The State of Broadband:
People-Centred Approaches for Universal Broadband

September 2021

BROADBAND COMMISSION
FOR SUSTAINABLE DEVELOPMENT

The State of Broadband 2021: People-Centred Approaches for Universal Broadband

ITU/UNESCO Broadband Commission for Sustainable Development

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Executive Summary

2021 sees the world continuing to address the intensive, extensive shocks inflicted by the global coronavirus (COVID-19) pandemic. While vaccine distribution and inoculation has brought some hope and relief, vagaries in vaccine availability, resurgence of cases, and the emergence of challenging variants continue to prolong the crisis.

For much of the world, return to pre-pandemic normalcy has yet to materialize. Various measures to support governments and society to function as normal have been explored, and many have turned to Internet connectivity to make these measures effective. As the world plans a transition out of the pandemic, Internet connectivity continues to play a pivotal role for countries, communities and individuals. Remote work remains the norm where possible. Distance learning, or hybrid structures, remain in place in hardest hit countries. And Internet-enabled telehealth services continue to gain regulatory approval and general adoption.

The prominence and importance of Internet infrastructure and connectivity have been further underlined in public life, along with increasing recognition of the need for relevant and timely information, literacy skills and reliable, factual content.

In terms of connectivity infrastructure, governments at national and sub-national levels exhibit renewed and urgent interest in addressing disparities of access, adoption and affordability. Network operators and service providers are investing heavily not only to expand networks but also to increase capacity and respond to the acceleration in broadband demand. And regulators, not just in telecommunications but in other sectors, increasingly recognize the importance of digital technology across all facets of economic activity.

The massive spike in the use and importance of Internet connectivity, triggered by the COVID-19 crisis, stands in sharp contrast to the slowing growth in Internet users globally, and the persistent, pernicious digital divide. While Internet connectivity has proved to be a crucial tool in responding to the impact of the COVID-19 pandemic and in coping with massive economic, social shocks, countries that were most vulnerable (because of more limited resource bases) are also those with the poorest Internet adoption levels. In 2019, the year before the start of the crisis, close to 87 per cent of individuals in developed countries were online using the Internet, while in stark contrast only 19 per cent of individuals in the least developed countries (LDCs) were online.[1]

Progress is being made in closing gaps and expanding the impact of broadband for all people on the planet.

While some form of network coverage reaches nearly every single human on the planet either via terrestrial or satellite networks, further effort is needed to densify network infrastructure and close the usage gap by increasing capacity and improving affordability.

To respond to massive demand for broadband connectivity in 2020 and the shift to online activity as a result of the COVID-19 crisis, extraordinary measures have been taken by governments, ministries, regulators, service providers, and many other participants in the global connectivity ecosystem. Many of these measures are presented in Chapter 2, together with a discussion of the role that connectivity has facilitated in helping the world move to distance learning, teleworking and telemedicine.

The successful expansion of Internet connectivity over the past three decades – led by the private sector and guided by policy and regulatory frameworks that encourage commercial developments – needs to continue and be accelerated. However, of the 3.7 billion people who remain unconnected, 85 per cent are covered by a mobile broadband network.[2] Now more than ever, a focus on individuals and inclusivity embodied in people-centred approaches can help ensure no one is left offline.

The Global Education Coalition, convened by UNESCO with more than 175 broadband and other partners, identifies connectivity as a flagship issue, but also recognizes that the digital divide is more than purely a technological issue.[3] The digital divide is associated with a wide range of factors related to education, age, gender, income status, skills, and residence. The 'human element of connectivity' describes the digital skills readiness and the type of solutions, tools, education resources and content needed to empower learners, teachers, and entire surrounding communities. To ensure connectivity that closes all digital divides, each of these elements must be addressed and advocated for in national regulation, connectivity investment and policies.

Over 30 international organizations and private sector corporations active in Internet connectivity efforts[4] support a people-centred approach which puts people at the centre in encouraging and expanding Internet adoption. It recognizes the heterogeneity of individuals and communities (across gender, age, race and abilities and other marginalized groups such as the forcibly displaced) and underlines affordability, useful service levels and quality content. The approach emphasizes digital skills and the digital literacy required to participate fully in the digital economy, while acknowledging the importance of trust and civility in online engagement. The approach carefully directs technologies and financing aligned with user needs and requirements.

Chapter 3 tracks progress across the seven dimensions of the 2025 Advocacy Targets of the Broadband Commission. The crisis has served to underline the need for accelerating efforts to achieve universal broadband connectivity, both for the benefits this can bring and to ensure greater resilience to future shocks.

Despite progress on Internet access and adoption, more effort is needed to ensure success and concrete movement towards the global 2030 targets. Additional investment and inclusive, open partnerships can advance progress towards universal broadband – which in turn will accelerate economic growth, help alleviate poverty, impact social development, and address climate change. The impact of connectivity on all other Sustainable Development Goals (SDGs) has led to some calling it, 'SDG Zero'.[5] Policy and regulatory actions will not only encourage and incentivize greater investment and Internet adoption, but will also address inequitable access sparked by market failures (such as monopolistic market concentration, rent-seeking, regulatory capture, barriers to entry, deadweight losses, leakage and public resource waste).

Putting individuals at the centre as we build digital infrastructure and progress towards the 2030 Agenda for Sustainable Development requires concerted effort. This will involve moving beyond mindsets focused on technological fixes, and focusing on those user issues that limit adoption – socio-demographics, skills, affordability, relevance, content and trust.[6] Efforts are required to direct funding to address the challenges of the unconnected. This includes enabling innovation in business models, technologies, policy and regulation, financing, and partnerships. While the year marker set for achieving the second part of SDG9c has come and gone – "Significantly increase access to ICT and strive to provide universal and affordable access to Internet in LDCs by 2020" – the opportunity remains for the global community to leverage broadband and

adoption of high-speed digital infrastructure, and achieve significant progress towards the Commission's 2025 targets and the 2030 Agenda for Sustainable Development. As new waves of innovation in digital infrastructure go mainstream (for example, 5G, IoT connectivity and LEO satellite broadband) concerted efforts must be made to ensure these developments particularly benefit low- and middle-income countries (LMICs) as well as developed countries.

Endnotes

1 UN. "Report of the Secretary-General: Roadmap for Digital Cooperation". 2020. https://www.un.org/en/content/digital-cooperation-roadmap/assets/pdf/Roadmap_for_Digital_Cooperation_EN.pdf

2 ITU, 2020 Facts and Figures Measuring Digital Development, https://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx and GSMA. 2020. "The State of Mobile Internet Connectivity Report 2020": https://www.gsma.com/r/somic/ . Statistic references total population who are not mobile Internet users. ITU data measures total population who are not Internet users. Many countries are adopting hybrid learning as well. For example, Bangladesh tested such arrangements forced by COVID-19, but will continue to keep such arrangements beyond, to have online /offline education. https://www.itu.int/en/myitu/News/2020/12/11/08/36/Universal-connectivity-urgency-billions-offline-Doreen-Bogdan-Martin

3 UNESCO. Global Education Coalition. https://en.unesco.org/covid19/educationresponse/globalcoalition; See also: https://globaleducationcoalition.unesco.org/members

4 High-level digital debate of the General Assembly on Connectivity and Digital Cooperation signatories of the open letter on "Leave No One Behind: A People-Centered Approach to Achieve Meaningful Connectivity". 2021. https://a4ai.org/leave-no-one-behind-a-people-centered-approach-to-achieve-meaningful-connectivity/

5 Jimnea Leiva Roesch. 2021. International Peace Institute. "SDG Zero? A People-Centered Approach to Universal Connectivity". https://www.ipinst.org/wp-content/uploads/2021/04/SDG-Zero.pdf

6 See for instance, as one example of this approach, the Principles for Digital Development. https://digitalprinciples.org/

1 The current state of play: major trends and drivers of change

In 2021, the world still reels from the biggest economic shock witnessed in living memory brought about by the COVID-19 pandemic. Data from the International Monetary Fund's (IMF) biannual World Economic Outlook (WEO) in April 2021 estimates that the drop in global economic production in 2020, at -3.3 per cent in gross domestic product (GDP) in real terms, is the worst on record, and is a result of a massive decline in other indicators of economic data (losses in trade, transportation, energy consumption, among others).[1]

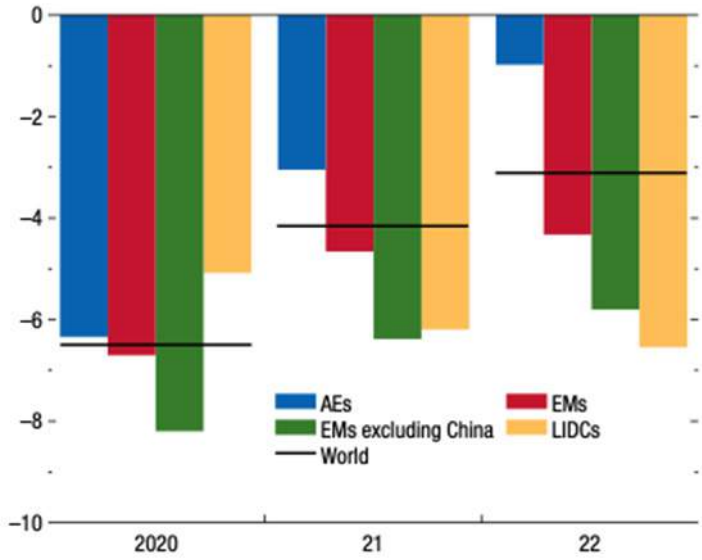
Significant mobilization of national and global resources (financial, technical and economic) in response to the COVID-19 virus in 2020 has led to some positive developments in 2021 in worldwide efforts to beat back infection levels, mortality and overall impact, and attempts to return to the pre-COVID-19 order. However, while some countries have been more successful in implementing countermeasures to the domestic spread of community contagion (such as with rigorous testing and contact-tracing coupled with strict entry and exit requirements) and accelerated vaccination of their population, other countries continue to experience the worst impacts of the virus only in 2021, including resurgence infections and mortality due to mutated strains of COVID-19.

Economic forecasts from the IMF across country groups comparing 2020 through 2022 highlight how emerging countries and low-income developing countries, who are some of the most vulnerable economically and socially, have not only suffered greater losses to GDP per capita growth in 2020 compared to advanced economies, but that those negative impacts will continue to be significant drags to their growth forecasts through 2021 and 2022.[2] Advanced

economies by comparison are expected to recover much more robustly (see Figure 1). It is also important to note that country wealth is not a predictor of initial success against the onslaught of the pandemic. A number of high-income countries did not manage nor implement public health measures in a manner that successfully limited infection and mortality, as compared to several low- and middle-income countries.[3]

Figure 1 Hardest-hit groups (IMF WEO April 2021)

Revisions to cumulative per capita GDP growth from 2019 between January 2020 and April 2021 WEO forecasts, percentage points



Source: IMF WEO April 2021; IMF staff estimates.
Note: Per capita real GDP (2017 purchasing-power-parity dollars) is used in the calculations. AEs = advanced economies; EMs = emerging market economies; LIDCs = low-income developing countries; WEO = IMF's World Economic Outlook.

As the planet continues to grapple with the response to the COVID-19 pandemic, full recovery at a global scale is still not in sight, nor is it guaranteed. Variations and mutations continue to emerge, leading to hotspots and 'breakthrough' infections of those already vaccinated. The emergence of this once-in-a-century global pandemic highlights how we continue to be susceptible to massive external shocks and 'black swan' events.[4] What is clear is that the role of digital technologies and digital infrastructure is as important as ever in building resilience and response capabilities as discussed below and in Chapter 2 (Broadband lessons from the pandemic). And while the future is yet to be written, we can identify major trends related to broadband and digital infrastructure that the pandemic has either highlighted or heightened, particularly in the case of major drivers of change.

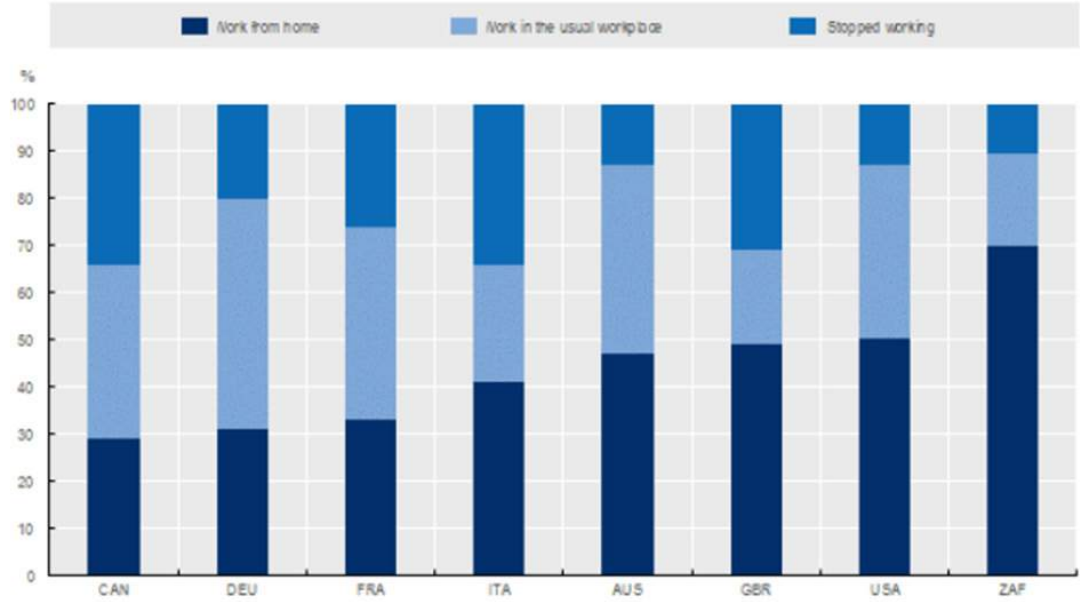
1.1 The centrality of connectivity has been crystalized in public life

The shutdowns around the world in 2020, with some continuing in 2021, highlighted the need for robust communications infrastructure, particularly broadband, to continue economic and social activities. The International Labour Organization (ILO) estimates that in 2020 the world lost 8.8 per cent of global working hours (compared to previous years), with an equivalence of 255 million full-time jobs (based on a 48-hour work week).[5] This figure represents nearly four times the losses incurred during the global financial crisis of 2008.

The ability for workers to continue employment during the pandemic differed significantly on the basis of the nature of the employment (for example between informal in-person, manufacturing, services or knowledge activities, among others) and the robustness of the communications infrastructure workers have access to. In the United States, nearly half of the US labour force moved to working remotely from home during the peak of the crisis, up from 15 per cent previously.[6] Across a range of countries, the share of previously employed individuals who were able to continue working remotely from home or had to stop working completely differed widely (see Figure 2). And more generally, 83 per cent of smartphone users claim that ICT helped them a great deal in coping during COVID-19 imposed lockdowns.[7] In many countries, constraints to basic access to Internet or ownership of computers exert a gating constraint to remote work opportunities in times of crisis.

Figure 2 The shift to working from home during the pandemic (ILO, 2020)

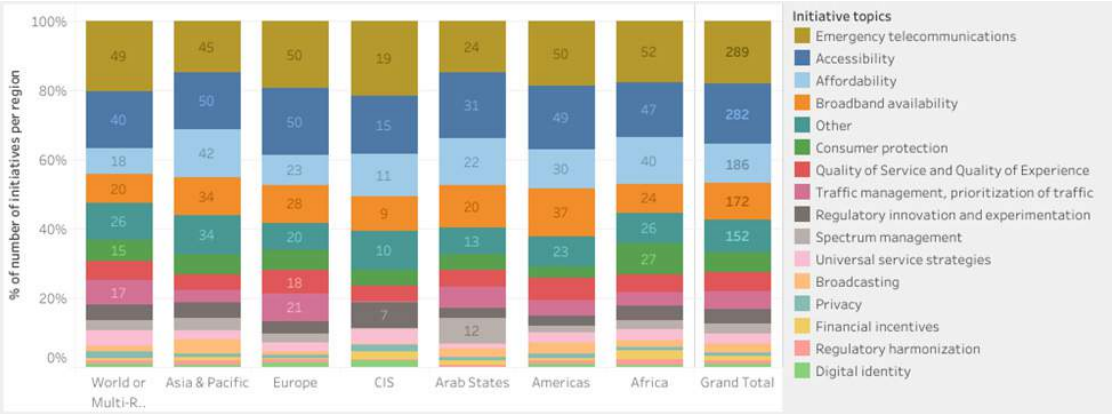
Share of total workers usually employed before the onset of the crisis by current place of work, April 2020 (%)



Source: ILO. 2020. "The impact of the COVID-19 pandemic on jobs and incomes in G20 countries". https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_756331.pdf
For South Africa, Statistics South Africa (2020), Results from Wave 2 survey on the impact of the COVID-19 pandemic on employment and income in South Africa, May. http://www.statssa.gov.za/?page_id=1854&PPN=Report-00-80-03&SCH=72638 ; For other countries, Foucault, M. and V. Galasso (2020), "Working after COVID-19: Cross-Country Evidence from Real-Time Survey Data", SciencesPo CEVIPOF, Note 9, May 2020. https://www.sciencespo.fr/cevipof/attitudesoncovid19/wp-content/uploads/2020/05/ Note9_FOUCAULT_GALASSO_ENG.pdf

While much economic, learning and even healthcare activity was able to shift online, the pandemic highlighted the importance of effective and robust digital infrastructure. This realization has led to significant immediate and long-term policy responses by governments, and investments by commercial and other entities. Chapter 2 provides much detail on the range of policy responses, including some of the 480+ ICT policy actions tracked in the REG4COVID ITU tracker alone, across various dimensions including emergency telecommunications, accessibility, affordability, broadband availability, etc.[8] (see Figure 3).

Figure 3: ICT Policy Responses to COVID-19, worldwide and by region (ITU REG4COVID)



Source: ITU. 2021. REG4COVID database. https://reg4covid.itu.int/dashboard-emergency-responses/

While many of these measures were temporary, the impact of COVID-19 on the nature of remote-based engagements (be it economic activity, learning, medical, or entertainment-focused, among other activities) may become much more permanent as more individuals transition more of their activities online and new users join the digital economy. Historically, the adoption and utilization of the Internet by new users, as well as existing users who upgrade to higher speed connections, demonstrate a virtuous circle of ever-increasing extensive and intensive data use (more users, and more data per user). Since 2000, Internet users have increased ten-fold from around 400 million users to more than 4 billion users today.[9] More intensive data uses are leading to different behaviours and eventually life outcomes. For example, Ericsson's recent ConsumerLab report, the largest consumer report of its kind, shows that 5G users spend two hours more per week on cloud gaming, one hour more on AR apps and one hour more consuming live broadcasts compared to 4G LTE users.[10] Globally, total data consumption has increased 283-fold from 0.2 exabytes per month in 2011, to 166 exabytes in 2021.[11]

In fact, some leading economists posit that the impetus caused by the pandemic to completely adopt digital technologies at individual and societal levels may in fact lead to economy-wide productivity booms. This is because mass intensive adoption of the Internet, as one of the few general-purpose technologies (GPT), is required for GPTs to systematically disrupt and innovate existing in-person and analogue processes.[12] For example, companies and organizations are learning how to use digital tools and connectivity to maintain or increase production levels using fewer resources (cutting commutes, office locations, and the associated goods and services required) as employees work from home.[13] With broader adoption of digital technologies, and more intensive utilization, existing resource uses and processes can be re-imagined, for example more intensive remote-work, location arbitrage (nationally and internationally), task outsourcing, improved outsourcing management, more efficient time management and distance services (education, health) among others.[14]

In response to the limitations of existing digital infrastructure and temporary measures, many governments are already planning or implementing large-scale plans to dramatically improve their countries' broadband infrastructure. For example, the United States is considering a USD

100 billion public investment in high-speed broadband investments as part of an overall USD 2 trillion infrastructure package, in excess of emergency broadband assistance authorized for temporary assistance.[15] Other countries too are considering or implementing large investments in broadband infrastructure as presented below.[16]

The importance of Internet connectivity at schools has also gained much attention. A recent report by the Economist Intelligence Unit, Ericsson and UNICEF estimates a 10 per cent increase in school connectivity can increase the effective years of schooling for children by 0.6 per cent, and GDP per capita by 1.1 per cent.[17] And in the United States, improving the bandwidth per student across states could increase national GDP by between 0.4 per cent and 5.5 per cent.[18]

1.2 A lingering digital divide remains, exacerbated by the pandemic

While overall and individual data consumption increased during the pandemic, it remains to be seen what the net effect on total users will be; while the crisis has brought many new users online, others have had to limit or stop their access because of the economic impact to income and affordability that most affects populations that use the Internet the least. As the world shifted to online engagement in the second quarter of 2020, Internet traffic growth significantly outpaced pre-COVID-19 era forecasts: average traffic in 2020 grew by 48 per cent while global peak traffic grew by 47 per cent, compared to forecasts of average annual growth between 2016 and 2020 of 30 per cent.[19] Globally, last year consumers' use of fixed broadband increased by an average of two and a half hours per day, and on mobile by one hour.[20] Similarly, 60 per cent of white-collar workers increased their use of video calls. In the US and Europe in particular, traffic on broadband networks increased 51 per cent because of the COVID-19 pandemic, and average per-subscriber (or household) usage increased from 344 GB per subscriber in Q4 of 2019 to 482.6 GB per month in Q4 of 2020, an increase of 40 per cent.[21]

In developed markets, high-speed broadband subscriptions may have increased significantly. In the United States for example, total broadband subscriptions increased by over 4.5 million subscribers in 2020.[22] In some countries, such as Spain, the share of fibre-to-the-home (FTTH) subscriptions has surpassed that of legacy broadband technologies subscriptions.[23] At the same time, a growing trend appears to be the transition of subscribers away from pay-TV subscribers. In the US major pay-TV providers lost over 5.1 million subscribers in 2020, and in Ireland, the Commission for Communication Regulation (ComReg) notes that nearly 80 per cent of Irish people either watch less traditional TV or have stopped watching it altogether.[24]

In developing economies, however, the absence of broadband remains a key issue in many countries where investment in broadband infrastructure remains uneconomic under current financing models. In addition, where broadband coverage exists, both broadband pricing and the cost of 4G devices before the onslaught of COVID-19 were already at prohibitive levels for significant segments of lower income populations. Even when average prices for data connectivity, such as 1 GB of mobile data, at national levels may reach below the 2 per cent of monthly GDP per capita as set by the Broadband Commission, the lowest income groups in a country can still be priced out of affordable service as demonstrated in the 2019 GSMA State of Mobile Connectivity Report. It showed that the lowest income quintile groups in Sub-Saharan Africa still face average prices of over 39 per cent of monthly GDP per capita, over 10 per cent for the same group in Latin America and the Caribbean, and similarly high levels in East Asia and the Pacific as well as the Middle East and North America.[25] Even minute changes, or shocks, in household incomes or data prices particularly affect those who are 'marginally online'; people

who can technically afford a minimum level of service, but whose ability to get online may be very susceptible to changing conditions and/or who may not be able to afford the increased usage required to conduct work or learning activities online, for example.[26]

Past research has already highlighted how lower income subscribers deploy cost-saving strategies using 'metered mindsets', such as using airplane mode much of the time and only 'sipping and dipping' data when low-cost options arise (free Wi-Fi) or during non-peak pricing hours.[27] Stories are surfacing of the difficult decisions people have to make between basic food products versus Internet data consumption for online activities, including that of a mother in the Philippines who has to choose between two kilos of rice for her family or one week of data to support distance education.[28] Already, significant disparities exist between countries and across urban versus rural areas within territories. While the overall global growth rate of Internet usage has been falling year on year in the last couple of years (2018 and 2019) and demonstrates a linear downward growth trend line over the last decade and beyond.[29] Some of the starkest disparities exist at the individual level. In 2019, nearly 87 per cent of individuals in developed countries were using the Internet versus only 19 per cent in least developed countries (LDCs), as well as by households where nearly 89 per cent of households in developed economies were using the Internet versus less than 10 per cent in low-income countries.[30]

The high cost of 4G devices remains another major barrier to connectivity in lower-income countries. Despite the cost of an entry level Internet-enabled device falling from 44 per cent of monthly income in 2018 to 30 per cent in 2019,[31] nearly 2.5 billion people live in countries where the cost of the cheapest available smartphone is a quarter or more of the average monthly income. In Africa, devices remain out of reach for many, where devices cost on average 62.8 per cent of average monthly income.[32] Where extreme poverty persists, the affordability gap is even worse, with the median cost of an entry level Internet-enabled handset in Sub-Saharan Africa at more than 120 per cent of monthly income for the poorest 20 per cent of the population.[33]

COVID-19 has exacerbated the situation, pushing between 80-115 million people into extreme poverty[34] and the disruption to global supply (and demand side declines) is leading to reduced smartphone shipments and increased component costs. There are 3.4 billion people globally who have mobile broadband coverage, but do not use it. The connectivity usage gap is now six times greater than the coverage gap. If the cost of devices is not lowered, the digital divide will remain for years to come, and operators will struggle to add new customers to their 4G base, which in turn impacts infrastructure investment decisions.

