ICC WHITE PAPER ON
Delivering Universal Meaningful Connectivity

CONTENTS

EXECUTIVE SUMMARY

Despite enormous progress in expanding connectivity (94% of the world's population lives in areas covered by a broadband network), only 63% of the global population were using the Internet in 2021, with 2.9 bn people still remaining offline.

Closing these coverage and usage gaps depends on addressing barriers to any of the three layers of the digital ecosystem (infrastructure, application and skills). This requires an appropriate mix of economic, technical and regulatory approaches—and hinges largely on private sector investment.

Drawing on extensive consultations with business across a broad range of geographies, this paper aims to:

- Identify, clarify, and classify major obstacles to delivering connectivity.
- Spotlight innovative and scalable industry approaches to tackle coverage and usage gaps.
- Establish an actionable roadmap for policymakers to enable and support business efforts to deliver meaningful connectivity and drive associated private sector investment.

Based on the learnings and strategies derived from the private sector's experience, we offer the following two basic principles for policymaking and highlight three priority areas for improvement.

- Policy and regulatory mechanisms should promote the value of the entire communications and digital services ecosystem.
- Policies should be non-discriminatory, technology-neutral, and supportive of innovative business models and the development and deployment of a wide range of technologies, standards, and system architectures.

To incentivise rapid and efficient action to close the connectivity gap, governments, in collaboration with businesses worldwide, should:

1. Facilitate investment across the entire digital value chain
2. Effectively manage spectrum
3. Ground policies in evidence and data

INTRODUCTION

Connectivity has rapidly become one of the most defining features of our everyday lives, the way we study, work, do business, consume content or connect with our communities. A recent report suggests that the digital economy is worth US $11.5 trillion globally, equivalent to 15.5% of global GDP, and that it has grown two and a half times faster than global GDP over the past 15 years.[1] Information and communication technologies (ICTs) are also transforming essential social services, such as education and health care, as well as the ways in which people interact with their governments.

In recent years we have seen enormous progress in expanding connectivity and the opportunities it brings across the globe. Today, 94% of the world's population is covered by *a mobile broadband network*, effectively reducing the number of people living in areas without a mobile broadband network to 450 million.[2] However, the International Telecommunication Union (ITU) estimates that only 63% of the global population (around 4.9 billion) were *using the Internet* in 2021[3], with some 2.9 billion people still remaining offline.[4]

The COVID-19 pandemic clearly showed the value of such connectivity, fostering societal resilience in the face of the crisis, and enabling people to continue their usual economic and social activities during the worldwide lockdowns of 2020. However, this lifeline was only available to those who possessed three key ingredients of meaningful connectivity: robust infrastructure, relevant digital services and effective skills.

The connectivity gap and its causes are not uniform. The unconnected are either 'uncovered' or 'covered but not connected'. The 'uncovered' are those who do not live in an area covered by a network. We refer to this as the coverage gap. The 'covered but not connected' are those who live within the footprint of a network but are not using Internet services. We refer to this as the usage gap. Although there continue to be significant increases in Internet adoption, inequalities persist and will do unless both the coverage and usage gaps are addressed.

For this, dedicated and effective actions are needed on both the supply and demand side of connectivity. It takes more than access to the Internet to fully benefit from the opportunities it offers. An interoperable, seamless ICT ecosystem is crucial to help populations reap the benefits of ICT and further development opportunity. Such an ecosystem consists of three layers:

1. accessible and affordable infrastructure and devices;
2. appropriate applications and services built upon the infrastructure;
3. user ability to use a device and understand the features of these application and services.

Closing the coverage and usage gaps depends on identifying and addressing barriers to any of the three layers of the ecosystem, which should be done with an appropriate mix of economic, technical and regulatory approaches. This paper explores various barriers to this ecosystem and showcases innovative approaches to overcome them. It is built on real-life case studies: projects across the world implemented by businesses and private-public partnerships to provide meaningful connectivity to unconnected or underserved communities of different demographic, geographic and economic circumstances. Each case study provides an example illustrating an innovative business model, technology or regulatory approach that helped to address connectivity barriers.

Our main take-away from examining these projects is that there is no one-size-fits-all model that can be applied everywhere. It takes a unique mix of technology, regulatory approaches and business models in order to appropriately respond to the needs of each community. This paper provides a menu of concrete policy actions distilled from these case studies, offered as a resource to policymakers worldwide who are endeavouring to foster meaningful connectivity for their communities.

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1 Oxford Economics : *Digital Spillover*
2 GSMA *State of Mobile Internet Connectivity Report 2021*
3 ITU *Measuring digital development Facts and figures 2021*
4 ITU *Measuring digital development Facts and figures 2021*

PART 1: Exploring the barriers to connectivity

As evidenced in the ITU and GSMA reports referenced in the Introduction, inequalities in connectivity are closely correlated with location, economic opportunity, education, gender as well as social and cultural norms and governance approaches. As a result, 96% of unconnected people live in developing countries, most often living in rural areas. Also, affordability remains a problem, with roughly half of the world's economies falling short of the UN Broadband Commission for Sustainable Development's target[5], both for mobile (43%) and fixed (56%) broadband connections. See a snapshot on the state of global connectivity today in Annex I.

Geography and infrastructure

Rural, sparsely populated, remote or hard-to-reach areas are particularly lagging behind, as the delivery and maintenance of networks in these areas is costlier and more difficult, and seldom promises a positive return on investment. Lack of mobile Internet coverage or a fixed network is often exacerbated by a lack of adjacent infrastructure such as roads or grid electricity.

Physical and basic infrastructure barriers in remote areas lead to a combination of technological factors such as, limited access to international bandwidth, an underdeveloped national core network and backhaul—all contributing to diminishing opportunities to connect.

On top of these geographical and technological setbacks, ineffective national strategies for broadband access and infrastructure development further contribute to persisting inequalities.

Investment and incentives

Developing, deploying and maintaining networks depends largely on long-term investments, whether public, private or in partnership. Given the large number of people still unconnected, there is significant growth opportunity and investment potential in expanding Internet access and increasing adoption, especially in the world's least developed countries.[6] Investment in connectivity promises to bring returns not only for the provider, but also for the wider community—several studies have demonstrated remarkably close positive links between digital infrastructure development and GDP growth, international competitiveness and social development (e.g. improvements in education, healthcare and public services). For example, the World Bank reported estimates of GDP growth attributed to broadband access as 1.38 percentage points for developing countries and 1.21 percentage points for developed countries, while an OECD study of 27 developed and 66 developing countries found a 1 percentage point increase in Internet use is correlated with a boost in exports of 4.3 percentage points.[7]

However, there are also large and varied risks associated with such investments that investors seek to minimise or mitigate at every step of a transaction. The value chain in communications networks (last mile connections, national backbone, international networks and content transmitted over the networks) involves a dynamic ecosystem of numerous operators, firms and individuals across several markets—each with their unique set of characteristics and incentives. Each actor is influenced by supply-side determinants such as investment conditions, market conditions and the institutional environment, which affect the impact of investments.

Investment deals have higher success rates when there is a significant convergence of industry viability (sector risk), company feasibility (execution risk), and transaction desirability (financing risk) within a given regulatory ecosystem (regulatory risk).[8]

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5 The Broadband Commission defines affordable connectivity as the availability of broadband access at a price of less than 2% of the monthly gross national income (GNI) per capita.

6 USAID: Research Report Barriers to Investing in Last-mile Connectivity, May 2020

7 CDC Insight: What is the impact of investing in connectivity?, August 2019

8 USAID: Research Report Barriers to Investing in Last-mile Connectivity, May 2020

Affordability

The low income of individuals in the offline population is a most often cited barrier to connectivity, exacerbated by high costs associated with providing access to the Internet for these populations, which—as we have seen above—live in rural, remote and hard-to-reach areas. The low income of large segments of the offline population is a reflection of other major macroeconomic factors in their regions such as need for economic development, high unemployment rate and lack of growth opportunities.

