched, or are planned to be launched, by private companies including Amazon Kuiper, SpaceX Starlink, OneWeb, and Telesat.

For developing countries in need of greater broadband connectivity, LEO satellites can offer several critical benefits including the power to connect the unconnected, support for disaster response and network resiliency, and valuable new business models in conjunction with incumbent telecommunications network operators. LEO satellite systems can help bridge the digital divide by providing fast, affordable service to places where broadband via legacy networks is otherwise unreliable or too expensive, or where it does not exist at all. LEO satellites can improve connectivity for individual households, as well as schools, hospitals, libraries, businesses, and government agencies in communities that struggle without access to reliable, affordable broadband².

The benefit of LEO satellite broadband is particularly pronounced in areas that are difficult or expensive to reach with terrestrial infrastructure. LEO satellites can provide coverage to even the most remote areas, and the minimal ground-infrastructure makes it a compelling solution for bridging the digital divide. Moreover, unlike terrestrial networks, the marginal operational cost of provisioning satellite broadband is the same to any location, where distance is not a barrier^{3,4}. The Internet Society has stated that they “see considerable potential in the use of LEO satellites for Internet access for unserved or underserved communities, especially where other

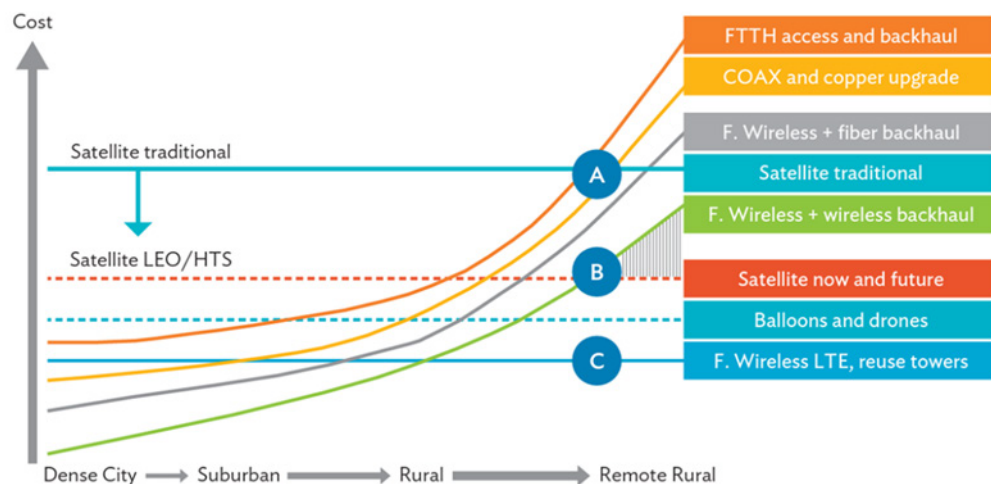
² ITU-D SG1 Document <https://www.itu.int/md/D22-SG01.RGO-C-0095> from Amazon

³ ITU-D SG1 Document <https://www.itu.int/md/D22-SG01.RGO-C-0248> from South Africa

⁴ ITU-D SG1 Document <https://www.itu.int/md/D22-SG01.RGO-C-0225> from Saudi Arabia

ways of delivering Internet access are not viable.”⁵ The expansion of LEO satellite coverage and increase in available capacity will also benefit countries that have limited international Internet bandwidth being supplied by undersea and terrestrial fibre-optic cables, such as landlocked developing countries.⁶

Figure 1: Broadband access technologies compared by costs and population density



COAX = coaxial cable, FTTH = fiber to the home, HTS = high-throughput satellite, LEO = lower Earth orbit, LTE = long term evolution.

Source: Adapted from World Bank. 2019. *Innovative Business Models for Expanding Fiber-Optic Networks and Closing the Access Gaps*.

Source: ADB⁷

The co-functionality of terrestrial and non-terrestrial infrastructure allows for scalable and flexible network expansion. The significance of the evolution of satellite technology is enhanced by partnerships with terrestrial mobile operators and Internet service providers (ISPs). For example, satellite networks can enable backhaul connectivity for cellular networks, allowing mobile operators to extend coverage at lower costs than by deploying more expensive terrestrial infrastructure, or they can also connect directly to handsets, also known as direct-to-device (D2D).

There are two primary approaches to D2D: one approach leverages existing spectrum allocations and standardized protocols and frameworks to capitalize on 3GPP non-terrestrial networks (NTNs) specifications for seamless terrestrial and satellite connectivity networks with no changes to ITU radio regulations.

The second approach is for D2D to operate in the same frequency bands as those used by mobile network operators (MNOs), which provides a solution to complement mobile coverage, and addresses gaps in connectivity by using off-the-shelf mobile handsets⁸.

⁵ Internet Society <https://www.internetsociety.org/wp-content/uploads/2022/11/Perspectives-on-LEO-Satellites.pdf>

⁶ ADB Sustainable Development Working Paper Series No. 76. <https://www.adb.org/sites/default/files/publication/696521/sdwp-076-digital-connectivity-low-earth-orbit-satellite.pdf>

⁷ ADB <https://www.adb.org/sites/default/files/publication/696521/sdwp-076-digital-connectivity-low-earth-orbit-satellite.pdf>

⁸ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0455/> from GSOA

Partnerships between satellite and mobile network operators have the potential to improve the state of connectivity by providing seamless and reliable connectivity to historical underserved areas. The Global System for Mobile Communications Association (GSMA) notes that such arrangements are “symbiotic and borne of pragmatism: satellite providers can help operators extend their network footprint to regions that would otherwise remain unconnected ... while telcos can reach new customer segments, bringing economic and societal benefits.”⁹

The evolution of satellite communications also includes the development of standards around NTN within 3GPP¹⁰ such as satellite narrowband IoT (NB-IoT) for Internet of things (IoT) services and 5G-non-terrestrial networks standards. These standards help to facilitate the delivery of high-speed D2D connectivity, ensuring uninterrupted coverage even in remote areas. This standard, along with clear regulations that protect existing users and open up new spectrum bands, is key to making satellite D2D technology a viable option for bridging the digital divide. The Global Satellite Operators' Association (GSOA) predicts that D2D satellite communication will improve connectivity for underserved areas by widening service availability and improving affordability, if supported by enabling regulations that allow access to essential spectrum frequencies.¹¹

Proponents argue that a 3GPP-compliant NTN solution would, in contrast to the bulky and expensive terminals used in non-3GPP-based legacy-MSS systems, provide immediate compatibility with mass-market smartphones, allowing terrestrial operators to boost their geographical coverage and close the connectivity gap with respect to voice and data coverage in sparsely populated areas, including rural settings, while serving new use cases such as maritime coverage¹².

It is worth mentioning relevant studies that were conducted under WRC-27 Agenda Item 1.13 (*).

Mobile network operators continue to make significant technological progress and investments in connectivity in their own right. Mobile operators invested USD 1.6 trillion in mobile capex between 2015 and 2023. Mobile broadband now reaches 96 per cent of the global population.

With connectivity infrastructure in urban areas of sub-Saharan Africa ‘increasingly reaching maximum capacity’ and mobile data traffic in the region set to quadruple over the next five years, MNOs are predicted to invest USD 45 billion in the region to continue advancing the 2030 Agenda and ensure that people can continue to enjoy the benefits that mobile Internet brings.¹³

The mobile industry continues to seek new and innovative means to finance and deploy broadband technologies in new areas. From lighter, easier-to-install mobile towers and solar powered equipment to the deployment of open-source virtual networks, Orange Middle East and Africa, for example, has tailored its connectivity infrastructure to meet the needs of rural and remote communities. In countries throughout the sub-Saharan Africa region, partnerships between Orange and Africa Mobile Networks (AMN), Vanu, and NuRAN have made it possible for people to connect to the Internet for the first time.

⁹ GSMA Intelligence, June 2021 <https://assets.oneweb.net/s3fs-public/2022-11/GSMA%20Radar%20Report%20-%20Connectivity%20from%20the%20Sky.pdf>

¹⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0112/> from GSOA

¹¹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0215/> from GSOA

¹² ITU-D Document <https://www.itu.int/md/D22-SG01-C-0238/> from Ericsson

¹³ GSMA (2023). The Mobile Economy Sub-Saharan Africa <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-economy/sub-saharan-africa/>

Another key emerging trend is open radio access network also known as open RAN (ORAN), an industry-driven approach to configuration of 5G and other wireless communications networks centred on "opening" technical interfaces between components of the radio access network (RAN), the part of the mobile network connecting user devices to the core. Opening what have generally been closed, vendor-specific interfaces lowers barriers to entry for a wider range of telecommunication infrastructure suppliers¹⁴.

Using open and interoperable wireless networks allows network operators greater flexibility in managing their networks, reduces their risk of overdependence on any single vendor, and enhances network security and visibility. A shift to open networks also increases competition and innovation from RAN suppliers and bolsters resilience in the global telecommunications equipment market. At the same time, ORAN faces some challenges such as system integration and network security that must continue to be addressed as the technology matures.

Mobile networks also have a symbiotic relationship with Wi-Fi. One of the most significant challenges posed by increased data traffic is mobile network congestion, particularly in densely populated urban areas and in high-traffic events. According to the Cisco mobile visual networking index, 51 per cent of global mobile data traffic was offloaded to Wi-Fi networks in 2022, which makes them a critical link in the connectivity ecosystem.

Artificial intelligence (AI) enables dynamic and efficient offloading of data from overloaded cellular networks to alternative networks, such as Wi-Fi or low-power wide-area networks (LPWAN)¹⁵. AI-driven data offloading systems leverage predictive analytics to anticipate traffic bottlenecks, allowing networks to pre-emptively offload data. This prevents congestion before it happens. Studies suggest that AI-based offloading can reduce latency by up to 50 per cent, making services such as video streaming, telehealth and connected precision industry smoother.

Voice over Wi-Fi (VoWiFi) is another AI-empowered strategy that has revolutionized how telecoms manage increased traffic while ensuring high-quality voice service. With VoWiFi, mobile voice calls are routed over Wi-Fi networks, which alleviates congestion in cellular networks, especially in high-demand areas.

Wi-Fi technology, based on the Institute of Electrical and Electronics Engineers (IEEE¹⁶) wireless communication standard 802.11¹⁷ has continually improved, with each generation bringing faster speeds, lower latency, and better user experiences in a multitude of environments and with a variety of device types.

Wi-Fi is a preferred choice for wireless connectivity¹⁸. According to a report released by IDC Research, 3.8 billion Wi-Fi devices are forecast to ship in 2023, contributing to 42 billion cumulative Wi-Fi shipments since the technology's creation. There are roughly 19.5 billion Wi-Fi devices in use worldwide, including access points, smartphones, laptops, security cameras, and smart plugs. An increasing number of devices support the latest Wi-Fi generations and provide users, service providers, and network administrators with the ability to support increasingly complex use cases.

¹⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0436/> from United States

¹⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0400/> from Access Partnership

¹⁶ <https://www.ieee.org>

¹⁷ <https://www.ieee802.org/11>

¹⁸ <https://www.wi-fi.org/beacon/the-beacon/wi-fi-by-the-numbers-technology-momentum-in-2023>

As more countries release 6 GHz unlicensed spectrum for Wi-Fi, users around the world are benefitting from the performance enhancements of Wi-Fi 6E (extended Wi-Fi 6) operations in the band. With high Gigabit speeds, extremely low latency, and increased capacity, the 6 GHz band offers numerous socioeconomic benefits, as well as the ability to support emerging applications, including 3D immersive medical training and telepresence, and security monitoring, and fuelling innovation in service provider networks that enable multi-gigabit speeds for customers¹⁹.

It is worth mentioning the fact that Wi-Fi is a successful standard amongst “broadband radio local area networks (RLANs)” technologies. (see inter alia Recommendation ITU-R M.1450-5).

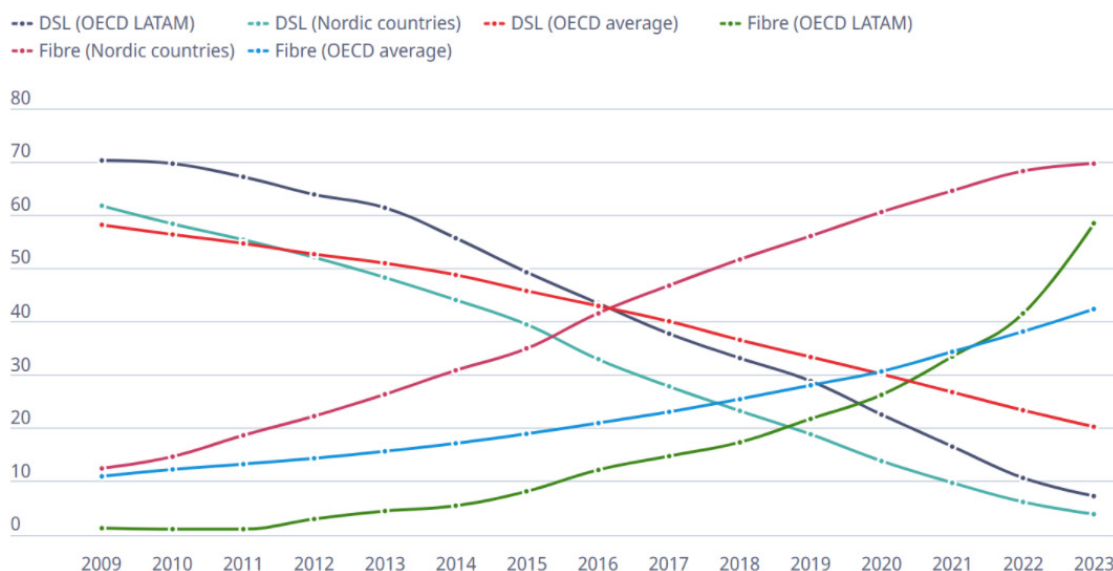
Fibre-optic expansion. Underpinning all these technologies are fibre-optic networks that help “future-proof” networks. Optical fibre continues to grow rapidly to meet the demand for high-quality, affordable and ubiquitous connectivity.

For example, member countries of the Organisation for Economic Co-operation and Development (OECD) in the Latin America region, notably Republic of Chile, Republic of Colombia, Republic of Costa Rica and the United Mexican States, have accelerated their transition to fibre-optic networks. Over the past four years, these countries have experienced a 258 per cent increase in fibre-optic connections while legacy digital subscriber line (DSL) subscriptions declined by 66 per cent. OECD Nordic members such as Denmark, Finland, Iceland, Norway and Sweden that initiated this technological shift approximately eight years ago, experienced a growth rate of 36 per cent in optical fibre and a 77 per cent decline in DSL over the same period (2019-23)²⁰.

Figure 2: Transition to future-proof networks and shutdown of legacy network by OECD, LATAM and Nordic countries

Transition to future-proof networks and shutdown of legacy networks by OECD LATAM and Nordic countries

% share of fibre and DSL in total fixed broadband subscriptions, 2009-23



Source: OECD

¹⁹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0199/> from Intel

²⁰ <https://www.oecd.org/en/data/insights/statistical-releases/2024/07/future-proof-broadband-access-technologies-are-gaining-ground-for-both-fixed-and-mobile-networks-across-the-oecd-in-2023.html>

1.2 Trends in national plans for fixed- and mobile-broadband development

Over the past several years there has been a proliferation of national broadband plans, spurred in part by the recognition of the importance of connectivity in the context of the COVID pandemic and general social and economic development. While the national broadband plans created by ITU Member States are all uniquely tailored to local needs, conditions, aspirations and abilities, they do share many common elements such as those outlined in the following paragraphs.

At a starting point, effective national plans rely upon accurate data and infrastructure mapping on the state of connectivity in a given jurisdiction. ITU uses geospatial tools to help pinpoint areas, such as schools and refugee camps, that lack connectivity. This data empowers governments to strategically plan network deployments, ensuring efficient infrastructure development and promoting sustainable last-mile access²¹.

The Communications Regulatory Agency of Bosnia and Herzegovina partnered with ITU to leverage best practices and create a national broadband map. This project tackles a key challenge mainly concerning the lack of data hindering investment in Bosnia and Herzegovina's broadband sector. By building a geographic information system (GIS), Bosnia and Herzegovina will establish a central data hub for network infrastructure. This system will be instrumental in pinpointing areas with inadequate coverage, allowing for targeted investments and a more robust broadband network across the country²².

China has introduced plans such as Broadband China and Digital China to implement top-level design for the development of network infrastructure including 5G networks, complemented by promoting policy implementation at industry level and promoting practical innovation at the local level.²³

Speed and coverage targets. National plans include measurable targets including coverage, access, use, and affordability. For example, the National Digital Network Plan (JENDELA)²⁴ in Malaysia, was formulated to provide wider coverage and better quality of broadband experience to enable Malaysians to have access to quality digital connectivity. Phase 1 (2020-2022) involved optimizing existing resources and infrastructure for both mobile and fixed connectivity by expanding 4G mobile broadband coverage to 96.9 per cent in populated areas; increasing mobile broadband speeds to 35 Mbit/s; and enabling 7.5 million premises to access gigabit speeds with fixed broadband services. In Phase 2 the targets were stretched further to achieve 9 million premises passed with gigabit access, 100 per cent Internet coverage in populated areas, and 100 Mbit/s mobile broadband speed leveraging on 5G technology by the end 2025.

The Government of the Republic of Cameroon has established a target to ensure broadband connectivity for on 95 per cent of its national territory within five years through the deployment of 4G technologies and other emerging technologies²⁵. Likewise, in Egypt the decent life initiative which committed to serve more than 4 500 villages (representing 99 per cent of the rural area) with fixed, wireless broadband, was launched in 2021, and was extended to 2024²⁶.

²¹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0250/> from BDT

²² ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0156/> from Bosnia and Herzegovina

²³ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0417/> from China

²⁴ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0083/> from Malaysia

²⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0036/> from Cameroon

²⁶ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0018/> from Egypt

Public access. Many national broadband plans and universal access policies include connecting to community anchor institutions such as schools, libraries, and government facilities, or providing public Wi-Fi connectivity that citizens can use without charge.

Through the National Infrastructure Plan 2050, the Government of the Republic of South Africa will connect all government buildings with fibre-optic high-speed broadband, which will offer free Wi-Fi to low-income residents²⁷. South Africa also launched the SA Connect Phase 2 project, which aims to provide 80 per cent of South African citizens with a secure, reliable, and affordable high-speed Internet access by 2024. The project will connect public facilities such as schools, clinics, police stations and other government facilities with broadband services. The project will also provide core and access network infrastructure to enable broadband connectivity to community Wi-Fi hotspots that will connect households.

The Government of Kenya has implemented the Free Public Wi-Fi project to provide free Internet access to citizens in public spaces including libraries, markets, bus stations, schools, government offices, and urban centres, to promote digital inclusion and access to information. The government targets to establish 25 000 public Wi-Fi hotspots over the next five years.²⁸

The Ministry of Communications and Technology of the Syrian Arab Republic, along with government partners, is tackling the challenge of public broadband access through a multi-year "Government Services Digital Transformation Strategy". This ambitious plan, launched in 2021 and extending to 2030, aims to bridge the digital divide by establishing both physical Citizen Service Centres and online e-centres. By July 2024, 14 such e-centres were already operational, offering 47 services and processing over 49 000 transactions²⁹.

Investments in backbone networks. Many national broadband plans include an emphasis on building out core backbone networks from which other services and institutions can connect. For example, Kenya's ICT Infrastructure Project involves the implementation of the National Optical Fibre Backbone Infrastructure to provide high-speed broadband connectivity to government institutions, businesses, and citizens. The government targets to lay a total of 100 000 kilometres of optical fibre across the country over the next five years as a partnership between government and the private sector³⁰.

In the Argentine Republic, the Conectar Plan envisioned the construction of a federal fibre-optic network. This network has made it possible to generate the conditions to provide access to information and communication technology (ICT) services throughout the entire territory of the Argentina, managing to connect small towns, towns with poor connectivity, and those far from urban centres³¹. The objective of the Conectar Plan is the extension of 4 408 kilometres of optical fibre to reach 38 808 kilometres. As of August 2023, it had reached 32 804 kilometres of illuminated optical fibre connecting 1 129 locations with wholesale Internet.

²⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0248/> from South Africa

²⁸ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0127/> from Kenya

²⁹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0199/> from Syrian Arab Republic

³⁰ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0127/> from Kenya

³¹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0178/> from Argentina

1.3 Trends in regulation, investment procedures, and public-private partnership

As noted in the previous section, the role of governments is fundamental to expanding broadband connectivity. However, even more important than providing a vision through national broadband plans, governments can empower deployment of broadband connectivity through their approaches to regulation, investment, and public-private partnerships.

ITU provides tools to support countries aiming to foster universal meaningful connectivity. These include reports such as "Benchmark for fifth generation collaborative digital regulation" and guides such as the [Universal Service Financing Efficiency Toolkit](#). The Digital Regulation Platform, a joint resource of the International Telecommunication Union (ITU) and the World Bank, offers best practices for policymakers on a range of topics, and the new Digital Regulation Network^{32, 33} fosters collaboration and knowledge sharing on digital policy and regulation.

Trends in regulation

Far too often, regulatory authorities around the world have succumbed to regulatory capture by incumbent operators using legacy technology. New and emerging technologies pose iterative challenges for regulators to adapt to new market conditions and maintain their independence in pursuit of affordable, accessible broadband services. Recently, some countries have now begun to rethink regulation in order to facilitate the innovation and marketplace competition needed to address long-standing connectivity challenges.

Many developing country governments have also sought to establish policies that incentivize private investment in broadband infrastructure, in particular tax incentives and subsidies for network expansion projects.³⁴

For example, the Government of the Republic of Madagascar realized that in order to flourish, the telecommunication sector must have a clear legal basis that is conducive to investment in and deployment of telecommunication/ICT infrastructure. The telecommunications ministry adopted new legislation that introduced a satellite licence, issued for five years; and the global licence, issued for 15 years. Global licences allow new entrants "to offer, on the wholesale and retail markets, all telecommunication services, including in particular fixed and mobile telephone services for local, national and international communications, Internet access services, special telephone services, value-added services and rental of capacity and infrastructure". In addition, the conditions of entry into the Madagascar telecommunication/ICT market, when applying for a licence, have been drastically revised and reduced.

The Ministry of Telecommunications and IT (MTIT) of the State of Palestine responded to increased demands for broadband connectivity by adopting a new model for fixed broadband through the rollout of optical fibre to the home (FTTH). Faced with competing options, MTIT opted to liberalize its communications sector and open its market to new Internet service provider (ISP) entrants³⁵. As a result, in 2021 approvals were given to several ISPs that expressed an interest to invest in FTTH and these approvals contained clear conditions and obligations. The

³² ITU-D Document <https://www.itu.int/md/D22-SG01-C-0051/> from BDT

³³ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0126/> from BDT

³⁴ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0153/> from Republic of the Congo

³⁵ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0105/> from Palestine. The State of Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference.

MTIT gave a 15-year fixed broadband licence to new ISP entrants with a mandate to challenge the existing monopoly on fixed infrastructure. The scope and duration of the new licences increased competition at the infrastructure level and attracted greater investment.

The Government of Kenya recognized that even after the creation of its National Digital Master Plan 2022-2032, the deployment of ICT infrastructure to some underserved and unserved areas of the country was still unacceptably slow. To fill these gaps in connectivity, communities have deployed self-sustaining community networks (CNs) using less expensive equipment than commercial ISPs³⁶.

To create an enabling policy and regulatory environment for bottom-up connectivity networks to grow, Kenya introduced a licence framework for CNs. These new changes have supported communities in order to organize themselves and operate their own localized telecommunications infrastructure. Since recognition of this service in 2021 as a licensable category, the Kenya ICT regulator has so far facilitated the licensing of 11 CNs, with 10 other applications under consideration. This has boosted confidence in this segment, attracting the private sector and digital development partners to support the provision of complimentary connectivity services³⁷.

In the satellite realm, in some cases regulatory constraints including complex licensing procedures and spectrum management issues have been shown to hinder the development of technological advancements such as new-generation LEO and high-throughput geostationary satellites. By embracing regulatory reforms and relaxing unnecessary regulatory constraints, and applying incentives as appropriate, countries would be better equipped to accelerate the expansion of broadband connectivity and bridge the digital divide³⁸. Countries and regulatory bodies are also increasingly recognizing the need to streamline licensing procedures to reduce barriers to market entry and encourage investment in technologies such as multi-orbit satellite systems, 5G, and IoT applications.

Embedded subscriber identity modules (eSIMs), which allow mobile platforms such as airplanes, ships, and vehicles to connect to the satellite networks, have seen much regulatory innovation. In the past, eSIMs were subjected to complicated approval processes requiring separate authorizations for distinct types of vehicles or regions of operation. This created significant administrative challenges for operators who needed to provide seamless connectivity across multiple countries and transportation modes. In response to the growing demand for in-motion connectivity, regulatory bodies are moving towards blanket type licensing regimes for eSIMs, which simplify the authorization process. These blanket licences eliminate the need for separate approvals, thus reducing both regulatory burdens and operational costs. Moreover, these regulations make it easier for operators to offer global services without having to navigate the licensing intricacies of every country.

Traditionally, NTN licensing was classified into distinct categories, such as geo-stationary orbit (GSO) and NGSO satellites, each with separate regulatory frameworks. However, as more satellite operators deployed hybrid systems that utilize both GSO and NGSO satellites for seamless service delivery, there has been a growing recognition of the benefits of a unified licensing structure. Several countries are implementing integrated licensing regimes that cover both GSO and NGSO services under a single authorization process. This can reduce

³⁶ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0094/> from Internet Society

³⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0164/> from Kenya

³⁸ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0225/> from Saudi Arabia

redundancy, speed up market entry, and align regulatory frameworks with the emergence of multi-orbit operations.³⁹

Trends in investment procedures

Development finance

Development finance institutions (DFIs) and development agencies have increased their focus on expanding access to broadband connectivity. This focus has been spurred by the recognition that broadband connectivity is a force multiplier for broader social and economic development.

For example, in the Dominican Republic, Indotel is executing a plan for the expansion of connectivity for digital transformation, with USD 115 million in financing from the Inter-American Development Bank (IDB). Within this macro plan, implementation has commenced of a USD 19 million project to deploy and operate Internet access networks in selected locations in the southern region of the country⁴⁰. In the Central African Republic, grants from the European Union and the African Union, have funded the first deployment of optical fibre⁴¹. In Kenya, the government has partnered with the World Bank to provide financial support for the National Optical Fibre Backbone Infrastructure.

The United States Agency for International Development (USAID) has implemented the [Digital Invest](#) blended finance programme to support fund managers, project developers, and other private sector partners seeking to accelerate sustainable market growth for ISPs that reduce the digital divide by serving traditionally excluded communities in developing markets⁴². Blended finance is "the use of catalytic capital from public or philanthropic sources to increase private sector investment in sustainable development." While there are various types or structures of blended finance, they all contribute to development objectives while still expecting a positive financial return. The participation of donors or other philanthropic actors improves the overall risk/return profile of a financial facility or project, thereby crowding in private investors. The public and private participants in a blended finance transaction will likely expect different types of returns (social versus financial, for example) and will support the transaction with different types of capital or support.

The Digital Invest programme "blends" USAID grant capital with new investment fund structures, technical assistance facilities, and infrastructure projects to maximize market impact. To date, Digital Invest partners have mobilized over USD 245 million for new or expanded financial facilities and have invested in 35 ISPs and fintech portfolio companies across 28 countries⁴³.

Universal service funds (USF)

The practice of using universal service funds to expand access to telecommunications has been ongoing for decades. However, in recent years ITU Member States have continued to reassess and deploy such programmes. As countries strive to integrate their populations into the digital age, the effectiveness of the USF becomes crucial for enabling inclusivity, expanding economic growth, and ensuring a nation's readiness to embrace the future. In this global context, the USF

³⁹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0432/> from South Africa

⁴⁰ ITU-D Document <https://www.itu.int/md/D22-SG01-RGQ-C-0166/> from Dominican Republic

⁴¹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0167/> from Central African Republic

⁴² ITU-D Document <https://www.itu.int/md/D22-SG01-C-0241/> from USAID

⁴³ ITU Universal Efficiency Toolkit <https://www.itu.int/itu-d/reports/regulatory-market/usf-financial-efficiency-toolkit/>

acts as a crucial component of telecommunications policy, addressing the challenges of unequal access to communication services while promoting connectivity and inclusivity⁴⁴.

In Argentina for example, the government passed a resolution that approved of financing of its federal fibre-optic network through the Universal Service Trust Fund.⁴⁵ In the Central African Republic, Law 18.002 defined universal service as a minimum package of services of a specified quality, to be accessible at affordable prices to the entire population on the national territory. Operator contributions have been fixed at two per cent of the previous year's turnover, which the Regulatory Authority for Electronic Communications and Posts can use to extend service to unserved and underserved portions of the population, in rural and urban areas alike. In India, the Telecommunications Act 2023 envisages to rename the universal service obligation fund (USOF) as "Digital Bharat Nidhi" and to enhance its scope to meet any or all of the following objectives, namely : (a) support universal service through promoting access to and delivery of telecommunication services in underserved rural, remote and urban areas; (b) support research and development of telecommunication services, technologies, and products; (c) support pilot projects, consultancy assistance and advisory support towards provision of universal service in underserved rural, remote and urban areas; (d) support introduction of telecommunication services, technologies, and products⁴⁶. In the United States of America, the USF continues to make yearly gains, achieving significant success in bridging the digital divide. In 2022, the E-Rate programme approved funding to connect over 128 500 schools, school facilities, and libraries. The High-Cost programme helped to provide service to over 6.4 million locations, with more than 710 000 now enjoying broadband speeds of 1 gigabit or better. The Lifeline programme served nearly 7.5 million households, and the Rural Healthcare programme provided connectivity support to over 14 000 healthcare providers, ensuring efficient and accessible healthcare services in rural areas.

Public private partnerships

The Government of the Central African Republic established the PNS2028 Infrastructure Master Plan, a two-pronged approach focusing on infrastructure development and government service improvements. The PNS2028 Infrastructure Master Plan outlines several key initiatives, including a public private partnership (PPP) with the South African telecommunication company MTN Global with the aim of marketing very high speeds on the national and international backbone and extending fibre-optic cables to unserved areas.⁴⁷

1.4 Trends in international connectivity in developing countries

Trends in international connectivity in developing countries indicate strong positive growth in recent years. However, when seen from a broader perspective they still indicate that a massive amount of work remains to be done. Despite an estimated sevenfold increase in Internet use in low-income countries since 2005, Internet use in these countries remains far below that of higher-income countries, reaching only 22 per cent in 2021. In contrast, high-income countries, at 91 per cent penetration, are close to universal usage. In least developed countries (LDCs), only 27 per cent of the population use the Internet and in landlocked developing countries (LLDCs) the share is 35 per cent.