The digital divide exacerbates the negative social impacts of the COVID-19 pandemic and threatens to exacerbate overall divides. For example, learners at all ages and levels were, and in many countries still continue to be, significantly affected by the pandemic in part due to a lack of remote learning ability. School closures occurred across 190 countries, impacting more than 91 per cent of students worldwide at an estimate of 1.6 billion children and young people.[35] At least 31 per cent of schoolchildren worldwide (463 million) cannot access distance education content via Internet access or broadcast technologies for a range of reasons including a lack of necessary technologies, among others. And the nature of COVID-19 itself, leading to contagion based on direct exposure and physical proximity to infected individuals, further stresses the need to be able to treat patients of all kinds (with COVID-19 and with other ailments) safely at a distance through telemedicine options. But even today, limited broadband adoption not only hampers future development and resilience, it is also impacting COVID-19 response activities. For example, in India, where a significant resurgence of COVID-19 swept across the

country in April and May 2021, the government imposed a requirement that by May 1, citizens between the age of 18 and 45 had to register in advance for vaccination online and could not walk-in for vaccination.[36] However, nearly 50 per cent of the population does not have access to the Internet.

Even within developed countries, the pandemic has exposed digital divides between populations, communities and ethnic groups, and has been a wake-up call that efforts to simply apply more infrastructure and more technology at cheaper prices do not fully address systemic differences between peoples. More targeted interventions that are cognizant of social inequalities, and the complexities of digital disparities are required.[37]

1.3 Shifting from network expansion to network densification

Global networks (terrestrial, space and undersea) across various technologies and dimensions combine to reach and cover every part of the world; the challenge now is ensuring sufficient capacity, competition, and affordability while continuing to attract sustainable investments into networks, services, technologies and capacities. According to mobile network carriers, only 7 per cent of the world's total population reside in geographic areas where they cannot provide mobile Internet connectivity (at least 3G data service).[38] These 570 million people outside of at least 3G cellular coverage may still have some connectivity via 2G for voice and basic text message functionality, though 2G and 3G services are now starting to be shut down in order to re-farm spectrum for 5G, and in some cases for 4G in emerging markets.[39] These transitions will have to be managed carefully as significant numbers of mobile users around the world, in developing as well as developed countries, continue to use 2G and 3G devices for a wide range of reasons, including affordability, limited digital skills and familiarity, as well as limits to service options.[40] Shutdowns will force many of these users to transition and many may not be ready to do so. For example, in the United States, estimates range between 13 to 17 per cent of mobile subscribers still relying on 2G and 3G services, which amounts to a significant share of the subscriber base.[41] Technology neutral spectrum regulations are key to enable mobile operators to smoothly transition users to new generation networks, increasing network capacity but avoiding shutting down old networks that may affect those who cannot afford new devices. While 85 per cent of the world's population are already covered by 4G networks, nearly half of them are still offline, in part because of the relatively high price of Internet access (though some geographies and populations remain economically unviable and governments and industry players continue to work together to find ways to ensure digital inclusion).[42] Building broadband connectivity on top of existing mobile broadband infrastructure is a fast and cost-efficient option to bridge the digital divide.

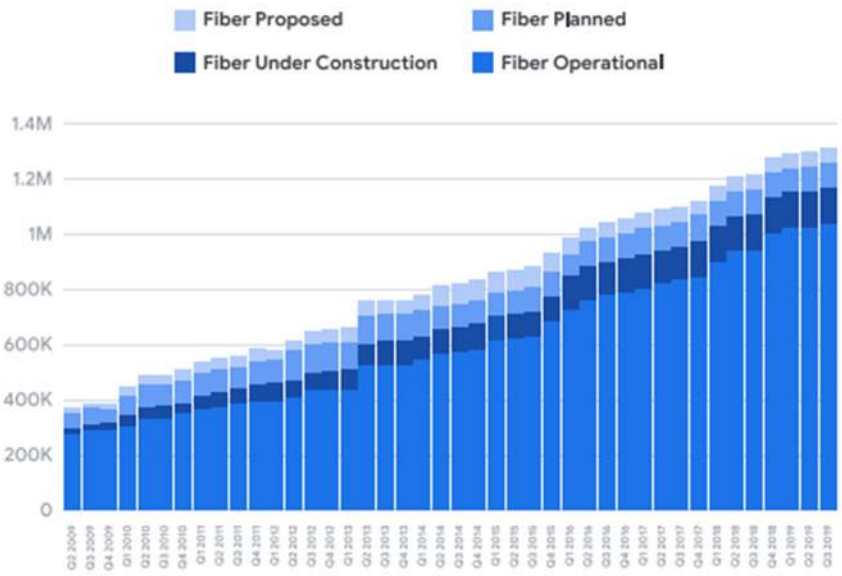
In addition, mobile networks are increasingly being used to provide broadband services for homes and business, commonly referred to as fixed wireless access (FWA). FWA adoption has increased significantly in recent years, from 100 to 224 out of 311 communication service providers (CSPs) in over 100 countries.[43] Various factors explain such adoption growth, including technological improvements in 4G and 5G (e.g. massive MIMO), additional spectrum bands (e.g. sub-6GHz TDD and millimeter wave), broad 3GPP FWA consumer premise equipment (CPE) ecosystem (more than 600 LTE CPEs and more than 100 5G CPEs) and easy of deployment leveraging existing mobile network sites. Converged operators use FWA as a complement to fibre in particular in areas with low population density (e.g. rural areas and suburbs), where fibre deployments are more costly.

Satellite technology provides coverage over every human-inhabited square kilometre on the planet. At the end of 2020, there were roughly 3 372 active satellites in orbit around the Earth and 1 819 were expressly used for communications purposes.[44] Of these, the satellites in geosynchronous geostationary orbits (GEO) at 35 786 kilometres above the Earth's surface are able to cover such large swaths of the planet that in theory only three or so GEOs in a constellation can already provide global network coverage.[45] A fast-emerging trend in satellite connectivity has been the deployment not only of next generation high throughput satellites (HTS) and very high throughput satellites (VHTS) into GEO, but also the use of medium Earth orbit (MEO) and low Earth orbit (LEO) altitudes to provide connectivity with lower latency. These technology advancements dramatically increase the amount of broadband capacity available through satellite transponders.[46] Some estimates suggest that satellite connectivity may be well suited for upwards of 697 million people around the world based on their location and other factors.[47]

Undersea and terrestrial fibre deployments continue to expand at breakneck pace. There are currently approximately 426 submarine cables in use around the world as of early 2021, with a total of around 1.3 million kilometres connecting nearly 100 countries.[48] Recent announcements for additional links include the planned Echo and Bifrost undersea cables connecting the Asia-Pacific region (particularly Singapore and Indonesia) with North America, spanning 15 000 kilometres and increasing overall transpacific capacity by 70 per cent with estimated completion in 2023 (Echo) and 2024 (Bifrost).[49] While capacity is being added on by major transoceanic routes even connecting remote islands, even more far-flung locations are being connected by fibre for the first time, such as the Galapagos Islands, as well as in-land up-river locales getting connected via submarine fibre such as the northern reaches of the Amazon River basin.[50]

Terrestrial investments in fibre continue at an even faster pace, particularly as fibre optic cable still provides the largest maximum capacity as an access and backhaul technology compared to other wired and wireless options. In Africa alone, the World Bank/IFC estimate a total of 1.1 million kilometres of fibre optic cable infrastructure, with roughly 50 per cent of the fiber deployed by mobile network operators (MNOs) while 40 per cent is publicly owned, including by government networks, state-owned enterprises (SOEs), and utilities.[51] In the US alone, fibre-to-the-home (FTTH) initiatives are dramatically increasing with investment in the next five years forecasted to be twice that of the previous five years.[52] Meanwhile, in Europe, FTTH deployment is unequal, although some of the big countries such as Spain and France are at the forefront of coverage extension, with 62.6 per cent and 35 per cent, respectively.[53]

Figure 4: Route-Kilometres of Terrestrial Transmission Network, Africa 2009-2019 (Google IFC, 2020)



Source: Africa Bandwidth Maps, Hamilton Research, Bath, UK as cited in Google & IFC. 2020. "e-Conomy Africa 2020: Africa's $180 billion Internet economy future". https://www.ifc.org/wps/wcm/connect/e358c23f-afe3-49c5-a509-034257688580/e-Conomy-Africa-2020.pdf?MOD=AJPERES&CVID=nmuGYF2

More technology options and increased capacity improves affordability, not just for individual users but also for the companies and enterprises using connectivity as the backbone of the computer-driven platform economy. As noted above, per user data consumption has increased over 200x over the last 20 years all the while the number of Internet users has increased 10x.[54] Data consumption is increasing at accelerating rates in part by the improvement in speeds across all technologies as well as the increased use of upload capacity during the COVID-19 pandemic as many more individuals rely on cloud-based conferencing systems for synchronous communications.

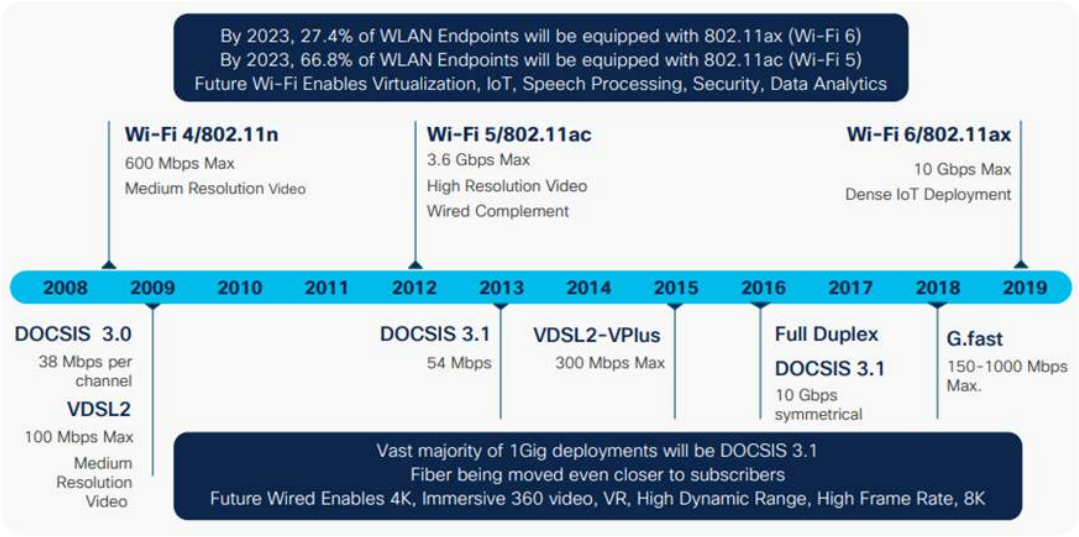
For example, even legacy technologies such as DSL continue to be used and experience speed upgrades. In developed markets, DSL remains one of the most dominant fixed-access technologies, such as in the EU-28, passing over 90 per cent of homes with subscriptions levels stable between 2018 and 2019.[55] VDSL, or very high-speed DSL, offering speeds up to 52 Mbps, is available in nearly 60 per cent of EU households and the next generation version, VDSL 2 Vectoring, was available to over 28 per cent of households as of June 2019. Because of legacy copper network infrastructure and high population density, VSDL coverage is, in fact, one of the most rapidly expanding fixed broadband technologies in rural areas of the EU.[56] The G.Fast version of DSL, released in 2018, can reach speeds of up to 1 Gbps on legacy technology (see Figure 5). However, there are important exceptions. In Europe, Spain stands out for its broadband coverage in rural areas. As of 2020, 100 Mbps coverage reaches 63 per cent of the population. If 85 per cent of the total Spanish population has fibre optic coverage, 60 per cent of the population living in rural areas has access to broadband via FTTH.[57]

Coaxial cable broadband connectivity provides much higher wired speeds than DSL with the DOCSIS 3.1 standard reaching up to 1 Gbps download and with the next generation DOCSIS 4.0 expected to allow for symmetrical download and upload in the Gbps range within three to five years. In one test deployment with coaxial cable using DOCSIS 3.1 in the very last mile (fibre node to the living room), up to 10 Gbps was reached.[58] In the EU, by mid-2019, over 45 per

cent of households had access to high-speed cable broadband while just under a fifth (19.2 per cent) of all EU homes with access to cable had been upgraded to the DOCSIS 3.1 standard.[59]

The next generation of Wi-Fi, known as 'Wi-Fi 6', built on the IEEE protocol version 802.11ax utilizing the 2.4, 5 and 6 GHz bands is beginning to be adopted around the world with various jurisdictions assigning spectrum bands for Wi-Fi 6 adoption. The maximum data rate of the 802.11ax version rises to nearly 10 Gbps, up from the 6.9 Gbps maximum data rate of previous 802.11ac standard.[60] Even before the increasing adoption of Wi-Fi 6, Wi-Fi hotspots were already forecasted to grow four-fold globally between 2018 to 2023, increasing from 169 million to nearly 628 million public Wi-Fi hotspots by 2023. Average speeds are expected to triple, reaching up to 92 Mbps on average by 2023, while Wi-Fi 6 hotspots will grow 13-fold between 2020 to 2023 and comprise 11 per cent of all public Wi-Fi hotspots by 2023.[61]

Figure 5: Historical evolution and future of wired and wireless technologies (Cisco, 2020)



Source: Cisco. 2020. "Cisco Annual Internet Report (2018-2023)". https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.pdf

As noted above, fibre investments, including in last-mile to homes and premises, continue to accelerate. Fixed broadband speeds globally are expected to more than double to 110 Mbps in part because of the FTTH deployments in major markets.[62] The next generation of gigabit passive optical networks (GPON), include asymmetric 10 Gbps known as XG-PON and symmetric 10 Gbps known as XGS-PON[63] (see Table 1). XGS-PON is already in deployment in Europe.[64] In development and in trials, speeds of even higher throughput capability over fibre have been reached, including up to 400 Gbps symmetric.[65] In markets like India, operators are collaborating with local cable operators (LCOs) to deliver fibre broadband experience to households using aerial fibre, where going underground is either expensive due to issues around rights of way (RoW) or difficult due to terrain.

Table 1: Specification differences between GPON, XG-PON and XGS-PON (Huawei, 2018)

Specifications	GPON	10G PON	
		XG-PON	XGS-PON
Maximum Line Rate	Downstream: 2.488 Gbit/s Upstream: 1.244 Gbit/s	Downstream: 9.953 Gbit/s Upstream: 2.488 Gbit/s	Downstream: 9.953 Gbit/s Upstream: 9.953 Gbit/s
Maximum Physical Transmission Distance*	60 km	100 km	100 km
Maximum Split Ratio**	1:128	1:256	1:256

* The physical reach is defined by split ratio, optical module size, and fibre quality.

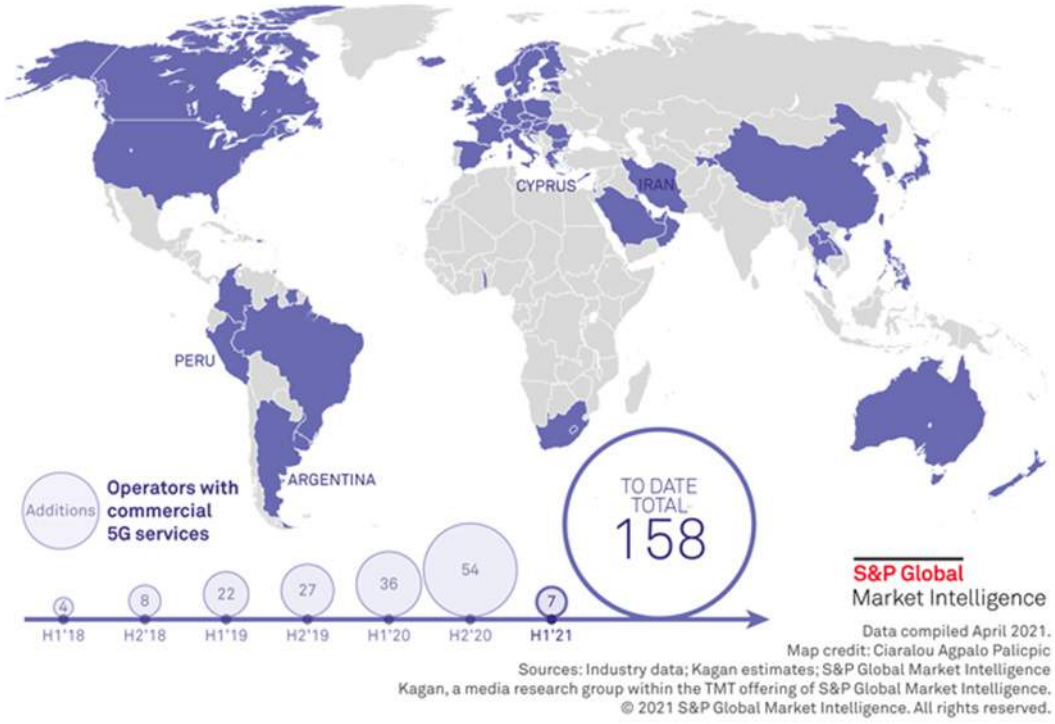
** The actual split ratio depends on the optical module model and fibre distance.

Source: Adapted from Huawei. 2018. "What are the differences between GPON, XG-PON and XGS-PON?". https://forum.huawei.com/enterprise/en/what-are-the-differences-between-gpon-xg-pon-and-xgs-pon/thread/475409-100181

In terms of mobile cellular technology coverage, 4G/LTE now accounts for more than 50 per cent of total mobile connections globally and over 85 per cent of the world's population.[66] And beyond planet Earth, the next stop in technology expansion include plans by Nokia and NASA for LTE to be utilized for connectivity on the Earth's Moon.[67] 4G adoption in LMICs has occurred at a quicker pace than 3G, taking seven years for 4G to reach 80 per cent coverage versus ten years for 3G. Some geographies in the world, however, predominately still utilize older generations of cellular technology such as in the African region where the majority of mobile connections are still using 2G.[68] By 2026, in terms of mobile subscriptions by technology generation across Sub-Saharan Africa, 7 per cent will be 5G, 28 per cent 4G, 41 per cent 3G, and 24 per cent 2G.[69]

5G expansion and deployments continue with concurrent handsets adoption and the introduction of applications and services that benefit from the features of the IMT-2020 standard. As of April 2021, 162 operators across 68 countries have launched 3GPP-compliant 5G services (either mobile broadband or, fixed wireless access (FWA)), out of a total of 435 operators in 133 countries that are more broadly investing in 5G with trials, license acquisition, plans, network deployments and launches[70] (see Figure 6).

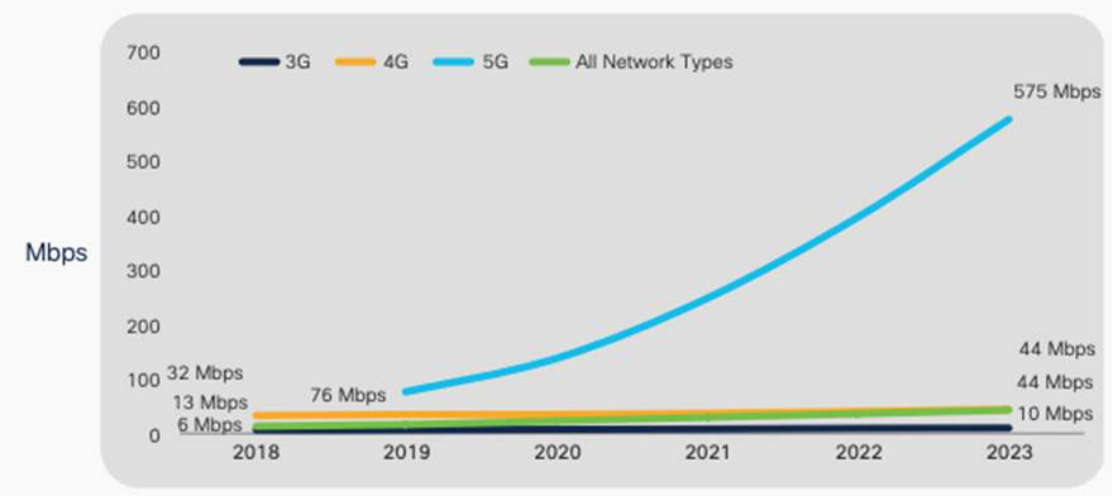
Figure 6: Commercial 5G service launches worldwide (S&P Global Market Intelligence, 2021)



Source: S&P Global Market Intelligence. 2021. "67 markets worldwide have commercial 5G services". https://www.spglobal.com/marketintelligence/en/news-insights/research/67-markets-worldwide-have-commercial-5g-services

In terms of 5G devices, there have been at least 703 announced 5G devices coming to market, 431 of which are commercially available.[71] These include 351 mobile phones, and shipments of 5G smartphones have increased dramatically in 2021, with Q1 2021 5G smartphone shipments increasing globally 458 per cent year on year to 133.9 million from 24 million in Q1 2020, due in part to significant demand in China, and global demand for the Apple iPhone as well as value-priced Android models.[72] The uptake of 5G is expected to be faster than 4G, reaching 1 billion subscribers two years faster than 4G[73] and the forecasted uptake of 5G phones and devices is expected to impact average speeds on mobile devices with the average 5G connection speed reaching 575 Mbps by 2023 (see Figure 7).