At the same time, as we note above, a lack of adjacent infrastructure, such as reliable electricity supply, increases the costs faced by network operators in extending coverage, while production costs for internet enabled smartphones, smart featurephones and other devices are unlikely to decline further in the near future. Device affordability is cited as one of the main barriers to connectivity, especially in developing countries. For example, estimates show that while a smartphone priced at $62 cost around 12% of the average monthly income in the Americas, a similarly prices device could represent up to 63% of the average monthly income across Africa.[9]

Furthermore, factors such as taxes[10], fees, customs duties and in some countries, unfavourable market structures, further contribute to the high cost of devices and connectivity.[11]

User awareness and capability

In order to go online, users first need to be aware of the Internet, know what benefits it can bring to them and understand how to use it. In recent years, studies find that lack of awareness of benefits, relevant content, content in local languages, and skills have surpassed affordability as the major barrier to connectivity.[12] [13] [14]

A recent GSMA survey reveals that nearly a quarter of adults across seven surveyed countries are not aware of mobile internet and its benefits. Awareness is lower in rural areas, partly due to unequal access to the network, but also to lower literacy levels and information campaigns not reaching the last mile.[15] Despite the growing utility of the Internet and the tools and technologies it enables, large segments of the offline population continue to note the lack of a compelling reason to go online, especially the lack of relevant content and services, in local languages and specific to local needs.

Furthermore, low literacy levels and lack of digital skills continue to be a critical barrier to connectivity, often coupled with under-resourced education systems, outdated curricula or lack of effective capacity building programs. The GSMA reports that more than 50% of mobile users who do not use mobile internet despite being aware of it cite literacy and digital skills as an important barrier, while around a third name it as the most important barrier to mobile internet use.[16]

Culture, norms and rights

In addition to lack of awareness, content or skills, the lack of social acceptance is also an often-cited cause for no or limited connectivity that disproportionately affects women, sexual and racial minorities and displaced populations. Cultural and normative barriers limit not only online activity (such as entertainment, communication, e-commerce or online banking), but limit access to basic services such as education and healthcare, lower the ease of doing business and limit internet freedom.

The World Bank reports that women and girls are limited by social norms in their ability to safely access ICTs to develop their digital skills in after-school or public access facilities, primarily because of persistent tendency to prioritise boys' education and use of ICT-related resources over girls and because of stereotypes which prevent

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9 Vodafone: A lifeline, not a luxury Accelerating 4G access in Sub-Saharan Africa

10 For example, Vodafone finds that taxes can represent up to 50% of the cost of a smartphone in some nations in Sub-Saharan Africa, see A lifeline, not a luxury Accelerating 4G access in Sub-Saharan Africa

11 McKinsey & Company: Offline and falling behind: Barriers to Internet adoption, September 2014

12 ITU Measuring digital development Facts and figures 2021

13 ITU Measuring digital development ICT Price Trends 2019

14 GSMA State of Mobile Internet Connectivity Report 2021

15 GSMA State of Mobile Internet Connectivity Report 2021 Countries surveyed: Algeria, Bangladesh, Guatemala, India, Kenya, Nigeria, Pakistan

16 idem

girls from selecting courses STEM fields. Women without digital skills tend to lack the confidence to use the Internet and may limit their use to so-called 'application islands' due to the inability to adapt and apply skills to new applications. Women also rely on friends and family who may have limited skills themselves to teach them how to use mobile applications and services and might discourage their exploration due to negative connotations and perceptions of the Internet. Social barriers impeding economic or physical mobility of women may also impede their ICT access. On the other hand, studies suggest that owning a device like a smartphone—as well as knowing how to use it—can increase women's social and community status.[17]

Furthermore, concerns over possible negative aspects of the Internet, such as harmful content, harassment, fraud, online security and privacy protection can pose further limits to people's willingness to connect.

Governance and regulation

As we have seen above, regulatory certainty and effectiveness is a crucial component of investment decisions, especially when it comes to investments in last-mile connectivity.

USAID identifies three major themes of how ineffective regulations or regulatory uncertainty inhibit investment in connectivity:

- Countries or regions where there is a tendency to control instead of relying on oversight and compliance drive investors away; regulatory frameworks that are transparent and consistent with rules fairly applied across all market participants attract investors

- Policies that do not enable shared access to adjacent infrastructure (such as street-level access, land, etc) raise costs for service providers

- Certain regulations might promote incumbent dominance and prevent competition, while others can foster competition, often expanding availability and affordability of Internet access for end users.[18]

Ineffective or outdated regulatory approaches and policies undermine the establishment of an enabling environment that incentivises investments in connectivity and finances research, development and innovation. As noted by the OECD and the G20 at its 2021 cycle, ensuring regulatory quality is essential to allow our societies to benefit from the potential of digital transformation to enhance prosperity and well-being while mitigating associated risks and potential adverse effects. In the current context of high uncertainty and rapid technological change, doing so requires a paradigm shift in regulatory policy and governance that enhances systemic resilience by enabling the development of agile, future-proof regulation.[19]

For the purposes of this paper, we group these barriers in three main categories as follows:

- **Financial barriers** refer to factors that impact public and private investment in connectivity, affect costs of developing, deploying or maintaining networks, or inhibit alternative business models to deliver connectivity.

- **Technology barriers** refer to factors that limit the development or deployment of new technologies or pose barriers to investment in innovation, research and development that would enable connectivity, especially in remote and hard-to-reach areas.

- **Regulatory barriers** refer to norms, policies, laws and regulations that limit the deployment of networks (especially through new and innovative technologies, methods), disincentivise investments, or inhibit the uptake and use of the Internet for certain segments of the population.

In Part 2, we combine this classification system (financial, technological, regulatory) with the layered ICT ecosystem model (access, applications, skills). This matrix allows us to drill deeper to the root cause of inequalities and discuss potential solutions from various policy angles. The paper thus presents a menu of policy options for decisionmakers to consider, combine and adapt to their specific needs.

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17 World Bank: _Engendering ICT Toolkit_
18 USAID: _Research Report Barriers to Investing in Last-mile Connectivity_, May 2020
19 OECD: _G20 survey on agile approaches to the regulatory governance of innovation. Report for the G20 Digital Economy Task Force_, 2021

PART 2: Addressing barriers to connectivity

2.1 Enabling innovative financial solutions and business models to deliver universal meaningful connectivity

In this section, we draw on case studies to highlight how innovative business models can help bridge digital divides in access, application, and digital skills in some of the most challenging rural and remote areas by addressing locally specific challenges in a holistic manner. While the examples described below are tailored to local socioeconomic particularities, they also provide generalisable insights that underpin the policy recommendations formulated at the end of the section.

CASE STUDY #1
Internet para Todos Peru

Internet para Todos Peru (IpT Peru) was launched in 2019 as a global initiative between an established network operator, Telefonica, an Internet based company, Facebook, and two regional development banks, IDB Invest and CAF.

The initiative brought mobile Internet service to remote areas of Peru with a collaborative and sustainable model that transforms the way in which telecommunication networks are developed in rural areas with high geographical complexity. The project featured an innovative investment and partnership structure and a distinct operational model that helped address underlying challenges.

By its second year of operation, IpT Peru had brought the benefits of the digital world to more than 6,000 locations across Peru, with the target to get to over 31,000 locations by the end of 2021. So far, IpT has over 1,600 3G and 4G base stations, with the challenge of deploying 4G overlay to more than 3,130 base stations by the end of 2021. IpT's goal is, by 2021, when celebrating the bicentenary of Peru, to have connected more than 6 million Peruvians to mobile internet.

Unserved and underserved populations are often characterised by relatively lower disposable income and relatively lower population density, resulting in lower revenue potential and thus higher incremental cost per customer, which often makes it challenging to prove a positive business case for the carriers or Internet Service Providers (ISPs) given the network capital and operational expenditure (CAPEX and OPEX) required. An additional economic obstacle to deploying networks in remote and rural areas is that they are difficult to access, bringing higher investment requirements and maintenance and operating costs than in more accessible urban areas. The combination of these two factors—low revenues and higher costs—leads to lower returns on investment and higher risk profiles that might dissuade private companies when operating alone.

CASE STUDY #2
ALO, MAKAIA, Microsoft and others

In 2017, an alliance of private companies, non-profits and government agencies came together to tackle the digital divide in the coffee grower communities in the Mesetas region of Colombia.

The region's jungled and mountainous terrain made it a perfect location for the application of a type of wireless technology called TV White Space (TVWS), which does not need line of sight and can be deployed much more economically in such areas than traditional telecommunication technologies.

This was the approach used by Anditel, a Colombian ISP with a focus on rural connectivity. The project was designed by the energy and agricultural supply chain innovator ALO & Partners and a Colombian non-profit organisation MAKAIA that provided digital skills training. Microsoft's Airband Initiative and the Italian coffee company Lavazza provided resources, Carcafe provided coffee expertise, and Colombia's national spectrum agency ANE was also an important partner.