⁴⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0168/> from United States

⁴⁵ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0079/> from Argentina

⁴⁶ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0206/> from India

⁴⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0189/> from Central African Republic

Europe, the Commonwealth of Independent States (CIS), and the Americas region are close to achieving 95 per cent usage. The Arab States and Asia-Pacific regions are also on a clear path to universal usage. Africa, however, has only 33 per cent of the population online.⁴⁸

By the end of 2023, 520 million people subscribed to mobile services in sub-Saharan Africa, representing 44 per cent of the population, an increase of 190 million since 2015, and during the same period, the number of mobile Internet subscribers tripled, rising from 110 million to 320 million people. This highlights how mobile represents a growing platform to accelerate progress on the sustainable development goals (SDGs) and to drive socioeconomic advancement in areas such as healthcare, education, digital commerce, industrial automation and smart city infrastructure in the Sub Sahara Africa region⁴⁹.

At the end of 2023, approximately 57 per cent of the global population (4.6 billion people) were using mobile Internet on their own device – up from 33 per cent in 2015. The number of users increased by 160 million people over the year, which is similar to the growth in 2022. More than 90 per cent of the growth in 2023, came from low- and middle-income countries, where 95 per cent of the unconnected population lives.⁵⁰

Affordability continues to be a main barrier to Internet use. Median fixed broadband prices in low-income countries accounted for one-third of monthly gross national income per capita in 2022. Even the cheapest smartphone accounts for more than 14 per cent of annual income for persons living on less than USD 2 a day.⁵¹

1.5 Trends in capacity building and supporting decisions in the process of broadband deployment

Just as governments around the world have rededicated themselves to expanding access to broadband connectivity in their countries, development-focused organizations have worked to expand the capacity of communications regulators and ministries in partner countries.

At the multilateral level, the World Bank Group supports least developed client countries through analytical work programmes and strategic partnerships such as the Digital Development Partnership, including developed country and private sector donors, to promote the deployment of low-cost advanced technologies and innovative business models to expand access to digital services⁵². This work involves new approaches to regulations and new approaches to empowering citizens, small businesses, schools and health clinics to acquire the devices and skills they need. The World Bank is also developing tools and approaches to assist client countries to ensure that the connectivity that is being provided can be trusted by consumers through safe and private access.

The World Bank Digital Development Global Practice works globally in more than 100 countries to help create strong foundations for the digital economy to thrive. The team deploys advisory services including policy guidance, technical assistance, and capacity building, as well as knowledge products including data and diagnostics to provide actionable insights at regional,

⁴⁸ <https://www.itu.int/itu-d/reports/statistics/global-connectivity-report-2022>

⁴⁹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0399/> from GSMA

⁵⁰ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0418/> from GSMA

⁵¹ World Bank “Digital Progress and Trends Report 2023” <https://openknowledge.worldbank.org/server/api/core/bitstreams/95fe55e9-f110-4ba8-933f-e65572e05395/content>

⁵² ITU-D Document <https://www.itu.int/md/D22-SG01-C-0070/> from World Bank

country, and local levels, and research and thought leadership to expand the global knowledge base.

At the individual organization level, the American Registry for Internet Numbers (ARIN) has developed the ARIN Fellowship Programme designed to foster new voices, policy and governance leadership in the field of Internet governance and number resource policy⁵³. The ARIN Fellowship Programme provides a specialized, interactive learning opportunity to individuals interested in these aspects of the Internet and their professional growth in the industry. A group of 'Fellows' is selected twice a year to participate in the month-long programme before and during an ARIN Public Policy and Members Meeting. Fellows receive an in-depth, expert-guided introduction to the workings of the ARIN organization and policy development process, along with opportunities for networking and direct participation in the process. The programme provides an overview of Internet governance, Internet number resource policy and its development, ARIN services and operations, and the Internet number registry system.

The GIGA initiative, a collaborative effort by the United Nations International Children's Emergency Fund (UNICEF) and ITU to connect every school worldwide with Internet connectivity, works to create comprehensive databases containing information on IT equipment, Internet connectivity, and geographical coordinates of all schools in partner countries such as Bosnia and Herzegovina. By pinpointing schools lacking Internet access, the initiative paves the way for targeted investments and infrastructure development. Ultimately, the role that GIGA plays, reflects a trend of capacity building through data collection that is crucial for supporting strategic broadband deployment and ensuring equitable access to technology for students⁵⁴.

1.6 Conclusion - chapter 1

The challenge of the digital divide is widely recognized around the world. More importantly, stakeholders now prioritize addressing the divide like at no other time in recent history. Accordingly, industry leaders have invested in innovative technologies to bring broadband to communities that have historically struggled to access it. These innovations include non-geostationary satellite systems that provide optical fibre-like speed and latency; advanced 5G, 6G, and open-source virtual mobile networks, and advanced Wi-Fi hardware that enables cutting-edge applications.

For their part, governments are responding to the challenge by increasingly adopting comprehensive national broadband plans that lay out tangible coverage targets, supported by mandates for increased investments in national backbone networks. Moreover, governments and regulators are starting to realize that to expand connectivity, they must transcend beyond their legacy regulatory frameworks and should adopt technology-neutral approaches that promote investment, innovation, and competition in their broadband markets. Additional funding and capacity building programmes from public entities and multistakeholder organizations provide supplementary support to the work from industry and governments. As the following chapters will demonstrate, overcoming the digital divide will require more than just infrastructure, but also tangible efforts to make broadband services more affordable and accessible to underprivileged groups, as well as building the knowledge and skills to make use of digital devices and technologies.

⁵³ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0247/> from ARIN

⁵⁴ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0155/> from Bosnia and Herzegovina

Chapter 2 – Broadband strategies and policies in the post-COVID-19 era

The COVID-19 pandemic affected the lives of almost every person on the planet. This was seen in the rapid pace of digitalization in all sectors of the economy, which was necessitated by the need for work and education to be transferred to a remote format due to the pandemic. As a result, the COVID-19 outbreak led to increased fixed and mobile Internet traffic, as well as an increase in the number of broadband users⁵⁵.

A certain trend was set in broadband strategies and policies, which can be observed even after the end of the active phase of the pandemic. Despite the fact that restrictions had already been lifted in many countries, the new digital habits developed during the quarantine persisted, leading to a significant increase in digital activity that continues to be manifested in widely different ways.

2.1 Impact analysis of the effect of the COVID-19 pandemic on deployment of telecommunication infrastructure

The COVID-19 pandemic dramatically increased the use of telecommunications infrastructure around the world, especially in developing countries. For example, in the Russian Federation in the second quarter of 2020, fixed Internet access traffic increased by 34.2 per cent compared to the same period in 2019. Mobile Internet access traffic in the 2nd quarter of 2020 increased by 51.9 per cent compared to the same period of 2019. In the 3rd quarter, after the loosening of quarantine measures, the intensity of mobile Internet consumption remained almost at the same level (+49.3 per cent compared to the 3rd quarter of 2019). In general, mobile traffic growth for 2020 amounted to 47 per cent (22.6 exabytes), this turned out to be lower than the dynamics of previous years, when long term evolution (LTE) network coverage significantly expanded in the Russian Federation⁵⁶.

COVID-19 has further fuelled the need for immediate broadband connectivity to support education, health, social networking, and entertainment for the rural population, which is being fulfilled through Wi-Fi hotspots⁵⁷. As studies of the experience of developed and developing countries have shown, the pandemic has affected the deployment of infrastructure⁵⁸. It is noted that COVID-19 had a negative impact on supply chains, and led to a decrease in investments, which as a result led to problems with the deployment of 5G networks, slowdown in the digital transformation and aggravated digital divide.

A study conducted in Cameroon⁵⁹ highlights the perception that profound economic and social changes are determined by technological advances. Such changes no longer reside in the realm of conjecture but are becoming a reality through the development of capabilities, universal connectivity and the establishment of "remote interactions". The handling of the COVID-19 pandemic clearly demonstrates just how far remote interactions have evolved.

⁵⁵ <https://www2.itif.org/2020-broadband-lessons-from-pandemic.pdf>

⁵⁶ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0191/> from Russian Federation

⁵⁷ ITU-D Document <https://www.itu.int/md/D22-SG01-RGQ-C-0093/> from Intel

⁵⁸ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0289/> from Republic of the Congo

⁵⁹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0036/> from SUP'PTIC

2.1.1 Broadband network connectivity in developing countries

Ericsson⁶⁰, Huawei, Nokia and ZTE together developed a document, which proposes some ideas on addressing rural connectivity in Africa. While the document was written primarily for rural areas, some of the arguments and recommendations can be adopted as a reference:

- Over the course of the pandemic, broadband network connectivity fast emerged as a critical, and sometimes, as the only means, of providing essential services, such as education and healthcare, and of keeping commerce going. The pandemic threw existing social fissures into greater relief. In such troubling times, the digital divide risked being widened in the absence of broadband network connectivity for those on the margins of society, both in an economic and a geographic sense.
- Administrations could help network expansion through regulatory support: facilitating site permits, allowing the use of state-owned assets, such as utility poles and reliable power sources, and permitting location of radio and antenna towers as well as microwave links, for example near government buildings on secure campuses. Policymakers could also permit network operators to enter into cooperation agreements, allowing them to share passive infrastructure elements. Possible practices for upgrading mobile broadband include:
 - a) Upgrading existing 2G/3G sites to later generations of mobile operating in low bands. Then there is also the potential to utilize larger antennas and beamforming to increase coverage and capacity even further.
 - b) Extending/densifying network coverage through low-cost technology solutions.
 - c) Deploying fixed wireless access (FWA) networks.

It should also be noted that in order to support the deployment of broadband infrastructure, the European Union has launched the Global Gateway programme, which is designed for the period from 2021 to 2027. The programme funding will amount to EUR 300 billion and is aimed at supporting projects in the telecommunication sector.⁶¹

2.2 Economic downturn and technological alternatives complementary to the existing network to accommodate increased data traffic

Economic downturn amid the COVID-19 pandemic resulted in a significant decrease in economic activity around the world. This decline was due to measures taken to combat the virus, including the closure of businesses, restrictions on travel and movement, and a decrease in demand for goods and services⁶². The report of an economic experts roundtable organized by ITU⁶³ showed that the increase in traffic led to an acceleration in capital expenditure. Spending on network modernization, which was not directly related to capacity expansion, was postponed, particularly among emerging markets. While the top five operators in Africa spent between USD 5.5 billion and USD 6 billion on network modernization in 2019, it was expected that this would decrease to between USD 4.5 billion and USD 5 billion in 2020. Most experts agreed that, given financial constraints, new infrastructure models such as passive, rural, and RAN sharing will become more prominent in order to reduce overhead costs.

⁶⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0010/> from Ericsson, Sweden

⁶¹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0380/> from Republic of the Congo

⁶² <https://www.imf.org/en/Blogs/Articles/2020/04/14/blog-weo-the-great-lockdown-worst-economic-downturn-since-the-great-depression>

⁶³ Economic impact of COVID-19 on digital infrastructure. https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-EF.COV_ECO_IMPACT-2020-PDF-E.pdf

In addition to such policies governments were undertaking additional technological solutions such as Edge computing, augmented/virtual reality and other emerging technologies in order to guarantee the uninterrupted and effective provision of telecommunication services in the face of a rapidly growing demand⁶⁴.

The increase in Internet traffic during the COVID-19 pandemic indicated the need for higher speed (especially higher upload speed) in the State of Palestine⁶⁵. Previously the predominant means of fixed broadband access was any type of digital subscriber line (xDSL) through a retail business system analysis (BSA) model where customers wishing to obtain Internet access needed to separately purchase the physical infrastructure access from Paltel and then, separately, obtain Internet services from one of many Internet service providers (ISPs). The Ministry of Telecommunications and IT (MTIT) decided to respond to the abnormal increase in demand by adopting a new model for fixed broadband through the rollout of FTTH. The MTIT adopted a sector liberalization approach and opened the market for all ISPs. Due to the absence of the universal service and access fund (USAF) in the State of Palestine, the MTIT increased subsidies for infrastructure development and deployment in commercially unattractive areas, by giving taxes exemptions for the licensing fees (7 per cent of total revenue). This decision was made and at the time of writing, was pending the approval of the Palestinian cabinet. The positive effects of such actions were evident and a total of 7 185 km of fibre-optic network were laid for a total of 53 724 FTTH subscribers. Competition at infrastructure level increased as did investments, and according to the Ookla speed test global index report the Internet speed rose. Lessons learned from the Palestine experience:

- Coordination with governmental agencies shall take a formal form such as a Cabinet decision.
- The technical requirements and labelling regarding digital maps of existing active and passive network infrastructure shall be agreed on before giving the approval to fibre-optic rollout.
- Flexible policies for technology choices (e.g., aerial cables, micro-ducting, etc.) is one of basic factors for the success of FTTH rollout. The decision to avoid aerial cables was made due to the consideration that aerial cable used in tourism sites and districts sometimes causes visual pollution.

2.3 National digital policies, strategies and plans to accelerate the deployment of advanced networks along with the promotion of e-education, e-health and telework after the COVID-19 pandemic

Since 2020, the COVID-19 pandemic has shown how important the Internet is during a crisis. The Internet has enabled millions of people worldwide to continue working and studying while following stay-at-home orders. Internet has provided access to crucial healthcare information, and allowed families, separated due to travel restrictions or quarantine, to stay in touch. Moreover, despite significant increases in the volume of traffic on its networks, the Internet has proved that it is up to the challenge. Its technical foundation, consisting of a network of networks operated cooperatively by service providers and platforms has ensured that the Internet has

⁶⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0291/> from Republic of the Congo

⁶⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-RGO-C-0105/> from Palestine. The State of Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference.

not experienced catastrophic failure. The pandemic demonstrated that the Internet is, indeed, a force for good⁶⁶.

Countries pursuing digital transformation are adopting policies that will see their attainment of high-speed Internet across each respective country. Countries are therefore increasingly adopting broadband policies that:

- Establish minimum broadband speeds for national operators and enforce compliance.
- Encourage utilisation of universal service and access funds (USAF) to subsidize broadband infrastructure rollout.
- Set minimum coverage rollout obligations for national operators and regional operators to expedite the closing of coverage gaps.
- Encourage coordination between respective government agencies for harmonised infrastructure deployment.
- Encourage use of renewable energy to power connectivity infrastructure.
- Implement effective digitalization of the administration.
- Empower the regulatory framework for telecommunications/ICT.

2.3.1 Experiences in extending broadband connectivity and adoption

In the United States, the National Telecommunications and Information Administration (NTIA) has been conducting a number of programmes aimed at extending broadband connectivity and adoption, including to rural/remote areas, and indigenous and marginalized communities⁶⁷. The *Internet for All* initiative focuses on programmes aimed at increasing access to the Internet and digital technologies for all citizens, including tribal nations and minority communities. The programmes cover not only physical access to the Internet, but also the development of digital skills, job creation and increased accessibility of digital technologies for everyone, including people with disabilities, the elderly, and representatives of various cultural groups. NTIA actively plans and evaluates programmes to ensure their effectiveness and the achievement of their goals.

The research indicated some key strategies to expand broadband access:

- hold public consultations to expand broadband access with the fullest range of stakeholders;
- ensure a competitive market and avoid dependence on a limited number of large players by encouraging participation from various providers, including smaller, local companies;
- maintain flexibility in administering requirements;
- engage local communities through outreach and education, as this is vital for building support and ensuring that everyone benefits from the programmes;
- collaboration between government agencies, private providers, community organizations, and individuals can create win-win scenarios and maximize the impact of broadband initiatives;
- articulating a clear vision for broadband development helps guide programme design and ensures that investments align with long-term goals.

⁶⁶ Policy Recommendations during the COVID-19 Pandemic: <https://www.internetsociety.org/covid19-policy-recommendations/>

⁶⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0247/> from United States

2.3.2 Example of developing country recommendations and plans

A study from Cameroon⁶⁸ shows, that since the markets for electronic communications were opened to competition, developing countries have experienced uneven development. The implementation of high-speed broadband technologies is no simple task for most of the Africa region south of the Sahara. Several factors, detrimental to digital evolution, have led to a phenomenon that could be described as a bottleneck. While the liberalization and privatization of the electronic communication sector has seen significant growth, the fundamental challenges to digital emergence have not gone away.

With this in mind, the activities of Cameroon have been informed by the SDGs to create hubs for sustainable development and balanced connectivity.

It is worth noting that broadband services remain a luxury in less developed regions and that this is often the case in rural and low-income communities. In order to improve the current situation, developing countries should:

- collaborate with other Member States of the Economic Community of Central African States (ECCAS) on connectivity and expertise;
- draw upon methods and strategies influencing the effective deployment of wireline and wireless, including satellite, broadband access technologies, together with backhaul considerations, for unserved and underserved populations in non-rural and urban areas;
- plan the migration to and implementation of broadband technologies, taking into account existing networks where appropriate;
- guarantee the availability of broadband to as wide a community of users as possible.

Cameroon for its part intends to:

- convert rural areas into smart cities and communities, with the support of telecommunication operators and ministries and agencies responsible for local development, in order to respond to digital evolution (the financial cost amounts to USD 500 million);
- ensure broadband connectivity for all;
- provide coverage to the population living in 95 per cent of its territory;
- ensure broadband connectivity for all through the deployment of 4G technologies and other emerging technologies for 95 per cent of Cameroon territory.

2.3.3 Connecting refugees

Some countries are focusing their efforts on specific vulnerable groups. This is the case for the Republic of the Sudan⁶⁹, where the Telecommunications and Post Regulatory Authority proposed a set of objectives to support rural and remote areas as well as refugee areas. This is to be achieved following careful examination of projects carried out by local companies in relation to elements such as technical design, technical connections, station management, operations and maintenance, performance monitoring, development, financing, and marketing.

⁶⁸ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0036/> from SUP'PTIC

⁶⁹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0038/> from Sudan

Some objectives of the proposed project include:

- providing broadband Internet services at reasonable prices for populations in universal services areas through Wi-Fi hotspots via microwave or very small aperture terminal (VSAT) Ka-band backhauling;
- providing services at meeting points in villages and towns (rural and remote areas), such as civil and religious schools, universities, hospitals, and healthcare centres;
- providing coverage via Wi-Fi hotspot access points using customer premise equipment around villages, towns, and meeting points or via standard stations or mesh topology in the area;
- establishing Wi-Fi hotspots to provide broadband Internet services in regions with communication towers (established as part of the current universal services project) that are experiencing weak Internet service.

2.3.4 Case study from Costa Rica⁷⁰

Intel Corporation provides a study that highlights the importance of computer and broadband programmes for households, students, and education. An example from Costa Rica shows that during COVID-19, the Ministry of Science, Technology and Telecommunications approved the extension of coverage for the Connected Homes Programme by 46 462 additional households, thus surpassing the goal of 140 496 beneficiary households to 186 958 households by 2021.

2.3.5 Case study from Malaysia⁷¹

The profound changes in broadband connectivity needs caused by the COVID-19 pandemic have led to the development of new national strategies in many countries. In the case of Malaysia, the seismic shift in connectivity demands led to the formulation of the National Digital Network Plan (JENDELA), a collaborative 5-year plan between industries and the Government, which was conceptualized through the National Digital Infrastructure Lab, conducted in 2020. JENDELA is also captured in a national digital communications enhancement initiative under the 12th Malaysia Plan (2021-2025). JENDELA was formulated to provide wider coverage and better quality of broadband experience to enable Malaysians to have access to quality digital connectivity. It was launched in August 2020 and is implemented in two phases over the period 2020-2025. Phase 1 (2020-2022) involved optimizing existing resources and infrastructure for both mobile and fixed connectivity, by expanding 4G mobile broadband coverage to 96.9 per cent in populated areas; increasing mobile broadband speeds to 35 Mbit/s; and enabling 7.5 million premises to access gigabit speeds with fixed broadband services. In Phase 2 which began in 2023, the targets have been stretched further to achieve 9 million premises with gigabit access, 100 per cent Internet coverage in populated areas, and 100 Mbit/s mobile broadband speed leveraging on 5G technology by the end 2025.

⁷⁰ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0076/> from Intel

⁷¹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0083/> from Malaysia

2.4 Conclusion – chapter 2

- The COVID-19 pandemic has led to an accelerated digitalization process around the world, which has required the development of national level broadband plans. Experience has shown that developing countries face several challenges in broadband deployment⁷², including infrastructure limitations that hinder the wider deployment of broadband, and financial barriers that make it economically less attractive for private companies to invest in broadband infrastructure to serve large segments of underserved population. These challenges restrict the reach of broadband services, particularly in rural and remote areas lacking e-health and Internet connectivity.
- Countries where the level of telecommunication/ICT development was high before 2020 were able to adapt to the new user requirements fairly quickly. This further confirms the significance of addressing the digital divide. Moreover, as studies show⁷³, telecommunication/ICT industries (including mobile, wired and satellite broadband connectivity) made a significant contribution to the COVID-19 pandemic economic recovery. Telecommunication/ICT industries not only outpaced the growth of the overall economy but were also a main contributor to improving employment figures. Additionally, telecommunication/ICT industries, through their connective capacity, helped support connectivity during the pandemic itself, preventing both loss of employment in rural areas and impeding economic losses.

⁷² ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0248/> from South Africa

⁷³ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0245/> from United States

Chapter 3 – Strategies, policies and regulations for broadband, including financing mechanisms

In today's digital age, broadband connectivity has become a vital utility that drives economic growth, innovation, and social inclusion. Governments and regulatory bodies worldwide are actively involved in developing strategies, policies, and regulations to ensure widespread access to connectivity including high-speed broadband services.

The future of sustainable and inclusive digital transformation will depend on implementing the right regulatory and economic incentives, encouraging innovation, and creating an enabling environment for all stakeholders, to foster social welfare and economic growth, and contributing to a better digital future for all.⁷⁴

3.1 Broadband policies

Broadband policies are designed to address priorities essential for advancing broadband access and establishing a framework for linking ICT services. Broadband policies must follow development trends and characteristics of broadband networks as they evolve towards the integration of sensing, transmission and computing technologies, driven by the rapid development of next-generation ICTs.⁷⁵

The present decade is characterized by the pursuit of high-capacity networks and global coverage. To keep up in this pursuit, Brazil approved the new Strategic Plan, which is important in terms of transparency and predictability concerning how the regulator, in the context of several regulatory and policy actions, will approach markets to assure their healthy condition in the years to come.⁷⁶

With the move towards full digitalization, and in view of the considerable impact of digital technology usage in almost every area of society, it is important to underline the need for clear regulations so that everyone has access to connectivity, as well as clear regulations on the use of accessible digital equipment in the digital space for all. Member States are encouraged to strengthen their regulatory, institutional and technical capabilities as regards national digital strategies and plans, guaranteeing accessibility to broadband for the broadest possible community of users.⁷⁷

3.1.1 Digital transformation strategies

Realizing the opportunities, and the risks of being left behind, in the digital transformation race, governments worldwide are increasingly putting digital transformation at the front and centre of their policy agendas to drive social development and economic prosperity. According to

⁷⁴ https://www.itu.int/en/ITU-D/Regulatory-Market/Documents/GSR23/GSR-23_Best%20Practice%20Guidelines-E.pdf

⁷⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0417/> from China

⁷⁶ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0350/> from Brazil

⁷⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0019/> from Central African Republic

the latest ITU data, half of all countries worldwide⁷⁸ have adopted digital strategies covering multiple economic sectors. The development of digital policy, and corresponding legal and governance frameworks across and within regions is, however, markedly uneven. Only nine countries, or fewer than 5 per cent of countries worldwide, are currently equipped with mature national frameworks for digital markets geared to transformational development of digital economies and societies. Additionally, only 30 per cent of countries globally have made progress in establishing an advanced national digital policy, and corresponding legal and governance frameworks. As a result, four distinct groups of countries can be identified, each at a different stage of digital development, and with varying levels of maturity in their national digital transformation strategies: countries with limited readiness, and transitioning, advanced and leading countries.⁷⁹

Despite progress in developing policies to address the digital divide and bring affordable connectivity to all, in many low-income economies, most regions must continue to contend with inadequate digital connectivity. Large swathes of their populations continue to have limited access to meaningful and affordable broadband Internet for inclusive development. This has constrained governments' efforts to address development challenges, such as sustainable delivery of a broad range of services to enhance productivity for economic growth. Policymakers can therefore facilitate digital transformation by crafting policies that incentivize private sector investment, streamline permitting processes for infrastructure deployment, and support digital literacy programmes.

3.1.1.1 National experiences

One example of policymakers facilitating digital transformation is the 2018 decree of the Russian Federation, that established and approved national projects for the period up to 2024. These national projects were aimed at the development of human capital, a comfortable living environment and economic growth. One of the key initiatives is the Digital Economy national programme, which aims to accelerate the introduction of digital technologies in the economy and social sphere, create conditions for high-tech business, increase the competitiveness of the country in the global market, and improve the quality of people's lives.⁸⁰

In Côte d'Ivoire, the national strategy for the development of the digital economy makes it possible to effectively coordinate government action in all domains and sectors contributing to building digital development. Plans for digital transformation aim to make companies more competitive, improve the quality of public services, and open new socio-economic opportunities for all citizens in an inclusive manner, while protecting individual and collective security. The national strategy for the development of digital economy for 2020-2025 is intended to make Côte d'Ivoire a leader and subregional hub in the sector, with large-scale, rationalized utilization of digital technology for administration, citizens and companies, and indeed at all levels of society. To accomplish this ambitious plan, Côte d'Ivoire adopted seven pillars for 2025, comprising digital infrastructures; digital services; digital financial services; digital skills; business environments in the digital sector; innovation; and cybersecurity and digital confidence⁸¹.

⁷⁸ https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-BB.REG_OUT01-2023-PDF-E.pdf

⁷⁹ National digital transformation strategy mapping <https://digitalregulation.org/national-digital-transformation-strategy-mapping-the-digital-journey/>

⁸⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0119/> from Russian Federation

⁸¹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0154/> from Côte d'Ivoire

In the Republic of Burundi, among the key factors that influence Internet use are the quality and availability of telecommunications infrastructure, including electricity supply and the deployment of mobile networks, as well as cost of access. This emphasizes the fact that policies aimed at reducing the high costs of Internet plans could have a significant impact on Internet uptake. Enabling policies for innovation and an open digital environment are key to boosting Internet use.⁸²

In all regions and in most countries worldwide, the current state of the enabling environment does not provide sufficient leverage to public sector initiatives, nor to private sector players, to unleash the full potential of digital transformation. There is a stark contrast between the level of preparedness of developed countries in Europe and North America, of respectively 6.8 and 7.8 out of 10, and the level of preparedness in developing regions that range between 3.4 and 4.6 out of 10 in Africa, the Arab States, the Asia-Pacific, and Commonwealth of Independent States, and 5 out of 10 in the Americas region⁸³.

3.1.2 Technology neutrality as a way to bridge digital gaps

Technology neutrality is an approach that ensures that policies and regulations do not require the use of any specific technology and do not favour one technology over another, allowing a diverse range of solutions to compete and be deployed based on their suitability and effectiveness. By embracing technology neutrality, policymakers can encourage innovation and competition, which can drive down costs and accelerate the rollout of broadband services. By way of illustration, connectivity through satellite technology contributes to bridging the digital divide and accelerating digital transformation. The key to the future of connectivity relies in pooling the strengths of different technologies to increase cost efficiency and coverage, whilst simultaneously working together to deliver the exceptional resilience and greater availability of services. Enabling technology-neutral connectivity in remote and underserved areas, promotes access to ICTs and supports economic development.⁸⁴

3.1.2.1 An update on broadband development⁸⁵

With the rapid development of broadband network technologies and applications, countries around the world are accelerating their progression toward gigabit societies that provide gigabit access to both fixed and mobile networks. In 2022, the European Union unveiled the Connecting Europe Facility digital programme, that aims to increase the coverage of digital connectivity infrastructure across Europe, including 5G, cloud infrastructure and high-speed gigabit networks, and ensure that gigabit connections will cover all European Union households, and that 5G networks will cover all densely populated areas by 2030. The Federal Republic of Germany has released the Gigabit Strategy 2030, proposing to increase the coverage of mobile networks nationwide by means of optimizing the approval process for broadband infrastructure construction, subsidizing the construction of mobile broadband networks and strengthening the deployment of 5G innovative applications. Germany plans to increase the coverage of FTTH networks to more than 50 per cent of households and enterprises across the country by the end of 2025 and provide all households and enterprises with access to FTTH networks and 5G

⁸² ITU-D Document <https://www.itu.int/md/D22-SG01-C-0374/> from RIFEN

⁸³ Global Digital Regulatory Outlook 2023. https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-BB.REG_OUT01-2023-PDF-E.pdf

⁸⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0251/> from GSOA

⁸⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0226/> from China

services by 2030. The United States has launched the 'Internet For All' initiative, which intends to deploy end-to-end fibre-optic infrastructure in underserved areas across the country by 2030 and provide affordable, high-speed and reliable broadband Internet services for all.

Japan has released basic policies concerning the Vision for a Digital Garden City Nation, which aims to increase FTTH coverage to 99.9 per cent of households nationwide by the end of 2027 and increase 5G coverage to 99 per cent of its population by the end of 2030. The country will continue to implement a tax system that promotes 5G investments, which provides telecommunication operators investing in 5G construction with a tax break equivalent to 15 per cent of their investments. The United Kingdom has updated its UK Digital Strategy, which sets out to build world-leading and secure digital infrastructure, and aims to increase the coverage of 5G networks to the majority of its population by 2027, through measures such as accelerating the commercial delivery of gigabit broadband across the country, investing more in 5G R&D and testing, and implementing the Government 5G diversification strategy.

China has also issued policy documents to promote the coordinated development of "dual-gigabit" networks and plans to basically complete a dual-gigabit network infrastructure that covers all urban areas and villages and towns where possible by 2023, and to ensure that fixed and mobile networks are universally equipped with gigabit-to-the-home capacity. A gigabit cities construction campaign has been launched to further expand the coverage of gigabit fibre-optic networks, accelerate the scale deployment of 5G networks, deepen cooperation in telecommunication infrastructure construction and sharing of its benefits, and encourage local governments at all levels to increase support for the construction of 5G and gigabit fibre-optic networks. Innovative applications have also been boosted to accelerate the formation of a healthy development cycle where technologies, networks and industries promote each other and give full play to the role of broadband networks in supporting economic and social development. Through collaboration among multiple government departments, industry applications such as 5G+smart tourism, 5G+smart education, and 5G+healthcare have been rapidly popularized. The evolution of broadband policy in China covers three areas: 1) improving the top-level design at the national level, 2) promoting policy implementation at the industry level, and 3) promoting practical innovation at the local level.⁸⁶

5G is expected to become the dominant mobile access technology by subscription in 2028. Global 5G subscriptions are forecast to reach close to 5.6 billion in 2029, making up 60 per cent of all mobile subscriptions at that time. It is projected that North America will still have the highest 5G penetration in 2029 at 90 per cent, followed closely by the countries of the Gulf Cooperation Council at 89 per cent and Western Europe at 86 per cent. 5G subscriptions in sub-Saharan Africa in 2029 are anticipated to exceed 320 million, accounting for 28 per cent of all mobile subscriptions at that time⁸⁷.