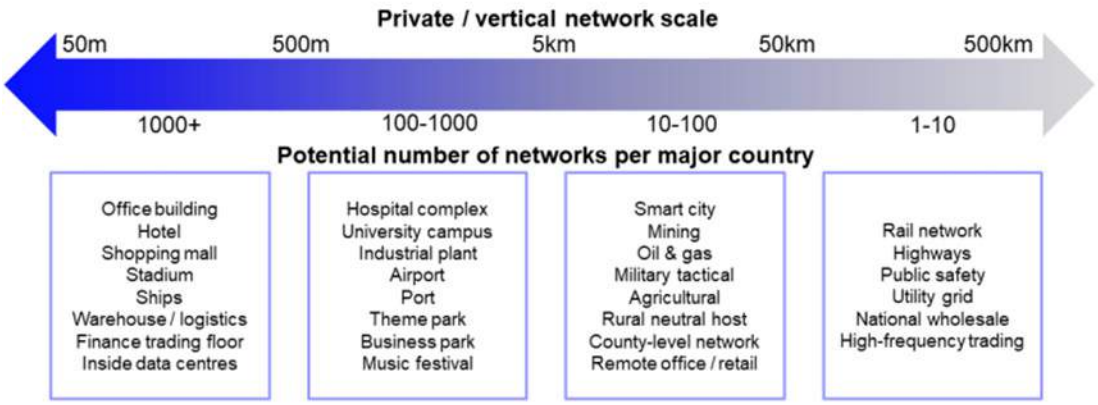
Figure 7: Global mobile average speeds by network type (Cisco, 2020)



Source: Cisco. 2020. "Cisco Annual Internet Report (2018-2023)". https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.pdf

In addition to the 162 service operators who have launched 5G services, private enterprise deployments of 5G are also expected to be a major use case for 5G (see Figure 8). Any given mid-sized country by 2025 could conceivably have thousands of private 5G networks consisting of national or state-wide 5G networks, for example for power grids or rail networks; city-wide or airport networks (for example the private 5G network deployed for the Brussels Airport which has been used to connect drones for inspection and surveillance purposes);[74] ports, business-parks or university campuses; office buildings, hotels and other sites.[75]

Figure 8: Private cellular networks have a broad range of scales (Disruptive Analysis, 2021)



Disruptive Analysis. 2021. "5G: Creating enterprise-friendly policies. Why private 5G networks are important". https://disruptivewireless.blogspot.com/2021/04/free-to-download-report-on-creating.html

FWA is gaining momentum in the industry, due to several reasons. Network performance keeps improving, making FWA increasingly competitive and good enough for various use cases, including extensive video streaming. In addition, new spectrum in several bands is being made available globally. At the same time, the network cost (cost per delivered bit) keeps dropping, enabling a viable operator business case for FWA, and making it affordable to households for services such as TV/video streaming. As an example, a site fully evolved with 4G and 5G capacity

will deliver mobile data ten times more cost-efficiently than a basic 4G site.[76] However, many of the cost-efficiency steps can already be achieved through LTE-A evolution.

It is also important to note in the overall context and trend of network expansion and network densification that in many cases, these various technologies (wireless, wired, and satellite) are more complementary rather than in direct competition, as connectivity has become so pervasive to daily life there is a plethora of needs, demands, constraints, and use cases for which each technology and service may be best fit (for example indoor versus outdoor, local area versus wide area, and in last mile versus backhaul).[77] And though 5G is still in early stages of deployment, work is already being done on setting the policy and technical foundations for 6G with the launch of the Next G Alliance and the European Commission's 6G research initiative, project Hexa-X.[78]

Endnotes

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2 Note too that many of the most affected are women. Women's exclusion from COVID-19 planning and decision-making leaves governments ill-equipped to respond effectively to the gendered social and economic fallout of the pandemic. In total, 214 countries and territories have adopted 1 700 social protection and labour market measures in response to COVID-19. However, only 23 per cent of these measures (397) are gender-sensitive in that they target women's economic security or address unpaid care. See UN Women-UNDP COVID-19 Global Gender Response Tracker: https://data.undp.org/gendertracker/

2 Similarly, 132 countries and territories have adopted 580 fiscal and economic measures to help businesses weather the crisis, but only 12 per cent of these measures (70) aim to strengthen women's economic security by channeling resources to female-dominated sectors.

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2 Broadband lessons learned from the pandemic

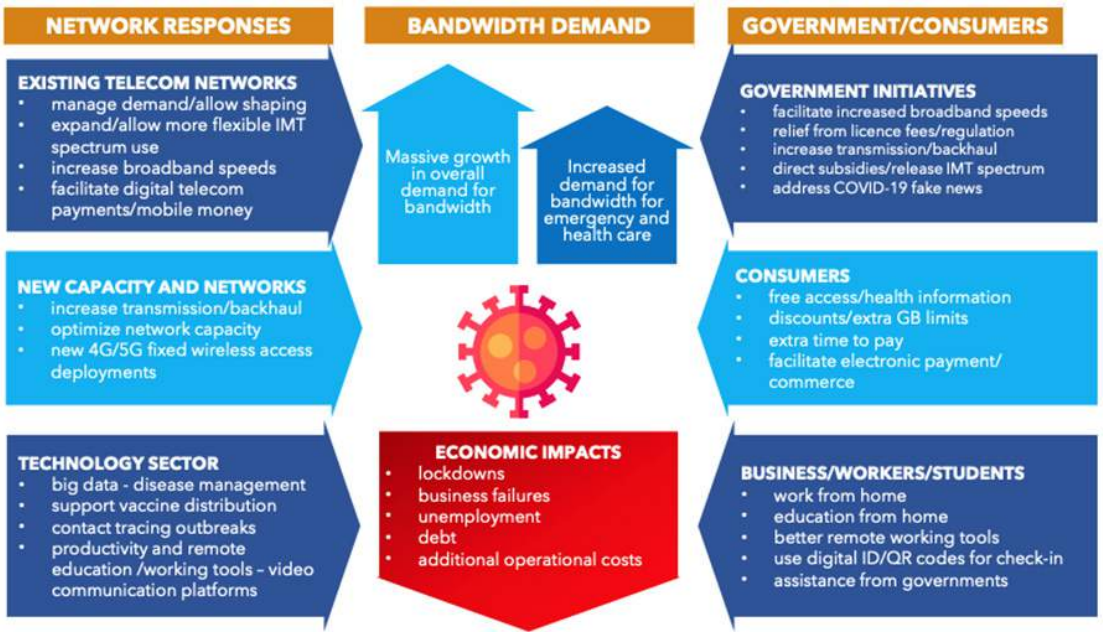
As noted in Chapter 1, broadband networks also experienced a significant external shock concurrent with the COVID-19 crisis as much of the world's population shifted to leveraging high-speed communications to continue working, learning, and communicating. Total international Internet traffic rose by 48 per cent with peak traffic growing by 47 per cent.[1] In some markets, local and regional networks witnessed increases in total downstream and upstream traffic by up to 60 per cent during peak hours.[2] Whereas total international capacity (or bandwidth) increased by 35 per cent, demonstrating a supply response over the previous year's growth of 26 per cent.[3]

Networks designed to robustly deliver quality of service (QoS) for spikes in peak-hour utilization as well as with sufficient upstream capacity to user-premises were for the most part able to withstand the spikes in overall traffic, with many operators investing in added capacity in order to ensure their networks remained robust and secure. While some digital infrastructure providers benefitted from the surge in data traffic and increased use of broadband services as the crisis resulted in significant demand increases in network use, many also voluntarily offered solutions to users suddenly facing financial hardship, such as flexible payment options and the lifting of data caps. Usage patterns by location and time of day have shifted with less differences now between weekends versus weekdays, and 'primetime' evenings versus daytime work and school uses.[4]

2.1 Effective responses to the broadband challenges posed by COVID-19

Nearly every single country around the world implemented some form of emergency ICT policy or regulatory initiative in response to the COVID-19 crisis (see Figure 9). The ITU's REG4COVID database tracks many of those measures, highlighting that some countries implemented a plethora of measures.[5] Over 480 policy responses have been identified to date, ranging from emergency telecommunications, accessibility, affordability, broadband availability, consumer protection, QoS issues, among several others, all undertaken by various stakeholders from policy-makers and regulators, operators and service providers, international and regional organizations, and the technical community and civil society.

Figure 9: COVID-19 Telecommunications sector responses (ITU, 2021)



Source: ITU-WPC, May 2020, updated March 2021 as presented in: ITU. 2021, "Pandemic in the Internet age: From second wave to new normal, recovery, adaptation and response". https://www.itu.int/en/myitu/Publications/2021/05/11/08/52/Pandemic-in-the-Internet-age

As the REG4COVID database demonstrates, the largest number of policy actions focused on stopgap measures to provide continuity and emergency communications, including expanding the availability of broadband network infrastructure. These actions range widely from direct funding for rural broadband connectivity for infrastructure expansion as a response to COVID-19 to extending temporary radio frequency spectrum assignments for licensees.

In late 2020 early 2021, ITU, as part of its REG4COVID activity, conducted a survey of ICT national regulatory authorities, regulatory associations and other ICT stakeholders, to collect information on ongoing initiatives, and innovative policy and regulatory measures designed to ensure communities and businesses remain connected. In response to Question 2 on immediate measures "implemented during the current crisis by the ICT National Regulatory Authority (NRA) or other government entities in your country", over two-thirds of responses focused on implementing emergency telecommunications measures, while other frequent responses included voluntary measures requiring network operators to cooperate in enhancing connectivity, accessibility, and affordability, as well as providing specific broadcasting channels for education and other public uses. For instance, in Spain the operators and the government

signed an 'Agreement for the Connectivity' and measures included, for example, ensuring that no citizen or company would have connectivity cut at any moment during the strict lockdown of the spring of 2020, even in case of no payment.[6]

In the immediate period when COVID-19 emerged, network operators of fixed wired infrastructure were comparatively more constrained in their ability to increase capacity on existing access, interconnection and content delivery infrastructure, except in cases where existing unused capacity was available, such as in fibre networks in last-mile, backhaul and core networks. Because of lower overall total capacity limits, other wired broadband networks, using for example DSL and cable, were more limited in their ability to expand coverage or increase capacity to individual subscribers.

Emergency options existed however to rapidly increase wireless and mobile broadband infrastructure capacity, particularly by making increased amounts of spectrum available across networks already designed to immediately utilize such spectrum bands. Several countries around the world did this in direct response to increased bandwidth demand during the COVID-19 crisis. For example, in the Middle East and North Africa region, the Telecommunication Regulatory Authority of Oman provided additional spectrum for the mobile operators, as was the case also in Jordan and Saudi Arabia which released spectrum in 700 MHz on a short-term basis. In Saudi Arabia, mobile service providers were granted temporary licenses to use an additional 40 MHz in the 700 MHz and 800 MHz bands. In Tunisia, the government made spectrum available on a technology-neutral basis.[7]

As COVID-19 abates and broadband infrastructure providers focus on the future, the pandemic appears to have encouraged some providers to accelerate network infrastructure investment plans to capitalize on the spike in demand for connectivity, while the economic slowdown has caused other network operators to slow investment.[8]

Further, a wide range of policies was implemented focusing on increasing access to broadband and ensuring service affordability. Individuals and households with sufficient resources to pay for more Internet connectivity services, including those that have had to sacrifice other necessities, have done so during the pandemic. For example, an Internet Society survey in Afghanistan found that respondents were paying more for Internet services during the pandemic (over 40 per cent were spending over USD 20 per month for connectivity, compared to 25 per cent prior to the pandemic), over a quarter of respondents had increased their spending on Internet during the pandemic, and that over half the survey respondents subscribed to a new Internet connection since the beginning of the pandemic.[9]

While higher-income individuals and households have been able to increase Internet data consumption and improve the quality of their connections, some lower-income consumers have reduced use (because of falling household income), purchasing less airtime and data bundles. It is these marginally connected individuals with little or insufficient ability to stay connected who are least able to shift their lives, including work, education and healthcare, to online platforms. In this way, COVID-19 may be further exacerbating and expanding the digital divide.

Ensuring consumers are getting what they have purchased and that networks fulfill expected QoS agreements has also been a focus of COVID-19 ICT policy responses. Implementing consumer protection measures, such as preventing or reducing customer terminations for non-payment during the most challenging period of the pandemic, was identified by over half of the respondents in the REG4COVID survey results as an action taken by their country and

these sets of measures were identified in the upper half of the actions with the greatest impact and value. Further, during sudden lock-down periods, MNOs supported the poor and those who needed extra talk-time or validity extensions in cases of prepaid subscriptions in countries such as India that have large internal migrant populations and daily wage workforces.[10]

Cognizant of the need to continue providing affordable digital access for all segments of society, IMDA Singapore increased support through initiatives like Home Access program, NEU PC Plus program and Mobile Access for Seniors that sought to subsidize digital connectivity and devices for low-income households and individuals. With the support received by corporates and the community, the Digital for Life national movement was launched by the Singapore President Halimah in early 2021 to galvanize and mobilize more People, Private and Public (3P) partners and resources to help fellow Singaporeans embrace and enrich their lives through digital. This included establishing a Digital for Life Fund to raise funds through a government dollar-to-dollar matching scheme to support projects and activities promoting both digital technology and inclusion, as well as digital literacy and wellness, including mitigating the risks of online harm.

A common challenge for many individuals, particularly on lower speed connections in developing countries or via mobile devices, is the difficulty in working or studying remotely. Even in more advanced markets, or even for subscribers with high-capacity download connections, significant asymmetries in network design cause subscribers with poor upload capacity to also face difficulties in engaging with cloud-based platforms for video conferencing and other services. The significant shift to remote-based activities has shined a spotlight on the importance of upload capacity, not just download, particularly as this segment of network infrastructure has shown some of the largest growth in the past year, increasing in some markets, for example, by 63 per cent.[11] This recognition of the importance of upload and other QoS issues highlighted by the pandemic is leading to new consumer protection legislation, calls for symmetrical broadband consumer packages, and a focus on minimum advertised speeds.[12]

2.2 Remote working: A buffering effect but only for some

Remote working helped to buffer against larger economic losses, but the ability and the option to do so is only available to certain segments of the global workforce. Past crises that have caused external economic shocks also led to the introduction of the idea of distance-based remote work, such as one historic analysis on the potential of working from home to ameliorate the challenges of commuting during the oil crises of the 1970s.[13]

During the start of the COVID-19 crisis, the ILO found that in some countries, upwards of 50 to 70 per cent of the workforce was able to shift to distance work via communications technologies.[14] In the United States, for example, estimates suggest that up to half of the US workforce was working from home at the peak of the pandemic, translating into some 73 million workers.[15] The ability to shift to remote working is credited with helping to dampen the full effect of the pandemic on national economies. One analysis by the Inter-American Development Bank finds that broadband helps to mitigate against even more acute economic slowdown, primarily because of the role of telecommunications in telework (but also schooling and remote healthcare) saving each country in their analysis between 20 to 25 per cent of GDP for the periods of limited mobility.[16]

A serious downside of remote work is the inability for all workers to employ this option, particularly for those in labour-intensive trade (including for example, agriculture and

manufacturing), in-person services and many activities in the informal sector.[17] Many of the policy measures implemented by governments around the world that directly affect workers' ability to work remotely focused specifically on network connectivity, not labour regulations (at least in the REG4COVID analysis). This could be one area of potential focus in preparation for future potential shocks exploring strategies that would allow for more distanced-based employment or help mitigate risks for those who have jobs and livelihoods that cannot be done remotely or online.[18]

In countries like India, the government and industry made quick decisions to come out with policy changes and plans to support work from home (WFH) requirements. While on one hand, the Ministry of Communications made it easier[19] for workers of its fledgling IT-ITeS/ BPM sector to work from anywhere, MNOs also implemented plans[20] to support WFH connectivity needs of enterprises.

2.3 Distance learning: benefits and limitations

Remote learning has helped ease the burden of school closures but has only been available to some students, and virtual learning has not yet proven to be an effective learning medium for extended periods of time. The United Nations Educational, Scientific and Cultural Organization (UNESCO) estimates that nearly 1.6 billion learners in more than 190 countries, 94 per cent of the world's student population, were affected by the closure of educational institutions at the peak of the crisis.[21] Hundreds of millions of students have been able to continue distanced-based educational activities because of communications technologies (Internet and broadcast). More than 90 per cent of countries with school closures adopted some form of digital or broadcast-based remote learning, and policy measures implemented during the crisis to aid learning continuity allowed for potentially reaching 69 per cent of schoolchildren globally in pre-primary through secondary education.[22] Of the various communication technology modalities to disseminate educational content, 83 per cent of countries relied on online platforms (though this allowed for potentially only reaching about one-quarter of schoolchildren worldwide).

Around the world, there are examples of countries and communities that have been better able than others to make the adjustment to large-scale remote learning. For example, Uruguay has been investing in digital education even before COVID-19, not only with its Plan Ceibal[23] one-laptop-per-child policy initiated ten years ago, but also concurrent investments in digital content, skills, and applications that effectively leverage the hardware infrastructure, including a centralized platform for digital schoolbooks where all content and exercises can be easily updated and downloaded.[24] With the system in place prior to the crisis, the program was able to react quickly, expanding its internal server capacity and also offering every schoolchild 50 GB of free Internet per month. Even in higher-income countries such as the US, tens of millions of students were still without digital devices or home Internet prior to the pandemic. Various local, state and national measures have been implemented to equip students with the necessary hardware and connectivity to continue learning, including Alabama's Broadband Connectivity (ABC) program that helped 200 000 students obtain home Internet service via USD 100 million in vouchers; a program in Oklahoma that provided data plans and 50 000 devices to students across 175 school districts; and 'Operation Connectivity' in Texas which provided one million laptops and half a million hotspots for students.[25]

There are significant challenges and limitations with remote learning. At least 31 per cent of school children worldwide (463 million) cannot access distance education content via Internet

or broadcast technologies for a range of reasons, including a lack of necessary technologies among others.[26] Many students, particularly in the hardest hit countries, have had to live with school closures for longer than a year, and the subsequent challenges of learning via video screen without in-person instruction or in-person engagement and collaboration with other students. Even programs designed to help students with catching up are missing some of the most disadvantaged students, as noted in the United Kingdom.[27] And even those accessing the Internet for education appear to internalize and associate some of the technical and situational challenges with themselves. For example, in a survey of over 26 000 students worldwide, children with no Internet access (63 per cent) were more likely to articulate they were more confident they would get the grades they deserved before the pandemic, versus children with regular Internet (38 per cent).[28] Mirroring this potential misidentification of technical issues as lower comprehension, academics are raising the issue of teachers giving lower grades to students with worse Internet service, attributing technical issues (such as response delays) to gaps in student understanding.[29]

Country reports and interviews demonstrate how remote learning poses organizational and time-management challenges for girls and women, who may take on greater domestic or caregiving responsibilities while at home. In Ukraine, girls reported feeling more pressure over online learning because they "study more and take school more seriously". At the beginning of the pandemic in Moldova, 40 per cent of female students reported having limited or no free time or time for rest, compared with 29 per cent of boys. Countries with existing digital platforms in place had an easier time making the switch.[30] For example, in Serbia a system called 'E-diary', implemented in 2018 to provide digital records of students' successes and conduct, facilitated the quick adaptation of distance learning in the education system.[31] Those without proper online platforms often used alternatives from private companies, such as Google Classroom and Microsoft Teams.

Box 1: The Global Education Coalition and the human element of connectivity for learning

The Right to Education, enshrined as Article 26 of the Universal Declaration of Human Rights, has increasingly become dependent on achievement of universal connectivity. The gap in access to broadband networks and new technologies is driving the persistent and widening disparities across economies, societies, and education systems. Universal connectivity must become a reality.

The Global Education Coalition, created by UNESCO with more than 175 broadband and other partners, identifies connectivity as a flagship, but also recognizes that the digital divide is more than purely technological. The digital divide is associated with a wide range of factors related to education, age, gender, income status, skills, and residence.

The 'human element of connectivity' describes the digital skills and the type of solutions, tools, education resources and content needed to empower learners, teachers, and entire surrounding communities. To assure true connectivity that closes all digital divides, these elements must be advocated in national regulations, connectivity investments and policies.

For more information, please visit: https://en.unesco.org/covid19/educationresponse/globalcoalition and https://globaleducationcoalition.unesco.org/

Part of the challenge is that other issues, in addition to affordability, also arise to cause digital divides between students. For example, one analysis in the United States found that 60 per cent of disconnected students (9 million) were unable to afford access while the other 40 per

cent (6 million) faced other binding constraints such as insufficient digital literacy and language barriers.[32] One long-term impact of this divide is that students caught in the digital divide have overall GPAs about 0.4 percentage points lower than their peers with Internet access, and this leads to 4 to 6 per cent lower expected income and an annual GDP loss of USD 22 billion to USD 33 billion across the K-12 cohort.[33] For updated information on Digital Learning, please visit the Broadband Commission Digital Learning Working group page: https://broadbandcommission.org/working-groups/digital-learning-2021/

2.4 The opportunity to cement the progress of remote health services

Telehealth services require greater adoption, expansion, and permanency, while ensuring vulnerable populations are not excluded. Around the world, prior to COVID-19, telehealth services had not yet reached critical mass in adoption and were usually reserved either for high-tech interventions between advanced facilities, or low-tech engagements using mobile phone messaging to communicate between providers and patients. Much has changed in terms of utilization, and perception, of the efficacy of telehealth due to greater adoption during COVID-19 because of the inability of patients to make in-person visits to their health providers. In one study of over 6 million beneficiaries in 2020 (compared to 2019), a more than 20-fold increase in use of telemedicine services in 2020 was found, though services were more concentrated among patients in metropolitan areas and among adults rather than children.[34] Forty-one per cent of US households took part in a telehealth visit in 2020 and almost 30 per cent plan another visit in 2021. Satisfaction with telemedicine was also high in one survey with 65 per cent of healthcare organizations surveyed rating telehealth delivery as a success, and 94 per cent planning to continue offering telehealth services.[35] Some services in particular, such as mental health visits, saw significant increases in telehealth sessions as a function of the stresses caused by the dramatic lockdowns and impact to daily life, as well as the nature of mental health consultations being well-suited to remote-based engagement. In one estimate with one provider, the use of plan members accessing mental healthcare through remote connectivity increased over 2 500 per cent.[36] MNOs like Airtel[37] have provided platforms for enterprises to support their employees, and offer subscribers to assess their COVID-19 risk profiles.[38]

Part of the lack of wide-scale adoption prior to the pandemic was the lack of formal legislation allowing the use of telemedicine as part of health services. However, with formalization of the use of telehealth services, underserved communities and offline populations (such as seniors and older individuals) are particularly at risk of becoming unable to access regular medical care unless issues of access are concurrently addressed, and issues of exclusion are mitigated against.[39]

Box 2: The Epidemic Management Working Group

In the advent of the COVID-19 pandemic, the whole world has been exerting immense efforts on overcoming the virus. While governments and medical sectors are concentrating on treatment and development of vaccines and medicines, the ICT sector has also been playing a pivotal role in enabling various economic activities while helping alleviate the spread of the virus.