Through the combined contributions of these stakeholders, the pilot project connected two schools and five farms to high-speed broadband via TVWS technology.

To solve such challenges, **providers need to find innovative approaches to connectivity infrastructure that address the inherent risks involved in building and sustaining costly network infrastructure while having an uncertain return on investment** (ROI) given little assurance of user uptake and ability to pay. For underserved areas, the high initial capital outlay cannot be justified by the low population density and low incremental revenue potentials, and the ongoing operational expenditures make it even less sustainable.

- To address these complex challenges, **IpT Peru** (Case Study #1) was started as a new company, a Rural Mobile Infrastructure Operator with a new business model that had a different risk investment profile and lower requirements of ROI. As a Rural Mobile Infrastructure Operator, IpT Peru deploys and runs an open wholesale-only mobile network providing an access service to other mobile service providers—Telefonica and Entel—who in turn provide the mobile service to end customers. IpT Peru ensures the network service quality to mobile providers, and mobile providers ensure the quality of service provided to end customers. This open model aggregates the dispersed end-user demand of the low population density rural areas of Peru in a unique network, thus resulting in more efficient investments with the goal of the long-term sustainability of the business model. Ultimately, IpT Peru leverages an open model that incorporates the use of shared access infrastructure (RAN Sharing), network virtualisation and automation of operational processes for cost reduction, thereby enabling the country's mobile operators, under a wholesale business model, to extend their mobile services to rural areas of the country, providing 4G mobile broadband to underserved communities across Peru.

An alternative approach that could be considered, particularly in areas where it has proved challenging to deploy traditional telecommunication technologies, is to look at possibilities to **leverage shared and unlicensed spectrum resources**.

- In Colombia, **Anditel** (Case Study #2) received strong support from Colombia's ICT Ministry and the national spectrum regulator, ANE, which put in place a regulatory framework to enable unlicensed, secondary access to vacant TV channels in the UHF band, known as TV White Spaces (TVWS). Using this TVWS technology, Anditel can offer a cost-effective last-mile connectivity solution that can provide long-range coverage in rural and remote areas, making it much more affordable to users, enabling the coffee-growing communities in that area to connect to new markets.

Access to financing for the deployment of networks in rural (and thus less profitable) areas remains a challenge. Seeking **new and innovative approaches to financing** can lead to network deployments in areas that would be hardly considered:

- **Partnerships** with a broader range of actors not only reduce risk exposure to less profitable and uncertain projects, but also provide access to a greater source of financing by adding new partners, making it possible to address new and greater network deployment projects. Such is the case of IpT Peru, with the participation of Telefonica and Facebook together with two development banks, IDB Invest and CAF.

- With the goal of deploying an open wholesale rural fibre network, Telefonica and Allianz have reached a similar agreement in Germany.[20] The joint company is investing €5,000 million over six years to pass over 2 million households with fibre to the home (FTTH) in rural and semirural areas of Germany.

- Similarly, to improve network coverage in Sub-Saharan Africa, Orange Middle East & Africa relies on technical solutions and innovative partnerships adapted to the particular requirements of such isolated environments: lighter mobile towers that are easier to install, solar-powered equipment that consume less energy and makes it easier to upgrade to 3G + / 4G. Through a partnership with AMN (Africa Mobile Networks) facilitated through loans from the European Investment Bank (EIB), more than 700 sites have been deployed in Cameroon and the Democratic Republic of the Congo reaching two million inhabitants, who previously had no connectivity.

- **Well-designed state subsidy programs** can also finance network expansion in rural areas. Subsidies should be made available on technology neutral terms in order to benefit from the innovative power of the market. For example, the Spanish government's UNICO-Banda Ancha[21] program[22] aims to expand next generation broadband networks in unconnected areas. With a technology-neutral approach, networks have to be capable of providing services at a minimum speed of 300 MBps and to be upgradable to 1GBps. Networks have to provide wholesale access to competitors at costs fixed by Spanish regulator for 7 years. The total program amounts to €250 million, with individual projects capped at €10 million and. Final awards were published in December 2021, with approved projects expected to cover a total of over 1,250,000 households across Spain with FTTH.

- **New approaches to financing broadband networks** have been the mandate of the United Nations Broadband Commission's "21st Century Financing and Funding Models for Sustainable Broadband Development" Working Group. The Commission endorsed the Chairman's Executive Summary[23] which set out the report's four strategic recommendations: (i) broadening the base of contributors that will support projects to increase both broadband deployment and adoption; (ii) earmarking proceeds from ICT sector participants; (iii) reforming Universal Service and Access Funds (USAFs); and (iv) creating an international fund.

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20 Press release: _Telefónica and Allianz create a partnership to deploy fibre in Germany through an open wholesale company_
21 UNICO-Banda Ancha = Universalización de Infraestructuras digitales para la Cohesión—Banda Ancha /Digital Infrastructure Universalization for the Cohesion—Broadband)
22 https://portalayudas.mineco.gob.es/InfraestructurasDigitales/Paginas/Index.aspx
23 UN Broadband Commission Working Group on 21st Century Financing Models for Sustainable Broadband Development: _21st Century Financing Models for Bridging Broadband Connectivity Gaps, Executive Summary_, September 2021

This divide in access to infrastructure is exacerbated by the divide in applications and content, often resulting in a vicious circle of perpetuating or even further widening inequalities. Indeed, connectivity recipients are often passive, if not unaware or reluctant, due to lack of relevant content or content in local languages, making it even harder for service providers to take the decision to invest. **Applications, services and content that are relevant, meaningful and understandable for the end user can drive investments in Internet infrastructure**.

- The **ALO, MAKAIA, Microsoft et al** example (Case Study #2) illustrates the importance of linking efforts to extend connectivity with locally-specific and meaningful applications. The underlying objective of the partnership was not only to connect populations that had remained at the margins of the network but, importantly, to leverage connectivity to drive entrepreneurship. Before this region was connected to the internet, coffee growers were all but cut off from the rest of the world — including their contacts at Lavazza where they sold their coffee beans. As a result, local farmers were not able to take advantage of opportunities to improve their crops, be more productive, and strengthen relationships with buyers. By including partners such as the Lavazza Foundation (which brought funding and assistance) and Carcafe (which provides coffee technicians), the project brought meaningful connectivity to local coffee growers, helping them produce more and better beans and reach new customers.

Furthermore, **digital skills and literacy are critical for making meaningful use of both Internet access and digital technologies beyond the functions of basic communications and entertainment**. UNESCO defines digital skills "as a range of abilities to use digital devices, communication applications, and networks to access and manage information. They enable people "to create and share digital content, communicate and collaborate, and solve problems for effective and creative self-fulfilment in life, learning, work, and social activities at large." Crucially, these projects in Colombia and Peru focused on digital skills and literacy to maximise the impact of the project.

- The project in Colombia included MAKAIA, a social organisation that focuses on digital transformation. It provided on-the-ground digital skills training and capacity building to these remote communities, building their competencies and skills to leverage the new tools and connectivity that was now available to them. While the project was initially designed to empower coffee growers, the enhanced connectivity and new applications, along with the digital literacy training greatly benefited the wider community, helping it to keep growing and thriving, despite the challenges of its remote location. Residents could search the internet and send messages to family, friends and potential buyers of their crops, and a telemedicine pilot enabled isolated residents to be treated by specialists in Medellin, a 14-hour drive away. The next phase of the project is introducing precision agriculture technology and data collection with smart devices to enable growers to fine-tune their production.

LEARNINGS AND STRATEGIES

- **Partnerships:** A conventional business model might suggest going alone. However, these examples showed how partnerships allowed for the leveraging of more funding and resources, and the sharing of risks, responsibilities and rewards.

- **A transformational approach that creates economic and social value:**
  A conventional business model tends to be transactional, with a simplistic access revenue model focused on value extraction and deeming the end-user largely passive and prone to churn. However, these innovative business models focused on value creation by investing in skills training and local applications that enabled people to get more from connectivity and improve their livelihoods. As a result, customers turned out to be much more proactive and participative and local communities and businesses were able to grow and flourish.

- **Holistic approach to policymaking:** Supporting and empowering business model innovations that create a virtuous circle of (1) affordable infrastructure and devices, (2) relevant local content and applications, and (3) skills training, will enable digital transformation and value creation, because these models create informed and incremental demand, resulting in greater investment and economic opportunities.