The United States has identified open radio access networks (ORAN) architecture and equipment as a key element to address mobile network enhancements and security measures. ORAN is a telecommunications approach that uses standardized software protocols and hardware interfaces, enabling components from multiple suppliers to work together seamlessly. This innovative, industry-driven model allows network operators to design, build, and upgrade mobile networks flexibly by mixing and matching equipment and software from various vendors, including local companies. By reducing reliance on single-vendor systems, ORAN

⁸⁶ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0417> from China

⁸⁷ Ericsson Mobility Report. <https://www.ericsson.com/mobility-report>

fosters innovation, lowers costs, enhances network performance through automation, and enables gradual, cost-effective technical upgrades, all while ensuring interoperability through standardized interfaces and protocols. To advance the deployment of ORAN, and recognizing the critical need for workforce development, USAID established the first-ever ORAN Academy, the Asia ORAN Academy or AORA, in the Republic of the Philippines in 2022.⁸⁸

3.2 Regulatory interventions

Regulatory interventions for broadband development aim at stimulating and shaping the deployment and usage of broadband infrastructure and services. Efficient regulations must ensure fair access, foster healthy competition, and protect end users' rights. Some of the regulatory and economic incentives towards achieving meaningful connectivity are defined in Global Symposium for Regulators (GSR) Best Practice Guidelines⁸⁹:

- **Market access:** Policymakers and regulators are encouraged to ensure a competitive environment in all layers of the digital ecosystem by providing incentives for incumbents, new entrants, and startups that bring new solutions and technologies to the market to meet national connectivity goals. This could include establishing safe spaces for experimentation and innovation such as sandboxes and testbeds.
- **Universal access and service:** Policymakers and regulators could consider incentives for network deployment in rural, unserved and underserved areas that may include subsidies, grants, low-interest loans, loan guarantees, reducing regulatory fees, introducing fee exemptions (e.g., customs waivers on import duties) or giving tax breaks for investors or tax holidays for market players after reaching certain investment thresholds in these areas.
- **Universal service funding:** Policymakers and regulators can employ universal service financing mechanisms to address the needs of rural, unserved and underserved areas and populations in vulnerable situations.
- **Balancing fiscal policies:** Policymakers and regulators could consider broadening the base of contributors taking into consideration the characteristics of markets and new developments.
- **Innovative regulatory last mile connectivity solutions:** Policymakers and regulators are encouraged to consider facilitating last mile solutions to connect the unconnected, through means such as municipal, community and mesh networks, and social enterprises, as well as spectrum and infrastructure sharing, and co-investment to extend networks and services to unserved and underserved areas.
- **Spectrum reform:** Policymakers and regulators could take steps to make sufficient spectrum available to support rapid deployment of next generation services, innovation and investment in terrestrial and satellite infrastructure, and spectrum-based services. Unlicensed spectrum use, spectrum refarming and redeployment, could be part of the regulatory tools employed to facilitate deployment in rural, unserved and underserved areas.

Unlicensed spectrum is open to use as long as devices follow certain technical rules, with exemption from individual licensing of certain types of radio equipment.

Mobile broadband technologies, anchored in global 3GPP cellular standards, currently constitute the principal means by which most people access voice and Internet services, to

⁸⁸ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0419/> from the United States

⁸⁹ GSR23 Best Practice Guidelines https://www.itu.int/itu-d/meetings/gsr-23/wp-content/uploads/sites/20/2023/06/GSR-23_Best-Practice-Guidelines-E.pdf

meet the policy goals of connectivity.⁹⁰ As noted in previous sections, advances in satellite technology represent another key means for addressing rural connectivity divides.

Satellite connectivity plays a critical role in connecting the 2.6 billion that remain unconnected to broadband service among other technologies. The optimum solution for future connectivity does not lie with one technology alone, but rather through a combination of multiple technologies, pooling their different strengths to increase cost efficiency, whilst simultaneously working together to deliver the exceptional resilience and greater availability for a much larger number of citizens.⁹¹

3.2.1 Infrastructure sharing

Infrastructure sharing in telecommunications improves efficiency and reduces costs through active and passive sharing. Passive sharing involves jointly using physical assets such as towers and shelters, and lowering capital costs and environmental impact. Active sharing includes network elements such as antennas and base stations, optimizing coverage and fostering competition. Combining both enhances cost efficiency, accelerates technology deployment, and supports sustainable networks.

Despite the advances that have been observed worldwide in terms of coverage, accessibility, and appropriation of mobile technologies (3G and 4G) and optical fibre, there remain great challenges to reaching that 40 per cent of the population that remains to be connected, as well as to the deployment of 5G, especially in rural and remote areas.⁹²

As concluded in a recent study "Latin American telecommunications at the crossroads of passive infrastructure sharing", the development of an independent, vibrant, and sustainable tower industry is critical for the future development of mobile telecommunications. Additionally, given the growing potential of towers to support edge computing, the deployment of fibre-optic network distribution nodes for mobile telecommunications, and for future alternative power generation, it is imperative that governments update policies and regulations to generate the right incentives for the development of the tower sector. A review of the research literature and interviews of regulators and policymakers has led to the identification of seven types of initiatives that can contribute to the development and sustainability of an independent tower sector: Dispensing of the need for service concessions, fast permit approvals with consistent and reasonable timeframes, regulations to prevent over-deployment, a cap on fees and taxes along with rights of construction, policies promoting shared infrastructure for 5G deployment, no price regulation on tower company contracts with service providers, and long-term guarantees in regulations and permits.⁹³

Regulators should explore collaborations with counterparts from other sectors such as the water, or electricity sectors, in order to exploit the concept of infrastructure sharing. Such an infrastructure model is particularly effective for deployment in congested urban areas where installing new infrastructure is prohibitive. In addition, this deployment can also be beneficial in newly established areas in terms of cost, right-of-way issues, and potential smart services and applications for utilities.⁹⁴

⁹⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0010/> from Ericsson

⁹¹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0215/> from GSOA

⁹² ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0049/> from SBA Communications

⁹³ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0049/> from SBA Communications

⁹⁴ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0179/> from Egypt

In the Republic of Peru, expanding mobile broadband coverage through voluntary infrastructure sharing has proven to be successful in the case of the Internet Para Todos collaborative initiative established in 2019 to connect rural towns in the country with 4G Internet. Voluntary infrastructure sharing, an agreement between two or more market players to share various parts of their infrastructure for the provision of telecommunications services, is an effective way to promote digital inclusion and increase adoption of digital technologies.⁹⁵

The rural mobile infrastructure operator (RMIO) model⁹⁶, developed through the Korea Information Society Development Institute (KISDI), is an infrastructure-sharing approach used in Peru to extend coverage to rural and underserved areas. RMIOs provide last-mile connectivity and form partnerships with mobile network operators (MNOs), helping MNOs overcome low returns on investment in remote regions. RMIOs offer wholesale services without directly serving end users or owning spectrum, and so allowing them to support multiple MNOs. The model highlights important policy recommendations for governments to ensure effectiveness and economic viability in rural coverage. Among the policy recommendations from this model are solutions such as increased government support, lower entry barriers, transparent access to information and mix and match infrastructure deployment of RMIOs with social infrastructure projects.

3.2.2 Regulation of competition

One crucial goal of regulation is to promote fair competition and prevent anti-competitive practices such as price fixing, market manipulation, unfair exclusionary tactics, and abuse of dominant market positions. The ultimate goal is to ensure fair competition and to protect the interests of consumers and smaller market players.

Most broadband providers rely on access to national fibre-optic backbone networks. However, in **Madagascar**⁹⁷, the national backbone network is built and managed by a single incumbent operator, which holds a monopoly on the backbone market while competing with other broadband providers. This dominant position risks a margin squeeze, leading to high broadband costs for end users. The Government used competition to boost the broadband market and bring down prices. As a result, currently two operators share the national fibre-optic backbone market. The Government hope is that this policy will eventually lead to a significant drop in the price of broadband access.

In the **State of Palestine**⁹⁸, the MTIT addressed the fixed broadband monopoly by liberalizing the sector and allowing all ISPs to enter the market under a new 15-year broadband licence with national coverage and speed obligations. To encourage competition and infrastructure development in commercially unviable areas, MTIT introduced tax exemptions on licence fees, pending Cabinet approval, in the absence of a universal service fund.

The telecommunication sector faces numerous challenges that deserve to be meticulously addressed. The first requirement is a sound legal basis enabling the development of competition in the market; hence the creation of new types of licence and the facilitation of interconnection

⁹⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0327/> from GSMA

⁹⁶ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0026/> from Republic of Korea

⁹⁷ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0039/> from Madagascar

⁹⁸ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0105/> from Palestine. The State of Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference.

and access to essential infrastructure. The development of the sector will inevitably involve digitalization.⁹⁹

3.3 Deployment strategies

Broadband deployment strategies are crucial components of broadband policies, focusing on expending infrastructure and improving access to broadband services.

The main challenges for broadband deployment in developing countries are as follows¹⁰⁰:

- **Infrastructure limitations:** Many developing countries face infrastructural challenges that hinder broadband deployment. Limited investment in backbone infrastructure such as optical fibre or satellite technology restricts the reach of broadband services, particularly in rural and remote areas which lack eHealth and Internet connectivity to schools.
- **Financial barriers:** The high cost of deploying broadband infrastructure poses a significant barrier to access in developing countries. Limited financial resources and investment incentives result in slower infrastructure expansion, leaving large segments of the population underserved.
- **Regulatory constraints:** While acknowledging significant advancements in satellite terminals and the emergence of new-generation LEO and high-throughput geostationary satellites, it is plausible that regulatory constraints could potentially hinder the thriving of technological advancements necessary to ensure broadband access for all. Regulatory frameworks and bureaucratic hurdles, including complex licensing procedures and spectrum management issues, may present challenges that could deter private sector investment and innovation in the sector. Addressing these potential regulatory constraints is essential to fostering an environment conducive to technological progress and universal broadband access.
- **Urban-rural disparities:** Disparities in broadband access between urban and rural areas are pronounced in many developing countries. Limited infrastructure development and lower population densities in rural regions often result in inadequate broadband.

Measurement and evaluation of national broadband plans and deployment strategies are a critical element for success in implementation. A number of policies and strategies considered by the Study Group included various forms of targets or measurements, including in Egypt, the National Broadband Strategic plan 2022-2025, in Kenya the 2022-2032 ICT Master Plan, in Malaysia, the National Digital Network Plan (JENDELA), in Democratic Socialist Republic of Sri Lanka, the National Digital Strategy, and in the United Kingdom, Project Gigabit. Through progression of a policy or of a strategy's implementation, policymakers can use a variety of tools to measure progress and aid their review process. Examples of this include Brazil's Connectivity Index¹⁰¹ (*Índice Brasileiro de Conectividade - IBC*) and the quarterly reports from the United Kingdom's quarterly updates for Project Gigabit¹⁰². Many plans/strategies, including those of Egypt and Sri Lanka mentioned above, include iterative milestones through the progression of the plan in order to continually measure progress.

⁹⁹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0163/> from Madagascar

¹⁰⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0248/> from South Africa

¹⁰¹ [Brazilian Connectivity Index](#) (*Índice Brasileiro de Conectividade - IBC*)

¹⁰² [Case Study: Gigabit Broadband Voucher Scheme](#) and [Project Gigabit progress updates- GOV.UK](#)

3.3.1 National broadband policy

In 2018, the Republic of Uganda¹⁰³ adopted a National Broadband Policy aiming to expand high-speed broadband in the country. The National Broadband Policy uses diverse strategies to expand high-speed broadband, including infrastructure sharing to reduce costs and reach underserved areas. A mix of technologies and technology-neutral regulations support universal coverage, while improving digital skills, and content development promotes digital service adoption. Developing countries should establish policies and licensing regimes that set minimum broadband speeds and coverage requirements for national operators, while using universal service and access funds to subsidize infrastructure where deployment is not commercially viable. Additionally, coordination among government agencies is essential to ensure a harmonized and efficient rollout of broadband services.

Central African Republic¹⁰⁴ faces severe infrastructure challenges, and lacks both international and domestic fibre-optic networks. It relies mainly on satellite connections for international traffic, resulting in high broadband prices. To overcome these issues, the national digitalisation plan, called the Plan National Centrafrique Digitale 2025 (PNCD2025) was launched as an expression of the country's determination to take a major step forward on the road to progressively reaching the level of modern and prosperous states.

The intention is to lay the foundation to develop an electronic administration and digital administration services. Within the PNCD2025 project, the 2025 master plan defines the principles and the phases in the construction of the digital administration platform in the country. The roadmap includes several steps: the regulatory documents definition, establishment of regulatory framework and guidelines, formulation of the institutional framework, and development of infrastructure. Member States aim to strengthen their regulatory, institutional, and technical capabilities as regards national digital strategies and plans, guaranteeing accessibility to broadband for the broadest possible community of users.

A common method for evaluating infrastructure projects is through detailed feasibility studies, however these can be slow and risk changes in socio-economic or technological factors. One solution is decision support systems that automate feasibility studies through simulation modelling. These systems, using standardized methods and current data, quickly filter viable projects from unfeasible ones. The key advantage is their ability to dynamically adjust input parameters, enabling rapid reassessment of projects.

In 2021 the United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP) launched a new Web-toolkit targeted on the Integrated Planning of Infrastructure Corridors solution, that is comprised from two innovative products: the Infrastructure Corridors Simulator and the Partnership Portal on Co-deployment of ICT infrastructure with road-transport and energy infrastructure. The simulation tool aims to determine the most appropriate model for development of new Integrated Infrastructure Corridors.¹⁰⁵

To date the solution has been used to calculate three infrastructure corridors connecting Almaty (Republic of Kazakhstan) with Cholpon-Ata (Kyrgyz Republic), Semey (Kazakhstan) with Rubtsovsk (Russian Federation), and Urzhar (Kazakhstan) with Chuguchak (China), and the

¹⁰³ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0045/> from Uganda

¹⁰⁴ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0019/> from Central African Republic

¹⁰⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0174/> from Institute of Telecommunications and Global Information Space, Ukraine

solution is replicable and adaptable to any country in the world. These outputs were then shared and promoted through the capacity-building workshops in July 2021, July 2022 and June 2023 with key stakeholders of Mongolia, Kyrgyzstan, and Kazakhstan (LLDCs).

3.3.2 Innovative approaches

Globally, most remote communities, especially those in developing countries, are facing the challenge either of lack of connectivity or of accessing unreliable and unaffordable Internet connectivity. This lack of access to connectivity hinders the attainment of the envisioned UN SDGs and individual countries socio-economic growth (Bidwell & Michael, 2019). Nationwide commercial telecommunications service providers, owned by private operators, have until recently been touted as the most effective ICT infrastructure providers, to address national connectivity needs. This position has lately come under scrutiny in the face of the slow pace of infrastructure rollout in developing countries, especially in the case of remote unserved communities. This has forced governments driven by the mantra of 'leaving no one behind', to begin exploring emerging connectivity models that will hasten the pace of connecting all citizens¹⁰⁶.

Furthermore, over a billion people worldwide live in rural communities where Internet access is poor or completely unavailable. This severely limits their access to key digital services such as telehealth and online education, as well as job opportunities that involve telecommuting. It is estimated that 37 per cent of the global population, or around 2.9 billion people, are poorly connected or unconnected. Two thirds of the world's school-age children, or 1.3 billion children aged 3 to 17 years old, do not have an Internet connection in their homes. This figure is according to a joint report from UNICEF and ITU. The Broadband Commission for Sustainable Development set a target of connecting 75 per cent of the world's population to fast Internet via cable or wireless by 2025.¹⁰⁷

Community networks (CNs) are often seen as a solution to help bridge the connectivity gap. Kenya¹⁰⁸ is pursuing the 'Bottom-Up approach' to encourage sustainable community-led telecommunications infrastructure network deployment, modelled on community-focused connectivity, micro-network approaches, and partnerships. Kenya has adopted a fixed wireless approach for community networks. It is considered that this solution presents advantages over traditional models, including: (1) Providing more local control over how the network is used and the content that is provided for the community over the network; (2) Greater potential for attention to the needs of marginalised people and specific populations; including women, persons living with disabilities and older people; and (3) Lowering of costs and retention of more funds within the community.

Solutions such as CNs use a variety of different technologies, but generally the equipment used to start a network is affordable and less expensive than the equipment used by commercial ISPs. This makes CNs an innovative way to meet current Internet connectivity challenges. The logistics and administration of CNs are less expensive because of their scale and local nature. These factors make CNs sustainable from an economic perspective. CNs are often environmentally sustainable as they frequently make use of renewable energy such as solar power.¹⁰⁹

¹⁰⁶ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0164/> from Kenya

¹⁰⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0093/> from Intel

¹⁰⁸ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0164/> from Kenya

¹⁰⁹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0094/> from Internet Society

According to the Internet Society, there are three main barriers that CNs face in attempting to provide connectivity to rural, remote and underserved areas:

Licensing and authorization

Community networks face significant challenges in securing licences and authorizations, particularly in rural areas. High fees, multiple registration requirements, and complex regulatory hurdles create financial and administrative burdens that make it difficult for small communities to establish affordable connectivity. These obstacles hinder CN initiatives, especially when accessing regulatory support is costly and inaccessible.

Spectrum management

Traditional licensing that grants exclusive use instead of shared use of portions of spectrum over large geographic areas can lead to large portions of spectrum being unused or underutilized. ISPs that are granted exclusive licences often lack economic incentive to build their networks in rural and remote areas, but their exclusive licences result in the exclusion of CNs that can adapt their sustainability models to connect these areas. Spectrum regulations should enable CNs by allowing access to available frequencies without interfering with primary users, and by adopting innovative licensing approaches to facilitate spectrum access. Additionally, involving CN experts in regulatory proceedings can help create more effective and inclusive policies.¹¹⁰

However, the regulatory mechanisms that will assure spectrum sharing and accelerate broadband deployment, are still in the development stage.

Innovative financial and legal mechanisms

There is a need to unlock funding in innovative ways from the public, as well as the private sector, to reach the goal of connecting the unconnected by 2030.

Concerning the private sector, it is key to help funders of broadband infrastructure identify opportunities for investing in 'complementary connectivity and access solutions'. Funders can consider participating in a blended capital stack and identify the evolving financing needs and capital structures of these innovative connectivity solutions over the infrastructure life cycle.¹¹¹

According to Internet Society, in some countries that do have universal service funds, a large portion of the funds are unused, this amounts to billions of dollars (USD) that could be used to connect underserved areas, remaining frozen or diverted to other purposes.¹¹² Often universal service funds do not have provisions in place for CNs to apply. This challenge is sometimes linked to some of the obstacles CNs face in obtaining licences and authorization that are necessary for applying for universal service funding.

Wi-Fi technology is also seen as a solution to provide affordable Internet access through Wi-Fi spots to bridge the digital divide. According to the Intel Corporation¹¹³ Wi-Fi is considered as the most suitable technology to provide digital connectivity in rural areas. However, there are many factors specific to rural areas which must be considered when defining rural Wi-Fi architecture

¹¹⁰ Financing Mechanisms for Locally Owned Internet infrastructure pp. 102-105: <https://www.internetsociety.org/resources/doc/2022/financing-mechanisms-for-locally-owned-internet-infrastructure/>

¹¹¹ Idem.

¹¹² Unleashing Community Networks: Innovative Licensing Approaches p. 6 : https://www.internetsociety.org/wp-content/uploads/2018/05/Unleashing-Community-Networks_Innovative_Licensing_Approaches-2.pdf

¹¹³ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0093/> from Intel

and deployments if Wi-Fi is to be used as a robust, efficient, and affordable access technology in these areas. Some of the critical factors applicable to Wi-Fi networks in rural areas include:

Broadband deployment challenges, relevant use cases, best practices in the ecosystem, the importance of unlicensed spectrum for Wi-Fi to connect the unconnected, and real-world case studies. It is estimated that the global economic value provided by Wi-Fi will grow to almost USD 5 trillion by 2025.

Other approaches that can be examined include personalised and tailor-made approaches.

For **Argentina**¹¹⁴ it is important to have a sustained public policy, as well as a personalized approach for each region involving tailoring of digital solutions based on the unique characteristics and needs.

Through the Conectar Plan, the Government worked to deliver connectivity infrastructure to remote areas. This sustained public policy has remained in effect through different administrations in the National Executive Branch, representing a continuation of the different initiatives implemented by the national government since 2010. Adopting a personalised approach for each region of Argentina involves providing a digital solution that fits the needs of the region and providing satellite or optical fibre according to the characteristics of each region and province.

The Argentina "Mi Pueblo Conectado" programme¹¹⁵ carried out by the 'Secretariat of Public Innovation of the Chief of Cabinet of Ministers' Office' in Argentina, seeks to promote the digital development of provincial and municipal governments, improving public services and reducing the digital divide in 377 locations. The plan includes satellite connectivity provided by Arsat, the state-owned satellite services company, government financing for Internet services for 12 months, transfers of funds to provinces to acquire technology, and the offer of digital services such as training, open government tools and the integration of platforms for efficient and transparent public management.

The key lesson learned was the importance of designing specific programmes that address the unique needs of different regions lacking connectivity. The implementation of such programmes highlighted the critical role of guaranteeing the right to connectivity in the digital age and emphasized the government role in reaching disconnected populations. "Mi Pueblo Conectado" provided many with Internet access, a fundamental right of citizenship. Additionally, the experience underscored the need for flexibility in policy implementation, as real-world complexities often require adapting beyond the original plan.

Connectivity of post offices enables each community to connect to the government and the economy. Digitalization of public services is very important for digital transformation and digital inclusion. According to Universal Postal Union (UPU) estimates, there are over 650 000 post offices worldwide and more than 100 000 remain unconnected. The postal network offers a unique critical national infrastructure to provide meaningful connectivity and bridge the digital divide in unconnected communities. Connected post offices provide essential government, commerce and financial services for sustainable and inclusive development in the digital economy. This "Connect.post" initiative has been developed in support of the SDGs and the UN Common Agenda, and with the support of Japan's Ministry of Internal Affairs and

¹¹⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0178/> from Argentina

¹¹⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0179/> from Argentina

Communications. Detailed information is available at the following web page including two examples from India and Italy on the connection and digitalization of post offices¹¹⁶: <https://www.upu.int/en/Universal-Postal-Union/Activities/Digital-Services/Connect-post>

3.4 Financing mechanisms

Financial barriers are among the main challenges for broadband deployment in developing countries. The high cost of deploying broadband infrastructure poses a significant barrier to access in developing countries. Limited financial resources and investment incentives result in slower infrastructure expansion, leaving large segments of the population underserved.¹¹⁷

There are a number of funding mechanisms that can be applied to universal access and service interventions, including:¹¹⁸

- **Standard financial products** such as loans, microfinance and small and medium enterprise (SME) finance, impact investment funds, private equity funds, and publicly-managed funding, including universal service and access funds.
- **Innovative financial products** such as public-private partnerships, social impact funds demand pooling, and crowdfunding.
- **Risk mitigation mechanisms**, which seek to reduce the high levels of perceived risk that often hold back private capital – these include subsidies, guarantees and insurance.
- **Result-based financing**, also known as outcome-based aid, such as for example green and social impact bonds and advance market commitments.

3.4.1 Standard financing tools and models

Planning for a wide variety of financing tools and models is a prerequisite for effectively carrying out an ambitious strategy. As detailed in the Egyptian Broadband Strategy, broadband projects can be financed through various methods, often involving a combination of tools. One approach is revenue-based financing, where existing market players use their revenue to finance network expansion and new projects. Another method involves private capital and financial markets, where investment funds and private investors seek stable returns by investing in tangible assets such as next-generation broadband infrastructure. This includes banks, investment funds, infrastructure funds, and other institutional investors. Government-backed financing options are also available, such as bank loans, bonds, and public funds supported by government initiatives.¹¹⁹

The lack of reliable high-speed connectivity is a major obstacle that is all too common in rural and remote areas, and this even though new and emerging technologies and their digitization have enormous potential to transform life and opportunities in rural and remote areas.¹²⁰

¹¹⁶ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0200/> from Intel

¹¹⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0248/> from South Africa

¹¹⁸ <https://www.itu.int/itu-d/reports/regulatory-market/2022/02/01/financing-landscape/>

¹¹⁹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0018/> from Egypt

¹²⁰ ITU GSR 2023 Best Practice Guidelines. https://www.itu.int/itu-d/meetings/gsr-23/wp-content/uploads/sites/20/2023/06/GSR-23_Best-Practice-Guidelines-E.pdf

3.4.1.1 Public-private partnership

Public-private partnership (PPP) is a viable solution for financing broadband development that is being adopted in many countries to leverage public and private resources, accelerate network expansion, and bridge digital divides. The Government of **Central African Republic**¹²¹, for example has signed a PPP with the South African telecommunication company MTN Global with the aim of marketing very high-speed connectivity on the national and international backbone and extend the fibre-optic infrastructure into unserved areas with a view to integrating and implementing ICT services.

In the **United States**¹²², USAID has developed the [Digital Invest](#) programme, a blended finance approach, which strategically uses development funding to catalyse additional investment capital towards sustainable development in developing countries. Since its launch in 2022, USAID's Digital Invest programme has developed 13 public-private partnerships to advance Internet connectivity and digital financial services for unserved and underserved communities in emerging markets. Through this blended finance programme, Digital Invest partners with investment fund managers, Internet infrastructure developers, and other private sector companies aiming to accelerate new investment and to catalyse a significantly higher amount of additional investment capital.

By working through intermediaries who are providing capital or enabling infrastructure for ISPs and digital finance providers, USAID can achieve greater impact than through direct company grants. Digital Invest partners provide the financial facilities (debt, equity, or grants) or enabling infrastructure (optical fibre, towers, etc.) that can support the growth of entire digital ecosystems in emerging markets. Additionally, partners provide significant market insights, and financial resources, and, by working together with the public sector, can deploy capital where it is most needed, faster.

The World Bank highlights the importance of blended finance as a tool to mitigate risk and facilitate financing for private sector-led projects. Blended finance involves using public or philanthropic capital to attract private sector investment in sustainable development. This approach, supported by organizations such as Convergence¹²³, aims to achieve development objectives while still expecting a positive financial return. The participation of donors or philanthropic actors improves the risk/return profile of projects, attracting private investors. Different participants in blended finance transactions may have varying expectations and types of capital or support, such as social versus financial returns.

The United States Digital Invest programme has led to various benefits, including: increased social impact in marginalized communities, improved insight into capital raising, project implementation, addressing of regulatory needs facing ISPs and the digital finance sector in emerging markets, and increased use of secure and trusted equipment and digital platforms.¹²⁴

The **Philippines** has undertaken significant policy and regulatory reforms to enhance broadband access. New initiatives include the amendment of the Public Service Act which now permits 100 per cent foreign ownership of telecommunication services, aimed at attracting substantial foreign investment. The introduction of the Public-Private Partnership code and streamlined

¹²¹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0189/> from Central African Republic

¹²² ITU-D Document <https://www.itu.int/md/D22-SG01-C-0241/> from the United States

¹²³ <https://www.convergence.finance>

¹²⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0423/> from the United States

permitting processes, is intended to optimize collaboration and accelerate infrastructure projects, further advancing digital connectivity.¹²⁵

3.4.1.2 Universal service mechanism

The universal service fund (USF) is a mechanism used by governments or regulatory authorities to ensure that essential telecommunication services are accessible and affordable to all citizens, especially those in rural, remote, or underserved areas. The USF is typically funded through contributions from telecommunication service providers, either as a percentage of their revenues or through specific fees, and managed by a designated government agency or regulatory body, which oversees the collection and disbursement of funds, as well as the implementation of programmes and projects aimed at achieving universal service goals.

The United States¹²⁶ offers an effective framework for managing the USF through the Federal Communications Commission (FCC) and the Universal Service Administrative Company (USAC). The FCC oversees the fund's management, while USAC, a not-for-profit independent entity, administers its programmes. The approach emphasizes transparency, accountability, and adaptability.

To streamline their collaboration, the FCC and USAC signed a memorandum of understanding (MoU) in 2018, outlining each entity's roles and responsibilities.

This MoU is pivotal in delineating duties and emphasizing each entity's joint commitment to the USF administration and oversight. For example:

- For the High-Cost programme, the FCC designs the fund distribution framework for service providers and identifies eligible areas. USAC, in turn, ensures adherence to programme guidelines, and confirms that carriers use the funds appropriately.
- In the Lifeline programme, the FCC sets the qualification criteria for low-income consumers, determines discount amounts, and specifies covered services. USAC manages enrolment, preventing benefit duplication through a dedicated database.
- Within the E-Rate programme, the FCC identifies services eligible for discounts, from Internet access to internal connections, and adjusts discount rates based on schools and libraries' economic status and location. USAC handles applications and verifies eligibility.
- For the Rural Health Care programme, the FCC defines eligibility for healthcare providers to receive discounted communications services and equipment and sets the funding cap. USAC evaluates provider applications and offers guidance on programme benefits.

In the United States, the USF continues to make yearly gains, achieving significant success in bridging the digital divide.

In **Central African Republic**¹²⁷, Law 18.002 on electronic communications established universal service, a defined minimum package of services of a specified quality, to be accessible at affordable prices to the entire population on the national territory. The specific measures to guarantee access respond to the needs of certain social groups and segments of the population, in particular low earners, inhabitants of isolated regions, and persons with disabilities

¹²⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0307/> from Philippines

¹²⁶ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0168/> from United States

¹²⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0019/> from Central African Republic

In **India**¹²⁸ the universal service obligation fund (USOF) has been the force behind the establishing of a high-quality network infrastructure across the rural and remote areas of the country, enabling non-discriminatory access to good quality, reliable and affordable telecommunication services. India's USOF through the Universal Access Levy, helps in promoting affordable and reliable Internet access in rural and remote areas. The USOF, soon to be renamed the "Digital Bharat Nidhi", leverages the Universal Access Levy to fund critical infrastructure projects and bridge the digital divide. It was established to address the lack of telecommunication services in underserved regions and has significantly improved network connectivity through various initiatives.