In continuation of the function of the Working Group on 'Epidemic Preparedness' in 2018, the new Working Group on 'Epidemic Management' will analyse various global efforts, best practices and valuable learnings in tackling COVID-19 and present how the world could work together to overcome future waves of epidemics and pandemics, reflecting various social, cultural and national environments and approaches.

The Working Group aims to:

- Analyse global best practices for COVID-19 prevention and response;
- Highlight requirement of end-to-end epidemic outbreak management based on 3T (Test, Trace, Treatment) and vaccination strategy;
- Present recommendations for global epidemic management framework based on collaboration amongst governments, academia, the private sector, etc.

The report will cover the current status of the COVID-19 outbreak, the need for a framework for responding to future pandemics and cases in 15 countries in Europe, America, Asia, and Africa including: 1) governance and regulatory response strategies for COVID-19; 2) quarantine and policies that can mitigate socio-economic impacts; 3) vaccination strategies; 4) public acceptance of policies; 5) contributions from international organizations responding to COVID-19; and, 6) best ICT practices for COVID-19 response.

Based on the results of these analyses, we would like to suggest the following: 1) expanded use of ICT for quarantine and liberalized movement; 2) infrastructure to ensure ICT accessibility for developing countries and marginalized sectors; 3) flexible regulation of data and networks for efficient use of ICT in outbreak management; 4) global public-private cooperation of infectious disease data and coordinating policies among countries.

For further information, please visit: https://broadbandcommission.org/working-groups/epidemic-management-2021/

Box 3: The Virtual and Data-Driven Health Working Group

The COVID-19 pandemic generated unprecedented growth in digital technologies, with Internet usage growing globally by 70 per cent at the height of the crisis. With billions of people forced to limit their movements and physical interactions, connectivity has enabled the possibility for family and friends to stay in touch, remote working and learning, and virtual access to healthcare. This latter area – virtual health and care services, as well as related data-driven and AI health solutions – saw particularly unprecedented adoption.

The Broadband Commission's new Working Group on Virtual and Data-Driven Health aims to build on the momentum sparked by COVID-19 to further advance long overdue innovation in our health systems. The Working Group is chaired by the Novartis Foundation, Microsoft and the World Health Organization (WHO). Aligned with the WHO's Global Strategy on Digital Health and building on the 2020 Broadband Commission Report on AI in Health, the group aims to present a call to action to governments to enhance equal access to health, enabled by virtual and data-driven care. It will conduct a global review of where regions and countries stand in the adoption of such services, and showcase:

- Recommended policies for countries to use in order to enable virtual and data-driven health services, as well as real-time data exchange to facilitate rapid response to health crises. These recommendations will be based on a thorough analysis of case studies where countries were able to pivot rapidly during the COVID pandemic and adopt solutions for the long run.
- Potential business models for virtual and AI or data-driven health services to stimulate local providers to invest in sustainable virtual solutions in health, also in low-resource settings.

These recommendations will build on the AI in health maturity roadmap from the last Broadband Commission Working Group on AI in Health.

For further information, please visit: https://broadbandcommission.org/working-groups/virtual-and-data-driven-health/

2.5 Next steps: From temporary to permanent measures

Cementing temporary measures into long-term improvements in access and connectivity in order to increase the availability and efficacy of remote work options, distance learning and telehealth services still requires further commitment and action by governments, private sector and society. These actions are summarized in the checklist (see Table 2) presented in the ITU report "Pandemic in the Internet Age", which highlights efforts that can be taken today and into the near future (2022 and 2023) to cement progress and leverage connectivity to ensure economic growth and social development continue.[40]

Table 2: Checklist of action and regulatory measures (ITU, 2021)

No.	Checklist of actions and regulatory measures	2021	2022	2023+
1	Together with the Ministry of Health, provide support for digital contact tracing and efficient vaccine distribution via digital supply chains.	Yes	Yes	
2	In conjunction with the Ministry of Education and all industry stakeholders, review support for online education in terms of connectivity and curriculum support materials, including online classes in domestic languages and materials to support COVID-19 education catch-up.	Yes	Yes	
3	In conjunction with the Ministries of Health and Home Affairs, support internationally portable digital vaccine certificates and vaccine passports utilizing digital ID, in order to promote international travel/trade and family reunions/social interaction.	Yes	Yes	Yes
4	Address the digital divide in order to secure ubiquitous broadband access, including by: • preparing revised national broadband targets and implementation plans to promptly address coverage and affordability issues; and, • implementing plans to address the digital divide by reducing the costs of smartphones and other consumer devices.	Yes	Yes	Yes
5	Revise national digital/broadband plans taking into account the impacts and lessons of the pandemic to accelerate recovery and move to the new normal, thereby ensuring digital deepening and digital resilience with regard inter alia to: • the transition to 4G/5G services; • the deployment of backhaul capacity; and, • international and cloud connectivity.		Yes by mid-2022	
6	Review IMT spectrum management in order to support delivery of the broadband and online services needed for digital transformation, prioritizing: • the temporary assignment of unused spectrum if required during the pandemic; • the release of sub-1 GHz spectrum to provide greater coverage and thereby narrow the digital divide; • endorsement of an overall target/roadmap for the assignment of at least 840 MHz IMT spectrum plus mmWave spectrum, so as to facilitate digital deepening, plus release of unlicensed spectrum where practicable; • support for fair and reasonable spectrum prices, to ensure an adequate return on capital for licensees and thereby facilitate investment in capacity and new technologies, including 4G and 5G services.	Yes	Yes	Yes

Table 2: Checklist of action and regulatory measures (ITU, 2021) (continued)

No.	Checklist of actions and regulatory measures	2021	2022	2023+
7	Review cybersecurity protections and legislative frameworks for cybersecurity, data privacy and protection, in order to build increased digital resilience, encourage online participation, etc.		Yes	
8	In conjunction with industry stakeholders, undertake stress testing (of networks, transmissions, cloud infrastructure, etc.) encompassing additional WFH/SFH pandemic and disaster loads, in accordance with ITU Recommendations, in order to drive digital deepening and build digital resilience.		Yes	
9	Review regulations and regulatory frameworks (especially outdated legacy rules) that inhibit or foreclose on the ability of industry licensees/stakeholders to utilize new technologies (e.g. IP interconnection rather than time-division multiplexing) and undertake network planning and deployments that have a high degree of resilience and nimbleness.		Yes	
10	In conjunction with other government ministries, undertake the second-order review of processes and laws/regulations allowing the public and industry to engage in the digital transformation of processes and to support societal and cultural change to effect that transformation utilizing digital IDs and similar.		Yes	Yes

Source: ITU. 2021. "Pandemic in the Internet age: From second wave to new normal, recovery, adaptation and resilience". https://www.itu.int/en/myitu/Publications/2021/05/11/08/52/Pandemic-in-the-Internet-age

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Video Conferencing ↓2.1↑0.6, Live Gaming ↓1.5↑0.1, HD Video Streaming ↓7.6↑0.4" US Broadband: Household Bandwidth Demand Study - Cartesian

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3 Universal connectivity, affordability, access, equality and use: Meeting the 2025 Advocacy Targets and beyond

The seven 2025 Advocacy Targets of the Broadband Commission reflect ambitious and aspirational goals and function as a policy and programmatic guide for national and international action. From the initial four connectivity goals established when the Commission was first organized, the targets were expanded to five in 2013 with the addition of the gender equality goal. In January 2018, at its Special Session during the Annual General Meeting of the World Economic Forum, the Broadband Commission extended and updated the five broadband targets to a total of seven targets focusing on 2025 target date.[1] This chapter focuses on progress towards the 2025 Advocacy Targets, including a review of the progress made since the start of the Commission in 2010.

The seven 2025 Advocacy Targets represent connectivity baseline targets and goals, and map onto the UN Secretary-General's Digital Cooperation Roadmap areas of actions, particularly universal connectivity, ensuring digital inclusion of all including the most vulnerable, digital capacity building, digital public goods, and digital trust and safety. The voice of youth is also pertinent in ensuring progress and ownership of these targets. ITU has launched Generation Connect, its overarching Youth Strategy that aims to engage global youth and encourage their participation as equal partners alongside the leaders of today's digital change, empowering

young people with the skills and opportunities to advance their vision of a connected future, in alignment with the vision and objectives of the United Nations Youth Strategy: Youth 2030 – working with and for young people.

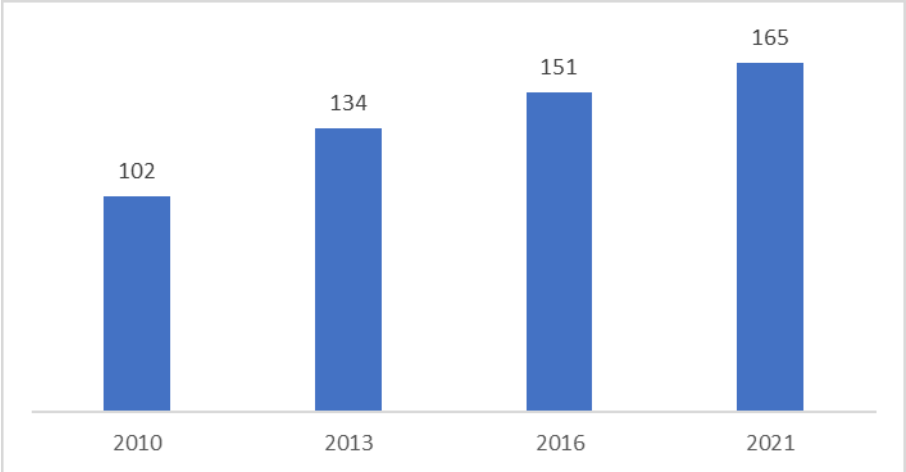
3.1 Advocacy Target 1

Making broadband policy universal: By 2025, all countries should have a funded national broadband plan (NBP) or strategy or include broadband in their universal access and service (UAS) definition

Since 2011, the Commission has been tracking the number of countries with a national broadband plan (NBP) or strategy as the first of its four main targets. In that year, data from ITU found that 112 countries worldwide had a national policy to promote broadband. This target was revised, building on the Commission's previous target for national broadband plans, with an increased emphasis on implementation capacity through the specification that plans / strategies are funded.

At the end of 2020, 165 countries worldwide have a broadband plan of some sort, with several countries currently in the process of adopting one and others having plans that have expired and or moving towards more specific strategies such as ones addressing AI or IoT. This is an increase from 102 countries in 2010[2] but a slight decrease from previous 2020 estimates (see Figure 10). Although much work remains, policy emphasis is also shifting to encompass more balanced efforts to address supply and demand constraints. In many countries, demand-side policies remain fragmented or non-existent.[3] Additionally, countries are focusing less on developing a new plan and rather looking to upgrade their universal access and service (UAS) definitions or terms of service, or developing broader digital transformation strategies and plans in which connectivity is one of the core components among other major issues.

Figure 10 Growth in the number of countries with a national broadband plan, or emphasis on broadband in a digital agenda or strategy, 2021



Note: National broadband plan or strategy includes: a plan, strategy or policy specific to broadband; digital plan, agenda, strategy or policy; ICT plan, strategy, or policy; or a communication plan, strategy, or policy. Countries may have identified several goals. Source: ITU ICT Eye portal. A complete list of countries with NBPs will be available on the Broadband Commission's website.

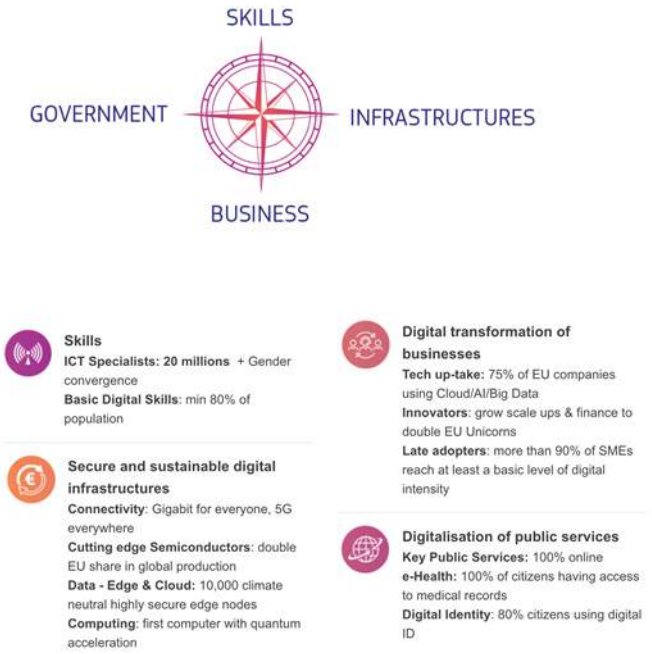
Ensuring that national broadband plans are designed to increase network availability, affordability of access including devices, safety, expand local ecosystems with relevant content and services,

and broadband adoption requires plans that are multifaceted and holistic, incorporating many, if not all, of the recommendations that the Commission has been advocating since its inception. Specifically, the State of Broadband reports have advanced recommendations to introduce, develop and enhance broadband plans in the 2013, 2017 and 2018 reports, and in the 2019 report, ensure that broadband plans focus on digital inclusion, child online safety, limit environmental impacts and address public access initiatives.[4] However, many recommendations from the reports directly address the goals intended of national broadband plans and these include, but are not limited to, developing a broadband plan/strategy that is inclusive of all technologies; plans that are focused on effective spectrum allocation; stimulating broadband infrastructure; a focus on broadband network mapping of all technologies;[5] ensuring gender-responsive broadband plans that specifically focus efforts on closing the digital gender divide, and consideration of digital skills-building to increase child safety online as well as relevant enforcement mechanisms to protect children online. In order for broadband plans to actively support reaching the 2030 Agenda, clear strategies and roadmaps are needed coupled with investment commitments on policy and in regulations.[6] As emphasized in the ITU report on Connectivity Humanity, it is also critical for policy-makers to embrace a 'whole-of-government approach,' one which is holistic, includes a whole-of-government investment strategy and integrates planning, design and delivery of services through well-coordinated efforts across all relevant ministries in a country.[7]

It is important to note too, however, that while 165 countries now have a national broadband plan, more work must be done to monitor and evaluate the current state of implementation of these national plans. In some cases, even after publishing and endorsing a national plan, government transitions and competing priorities lead to situations where national plans are no longer effectively implemented and/or targets need to be revised in order to have an impact on broadband adoption. One major bottleneck area that must be addressed by countries to increase the speed of fibre and high-speed broadband networks is rights of way (RoW) permissions including the charges and time delays. Countries like India have tried to address it through central RoW rules[8] that requires various state governments to align their local RoW policies to it, but implementation on the ground remains patchy, complex and difficult. Rather, RoW permissions should be timely, affordable and not denied as broadband networks become the fundamental backbone of socio-economic activities.

In the wake of the previous global economic crisis of 2007-2008, a number of countries implemented fiscal stimulus plans that included significant investments in broadband infrastructure, and other analysis has highlighted the supply-side focus of broadband plans that emerged after the global financial crisis.[9] Already a number of countries are introducing broadband infrastructure initiatives with twin targets of increasing employment and improving social development outcomes (such as remote education and healthcare). For example, the US Government's plan to invest USD 100 billion into broadband infrastructure is being called 'The American Jobs Plan'.[10] In the United Kingdom, the government launched a new GBP 5 billion program called 'Project Gigabit' with the goal of connecting one million hard-to-reach homes and businesses.[11] Across Europe, the EU launched the 'Digital Compass' initiative, focused on targets within four focus areas (Skills; Secure and sustainable digital infrastructure; Digital transformation of businesses; Digitalization of public services) with concrete targets and milestones to be reached by 2030[12] (see Figure 11 below).

Figure 11: Europe's Digital Compass (EU, 2021)



Source: EU. 2021. "Europe's Digital Decade: digital targets for 2030". https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en

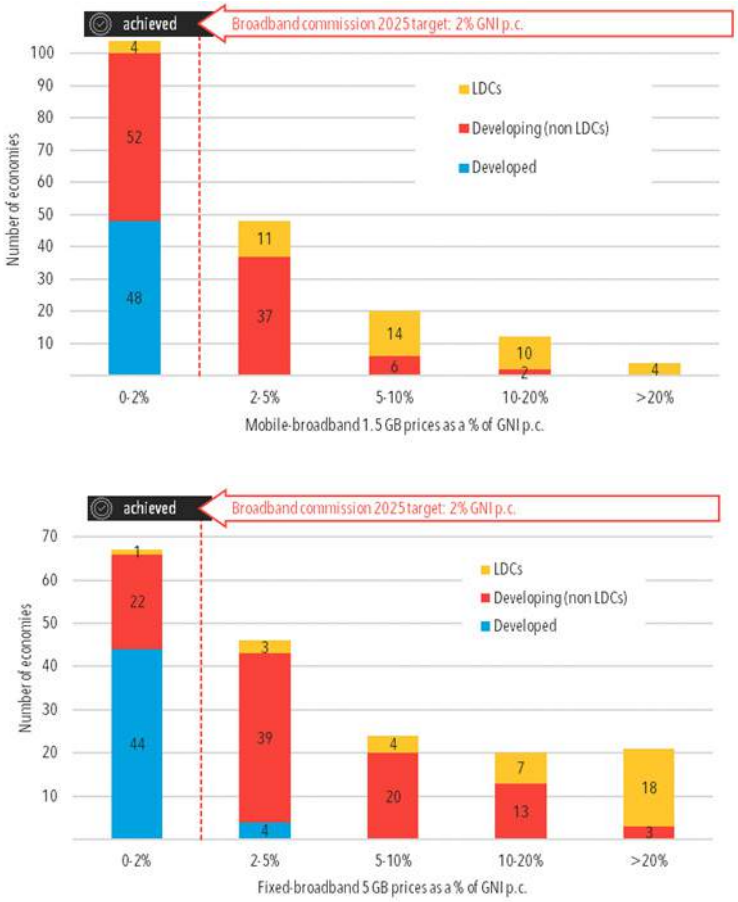
3.2 Advocacy Target 2

Making broadband affordable: By 2025, entry-level broadband services should be made affordable in developing countries at less than 2 per cent of monthly gross national income (GNI) per capita

There is some way left to go before the target is reached. In 2020, 56 developing economies (including 4 LDCs) achieved the 2 per cent affordability target for entry level mobile broadband basket (1.5 GB) whereas it remained unaffordable in 84 of the economies around the world (45 per cent), and the fixed broadband basket (5 GB) was unaffordable in 111 (56 per cent) and only achieved in 23 developing economies[13] (see Figure 12 below).

For example, since 2016, the cost of 1 GB of data as a share of monthly GDP per capita in low- and middle-income countries (LMICs) has fallen by more than 40 per cent, but more than half of LMICs still fall short of the Broadband Commission's 2 per cent target.[14] For LMICs, prices on average have dropped from 7 per cent of monthly income in 2015 to 3.1 per cent in 2019. Some countries, such as Ecuador, India and Rwanda, have witnessed a decline of more than 60 per cent in prices over this time.[15] However, there are still at least 1 billion people living in 57 countries across the world where 1 GB of mobile data does not meet this Broadband Commission standard for affordable Internet.[16] And in 18 of the LDCs, the price of 5 GB of fixed broadband is more than 20 per cent of monthly gross national income per capita.[17]

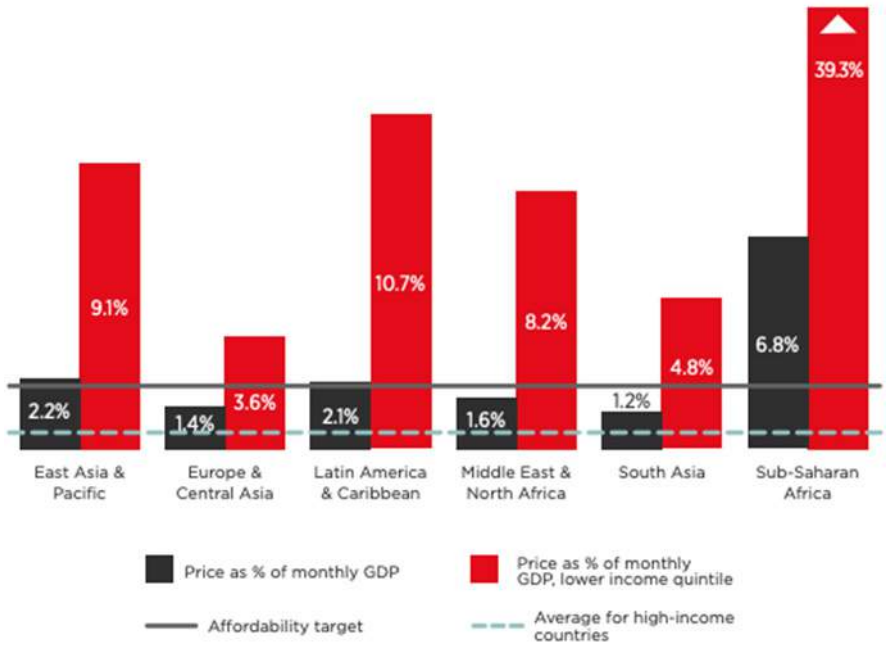
Figure 12: Progress towards achieving the 2 percent affordability target (ITU 2021)



Source: ITU. 2021. ICT price trends 2020.

The COVID-19 pandemic has brought further emphasis to the importance of high-speed data connectivity and affordability particularly for individuals and households. In developed and developing countries alike, issues of affordability remain especially for low-income communities and individuals unable to access the full amount of bandwidth throughput needed to shift to remote working and learning. Even when countries reach notional levels of broadband affordability at their national average level, lower income segments of a population can still face affordability challenges (see Figure 13 below). Many individuals and households are also 'marginally connected', able to access basic levels of connectivity, but at insufficient levels to fully transition to full-scale remote work and learning activities.