2.2 Leveraging innovative technologies to deliver universal meaningful connectivity

This section draws on further case studies to highlight how various technologies can be deployed to help bridge digital divides in access, applications, and digital skills in remote areas.

CASE STUDY #3

AirJaldi and Microsoft Airband: delivering connectivity to rural India

In much of rural India, internet connection is only partially available. One town might have fast and reliable connectivity while others nearby have patchy and unreliable access.

AirJaldi is an Internet Service Provider (ISP) focused on investing in scalable solutions to expand connectivity into rural India, currently offering Internet access to more than 1,500 villages across eight states.

AirJaldi began partnering with the Microsoft Airband Initiative in 2016, when it received a grant to expand its work bringing internet access underserved rural areas.

The ISP provides broadband via Wi-Fi, fibre and TV White Space (TVWS) as a last-mile solution. In addition to connectivity, the AirJaldi and Airband teams are cooperating on developing suitable

offerings to rural areas in areas of women empowerment, economic development, Internet of Things (IoT) for rural areas and introduction of technological solutions to rural internet operations.

Innovative technologies are key to addressing the high cost of deploying and running a network in low income and low population density remote areas.

Fixed wireless access (FWA), although not new, is one of the main technologies used to provide coverage in more remote areas because it enables low-latency, high-speed broadband in areas where fibre might be too expensive to roll out and maintain. It is also becoming one of the main technologies used by mobile operators to support 5G roll-out - the GSMA estimating that 55 of 157 commercial 5G networks operate FWA broadband services, while Ericsson's Mobility Report reported that 70% of operators offer FWA services, either via 5G or 4G networks.

FWA can be understood as a connection based on IMT/3GPP technologies that provides broadband access via a mobile network to customer premises equipment (CPE) which could be indoor (desktop and window) or outdoor (rooftop and wall mounted) but which does not include portable battery-based Wi-Fi routers or dongles. FWA connections are forecast to grow threefold and reach close to 180 million by the end of 2026, accounting for 20% of total mobile network data traffic globally.[24]

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24 Ericsson Mobility Report 2021

Chicos.net and The Walt Disney Company

Chicos.net is a non-profit organisation focused on improving the quality of life of children and adolescents through the promotion of responsible and meaningful use of ICTs, with a focus on a positive and safe experience for children and adolescents in cyberspace.

Through its partnership with the Walt Disney Company, Chicos.net established Disney TinkerLab, a program that combines storytelling and maker experiences to inspire children to tell their own stories through digital media. The project was launched in Mexico, Brazil, and Argentina and provided a curriculum to facilitate transmedia storytelling, utilising different platforms to stimulate the development of diverse skills and promote creative expression.

In May 2021, Chicos.net worked with a multi-sectoral alliance of public agencies, international organisations and NGOs across the region to launch and support Historias para Armar, an educational digital citizenship program uniquely developed for the COVID-19 context. Based on the design and learnings from TinkerLab, Historias para Armar offers an interactive digital platform that invites 8-11 year-old children to devise and create stories and provides them with the tools and educational support to see these stories realised through digital media. As a result, children become fluent in the languages of the connected world and they gain hands-on experience using technology in a way that is responsible and meaningful. Historias Para Armar has already exceeded 500,000 boys and girls impacted; over 18,000 teachers have received the trainings and resources for classroom implementation; and many more are utilising the platform and shareable resources.

FWA delivered over 4G or 5G is an increasingly cost-efficient broadband alternative in areas with limited availability of fixed services such as DSL, cable or fibre. Increasing capacity—allowed by greater spectrum allocations and technology advancements for 4G and 5G networks—is driving higher network efficiency in terms of cost per gigabyte. The technologies are anchored in global standards and come with the economic and social benefits of scale—from lowered cost of coverage for the marginalised in low-population density areas and cheaper devices to roaming and interoperability to long-term investment assurance for manufacturers, network operators and others in the ecosystem.

For example, MTN South Africa has worked with Ericsson since 1994 for the deployment of MTN's mobile system networks. MTN's FWA offering in South Africa with Ericsson was launched in 2019 to complement its fibre offering and is sold through MTN commercial channels and external ISPs. FWA is enabled nation-wide using Ericsson's core and charging systems.[25] MTN South Africa and Ericsson have also been recognised for their joint efforts to launch 5G in South Africa,[26] with a focus on developing 5G use cases and applications that will contribute to the digital transformation of industry verticals in the country.

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25 Ericsson: *5G Fixed Wireless Access unlocks a world of opportunity*

26 https://www.ericsson.com/en/press-releases/1/2020/mtn-south-africa-and-ericsson-win-building-a-better-more-inclusive-digital-world-award-at-africacom-2020

Orange: Deploying superfast networks in Africa

In Africa, the volume of internet traffic, accelerated by the COVID-19 crisis, has doubled in the space of two years and is expected to continue at a sustained rate of 20-50% per year.

Orange invests over €1bn annually in renewing and expanding national and regional networks, and in Africa's interconnection with the rest of the world. With the commissioning and commercial launch of the regional Djoliba network in November 2020, Orange has connected Western Africa's main cities between themselves and with the rest of the world via secure and seamless superfast fibre broadband, with the objective to improve service quality for end customers and complete existing national networks.

Intercontinental connectivity is mainly based on submarine cable systems, supplemented by satellite coverage for landlocked territories. Recently, Orange has partnered with SES to locate the first O3bmPOWER gateway at the Sonatel teleport in Gandoul (Senegal). O3bmPOWER is SES' next-generation medium Earth orbit (MEO) satellite network, to be launched

in 2022, aiming to enable Orange Middle East & Africa to deliver more bandwidth more flexibly to remote and underserved regions. Orange Middle East & Africa is also part of the new 2Africa cable consortium, set up by Facebook with six other operator investors.

This 37,000 km cable, which will eventually encircle Africa, is scheduled to be operational in 2023/2024, making it easier to deploy 4G, 5G, and fixed broadband access for hundreds of millions of people.
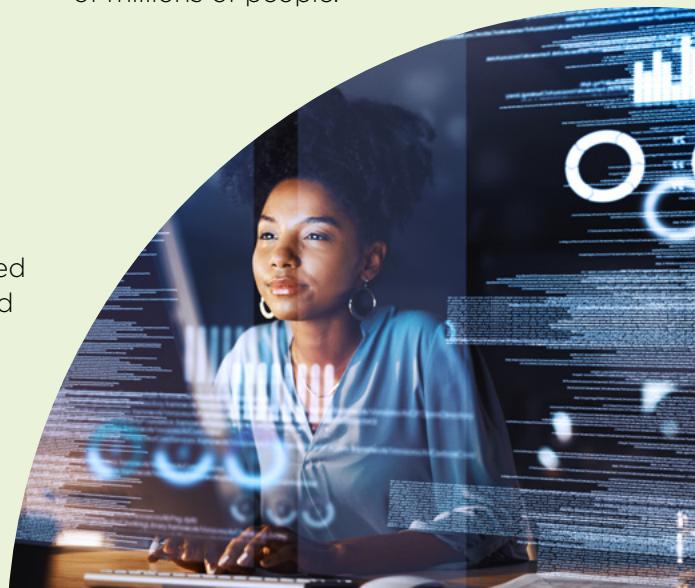
An **existing mobile radio network, normally designed for voice and mobile broadband, is an excellent base for offering an FWA service**. By taking advantage of existing network infrastructure and assets which serve 92% of the world population, broadband connectivity can be provided in an economical and practical way. With no need for new infrastructure, this solution is much less resource-intensive than building out new fibre networks. A key re-usable asset is spectrum that has been already acquired in auctions but is still generally undeployed in suburban and rural areas. The geographical fit for FWA is excellent, since FWA-targeted areas are often suburban and rural, where unused spectrum is most prevalent. Utilising undeployed bands and adding radios for them is a natural next step to cater for FWA, if utilising previously deployed bands is not sufficient to meet FWA ambitions. It is also possible for networks to handle a combination of voice, mobile broadband and FWA. These choices can be summarised as utilise the existing radio network assets, add radio network capabilities, and densify the radio network grid. A well-planned mix of these choices should be deployed to meet the particular needs of each local situation.