3.4.2 Innovative financing models

In addition to traditional financing and contribution models there are some innovative models that could be applied, according to case specifics:¹²⁹

- Loss-guarantee scheme model: In a loss-guarantee scheme, public entities or governments are guarantors for certain risk events that may deter private investors from investing.
- Blended-financing model: This model consists of financing a project with a mix of sources of funds from contributors with different interests (investors, financiers, and funders). Combining investments that require market returns with the use of funds that expect a lower return and public subsidies (generating no return), allows all parties to receive the return they require.
- Government-anchor tenant model: The government commits to certain purchases of ICT services as the anchor tenant of the new infrastructure project; the network is usually managed and deployed by operators or ISPs, and the government only provides demand through tenancies (e-government, etc.). This model can stimulate the creation of new infrastructure where demand is uncertain (such as rural areas) or price sensitive.
- Dual-deployment model: This model involves deploying another complementary service in addition to connectivity, such as for example, selling energy or other utility services on top of connectivity. Supply of energy/utility services can be of great relevance to remote rural communities which do not yet have access to electricity, and therefore cannot make use of broadband. This model could be applied in rural and remote areas where there is demand for utility services but uncertainty over demand for broadband services.
- Demand aggregation model: This model is financed by operators and includes clustering demand to make investments more attractive by anticipating minimum demand before launching a service or deploying a network, so that at least a percentage of usage is guaranteed. This can be done through an e-governmental obligatory project for schools or hospitals. The model helps in areas with an adoption gap and low return on investment (ROI).

In **Kenya**¹³⁰, best practice in supporting connectivity projects has been informed by:

- Focused coordination of connectivity projects, a case in point being the [GIGA schools connectivity project](#) where ITU and other like-minded global partners have created a common framework and platform for bringing interested parties together and establishing linkages between financiers, other relevant stakeholders and beneficiary jurisdictions. The unity of purpose derived from such coordination comes out as a strength that both ITU and developing Member States can leverage to attain universal connectivity.

¹²⁸ ITU-D Document <https://www.itu.int/md/D22-SG01.RGO-C-0206/> from India

¹²⁹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGO-C-0018/> from Egypt

¹³⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGO-C-0024/> from Kenya

- Consideration of various options for financing of broadband connectivity projects, including involvement of a universal service fund, mainly used for one-off subsidy financing of connectivity projects.
- Governmental creation of an enabling environment and appropriate regulatory framework to attract private sector investments to invest more in the deployment of broadband network infrastructure.
- Leveraging on public-private partnerships to deploy broadband connectivity projects.

Furthermore, initiatives such as the GIGA project in Bosnia and Herzegovina¹³¹ may serve as a good example for cross-sectoral and cross-institutional cooperation, involving all stakeholders such as the government, regulators, industry and international organizations. This proves that the joint efforts and clear vision of all the involved stakeholders helps to overcome the digital divide, and as a consequence improves the connectivity of special categories of users such as schools, which is in the best interests of children and young people. The United Kingdom¹³² introduced the Gigabit Broadband Voucher Scheme to pool demand among homes and businesses in eligible rural areas, to help cover the cost of deploying gigabit-capable broadband infrastructure. This experience helps inform new strategies for pooling resources, identifying gaps in supply versus demand for ICT services, and funding of infrastructure rollout in a way that supports market competition by supporting a range of suppliers.

3.5 Conclusion – chapter 3

As governments increasingly prioritize digital strategies, significant disparities in policy maturity and infrastructure readiness persist. To bridge the digital divide, policymakers are adopting technology-neutral approaches and implementing regulatory frameworks that support innovation, affordability, and equitable access. Key to this effort is infrastructure sharing, which reduces costs, enhances coverage, and promotes sustainability. Policies that encourage the development of independent tower sectors, fast-track permit approvals, and that limit taxation, are vital for network expansion, while collaboration between ICT and urban planning authorities ensures efficient deployment.

Competition regulation plays a crucial role in preventing market monopolies and in fostering fair pricing, with many jurisdictions opening markets to multiple providers and using tools such as price caps and investment incentives to enhance accessibility. Successful management of USFs has proven effective in expanding broadband to underserved areas, complemented by innovative approaches such as CNs and personalized digital solutions. As advancements in 5G, 6G, and spectrum management continue, public-private partnerships will be key to achieving universal broadband access and to driving socio-economic development. A diverse range of financing models, including blended finance, social impact bonds, and pooled demand, also supports infrastructure projects.

¹³¹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0155/> from Bosnia and Herzegovina

¹³² ITU-D Document <https://www.itu.int/md/D22-SG01-C-0246/> from United Kingdom

Chapter 4 – Transition to high-speed and high-quality broadband networks through various broadband technological alternatives

The demand for data is strong and is continuing to grow. Over the past five years, global data consumption has increased by over 50 per cent per year, or by more than eight times over the entire period¹³³. New and emerging technologies are also adding network capacity and thereby creating the foundation for further data consumption growth. This additional network capacity forms the basis for the monetisation of growing consumer demand through larger data packages.

4.1 Importance of high-speed and high-quality broadband

Developing countries need high-speed broadband connectivity for digital equity and achieving the UN SDGs. The Broadband Commission for Sustainable Development report "The State of Broadband"¹³⁴ explains the importance of high-speed broadband for the 2030 Agenda, where it is estimated that 6 billion people will rely on high-speed broadband for essential services, such as healthcare, education and financial inclusion. The Regional Preparatory meetings for WTDC-22 have also prioritized high-speed broadband in regional initiatives and was agreed as indicated in the Kigali action plan.¹³⁵

Digital divide persists in both developed and developing countries and threatens to become "the new face of inequality," according to UN Deputy Secretary-General Amina Mohammed¹³⁶. The Broadband Commission for Sustainable Development¹³⁷ set a target of connecting 75 per cent of the world's population to fast Internet via cable or wireless by 2025. In September 2022, the United States administration announced USD 502 million¹³⁸ for high-speed Internet in rural communities to help address the issue in the United States. Hence the need to continue focusing on broadband.

As more devices are connected, ensuring high-speed and high-quality broadband is critical for economic growth and digital inclusion. According to the Ericsson 2024 Mobility Report, the growth of mobile network data traffic was by approximately 4 per cent between Q2 2024 and Q3 2024. Long-term traffic growth is driven by continued strong uptake of smartphone

¹³³ 5G driving revenue growth in top 20 markets

¹³⁴ <https://www.itu.int/itu-d/reports/broadbandcommission/state-of-broadband-2021/>; <https://www.broadbandcommission.org/publication/state-of-broadband-2024/>

¹³⁵ https://www.itu.int/dms_pub/itu-d/opb/tdc/D-TDC-WTDC-2022-PDF-E.pdf

¹³⁶ <https://news.un.org/en/story/2021/04/1090712>

¹³⁷ <https://broadbandcommission.org/download/7498/?tmstvt=1718854221>

¹³⁸ <https://www.usda.gov/about-usda/news/press-releases/2022/09/22/biden-harris-administration-announces-502-million-high-speed-internet-rural-communities#:~:text=WASHINGTON%2C%20Sept.,and%20businesses%20in%2020%20states>

subscriptions and an increasing average data volume per subscription, fuelled by data-intensive services such as video¹³⁹.

Multiple technologies such as 5G, Wi-Fi technology, satellite communications, open RAN (ORAN), and optical fibre are available to bring connectivity to all in addressing the digital divide and increase in traffic demand.

5G is a key technology for high-speed broadband digital infrastructure, digital economy, and enhancing of the quality of life of people. Sound policies and regulations will accelerate the deployment of 5G. The 5G mid-band delivers high capacity and broad coverage, making it ideal for a full 5G experience. Paired with low-band frequency division duplexing (FDD), it ensures complete coverage and mobility. The 5G standalone core offers flexibility and programmability, enabling service customisation with assured quality of service (QoS), security, and adaptability. Its benefits include lower latency, agile service creation, and network slicing where 5G standalone (SA) subscriptions are to reach 1.2 billion in 2024.

With over 19.5 billion Wi-Fi devices in use in 2023¹⁴⁰ **Wi-Fi technology** evolution has been instrumental in bringing innovations and it continues to play a key role in providing affordable Internet access to the poorest parts of the world. The operation in unlicensed frequency bands, higher data rates, ease and lower costs of deployment, and operation and maintenance are the key factors that are driving the deployment of Wi-Fi in rural areas around the world.

Mobile network operators (MNOs) rely on optical fibre, microwave, and satellite for backhaul, especially where terrestrial links are unreliable. In developed markets, satellite backhaul eases 4G congestion, while in regions with poor infrastructure, it remains essential for 2G, 3G, and 4G/LTE connectivity. As 5G expands, ensuring reliable, wide-coverage and cost-effective backhaul will be increasingly challenging, making satellite a crucial solution where terrestrial deployment is unfeasible.¹⁴¹

With the deployment of new high-capacity satellite systems and recent technology advances, **satellite communications** is a vibrant and competitive market. New generations of satellites have significantly improved the bandwidth and radio spectrum usage of satellite transmissions. Satellite technology can deliver high speed broadband to households in unserved or underserved areas.¹⁴²

Open RAN (ORAN)¹⁴³ is an industry-driven approach to configuration of 5G and other wireless communications networks. It centres on "opening" technical interfaces between components of the radio access network, the part of the mobile network connecting user devices to the core. Opening what have generally been closed, vendor-specific interfaces stands to lower barriers to entry for a wider range of telecommunication infrastructure suppliers.

The open, interoperable design of ORAN disrupts traditional networks, lowering barriers for new suppliers. Operators gain flexibility, reduce vendor reliance, and enhance security. This fuels competition and innovation, strengthening the global telecommunication market. Crucial

¹³⁹ Ericsson Mobility Report June 2024 <https://www.ericsson.com/492af1/assets/local/reports-papers/mobility-report/documents/2024/ericsson-mobility-report-q4-2024-update.pdf>

¹⁴⁰ Wi-Fi Alliance: <https://www.wi-fi.org/beacon/the-beacon/wi-fi-by-the-numbers-technology-momentum-in-2023>

¹⁴¹ <https://gsoasatellite.com/wp-content/uploads/2017-11-Connectivity-through-Backhaul.pdf>

¹⁴² ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0108/> from GSOA

¹⁴³ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0436/> from United States

for current and future deployments, ORAN boosts reliability in developing countries, expands vendor choice, and lowers deployment costs. Consumers benefit from increased competition and faster feature enhancements. This accelerates network solutions for underserved communities. To adopt ORAN effectively, countries must engage with industry stakeholders, including local mobile network operators, to understand their specific deployment needs.

For the success of ORAN, global adoption and supply chain engagement are vital for commercial scale. Government support, signalled by ORAN policies, boosts industry and academic confidence. A diverse supplier market ensures network openness and security. Small vendors need investment for survival and testing access. Policy implementation demands workforce training and ecosystem support. R&D collaboration among labs, and avoiding redundancy, is crucial. International cooperation reinforces governmental commitment, driving ORAN initiatives.¹⁴⁴

Fibre-optic technology is widely recognized as a cornerstone in the global transition towards high-quality and high-speed broadband. The [Global Connectivity Report 2022](#) underscores the critical role of fibre-optic technology in achieving high-quality, high-speed broadband access. As of 2021, only 29 per cent of the global population, approximately 2.3 billion people, lived within 10 kilometres of a fibre-optic network. Proximity alone does not guarantee access, as many areas lack the necessary infrastructure, such as points of presence or optical-line terminals, to connect homes and businesses to the network. Fixed broadband networks, particularly those utilizing fibre-optics, offer higher data capacity, faster speeds, and greater reliability compared to mobile networks. These attributes make fibre-optic connections more suitable for high-bandwidth activities, including video conferencing, online gaming, and streaming services. However, deploying fibre-optic infrastructure is capital-intensive, especially in regions with challenging geography or low population density. The high costs associated with installation and maintenance can deter investment, particularly in underserved or rural areas in alignment with ITU's agenda of universal and meaningful connectivity.

4.2 Transition to high-speed and high-quality broadband networks

Third and fourth generation mobile networks, together cover roughly 95 per cent of world population today. If second generation (2G) GSM networks are added to the mix, nearly 98 per cent of the world population is today covered by mobile networks.¹⁴⁵ By 2025, more than 90 per cent of the world population is likely to be covered by 4G/LTE networks that continue to evolve to deliver increased network capacity and faster data speeds.¹⁴⁶ In addition, by 2030, the number of satellite broadband users is set to double to at least 500 million people (more than 6 per cent of the world population at 2030) extending services with the intrinsic global coverage of this technology.¹⁴⁷

Recent and ongoing 3GPP standardization activities on non-terrestrial network services have included satellite as a key part of 5G systems in 3GPP Release 17 and beyond. This standard enables the 5G system to support any satellite networks, including the provision of wideband services directly to handheld devices/smartphones. It also leverages the economies of scale of the mobile industry that comes with being included in the 3GPP ecosystem. This work is

¹⁴⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0436/> from United States

¹⁴⁵ <https://www.itu.int/itu-d/reports/statistics/2022/11/24/ff22-foreword/>

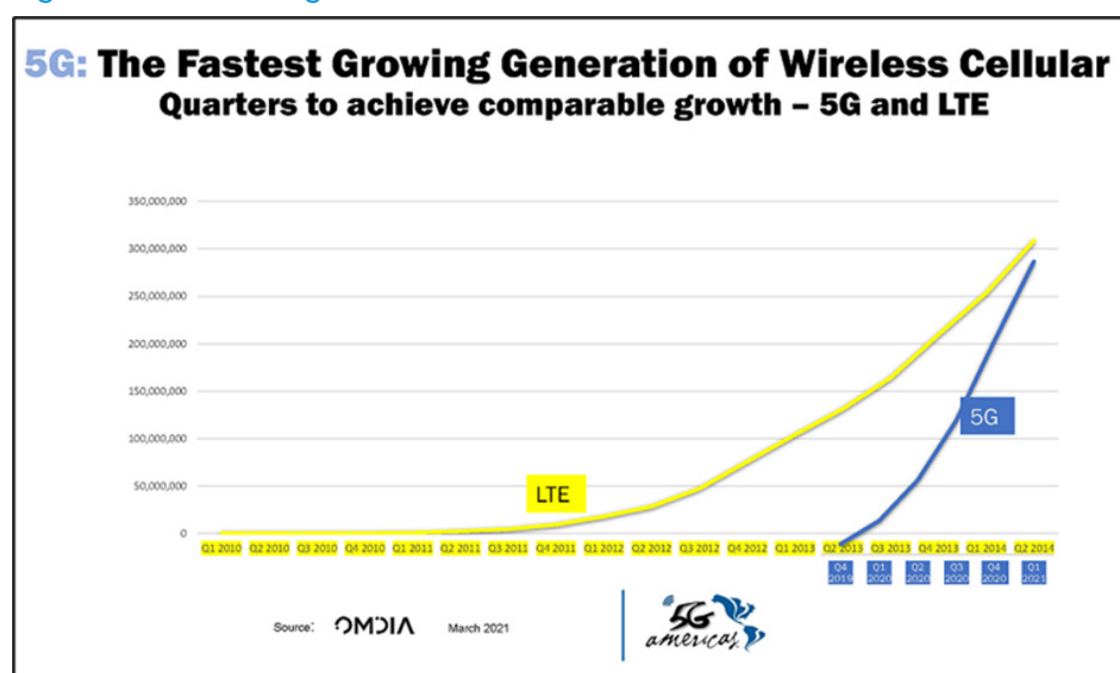
¹⁴⁶ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0010/> from Ericsson

¹⁴⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0108/> from GSOA

continuing in Releases 18, 19, and beyond with the introduction of additional frequency bands and features that enable additional use cases and increased service performance.¹⁴⁸

Leading communications service providers are now preparing to build high-performing, open and programmable 5G networks¹⁴⁹. Today, the main connectivity offerings for consumers and enterprises are based on a best-effort performance model. High-performing, open, programmable networks that utilize 5G architecture provide new opportunities for service innovation and possibilities for performance-based business models. According to the Ericsson Mobility Report 2024, 5G subscriptions worldwide are expected to total around 6.3 billion by 2030, making up 67 per cent of all mobile connections¹⁵⁰. 5G deployment is ongoing, with mid-band spectrum being prioritized. To date, approximately 50 service providers have deployed or launched 5G standalone in public networks.

Figure 3: LTE and 5G growth



Source: <https://www.5gamericas.org/resources/charts-statistics/global>

Global 5G networks and connections are growing rapidly. By mid-August 2021, 461 operators in 137 countries/territories were investing in 5G, including trials, acquisition of licences, planning, network deployment and launches. 5G is the fastest growing generation of wireless cellular technology, as can be seen from the Figures 3 and 4^{151 152}.

¹⁴⁸ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0215/> from GSOA

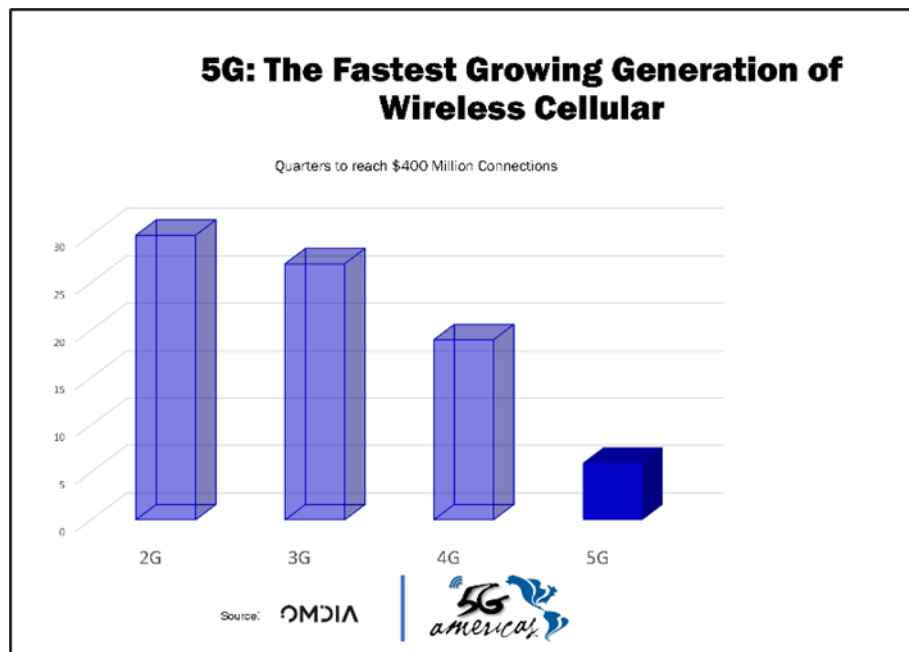
¹⁴⁹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0427/> from Ericsson

¹⁵⁰ <https://www.ericsson.com/4adb7e/assets/local/reports-papers/mobility-report/documents/2024/ericsson-mobility-report-november-2024.pdf>

¹⁵¹ <https://www.5gamericas.org/resources/charts-statistics/global>

¹⁵² ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0008/> from Intel, USA

Figure 4: Wireless cellular technologies growth



Source: <https://www.5gamericas.org/resources/charts-statistics/global>

Mobile networks have evolved and now deliver capabilities beyond what most individual services require. However, the low latency and vastly improved throughput of 5G networks are expected to lead to new, exciting services being developed in the future. This is especially the case in moving imagery and can already be seen in gaming and virtual reality (VR)/augmented reality (AR). Approximately 230 5G networks are in commercial service today, with a growing 5G subscription base that has surpassed 1 billion. An important aspect of 5G is that it also brings cost advantages and helps service providers to handle the data growth needed to drive future revenue. Upgrading existing 4G sites to 5G has the potential to realize increases of up to ten times in capacity and to reduce energy consumption by more than 30 per cent, offering the possibility to grow revenue and reduce costs while addressing sustainability.¹⁵³

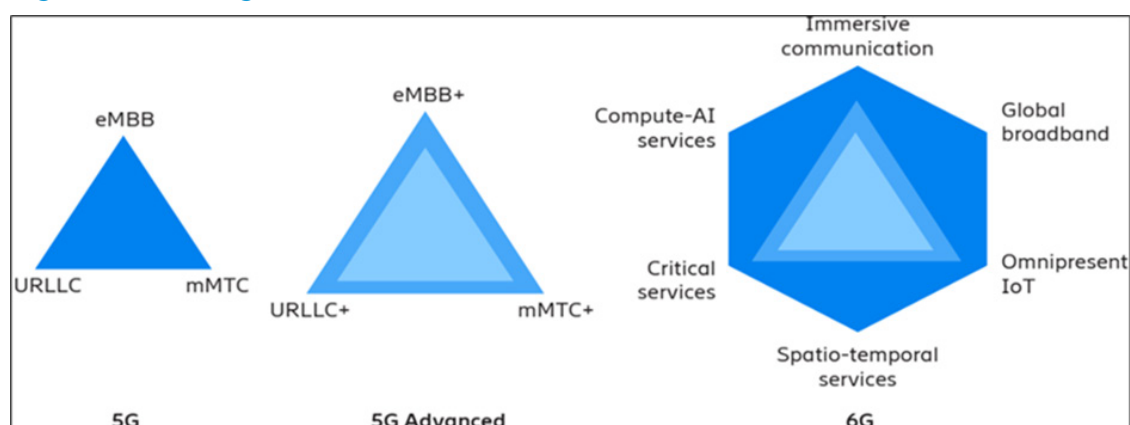
ICT industry, academia, and standardization bodies have already begun to discuss and invest in new technologies to power the next generation of limitless wireless possibilities beyond 5G and 5G-Advanced toward 6G. Countries and regions have already initiated large research projects, and plans are being made for the standardization of this next generation of mobile wireless communication. According to Ericsson's whitepaper¹⁵⁴ 6G use case categories are i) The Internet of senses, ii) Digitalized and programmable physical world, iii) Connected intelligent machines, and iv) Connected sustainable world. To realize the future network vision enabled by 6G and to deliver its full potential, there is a need to secure timely spectrum availability. The journey toward 6G is not straightforward and will be shaped through years of continuous learning from the evolution of 5G, and the exploration of groundbreaking new technologies for visionary use cases¹⁵⁵. The technological path to 6G is shown in Figure 5.

¹⁵³ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0114/> from Ericsson

¹⁵⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0429/> from Ericsson

¹⁵⁵ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0109/> from GSOA

Figure 5: Growing from 5G to 6G



Source: Ericsson White Paper, 6G spectrum – Enabling the future mobile life beyond 2030

According to Ericsson's Report¹⁵⁶ of November 2024, there are four trends driving the evolution of high-performing networks:

- Using network programmability to meet the need for service differentiation.
- Leveraging telecommunication artificial intelligence (AI) to boost the programmability of the high-performing network.
- Transitioning toward a network architecture with horizontal layers to enable innovation for enhanced and expanded capabilities.
- Pursuing innovations over the next decade that enhance performance, sustainability and security.

Fixed wireless access (FWA) uses customer premises equipment (CPE) for last-mile broadband via 4G or 5G. It is a cost-effective option where digital subscriber line (DSL), cable, or optical fibre are limited. Increased 4G and 5G spectrum and technology advancements boost network efficiency, lowering the cost per megabyte delivered.¹⁵⁷ FWA a key 5G application, is booming in areas lacking robust broadband. Global FWA revenues, USD 27 billion in 2022, are expected to hit USD 67 billion by 2028, a 16 per cent compound annual growth rate (CAGR). Leveraging 4G/5G, providers deliver broadband to homes and small and medium enterprises (SMEs). In 139 surveyed countries¹⁵⁸, over 75 per cent of service providers now offer FWA. Ericsson's FWA Handbook¹⁵⁹ 2024, provides six actionable insights that might help capture the value of FWA using 5G technology, based mostly on service provider adoption.

The revised edition of the [ICT infrastructure business planning toolkit – 5G networks 2023](#)¹⁶⁰ was published in March 2023. ITU first published the ICT infrastructure business planning toolkit in 2019 to address business planning challenges with mobile 4G and fibre-optic networks and it continues to offer a clear and practical methodology for the accurate economic evaluation of broadband infrastructure installation and deployment plans, focusing on rural and remote areas. The revised edition adds the design of networks to support sustainable 5G technology rollout. 5G networks have the potential to expand high-speed connectivity, but adoption remains a

¹⁵⁶ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0433/> from Ericsson

¹⁵⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0010/> from Ericsson

¹⁵⁸ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0114/> from Ericsson

¹⁵⁹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0426/> from Ericsson

¹⁶⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0261/> from BDT

challenge in many developing countries. The toolkit addresses mechanisms to evaluate the sustainability of 5G projects.

4.3 Best-practice guidelines for mobile network operators

Mobile operators should proactively engage with regulators to shape policies that foster high-bandwidth access for emerging technologies. This involves that mobile network operators:

- Actively contribute to and align with comprehensive national broadband plans, advocating for clear targets and streamlined regulatory reforms.
- Champion technology-neutral spectrum licensing, ensuring efficient use and future-proofing networks for 5G, 6G, and beyond, securing ample backhaul capacity.
- Drive infrastructure investment through strategic partnerships and efficient deployment, focusing on fibre-optic and mobile broadband expansion, and overcoming deployment barriers.
- Support affordability initiatives through innovative pricing and participation in community broadband projects, expanding digital access to underserved populations.
- Embrace a diverse technology mix (5G, Wi-Fi, satellite, FWA) to achieve universal connectivity, particularly in rural areas, and explore ORAN for cost-effective deployment.
- Invest in digital literacy programmes, workforce training, and collaborate on cybersecurity initiatives, fostering a secure and inclusive digital environment.

4.4 Country/regional examples

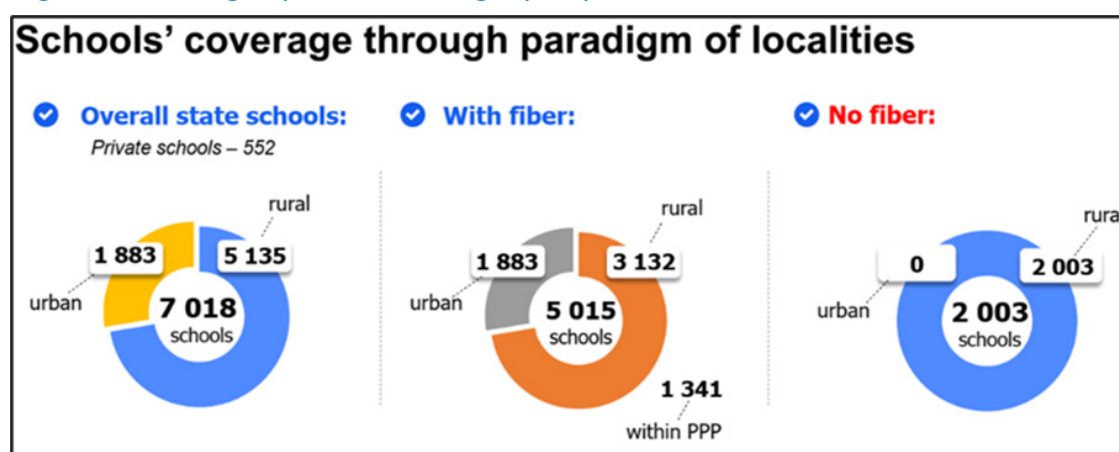
The Russian Federation federal project¹⁶¹ aims for universal access to modern telecommunications to all parts of the country by 2030. Infrastructure requirements were set for line-cable facilities during highway projects and building code revisions for apartment communication infrastructure were finalized. The project targets 97 per cent household broadband Internet coverage by 2030, ensuring equal opportunity for all residents and businesses. This initiative focuses on developing and implementing necessary infrastructure to achieve nationwide connectivity, ensuring modern communication services are available across the entire Russian Federation.

In **India**, the Department of Telecommunications (DOT) launched the **PM WANI**¹⁶² (Prime Minister's Wi-Fi Access Network Interface) scheme in December 2020 to expand public Wi-Fi access, especially in rural areas. The scheme allows a village level entrepreneur (individual or a small store owner) to become a public data office (PDO) with minimal investment and to resell Internet service to users. The PDOs procure the service from PDO aggregators (PDOAs) who, in turn, procure the service from telecommunication service providers or ISPs. An early deployment under the scheme took place in Baslambi village (population 3 000) in the northern Haryana state, in March 2021, and was soon followed by a deployment in Baidebettu village (population 9 000) in the southern Indian State of Karnataka in June 2021. Since then, several hundred other villages in various parts of the country have been connected under the scheme.

¹⁶¹ ITU-D SG1 Document <https://www.itu.int/md/D22-SG01.RGQ-C-0119/> from Russian Federation

¹⁶² ITU-D SG1 Document <https://www.itu.int/md/D22-SG01.RGQ-C-0093/> from Intel

Figure 6: Sharing experience of Giga: perspective of Kazakhstan



Source: ITU-D SG1 Cross Cutting Workshop on Meaningful Connectivity – The Key to Sustainability https://www.itu.int/dms_pub/itu-d/oth/07/2e/D072E0000010052PDFE.pdf

Kazakhstan's Giga experience¹⁶³

Kazakhstan's plan for raising the speed in schools up to Giga, recommendations and appropriate local network + Wi-Fi in schools:

- 2 810 additions by September 2023 (in localities with optical fibre)
- 1 534 additions by September 2024
- 1 876 additions by September 2025

In **Argentina**, the Conectar Plan¹⁶⁴, aims to expand connectivity. Its federal fibre-optic network, initiated in 2010, targets 38 808 kilometres of optical fibre. As of August 2023, 32 804 kilometres were illuminated, connecting 1 129 locations with wholesale Internet. The plan also includes the Argentine satellite system, featuring the ARSAT-SG1 satellite. This Ka-band capacity, high-throughput satellite (HTS), will provide high-quality connectivity to over 200 000 Argentine homes in remote areas and 80 000 homes in neighbouring countries. The plan's focus is to bridge the digital divide through optical fibre and satellite technology.

In the **United States**¹⁶⁵, in communities where Hurricane Ian rendered cellular networks unavailable, satellite connectivity was crucial in arming first responders with a data and communications solution to support the deployment of essential personnel and mission critical resources. In leveraging the fully integrated broadband solution, first responders and essential personnel leading relief and rescue operations on the ground were able to quickly setup and deploy high speed Internet to manage fuel delivery operations, view high-resolution maps, and utilize data applications.