Figure 13: Affordability of 1 GB of data in low- and middle-income countries, by region (GSMA, 2018)

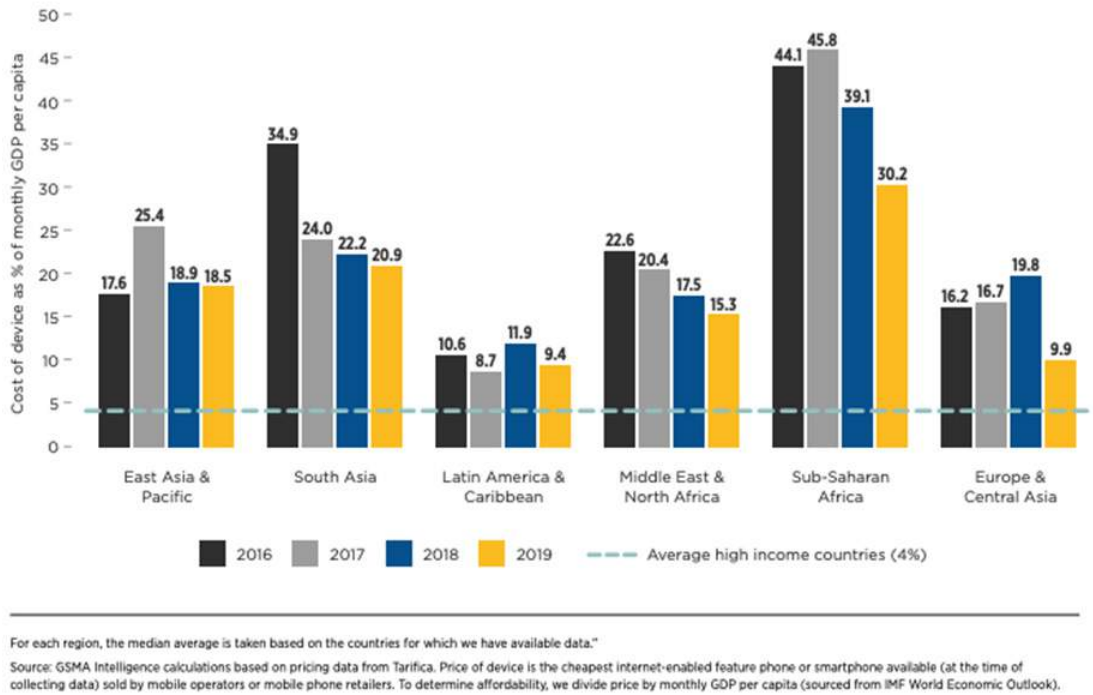


Source: GSMA. 2019. "State of Mobile Internet Connectivity Report 2019". https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/07/GSMA-State-of-Mobile-Internet-Connectivity-Report-2019.pdf
Note: GSMA Intelligence calculations based on pricing data from Tarifica. For each region, the mean average is taken based on the countries for which we have available data. Data on income distribution is sourced from the World Bank.

The cost of devices is critical in overall total affordability of Internet access as mobile Internet has become the primary method of accessing connectivity. As with technology in general, newer devices are more expensive than older ones, and as more countries expand 4G/LTE networks and pave the way for 5G while concurrently shutting down 2G and 3G services, legacy low-cost devices will need to be replaced with higher cost smartphones. Already, over 2 billion people live in countries where the most affordable smartphones cost more than 25 per cent of average monthly income.[18] In LMICs, entry-level, Internet-enabled devices are on average 34 per cent of monthly income ranging up to 80 per cent on average in some African countries[19] (see Figure 14). Millions of 2G handsets are still sold in Africa every year, with no or very limited transition of 2G customers to 4G handsets due to the cost gap between the two technologies, which is almost double. Some operators in LMICs, including Vodacom in Lesotho, South Africa and Mozambique, are subsidizing devices by selling below cost 4G entry-level smartphones to reduce the 2G-4G gap and drive 4G adoption.

In many countries in Sub-Saharan Africa, high import costs of devices and taxes also increase their local price. By way of example, 2G devices can be purchased from Chinese factories between USD 5 to USD 8. The sale price by the time they reach Africa is USD 5 to USD 25, due to tax, duty fees, logistic costs, and subsidies added by operators. Entry-level 4G smartphones[20] cost around USD 40. Import duties and tax can make up 40 per cent of this price. These prices can also be heavily impacted by fluctuations in local currency exchange rate against the US dollar. Currently, 70 per cent of the African mobile device market is supplied by Asian brands.[21] Due to COVID-19 pandemic effects on logistics and components availability, the cost gap between 2G and 4G devices is increasing and not decreasing – this is in direct contrast to the declining prices / value of older technologies in the past. This means that while the coverage gap reduces, the usage gap may remain open.

Figure 14: Affordability of an entry-level internet-enabled phone in LMICs, by region, 2016-2019 (GSMA, 2020)



For each region, the median average is taken based on the countries for which we have available data."

Source: GSMA Intelligence calculations based on pricing data from Tarifica. Price of device is the cheapest internet-enabled feature phone or smartphone available (at the time of collecting data) sold by mobile operators or mobile phone retailers. To determine affordability, we divide price by monthly GDP per capita (sourced from IMF World Economic Outlook).

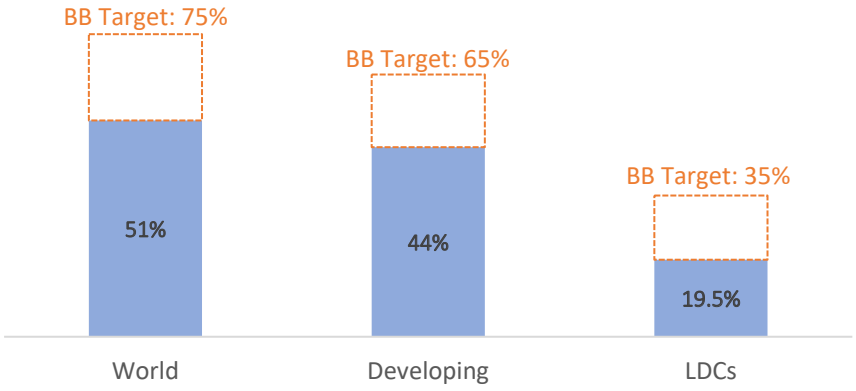
Source: GSMA. 2020. "The State of Mobile Internet Connectivity 2020". https://www.gsma.com/r/wp-content/uploads/2020/09/GSMA-State-of-Mobile-Internet-Connectivity-Report-2020.pdf

3.3 Advocacy Target 3

Getting people online: By 2025, broadband-Internet user penetration should reach: i) 75 per cent worldwide; ii) 65 per cent in developing countries; and iii) 35 per cent in least developed countries

According to the latest ITU data, global Internet user penetration is currently at 51 per cent (note that the ITU tracks data on broadband defined as more than 256 kbps). Internet user penetration is 44 per cent in developing countries, and in LDCs, Internet adoption is at 19.5 per cent, well below the 35 per cent target (see Figure 15). The proportion of individuals using the Internet in landlocked developing countries (LLDCs) in 2019 was 27.4 per cent and in small island developing states (SIDS) it was 52.4 per cent.[22]

Figure 15: Global internet user penetration, and by region, vs Commission target (ITU, 2019)



Note: For statistical purposes, broadband is defined as "everything greater than or equal to 256 kbit/s". See: "Handbook for the Collection of Administrative Data on Telecommunications/ICT, 2011": https://www.itu.int/en/ITU-D/Statistics/Pages/publications/handbook.aspx
Source: ITU. "Measuring digital development: Facts and figures 2020". https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2020.pdf

Prior to the COVID-19 pandemic, Internet usage growth around the world had been slowing globally, and between major country groups.[23] For example, household Internet access in low-income countries has increased on average by 18.8 per cent but in the most recent 12 months of data, it only increased by 3.8 per cent.[24] It remains to be seen how the pandemic will impact overall Internet usage growth as more people have had to go online to work, learn and communicate while some have not been able to continue using the Internet because of loss of income during the crisis. In some cases, recent survey data suggests new users are coming online in some developing countries, such as a recent survey in Afghanistan that found 60 per cent of respondents had subscribed to a new Internet connection since the beginning of the pandemic.[25] There is some indication that some of these new users will continue using connectivity even after the pandemic is over, as in Southeast Asia, a recent survey suggests that more than 1 in 3 digital services consumers (36 per cent of the total) are new to the service, and 94 per cent of them intend to continue using those digital services indefinitely, even after the pandemic.[26] In other markets such as in the US, millions of households have cancelled their home broadband connections and are only relying on mobile broadband connectivity.[27]

The significant gap between actual uptake and the Commission's target shows the urgent need for policies to increasingly prioritize demand-side challenges and address the barriers that prevent people from adopting and using the Internet. This is even more so, as data suggest that the vast majority of people that are excluded from the Internet are already covered by a (mobile) broadband network.[28] An investment-friendly policy framework for infrastructure will remain a top priority for enabling ever better Internet experiences. However, a narrow focus on infrastructure policies will not be enough to address the digital divide and achieve truly inclusive digital growth. Given a persistent lack of adoption and use, more needs to be done to complement infrastructure policies with demand-side policies. Such policies not only enable more people to participate in increasingly digital societies, but also contribute to the long-term sustainability of infrastructure investments.

3.4 Advocacy Target 4

Digital skills and literacy: By 2025, 60 per cent of youth and adults should have achieved at least a minimum level of proficiency in sustainable digital skills

Digital skills continue to be extremely important, all the more so today with the shift to remote work and learning brought about by the COVID-19 pandemic. Even prior to the crisis, economies around the world have been increasingly relying on digital infrastructure, applications and services. For example, one estimate by the United Nations forecasts that by 2030, there will be 230 million 'digital jobs' in Sub-Saharan Africa, requiring significant training to make this transition and fulfill this demand.[29] However, in LMICs, the lack of literacy and digital skills remains the main barrier reported to mobile Internet use (for those aware of the mobile Internet) and this is also the case for rural population in general (citing literacy and skills as the main barrier) compared to urban populations.[30] There are examples, however, of how pervasive digital mobile technology is, and how individuals who may not be writing-literate are able to use oral media and symbols to utilize mobile technologies for work and communication purposes.[31]

Box 4: The Digital Learning Working Group

With the broad interest of the Broadband Commission membership, the Working Group on Digital Learning leverages the unique composition of the Broadband Commission in order to better address the human element of school connectivity through solutions and contents that can empower learners and teachers. Convened through the UNESCO secretariat, the diverse Working Group of Commissioners and external experts has advised on the challenges and opportunities related to digital learning: including requirements for smart investments in infrastructure, delivery, skills development and future prospects through frontier technologies. Through its final report to be launched in autumn 2021, the Broadband Commission will be able to share expertise and perspectives that add to global knowledge and pathways for collective action.

The Working Group has been structured according to four strands of work:

1) **Infrastructure** (led by ITU): Innovation in infrastructure and connectivity operating models to ensure inclusive digital learning (in synergy with Giga, equipment and devices makers, investments models to create a sustainable digital learning infrastructure, etc.).
2) **Hybrid Learning** (led by UNESCO): Understanding the human dimension that facilitate effective hybrid learning, including analysis about appropriate roles for teachers and other facilitators, sustainable models of curriculum-aligned resource production and dissemination, and successful household and blended pedagogical learning practices.
3) **Digital Skills** (led by Ericsson): Competencies to use connected technology for learning and empowerment, digital skills for employability, anticipated labour market demands, abilities to navigate shifting and disrupted labour markets.
4) **Frontier-Technology impact** (led by Huawei): Scenarios for the future of digital learning, educational implications and advantages of frontier technologies, including AI, IoT, 5G, machine learning, data analytics, etc.

(continued)

The final report will introduce a range of factors that should be in place in order for hybrid learning to be a viable option for students, requiring deliberate planning, informed decision-making and substantial investment. It also will address considerations for accessing hybrid learning, especially those related to equitable access as required by SDG4: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all". The report will draw attention to trends, promising practices, and positive deviants related to the delivery of hybrid learning and student engagement. Emphasis will be on the experience of the teacher and student. It will begin with a taxonomy of the most common models of hybrid learning and proceed to examine the changing role of the teacher, approaches for monitoring and evaluating hybrid learning, and the value of diverse tools, open content, and digital skills in augmenting user experience. Finally, the Broadband Commission report will explore anticipated outcomes of hybrid learning and projections for the future of education and, by extension, the future of digital learning, which will include an analysis of select frontier technologies for hybrid learning, and associated recommendations for both low and high resource contexts.

For further information, please visit: https://broadbandcommission.org/working-groups/digital-learning-2021/

3.5 Advocacy Target 5

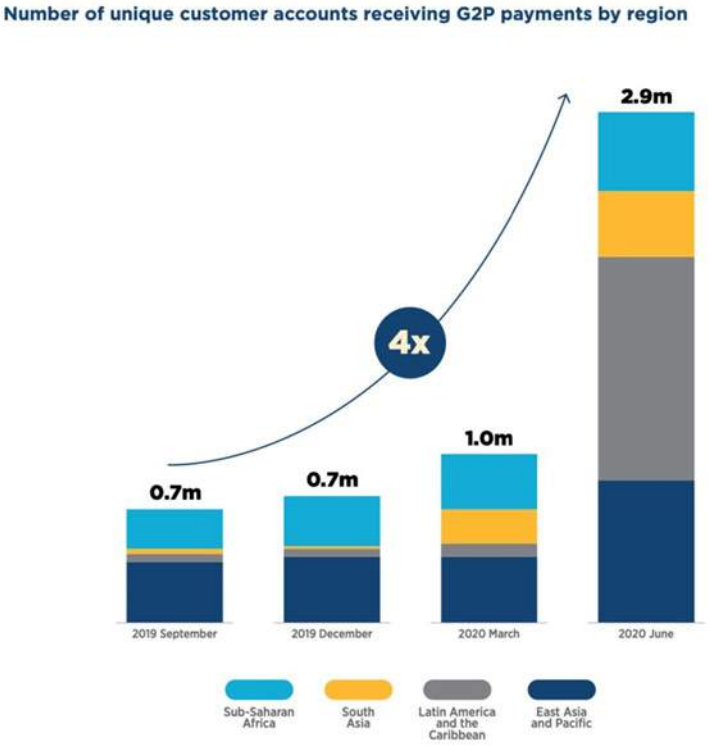
Digital financial services: By 2025, 40 per cent of the world's population should be using digital financial services

As with other digitally-enabled services that improve daily life, digital financial services have been heavily utilized during the COVID-19 pandemic for payment of transactions as well remittances. E-commerce has substituted for in-person shopping experiences. For example, in South Africa, 37 per cent of South Africans have reported shopping online more than usual during the crisis.[32] Other sectors that rely on or are connected to digital financial services are also seeing surges in utilization and adoption, such as e-logistics, entertainment, remote healthcare and other forms of FinTech.

In some regions, digital financial accounts already outpace traditional banking accounts such as in Sub-Saharan Africa where there are over 469 million registered mobile money accounts with daily transactions reaching USD 1.25 billion (at the end of 2019) versus 298 million traditional bank accounts registered.[33] With over 20 million active customers, M-PESA in Kenya now provides more revenue to its parent company (Safaricom) than any of its other business lines (voice; messaging; mobile data).[34] In India, the FinTech revolution has led to significant progress in digital financial inclusion. Innovative approaches like MNOs-backed payment bank licenses e.g. Airtel Payment Bank, are driving[35] financial inclusion across spectrum supporting communities like farmers and small-scale businesses.

Governments around the world have also been promoting cashless transactions, reducing charges on lending and leading efforts to limit cash handling as part of overall COVID-19 responses.[36] In an effort to bolster household income and social protection services, governments have also increased direct payments to citizens struggling with the impact of the pandemic. The number of citizens receiving 'G2P', or government-to-person payments, increased four-fold from September 2019 to June 2020, though much greater adoption is still likely (see Figure 16 below).

Figure 16: Number of unique customer accounts receiving G2P payments by region (GSMA, 2021)



Source: GSMA. 2021. "State of the Industry Report on Mobile Money 2021". https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2021/03/GSMA_State-of-the-Industry-Report-on-Mobile-Money-2021_Full-report.pdf

An innovative and disruptive component of digital financial services has been the rise of digital currencies which have risen in popularity and in direct investment in 2021. So much so that even the IMF's Managing Director has noted the potential for digital currencies to particularly benefit low-income and vulnerable groups who currently send small value remittances which are currently subject to high proportional transaction fees.[37] Over 50 monetary authorities worldwide are studying digital currencies because of their potential to dramatically change the nature of global finance.[38] For example, one estimate places the share of cryptocurrencies being used for remittances going to Mexico at least at 2.5 per cent, amounting to over USD 1 billion of the USD 40 billion sent home from Mexicans living in the United States.[39]

3.6 Advocacy Target 6

Getting businesses online: By 2025, improve connectedness of micro-, small- and medium-sized enterprises (MSMEs) by 50 per cent, by sector

Micro-, small- and medium-sized enterprises (MSMEs) were particularly hard hit by the pandemic because of their smaller size and fewer options for lines of credit and lower collateral in comparison to large firms. Evidence from the global ITC COVID-19 Business Impact Survey[40] shows that nearly two out of three smaller businesses saw their business operations strongly affected, compared to less than half of large companies. MSMEs were also at a higher risk of closure, with one in four (26 per cent) of micro firms expected to shut down permanently within three months. In comparison, only 9 per cent of large firms feared the same.[41] MSMEs that required close customer interactions were particularly affected, such

as those in hospitality services (cafes, restaurants, hotels), which faced closures, sales declines and workforce reductions, according to a Facebook survey of more than 35 000 small- and medium businesses (SMBs) across 27 countries in February 2021.[42] However, over 60 per cent of SMBs have introduced at least one process change to how they do business with over half (55 per cent) of SMBs globally using digital tools to communicate with customers. The higher the share of digital sales, the higher the share of overall sales for SMBs in the survey.

Research from the ITC finds that that what makes a company competitive in good times also makes it more resilient during crises.[43] Digitalization can therefore both give MSMEs a competitive edge during normal times and enable them to better cope with the increasing challenges brought by the pandemic and strengthen their future resilience. However, the key adoption challenges specific to MSMEs are: (i) availability of necessary technologies to digitalize (high-speed connectivity in urban and rural areas) and suitable digital tools and services; (ii) capacity of SMEs to digitally transform, when it comes to financial resources and time (and the pandemic has deepened these constraints); and (iii) capability of SMEs to gauge, plan, implement and optimize their transformation through digital skills.[44]

Singapore leveraged IMDA's SMEs Go Digital program to help enterprises during the COVID-19 period in 2020. This included the roll-out of the Digital Resilience Bonus (DRB) in May 2020 to uplift digital capabilities and provide additional support for enterprises in the food services and retail sectors, which were hardest hit by COVID-19. Eligible enterprises could receive up to USD 7 500 in one-time cash payouts when they adopted digital solutions that improved their business processes, strengthened their online presence and used data analytics to make informed business decisions.

In terms of SMEs addressing key connectivity challenges, the GSMA Innovation Fund for Mobile Internet Adoption and Digital Inclusion specifically focuses on start-ups and SMEs that are looking to tackle connectivity barriers around accessibility, affordability, digital skills, and safety and security that are preventing people from connecting to the mobile Internet.[45] SMEs can only benefit from the new opportunities arising from digitalization if their business ecosystem and national environment provide the necessary framework.[46] At the national level, SMEs can benefit from a strategic digitalization policy framework that:

- addresses availability gaps by supporting investment in areas where digital infrastructure is not available to SMEs (with a focus on closing the rural-urban connectivity gap);[47]
- offers grants or vouchers for digital investment so that SMEs have the capacity to find solutions based on their individual needs;
- delivers additional support measures to support capability such as curated online resources, training and incentives to encourage uptake; and,
- encourages and enables firms to adopt standards for digital goods and comply with technical regulations to make them more competitive in international value chains.[48]

The uptake and use of digital technologies by MSMEs will determine the extent of overall Internet economy growth, particularly in developing countries. For example, Accenture estimates that by 2025, the Internet economy could contribute 5.2 per cent of Africa's GDP, depending on the intensity of digital technologies usage by businesses.[49] This is where MNOs[50] are also coming forward to support the economic backbones of their nations by offering digital transformation solutions. Additionally, the Digital Villages Initiative by the UN Food and Agriculture Organization (FAO) highlights the potential for e-commerce and ecotourism to spearhead digital rural transformation especially for MSMEs.[51] Digital platforms – online intermediaries that link producers, consumers and service providers – are also opening up new

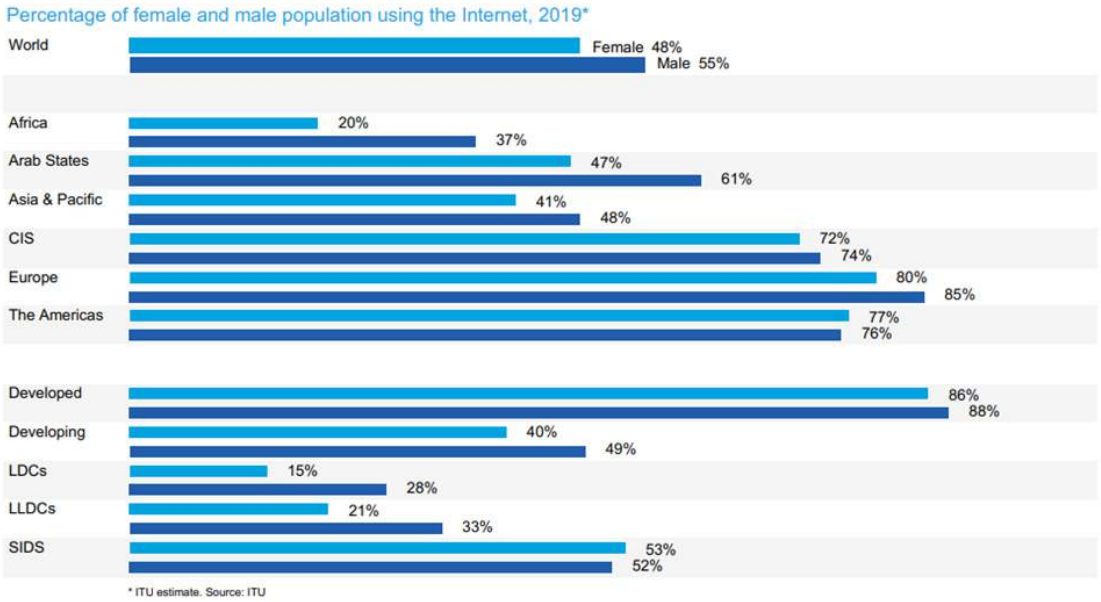
avenues of business for SMEs. They allow firms to move a number of brick-and-mortar business activities online, a crucial coping strategy during the COVID-19 pandemic.[52]

3.7 Advocacy Target 7

Achieving gender equality in access to broadband by 2025: By 2025, gender equality should be achieved across all targets

As more people use the Internet around the world, the growth rates of Internet adoption may be faster for men than women as the gender gap in Internet use appears to be larger in developing and least developed countries (see Figure 17 below). In 2019, it is estimated that globally, 55 per cent of the male population was using the Internet, compared with 48 per cent of the female population.[53]

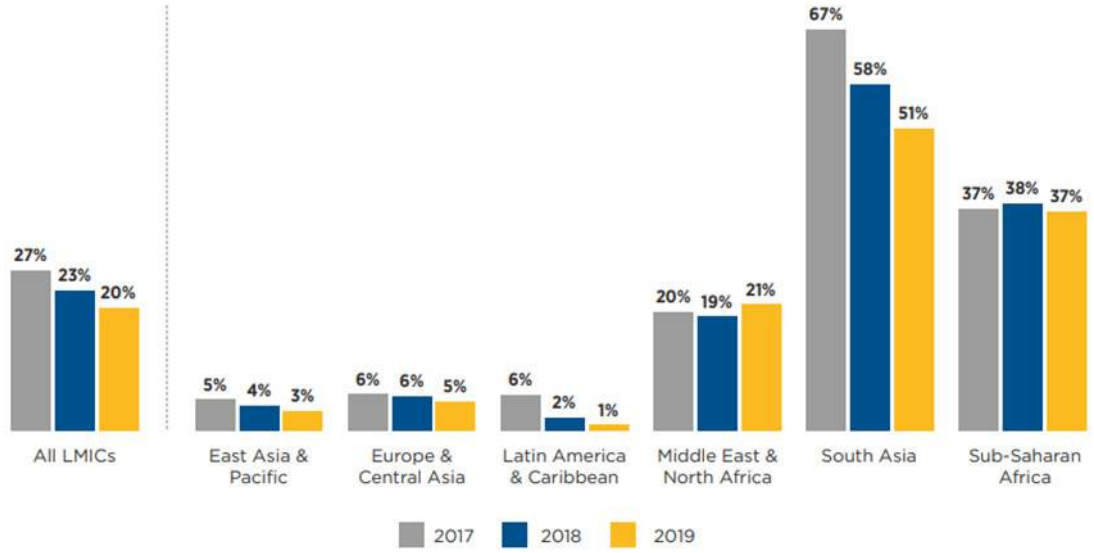
Figure 17: Percentage of female and male population using the Internet (ITU 2020)



Source: ITU Fact & Figures 2020. https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2020.pdf

In terms of the gender gap in mobile Internet use, particularly in LMICs, the gaps have been declining in the past three years. However, women in LMICs are still 20 per cent less likely than men to use mobile Internet, meaning around 300 million fewer adult women than men use mobile Internet[54] (see Figure 18 below).