One of the approaches used within Microsoft's Airband initiative, as seen in Case Study #2 and #4 in Colombia and India respectively, is the utilisation of a fixed wireless access technology that uses a dynamic spectrum sharing approach known as **TV white spaces (TVWS).** TVWS are frequencies that have not been assigned or are otherwise not being used by broadcasters and other licensees in the VHF and UHF broadcast bands. Because TVWS are in lower band frequencies, signals can travel

over longer distances and penetrate many obstacles, making it useful in remote areas where the topography can prevent other FWA technologies that rely on clear lines of sight from the base station to the antenna. ISPs utilise different technologies and leverage different spectrum bands depending on the geographies and population densities of the areas being served. For example, millimetre wave technologies (e.g., on 60 GHz spectrum) are ideal for flexible urban deployments (extending fibre by perhaps up to 300 feet). Wi-Fi and microwave technologies (e.g., on 3.5 GHz and 5 GHz spectrum) can be used to reach consumers in higher density areas up to four miles from a tower. TVWS technologies on UHF spectrum are ideal for reaching consumers in lower density areas typically located up to seven miles from a tower. Microsoft's various projects around the world validated that FWA technology approaches, including TVWS technologies can be a helpful complement to other technologies when an ISP is looking to cost-effectively deliver broadband access in rural areas where alternative infrastructure that can deliver affordable broadband access does not already exist.[27]

In addition to providing innovative solutions to deploying networks, emerging technologies can assess the needs and specificities of localities where they will be deployed. When servicing remote areas, it is important to have a thorough overview of local socio-demographic, economic and geographic specificities to help determine what kind of technology should be chosen, as well as where and how it should be deployed. Technological advances can help with these considerations and with network planning to improve efficiency of deployment and bring down investment costs. In addition, network supervision, management and maintenance have to be as automated as possible.

- For the **IpT Peru project**, Telefonica employs Artificial Intelligence to bring down the cost: developing a high-resolution visual representation map placing where the unconnected live through a self-learning visualisation algorithm that combines data from high-definition satellite images, census and regulatory data, and data from existing Telefonica networks. Furthermore, a neural network trained with data of network failures allowed the design of an automated network supervision system with fault prediction capabilities and the design of optimised maintenance routes.

Innovative technology can also help in reducing the cost of equipment.

- To lower the price of equipment, **IpT Peru has adopted Open RAN technology**, used general purpose equipment based on open source software, and a fully virtualised and programmable network. This was for the development of open network equipment, enabled by Telefonica's involvement in the Telecom Infra Project (TIP)[28] together with the collaboration of Facebook, founder of the TIP initiative. Opting for standard mobile technology was another important choice for IpT Peru because it enabled the use of affordable mobile handsets which not only worked within the IpT Peru mobile rural network but also when leaving the rural network and entering the coverage area of traditional mobile network providers. At the same time, customers from outside the region will be able to connect and use the IpT Peru network seamlessly when entering its coverage area.

Greater connectivity creates new opportunities across communities and can help empower both the public and private sector as demonstrated by the examples below. Digital transformation is a tool for economic and social development in developing countries and **the public sector can be a key driver of this transformation as an early adopter of technology that spills over to inspire transformation for citizens and businesses**.

- In 2018, **Ericsson deployed a Virtual Reality (VR) training tool for its Connect to Learn[29] project in Myanmar**. Myanmar is one of the first countries in the world to implement VR as a professional development tool for teachers, with 31 secondary schools from across to the country integrating the VR technology into their day-to-day classroom teaching to access relevant content, even while they are away from the physical classroom. Cloud-based

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27 Microsoft Airband Program
28 https://telecominfraproject.com/
29 https://www.ericsson.com/en/about-us/sustainability-and-corporate-responsibility/digital-inclusion/access-to-education/improving-education-in-myanmar

servers also provide teachers with VR training tools and then record and store the teachers' performances to allow for monitoring and self-improvement.

- **Bangladesh has successfully leveraged connectivity to implement its Vision 2021 agenda**. One of the key elements was the 'Digital Bangladesh' approach of using ICTs as a tool for development and sustainability. Driven by widespread digitisation in the public and private sectors, the country has seen exponential growth in its internet connectivity, mobile phone usage, IT export earnings and use of ICT in education and accessibility of public services. By 2017, over 4500 digital centres had been set up across the country and more than 200,000 civil servants and thousands of Digital Centre Entrepreneurs were trained to implement e-services centrally, including registration of births and providing essential information to more than 2 million overseas job-seekers. Through this programme, around 1.3 million ICT professionals, along with, 10,000 ICT entrepreneurs have become self-reliant, helping the country build a robust ICT sector.[30]

Greater connectivity is also having a transformational effect for the private sector, particularly for SMEs in developing markets. Enhanced connectivity enables greater access to international markets and more potential new customers. The use of digital technologies can improve business operations and lead to efficiency gains that increase the overall competitiveness of the businesses. Connectivity reduces transaction costs by providing better and quicker access to information, as well as timely and effective communication between staff, suppliers and networks. It can also simplify international payments and provide wider access to finance.

- **Mastercard** has been building new technology platforms that help increase access to credit for small businesses. This is in line with the company's broader target to connect one billion people (including 50 million SMEs and 25 million women entrepreneurs) to the digital economy by 2025—to speed up digital inclusion and the digitalisation of businesses. As an example, the Mastercard Farmer Network digitises marketplaces, payments and transactions for about 450,000 farmers in Tanzania, Uganda and India. As consumers shift quickly to on-demand products and services, online shopping, and contactless payments, it is also imperative for SMEs to operate across both physical and digital spaces. As more ways to deliver products and services come to market, e.g. via connected devices and the Internet of Things, new ways to shop new ways to authenticate payments, including the use of biometrics, will emerge. Mastercard has several initiatives in place to help SMEs go digital, including training curriculums and cyber risk management tools. Its solutions also enable smartphones to double up as payment terminals, which brings more consumers and merchants into the digital commerce ecosystem.

Furthermore, **meaningful connectivity also enhances the resilience of countries and societies in the face of global crises**, such as the ongoing COVID-19 pandemic. Digital tools, applications and content available in local languages and relevant to local contexts help maintain essential services, such as education, in the face of unexpected shocks.

- The **Historias para Armar program** described in Case Study #4 represents this type of digital solution that is both locally relevant and globally responsive to the unexpected shock of the COVID-19 pandemic. When the threat of COVID kept kids and teachers out of the classroom, Historias para Armar offered kids a remote-learning-ready interactive digital platform with both a mobile app and materials available for download and use without an Internet connection. The program also features a tutorial section for families, so parents can help their children use the materials. While this approach was responsive to the remote-education constraints of COVID-19, the available tools are designed to be adaptable back to in-person classroom settings as well. Historias para Armar continues to inspire the next generation of storytellers and is helping to build socio-emotional and other 21st century skills much needed to breach the digital gap in education.

Meaningful connectivity can only be achieved if the newly connected have the skills to leverage new technologies and seize the opportunities that these tools help generate.

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30 Centre for Research and Information (CRI): *Bangladesh's Digital Revolution*

- In India, **AirJaldi** recognised the need for trained local professionals with I technical skills to support the deployment and operation of connectivity networks. The AirJaldi Academy[31] provides seminars and training programs focusing on rural connectivity, its benefits, and uses, and tailors its programs to address local issues, including gender issues. The Academy's training provides skills needed to seek employment with ISPs and also focuses on introducing girls to the use of computers, the internet, and the impact of technology on their lives. A sizable portion of AirJaldi's 175-strong workforce was hired after completing a month-long course, signing up for which simply requires "intellectual curiosity and technical curiosity". Some of the roughly 1,000 people trained by AirJaldi have gone on to find jobs with other firms. One success story is Asha Kumari, a B-Tech graduate and young mother, who manages a network for AirJaldi in her village in Jharkhand.

The promotion of **digital literacy and skills is also a way to create a renewed sense of opportunity and direction** in communities that have been plagued by conflict and violence.

- **Ericsson has partnered with the Whitaker Peace & Development Initiative (WPDI)** for almost 10 years to help youngsters affected by conflict and violence to foster safer and more productive communities in Africa and Latin America. As WPDI's technology partner, Ericsson provides ICT equipment and works together with mobile network operators to enable connectivity and internet access for the computer-equipped community learning centres that WPDI develops in remote areas. To date, community learning centres have been established across South Sudan, Uganda and Mexico, with more than 25,000 young people having directly benefited from the program. WPDI provides a unique approach to working with young people, including training in mediation and conflict transformation, and developing vocational skills in ICT. Young people also receive mentoring by Ericsson employee volunteers and funds from WPDI to help them kickstart entrepreneurial projects that benefit their local communities. Access to internet has provided the young beneficiaries of the program with a broader set of opportunities for employment and entrepreneurship as well as tools to contribute to the betterment of their communities.