Motor Verde¹⁶⁶ is a partnership agreement to develop new high-end technological applications that will revolutionize reforestation and wildfire detection and tracking of 1 400 hectares in Las Hurdes, Cáceres, **Spain**. The solution works with the latest satellite information generation technologies, including high-resolution Earth observation images and Internet of things (IoT)

¹⁶³ ITU-D SG1 Cross Cutting Workshop Meaningful Connectivity – The Key to Sustainability https://www.itu.int/dms_pub/itu-d/oth/07/2e/D072E0000010052PDFE.pdf

¹⁶⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0178/> from Argentina

¹⁶⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0251/> from GSOA

¹⁶⁶ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0251/> from GSOA

solutions, as well as big data, blockchain and AI for the analysis and processing of the data obtained. The sensors transmit the collected information via satellite.

Bosnia and Herzegovina¹⁶⁷ and the ITU project dedicated to enabling an environment for broadband mapping in Bosnia and Herzegovina may serve as a good example of multi-stakeholder cooperation, which proves to be an important vehicle for mobilizing and sharing knowledge and expertise, to support the achievement of connectivity for all, as a part of the sustainable development agenda. ITU dedication to develop and implement partnerships is therefore highly appreciated.

European Electronic Communications Code¹⁶⁸ focuses on measures that aim to provide incentives for investment in high-speed broadband networks, namely through the following articles:

- Article 20 on "Information request to undertakings"
- Article 22 on "Geographic surveys on network deployments"
- Articles 64 to 67 on "Market analysis and significant market power"
- Articles 84 to 92 on "Universal service obligation"

Telecommunication and water authorities are collaborating in **Egypt¹⁶⁹**, exemplified by the National Telecom Regulatory Authority (NTRA) and the Egyptian water and wastewater regulatory agency (EWRA) partnership, to install optical fibre within raw water pipelines. This infrastructure sharing strategy addresses deployment challenges, especially in congested urban areas where new installations are difficult and offers cost-effectiveness in new developments. An MoU between Telecom Egypt and the Great Cairo Water Company (GCWC) has initiated a pilot project to connect two central offices, demonstrating the practical application of this regulatory collaboration. This approach improves telecommunication infrastructure and service availability.

Despite digital potential, rural areas often lack reliable high-speed connectivity. The **Central African Republic¹⁷⁰** aims to bridge this gap, extending broadband access to all, including underserved urban populations, and regulating backbone costs. Partnering with a South African telecommunication company, the government will market high-speed Internet and expand fibre-optic infrastructure. This public private partnership, through the Ministry of Digital Economy, Posts and Telecommunications, focuses on integrating ICT services and new technologies. Using a master plan combining optical fibre and satellite, the goal is to achieve nationwide coverage by 2025.

The country experience from **United States¹⁷¹** describes the United States National Telecommunications and Information Administration's (NTIA) ongoing experiences during the 2022-25 Study Cycle with broadband connectivity, adoption, digital inclusion, and equity, especially through the United States Internet for All initiative. This includes the Broadband Equity, Access, and Deployment/BEAD programme, the Tribal Broadband Connectivity programme, and three new Digital Equity programmes. In November 2023, the USD 65 billion Bipartisan Infrastructure Law, passed two years prior, aimed to boost United States Internet access. NTIA, FCC, Treasury, and USDA oversee programmes for planning (data, mapping), infrastructure

¹⁶⁷ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0156/> from Bosnia and Herzegovina

¹⁶⁸ <https://eur-lex.europa.eu/EN/legal-content/summary/european-electronic-communications-code.html>

¹⁶⁹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0179/> from Egypt

¹⁷⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0189/> from Central African Republic

¹⁷¹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0247/> from United States

(deployment), and adoption (subsidies, training, telehealth), ensuring meaningful high-speed Internet use.

The NTIA's "Internet for All" initiative tackles connectivity gaps with multiple programmes. The USD 42.45 billion BEAD programme funds broadband expansion across the United States. Specifically, USD 3 billion is allocated to the Tribal Broadband Connectivity Programme for Tribal lands. The Broadband Infrastructure Programme (BIP), with USD 288 million, focuses on underserved, particularly rural, areas. Recognizing digital access is insufficient, the Digital Equity Act provides USD 2.75 billion for programmes promoting digital skills and inclusion. These efforts aim to bridge divides in connectivity, skills, and affordability, addressing needs in minority and tribal communities.

In **South Africa**, NIP 2050¹⁷² targets universal high-speed broadband through regulation and public-private partnerships, prioritizing rapid infrastructure deployment. This aims to connect all citizens, establish efficient e-government, and equip government buildings with optical fibre, offering free Wi-Fi to low-income residents. Streamlining processes will accelerate digital network expansion. Complementing this, SA Connect Phase 2 seeks to provide 80 per cent of citizens with secure, affordable high-speed Internet by 2024. This project connects public facilities and establishes community Wi-Fi hotspots, addressing data affordability to ensure digital economy participation for all, especially underserved populations.

Currently, significant parts of the **Republic of Bulgaria**¹⁷³ are excluded from the possibility of connecting to high-speed networks. Over 35 per cent of Bulgaria's nearly 111 000 sq km faces high-speed network exclusion due to mountainous and forested terrain, hindering a gigabit society. To bridge this, Bulgaria is investing in rural fibre-optic networks. The "Large-scale deployment of digital infrastructure" project aims to expand very high-capacity networks, including 5G, in remote areas. It includes: (Action 1) enhancing the national backbone network, connecting all municipal centres; (Action 2) improving peripheral rural connectivity via very high-capacity networks; and (Action 3) capacity building. This initiative seeks to ensure nationwide access to high-speed Internet.

Effective telecommunication infrastructure in **Malaysia**¹⁷⁴ requires federal and state alignment. Joint government-industry efforts are crucial for underserved areas, supported by a national broadband plan. Designating telecommunication as a public utility and establishing clear guidelines, including for micro cells, aids the rollout of mobile networks including 5G. The regulator enforces Internet service quality, enforcing mandatory standards for quality of service (MSQoS), with minimum download speeds of 7.7 Mbit/s (2024) and 10 Mbit/s (2025). Rural broadband deployment faces terrain and population challenges, demanding multi-operator core network (MOCN) sharing and fit-for-purpose solutions. Addressing ICT literacy in rural areas through the nationwide establishment of national information dissemination centres (NADI) is essential. Compliance with the 2000 Technical Standards and nationwide gazetting of revised uniform building by-laws (UBBL 1984) that mandates certification of telecommunication cabling by qualified professionals.

The ProICT programme¹⁷⁵ activity that supported the work in **Colombia** is a part of the broader **United States** Government Digital Connectivity and Cybersecurity Partnership (DCCP). The

¹⁷² ITU-D Document <https://www.itu.int/md/D22-SG01-RGQ-C-0248/> from South Africa

¹⁷³ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0304/> from Bulgaria

¹⁷⁴ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0339/> from Malaysia

¹⁷⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0358/> from Colombia and United States

ProlCT activity is managed by the digital inclusion team within USAID's Innovation, Technology, and Research Hub (ITR Hub). USAID's ProlCT, under DCCP, aided Colombia's 2023 5G spectrum auction, a first for embedding digital inclusion. On December 20, 2023, MinTIC auctioned 83 per cent of 3.5 GHz and 2.5 GHz spectrum for COP 1.5 billion, enabling a new operator. This secured in-kind obligations: Internet for 1 200 schools (73 000 children) and 700 km of 4G road coverage. Bidders offered in-kind obligations, offsetting cash payments. In February 2024, the 5G rollout began. Benefits include faster Internet, higher capacity, greater flexibility, expanded coverage, and universal service funds. Future United States-Colombia spectrum collaboration is planned.

Broadband's evolution demands ecosystem innovation. The **United States Government**¹⁷⁶, through NTIA, champions open RAN (ORAN) to boost competition, innovation, and network resilience. ORAN, a progressive network architecture, is gaining global traction. NTIA promotes ORAN benefits bilaterally, guiding governments on effective engagement. NTIA office of international affairs (OIA) supports secure 5G infrastructure, including ORAN. The Department of Commerce, via NTIA, drives domestic and international ORAN efforts, guided by the National Security Council. This includes managing the USD 1.5 billion Public Wireless Supply Chain Innovation Fund, fostering international partnerships, and building consensus for ORAN widespread adoption.

In September 2024, Colorado hosted the inaugural International Open RAN Symposium (IORS)¹⁷⁷, where over 250 participants from 20+ countries convened. The NTIA-organized event aimed to accelerate ORAN adoption, featuring three days of discussions among MNOs, governments, industry, and academia. While ORAN networks now cover 70 per cent of the United States population, further technical development is crucial for global viability. IORS highlighted ORAN's benefits: enhanced supply chain resilience, innovation, cost-effectiveness, and security. NTIA workshops share expertise on ORAN advancements, case studies, and enabling policies.

Lessons learned: Examples of measures taken by different countries and organizations

France has heavily invested in optical fibre, incentivized private networks, and recommended 5G spectrum release. France fostered operator competition, regulated equitable access, and supported local digital initiatives. The Republic of Mauritius partnered across sectors for a national broadband strategy, encouraged ICT innovation, and supported mobile expansion via LTE, 4G, and 5G. The United States' Connect America Fund subsidized rural broadband, liberalized spectrum, adopted net neutrality, and promoted public-private partnerships. The United Kingdom's Superfast Broadband programme aimed for 95 per cent household coverage by 2020, promoted competition, modernized regulations, and used optical fibre and cable technologies.

4.5 Strategies to enhance the quality of service with increased data traffic

The development of today's economy relies heavily on the potential of ICT technologies. ICTs are fundamental to fostering the achievement of the sustainable development goals (SDGs)

¹⁷⁶ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0436/> from United States

¹⁷⁷ <https://its.ntia.gov/about/archive/2024/inaugural-international-open-ran-symposium-iors-opens-global-conversation/>

on a global scale, reaching all groups of society in meaningful and impactful ways. Required digital transformation can only be fully realized if high-quality, secure and affordable access to communications networks and services is available.¹⁷⁸

Telecoms are faced with costly and limited spectrum with 2G/3G/4G, while data demand surges due to faster speeds and cheaper devices. To combat this, they offload data to Wi-Fi, enabling voice over Wi-Fi (VoWiFi) and high-speed services, and cutting costs. Global carriers consider this crucial for diverting significant traffic and easing congestion, especially in urban areas. This strategy improves network quality and user experience. Wi-Fi provides a flexible, cost-effective way to expand bandwidth and capacity, essential for managing rising data consumption.

In some instances, MNOs are not able to provide high-speed Internet in the rural areas due to the huge Capex/Opex of cellular networks and low average revenue per user (ARPU). In such a scenario, it can become good business for an MNO to serve users in rural areas in collaboration with satellite and Wi-Fi hotspots, as the Capex/Opex for Wi-Fi networks is very low when compared to that of cellular networks.¹⁷⁹

In the top 20 5G markets, the average downlink throughput has increased by 4.3 times over the past five years. This is 32 per cent more than other markets on a global level, showing the positive impact 5G has had on network performance and user experience. The impressive network performance levels of 5G when the new generation was first introduced in 2019 have gradually decreased over time, as the traffic and the utilization rate of the 5G networks have increased. As usage of 5G has matured in these leading markets, performance levels have now stabilized at around 200 Mbit/s for median downlink throughput.¹⁸⁰

4.6 Conclusion - chapter 4

In conclusion, high-speed broadband is crucial for developing nations to achieve digital equity and UN SDGs. The Broadband Commission highlights its importance for the 2030 Agenda, and the Kigali Action Plan, from WTDC-22, underscores 136 regional initiatives. Global data consumption has surged over eight times in five years, with 5G further boosting capacity. The digital divide, deemed "the new face of inequality," persists. ITU targets 75 per cent global fast Internet connectivity by 2025. Investment in the deployment of variant broadband futureproof technologies, is vital for economic growth and inclusion.

Embracing technology-neutral spectrum licensing regimes is crucial, enabling operators to optimize spectrum use, freely chose the most suitable technology, and deliver enhanced broadband without prior potentially time-consuming licence modification procedures. A service-agnostic approach, alongside spectrum consideration, strengthens infrastructure, coupled with network virtualization ensuring high-quality, and low-latency services. Create an environment that encourages exploitation and use of all technological alternatives and incentivize operators/service providers to improve connectivity in underserved areas, enhancing service reliability, and expanding broadband access. Finally, integrating terrestrial networks with satellite solutions bridges the digital divide, extending Internet access to underserved rural and remote communities.

¹⁷⁸ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0156/> from Bosnia and Herzegovina

¹⁷⁹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0156/> from Bosnia and Herzegovina

¹⁸⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0114/> from Ericsson.

Chapter 5 – Indirect aspects for the deployment of broadband

The present global communications world has blurred traditional boundaries in network access between telecommunication network operators, communications services providers, satellite and cable TV networks, mobile networks, and information technologies¹⁸¹. The deployment of broadband at the 'last mile' is directly impacted by equipment, protocols and decisions made at the core of the Internet. This is why this chapter will focus on some of the indirect aspects that can impact the quality, speed, and resilience of broadband networks. The following section includes aspects of IPv4 to IPv6 transitions, and the development of core Internet infrastructure such as Internet exchange points (IXPs).

5.1 Transition from IPv4 to IPv6

The deployment of IPv6 is essential to the future growth of the Internet. Since implementation is well underway throughout the world, it is vital that Internet services and applications be available to the entire Internet via both IPv4 and IPv6. This implies providing online services and content over both protocols. For those ITU Member States and Associate Members that already have IPv4 address space from a regional Internet registry (RIR), the receiving IPv6 address space may be available at no additional cost. While most of the RIRs have depleted their IPv4 resources for allocation, IPv4 blocks may have been reserved for IPv6 deployment as a result of one of the many community-established policies. It is worth noting that networks vary in size, even with IPv6 and while IPv6 address space is vast, it is still a finite resource and RIRs offer to assist organizations in efficient use¹⁸².

Member States are pushing for this transition, with experiments being held, alongside other networking aspects.¹⁸³

IPv6 case studies

American Registry for Internet Numbers ¹⁸⁴

The American Registry for Internet Numbers (ARIN) maintains a community blog as a public service to inform individuals, businesses, civil society, and governments on topics of interest to the Internet community. ARIN also features a library of IPv6 case studies which offer detailed accounts from organizations that have already made progress on their IPv6 journey.

Guest authors from different organizations, including government, private sector, and academia, provide insight on IPv6 deployment challenges for all levels, and share any opportunities related to IPv6 implementation to encourage others to adopt IPv6. These case studies share experiences and business processes regarding IPv6 implementation and may be useful to those seeking such information. The posts are also relevant to broadband deployment, as the continued development and growth of the Internet is dependent on the deployment of IPv6.

¹⁸¹ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0043/> from ITU-T Study Group 15

¹⁸² ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0247/> from United States

¹⁸³ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0199/> from Syrian Arab Republic

¹⁸⁴ ARIN – IPv6 Case Studies: <https://www.arin.net/blog/ipv6/>

China¹⁸⁵

Through mobile terminal upgrades, mobile network readiness, and in-depth transformation of mobile applications, etc., the number of IPv6 users in China has increased rapidly. At the beginning of 2017, the proportion of IPv6 active users to the total number of netizens was only 0.51 per cent. As of May 2024, this figure had increased to 72.70 per cent, and the number of IPv6 active users in China had reached 794 million.

Syria¹⁸⁶

The contribution highlights that since 2024, there is an approved plan to move to version 6 of the Internet protocol (IPv6), and a national team is working on its implementation. Numerous experiments have been conducted and some aspects of these related to network security are awaiting completion.

5.2 Using NFV and SDN based networks

With the emergence of the Internet and the diversification of services, the need for more dynamic resource management has grown. It is in this context that software-defined networking (SDN) and network function virtualization (NFV) technologies emerged, making it possible to separate control of the network from the underlying hardware, and to virtualize network functions. These innovations have revolutionised the approach of telecommunications operators, offering unprecedented agility in the deployment and management of services, while meeting the demands of ever-changing connectivity.¹⁸⁷

Contributions by the Republic of the Congo highlight how SDN/NFV virtualizes networks for agility, cost savings, and scalability, while facing interoperability, security, and performance challenges, and is essential for 5G, IoT, and 6G. Other countries applying these strategies include; South Africa, China, and countries in Europe.¹⁸⁸

5.3 Development of Internet exchange points (IXPs)

An Internet exchange point (IXP) is a physical location where Internet infrastructure companies connect with each other to exchange Internet traffic. IXPs improve traffic flow and help people get cheaper, faster, and better Internet service. IXPs help create shorter, more direct routes for Internet traffic. They provide a more affordable alternative to sending local Internet traffic abroad, instead of returning that local traffic via an international link, which can be an expensive business.

There are over 1 100 IXPs globally, though certain areas are still in need of Internet growth and development. Member States and Associate Members should consider the merits of possible deployment of IXPs. IXPs may be deployed using IPv4 and/or IPv6 addresses.¹⁸⁹

¹⁸⁵ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0403/> from China

¹⁸⁶ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0199/> from Syrian Arab Republic

¹⁸⁷ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0294/> from Republic of the Congo

¹⁸⁸ ITU-D Document <https://www.itu.int/md/D22-SG01-C-0292/> from Republic of the Congo

¹⁸⁹ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0247/> from United States

IXPs are anchors of a thriving Internet ecosystem:

- they keep Internet traffic within local infrastructure and reduce costs associated with traffic exchange between networks;
- they spark development by acting as catalysts for overall Internet development including commercial, governmental, and academic stakeholders;
- they attract local investment by creating a convenient hub for key Internet infrastructure and services;
- they improve the quality of Internet services by reducing delay and improving traffic management and end-user experience;
- and they improve Internet infrastructure resiliency in cases of natural disasters and major Internet access outages.

However, there are still barriers that IXPs face in attempting to provide sustainable peering infrastructure in some of the regions that need it the most. To lower these barriers, a multistakeholder approach including policymakers and decision-makers as well as technical communities, is key. As part of the telecommunication infrastructure, IXPs are required to work with many actors to exchange traffic, some of which may be competitors. The success of an IXP depends on its facilitative environment and support from other stakeholders in general and many IXPs undertake initiatives to actively support information exchange between local stakeholders.

Regional IXP associations form a crucial link in the networking of IXPs and can act as venues for meaningful multi-stakeholder exchange within the community. As IXP associations are managed by stakeholders in the IXP ecosystem, they are responsive to the needs of IXPs. IXP associations foster inclusivity and provide a structure for ensuring that IXPs play a leading role in organizational governance.

Policymakers need to be aware that ISPs often drive the development of an IXP. An IXP is only needed if there are at least three ISPs; one ISP does not need to exchange traffic, and two can do it bilaterally. Thus, the first step toward developing demand for an IXP in a country is telecommunication market reform that leads to the emergence of a diversity of networks, including fixed ISPs and mobile operators that provide Internet access. Therefore, measures to increase the number of licences of operators and lower the barriers to all (or most) licence-related costs should be considered.

Terrestrial connectivity is required to enable ISPs and other organizations to connect to an IXP as competition between connectivity providers ensures that the cost of access is affordable and that the access is resilient. The topic of long-distance connectivity is critical to developing a healthy Internet ecosystem.

International connectivity is closely related to long-distance connectivity to enable IXPs. In this case, liberalizing the gateway promotes regional and global ISPs joining an IXP and turning it into a regional hub. At the same time, low-cost, international IP transit is critical to enable foreign and international networks, such as content delivery networks (CDNs), to peer and exchange traffic at local IXPs. This will directly impact the percentage of content kept local.

There are a number of actions that will promote the sustainability of IXPs:

- create transparent policy and regulatory processes that encourage regional and international entities to participate in local interconnection environments;

- minimize any potential barriers to IXP establishment such as taxation, authorization, or licensing;
- promote local investment opportunities and development of local content, via tax holidays or reduced duties on the equipment needed to build IXPs and operator networks;
- foster relationships with IXPs and technical communities to learn more about local interconnection environments and sustainability models;
- learn from others. Work with existing IXPs and expert organizations to collaborate, train, and develop opportunities;
- champion the development of IXPs and remove roadblocks to their growth and success;
- develop and enhance cross-border interconnection policies to build resilience between countries and regions;
- work with industry to develop an IXP if there is none, or to increase deployment of an existing IXP to new sites and secondary markets;
- develop conditions to attract investment in new data centres, and to upgrade existing data centres as needed;
- ensure reliable power to sustain data centres.

Case studies on IXPs¹⁹⁰

The Burkina Faso Internet exchange point (BFIx) was established in 2015 as a non-profit membership association with financing from the World Bank West Africa Regional Communications Infrastructure Project. The IXP is part of a broader project designed to help countries overcome the challenges of being landlocked without direct access to submarine cable landing capacity. While none of the three international CDNs that provided data are directly connected to the IXPs, two have caches in the country connected to ISPs. One CDN reports that 72 per cent of its traffic is served from within the country, 90 per cent is served within the region, and the rest comes from outside Africa. The leadership and policies of BFIx have helped it to rapidly grow over the past months and it has now expanded to a second city. In addition, no stakeholders indicated any regulatory challenges with respect to Internet connectivity or content hosting. Indeed, the government actions with the virtual landing point have significantly lowered the cost of IP transit, and ANPTIC (Agence Nationale de Promotion des Technologies d'Information et de la Communication) was a founding member of the IXP in order to peer government content with local ISPs.

The Rwanda Internet exchange (RINEX) was launched by the Rwanda Information Technology Authority in 2004, and it is now managed by the Rwanda Internet Community and Technology Alliance (RICTA) and hosted at an ISP data centre. RINEX has a number of both international and local content providers as connected networks. Facebook, Cloudflare, and Netflix are members of the IXP; and Akamai and Google are available through ISP connections. Although Rwanda has the intrinsic challenge of being a relatively small, landlocked country, it has done very well, thanks largely to its forward-looking and high-level policies for developing a digital infrastructure and transforming its economy. Challenges remain, however, in its marketplace, as the cost of local hosting is relatively high, which leaves local websites to seek hosting outside the country.

The Bangladesh Internet exchange point (BDIX) is one of the first IXPs in the region and was set up in 2004. It connects 120 networks handling an average traffic load of 45 Gbit/s. BDIX

¹⁹⁰ ITU-D Document <https://www.itu.int/md/D22-SG01.RGQ-C-0094/> from Internet Society

is a not-for-profit venture in the People's Republic of Bangladesh Sustainable Development Networking Foundation (SDNF).

The Bhutan Internet exchange point (btIX) was formally established in December 2017, as a non-profit association of ISPs and operators in the Kingdom of Bhutan, under the auspices of the Government of Bhutan. Currently, 13 networks are exchanging an approximate average of 600 Mbit/s daily traffic on the btIX.

The Pakistan Internet exchange point (PKIX) was first established in Islamabad at a neutral venue, the Higher Education Commission (HEC) of the Islamic Republic of Pakistan, in 2016. The second IXP was launched in Karachi in 2019, and work is underway for a third IXP in Lahore. PKIX handles 16 GB of traffic on average of the nine networks.

The Internet infrastructure of Bangladesh, Bhutan, and Pakistan has its own unique set of advantages and challenges. In general, it is recommended to prioritize best practices, such as classifying telecommunication services as essential services during lockdowns, subsidizing equipment, sharing infrastructure, reconciling coverage and QoS obligations, and most importantly, doing national contingency planning. Governments' and industry actors' response to strengthening the Internet infrastructure has been swift, with the prime focus on immediate short-term results rather than on a long-term approach.

Chapter 6 – Key findings

- Recent technological developments in the satellite, terrestrial mobile, Wi-Fi, and fibre-optic sectors have created new opportunities to connect the unconnected. Coupled with new business models and technical standards that promote complementarities and interoperability, developments in each sector have strengthened the other sectors, to the ultimate benefit of end users.
- Emerging innovations, such as non-geostationary satellite orbit (NGSO) satellites in low earth orbit, have unique potential to serve people living in unserved and underserved communities around the world, that have historically been too difficult or expensive to reach with terrestrial infrastructure. Meanwhile, more established technologies including mobile terrestrial telecommunications, fibre-optic cables, and Wi-Fi have continued to deliver broadband to more and more people.
- While technical innovation is mostly driven by the private sector, support and partnership from the public sector can accelerate progress towards connecting the unconnected and underserved.
- Governments are encouraged to establish national broadband plans with ambitious speed and coverage targets and mechanisms for publicly-accessible connectivity in anchor institutions such as schools, libraries, postal offices, and government facilities. However, governments are encouraged to adopt technology-neutral approaches to connectivity targets that provide consumers and providers flexibility to choose the technologies that best fit local needs.
- Public authorities are encouraged to rethink their policy and regulatory environments in order to facilitate the innovation and marketplace competition needed to address long-standing connectivity challenges. Such environments should be based on transparent, stable, predictable, flexible, and non-discriminatory policies and regulatory frameworks to support investment in, and access to, broadband connectivity.
- Regulators should recognize the value of streamlining licensing procedures to reduce barriers to market entry for telecommunications/ICT service providers.
- By embracing regulatory reforms and relaxing unnecessary regulatory constraints, countries would be better equipped to accelerate the expansion of broadband connectivity and bridge the digital divide.
- Telecommunication/ICT industries (including mobile, wired and satellite broadband connectivity) made a significant contribution to the COVID-19 pandemic economic recovery, they not only outpaced the growth of the overall economy, they were also a main contributor to improving employment and job figures.
- Governments are advised to ensure that broadband policies align with development trends and the characteristics of broadband networks which evolve, driven by the rapid advancement of next-generation information technologies, while maintaining the principle of technological neutrality.
- In view of the considerable impact of digital technology usage in almost every area of society, governments are encouraged to strengthen their regulatory, institutional and technical capabilities regarding national digital strategies and plans and guaranteeing accessibility to broadband for the broadest possible community of users.
- Measurement and evaluation of national broadband plans and deployment strategies are critical elements for success in implementation. Through the progression of a policy or a strategy implementation, policymakers can use a variety of tools to measure progress and aide their review process.

- It is advised to create regulatory incentives that stimulate actions such as infrastructure sharing, including the development of the tower sector and collaboration with other sectors, as well as regulation of competition.
- Developing countries should consider establishing policies and licensing regimes that set minimum broadband speeds and coverage requirements for national operators while utilising universal service and access funds to support infrastructure in areas where commercial deployment is not viable. Additionally, coordination with other government agencies is essential to ensuring a harmonized and efficient rollout of broadband services.
- Governments are encouraged to create enabling mechanisms for development of community networks including simplification of the licensing regime, and spectrum regulation and innovative financial and legal mechanisms.
- In addition to traditional financing models such as PPP, USF, and others, governments are encouraged to explore innovative mechanisms and cooperation with global partners to overcome digital divide.
- Development of a comprehensive national broadband plan with clear targets for coverage, speed, affordability, and digital inclusion, encompassing infrastructure development, spectrum allocation, and regulatory reform.
- Implementation of technology-neutral spectrum licensing policies to enable operator adaptation to emerging technologies, ensuring sufficient bandwidth by means of the latest mobile broadband and backhaul technologies.
- Establishment of incentives for infrastructure investment, including fibre-optic networks and mobile broadband expansion, potentially through public-private partnerships and streamlined permitting processes.
- Implementation of policies to ensure broadband affordability, such as subsidies for low-income households, community broadband initiatives, and competitive pricing models.
- Achievement of universal broadband through a 'fit-for-purpose' combination of technologies (5G, Wi-Fi, satellite, FWA, optical fibre), with a focus on rural areas and potential promotion of ORAN.
- Investment in digital literacy programmes, workforce training, strengthened regulatory body capacity, and robust cybersecurity and data protection measures.

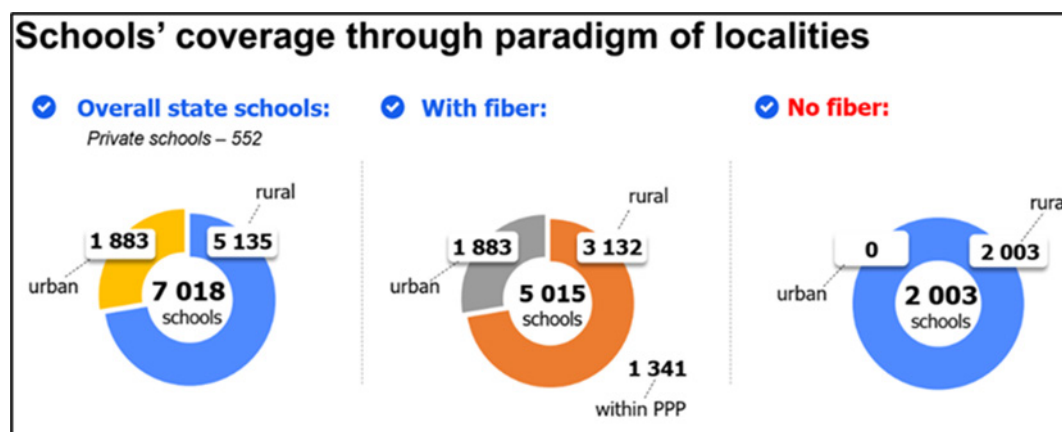
Annex 1 – Summary of case studies

Document [SG1RGQ/119](#) **Russian Federation**: The goal of the federal project is to create equal opportunities for access to modern telecommunications services for all residents and companies in the Russian Federation. As part of the project, proposals were developed with infrastructure requirements for line-cable communication facilities during the construction and reconstruction of highways, and the final revision of the draft Code of Rules was submitted with requirements for communication infrastructure in apartment buildings during their construction and reconstruction.

It is intended that by 2030, the entire territory of the Russian Federation, including the Arctic zone and the Far East regions, will be provided with modern communication services. As part of the indicator, 97 per cent of households will be provided with broadband Internet access by the end of 2030.

Document [SG1RGQ/93](#) **India PMWANI Programme**: In India, the PMWANI (Prime Minister's Wi-Fi Access Network Interface) programme is being promoted by the government to proliferate high-speed affordable broadband over public Wi-Fi, boost local employment, and provide a new business model for sustainability. Here, village level entrepreneurs, designated as public data offices or (PDOs) can become resellers of the Internet with minimum Capex/Opex, as they are only required to own the Wi-Fi access infrastructure. The complexity of Wi-Fi core functions comes in the form of service from bigger Wi-Fi service providers called public data office aggregators (PDOAs). In March 2021, IO by HFCL took the lead and deployed India's first PMWANI in Baslambi village. Wi-Fi access points to cover the entire village area of 3.84 sq km were deployed to provide high-speed Wi-Fi-based Internet to 6 000 residents of this remote village. Another such unconnected town was the small remote village of Baidebettu in the state of Karnataka in Southern India. In June 2021, IO by HFCL took the lead in one of India's earliest PM-WANI deployments, in Baidebettu village. The Baidebettu village connectivity offers Wi-Fi-based Internet to 9 000 residents with a total bandwidth of up to 500 Mbit/s in all common areas of the village, spread across a radius of six kilometres. Key success factors are i) Affordable high-speed Internet with sufficient coverage in rural areas ii) Ability to identify unconnected sites with enough demand to sustain a profitable operation.