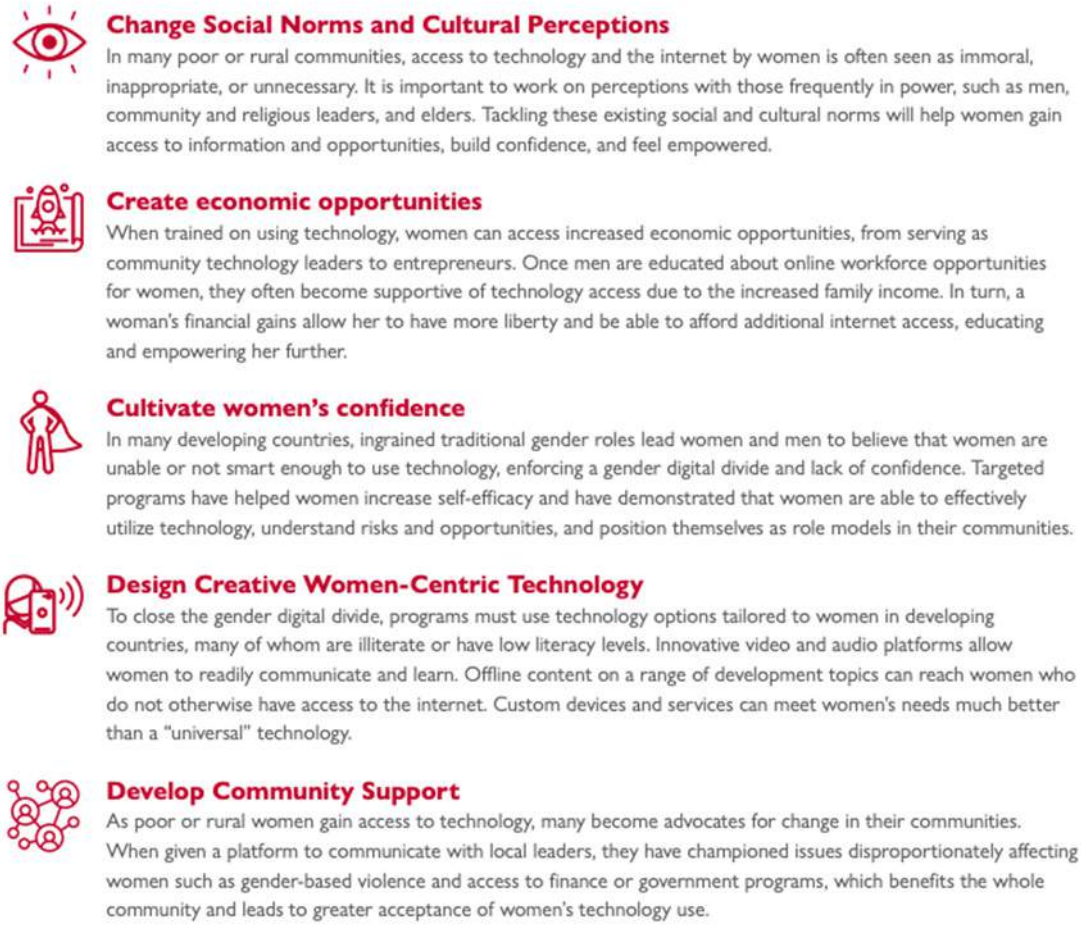
Figure 18: Gender gap in mobile Internet use in LMICs, by region (GSMA, 2017-2019)



Source: GSMA. 2020. "State of Mobile Internet Connectivity Report 2020". https://www.gsma.com/r/wp-content/uploads/2020/09/GSMA-State-of-Mobile-Internet-Connectivity-Report-2020.pdf
Note: The gender gap refers to how much less likely a woman is to use mobile Internet than a man. Based on survey results and modelled data for adults aged 18+.

Closing digital gender divides requires concerted effort by all those involved in the digital connectivity ecosystem.[55] One such analysis by the Digital Empowerment Foundation (DEF) recommends a number of actions to close the digital divide in India, including: adopting a targeted approach; envisaging a gendered digital strategy; building sustainable digital safety nets; prioritizing last-mile connectivity; strengthening e-learning for girls in public schools; encouraging attitudinal shift in parents and families; establishing regular short-term digital skill-building programs; creating useful, safe content and a secure digital space; fostering multi-stakeholder partnerships; and designing a digital policy framework for girls.[56] Similarly, the WomenConnect Challenge at USAID has identified five proven strategies to close the gender digital divide (see Figure 19 below). A range of additional materials, technical analyses, risk mitigation strategies and other tools are also available for assistance in designing interventions.[57]

Figure 19: Effective Practices in Closing the Gender Digital Divide (USAID)



Source: USAID. 2021. "Closing the Gender Digital Divide". https://womenconnectchallenge.s3.amazonaws.com/media/uploads/proven_strategies_digitalgenderdivide_final.pdf

In the context of the World Economic Forum Davos Agenda, leaders from the Generation Equality Forum Action Coalition on Technology and Innovation for Gender Equality have released a compelling call for collective action to spark a more equal and diverse digital transformation.[58]

Box 5: The Generation Equality

The 2021 Generation Equality Forum was a major global inflection point for gender equality. This landmark effort brought together governments, corporations and change makers from around the world to define and announce ambitious investments and policies. These diverse stakeholders have embarked on a 5-year journey to accelerate equality, leadership and opportunity for women and girls worldwide. This work will culminate in 2026.

The Generation Equality Forum took place in Mexico City in March and in Paris from 30 June – 2 July 2021. The Forum launched a 5-year action journey to achieve irreversible progress towards gender equality, founded on a series of concrete, ambitious and transformative actions, including USD 40 billion in financial commitments.

The Action Coalition is working to make sure women and girls have equal access to digital tools, are protected from online gender-based violence and can become the new generation of innovators.

The Action Coalition on Innovation and Technology, by 2026 will:

1) Reduce by half the gender digital divide across generations.
2) Increase investments towards feminist technology and innovation by 50 per cent to better respond to women and girls' most pressing needs.
3) Double the proportion of women working in technology and innovation.
4) Make sure countries and tech companies demonstrate accountability to fight online gender-based violence, which has spiked along with other forms of gender-based violence during the COVID-19 crisis.

The Action Coalition blueprint calls for boosting government and corporate accountability for policies and solutions to end online and tech-related violence and discrimination, so that technology remains a force for good.

For more information, see: https://forum.generationequality.org/sites/default/files/2021-03/TIGE_FINAL_VISUAL_EN.pdf

The EQUALS Global Partnership for Digital Gender Equality[59] aims to achieve equal access and use of digital technologies by 2030; empower women and girls in acquiring skills that will help them become both ICT users and creators in the digital world as well as in broader science, technology, engineering and mathematics (STEM) fields by 2030, and empower women as ICT leaders, creators, and entrepreneurs by 2030. Its activities include:

- Providing opportunities for collaboration, maximizing impact and supporting the scaling up of successful projects;
- Creating a networking platform for practitioners to leverage and strengthen current efforts to bridge the gender digital divide; and,
- Measuring progress towards the goals in the partnership vision as a vehicle to accelerate implementation of Sustainable Development Goal 5, especially Target 5B.

Box 6: Voices of the Youth, Building the Future We Want

Tackling inequalities is not something new, whether you've experienced inequality first-hand, witnessed a situation or read about it you probably know it can impact many different aspects of a person's life. In the scope of gender inequality, girls and women are now facing digital inequalities and this has only been heightened with the onset of COVID-19.

Knowing that broadband Internet is critical to economic growth, social development, and meeting the SDGs, it is something that should be universally available for everyone, including girls. This need was exemplified recently when our world went online due to COVID-19. Individuals were left to rely on Internet connectivity to communicate with the outside world and conduct purchases, and those lacking or with limited access were left behind.

The Broadband Commission has been leading the charge on advocating for broadband infrastructure, they utilize support from its members and are a voice of global leadership in universal connectivity but they also use voices like ours, voices of the youth, to advocate for the digital future we want. With the continuation of collaboration between Commissioners, their organizations and the youth, we can build high-impact partnerships to pave the way to meeting the SDGs and bridging the gender digital divide. We are the future and we need action for women, by women and with girls like ourselves, included. A unified approach is a strong approach, and together we can bridge the divide through effective partnerships.

We the youth also want greater connectivity access on a global scale to ensure that no girl gets left behind. Having access to broadband Internet is what powers mobile and learning devices. And once in the hands of girls, their future awaits. Following access to broadband Internet, advocating and action for the development of digital literacy for girls is the first step for girls entering the digital space. Access to devices and connectivity is important but we also need learning environments for girls that allow them to develop skills for industry ICT jobs, online marketplaces, personal projects and the science, technology, engineering and mathematics (STEM) field. With the movement of girls in STEM, it is important to remember that digital literacy sets the foundation for all the other great opportunities for them in the STEM fields and the workforce in today's digital economy. Skills that may be second nature for one girl can make the difference for the next, working to give these opportunities to girls is what we want and expect in the digital world we live in today, and it is how we create digital equality.

Source: from Alisha Arora (15), Nicole Damianidis (17), Maria Ivoditova (16), and Marianna Speranza (17).

3.8 Data Collection Challenges

Accurate and up-to-date data collection remains a challenge for some of the advocacy targets, as noted in the sections above. Many of the data series used for these targets come from national statistical agencies. The process of collecting data at these levels of granularity remains labour-intensive and incurs high-cost burdens. Some of the data available for measuring progress against the targets is more robust for developed countries and remains a challenge for some developing countries. There may be other methodologies to collect similar, or proxy, datasets, and/or consider reporting on a semi-annual basis rather than annual. As such, further discussion on these challenges, possibilities and trade-offs is required. See for example, the use of proxy data sets and collection methods (remote sensing, mobile phone usage, CDR) that can provide enormous potential to have a better way of monitoring progress on the SDGs in near real time.[60]

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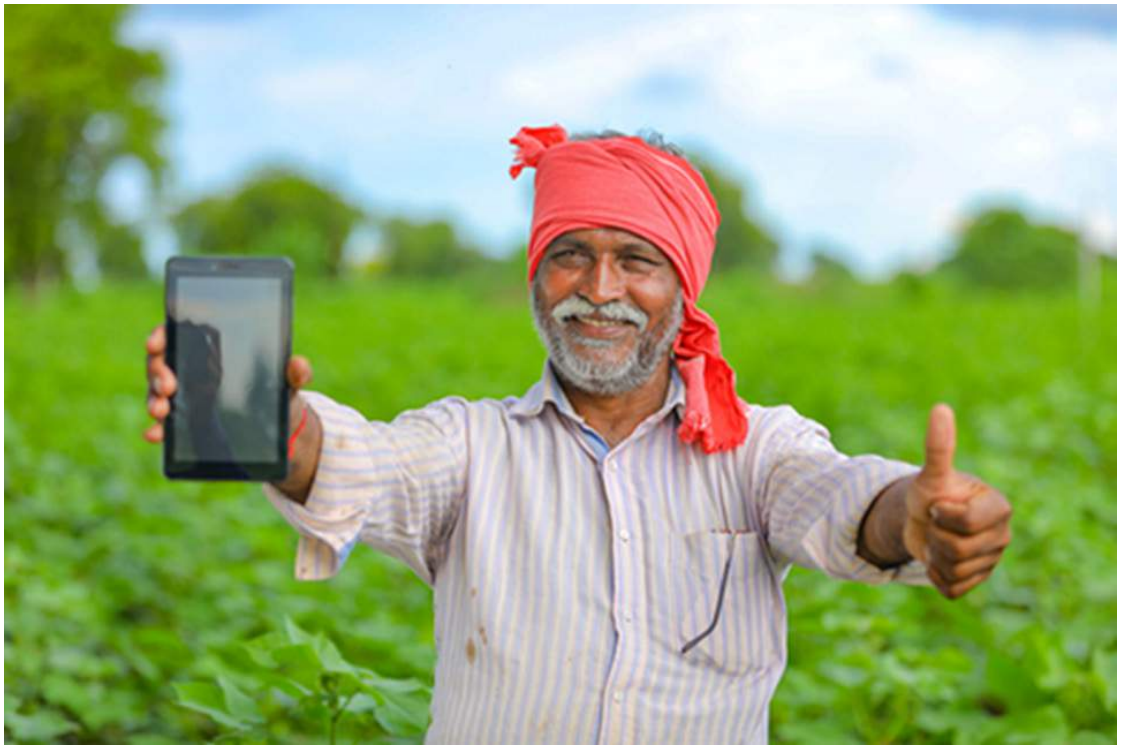
4 Policy perspectives on achieving people-centred digital transformation



As the world attempts to rebound from the COVID-19 crisis, national ICT policies, broadband plans and digital strategies are required to fully embed and integrate digital infrastructure, ensuring adoption and use of Internet services and applications in order to best leverage the potential for digital transformation to help transform society and ensure no one is left behind and left offline. The IMF is estimating that, compared with pre-crisis forecasts, incomes per person in 2022 will still be 20 per cent lower in emerging and developing countries (and 11 per cent lower for advanced economies).[1] A crisis prolonged by additional waves of COVID-19 outbreaks, particularly in developing countries, would impact income levels even further and require even more effort and measures to build back better. Policies that focus on the impacts of digital at the individual level and address end-user challenges and needs may prove to be the most effective in order to spur investment, innovation, improve affordability of access and devices, and achieve digital inclusion. Key elements of any policy focused on digital transformation must ensure prioritization of people, inclusivity, fundamental rights and equality of opportunity; focus on core development issues such as agency, power, and structure in this digital age; employ a comprehensive ecosystem approach recognizing spillovers; be inclusive, leaving no one behind and prioritizing the protection of the most vulnerable; be integrative, not additive; and require leadership and ownership.[2,3]

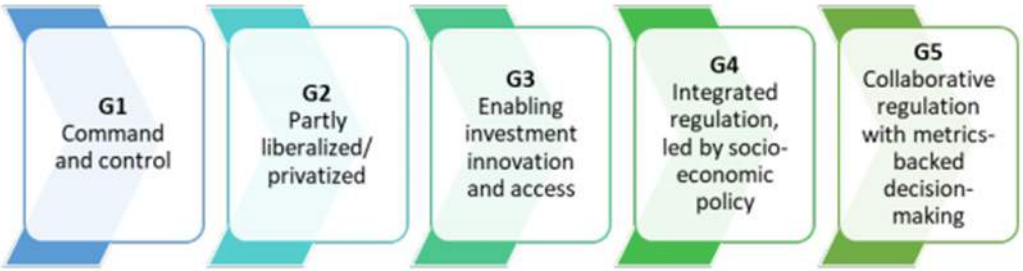
4.1 Increasing convergence between high-speed digital infrastructure and all other sectors

Due to the ubiquity of digital infrastructure across business, government and at the individual level, approaches to policy on broadband are increasingly incorporating other sectoral issues, and vice-versa. The increasing reliance on digital infrastructure, services, and applications in nearly every sector and facet of economies and societies is made clear by the overlaps and engagements in policy issues between sectors and the subsequent government departments and ministries responsible for the sets of issues in those domains. Organizations around the world are developing their own internal digital transformation strategies as well as incorporating digital infrastructure advisory into their project work. The United Nations Development Programme (UNDP) has introduced its first organization-wide digital strategy.[4] UNHCR, the UN Refugee Agency, has also begun to develop a digital strategy, and, as part of the UN Secretary-General's 2030 Roadmap, is developing a specific working group on digital inclusion of forcibly displaced people. Similarly, USAID launched its Digital Strategy in April 2020, taking a systems-level approach to understanding and responding to the opportunities and risks of digital technology internally and externally.[5]

Investments in agriculture, health, education, and finance, among others, not only rely on digital connectivity but in some cases are spurring direct investment in digital infrastructure to support investments and service delivery in other sectors.[6] For example, legislation focused on agricultural development that also builds investment for high-speed broadband to support rural communities.[7] And some efforts, such as ITU's Smart Villages project in Niger alongside the World Bank take a comprehensive approach to development, underpinned by connectivity.[8]

As telecommunications regulators move towards a notional next generation (or 'G5' as it is being called) of sector regulation, transitioning from "integrated regulation, led by socio-economic policy" to "collaborative regulation with metrics-backed decision making", examples of collaboration between ICT regulators and non-ICT regulators are emerging (see Figure 20, Table 3, and Figure 21 below).

Figure 20: Generations of regulation: G1 to G5 (ITU, 2020)



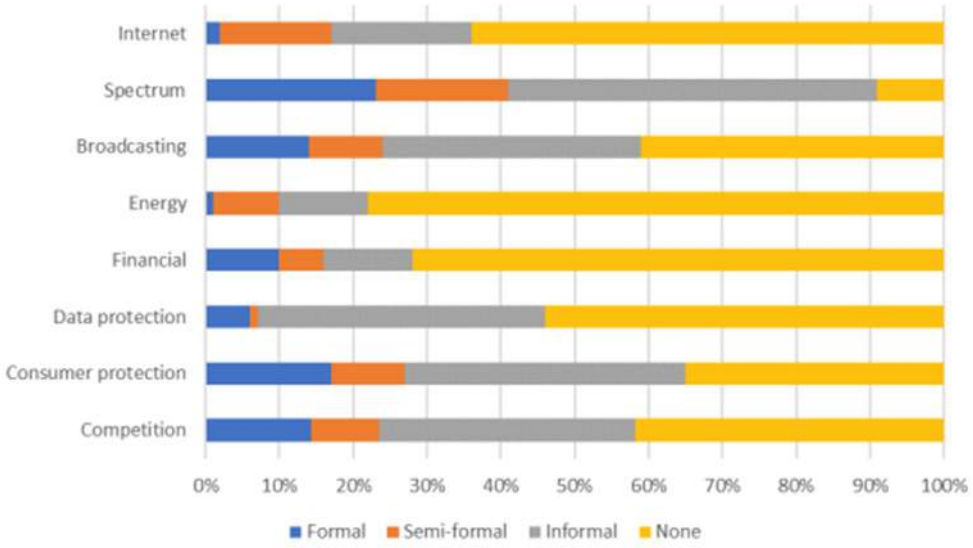
Source: ITU & World Bank. 2020. "Digital Regulation Handbook". https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-TRH.1-2020-PDF-E.pdf and platform www.digitalregulation.org
Note: Generations 1 through 4 are measured through the ICT Regulatory Tracker: https://appdev.gen5.digital/g5/metrics Generation 5 is measured through the G5 Benchmark: https://gen5.digital/g5-benchmark/.

Table 3: Examples points of collaboration between ICT regulators and other agencies (ITU & World Bank, 2020)

Non-ICT regulator	Topics of potential colleaboration with the ICT regulator
Commerce / trade	Digital taxation, online digital services
Cybersecurity	Data use, end user devices, IoT
Education	Child online protection, digital divide
Energy	AI, blockchain, IoT
Finance	Blockchain, cybersecurity, financial inclusion, mobile financial services, privacy
Transportation	Cybersecurity, IoT, privacy

Note: Other sectors as well, such as agriculture, have various issues that require collaboration between regulators.
Source: ITU & World Bank. 2020. "Digital Regulation Handbook". https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-TRH.1-2020-PDF-E.pdf and platform www.digitalregulation.org

Figure 21: State of regulatory collaboration between ICT regulators and other authorities in cases where both exist and are separate entities, worldwide (ITU &World Bank, 2020)



Source: ITU & World Bank. 2020. "Digital Regulation Handbook". https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-TRH.1-2020-PDF-E.pdf
Note: Country sample size in order from top to bottom: 48, 22, 92, 116, 172, 72, 101, 92.

Even new ministries and departments are emerging to handle the cross-sector nature of digital technologies. For example, in Japan, the parliament signed a set of laws establishing a new government agency in charge of a range of digital issues from infrastructure investments to policies governing use.[9] In Spain, the economy, connectivity and digitalization have merged into the new Ministry of Economic Affairs and Digital Transformation.[10] One clear example of the cross-sector nature of digital technologies has been in the case of how a wide number of sectors experienced delays in production in 2021 due to a global shortage computer chip manufacturing.[11] As such, digitalization strategies should be cross-sectoral, harmonized and driven by horizontal guiding principles that promote a pro-innovation and pro-investment regulatory environment. In relation to digital, related policies need to incorporate a detailed

and specific focus on realizing the industrial and economic benefits associated with 5G, IoT, Data, Cloud and SMEs.

4.2 Ensuring public confidence in broadband

Ensuring trust, security and confidence in engaging online is critical for encouraging more participants to join the digital economy. The continuous increase in cybersecurity incidents is a growing negative trend that requires more action. In the first quarter of 2020 alone phishing scams increased by 350 per cent globally as more individuals shifted more of their activities online and criminals took advantage of people's fears and anxieties.[12] Several large-scale attacks on critical infrastructure have also occurred recently, such as the ransomware attack that shut down half of the United States' gasoline pipeline.[13] Vulnerabilities in systems can be far-reaching and allow malicious actors to exploit systems undetected.[14] In these cases, more robust tools, more assistance and coordination between public and private agencies could be impactful. MNOs are providing tools to their customers to generate confidence in digital engagement, and provide a safe, secure cyber experience, e.g. Airtel's 'Secure Internet' subscription for its fibre customers[15] or offering Kaspersky security solutions for PC and smartphones via Airtel's Thanks app.[16] Greater government investment in capacity building to increase systemic cyber resilience could also be coupled with incentives, and private and public investments to fuel cyber defense initiatives and projects at international, national and individual levels.