Targeted projects to expand **digital skills help empower certain segments of the population that have long been at the margins of ICT-use**.

- **Laboratoria** is a Latin American non-profit organisation focused on training low-income young women as programmers and experts in web development, with the aim of promoting their employment in the digital sector. Founded in 2014, it currently operates in Brazil, Chile, Colombia, Mexico and Peru. Laboratoria identifies talented women who demonstrate high potential to learn and aspire to build a career in technology. The organisation also builds relationships with hiring companies and helps match them with graduates, which helps to close skills gaps in companies and build more diverse and inclusive teams. Students pay nothing during the program and, after getting a job, pay back a subsidised amount in monthly instalments so that other women can have the same opportunity. Thus far the organisation has had over 2000 graduates and has an 83% placement rate in over 800 hiring companies.

- The **Historias para Armar** project launched by Chicos.net addresses the digital gap while also targeting gender disparities in technology engagement. Storytelling activities have proven to serve as a positive means of entrance for girls' access and interest in the digital space, and Historias Para Armar prioritises and empowers the female characters that are a part of all the stories. The story-creation tool also includes elements that enable diverse character development across race and ability and beyond binary conceptions of gender.

- **IpT Peru's "Escuelita IpT"** (little school IpT) project serves as a digital platform that compiles and groups online courses to foster the development and education of the rural population, oriented to their need and improvement in their quality of life, and accompanied by follow-up and mentoring. IpT also promotes alliances that strengthen connectivity and support progress in the challenge of digitalisation. An example is the CR3CE alliance,

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31 [AirJaldi Academy](#)

promoted by IpT and CEDRO (Centre for Information and Education for the Prevention of Drug Abuse) with the technical advice of USAID (The United States Agency for International Development), which aims to promote digital inclusion in the Peruvian Amazon, expanding connectivity, generating useful content and strengthening the capacities of the population.

LEARNINGS AND STRATEGIES

Network technologies—old and new—that enable connectivity across the globe are essential in furthering sustainable development and inclusive growth, which makes it all the more important to provide stable Internet connections for those who are not yet connected.The following policy steps are crucial in efforts to enable and expand the uptake of such technologies:

- **Encouraging investment in broadband development through:**

  - open and competitive markets with fair, investment-friendly and comparable regulatory intervention for all actors active in the digital value chain;
  - strong reliance on voluntary commercial arrangements;
  - promoting technology neutral regulation to permit market actors to choose the best available technology;
  - policies that promote efficiency through engineering-driven design, such as the creation of Internet Exchange Points (IXP); and
  - policies that promote the growth of the products and services delivered over broadband.

- **Tackling spectrum allocation:** There are considerable economic benefits from ensuring that sufficient spectrum is available to support the increasing demands for connectivity demonstrated by current and forecast data traffic trends, whether being used for mobile broadband, satellite, fixed wireless or Wi-Fi access technologies. Availability of spectrum, for both shared licensed and unlicensed use, has a critical role in promoting the accessibility of the Internet. Research and development on new technologies that lower cost and increase bandwidth can also help. The different availability of spectrum in rural vs. urban areas due to the lower population density in rural areas demand a differentiated policy approach to spectrum. Two ways to enable more connectivity in rural and remote areas are putting in place non-discriminatory frameworks for providing access to low-cost licensed spectrum, preferentially at lower frequency bands which provide greater coverage, and providing greater access to unlicensed spectrum where it can support low-cost technologies in unserved or underserved areas. The allocation of spectrum among different options should be based on a holistic analysis, considering the long term effect of allocation decision, with a focus on efficiency and achieving the best outcome possible in terms of achieving meaningful connectivity. Effective and technologically neutral management of this increasingly scarce resource must be a priority for policy-makers while ensuring the integrity of services offered by incumbent spectrum license holders.

- **Supporting the development and deployment of innovative technologies, services and applications:** such technologies could help mitigate the cost of deploying connectivity in remote or underserved areas, while applications and services help drive the demand for connectivity.

- **Promoting the development of locally-relevant content, resources and tools:** Access isn't always enough, relevant content that is in-demand by users is also critical to broadband adoption and a sustainable ICT ecosystem. Investment that supports the local creative economy should be enabled and interventions that limit the development of locally relevant content should be avoided. A facilitative policy environment for content creation includes protections for the freedom of expression, the press, privacy and intellectual property.

2.3 Promoting innovative regulatory frameworks to deliver universal meaningful connectivity

This section builds on the cases presented above, adding a few further examples to present innovative regulatory approaches designed to help bridge digital divides in access, application, and digital skills in areas where additional or different incentives than traditional approaches were necessary.

As noted above, to achieve universal meaningful connectivity with affordable services and user equipment, **efficient spectrum management** is fundamental.

- For example, the African Telecommunications Union (ATU) and Ericsson published a series of recommendations for spectrum audit, licensing, evolution and management principles on national broadband spectrum plans in April 2021.[32]

It is also worth exploring ways in which **spectrum sharing** can help to make more efficient use of spectrum. Several regulators have put in place various dynamic and other spectrum sharing models that have helped expand access to mobile broadband whilst ensuring incumbent applications are protected.[33] Increasingly sophisticated technologies using databases of assignments and radio sensing technologies allow for the implementation of innovative new spectrum sharing models that can dynamically allocate spectrum between different tiers of users, while protecting incumbents.

- For example, in cases where an IMT band is being partially used by an incumbent, such as a public agency or the military, the band could be a candidate for tiered spectrum sharing of the kind employed in the 3.5GHz band in the United States[34]. This tiered spectrum sharing model (TSSM) uses a spectrum access system that prioritises access to IMT spectrum by user, with the public sector incumbents in tier 1, followed by a second tier of priority access licenses (which is being used by some U.S. operators to roll out 5G networks, and then a third general authorised access (GAA) which allows for the spectrum not in use by tier 1 and 2 users to be used in a license-exempt manner as long as the GAA user does not cause harmful interference to the tier 1 and 2 users.

Regulatory and policy approaches are a relevant lever to **address investment and cost challenges of deploying networks in lower income and sparsely populated areas**. In these areas, bundling all possible demand for connectivity into one infrastructure to make investments sustainable from a business point of view can lower barriers for businesses to tackle the access divide.

- The **IpT Peru** project was launched in Peru as the regulatory framework provided an innovative approach for the deployment of networks in rural areas—the model of a Rural Mobile Infrastructure Operator (RMIO—Law 30083). The RMIO provided an investor-friendly regulatory model for a rural operator by including the following conditions:

  - Operating cellular base stations in rural areas where MNOs lack mobile service coverage.
  - Not having mobile end-customers nor assigned spectrum for the provisioning of mobile services.
  - Being responsible for the quality of service of the network, while leaving mobile network operators to be responsible for customer service.
  - Mobile operators wanting to cover those rural areas must reach an agreement with this rural wholesale operator, creating effectively a single Rural Mobile Infrastructure Operator

  The regulation in Peru clearly separates responsibilities and obligations between a "mobile wholesale infrastructure operator for rural areas" and the mobile operators that use this rural network. Mobile operators need to provide spectrum to the RMIO and pay the RMIO for the wholesale services received. Further regulatory modification that could support the IpT Peru project include the payment and use of Universal Service Funds and a more flexible

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32 African Telecommunications Union (ATU) and Ericsson: *Recommendations on spectrum policy*
33 Dynamic Spectrum Alliance: *Enhancing Connectivity Through Spectrum Sharing*, 2019
34 US Federal Communications Commission: *3.5 GHz Band Overview*

approach for mobile network operators on their coverage obligations by considering IpT network coverage for compliance of such obligations.

Public-private partnerships also underpin a stable, clear, impartial, and forward-looking regulatory framework. For example, telecom operators are creating shared and mutualised solutions to make their unused infrastructure more profitable. The sharing of passive infrastructure (radio towers) or active infrastructure (equipment, frequencies), national roaming agreements (between mobile operators), and hosting agreements for Mobile Virtual Network Operators (MVNOs) are the most common among them.

- For example, **Orange**, in partnership with SOGEM has joined forces with Sonatel as its "wholesale" operator to operate and resell the excess capacity of its optical ground wire connecting Mauritania, Senegal, and Mali. In October 2020, Sirius Telecom launched its first MVNO "light" service in West Africa on the Sonatel network, while passive infrastructure sharing agreements have been implemented in Morocco, Tunisia, Senegal, and Egypt.