ITU-D SG1 Workshop presentation¹⁹¹ on Kazakhstan Giga experience



¹⁹¹ https://www.itu.int/dms_pub/itu-d/oth/07/2e/D072E0000010052PDFE.pdf

Kazakhstan's plan for raising the speed in schools up to Giga, recommendations and appropriate local network + Wi-Fi in schools:

- 2 810 additions by September 2023 (in localities with optical fibre)
- 1 534 additions by September 2024
- 1 876 additions by September 2025

Document [1/178](#) **Argentina Conectar Plan:** The Conectar Plan, executed by the telecommunications state-owned company Arsat includes:

- Federal fibre-optic network: The construction of the REFEFO network upgrade programme began in 2010. The objective of the Conectar Plan is the extension and upgrade of 4 408 kilometres of optical fibre to reach 38 808 kilometres. As of August 2023, it has 32 804 kilometres of illuminated fibre-optic network and connects 1 129 locations with wholesale Internet.
- Argentine satellite system: Plans for the construction of the ARSAT-SG1 satellite, which will be a high-throughput satellite (HTS) with Ka-band capacity. Once the satellite is launched into orbit, Argentina will be able to provide high-quality satellite connectivity to more than 200 000 homes in rural or difficult-to-access areas and 80 000 homes in neighbouring countries.

Document [1/251](#) **Global Satellite Operators' Association (GSOA)**

Rapid response in the United States: In communities where Hurricane Ian rendered cellular networks unavailable, satellite connectivity was crucial in arming first responders with a data and communications solution to support the deployment of essential personnel and mission critical resources. In leveraging the fully integrated broadband solution, first responders and essential personnel leading relief and rescue operations on the ground were able to quickly setup and deploy high speed Internet to manage fuel delivery operations, view high-resolution maps, and utilize data applications.

GSOA - Motor Verde, Spain: Motor Verde is a partnership agreement to develop new high-end technological applications that will revolutionize reforestation and wildfire detection and tracking of 1 400 hectares in Las Hurdes, Cáceres, Spain. The solution operates with the latest satellite information generation technologies, including high-resolution Earth observation images and IoT solutions, as well as big data, blockchain and AI for the analysis and processing of the data obtained. The sensors transmit the collected information via satellite.

Document [SG1RGO/156](#) **Bosnia and Herzegovina:** The existing legal, institutional, and technical environment that determines broadband mapping in Bosnia and Herzegovina needs to be upgraded to respond to the requirements of advancing market developments. The essential requirement to collect data on total service availability, and to identify areas of limited or no affordable connectivity, has been reinforced by strengthening infrastructure mapping and investment mapping. The ultimate goal is to collect relevant data and to develop regulatory tools to address identified failures in ICT and digital markets, and to turn them into opportunities for investment and growth. The proper scope of broadband mapping, as well as collaboration between different stakeholders, needs to be determined, ensuring that a responsible body is authorized to collect data from the operators. In order to lay down a proper outline for broadband mapping in Bosnia and Herzegovina, taking into account the vast experience and best practices available, the Communications Regulatory Agency applied for technical assistance from ITU. The anticipated project aims to enable Bosnia and Herzegovina to align with existing regulatory, technical and policymaking practices in the European Union, thus

mitigating the digital gap between the European Union and Bosnia and Herzegovina as a potential candidate country.

European Electronic Communications Code¹⁹² which focuses on measures that aim to provide incentives for investment in high-speed broadband networks, namely through the following articles:

- Article 20 on "Information request to undertakings"
- Article 22 on "Geographic surveys on network deployments"
- Articles 64 to 67 on "Market analysis and SMP"
- Articles 84 to 92 on "Universal service obligation"

Document [SG1RGQ/179](#) **Egypt**: Installing fibre-optics in water pipes is one manifestation of collaborative regulation between the telecommunication and water management sectors helping to improve and expand existing telecommunication infrastructure and yielding broader availability and enhanced services. As a realization of the collaborative regulation strategy, the national telecommunication regulatory authority (NTRA) of Egypt has been collaborating with its water sector counterpart the "Egyptian water and wastewater regulatory agency" (EWRA). Such collaboration exploits the concept of infrastructure sharing as an effective way for installing fibre-optic cables in water pipelines. Such an infrastructure model is particularly effective for deployment in congested urban areas, where installing new infrastructure implies prohibitive costs. In addition, this deployment can also be beneficial in newly established areas in terms of cost, right-of-way issues, and potential smart services and applications for utilities. Such collaborative regulation has resulted in issuance of a MoU/Protocol of cooperation between the incumbent telecommunication operator (Telecom Egypt) and the Great Cairo Water Company (GCWC) to start deploying a pilot project to connect two central offices (COs).

Document [SG1RGQ/189](#) **Central African Republic**: The lack of reliable high-speed connectivity is a major obstacle that is all too common in rural and remote areas. However, new and emerging technologies and their digitization have enormous potential to transform life and opportunities in rural and remote areas. The Central African Republic, aims to popularize high-speed broadband for the benefit of the entire population. This includes connecting unserved and underserved populations in non-rural and urban areas and regulating national backbone price caps, while integrating and implementing ICT services including new and emerging technologies. The Government, through the Ministry of the Digital Economy, Posts and Telecommunications, has signed a PPP with the South African telecommunication company MTN Global with the aim of marketing very high speeds on the national and international backbone. The aim is to extend the fibre-optic infrastructure in unserved areas of national coverage with a view to integrating and implementing ICT services in the Central African Republic. The implementation of the Central African Republic's infrastructure master plan coupling optical fibre with satellite, will enable coverage of the entire country by 2025.

Document [SG1RGQ/206](#) **India**: The universal service obligation fund (USOF) has been the force behind the establishing of a high-quality network infrastructure across the rural and remote areas of the country, enabling non-discriminatory access to good quality reliable and affordable network services. With its expanded scope, it is also expected to provide a catalyst effect on research, development and the introduction of new telecommunication services and technologies. Various projects have been funded through the USOF, such as the flagship

¹⁹² <https://eur-lex.europa.eu/EN/legal-content/summary/european-electronic-communications-code.html>

project of BharatNet, ensuring high-speed broadband connectivity in remote and rural areas of India, laying of undersea cable to provide high-speed network connectivity along the Andaman & Nicobar and Lakshadweep islands, installation of mobile towers and satellite connections to ensure last mile connectivity in the uncovered remote regions/villages of the islands, and financial support to promote an ecosystem for research and design in telecommunications.

Document [SG1RGQ/247](#) **United States**: This document presents the United States National Telecommunications and Information Administration (NTIA) ongoing experiences during the 2022-25 study cycle with broadband connectivity, adoption, digital inclusion, and equity, especially through the Internet for All initiative. This includes the Broadband Equity, Access, and Deployment (BEAD) programme, the Tribal Broadband Connectivity programme, and three new digital equity programmes. November 2023 marked two years since passage of the Infrastructure Investment and Jobs Act, a Bipartisan Infrastructure Law (BIL), which designated USD 65 billion to improve high-speed Internet access for people across the United States. Four federal-level agencies lead the implementation in the United States: NTIA, the FCC, the Department of the Treasury, and the U.S. Department of Agriculture (USDA). The BIL programmes support high-speed Internet planning, infrastructure, and adoption, defined as follows:

- **Planning:** Data collection, mapping, and feasibility studies to help develop Internet expansion projects.
- **Infrastructure:** Infrastructure for high-speed Internet deployment.
- **Adoption:** Activities that ensure users can access and meaningfully use high-speed Internet. Includes subsidies, equipment, public access, digital literacy, skills training, workforce development, telehealth, and remote learning.

To serve varying community needs, NTIA designed multiple programmes to address a lack of connectivity including to the tribal nations and minority communities, create jobs and new manufacturing, promote digital skills, and address affordability of access, under the Internet for All initiative. These programmes include:

- **Broadband Equity, Access, and Deployment (BEAD):** BEAD provides USD 42.45 billion to expand high-speed Internet access by funding programmes for planning, infrastructure deployment and adoption across the United States.
- **Tribal Broadband Connectivity Programme:** This USD 3 billion programme supports Tribal government efforts to bring high-speed Internet to Tribal lands.
- **Broadband Infrastructure Programme (BIP) and the Connecting Minority Communities (CMC) Pilot Programme:** The Broadband Infrastructure Programme (BIP) provides USD 288 million for states and Internet providers to expand Internet access to areas without broadband service, especially to rural areas.
- **Digital Equity Act grant programmes:** The Digital Equity Act responds to the critical principle that digital access alone does not bring transformation or inclusion, providing USD 2.75 billion for three new programmes to help ensure that all people and communities have the skills, technology, and the capacity needed to reap the full benefits of our digital economy.

Document [SG1RGQ/248](#) **South Africa**: The Government of South Africa has adopted the National Infrastructure Plan 2050 with a vision to make high-speed broadband universally accessible through regulation and public and private sector participation. A primary goal of this plan is to foster the rapid deployment of broadband infrastructure, which will connect all citizens to high-speed broadband Internet and create an efficient, cost effective and capable e-government. All government buildings will be connected or wired with fibre-optic high-speed broadband,

which will offer free Wi-Fi to low-income residents. By streamlining the deployment process, reducing bureaucratic hurdles, and promoting responsible practices, the policy also aims to create an environment conducive to the swift expansion of essential digital communication networks across the nation. South Africa also launched the SA Connect Phase 2 project, which aims to provide 80 per cent of South African citizens with a secure, reliable, and affordable high speed Internet access by 2024. The project will connect public facilities such as schools, clinics, police stations and other government facilities with broadband services. The project will also provide core and access network infrastructure, to enable broadband connectivity to community Wi-Fi hotspots that will connect households. Access to affordable data prices remains one of the barriers for uptake to broadband services. As a result, the deployment of broadband services in underserved areas will enable all citizens, particularly those who cannot afford to purchase mobile data, to participate fully in the digital economy.

Document [1/304](#) **Bulgaria**: Currently, significant parts of Bulgaria are excluded from the possibility of connecting to high-speed networks, as more than 35 per cent of its territory, of almost 111 000 km² is sparsely populated, mountainous and forested, which presents obstacles to the growth of a gigabit society in the country. Bulgaria is trying to stimulate rural areas and to ensure access to very high-capacity networks for all Bulgarians by investing in fibre-optic networks for transmission to remote and sparsely populated areas. The objective of the project “large-scale deployment of digital infrastructure over the territory of Bulgaria” is to support the deployment of very high-capacity networks, including 5G connectivity, with a focus on less populated and remote rural areas. The project proposal includes the following activities: *Action 1* – Development of the national backbone network by increasing its transmission capacity and ensuring connectivity to all municipal centres; *Action 2* – Improving connectivity of peripheral sparsely populated and rural areas and deployment of very high-capacity networks (VHCNs) and *Action 3* – Capacity building and strengthening.

Document [1/339](#) **Malaysia**: Federal and state alignment is vital for telecommunication infrastructure. Collaborative efforts between governments and industry are needed to connect underserved areas. A national broadband plan, supported by both levels, ensures efficient rollout, designating telecommunication as a public utility and implementing clear planning guidelines, including for micro cells and so aiding 5G deployment. Malaysia's regulator strengthens ISP rules, enforcing quality standards. Minimum wireless broadband download speeds rose to 7.7 Mbit/s in 2024, and to 10 Mbit/s in 2025, with penalties for non-compliance. Network assessments, crowdsourced data, and infrastructure databases ensure service quality and development. Malaysia faces broadband deployment hurdles in rural areas due to high costs incurred from terrain and population scattering. Prioritizing infrastructure and network sharing via multi-operator core network (MOCN) sharing is crucial. Geographical challenges demand fit-for-purpose solutions such as satellite or wireless solutions. Addressing ICT literacy gaps in rural areas through nationwide establishment of national dissemination information centres (NADI) is essential. Initiatives must comply with the Malaysia's communications and multimedia (technical standards) regulations 2000 to avoid instability. Revised Uniform Building By-Laws 1984 (UBBL 1984) standards, mandating professional certification for telecommunication cabling, must be gazetted nationwide to ensure quality internal infrastructure.

Document [1/358](#) **Colombia** and **United States**: The ProICT programme activity that supported the work in Colombia, is a part of the broader United States Government Digital Connectivity and Cybersecurity Partnership (DCCP). The ProICT activity is managed by the digital inclusion team within the USAID Innovation, Technology, and Research Hub (ITR Hub). In 2023, the governments

of Colombia and the United States collaborated to design and conduct an innovative national 5G spectrum auction that embedded digital inclusion and universal service objectives into the competitive process. The successful outcome of this auction promised enhanced mobile network coverage and opened the door to large-scale 5G network development in Colombia, beginning in 2024. On December 20, 2023, MinTIC held a successful auction, allowing the entry of a new operator, while awarding 83 per cent of available spectrum to bidders for 3.5 GHz band plus 2.5 GHz band, for COP 1.5 billion. One crucial outcome was securing in-kind obligations for new fixed Internet connections in nearly 1 200 schools benefiting approximately 73 000 children and expanded 4G coverage along 700 km of roadways in Colombia. Aside from this favourable outcome, the auction represented the first of its kind in Colombia to enable auction bidders to offer in-kind obligations for improved connectivity in schools and along roadways, to offset a portion of its cash payment for spectrum rights. In February 2024, following the 5G auction, the successful bidders began rolling out new 5G technology infrastructure in Colombia. Based on the success of this 5G auction, future United States-Colombia collaboration in the spectrum management space is being contemplated. The socioeconomic benefits of this achievement are expected to be wide ranging and include the following:

- Faster Internet speeds and higher network capacity: Increased spectrum will allow for faster data transmission, enabling quicker Internet access, and accelerated development of various services such as e-commerce, telehealth, and digital education. Additionally, more spectrum availability will enable networks to handle more network traffic, improving throughput and reducing network congestion during peak usage times.
- Greater flexibility: Larger block sizes will permit greater flexibility in 5G system design and allow a wider range of network services to be offered in a given spectrum range.
- Expanded network coverage: Additional spectrum will lead to expanded network coverage, making wireless services more accessible in rural or remote areas. The operators' requirement to offer in-kind obligations helps reinforce this benefit.
- Additional revenues to fund other universal service projects.

Document [1/436 United States](#): As broadband technologies continue to transform people's lives, these technologies will need innovative approaches to further develop the ecosystem. The United States National Telecommunications and Information Administration (NTIA), along with other government agencies, has promoted open radio access networks (ORAN) as an avenue to drive competition, innovation, and resilience within the ecosystem. The United States Government is fully supportive of ORAN as an innovative approach to telecommunication network architecture that continues to see wider adoption, technical progress, and engagement by global industry. To advance the development and deployment of ORAN, NTIA engages bilaterally with countries to highlight the assessment of its expected benefits for those countries and their domestic stakeholders, as well as how governments can effectively engage with it. The NTIA office of international affairs (OIA) supports the development and deployment of secure, reliable 5G infrastructure, including open and interoperable networks such as ORAN. Through NTIA, the Department of Commerce continues to advance the United States Government domestic and international engagement on ORAN, in alignment with strategic direction from the National Security Council. This includes developing and administering the USD 1.5 billion Public Wireless Supply Chain Innovation Fund to advance ORAN and building international consensus and partnerships needed for ORAN to achieve scale and deliver on its potential policy and commercial benefits. In September 2024, NTIA welcomed over 250 participants from 20+ countries to the inaugural [International Open RAN Symposium \(IORS\)](#), held in Colorado. The primary goal of IORS was to accelerate the global adoption and deployment of ORAN. The Symposium featured three separate days of robust discussions by a diverse mix of MNOs,

government, industry, academia, and community organizations. OIA organized and led the policy track. While there has been steady progress and deployments, including within the United States where an ORAN network now covers 70 per cent of the population, ORAN is still undergoing necessary technical developments that will make it more viable globally, and it is understood that there is no perfect solution to fit every country. However, the benefits of adopting an ORAN model, demonstrated across a growing number of deployments, include increased supply chain resiliency, innovation, cost effectiveness, and security. In United States Government-hosted and internationally based workshops on ORAN, NTIA highlights lessons learned on effectively engaging with governments on ORAN and shares their policy and technical subject matter expertise on specific ORAN topics, including the latest advances in ORAN, case studies of successful pilot and commercialization projects, and the policies that enable supplier diversity in the ecosystem.

Annex 2 – Lessons learned, received as contributions to Question 1/1 from 2022-2025

Web	Received	Source	Title
1/455	2024-10-22	Global Satellite Operators' Association (GSOA)	The future of satellite connectivity: Various approaches to direct-to-device services

The advent of satellite direct-to-device connectivity heralds an exciting era for the telecommunication industry, introducing novel services that offer consumers ubiquitous connectivity benefits. This paper examines two variants of satellite direct-to-device (D2D) applications, focusing on their significance within the satellite communication market.

Satellite D2D service presents both promising opportunities alongside some challenges. Exploring the two variants, D2D in mobile-satellite service (MSS) bands and D2D in MS bands, underscores the innovative landscape of satellite communications.

Collaboration between satellite operators, MNOs, and regulatory bodies is indispensable to realize the full potential of satellite D2D connectivity and usher in a new era of ubiquitous and seamless communications.

Web	Received	Source	Title
1/454	2024-10-22	Global Satellite Operators' Association (GSOA)	New satellite technologies for transformative connectivity

The paper highlights the importance of integrating non-terrestrial networks (NTN) with terrestrial systems, using multi-orbit satellites and software-defined architectures for scalable, affordable and reliable connectivity. Artificial intelligence, machine learning and quantum technologies are recommended for optimizing operations and improving security, while inter-satellite links enhance real-time data transfer. Best practices include leveraging these advancements to meet growing global demand for secure, high-capacity communications and ensuring seamless, efficient, and resilient connectivity by adopting a unified, software-driven, and multi-layered satellite approach.

Web	Received	Source	Title
1/449	2024-10-29	Global Satellite Operators' Association (GSOA)	GSOA Comments to Question 1/1 Report Draft

Improving this report now is essential to providing ample time to refine and enhance its accuracy, coherence, and impact before WTDC25 and ensure that they are future proof. By addressing gaps, clarifying points, and ensuring alignment a strong foundation for the final stages of the report will be set.

Web	Received	Source	Title
1/436	2024-10-22	United States	U.S. experiences, lessons learned, and suggested best practices for bilateral engagement on Open RAN
1) International adoption and participation in ORAN supply chains will be crucial to ensure the approach can achieve the commercial scale needed to make a lasting impact. 2) ORAN initiatives and policies provide an important signal to industry and academia that governments support ORAN approaches. 3) A diverse and competitive marketplace of telecommunications infrastructure suppliers is important to ensure that networks remain open, interoperable, reliable, and secure.			

Web	Received	Source	Title
1/435	2024-10-22	ITU-APT Foundation of India	Minimum basic broadband services for rural and remote areas in developing countries
This contribution draws attention to the provision of a broadband service for rural and remote areas to reduce the digital divide in developing countries with the help of reliable mobile and non-terrestrial network technology, which can provide coverage in rural and remote areas and connect billions of unconnected or under-connected people. With high quality broadband connectivity for humans and machines, Internet of things (IoT) can revolutionize business processes bringing new opportunities for both people and businesses.			

Web	Received	Source	Title
1/428	2024-10-22	Global Satellite Operators' Association (GSOA)	GSR24 Outcomes and GSOA contribution
GSOA would like to bring to the attention of the administrations, their contribution submitted to the ITU consultation on GSR24 best practice guidelines "Charting the course of transformative technologies for positive impact" that are considered as relevant to the ITU-D reports and especially in building for the preparatory work for WTDC25. Equally, this document highlights the outcomes concluded during the industry meeting IAGDI-CRO for the consideration of the meeting.			

Web	Received	Source	Title
1/423	2024-10-22	United States	Lessons learned leveraging co-creation to increase access to connectivity and digital finance in marginalized communities through the USAID Digital Invest Programme

Lessons learned from Digital Invest:

- 1) Digital Invest uses public-private partnerships through which it provides blended finance for the private sector, which connects specifically to [SDG 17: The power of partnerships](#). Utilizing co-creation activities, including but not limited to, brainstorming sessions, information sharing, and stakeholder engagement during the development and implementation of public-private partnership-led projects has led to various benefits, including:
 - a) **Increased social impact in marginalized communities:** Donors and private sector companies, such as investment fund managers and Internet infrastructure providers, can proactively explore various impact strategies. This enables partnerships to better target and reach rural communities and marginalized populations with access to broadband connectivity and digital financial services (DFS).
 - b) **Improved insights into the capital raising, project implementation, and regulatory needs facing ISP and DFS sectors in emerging markets:** Private sector companies in the broadband connectivity and digital finance sectors often reveal unique insights into the rapidly changing needs of the ISP and DFS sectors in emerging markets. Regulators and governments can use these insights to better design policies, strategies, and programming.
 - c) **Increased use of secure and trusted equipment and digital platforms:** Co-creation activities offer a collaborative environment for donors, regulators, and governments to communicate the importance of using secure and trusted equipment and digital platforms to private sector companies, such as ISPs and fintechs, in addition to connecting them with relevant equipment and platform providers.
- 2) Digital Invest recommends supporting private sector companies working on access to broadband Internet and digital financial services to streamline, improve, or begin their reporting on data disaggregated by gender, first-time borrowers, business ownership, and more.

Web	Received	Source	Title
1/419	2024-10-22	United States	U.S. experiences, lessons learned, and suggested best practices administering open RAN academies

Lessons learned from conclusions:

- 1) An emphasis on hands-on learning, real-world applications, and continuous professional development supports the long-term sustainability of broadband initiatives.
- 2) Partnering with industry leaders in ORAN is essential to keep the curriculum current and ensure alignment with industry changes.
- 3) Incorporating hands-on lab sessions, practical projects, and real-world testbeds is crucial for enhancing students' experiential learning in ORAN.
- 4) Designing a modular curriculum with elective courses allows students to focus on specific areas of interest within ORAN, ensuring comprehensive coverage of the field.

Web	Received	Source	Title
1/399	2024-10-21	GSM Association	2024 mobile industry impact report: Sustainable development goals

- 1) A case study discussing the Data Insights for Social & Humanitarian Action (DISHA) a platform for planning disaster response deployment and observing the medium/long-term impact of poverty alleviation programmes is provided. The solution uses anonymized mobile phone data from telecommunication companies and aggregates them to detect major population movement across target areas. It also correlates utilization of the telecommunications company products with historical census poverty data to estimate how poverty rates change over time.
- 2) A case study showcasing Nokia Rural Connect, a solution enabling operators to provide reliable rural coverage quickly, with a secure power supply, is presented.
- 3) The report contains insights on Bharti Airtel work to improve knowledge and skills in India. It also includes a spotlight on the Whiz Kids Project, conducted by Turkcell in collaboration with the Ministry of National Education, aims to introduce Türkiye's talented students to technology and develop their technical abilities at an early age. The objective is to foster a generation aged 8-18 who not only consume technology but also contribute to its development.
- 4) Case studies showcasing the Ericsson and Kiona solutions to save energy and decarbonise residential homes and work by Reliance Jio to improve the energy efficiency of mobile networks are presented.
- 5) The report presents the case study IoT solutions from Telia to improve health outcomes for older populations.

Web	Received	Source	Title
1/358	2024-09-19	Colombia, United States	Spectrum auctions with in-kind payment obligations, cross-country digital transformation collaboration and lessons learned

The partnership between Colombia and the United States described in this contribution represents a positive example of cross-country collaboration on 5G radio spectrum auction design and implementation. Among other benefits, the work undertaken as part of this collaboration supports digital transformation to achieve SDGs and ongoing efforts to provide access and connectivity to all.

Traditional auction processes can be tailored to achieve specific infrastructure requirements of un- or under-served regions. For example, "in-kind" payment obligations, which allow operators to provide connectivity to underserved or unserved locations in lieu of some portion of licensing fees can be included in auction design to increase competitive bidding.

To achieve a successful outcome, specific market attributes and maturity must be taken into consideration. Adequate stakeholder consultation is essential for assessing market specificities.

Developing trusted relationships between the policy advisors and host government counterparts is vitally important and sustained engagement increased over a number of months. The ability of partner teams (ProICT and MinTIC) to achieve consensus on project design and goals, proving pivotal to the success of the project.

Web	Received	Source	Title
1/328	2024-09-18	Uzbekistan	"Bridging digital gaps towards universal and meaningful connectivity": ITU data visualization hackathon. The annual summer school "Digital youth in defining a common future"

The data visualization hackathon titled "Bridging digital gaps" was held on June 27, 2024, in Tashkent, Uzbekistan, during the ICT statistics week for the CIS region. The hackathon focused on presenting and analysing ICT statistics using modern data visualization technologies. This provided future professionals with insights into how strategic decisions in digital development are informed by ICT statistical data.

Participants presented innovative approaches to visualizing digital inequality parameters and proposed solutions to overcome these challenges. The event concluded with the awarding of certificates and commemorative prizes to participants and winners.

Key lessons learned:

- **Need for expansion and scaling:** To effectively address digital inequality, it is essential to expand and scale initiatives like the hackathon to other countries and regions. This will facilitate the development of globally scalable solutions crafted by young people from diverse backgrounds.
- **Intergenerational and international collaboration:** There exists a gap in interaction between generations (professionals and youth aspiring to develop in IT) and between developed and developing countries. Bridging this gap requires platforms that foster collaboration across age groups and nations.
- **Insufficient time for knowledge transfer:** While the hackathon was successful, there was insufficient time for in-depth knowledge transfer. Extended events would allow for more comprehensive learning and skill development.

Suggested best practices:

- **Organize periodic hackathons and summer schools:** Establish regular events, such as annual summer schools titled "Digital youth in defining a common future," to promote sustained engagement and collaboration among youth globally.
- **Promote intergenerational interaction:** Create platforms and programmes that encourage exchange between youth and experienced professionals from different countries. This facilitates knowledge sharing, mentorship, and the integration of innovative ideas with seasoned expertise.

Involve leadership in youth engagement: Encourage ministers and leaders to participate and speak at youth events, underscoring the importance of youth contributions to digital development and policymaking.

Web	Received	Source	Title
1/327	2024-09-18	GSM Association	Advancing digital inclusion through infrastructure sharing

Regulators dealing with the issue of extending coverage to remote and rural areas should facilitate and encourage infrastructure sharing models which, by generating operational and financial efficiencies in the deployment of networks in rural areas, can help lower the cost of extending coverage to these areas.

Network sharing can be less appealing to operators in markets, particularly in emerging economies, which consider coverage to be a competitive advantage. In cases such as these, compelling market actors to enter infrastructure sharing agreements may reduce their incentives to invest and expand to new areas. In order not to disincentivize investment, sharing agreements should therefore be driven by market considerations and should not be made mandatory. The use of network sharing agreements by operators is therefore likely to facilitate a faster and more efficient rollout in congested urban areas as well.

Web	Received	Source	Title
1/304	2024-09-10	Bulgaria	Large-scale deployment of digital infrastructure on the territory of Bulgaria

In order to deploy very high capacity networks (VHCNs) in many areas of the country, investments need to be made in fibre-optic networks for transmission to remote and sparsely populated locations. Without such investments, telecommunication and other network operators will have no market interest in further investment in VHCN in such locations. Private operators are reluctant to invest in transmission and access networks in those areas due to declining population densities and the relatively low purchasing power of local residents. The State supports the investments in fibre-optic networks for transmission to remote and sparsely populated areas with various projects such as the project presented in the document.

Web	Received	Source	Title
1/251 +Ann.1	2023-10-11	Global Satellite Operators' Association	Satellite for SDGs - Transforming lives

Satellite connectivity plays a critical role in connecting the 2.6 billion that remain unconnected. The optimum solution for future connectivity does not lie with one technology alone but through a combination of multiple technologies, pooling their different strengths to increase cost efficiency, whilst simultaneously working together to deliver the exceptional resilience and greater availability for a much larger number of citizens.

Web	Received	Source	Title
1/246	2023-10-10	United Kingdom	Case study: Gigabit broadband voucher scheme

This experience helps inform new strategies for pooling resources, identifying gaps in supply versus demand for ICT services, and funding infrastructure rollout in a way that supports market competition by supporting a range of suppliers. For this example, ICT policymakers and regulators should:

- Pool together market demand in rural and remote areas to better encourage investment in underserved areas;
- Define open rules that encourage market competition and support a diverse range of Internet service providers within the market;
- Provide targeted participation materials for different stakeholder groups, such as consumers and service providers of various sizes and business models, as demonstrated in the gigabit broadband voucher scheme (GBVS) materials; and
- Publish regular programme updates to demonstrate transparency, build accountability, and inform future investments in infrastructure deployment, as demonstrated in the quarterly reports in this contribution.

Web	Received	Source	Title
1/241	2023-10-10	United States	United States experiences, lessons learned, and suggested best practices administering the Digital Invest Blended Finance programme

Lessons learned from conclusions:

- 1) A blended finance approach to telecommunications and ICT industries and digital ecosystems, including broadband connectivity and digital financial services, can support the advancement of open, inclusive, and secure digital ecosystems in emerging markets.
- 2) A blended finance approach can be used to leverage limited budgets to mobilize a higher volume of private capital to address key development objectives and to attract investment to geographies and populations that are perceived as risky or outside of market-rate returns.
- 3) A blended finance approach allows for different structures for investment fund managers to leverage grant capital to offset structuring and design costs; enables first loss protection; measures, demonstrates, and expands their social impact; or provides technical assistance to portfolio companies, enabling them to launch or expand their funds (debt or equity), attracts new investors, and gets capital to financial technology companies (fintechs) and ISPs in the market more quickly.
- 4) A blended finance approach can also directly support broadband-enabling infrastructure companies advancing projects for the expansion of optical fibre, towers, Internet exchange points, etc., which can expand the infrastructure required for ISPs to grow their networks.
- 5) A blended finance approach is well-suited to financiers and infrastructure providers working with local, independent ISPs that can advance connectivity, competition, and choice in emerging markets.

Web	Received	Source	Title
1/238 +Ann.1	2023-10-10	Ericsson Ltd.	Using 3GPP technology for satellite communication

Satellite connectivity based on open Third Generation Partnership Project (3GPP) specifications offer the best opportunity to create a large non-terrestrial network (NTN) ecosystem, enabling connectivity between terrestrial systems and satellite systems on the same mobile platform. As satellite systems will not have the same capacity as terrestrial systems, they should be viewed as complementary rather than competing systems. More cooperation between satellite operators and terrestrial communication service providers (CSPs) is expected to be seen in the years ahead to achieve mutual benefits in this area.