Issues of targeted misinformation, undermining of public trust and civility can sow societal discord. Malicious actors have demonstrated an ability to leverage technology and social media to subdue opponents and gain (or exert) political power.[17] Misinformation has been particularly rampant in the anxiety surrounding the COVID-19 pandemic, and even some unfounded conspiracy theories, such as the safety around 5G, have reached more audiences online.[18] Toolkits of counter actions, such as the 23-step tool to assess disinformation responses, as presented in the Broadband Commission's 2020 report "Balancing act: Countering digital disinformation while respecting freedom of expression", as well as public trackers, along with coordinated responses can help in this regard.[19] To counter such myths propagated around new technologies like 5G, it is important that the governments and industry work together in advocacy and awareness campaigns, e.g. in India, the Ministry of Communications recently highlighted[20] there was no link between COVID-19 and 5G. A user-centric approach means that it is critical that users are equipped through capacity building and digital skills training (at all levels of education) with the right tools to address online risks and safety issues. The European Union has proposed a Digital Services Act which introduces regulatory supervision for very large online platforms.[21] The UK has introduced an Online Safety Bill which would introduce a duty of care for digital services in respect of illegal or harmful content they host.[22]

Increased security and accountability of global ICT supply chains is also needed. Over the past 20 years, supply chains have become globalized and complex, entailing intricate networks of partners with strong interdependencies. This evolution and its effects are particularly acute in global ICT supply chains, as they involve a sophisticated and partly intangible ecosystem of hardware, software components, IT and data systems, and real-time remote services.

The world should prepare for major changes in its supply chain landscape. With the advent of 5G, operators are going to deploy a virtualized and software-defined infrastructure that will enable edge computing and network slicing. While 5G standards incorporate many advanced security features, as in previous generations, security will be achieved through how security is

implemented in the software and hardware provided by the suppliers and then operationalized by network operators. The telecom networks and digital services of tomorrow will be delivered by an environment of operators, vendors, cloud providers and managed service providers, where certain functions will move closer to the user and some functions may be outsourced to third party suppliers. Already today, a third of telecom security incidents in Europe are third-party failures, such as hardware malfunctions and software bugs.[23] The greater connectivity solutions enabled by advanced networks will increase the attack surface through the sheer volume of new devices connected to the network. Therefore, it will continue to be necessary for security to be a priority in the design of connected technologies going forward. However, many of the vulnerabilities involved with software and hardware failures are not new as documented by Europe's experience.

In issues of privacy particularly during the COVID-19 crisis, the use of digital identification has enabled the expansion and delivery of public services. But the growth and deployment of digital identification also needs to be balanced with concerns of digital privacy issues. Engendering trust in digital ecosystems requires ensuring that any sort of digital identity preserves privacy and control over an individual's own information while empowering them to gain access to much needed services. However, for at least over 1 billion individuals worldwide, lack of recognized identification limits their ability to access basic goods and services.[24] In Indonesia, for example, exclusion from the digital ID system for underrepresented groups results in exclusion from the COVID-19 vaccination program.[25] Recent work by the World Bank seeks to identify how to address many of the misaligned incentives, incompatibility of data systems, and growing distrust in data use, while recognizing the data-driven services that can be provided to individual citizens.[26] The World Development Report 2021 articulates a new vision for a social contract that enables the use and reuse of data to create economic and social value, ensuring equitable access to that value and fostering trust that individuals' data will not be used in harmful ways. Several country examples are emerging with effective approaches to establishing positive mixes of laws and policies, institutional arrangements, and technical architectures in creating trusted data sharing environments between providers and users.[27]

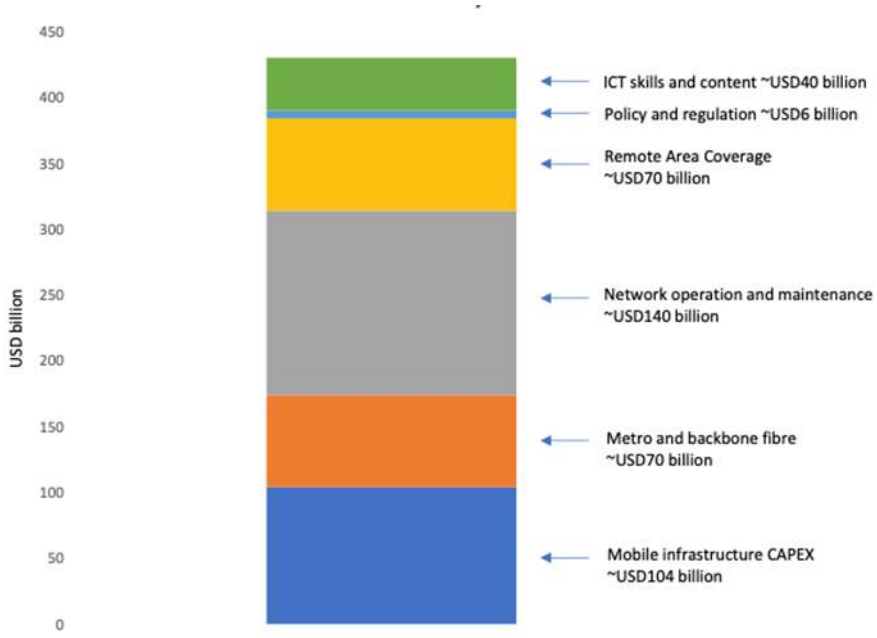
For example, Singapore's Personal Data Protection Act (PDPA), which was first enacted in 2012, was updated in 2021 with amendments to keep pace with rapid technological changes and increasing data use. The amendments include recognizing legitimate purposes for the collection, use and disclosure of personal data to support digital innovation, and to mandate data breach notifications.

4.3 Additional investment policy options

Recent estimates by the ITU suggest that at least USD 428 billion is required to reach universal broadband connectivity by 2030.[28] These investments span mobile infrastructure investments (capital expenditures), metro and backbone fibre networks, network operation and maintenance, supporting device affordability, rural and remote deployments, policy and regulations, and ICT skills and policies (see Figure 22 below). Other analysis by the Boston Consulting Group suggests it could take USD 2 trillion to halve the digital divide and bring 2 billion more people into the digital age.[29] In addition to the significant funding levels required, issues of fragmentation (of funding, legislative and regulatory frameworks, investment and distribution) and coordination across regions, government levels, and between public and private sector entities exist, and innovative funding models and partnerships may be required to overcome these challenges.

Figure 22: Investment needed to achieve universal access to broadband connectivity by 2030 (ITU, 2020)

~USD 428 billion is needed to achieve universal access to broadband connectivity across the world



Source: ITU. 2020. "Connecting humanity". https://www.itu.int/en/myitu/Publications/2020/08/31/08/38/Connecting-Humanity

Furthermore, strategic policy initiatives and investments should also aim to expedite 5G networks deployment (by reducing 5G deployment obstacles), enhance SMEs' digitalization, promote the industrial data economy (including industrial data sharing) and unlock Industrial IoT. In developing and large markets where affordability of connectivity and services is a prime concern along with the need to attract investments into network rollouts, it is important that policy-makers continue to find approaches to keep the input costs for network operators low.

Box 7: 21st Century Financing Models for Sustainable Broadband Development Working Group – Outcomes

The Working Group for 21st Century Financing and Funding Models for Sustainable Broadband Development was established as a cross-sector group of thought-leaders with representation from national regulatory authorities, telecommunications operators, financial institutions, trade associations, academics and not-for-profit development organizations operating under the auspices of the Broadband Commission for Sustainable Development. Its objective was to explore and identify new and innovative funding, financing and investment strategies to address the challenge of extending broadband connectivity and services to the 3.7 billion people who remain unconnected today, particularly in Africa, Asia, South America and the Pacific Islands. The Working Group was co-chaired by Scott Gegenheimer, CEO – Operations of Zain Group, and Bocar A. Ba, CEO of SAMENA Telecommunications Council.

The Working Group on 21st Century Financing Models for Sustainable Broadband Development recognizes that to address the critical issues of access, affordability, and equality there will have to be new approaches that support the development of digital infrastructure, especially where it would otherwise not be profitable. Additional support for the confluence of factors beyond infrastructure is also needed to create and sustain socially relevant and functioning digital ecosystems. Establishing these new approaches will mean resolving complex concerns and attending to stakeholder interests that demand thoughtful multilateral engagement. It is imperative to come to solutions that reflect the interests of all parties, which do have a direct role to play to help create the global infrastructure and also help sustain social and economic ecosystems that will define the next century, and beyond.

With the combined efforts of the Broadband Commissioners and external experts, Working Group members have identified a variety of innovative models through novel combinations of traditional ones as well as employing completely new ones. The report integrates these models as core components into four larger strategic recommendations representing the report's key outcomes, that structure the document and that reflect current economic and political realities. The strategic recommendations focus on broadening the base of contributors: earmarking proceeds from ICT sector participants, reforming Universal Service and Access Funds (USAFs), and creating an international fund.

For more information, see: https://broadbandcommission.org/working-groups/21st-century-financing-models-2020/

4.4 Innovative partnerships

Inclusive, innovative partnerships that leverage the unique strengths of each participant in digital infrastructure development are required to translate roadmaps and action plans into concrete achievement by the United Nations' 2030 target date. As shown above, Internet user growth rates are slowing while the digital divide, in some respects such as in gender, is widening. As such, the global community is at an inflection point in our shared mission of connecting the world to bring the power of digital transformation to every community.

As the pandemic surfaced and amplified inequalities in education, UNESCO rapidly mobilized support to launch the Global Education Coalition in March 2020 to ensure the continuity of learning around the world. Working around the three central flagships of Connectivity, Teachers and Gender Equality, the multi-sector Coalition now brings together 175 institutional partners, representing the UN family, civil society, academia, and the private sector, including numerous members of the Broadband Commission. The Coalition uses a mission approach to achieve large-scale targets and as a way to operationalize actions.[30] As of March 2021, the

Coalition's Global Skills Academy had reached 142 000 beneficiaries through training on skills for employability and resilience; the Global Teacher Campus delivered free training on quality and inclusive remote, hybrid and in-presence teaching to 30 000 educators; and the Global Learning House reached 149 000 learners, with a special focus on STEM.[31]

These innovative approaches include public-private collaboration to connect the unconnected[32] as well as 'coopetition' whereby seemingly competitors in the private sector can benefit by working together, with a higher vision of jointing impacting efforts to meet the Sustainable Development Goals.[33] Examples in this regard can include industry groups gathering competitors to introduce new technologies that lower the cost of capital investment upgrades as well as implement whole scenario end-to-end solutions that lower the cost of capital investment upgrades, such as site sharing, or flexible license spectrum. For these partnerships to succeed, certain conditions are required:

- policy frameworks which incentivize investment and ensure sustainable competition;
- policies which encourage the digitization of industry, leveraging cutting-edge technologies;
- empowering citizens by ensuring that trust is built in by design, through smart regulation which can keep pace with the speed of technological change.

Collaboration between different sectors in voluntary infrastructure co-deployments and/or sharing can also further reduce the cost of expanding networks. These include sharing rights-of-way via sewage and water systems, railways, electrical power grids (including directly using optical ground wire, or OPGW), roads and carriageways, as well as gas and oil pipelines. Telecom networks can leverage these other sector assets via ducts, poles, sites, masts, dark fibre, spectrum sharing and also active network equipment. Analysis by Deloitte and APC found that coordinating network rollout between telecom and road construction, leveraging passive infrastructure, could save approximately 80 per cent of the fibre roll-out cost (or USD 16 million per 1 000 kilometres) and only add 0.9 to 2 per cent of the total cost of the road.[34] A number of other assessments have reiterated the benefit of such multi-sector infrastructure deployments (see Table 4 below).

Table 4 Cost savings to telecom from infrastructure sharing

Study	% Savings	Summary
EC, "Impact assessment" (2013)	75	The initial cost of network deployment in Western Europe using existing ducts ranges from EUR 20–25 per metre compared to an average of EUR 80–100 per metre for deployments that require digging.
Ofcom/CSMG, "Economics of Shared Infrastructure Access" (2010)	57-67	Sharing infrastructure networks such as reusing existing ducts where possible could result in up to 57 per cent cost savings in urban and 67 per cent in suburban areas.
Analysis Mason (2012), "PIA Versus Self-Build Fiber in the Final Third: Digging into the Financials"	29-58	Cost savings that may be achieved by using passive infrastructure sharing in the UK depend on areas covered and additional works to be done. Savings could range from 29 per cent in relatively densely populated areas using a combination of infrastructure sharing and traditional trenching, to 58 per cent in sparsely populated areas using the cheaper slot-cutting trenching approach.

Sources: Adapted from IDB. 2020. "Digital transformation: Infrastructure sharing in Latin America and the Caribbean". https://publications.iadb.org/publications/english/document/Digital-Transformation-Infrastructure-Sharing-in-Latin-America-and-the-Caribbean.pdf

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5 The path for broadband to impact progress towards the 2030 Goals

Since 2012, the Broadband Commission for Sustainable Development has provided a high-level platform to advocate for policies that advance the deployment of broadband infrastructure and the adoption of high-speed communications applications and services that advance economic growth, social development and environmental sustainability. Annex 1 summarizes the recommendations of the Commission from the previous State of Broadband reports, all of which are focused on achieving digital inclusion and closing the digital divide. In addition, a number of recent and current Working Groups of the Commission have researched related topics such as the use of ICT in epidemic management, innovation measures on financing and investment, and digital learning, among others.

The spirit of the recommendations of the Commission have also been reiterated in other organizational proclamations, including the recent launch of the OECD's "Recommendation on Broadband Connectivity", adopted by the OECD Council in 2021. These include: Fostering competition, investment, and innovation in broadband development; Measures to eliminate digital divides and reduce barriers to broadband deployment; Measures to ensure resilient, reliable, secure, and high-capacity networks; Minimizing negative environmental impacts of communications networks; and, Regularly assessing broadband markets.[1]

5.1 Measuring the economic and social impacts of broadband for the 2030 Agenda

The economic literature on the positive contributions of broadband to growth continues to expand with recent analysis adding to the picture. Various methods of economic analysis are demonstrating economic impact and these different methodologies include cost-effective analysis, econometric analysis, cost-benefit analysis, social returns on investment, and multi-criteria analysis.

Over the past five years, network operators have invested over USD 900 billion in capital expenditure, reducing the number of individuals living outside of mobile broadband coverage by close to 1 billion. And over the next five years, operators will invest an additional USD 1.1 trillion in their networks globally, with close to USD 250 billion in the Asia Pacific and USD 50 billion in Sub-Saharan Africa. Investments by other players are also having an impact. For example, Analysys Mason's recent analysis of the economic impact of network infrastructure investments by Facebook in Latin America, Southeast Asia, and Sub-Saharan Africa points to positive economic contributions of more than USD 200 billion in economic growth in these regions over the next five years, including contributions from operator partners.[2] Similarly, as a result of Google's more than USD 2 billion in network infrastructure investment in the Asia-Pacific region since 2010, Analysys Mason estimates over 1.1 million additional jobs were created and USD 430 billion in aggregate GDP growth between 2010 to 2019.

Similarly, a joint research project between Imperial College and Ericsson, covering data from 135 countries, has shown that a 10 per cent increase in mobile broadband (MBB) adoption ratio causes an average 0.8 per cent increase in GDP.[3] The effect from MBB is considerably larger and more significant in low-income and non-OECD countries compared to high-income and OECD countries. This means that there is considerable potential for low-income and non-OECD countries to leapfrog their economic development by investing in MBB infrastructure.

At a more local and granular level, other initiatives point to the impact of basic digital access and literacy training, such as the USD2.40 in social value generated for every USD 1 in investment in 'TechPaks', or individual laptops, access and guides to equip individuals with digital literacy training, skills and Internet technology.[4] Among migrant and refugee populations, recent analysis by Mercy Corps and the Harvard Humanitarian Initiative identified a positive correlation between Wi-Fi connectivity and reduced depression and anxiety among migrants and refugees, as well as a direct relationship between connectivity and improved measure of psychosocial well-being.[5] UNHCR has expanded its digital inclusion work, emphasizing 'people-centric' approaches to this, ensuring that refugees and their host communities are part of solutions to break down digital divides. For example, community network projects are being carried out that leverage communities' skills and capacity to build out sustainable connectivity solutions. This is complemented by detailed assessments with communities on their connectivity and digital technology needs.[6]

Additionally, the Internet Society highlights how digital platforms are supporting individuals in the informal sector by bolstering societal resilience as platforms have been critical in supporting government responses to the outbreak and supporting harder-to-connect groups.[7] One such example is in Nigeria where the government relied on payment service providers to distribute cash transfers to 3.6 million impoverished households by August 2020.[8]

5.2 Broadband connectivity and the climate emergency

As countries around the globe have banded together over the past year to address the existential threat that COVID-19 has levied on humanity, another significant global problem is demanding at least a similar level of effort and cooperation. The planet's changing climate will particularly affect low-income populations, and digital technologies and the broadband ecosystem are positioned to make an outsized contribution to addressing the climate emergency both by helping to build resilience to climate stresses through the use of digital technologies, as well as by demonstrating leadership and investment in commitments to reach net zero, and beyond, in terms of carbon emissions.

GSMA recently highlighted how digital and mobile-enabled solutions can address climate change specifically in seven dimensions: enabling clean energy and energy efficiency; improving mobility and logistics; improving natural resource management and forestry; improving agriculture; managing water solutions; improved waste management and circular economy solutions; and increased disaster preparedness and effective response.[9] In addition, 18 thematic areas were shortlisted from an assessment of likely intervention and the scale of their impact to greenhouse gas (GHG) mitigation, adaptation and resilience (see Figure 23 below).

Figure 23 Eighteen high-potential thematic areas in which digital solutions can address the climate challenge (GSMA, 2021)

Sector and intervention area	Description	Scale of impact of GHG mitigation, adaptation or resilience	Transformational role of mobile-enabled solutions
Energy – Mitigation	PAYG solutions to enable household or business access to clean energy, battery storage or cooking technologies, and linkage to productive energy use.	Decentralized renewable sources help reduce the need for fossil fuel generation. PAYG solar and storage can also displace diesel generators, which are responsible for the same amount of GHG emissions as 700 to 1 000 coal-fired power stations in LMICs.	Mobile has a vital role in linking service providers to customers, changing consumer behaviour and providing incentives, and facilitating monthly payments via mobile money.
Energy – Mitigation	Digital services to enable energy efficiency and demand response via smart metering of homes, industry, businesses and offices, connect to IoT, etc.	Reduced usage and mechanisms to flatten peak demand for energy generation have a significant impact on reducing GHG emissions from fossil fuel energy generation.	Mobile-based solutions are an enabling interface, linking IoT-connected devices together and to the smart meter, along with mobile money for bill payments.

(continued)

Sector and intervention area	Description	Scale of impact of GHG mitigation, adaptation or resilience	Transformational role of mobile-enabled solutions
Agriculture – Mitigation, Adaptation & Resilience	Digital solutions in logistics and supply chain efficiency and integration (such as access to chilled storage, producer-to-market solutions, home grocery delivery, etc.).	Reducing food/produce waste is a major driver of GHG mitigation, supported by reduced transport emissions. Digital solutions can also greatly improve the resilience of value chains, as experienced during COVID-19.	Mobile is an enabler, helping to link producers to markets more efficiently, and provide platforms for marketplace services, including payment, aggregation and allocation. Significant scope for accountability and traceability to be incorporated via blockchain, etc.
Agriculture – Mitigation, Adaptation & Resilience	Digital tools that enable more climate-smart/resource-efficient farming, including to help farmers respond to less reliable rainfall and weather patterns; to identify crop disease or other crop or livestock related problems; and suggest mitigating actions and support climate-smart agriculture value chains.	Climate-smart agriculture is predicted to be a major driver of GHG emissions mitigation. Agriculture is also on the frontline of climate change impacts and can greatly benefit from a range of more resilient approaches.	Central role for mobile-enabled services that draw on mobile money and AI (machine learning) in particular. Mobile also enables enhanced monitoring, diagnostics, and predictive and prescriptive functionality to improve agricultural production, resource allocation and management and reduce post-harvest losses.
Agriculture – Adaptation & Resilience	Provision of livestock management and remote veterinary services. Could include geotagging of nomadic livestock herds using GPS or integration of migration patterns with real-time water and pasture resource mapping.	Such a system can be used in several ways, including cross-border animal health systems, epidemic early warning systems and drought early warning systems.	Central role for mobile-enabled services depending on connectivity in remote areas for tracking and monitoring. Potential use of network-connected veterinary measurement devices (IoT).
Natural Resource Management (NRM) (including forests) – Mitigation	Integrated digital solutions to measure, report and verify avoided deforestation and sustainable resource management, linked to payments for ecosystem services, especially for local residents and indigenous communities.	Forest conservation is extremely important for mitigation. Forests are also vital to maintaining biodiversity and resilience, including by reducing the likelihood of flooding during heavy rainfall events.	Central role for mobile as an interface and mobile money for payments, awareness-raising and community-based NRM.

(continued)

Sector and intervention area	Description	Scale of impact of GHG mitigation, adaptation or resilience	Transformational role of mobile-enabled solutions
Natural Resource Management (NRM) (including forests) – Mitigation	Gamification initiatives that channel financial resources to NRM or afforestation programs, often linked to use of mobile money services (e.g., Ant Forest, China).	Afforestation and restoration of natural resources is extremely important for mitigation and resilience.	Central role for mobile as the interface to incentivize behaviour and facilitate calls to action and payments.
Natural Resource Management (NRM) (including forests) – Mitigation	Digital solutions (including awareness, information, market linkage opportunities) to catalyse sustainable livelihoods in high natural resource value-areas (forests, watersheds, coastal and marine zones) or buffer zones, helping to reduce activities or livelihoods that are destructive to natural habitat.	Forest conservation, afforestation and restoration of natural resources, are extremely important for mitigation and resilience.	Role of mobile is central to providing solutions at scale to recently connected populations. It also has a role in improving communication, access to resources and community-based NRM.
Transport & Mobility – Mitigation	Digital information, platforms and tools to facilitate greater, more efficient and convenient use of public or informal transit services, ride sharing, micro-mobility and uptake of electric vehicles (EVs).	Public transit and shared mobility are extremely important mitigation factors, helping to reduce the mode-share of private vehicles.	Central role for mobile as an enabler, particularly for people on the move. Use of AI and other frontier technologies as part of solutions. Central role for mobile as the interface and mobile money for payments and public advocacy.
Water Supply – Adaptation & Resilience	Digital solutions for integrated water management to improve the efficiency of revenue collection and improve management of water resources and infrastructure, helping to reduce losses and provide more reliable, resilient and inclusive services.	Due to climate change, access to clean water is becoming an increasingly critical challenge for many communities in LMICs. Improving water resource management and access is critical for adaptation and resilience.	Central role for mobile as the interface and mobile money for payments, behaviour change and incentivization.