A key element for expanding connectivity is **using accurate and meaningful data to measure connectivity gaps.** This data informs decisions about where to target public funds aimed at plugging connectivity gaps, and potentially also to inform private investment decisions. Progress has been made by regulators in the last decade to develop and update broadband maps, but the prevailing wisdom has been to measure coverage. However, it would be more meaningful to measure actual Internet usage, which will be able to better reflect issues like affordability.

- For example, in 2021, the US National Telecommunications and Information Administration released a new *Indicators of Broadband Need* mapping tool[35] that combines public and private data and coverage and usage data, giving a more accurate picture of gaps in broadband usage than the FCC's previous data had been able to show.

In order to enable public bodies and interested stakeholders to target their solutions to have the most impact on closing the digital divide, it is therefore important that regulators measure access using not just availability/coverage data, but also using actual usage and /or subscription data.

Universal Service Funds (USFs) are one of the most often cited mechanisms to increase access to ICTs. To increase their effectiveness, **USFs should be flexible and agile enough that they can be adapted to the needs, circumstances and available technology approaches of different areas.** They should be technology-agnostic, open to whatever technical approaches to infrastructure and last-mile connectivity are relevant in each situation. This could include using Low Earth Orbit (LEO) satellites, fixed wireless systems, and shared spectrum technologies, in addition to fibre and mobile services, where practical. It could also include opening them up so that they can be used to finance local IXPs and community networks.

Beyond the funding available via USFs and other government programmes, access to financing is important for investment in connectivity projects. When thinking about connectivity as an enabler for achieving the Sustainable Development Goals, it is important to recognise that the cost of borrowing tends to be much higher in developing countries, and also that development finance institutions (DFIs) often have a high threshold for lending money, which can put loans out of reach of smaller businesses and organisations. It would be helpful for DFIs to become more tolerant of risk and find ways to mitigate risk, as well as be more open to working with stakeholders of different sizes.

Financing of USFs should be reconsidered not to hamper initiatives of agents already working on the closing of the connectivity gap. A wider approach of contributions of USFs should be considered taking into account all agents benefiting from the expansion of connectivity in line with the recommendations of the UN Broadband Commission Working Group on 21st Century Financing Models for Sustainable Broadband Development.[36]

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35 BroadbandUSA, National Telecommunications and Information Administration: *Data & Mapping*
36 UN Broadband Commission Working Group on 21st Century Financing Models for Sustainable Broadband Development: *21st Century Financing Models for Bridging Broadband Connectivity Gaps, Executive Summary*, September 2021

There is also an important role for **blended financing approaches**—partnerships that can include multilateral organisations, national or local governments, the private sector and local organisations, as appropriate.

Finally, **financing solutions for connectivity should think beyond the access component** in or to provide solutions that enable meaningful connectivity and help close the digital divide. This means reflecting on how connectivity financing projects can consider needs related to, for example, literacy, skills, affordability, and inclusion of marginalised groups.

To take advantage of the economic development opportunities of digital transformation, it is necessary to have a skilled workforce. While this will require investment from the private sector to train employees, there is also a role for the public sector, which should look at digital skills training both in schools and in skills and training programmes. Governments can also facilitate the transition to a digital economy and society and provide incentives for people to go online by showing the positive impacts of being connected and by making basic human services, such as education and healthcare, available online.

Governments can play an important role in the development of digital literacy and skills, through direct investments in capacity building programs and through the guidelines and standards that shape educational institutions and outcomes. Such efforts are most successful when supported by curriculums adaptable to meet evolving knowledge and skills demands, and mechanisms to support educators to capitalise on the new technologies and tools. Likewise, there are innovative models and programs for advancing digital skills that are being driven by educators, NGOs, and the private sector that governments can help promote.

- **Mapping the internet connectivity landscape for schools and their surrounding** communities is a critical underpinning activity of UNICEF and ITU's Giga initiative as it serves as a foundational information layer for the project that aims to connect every school to the Internet.[37] Before the Giga initiative can connect schools, it needs to understand where the connectivity gaps are. **Ericsson, the first Global UNICEF partner for School Connectivity Mapping**, provides expertise in connectivity and experience with mobile operator data derived from communications infrastructure. It also provides data science, AI and automation competencies to help collect, validate, analyse, visualise and monitor school connectivity data in real time. Giga will assess the data and convene governments and the private sector to design and deploy digital solutions that will ultimately enable learning for children and young people.

- As set out in Case Study #4, **Chicos.Net and The Walt Disney Company** collaborate on programs and educational resources that support and promote the proactive, positive and safe use of ICT. These programs have benefited from a multi-sectoral alliance of public agencies, international organisations and NGOs across Latin America to strengthen their impact with communities that otherwise would lack access to similar capacity building opportunities. In many countries, government partners have directly promoted the program and partnered as a facilitator to introduce the resources into the education system. These efforts helped advance adjacent government objectives of **supporting and deepening digital citizenship.**

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37 https://gigaconnect.org/

LEARNINGS AND STRATEGIES

Given the large variety of barriers to connectivity to be addressed, as well as the speed at which new services, players and business models appear, it is vital that regulatory regimes are flexible, forward-looking, adjust to rapidly evolving markets and encourage innovation and large-scale private sector investment.

Regulations should focus first and foremost on critical societal objectives they wish to address and introduce flexible and light-touch approaches for achieving those objectives. Regulators need to be cautious not to regulate prescriptively at too granular a level, which may limit the flexibility needed to consider or capitalise on innovative potential. Overly detailed regulation risks becoming outdated by technological evolution and advancements or inhibiting their potential benefits.

As the vast majority of investment in the digital economy will come from the private sector, all policy and regulatory approaches should apply an economic-based lens that examines whether rules will create opportunities for investment and competition among all players of the digital ecosystem. In the same vein, regulatory and policy approaches should be flexible and adaptable to support various innovative financing, business, and capacity building models.

It is also critical that policymakers and regulators adopt a policy mindset that appreciates the value and understands the nature and particularities of the entire digital ecosystems—from infrastructure, through applications to skills—and the various actors operating within. This will foster a positive environment for the investment in the development and proliferation of capable and compelling digital networks, content, applications, and services.

In order to ensure that everyone, everywhere can reap the benefits of meaningful connectivity, regulatory and policy approaches must ensure low barriers to entry, low cost of delivery, and vibrant competition among application and service providers. Such a policy environment can help support new business models as well as the investment necessary for connectivity, innovation and entrepreneurial opportunities throughout the digital ecosystem.

PART 3: Recommendations

Based on the case studies and examples presented and the learnings and strategies derived from the private sector's experience in implementing these projects, we offer two basic principles for policymaking and highlight three priority areas for improvement.

We ground these recommendations in the basic principle that policy and regulatory mechanism should promotes the value of the entire communications and digital services ecosystem. Furthermore, policies should be non-discriminatory, technology-neutral, and supportive of innovative business models and the development and deployment of a wide range of technologies, standards, and system architectures. We identify the following three areas for priority action:

1 FACILITATE INVESTMENT ACROSS THE ENTIRE DIGITAL VALUE CHAIN

- Policies should foster investment, competition, and innovation in the development and deployment of broadband services and connectivity devices, with the aim of expanding affordable access and end user choice for broadband connectivity.

- Policies should facilitate investment in and enable the development of content that helps drive and sustain adoption, including through expanded e-government services.

- Governments should also invest directly in digital literacy and skills development, while playing a facilitative and supportive role for multi-sectoral initiatives that meet these objectives.

2 EFFECTIVELY MANAGE SPECTRUM

- Allocation and licensing of spectrum should be transparent, fair, economically efficient, technology-neutral, and aimed at ensuring that sufficient broadband-capable spectrum is made available. Unlicensed, shared, and secondary uses of spectrum should be facilitated, and operators should be incentivised to use spectrum efficiently.

- When targeting remote and rural areas, policies should aim reducing cost of deploying broadband access through easing licensing and permit processes, providing access to sufficient spectrum, including licensed spectrum at reasonable cost and unlicensed spectrum to support alternative technology approaches.

- Two ways to enable more connectivity in rural and remote areas are putting in place non-discriminatory frameworks for providing access to low-cost licensed spectrum, preferentially at lower frequency bands which provide greater coverage and providing greater access to unlicensed spectrum where it can support low-cost technologies in unserved or underserved areas.