Web	Received	Source	Title
1/189	2023-10-05	International Chamber of Commerce	Expanding connectivity and digitalization to achieve global development goals

It has been found that initiatives that combine the dynamism of industry innovation with enabling policy and regulatory measures can expand connectivity in developing countries and rural and remote areas.

Please refer to the [ICC Digitalisation for People, Planet and Prosperity case study repository](#) for further case studies that explore initiatives and strategies to increase connectivity, drive the adoption of digital tools and services, and fulfil development goals.

Web	Received	Source	Title
1/180	2023-09-29	Argentina	Federal ICT training plan

In terms of lessons learned, the importance of reviewing and thinking about the best way to promote the reduction of gender disparity in this type of training is highlighted, taking into account that a significant difference continues to be registered in terms of the number of male registrations over those of women.

Web	Received	Source	Title
1/179	2023-09-29	Argentina	Mi Pueblo Conectado Programme

The main lesson learned was to understand the relevance of having specific programmes that contemplate particular situations within the country (geographic, population, productive development, etc.) for the different localities that lack access to connectivity or have very poor access. Its implementation demonstrated and highlighted the need to guarantee the right to connectivity, essential in the era of digital transformation. It also reinforced the importance of the government as an active actor to effectively reach all the people who are currently disconnected throughout the country. Mi Pueblo Conectado means for many people, the opportunity to access the Internet, and digital services, a basic right of citizenship.

Another lesson learned was understanding that the implementation of a public policy does not always correspond to its original planning. This happens due to the complexity added by the necessary articulation to multiple actors and the large deployment throughout the country that this programme required, which required adaptation to the circumstances and flexibility in the implementation process, beyond what was planned.

Web	Received	Source	Title
1/178	2023-09-29	Argentina	Plan Conectar

The role of ICT was reinforced during the Covid-19 pandemic. Connectivity became essential for citizens to continue with their jobs, education, communication and entertainment. Without it, people risk being excluded from the digital economy. Providing connectivity to all of Argentina involves thinking about various specific strategies that are integrated into a general strategy.

Through the Conectar Plan, the Government of Argentina has worked to deliver connectivity infrastructure to remote areas so that everyone can participate in digital technologies and take advantage of their full potential. Regarding the Conectar Plan, the lesson learned is that it is a public policy sustained over time and that transcends the successive administrations in the National Executive Branch. In this sense, the connectivity policy that is reflected in the Conectar Plan is a continuation of the different initiatives implemented by the National Government since 2010, in which the Conectar Plan emerged.

Adopting a personalised approach for each region of the country, considering its singularities, involves providing a digital solution that fits the needs of the region, providing satellite or optical fibre according to the characteristics of each region and province. For remote areas, satellite connectivity worked as an effective solution to connect small towns and cities where it is difficult to deploy fibre-optics. Therefore, it is important to diversify investments in connectivity to effectively connect the unconnected and to strategically allocate public resources.

Web	Received	Source	Title
1/170	2023-09-16	Burundi	The impact of the deployment of ICT infrastructures in the digitalization of services

The digitalization of public services requires deployment of a broadband network in the fight against the digital divide. This constitutes a great challenge for developing countries: the challenge of extending the network to unserved or underserved areas for the interconnection of institutions and businesses.

Web	Received	Source	Title
1/167	2023-09-07	Central African Rep.	Strategy for extending connectivity to unserved and underserved segments of the population in rural and urban areas

Deployment of fibre-optic network remains a major challenge for developing countries. It involves the challenge of extending the network to reach unserved and underserved areas and the challenge of keeping the price of broadband access affordable for all.

Member States are encouraged to strengthen their regulatory, institutional and technical capacities with their national strategies and plans for fibre-optic deployment to guarantee access to broadband for the largest possible community of users.

Web	Received	Source	Title
1/70	2022-11-14	World Bank	World Bank Study Group 1 Submission: Enabling environment for meaningful connectivity

The World Bank Group stands ready to support its least developed client countries with a special emphasis on fragility, conflict and violence (FCV) and small island developed States. Through the analytical work programme and strategic partnerships (e.g., the Digital Development Partnership, including developed country and private sector donors). The World Bank is working closely with client countries to promote the deployment of low cost advanced technologies and innovative business models to expand access to digital services not only in rural and remote areas, but also in the peri-urban areas, where so many are not able use the Internet productively.

This work will involve piloting new, agile approaches to regulations, open data/standard infrastructure mapping, and new approaches to empowering citizens, small businesses, schools and healthcare clinics to acquire the devices and skills they need. The World Bank is also developing tools and approaches to assist client countries to ensure that the connectivity that is being provided can be trusted by consumers through safe and private access.

Web	Received	Source	Title
1/48	2022-10-13	Bhutan	Strategies: Deployment of broadband in Bhutan

In order to operate and manage a network, it is necessary to involve stakeholders in ensuring reliable and available service anytime.

Government needs to provide subsidy/ incentives to telecommunication operators in development of ICT infrastructures.

Government developed infrastructure (fibre-optic network) and leased it to telecommunication operators and the Demand Aggregation Project reduced the tariffs to make it affordable for communities.

Web	Received	Source	Title
SG1RGQ/247	2024-04-02	United States	Programmes that reflect a whole-of-nation approach to high-speed Internet to increase connectivity and digital inclusion

NTIA notes that the Internet for All Initiative is still ongoing, with some programmes yet to launch. Some preliminary lessons learned include:

- Holding public consultations with the fullest range of stakeholders is key for digital inclusion and Internet access programmes to ensure inclusive, effective programming. NTIA held national-level public consultations before issuing notices of funding opportunity (NOFO) for these programmes. In addition, the 56 states and territories of the United States also pursued public consultations prior to submission of their BEAD initial proposals.
- Effective broadband grant programmes need broad participation from a variety of providers as well as safeguards to ensure appropriate use of public funds.
- Maintaining flexibility in administering requirements enables participation from a broader range of providers. For instance, after NTIA received feedback that the BEAD letter of credit requirement could limit participation in the programme, NTIA issued a waiver providing specific alternatives that will encourage participation from a wide range of providers, while still protecting taxpayer dollars.
- Stakeholder engagement during broadband grant proposals for development at state and local level should include:
 - Letting community priorities drive the planning process
 - Encouraging deep community engagement and outreach
 - Cultivating win/win partnerships
 - Leveraging local assets
 - Articulating a broadband vision
- The United States looks forward to sharing additional lessons learned as these critical connectivity programmes are further implemented.

Web	Received	Source	Title
SG1RGQ/215	2024-04-01	Global Satellite Operators' Association	Satellite direct-to-device connectivity Bringing connectivity to everyone, everywhere, anytime

Satellite connectivity plays a critical role in connecting the 2.6 billion that remain unconnected and the majority of unconnected devices are limited to 20 per cent of the world. The optimum solution for future connectivity does not lie with one technology alone but through a combination of multiple technologies pooling their different strengths to increase cost efficiency, whilst simultaneously working together to deliver the exceptional resilience and greater availability for a much larger number of citizens.

The satellite industry is going through a phase of unprecedented growth and innovation expected to bring an estimated USD 250 billion in social and economic benefits across the world by 2030.

Satellite D2D will continue to contribute to bridging the digital divide, while improving users' safety and opening new horizons for connecting everyone. The result is bringing meaningful connectivity to consumers, increased digitalization of services for governments, and new business opportunities for enterprises. The continued development of the global 3GPP defined NTN standard, coupled with a regulatory regime that is transparent, safeguards existing spectrum and enables access to additional harmonized spectrum at a worldwide level, and will ensure that affordable D2D services are available to all.

Web	Received	Source	Title
SG1RGQ/206	2024-03-29	India	Universal service obligation fund (USOF): Promoting access to and delivery of telecommunication services for bridging the digital divide

Broadband connectivity is a pre-requisite for transformation into a digital society. Various e-Governance services, banking services, telemedicine, online education, etc., require broadband connectivity. Mobile wireless broadband is one of the most important means to provide broadband Internet access to the general public. The USOF of India has been the force behind the establishing of high-quality network infrastructure across the rural and remote areas of the country, enabling non-discriminatory access to good quality reliable and affordable telecommunication services.

Web	Received	Source	Title
SG1RGQ/189	2024-03-06	Central African Rep.	Integration and implementation of ICT services in rural and remote areas including new and emerging technologies

Digitization of isolated and underserved areas and deployment of the fibre-optic network remains a major challenge for developing countries, where there is the challenge of network expansion for unserved or underserved areas and the challenge of high-speed prices accessible to the entire population.

Member States are encouraged to strengthen their regulatory, institutional and technical capabilities as part of national fibre-optic deployment strategies and plans, ensuring broadband accessibility to as large a user community as possible.

Web	Received	Source	Title
SG1RGQ/153	2024-02-21	Republic of the Congo	Strategies and policies for the deployment of broadband in developing countries

Table 2 of the document provides an overview of examples of measures taken by different countries and organizations.

Country	Lessons learned	Suggested best practices	GSMA contribution
France	Massive investment in fibre-optic infrastructure to extend broadband coverage nationwide, including rural areas.	Introduction of incentive policies to promote private investment in fibre-optic networks.	Recommendations on release of spectrum for 5G network deployment.
	Promotion of competition among operators to improve the quality of service and reduce costs to users.	Effective regulation to ensure equitable access to broadband infrastructure for all operators.	Support for digitalization initiatives of local governments.
Mauritius	Collaboration between government, private sector and civil society to develop a national broadband strategy.	Promoting innovation and entrepreneurship in the ICT sector to stimulate economic growth and job creation.	Support for the adoption of regulatory policies conducive to the expansion of mobile connectivity.
	Use of wireless technologies such as LTE to provide broadband access in rural and remote areas.	Improvement of data transport infrastructure in order to ensure reliable, fast Internet connectivity.	Support in the development of 4G and 5G mobile networks.
United States	The Government Connect America Fund programme to extend broadband access to millions of rural households.	Use of public funds to subsidize investment costs for broadband infrastructure in underserved areas.	Support for implementation of spectrum liberalization policies to improve mobile connectivity.
	Adoption of net neutrality policies to ensure equitable access to the Internet and promote innovation and competition.	Promotion of public-private collaboration to maximize the effectiveness of broadband infrastructure investments.	Promotion of simplification in regulatory processes for mobile network deployment.

Country	Lessons learned	Suggested best practices	GSMA contribution
United Kingdom	Superfast broadband programme aiming to provide broadband access to 95 per cent of households by 2020.	Promotion of competition among service providers to improve quality of service and reduce prices.	Support for modernization of regulatory policies in order to foster investment in mobile networks.
	Use of cable and fibre-optic technologies for the deployment of fast, reliable broadband networks.	Raising of awareness and training of end users on benefits and efficient use of broadband.	Promotion of mobile network energy efficiency
South Africa	Adoption of telecommunication market liberalization policies to stimulate competition and reduce prices.	Investment in broadband infrastructure to provide affordable, reliable Internet access in underserved areas.	Assistance in mobile network development for rural and underserved areas.
	Implementation of rural connectivity projects aimed at extending broadband access to remote areas across the country.	Promotion of innovation in the development of technological solutions adapted to the specific needs of rural communities.	Support for spectrum allocation policies to improve mobile coverage.
Morocco	The national Digital Morocco 2020 programme aimed at developing broadband infrastructure and promoting the use of ICTs in all sectors of the economy.	Strengthening of regional cooperation to develop interconnection and of Internet traffic exchange projects with neighbouring countries.	Assistance in the development of mobile connectivity and spectrum access policies.

Web	Received	Source	Title
SG1RGQ/219	2024-04-02	5G Broadcast	Qualcomm, Inc.

A key lesson learned from past mobile broadcast attempts is that their success depends on more than just their technical merits but also on the overall support in devices (i.e., a critical mass needs to be reached). While 5G Broadcast is indeed a broadcast technology, it intentionally leverages most of the building blocks from a 4G/5G cellular modem. This can significantly lower the barrier for mobile devices already with cellular connectivity to also support 5G Broadcast (e.g., smartphones). For broadcasters, 5G Broadcast can unlock access to billions of devices while bringing new experiences and benefits to consumers in both developed and emerging countries. Thanks to the potential cost synergy, 5G Broadcast should be a very attractive broadcast technology solution for consumers, mobile original equipment manufacturers (OEMs), broadcasters, and the broader ecosystem.

Web	Received	Source	Title
SG1RGQ/152	2024-02-20	Cameroon	Extension of the use of FM from 76 MHz to 108 MHz, for African countries in general and Cameroon in particular
Proper use of the band 76-108 MHz for FM broadcasting, in Region 2, following the example of Brazil.			

Web	Received	Source	Title
SG1RGQ/151	2024-02-20	Cameroon	Update on the process of migration from analogue to digital broadcasting
In addition to the problem of assigning responsibility for managing the migration process, which has been resolved because now it is known exactly who should do what, the process of migrating from analogue to digital broadcasting continues to encounter a number of difficulties, namely: - Obtaining funding; - The project is burdened by the need to take into account problems relating to radio production, TV production and radio broadcasting, as part of the rehabilitation of CRTV; - The project has undergone several modifications in response to various demands.			

Web	Received	Source	Title
SG1RGQ/95	2023-04-25	Amazon	Bridging the digital divide through advances in satellite technology
Further development of policies and regulatory regimes, and alignment among countries, can help support the deployment LEO satellite networks and the expansion of broadband connectivity in underserved communities around the world. As a starting point, ITU Member States can work to modernize and harmonize regulations by undertaking the following measures: - Simplify the regulatory processes and procedures for obtaining authorizations to provide NGSO satellite services and adopt general authorization and blanket licensing regimes to expedite practical, widespread and economical deployment of customer terminals and network gateways. - Create and safeguard transparent and predictable regulatory regimes, including the preservation of spectrum allocations to the fixed satellite service (FSS) and mobile-satellite service (MSS). - Adopt satellite regulations that promote competition and technology neutrality. - Adopt a reasonable, administrative fee structure for the issuance of licences and authorizations for the provision of satellite services. - License and authorize satellite communications providers and operators on a non-discriminatory basis. - Adopt spectrum management practices that recognize the value proposition of satellite services and the role in bridging the digital divide.			

Web	Received	Source	Title
SG1RGQ/83	2023-04-25	Malaysia	National Digital Network Plan (JENDELA)

- i) Coordination of national broadband plan at the national level by the respective ministries and regulatory agencies to ensure successful implementation of targeted objectives.
- ii) Setting up of minimum targets to be achieved by the service providers to close the gap in infrastructure and services in unserved and underserved areas.
- iii) Consistent review of the regulatory framework to ensure its relevancy in supporting growth of the industry and maintaining provision of the right level of quality to the consumers.
- iv) Strategic and effective coordination with other government agencies to facilitate harmonized infrastructure rollout noting the limitation that certain matters fall under their purviews.
- v) Enforcement of stringent regulatory measures upon rollout failure by the service providers which constitutes non-compliance to the mandatory standards imposed upon them.
- vi) Regular assessments on coverage and quality to ensure the uninterrupted services to the consumers.
- vii) The use of on-site measurement and crowdsourced data to provide comprehensive analysis and insights to support coverage and service improvement.
- viii) Robust database of communications infrastructure management and reporting to ensure reliability of the national digital infrastructure mapping to facilitate future development.

Web	Received	Source	Title
SG1RGQ/79	2023-04-24	Argentina	Use of universal service funds for infrastructure deployment - The case of the federal fibre-optic network

Participants are asked to analyse the existing options for financing backbone networks and regulatory alternatives, to use tools available within national regulatory frameworks, such as universal service funds, and to achieve a universalization of broadband access.

Web	Received	Source	Title
SG1RGQ/52	2023-04-02	Burkina Faso	Security crisis in Burkina Faso, strengthening the resilience of consumers in localities affected by insecurity through the restoration of electronic communication infrastructures

Telecommunication infrastructures have become a target of choice for armed groups who try to isolate the populations of the affected localities and compromise the accessibility of said populations to communication services. Despite the complexity of the situation, the States where these groups operate must take measures to ensure the provision of communication services. Appropriate technological solutions exist and can be implemented by associating telecommunication operators and the regulatory authority. Financial solutions or mechanisms can be considered by States. Burkina Faso has set up a support fund for the implementation of exceptional measures in the electronic communications sector which makes it possible to finance the restoration of destroyed telecommunication sites.

Web	Received	Source	Title
SG1RGO/49 +Ann.1	2023-03-29	SBA Communications	The sharing of passive infrastructure as a tool for bridging the digital divide and economic and social growth

A review of the research literature and interviews of regulators and policymakers have led to the identification of seven types of initiatives that can contribute to the development and sustainability of an independent tower sector:

- No need for service concession: The construction of a cell tower does not rely on a public good, as is the case of spectrum. Therefore, it should not be ruled by a concessionary framework. Furthermore, the tower industry is not a natural monopoly requiring a concessionary regime, as in the case of power transmission, and railways. This concept supports the need to provide public right of way access at market rates. As a caveat, considering that the tower industry is not unlike other forms of private real estate, regulation should be limited to over-deployment, as determined by environmental reasons (see below).
- Need for fast permit approvals driven by consistent and reasonable timeframes: At present, many Latin American countries municipalities have constitutional autonomy to grant installation permits for antennas and rights of way for fibre-optic rollout. Accordingly, they can interfere with the provision of telecommunication/Internet services that are under federal authority. Frequently, in many countries of the region, local regulations have been imposed over federal authority, becoming very restrictive, not transparent, bureaucratic, and even irrational for obtaining municipal permits. These barriers increase the opportunity cost for deploying passive infrastructure, adding to the cost of deployment.
- Regulations to prevent over-deployment: Tower over-deployment, in many cases driven by straight financial speculation, is a frequent feature in Latin American countries. The negative consequences of this situation are environmental and economic. Focusing on the latter, a simplified financial model developed for this study indicates that, on average, unless a single tower is not supporting the radios of more than one operator (preferably three), its profitability is questionable, especially in suburban and rural settings over a ten-year time period. On this basis, governments should promote policies and regulatory frameworks preventing over-deployment while fostering sharing especially in rural areas.
- Establishment of a cap on fees and taxes, and rights of construction: Fees and taxes, also referred to as the "cost of compliance", have an impact on the tower business case. In general terms, most macroeconomic research literature has found that taxation regimes play an important role in driving capital flows, when controlled for economic development, and currency fluctuations. In this context, tower deployment is affected by the fiscal burden imposed by municipalities in the form of specific fees with the purpose of either limiting deployment of infrastructure or increasing revenues. Sometimes these fees become recurrent and even subject to annual increases defined on an ad-hoc basis. Without making any judgement about the need of municipalities to collect revenues to support the delivery of public services, it is also the case that by increasing the pre-tax cost of tower deployment, local authorities limit the capacity for the wireless industry to support the connectivity needs of their population.
- Implement policies to promote development of infrastructure to be shared for deployment of 5G: The deployment of 5G will require significant expansion of the level of densification of radios and antenna arrangements at street level to achieve useful coverage in some high data traffic spaces. Considering the layered architecture of wireless networks that necessitates both macro sites and small cell sites, it is estimated that by 2030 between two and three times the current number of sites will be required. In the context of these deployments, zoning regulation will become critical to address over-deployment, reduce permit approval processes, and to access public buildings and right-of-way, at market prices.

(continued)

Web	Received	Source	Title
- Do not impose price regulation on tower company contracts with service providers: In economic terms, price regulation is normally justified when markets fail to produce competitive prices. In the past, price regulation has been applied in the telecommunication sector to meet efficiency (under scarcity conditions) and equity objectives (fair access to an essential service). Similarly, interconnection prices have been regulated at times to ensure against anti-competitive behaviour of incumbent carriers at times of market liberalization. None of these conditions apply to contracts between a provider of infrastructure and a service provider. Prices to be charged between an independent tower company and wireless operators should not be regulated because: (i) they reflect contracts between private parties based on agreed prices; (ii) they do not reflect excessive or unconscionable pricing of an essential good (also called "price gouging"); and (iii) they would represent a disincentive to invest in infrastructure. - Define long-term guarantees in regulations and permits: Heavy initial CAPEX for tower deployment should be accompanied by relatively stable and predictable rules to ensure profitability and re-investment. While the financial profile developed in the context of this study is calculated over a ten-year timeframe, stability and predictability of regulatory frameworks are a critical industry requirement			

Web	Received	Source	Title
SG1RGO/47	2023-03-29	Burundi	National policy, regulations and strategy put in place to provide access to telecommunications/ICTs in rural and remote areas
- Establishment of a national ICT development policy - National fibre-optic backbone - Implementation of multipurpose community telecentres in rural areas - Establishment of ICT clubs in schools			

Web	Received	Source	Title
SG1RGO/45	2023-03-27	Uganda	Increase in broadband rollout in Uganda
i) Developing countries should pass policies and licensing regimes which set minimum broadband speeds for national operators. ii) Where it is not commercially viable for national operators to deploy infrastructure or rollout services, developing countries should utilise their universal service and access funds to subsidize such infrastructure and service rollout. iii) A minimum coverage/ rollout percentage should be set for national operators to close the service and infrastructure gap in the unserved and underserved areas. iv) Coordinating with other government agencies to facilitate harmonized infrastructure rollout.			

Web	Received	Source	Title
SG1RGQ/19	2023-03-20	Central African Republic	National digital policies, strategies and plans to ensure broadband accessibility to the broadest possible community of users

With the move towards full digitalization, and in view of the considerable impact of digital technology usage in almost every area of society, it is important to underline the need for common regulations for all on access to connectivity but also, and above all, on the use of accessible digital equipment in the digital space for all.

Member States are encouraged to strengthen their regulatory, institutional and technical capabilities as regards national digital strategies and plans, guaranteeing accessibility to broadband for the widest possible community of users.

Web	Received	Source	Title
SG1RGQ/18 +Ann.1	2023-03-16	Egypt	National broadband strategy

A corresponding increase in the supply of broadband connectivity to meet rising demand requires robust investment in telecommunications infrastructure. Broadband connectivity is not only important in its own right; it provides a platform for the growth of digital services including online communication tools, e-commerce, digital financial services, and e-government services, which together make up the foundation of a digital economy.

Digital services are the enablers of a digital economy, and the success of digital economy initiatives largely depends on a robust, reliable, low-latency, and high-speed broadband infrastructure in the country. The growth and competitiveness of the economy will increasingly depend on investments in the information and communications technology (ICT) sector.

Annex 3 – Useful references to work conducted by Question 1/1

[Transformative Connectivity: Trends in satellite innovation](#)

Report of the Information Session entitled "Terrestrial wireless broadband technologies and use cases" ITU-D Document [1/482](#) from Rapporteur for Question 1/1

[ITU-D Network and Digital Infrastructure](#) website

[ITU-D Policy and Regulation](#) website

[Broadband Commission Publications](#)

Annex 4 – Regional activities, including realization of the ITU-D regional initiatives, related to the topics of this Report

[Regional Initiatives 2023-2025 at a Glance](#)

[Regional Development Forums](#)

[Regional Preparatory Meetings – WTDC 2025](#)

[State of digital development and trends in the Africa region: Challenges and opportunities](#)

[State of digital development and trends in the Americas: Challenges and opportunities](#)

[State of digital development and trends in the Arab States region: Challenges and opportunities](#)

[State of digital development and trends in Asia and the Pacific: Challenges and opportunities](#)

[State of digital development and trends in the CIS region: Challenges and opportunities](#)

[State of digital development and trends in the Europe region: Challenges and opportunities](#)

Annex 5 – List of contributions and liaison statements received for Question 1/1

Contributions for Question 1/1 for Rapporteur Group and Study Group meetings

Web	Received	Source	Title	Question
1/537	2025-04-22	BDT Focal Points for Q1/1, Q2/1, and Q5/1	BDT report on the implementation of ICT Infrastructure work since the last ITU-D Study Group meeting	Q1/1, Q2/1, Q5/1
1/527	2025-04-15	GSOA	Satellite solutions for universal service: Bridging the digital divide	Q5/1, Q1/1
1/524	2025-04-15	BDT Focal Points for Question 1/1, 6/1 and 4/1	BDT report on the policy and regulation work including activities, events and resources since the last ITU-D Study Group 1 meeting	Q6/1, Q4/1, Q1/1
1/519	2025-04-15	Switzerland	Proposals for improvements of draft output reports on Question 1/1	Q1/1
1/501	2025-04-08	GSM Association	Advancing digital inclusion by addressing handset affordability	Q5/1, Q1/1
1/494	2025-03-20	Dominican Republic	Project for the deployment and operation of Internet access networks in selected localities in the southern region of the Dominican Republic	Q5/1, Q1/1
1/493	2025-03-12	Dominican Republic	2025-2026 Biennial plan of development projects	Q5/1, Q1/1
1/483	2025-03-13	Rapporteur for Question 1/1	Draft output report on Question 1/1	OR, Q1/1
1/482	2025-03-11	Rapporteur for Question 1/1	Report of the information session entitled "Terrestrial wireless broadband technologies and use cases"	Q1/1
1/455	2024-10-22	GSOA	The future of satellite connectivity: Various approaches to direct-to-device services	Q5/1, Q1/1
1/454 +Ann.1	2024-10-22	GSOA	New satellite technologies for transformative connectivity	Q5/1, Q1/1
1/449	2024-10-29	GSOA	GSOA Comments to Question 1/1 report draft	Q1/1

(continued)

Web	Received	Source	Title	Question
1/441	2024-11-01	BDT	Extracted lessons learned from contributions to ITU-D Study Group 1 Questions (third meeting of ITU-D Study Group 1)	Q7/1, Q6/1, Q5/1, Q4/1, Q3/1, Q2/1, Q1/1
1/436	2024-10-23	United States	United States experiences, lessons learned, and suggested best practices for bilateral engagement on Open RAN	Q1/1
1/435	2024-10-23	ITU-APT Foundation of India	Minimum basic broadband services for rural and remote areas in developing countries	Q5/1, Q1/1
1/433 +Ann.1	2024-10-22	Ericsson	Trends shaping the evolution of high-performing networks	Q1/1
1/432	2024-10-23	South Africa	Regulatory trends and technological advancements in non-terrestrial networks (NTNs),	Q1/1
1/429 +Ann.1	2024-10-22	Ericsson	6G use cases and the need for spectrum	Q1/1
1/428	2024-10-22	GSOA	GSR24 outcomes and GSOA contribution	Q5/1, Q1/1
1/427 +Ann.1	2024-10-22	Ericsson	The Ericsson mobility report	Q5/1, Q1/1
1/426 +Ann.1	2024-10-22	Ericsson	Actionable insights relating to fixed wireless access for extending coverage Rural connectivity	Q5/1, Q1/1
1/423	2024-10-22	United States	Lessons learned leveraging co-creation to increase access to connectivity and digital finance in marginalized communities through the USAID Digital Invest programme	Q5/1, Q4/1, Q1/1
1/419	2024-10-22	United States	United States experiences, lessons learned, and suggested best practices administering Open RAN academies	Q1/1
1/418 +Ann.1	2024-10-22	GSM Association	GSMA research on mobile Internet connectivity and recommendations to expand digital inclusion	Q5/2, Q5/1, Q1/1
1/417	2024-10-22	China	Broadband evolution trends and broadband policy progress in China	Q1/1
1/404	2024-10-22	China	SDN technology promotes the all-round development of ICT technology	Q1/1

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Web	Received	Source	Title	Question
1/403	2024-10-22	China	The development and innovation of IPv6 in China	Q1/1
1/400	2024-10-21	Access Partnership Limited	AI strategies to enhance quality of service amid increasing data traffic	Q1/1
1/399 +Ann.1-2	2024-10-21	GSM Association	2024 mobile industry impact report: Sustainable development goals	Q6/2, Q5/2, Q2/2, Q7/1, Q5/1, Q3/1, Q1/1
1/387 (Rev.1-2)	2024-10-14	Rapporteur for Question 1/1, Co-Rapporteurs for Question 5/1, Co-Rapporteurs for Question 3/1	Transformative connectivity: Trends in satellite innovation	IR, Q1/1, Q3/1, Q5/1
1/382	2024-10-03	Rapporteur for Question 1/1	Draft final report on Question 1/1 for the ITU-D study period 2022-2025	OR, Q1/1
1/380	2024-10-01	Republic of the Congo	Analysis of the impact of the delay in the deployment of advanced telecommunications infrastructures caused by the COVID-19 pandemic	Q5/1, Q1/1
1/374	2024-09-21	RIFEN	Using the Internet for the development and improvement of digital skills - the case of Burundi	Q5/2, Q5/1, Q1/1
1/358	2024-09-19	Colombia, United States	Spectrum auctions with in-kind payment obligations, cross-country digital transformation collaboration and lessons learned	Q5/1, Q4/1, Q1/1
1/350	2024-09-19	Brazil	High-speed high-quality networks in Brazil - Impact of public policies and regulatory actions	Q1/1
1/346	2024-09-19	Rapporteur for Question 1/1, 3/1 and 5/1	Report of the Joint workshop with Question 1/1, 3/1 and 5/1 entitled "Transformative connectivity: Satellite workshop" on 23 April	Q5/1, Q3/1, Q1/1
1/339	2024-09-19	Malaysia	Case study leveraging the latest AI technologies to improve information accessibility of hearing-impaired community.	Q1/1

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Web	Received	Source	Title	Question
1/334	2024-09-19	BDT Focal Point for Question 1/1, 2/, 5/1, 4/2 and 7/2	BDT report on the implementation of ICT infrastructure work since the last ITU-D Study Group meeting	Q7/2, Q4/2, Q5/1, Q2/1, Q1/1
1/329	2024-09-18	Vice-Chairs, ITU-D Study Group 1	Updates on the implementation of Resolution 9 across ITU-D Study Group 1	QALL/1, Q5/1, Q4/1, Q3/1, Q2/1, Q1/1
1/328	2024-09-18	Uzbekistan	"Bridging digital gaps towards universal and meaningful connectivity": ITU data visualization hackathon. The annual Summer School "Digital youth in defining a common future"	Q7/1, Q1/1
1/327	2024-09-18	GSM Association	Advancing digital inclusion through infrastructure sharing	Q5/1, Q1/1
1/318	2024-09-13	BDT Focal Points for Question 1/1, 4/1 and 6/1	BDT report on the Policy and Regulation work including activities, events and resources since the last ITU-D Study Group 1 meeting	Q6/1, Q4/1, Q1/1
1/309 +Ann.3	2024-09-19	Rapporteur for Question 1/1	Annual progress report for Question 1/1 for November 2024 meeting	QALL/1, PR, Q1/1
1/307	2024-08-30	Philippines	Philippines report on policy and regulatory reforms for the deployment of broadband	Q1/1
1/304	2024-09-10	Bulgaria	Large-scale deployment of digital infrastructure on the territory of Bulgaria	Q5/1, Q1/1
1/294	2024-08-13	Republic of the Congo	Use of NFV and SDN-based networking	Q1/1
1/293	2024-08-10	Sri Lanka	National Digital Strategy of Sri Lanka	Q1/1
1/292	2024-08-07	Republic of the Congo	Strategies to improve quality of service with increased data traffic	Q2/1, Q1/1
1/291	2024-08-07	Republic of the Congo	COVID-19: Economic slowdown and complementary technological alternatives to existing networks to cope with increased data traffic	Q2/1, Q1/1
1/289	2024-08-06	Republic of the Congo	Analysing the impact of the anticipated delay in the deployment of advanced telecommunications infrastructure as a result of the COVID-19 pandemic	Q1/1

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Web	Received	Source	Title	Question
1/261	2023-10-16	BDT Focal Points for Q1/1, Q2/1, Q4/2, Q5/1, Q7/2	BDT report on the implementation of ICT infrastructure work since the last ITU-D Study Group meeting	Q7/2, Q5/1, Q4/2, Q2/1, Q1/1
1/258 (Rev.1)	2023-10-20	BDT	Extracted lessons learned from contributions to ITU-D Study Group 1 Questions (first meeting of ITU-D Study Group 1)	Q7/1, Q6/1, Q5/1, Q4/1, Q3/1, Q2/1, Q1/1
1/251 +Ann.1	2023-10-11	GSOA	GSOA	Q5/1, Q1/1
1/247	2023-10-10	American Registry for Internet Numbers (ARIN)	Considerations on broadband deployment - Critical Internet infrastructure, security, and support mechanisms	Q1/1
1/246	2023-10-10	United Kingdom	Case Study: Gigabit broadband voucher scheme	Q5/1, Q4/1, Q1/1
1/241	2023-10-10	United States	United States experiences, lessons learned, and suggested best practices administering the Digital Invest Blended Finance programme	Q4/1, Q1/1
1/238 +Ann.1	2023-10-10	Ericsson Ltd.	Using 3GPP technology for satellite communication	Q5/1, Q1/1
1/226	2023-10-10	China	Progress in broadband network development strategies of major countries	Q1/1
1/204	2023-10-09	GSOA	Transformative meaningful connectivity: Satellite innovation workshop	Q5/1, Q3/1, Q1/1
1/200	2023-10-09	Intel Corporation	Connect.post initiative to connect every post office to the Internet by 2030	Q5/1, Q2/2, Q1/1
1/199	2023-10-09	Intel Corporation	Updated information on Wi-Fi technology	Q5/1, Q2/2, Q1/2, Q1/1
1/197	2023-10-09	Vice-Chairs, ITU-D Study Group 1, Co-Rapporteur for Question 7/2, Vice-Chair, ITU-D Study Group 2	Implementation of Resolution 9 across ITU-D Study Group Questions	Q7/2, Q5/1, Q4/1, Q3/1, Q2/2, Q2/1, Q1/2, Q1/1

(continued)

Web	Received	Source	Title	Question
1/192	2023-10-09	Russian Federation	Development of space information technologies in the Russian Federation (project SFERA)	Q1/1
1/191	2023-10-09	Russian Federation	Government measures to eliminate digital inequality	Q1/1
1/189 (Rev.1-20)	2023-10-05	International Chamber of Commerce	Expanding connectivity and digitalisation to achieve global development goals	Q1/1
1/184	2023-09-29	Argentina	Spectrum management: Argentinian experience	Q2/1, Q1/1
1/180 (Rev.1)	2023-09-29	Argentina	Federal ICT Training plan	Q5/2, Q5/1, Q1/1
1/179	2023-09-29	Argentina	Mi Pueblo Conectado programme	Q5/2, Q5/1, Q1/2, Q1/1
1/178 (Rev.1)	2023-09-29	Argentina	Conectar plan	Q5/1, Q2/2, Q1/1
1/174	2023-09-24	Institute of Telecommunications and Global Information Space, Ukraine	Web-toolkit for integrated planning of infrastructure corridors	Q1/1
1/170	2023-09-16	Burundi	The impact of the deployment of ICT infrastructures in the digitalization of services	Q5/1, Q1/1
1/168 (Rev.1)	2023-09-07	United States	Management and implementation mechanisms for universal service funds in the United States	Q1/1
1/167	2023-09-07	Central African Republic	Strategy for extending connectivity to unserved and underserved segments of the population in rural and urban areas	Q5/1, Q1/1
1/159 +Ann.3	2023-09-09	Rapporteur for Question 1/1	Annual progress report for Question 1/1 for October 2023 meeting	QALL/1, Q1/1, PR
1/154	2023-09-07	Côte d'Ivoire	The needs of persons with disabilities in the national strategy for the development of the digital economy	Q7/1, Q1/1
1/141	2023-09-06	Brazil	Mobile broadband availability in outskirts of Brazilian big cities	Q1/1
1/139	2023-09-06	Brazil	Brazilian connectivity index (Índice Brasileiro de Conectividade (IBC))	Q4/1, Q1/1

(continued)

Web	Received	Source	Title	Question
1/127	2023-09-01	Kenya	The multi-pronged strategy to hasten broadband connectivity for sustainable meaningful connectivity - The case of Kenya's 'Digital super highway'	Q1/1
1/126 (Rev.1-2)	2023-09-01	BDT Focal Points for Question 1/1, 4/1 and 6/1	BDT report on the policy and regulation work including activities, events and resources since the last ITU-D Study Group 1 meeting	Q6/1, Q4/1, Q1/1
1/TD/1	2022-11-28	Rapporteur for Question 1/1	Proposals towards the work plan for Study Question 1/1	Q1/1
1/91	2022-11-17	ITU-APT Foundation of India	Strategies for the deployment of broadband using Wi-Fi connectivity through a public data office (PDO) for rural and remote areas	Q1/1, Q5/1
1/88	2022-11-21	BDT	Extracted lessons learned from contributions to ITU-D Study Group 1 Questions (first meeting of ITU-D Study Group 1)	Q7/1, Q6/1, Q5/1, Q4/1, Q3/1, Q2/1, Q1/1
1/76	2022-11-15	Intel Corporation	Importance of computer and broadband programmes for households, students and education	Q5/2, Q5/1, Q2/2, Q1/1
1/70	2022-11-14	World Bank	World Bank Study Group 1 submission: Enabling environment for meaningful connectivity	Q6/1, Q5/1, Q4/1, Q1/1
1/60	2022-10-18	BDT Focal Point for Q1/1, Q2/1, Q5/1, Q4/2, Q7/2	BDT report on the implementation of ICT infrastructure work since the last ITU-D Study Group meeting	Q7/2, Q5/1, Q4/2, Q2/1, Q1/1
1/53	2022-10-17	ISCG	Mapping of ITU-D Questions to ITU Telecommunication Standardization Sector (ITU-T) Questions and ITU Radiocommunication Sector (ITU-R) working parties	QALL/2, QALL/1, Q7/2, Q7/1, Q6/2, Q6/1, Q5/2, Q5/1, Q4/2, Q4/1, Q3/2, Q3/1, Q2/2, Q2/1, Q1/2, Q1/1
1/51	2022-10-17	BDT Focal Point for Question 1/1, 4/1 and 6/1	BDT report on the policy and regulation work including activities, events and resources since the last ITU-D Study Group 1 meeting	Q6/1, Q4/1, Q1/1
1/48	2022-10-13	Bhutan	Strategies: Deployment of broadband in Bhutan	Q5/1, Q2/1, Q1/1

(continued)

Web	Received	Source	Title	Question
1/39	2022-10-12	Madagascar	Upstream popularization of broadband for the benefit of end users	Q5/1, Q1/1
1/38 (Rev.1)	2022-10-11	Sudan	Benefits of a draft resolution on connecting refugees to Internet services in developing countries	Q1/1
1/36	2022-10-11	SUP'PTIC	Strategies and policies for broadband deployment in developing countries	Q5/1, Q1/1
1/2 +Ann.1	2022-11-25	BDT	Resolution 2 (Rev. Kigali, 2022) Establishment of study groups + Full text of all ITU-D Study Group 1 and 2 Questions in Annex 1	QALL/2, QALL/1, Q7/2, Q7/1, Q6/2, Q6/1, Q5/2, Q5/1, Q4/2, Q4/1, Q3/2, Q3/1, Q2/2, Q2/1, Q1/2, Q1/1

Contributions for QAll for Rapporteur Group and Study Group meetings

Web	Received	Source	Title	Question
1/544	2025-04-24	Chair, Study Group 1, Chair, Study Group 2	Update on joint work on practical guidelines	QALL/1, QALL/2
1/543	2025-04-22	Co-Rapporteurs for Question 6/1	Annual progress report for Question 6/1 for April 2025 meeting	QALL/1, PR
1/534	2025-04-15	Coordinators	Coordinator's update document	QALL/1
1/533	2025-04-15	BDT	Update on WTDC-25 Preparations	QALL/1
1/532 +Ann.1	2025-04-15	BDT	Report of end-of-cycle survey on ITU-D Study Groups for the 2022-2025 study period	QALL/2, QALL/1
1/523	2025-04-15	Rapporteur for Question 1/1	Progress report	QALL/1, PR
1/522 +Ann.1	2025-04-15	BDT	ITU statistical work: Recent and upcoming activities	QALL/2, QALL/1
1/521 +Ann.1	2025-04-15	TSB	Overview of ITU-T activities	QALL/2, QALL/1
1/517	2025-04-15	Rapporteur for Question 4/1	Progress report	QALL/1, PR
1/516 +Ann.1	2025-04-14	BR	Update on ITU-R Radiocommunication Study Groups' activities	QALL/2, QALL/1
1/514	2025-04-15	Vice-Chair, ITU-D Study Group 1, Vice-Chair, ITU-D Study Group 2	Report on ITU Coordination Committee for Terminology (ITU CCT)	QALL/2, QALL/1
1/512	2025-04-15	Co-Rapporteurs for Question 5/1	Progress report	QALL/1, PR
1/511	2025-04-14	Vice-Chairs, ITU-D Study Group 1	Final compilation for the implementation of Resolution 9 across ITU-D Study Group 1	QALL/1
1/510	2025-04-14	Co-Rapporteurs for Question 2/1	Progress report	QALL/1, PR
1/508	2025-04-14	Co-Rapporteurs for Question 7/1	Progress report	QALL/1, PR
1/443 +Ann.1	2024-10-28	TSB	Overview of ITU-T activities and preparation for WTS-24	QALL/2, QALL/1

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Web	Received	Source	Title	Question
1/442 +Ann.1	2024-10-25	General Secretariat	WSIS Secretariat presentation to ITU-D Study Group 1 and 2 meetings	QALL/2, QALL/1
1/440 +Ann.1	2024-10-24	ITU-D Study Group 1 Coordinators	Report from ITU-D Study Group 1 Coordinators	QALL/1
1/439	2024-10-24	BDT	Change in SG1 management team	QALL/1
1/437	2024-10-23	BDT	Presenting linkages between ITU projects and ITU-D Study Group 1 and 2 Questions	QALL/2, QALL/1
1/398 +Ann.1	2024-10-21	BR	Update on ITU-R Radiocommunication study group activities	QALL/2, QALL/1
1/395 +Ann.1	2024-10-21	BDT	Overview of ITU-D statistical products and activities in 2024	QALL/2, QALL/1
1/379	2024-10-01	BDT	Joint survey on the work of the ITU-D study groups for the 2022-2025 study period	QALL/2, QALL/1
1/372	2024-10-06	Vice-Chair of ITU-D Study Group 1, Vice-Chair of ITU-D Study Group 2	Report on ITU coordination committee for terminology (ITU CCT)	QALL/2, QALL/1
1/332	2024-09-18	BDT	Report of the public workshop entitled "International Girls in ICT Day celebrations - Women in tech!" held in Geneva on 25 April 2024	QALL/1
1/331	2024-09-18	Uzbekistan	Youth2Connect: Empowering Youth to develop and implement digital projects	QALL/2, QALL/1
1/330	2024-09-18	Uzbekistan	ITU youth digital magazine: A platform for young people to contribute scientific ideas to digital transformation projects	QALL/2, QALL/1
1/329	2024-09-18	Vice-Chairs, ITU-D Study Group 1	Updates on the implementation of Resolution 9 across ITU-D Study Group 1	QALL/1, Q5/1, Q4/1, Q3/1, Q2/1, Q1/1
1/315	2024-09-16	Co-Rapporteurs for Question 7/1	Annual progress report for Question 7/1 for November 2024 meeting	PR, Q7/1, QALL/1
1/314	2024-10-04	Co-Rapporteurs for Question 6/1	Annual progress report for Question 6/1 for November 2024 meeting	QALL/1, PR, Q6/1

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Web	Received	Source	Title	Question
1/313 +Ann.1	2024-09-19	Co-Rap- porteurs for Question 5/1	Annual progress report for Question 5/1 for November 2024 meeting	QALL/1, PR, Q5/1
1/312	2024-10-22	Rapporteur for Question 4/1	Annual progress report for Question 4/1 for November 2024 meeting	QALL/1, PR, Q4/1
1/311	2024-10-27	Co-Rap- porteurs for Question 3/1	Annual progress report for Question 3/1 for November 2024 meeting	QALL/1, PR, Q3/1
1/310	2024-09-18	Co-Rap- porteurs for Question 2/1	Annual progress report for Question 2/1 for November 2024 meeting	QALL/1, PR, Q2/1
1/309 +Ann.3	2024-09-19	Rapporteur for Question 1/1	Annual progress report for Question 1/1 for November 2024 meeting	QALL/1, PR, Q1/1
1/260 +Ann.1	2023-10-20	BDT	Report from ITU-D Study Group 1 Coordinators	QALL/1
1/257	2023-10-16	BDT	Change in Study Group 1 management team	QALL/1
1/253	2023-10-10	BDT	Presenting linkages between ITU projects and ITU-D Study Group 1 and 2 Questions	QALL/2, QALL/1
1/252 +Ann.1	2023-10-10	BDT	Overview of ITU-D statistical products and activities in 2023	QALL/2, QALL/1
1/228	2023-10-10	BDT Focal Points for Gender and Youth	BDT progress report on the implementation of gender related programmes	QALL/2, QALL/1
1/227	2023-10-10	Vice-Chair, ITU-D Study Group 2	Report on ITU coordination committee for terminology (ITU CCT)	QALL/2, QALL/1
1/218 +Ann.1	2023-10-19	General Secretariat	WSIS secretariat presentation to ITU-D Study Group 1 and 2 meetings	QALL/1, QALL/2
1/193 +Ann.1	2023-10-07	BDT focal point for youth	Integrating a youth-centric perspective within the ITU-D work in study groups to support ITU-D efforts in fostering active participation in the digital soci- ety, economy, and environment of global youth	QALL/2, QALL/1
1/190 +Ann.1	2023-10-06	TSB	Overview of ITU-T activities and preparation for WTS-24	QALL/2, QALL/1

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Web	Received	Source	Title	Question
1/186 +Ann.1	2023-10-03	BR	Update on ITU-R Radiocommunication study group activities	QALL/2, QALL/1
1/172 (Rev.2)	2023-09-07	Co-Rapporteur for Question 6/1	Proposed interim deliverable for Question 6/1: Best practices being adopted on fit-for purpose digital regulation tools for consumer protection	QALL/1, Q6/1, ID
1/165	2023-09-07	Co-Rapporteurs for Question 7/1	Annual progress report for Question 7/1 for October 2023 meeting	QALL/1, Q7/1, PR
1/164	2023-10-19	Co-Rapporteurs for Question 6/1	Annual progress report for Question 6/1 for October 2023 meeting	QALL/1, Q6/1, PR
1/163	2023-09-07	Co-Rapporteurs for Question 5/1	Annual progress report for Question 5/1 for October 2023 meeting	QALL/1, Q5/1, PR
1/162	2023-10-05	Rapporteur for Question 4/1	Annual progress report for Question 4/1 for October 2023 meeting	QALL/1, Q4/1, PR
1/161	2023-10-10	Co-rapporteur for Question 3/1	Annual progress report for Question 3/1 for October 2023 meeting	QALL/1, Q3/1, PR
1/160	2023-09-07	Co-Rapporteurs for Question 2/1	Annual progress report for Question 2/1 for October 2023 meeting	QALL/1, Q2/1, PR
1/159 +Ann.3	2023-10-09	Rapporteur for Question 1/1	Annual progress report for Question 1/1 for October 2023 meeting	QALL/1, Q1/1, PR
1/92 +Ann.1	2022-11-19	General Secretariat	PP-22 outcomes	QALL/2, QALL/1
1/90	2022-11-16	BDT	Template for drafting a work plan for each study Question	QALL/2, QALL/1
1/89 (Rev.1-2)	2022-11-27	BDT	List of proposed Rapporteurs and Vice-Rapporteurs by (Chairman, ITU-D SG1) and another for SG2	QALL/1
1/87	2022-11-17	Chairman, ITU-D SG1	Study Group 1 Work Plan for the Study Period 2022-2025	QALL/1
1/86 (Rev.1)	2022-11-17	BDT	List of Rapporteur and Vice-Rapporteur candidates	QALL/1
1/84	2022-11-15	General Secretariat	WSIS prizes 2022 and 2023	QALL/2, QALL/1

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Web	Received	Source	Title	Question
1/83	2022-11-15	General Secretariat	WSIS stocktaking 2022 and 2023	QALL/2, QALL/1
1/82	2022-11-15	General Secretariat	ITU contribution to the implementation of the WSIS outcomes (2022) and ITU roadmaps C2, C4, C5, and C6	QALL/2, QALL/1
1/81	2022-11-15	General Secretariat	WSIS Forum 2023 (preparations)	QALL/2, QALL/1
1/80 (Rev.1)	2022-11-15	General Secretariat	WSIS Forum 2022 outcomes	QALL/2, QALL/1
1/79	2022-11-15	BDT	Presenting linkages between ITU projects and ITU-D Study Group 1 and 2 Questions	QALL/2, QALL/1
1/78 +Ann.1	2022-11-15	BDT	Generation connect: Amplifying youth voices in digital development	QALL/2, QALL/1
1/77 +Ann.1	2022-11-15	TSB	Overview of ITU-T activities and WTSA-20 outcomes	QALL/2, QALL/1
1/75 +Ann.1	2022-11-14	BDT	Overview of ITU-D statistical products and activities in 2022	QALL/2, QALL/1
1/74 +Ann.1	2022-11-14	BR	Update on ITU-R activities	QALL/2, QALL/1
1/63	2022-11-09	BDT	Connect2Recover research competition reports on digital inclusion and digital connectivity and resilient digital infrastructure: Lessons learnt from COVID-19 pandemic	QALL/1
1/53	2022-10-17	ISCG	Mapping of ITU-D Questions to ITU-T Questions and ITU-R Working Parties	QALL/2, QALL/1, Q7/2, Q7/1, Q6/2, Q6/1, Q5/2, Q5/1, Q4/2, Q4/1, Q3/2, Q3/1, Q2/2, Q2/1, Q1/2, Q1/1
1/35	2022-10-11	Kenya, ATDI	Resolution 9 (Rev. Kigali, 2022) implementation, ITU-R and ITU-D collaboration	QALL/2, QALL/1

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Web	Received	Source	Title	Question
1/2 +Ann.1	2022-11-25	BDT	Resolution 2 (Rev. Kigali, 2022) Establishment of Study Groups + Full text of all ITU-D Study Group 1 and 2 Questions in Annex 1	QALL/2, QALL/1, Q7/2, Q7/1, Q6/2, Q6/1, Q5/2, Q5/1, Q4/2, Q4/1, Q3/2, Q3/1, Q2/2, Q2/1, Q1/2, Q1/1
1/1	2022-11-25	BDT	Resolution 1 (Rev. Kigali, 2022) Rules of procedure of the ITU telecommunication develop- ment sector	QALL/2, QALL/1

Incoming Liaison Statements for Question 1/1

Web	Received	Source	Title	Question
1/529	2025-04-16	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D Study Groups 1 and 2 on contributions from developing countries	Q2/1, Q1/2, Q1/1, ILS
1/498	2025-04-07	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D Study Group 1 on the latest updates of access network transport (ANT) and home network transport (HNT) Standards Overviews and Work Plans (reply to SG9-LS96 and SG21-LS9)	Q2/1, Q1/1, ILS
1/298	2024-08-23	ITU-T Study Group 13	Liaison statement from ITU-T Study Group 13 new Technical Report ITU-T TR.SME.FRAMEWORK "Framework for future network technology integration for small and medium scale enterprises in developing countries"	Q2/2, Q1/1, ILS
1/288 +Ann.1	2024-08-05	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D Study Group 1 Question 1/1 on new work item on practical considerations for network infrastructure sharing	Q1/1, ILS
1/286	2024-07-24	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D Study Group 1 Question 1/1 on contributions from developing countries	Q1/1, ILS
1/285	2024-07-19	ITU-T Study Group 3	Liaison statement from ITU-T Study Group 3 to ITU-D Study Groups 1 and 2 on creation of new work item on economic and policy aspects of the provision of high-speed Internet connectivity by retail satellite operators	Q2/2, Q5/1, Q3/1, Q2/1, Q1/1, ILS
1/58 +Ann.1	2022-10-28	ITU-R Working Party 5D	Liaison statement from ITU-R Working Party 5D to ITU-D Study Group 1 Question 1/1 and Question 5/1 on terrestrial IMT for remote sparsely populated areas providing high data rate coverage	Q5/1, Q1/1, ILS
1/50	2022-10-13	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D Study Group 1 Question 1/1 on ITU-T SG15 comments on recently published ITU-D documents for guidance on the choice and procurement of network access equipment for last mile connectivity	Q1/1, ILS

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Web	Received	Source	Title	Question
1/49	2022-10-13	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D Study Group 1 Question 1/1 on contributions from developing countries	Q1/1, ILS
1/43	2022-10-12	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D Study Groups 1 and 2 on the new version of the access network transport (ANT) and home network transport (HNT) Standards Overviews and Work Plans	Q5/1, Q1/2, Q1/1, ILS
1/25 +Ann.1	2022-06-16	FG-TBFxG	Liaison statement from ITU-T Focus Group on testbeds federations for IMT-2020 and beyond (FG-TBFxG) to ITU-D Study Groups 1 and 2 on call for use cases on testbeds federation	Q4/2, Q1/1, ILS
1/20 +Ann.1-2	2022-04-14	FG-TBFxG	Liaison statement from ITU-T Focus Group on testbed federations for IMT-2020 and beyond (FG-TBFxG) to ITU-D Study Groups 1 and 2 on the outcomes of the first meeting of the Focus Group	Q4/2, Q1/1, ILS
1/19 +Ann.1	2022-03-22	ITU-R Study Group 6	Liaison statement from ITU-R Study Group 6 to ITU-D Study Group 1 on Information on the progress of ITU-R Study Group 6 Rapporteur Group on A vision for the future of broadcasting (RG-FOB)	Q7/1, Q2/1, Q1/1, ILS
1/15	2021-12-23	ITU-T Study Group 15	Liaison statement from ITU-T Study Group 15 to ITU-D Study Groups 1 and 2 on the new version of the access network transport (ANT) and home network transport (HNT) Standards Overviews and Work Plans	Q5/1, Q1/2, Q1/1, ILS
1/13 +Ann.1	2021-12-21	ITU-T Study Group 11	Liaison statement from ITU-T Study Group 11 to ITU-D Study Groups 1 and 2 on establishment of a new ITU-T Focus Group on testbeds federations for IMT-2020 and beyond (FG-TBFxG) and first meeting (virtual, 4-7 April 2022)	Q4/2, Q1/1, ILS

Incoming Liaison Statements for QAll

Web	Received	Source	Title	Question
1/500 +Ann.1	2025-04-11	Chair, IAGDI CRO	Liaison statement from IAGDI CRO to ITU-D Study Groups 1 and 2 on collaboration through two tech talks organized by IAGDI-CRO	QALL/2, QALL/1, ILS
1/438	2024-10-21	IAGDI-CRO	Liaison statement from ITU-D IAGDI-CRO to ITU-D Study Groups 1 and 2 on collaboration through two tech talks organized by IAGDI-CRO	QALL/2, QALL/1, ILS
1/322	2024-09-17	ITU-T Study Group 9	Liaison statement from ITU-T Study Group 9 to ITU-D Study Groups 1 and 2 on requests to continue the survey on hybrid cable network and respond to the revised TSB Circular 219	QALL/1, QALL/2, ILS
1/283	2024-07-09	ITU-T Study Group 2	Reply liaison statement from ITU-T Study Group 2 to ITU-D Study Groups 1 and 2 on draft analysis of operational parts (resolves, instructs, etc.) of WTSA/PP/WTDC/ Council/ITU-R Resolutions (reply to TSAG-LS42)	QALL/2, QALL/1, ILS
1/281 +Ann.1	2024-07-30	ITU-T FG-AI4A	Liaison statement from ITU-T FG-AI4A to ITU-D Study Groups 1 and 2 on overview of work of FG-AI4A	QALL/2, QALL/1, ILS
1/280 +Ann.1+4	2024-06-28	ITU-T FG-AI4A	Liaison statement from ITU-T FG-AI4A to ITU-D Study Groups 1 and 2 on completion of FG-AI4A deliverables	QALL/2, QALL/1, ILS
1/279	2024-06-21	ITU-T FG-MV	Liaison statement from ITU-T FG-MV to ITU-D Study Groups 1 and 2 on results of the seventh and final meeting of the FG-MV	QALL/2, QALL/1, ILS
1/278	2024-06-10	ITU-T Study Group 9	Liaison statement from ITU-T Study Group 9 to ITU-D Study Groups 1 and 2 on collaboration between ITU-D SG1/SG2 and ITU-T SG9	QALL/2, QALL/1, ILS
1/275	2024-05-03	ITU-T FG-MV	Liaison statement from ITU-T FG-MV to ITU-D Study Groups 1 and 2 on results of the sixth meeting of the FG-MV	QALL/2, QALL/1, ILS
1/274 +Ann.1	2024-04-17	ITU-T FG-MV	Liaison statement from ITU FG-MV to ITU-D Study Group 1 on definition of CitiVerse	QALL/1, ILS

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Web	Received	Source	Title	Question
1/273	2024-04-09	ITU-T Study Group 13	Liaison statement from ITU-T Study Group 13 to ITU-D Study Group 1 on initiation of new Supplement ITU-T Y.NGNe-Use-Cases "Use cases of next generation network evolution in developing countries"	QALL/1, ILS
1/272	2024-04-09	JCA-IMT2020	Liaison statement from ITU-T JCA-IMT2020 to ITU-D Study Group 1 on invitation to update the information in the IMT-2020 and beyond roadmap technology in networks of developing countries	QALL/1, ILS
1/271	2024-04-09	ITU-T Study Group 13	Liaison statement from ITU-T Study Group 13 to ITU-D Study Group 1 on initiation of new Supplement ITU-T Y.DLT-Use-Cases "Use cases of distributed ledger technology in networks of developing countries"	QALL/1, ILS
1/262	2023-10-17	ITU-T Focus Group on metaverse (FG-MV)	Liaison statement from ITU-T Focus Group on metaverse to ITU-D Study Groups 1 and 2 on results of the third meeting of the FG-MV	QALL/1, QALL/2, ILS
1/256 +Ann.1	2023-10-13	ITU-T Focus Group on metaverse (FG-MV)	Liaison statement from ITU-T Focus Group on request to provide the standardization status for metaverse cross-platform interoperability	QALL/2, QALL/1, ILS
1/255 +Ann.1	2023-10-13	ITU-T Focus Group on metaverse (FG-MV)	Liaison statement from ITU-T Focus Group on metaverse to ITU-D Study Groups 1 and 2 definition of metaverse	QALL/2, QALL/1, ILS
1/124	2023-08-11	TSAG RG-DT	Liaison statement from TSAG Rapporteur Group on sustainable digital transformation (RG-DT) to ITU-D Study Groups 1 and 2 on the activities and studies on sustainable digital transformation	QALL/2, QALL/1, ILS
1/123	2023-08-04	ITU-T Focus Group on metaverse (FG-MV)	Liaison statement from ITU-T Focus Group on metaverse to ITU-D Study Groups 1 and 2 on results of the second meeting of the FG-MV and approval of its first deliverable	QALL/2, QALL/1, ILS
1/121 +Ann.1	2023-08-04	ITU-T Study Group 16	Liaison statement from ITU-T Study Group 16 to ITU-D Study Groups 1 and 2 on requesting collaboration on metaverse standardization work	QALL/2, QALL/1, ILS

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Web	Received	Source	Title	Question
1/61	2022-11-08	ITU-T Study Group 5	Liaison statement from ITU-T Study Group 5 to JCA-IMT2020 on invitation to update the information in the IMT2020 roadmap	QALL/2, QALL/1, ILS
1/26	2022-07-25	JCA-IMT2020	Liaison statement from JCA-IMT2020 to ITU-D Study Groups 1 and 2 on invitation to update the information in the IMT-2020 and beyond roadmap	QALL/2, QALL/1, ILS
1/23 +Ann.1-7	2022-05-31	ITU-T Study Group 3	Liaison statement from ITU-T Study Group 3 to ITU-D Study Groups 1 and 2 on SG3 representative to ITU-D and topics of common interest	QALL/2, QALL/1, ILS
1/22 +Ann.1	2022-05-19	ITU-R Working Party 5D	Liaison statement from ITU-R Working Party 5D to ITU-D Study Groups 1 and 2, and ITU-T Study Group 13 on new edition of the Handbook on international mobile telecommunications (IMT)	QALL/2, QALL/1, ILS
1/17	2022-01-18	TSAG	Liaison statement from Telecommunication Standardization Advisory Group (TSAG) to ITU-D Study Groups 1 and 2 on the establishment of JCA on digital COVID-19 certificates (JCA-DCC)	QALL/2, QALL/1, ILS
1/16	2022-01-18	TSAG	Liaison statement from Telecommunication Standardization Advisory Group (TSAG) to ITU-D Study Groups 1 and 2 on consideration for accessible meetings	QALL/2, QALL/1, ILS
1/12 +Ann.1	2021-12-14	ITU-T Study Group 13	Liaison statement from ITU-T Study Group 13 to ITU-D Study Groups 1 and 2 on invitation to review big data and data handling standardization roadmap and provide missing or updated information	QALL/2, QALL/1, ILS
1/11	2021-12-02	JCA-IMT2020	Liaison statement from JCA-IMT2020 to ITU-D Study Groups 1 and 2 on invitation to update the information in the IMT2020 roadmap	QALL/2, QALL/1, ILS

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ISBN 978-92-61-40861-9



9 789261 408619

Published in Switzerland
Geneva, 2025

Photo credits: Adobe Stock