3 GROUND POLICIES IN EVIDENCE AND DATA

- Policymaking and regulation should be evidence-based, transparent, inclusive of all interested stakeholders, and aimed at improving the ease and predictability of doing business.

- When targeting remote and rural areas, policymakers should strongly consider the increased complexity of delivering connectivity, and provide specific, adapted, flexible and non-discriminatory policy solutions in these areas.

- Private investments and public funding mechanisms alike should be informed by accurate information and reliable data, including coverage and usage data, but also satellite images, census data and other relevant information that combined can provide detailed understanding ahead of decisions taken on where and how to deploy networks.

ANNEX I: A snapshot on global connectivity

Despite significant improvements in Internet coverage and usage over the past years, a significant portion of the population remains uncovered or unconnected. They are more likely to be from developing countries and/or rural areas, poorer, female, older and less educated.

Percentage of individuals using the Internet, 2021*
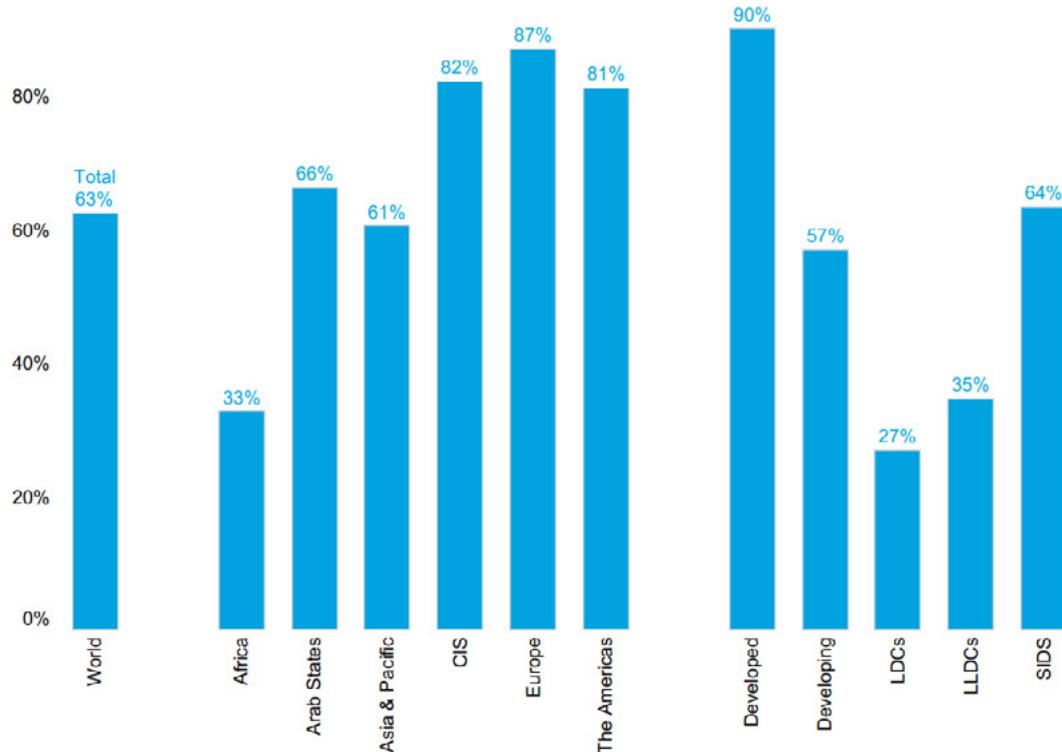
Figure 1: Percentage of individuals using the Internet in 2021 | Source: ITU

Nearly the entirety (96%) of the 2.9 billion unconnected people live in developing countries, and on average, people in urban areas are twice more likely to use the Internet than those in rural areas. This gap is not uniformly distributed across the globe. While in developing countries the connectivity rate in urban areas is merely four percentage points higher than in rural areas (89% versus 85%), in least developed countries (LDCs) people in urban areas are almost four times more likely to use the Internet than their fellow citizens in rural areas (47% versus 13%).[38]

Furthermore, affordability continues to pose challenges for connectivity, especially for the population with lower income levels. The UN Broadband Commission for Sustainable Development defines affordable connectivity as the availability of broadband access at a price of less than 2% of the monthly gross national income (GNI) per capita. In recent years broadband costs have experienced a steady decline, to the point where today the global average price of fixed broadband connectivity is at 2.8% of GNI per capita, while mobile broadband data costs are at 1.2%.

However, taken separately, roughly half of the world's economies fall short of the Broadband Commission target, both for mobile (43%) and fixed (56%) broadband connections, with LDCs standing furthest from the average.[39] For example, while major improvements were made to mobile data affordability in low- and middle-income countries (especially looking at 5GB data bundles), significant gaps remain, most strikingly in Sub-Saharan Africa.[40]

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38 ITU Measuring digital development Facts and figures 2021
39 ITU Measuring digital development Facts and figures 2021
40 GSMA State of Mobile Internet Connectivity Report 2021

Affordability of 1 GB and 5 GB in LMICs, 2018 versus 2020
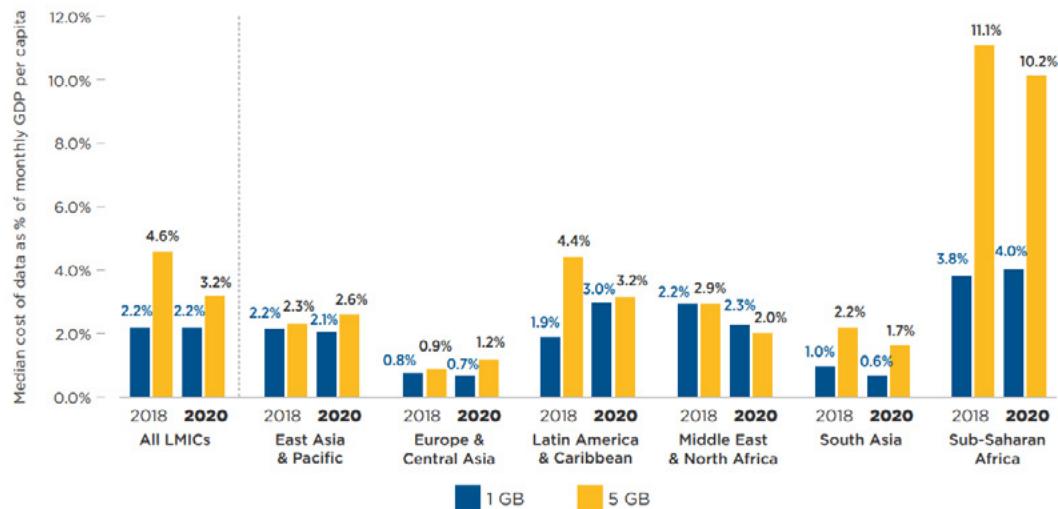
Source: GSMA Intelligence calculations based on pricing data from Tarifica

Figure 2: Cost of 1GB and 5GB data as % of monthly GDP/capita in LMICs 2018-2020 | Source: GSMA

The gender gap in access has also been significantly reduced in recent years across all regions. In 2020 on a global average 62% of men were using the Internet, compared with 57 per cent of women. Parity in access (the female percentage divided by the male percentage standing between 0.98 and 1.02) was achieved in all developing countries and across the Americas, with near parity in the Commonwealth of Independent States (CIS) region, the small island developing states (SIDS) and Europe. Highest divides can be observed in the Arab States (68% of men versus 56% of women) and Africa (35% of men versus 24% of women).[41]

Women's access to mobile internet is also continually improving, with reports showing significant increase across low- and middle-income countries. Women are also reported more likely than men to access the internet exclusively on a mobile handset. This being said, women in LMICs are still 15% less likely to use mobile internet than men.[42]

Furthermore, the digital age gap continues to persist. Globally, people over 24 years old are 1.24 times more likely to use the Internet than those who are older, with this ratio reaching 1.53 in LDCs.[43] In addition those reporting low levels of literacy are also more likely to be unconnected.

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41 ITU Measuring digital development Facts and figures 2021
42 GSMA State of Mobile Internet Connectivity Report 2021
43 ITU Measuring digital development Facts and figures 2021

ANNEX II: Relevant existing ICC work and positions

- ICC Policy Statement on ICT, Policy and Sustainable Development (2017)
- Regulatory Modernization in the Digital Economy: Developing and Enabling Policy Environment for Innovation, Competition and Growth (2016)
- ICC Discussion Paper on ICTs and Environmental Sustainability (2010)