(continued)

Sector and intervention area	Description	Scale of impact of GHG mitigation, adaptation or resilience	Transformational role of mobile-enabled solutions
Solid Waste Management – Mitigation, Adaptation & Resilience	Digital circular economy solutions across general waste management and plastic waste management value chains (collection, transport, processing, reselling, etc.).	Waste management is an important part of mitigating GHG emissions, particularly related to organic content, so segregation of waste is a vital component. Waste management also enhances resilience, as plastic waste and other items often block drainage systems and make flooding worse.	Mobile-enabled solutions have great potential to improve waste management value chains, providing value to each actor in the chain, such as enabling greater access to information on supply and demand for waste plastics.
Wastewater Management – Mitigation, Adaptation & Resilience	Digital solutions to improve the efficiency and security of wastewater collection and management.	Poorly managed wastewater poses significant public health risks during increasingly frequent flooding, and proper management greatly improves resilience to disease. Innovative wastewater treatment can also reduce GHG emissions, but the impact is less.	GSMA M4D Utilities studies have shown strong potential for mobile-enabled commercialization at scale.
Data-driven Urban Planning – Mitigation, Adaptation & Resilience	Urban planning solutions that draw on call detail records (CDR) and other mobile-related big data to understand locations and movements of residents and other factors.	Mitigation can be greatly enhanced by urban planning that minimizes the need for private vehicle use. A pillar of disaster resilience is often well-planned communities, drawing on hazard mapping and vulnerability assessments.	Mobile is an enabler for resource allocation, spatial mapping and community monitoring.
Disaster Risk Reduction – Adaptation & Resilience	Mobile-based early warning systems linked to better observations provided by digital systems and sensors (e.g. of localized heat, landslides, river flow or storm surges).	Early warning systems are critical for disaster resilience, helping residents to identify threats, evacuate and prepare.	Mobile needed for GPS and satellite images, as well as local reporting and communication on the ground (by local population), to make it as efficient as possible.

(continued)

Sector and intervention area	Description	Scale of impact of GHG mitigation, adaptation or resilience	Transformational role of mobile-enabled solutions
Disaster Risk Reduction – Adaptation & Resilience	Post-disaster vulnerability and damage assessment, identifying the need for urgent assistance and potential loss and damage, including through digital volunteerism.	Resilience also depends on rapid response, which can be aided by well-defined systems to bring technology and volunteers together to help identify and respond to needs as soon as a disaster strikes.	Digital volunteerism facilitated by mobile and digital technology. It could also be facilitated via a larger digital platform related to mobile money, humanitarian aid, community management, etc.
Disaster Risk Reduction – Adaptation & Resilience	Role of mobile-enabled insurance for individuals and businesses in agriculture and other sectors to cover losses from disasters and enable faster recovery and avoidance of poverty traps.	Insurance strengthens resilience considerably by allowing customers to avoid a poverty trap that may be caused by loss of income or damage to assets or property.	Mobile solutions are likely to be key via mobile money platforms, consumer awareness, digital identity, analytics and reporting, etc.
Disaster Risk Reduction – Adaptation & Resilience	Digital cash transfer solutions to help vulnerable citizens cope with shocks and stresses, especially in remote areas	Cash transfers enable more resilient livelihoods and local economies and faster post-disaster recovery.	This can be greatly enhanced via mobile, particularly in terms of transparency, speed, accessibility and efficiency.
Individual Climate Awareness – Mitigation	Apps that promote low-carbon lifestyle information and advice, including through gamification and competition between users.	Such solutions can raise significant awareness of how personal actions can help reduce GHG emissions, as well as provide motivation to take practical actions. Personal changes multiplied by millions of individuals can lead to transformational reduction in GHG emissions.	Central role for mobile as the interface for public advocacy, consumer awareness, payments and behaviour monetization.

Source: GSMA. 2021. "The Role of Digital and Mobile-Enabled Solutions in Addressing Climate Change". https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2021/03/The-Role-of-Digital-and-Mobile-Enabled-Solutions-in-Addressing-Climate-Change-Final..pdf

Research from 2018, developed by Ericsson, estimates that the overall carbon footprint of the ICT sector corresponds to 1.4 per cent of the global emissions and uses 3.6 per cent of the global electricity for its operations.[10] Moreover, despite the exponential growth of data between 2010 to 2015, the carbon footprint has remained the same. However, the operation of data centres and networks account for the main part of the emissions, indicating that there is a need for continued focus on energy efficiency to reduce the carbon footprint.

Examples of digital infrastructure companies deploying more efficient systems include that of Amazon, Google, and Microsoft employing more renewable energy to power its systems[11]

and Deutsche Telekom and others relying on more solar power for mobile cellular base station sites.[12] Operators such as Airtel are also focused on reducing their carbon footprint by installing renewable (solar) power plants to power their data centres.[13] Nokia recently released a white paper demonstrating how increased energy efficiency with 5G solutions could potentially support a 100-fold increase in data traffic over networks, but at existing levels of energy consumption through techniques such as increasing spectral efficiency, increasing overall throughput in existing spectrum bands and overall power savings.[14] See also Ericsson's network-level approach that enables exponential growth of data traffic without increasing energy consumption.[15]

Many of these developments support individual companies' commitments to reduce their own overall carbon footprints and taken collectively, the mobile sector is leading others in efforts to eliminate emissions. Already more than one-third of mobile operators (estimated by overall global revenue) have met robust standards in their commitments to net zero emission by 2050 at the latest.[16] (These include: America Movil Group, Bharti Airtel Group, BT Group, Deutsche Telekom Group, Magyar Telekom Group, Orange Group, Proximus Group, Reliance Jio, Safaricom, Singtel Group, STC Group, Swisscom, TDC Group, Telefonica Group, Telia Group, Telstra Group, Telus, T-Mobile US, Verizon Wireless, Vodafone Group; more broadly other ecosystem participants who also meet the standard include Apple, Ericsson and Nokia.)

Satellite technology produces massive amounts of climate-related data used by government agencies such as the European Space Agency and the National Oceanic and Atmospheric Administration to monitor greenhouse gas concentration in the atmosphere, weather patterns, vegetation health, melting of glaciers and polar ice, bleaching of coral reefs, ocean acidification, changes in wildlife migratory patterns, and many other environment indicators. Satellites not only monitor the global environments but technological innovations such as miniaturization of sensors, high-speed data transfer, and upgraded storage capacity have revolutionized climate science.[17]

Satellite technology provides solutions to many industrial sectors, including energy, agriculture and transportation, enabling companies to collect and leverage data about their operations to improve efficiency and contribute to environmental sustainability. Satellite industrial IoT applications reduce climate change enabling the:

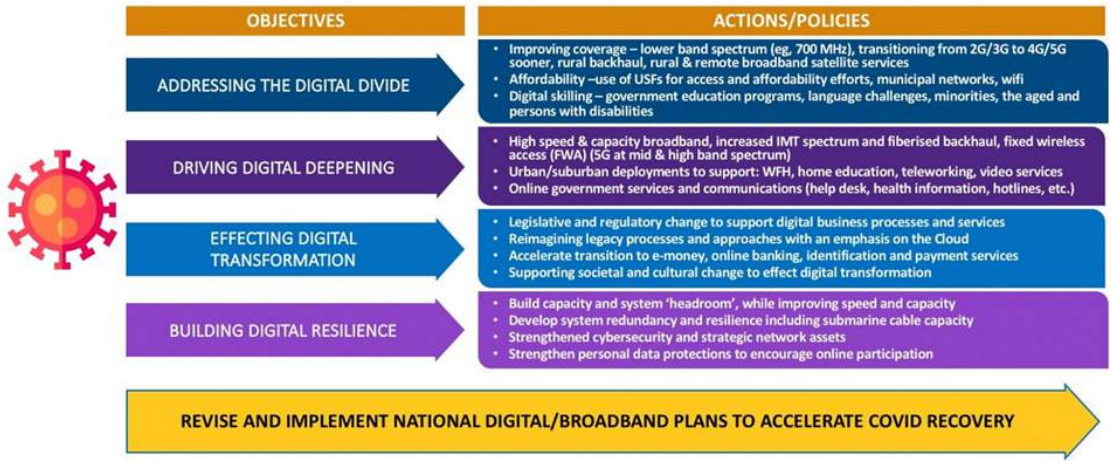
- Energy sector to meet increasing demands to reduce non-renewable energy consumption through accelerated and enhanced seismic data acquisition and analysis to improve production performance leading to the faster and safer extraction of gas or oil. It can also enable real-time process monitoring and predictive maintenance improving the efficiency of operations and reducing harmful environmental impacts.
- Agricultural sector to combat the effects of rising temperatures, increasingly unpredictable rain patterns, and increasing instances of extreme weather events by helping farmers use satellite data to reduce the need for fertilizer, make crop irrigation decisions and predict crop growth stage and yield.
- Transportation sector to minimize negative environmental impacts by driving down its carbon footprint. Connected aircraft in the skies enable better air traffic management. The International Air Transport Association (IATA) noted that at least a 10 per cent reduction in CO_2 emissions could be achieved in Europe alone, just by more effective policing of airspace.[18]

5.3 A people-centric approach to universal broadband approaches

In addition to loss of life, a major impact of COVID-19 continues to be the sheer extent of shock to livelihoods and the number of people who are experiencing short-term and long-term poverty because of the pandemic. The latest forecasts by UNDP, updated from last year whereby UNDP estimated the total number of people living in extreme poverty could reach over 1 billion by 2030, is that without ambitious countermeasures, at least 41 million more people may live in extreme poverty in low and medium human development countries by 2030.[19]

ITU's report "Pandemic in the Internet age" details a range of actions and policies that can be implemented by participants in the broadband ecosystem to leverage high-speed digital infrastructure that goes beyond simple recovery from COVID-19. These include specific actions focused on: addressing the digital divide, driving digital deepening, effecting digital transformation, and building digital resilience (see Figure 24 below).

Figure 24: Digital responses to COVID-19



Source: ITU-WPC, May 2020, updated March 2021 as presented in: ITU. 2021, "Pandemic in the Internet age: From second wave to new normal, recovery, adaptation and response". https://www.itu.int/en/myitu/Publications/2021/05/11/08/52/Pandemic-in-the-Internet-age

Putting individuals at the core of strategies to build up digital infrastructure and progress towards the achievement of the 2030 Agenda requires concerted effort to internalize the heterogeneity of individual situations and the complexity of the challenge of global connectivity at a worldwide scale. This includes moving beyond mindsets focused on technological fixes, building into the consciousness a primary focus on user issues limiting adoption based on socio-demographics, skills, affordability, relevance, content and trust. An effort to coordinate and direct funding to efforts that address the most pressing challenges of the unconnected is required, and this includes allowing for innovations in business models, technologies, policy and regulations, and financing and partnerships.

5.4 Conclusion

While the year marker set for achieving SDG9c has come and gone ("to significantly increase access to information and communication technology (ICTs) and strive to provide universal and affordable access to Internet in LDCs by 2020"), the global community still has an opportunity to effectively leverage broadband and adoption of high-speed digital infrastructure to achieve

significant progress towards the SDGs and the 2030 Agenda. To do so, however, requires concerted effort in line with the various recommendations presented by the Broadband Commission in previous editions of the State of Broadband, as well as other Working Group and research reports.

This includes:

- Ensuring public confidence in participating online in the digital economy by increasing efforts to prevent cybercrime and cybersecurity incidents in ways that also protect individual privacy;
- Increasing funding levels and addressing issues of fragmentation (of funding, legislative and regulatory frameworks, investment and distribution) and coordination across regions, government levels, and between public and private sector entities in order to achieve universal broadband adoption;
- Supporting and engaging in innovative partnerships that leverage the unique strengths of each participant in digital infrastructure in order to translate roadmaps and action plans into concrete achievement;
- Addressing environmental impacts of digital infrastructure and unleashing the potential of connectivity to make an outsized contribution to addressing the climate emergency both by helping to build resilience to climate stresses through the use of digital technologies, as well as by demonstrating leadership and investment in commitments to reach net zero, and beyond, in terms of carbon emissions; and
- Employing a people-centric approach, with a focus on individuals and inclusivity in order to ensure no one is left offline.

Endnotes

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6 Commissioner Insights[1]

(Arranged alphabetically by organization)

Insight from Commission Co-Chair Mr. Carlos Slim (Carlos Slim Foundation)

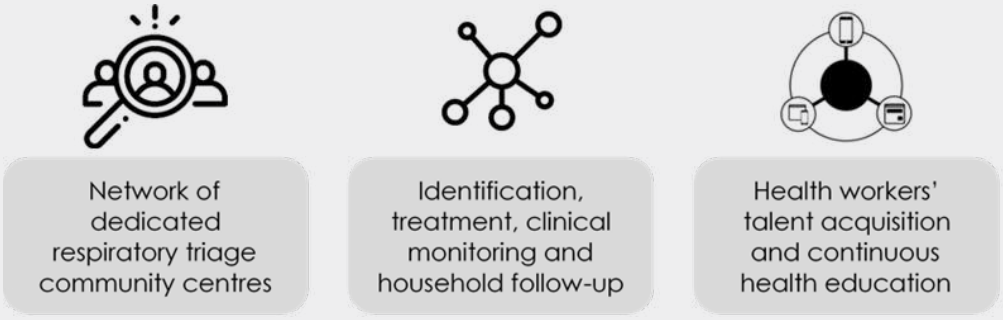
The Carlos Slim Foundation's response to COVID-19 Epidemic

To support the most vulnerable population in the wake of the pandemic, the Carlos Slim Foundation (CSF) started a comprehensive program aimed at supporting national institutes of health and state government's efforts to provide timely and high quality of care health services to cope with the increasing demand.

The CSF convened a strategic non-profit public-private partnership with the Government of Mexico City and other partners to transform Latin America's largest convention centre into a Temporary COVID-19 Hospital to streamline patient referral, admission, treatment, clinical monitoring, discharge, and household follow-up to mitigate the impact of the COVID-19 pandemic in Mexico City using a digital health platform.

This partnership was aimed at reducing the burden on the healthcare system, reducing community spread by providing timely containment of COVID-19 patients, and implementing strict safety measures while providing high-quality medical care through a patient-centric approach.

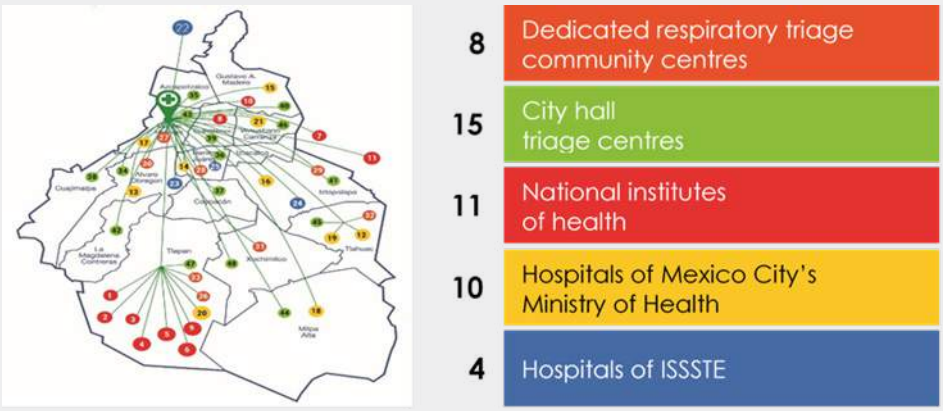
Figure 1. COVID-19 Hospital Digital Health Ecosystem



Network of dedicated respiratory triage community centres

The Temporary COVID-19 Hospital prioritizes the early hospitalization of patients through the network of triage centres during the initial stages of the disease to enable the rapid diagnosis and early hospitalization of patients.

Figure 2. Network of triage centres, primary care clinics and hospitals



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Identification, treatment, clinical monitoring and household follow-up

In a joint partnership with Claro360, the Temporary COVID-19 Hospital implemented a streamlined patient journey with five steps as follows:

Figure 3. Patient journey through the Digital Health Platform COVID360

Referral to COVID-19 Hospital

When patients are admitted from one of the centres, the entire process is monitored in real time.

Ambulances' traceability

After the patient is accepted, the ambulance's route is monitored by the COVID-19 Hospital's admission area.

Medical care at COVID-19 Hospital

Robust clinical, safety and research protocols implemented to provide standardized systematic quality of care, from admission to daily assessments and update on health status to intermediate therapy if condition deteriorates.

Communication with the family

The physician communicates with one family member daily to inform patient's current health status.

Household follow-up

Follow up on patients up to 90 days after discharge to assess their adherence to medication and to timely identify signs of alarm while enabling an assessment of long COVID.

Health workers' talent acquisition and continuous health education

Hospital personnel were selected through a stepwise process, that include two online courses and a face-to-face training on the fundamentals and clinical management of COVID-19, the use of PPE, and the use of the COVID360 Digital Health platform.

Insight from Co-Vice Chair Mr. Houlin Zhao (ITU)

There will be a before and after COVID-19 in terms of digital transformation. When the world looks back on this period, it will remember the role that broadband played in addressing one of the greatest global challenges in living memory. But history will judge us on how we as a society used this time to accelerate this transformation and leave no one behind.

The Commission is made for this moment, bringing a decade's long multi-stakeholder effort to promote broadband worldwide. I am confident that together we can not only connect the unconnected, but also unleash AI, 5G and other emerging technologies central to the digital economy and our efforts to build back better with broadband. Post-pandemic recovery efforts need to be built on new regulatory and policy frameworks that embrace collaborative participation across and within sectors, with a new whole-of-government investment strategy at their centre.

We can make faster progress if we have the optimal combination of effective and agile regulatory environments, robust connectivity infrastructure, and a vibrant ecosystem of digital technology providers. It means adopting a new mindset, one that attracts investors to under and unserved areas and encourages all actors to cooperate and make the best use of limited resources. It also means changing the false perception that the ICT industry is always more profitable than others and that we need not worry about ICT investments and development. At stake is no less than our ability to achieve the Commission's 2025 targets and help deliver meaningful connectivity to all those for whom the digital technologies and services that have proven so essential during this crisis are still out of reach, unaffordable, irrelevant, too complicated to use, or not secure enough.

At ITU, we have redoubled our efforts to unlock these barriers to connectivity through key initiatives like Connect2Recover, which helps expand access to affordable and reliable connectivity in some of the least well-connected countries, and our newly launched Partner2Connect Digital Coalition, a multi-stakeholder alliance to foster digital transformation in the hardest-to-connect communities. ITU also works with UNICEF through Giga to connect every school to the Internet, and with the African Union and ILO to enhance skills for youth in Africa's digital economy.

The recognition of broadband's value has never been higher, calling on all of us to put people at the centre of our collective efforts to ensure an equitable digital future for all.

Insight from Commissioner Dr. Carlos Jarque (America Móvil)

Universal Digital Inclusion

Worldwide there are 3.7 billion people that are not online. Of those, 15 per cent is due to lack of infrastructure in their regions. This can be solved by the options described in this State of Broadband Report. The other 85 per cent is an 'Adoption Gap'.

There are three main elements that need to be addressed to close the 'Adoption Gap': i) Availability of devices; ii) Relevant content and digital skills, and iii) Affordable cost.

i) Regarding availability of **devices**, it is possible to have micro finance options, tax and import fees reductions, elimination of 'patent royalties', and demand aggregation. Also, the recycling of usable devices is another possibility (in the US, alone, 152 million units are disposed per year).

ii) In relation to **content**, there is a wide collection of materials available to be mapped, to identify additional relevant local educational content to be developed and made available through the different existing platforms to train the workforce, support local industries, and promote commerce and employment. For example, via the 'Fundación Carlos Slim', hundreds of free access courses are available covering many areas.

iii) Perhaps one of the most complex aspects to deal with from the demand side is affordability, i.e. **accessible cost**. Since the 1990s, 'comprehensive' poverty reduction programs have been implemented, known as Conditional Cash Transfer Programs. These have been applied in Asia, Africa, Latin America (the Progresa program in Mexico and Bolsa Familia in Brazil) and in other regions.

These government funded programs provide financial support to families in the areas of education (subject to children attending school); and in health to receive health services; and for nutrition (micronutrients and family food intake), subject to actions complied with by the beneficiaries, within a framework of **co-responsibility**, and recognizing that poverty is multidimensional.

Important resources to identify the beneficiaries, establish, and administer these 'comprehensive' poverty programs have been made in all regions throughout the years. The total average amount of resources granted per family is USD 32 per month.

There are now millions of family beneficiaries in all regions. Via rigorous evaluations, these programs have been described by UN Institutions and others as the most comprehensive and effective strategy to combat poverty.

But today, in a digital world we are facing a **new reality**, and like Education, Health and Nutrition, **Connectivity** now also becomes a human right in its own, an enabler to other rights (employment, health, freedom of speech), and an essential ally to increase human capital and skills for employment.

Poverty alleviation comes with employment and having access to connectivity is a fundamental condition for working in a more digital world. The same applies to health, improved via telemedicine.

Therefore, why not consider incorporating an additional 'connectivity' component into these traditional Conditional Cash Transfer programs for these to become a New Generation of Education, Health, Nutrition and Connectivity Programs?

To close the 'Adoption Gap', actual beneficiaries of these comprehensive programs could be granted 'Connectivity Coupons' (such as prepaid cards, of about USD 10 per family per month), conditional on attending seminars/courses on digital skills. Other social programs could participate. The annual cost would not imply a significant increase in the public budget **that is already allocated to these programs**. Others may contribute. At the moment, implementation costs would be very low, as the administration and logistics are already in operation.

(continued)

The benefits of this initiative, together with other options, would contribute to eliminating the 'Adoption Gap' (which is concentrated in this cohort of population), improve the profitability of telecommunication infrastructure already installed; increase access to e-education and content, providing an enriched digital dimension to current education efforts; provide extensive telemedicine services in areas with poor health infrastructure; give access to relevant job training with appropriate local content; make available new digital financial resources via 'mobile money', and e-commerce opportunities with access to a larger market with local products and services. It would therefore increase the well-being of beneficiaries. The synergies would be tremendous. Development could be propelled. Universal Digital Inclusion is possible.

Insight from Commissioner H.E. Dr. Mohammed Bin Saud Al Tamaimi (Communications and Information Technology Commission of Saudi Arabia, CITC)

The COVID-19 pandemic changed life, as we know it and has taught us many lessons. One key lesson we have learned from the pandemic is that the prioritization of deploying next generation networks paid off: the core design feature of digital infrastructure, namely its design to handle peak loads in busy periods, meant that service providers and regulatory/governmental bodies were able to ensure continuity of services.

CITC recognizes that the importance of upgrading digital infrastructure lies in both increased capacity and functionality that next generation networks bring and consequently, as part of its National Spectrum Strategy, CITC published proposals in 2021 to allocate or improve access to more than 23 GHz of spectrum for a wide range of uses. Allocating this spectrum in this flexible manner will both help mobile operators cope with the ongoing huge increase in mobile broadband traffic and help Saudi Arabia on its path to transform itself to a digital society.

In addition, the pandemic taught us that the transformation into a digital society requires a 'wider lens' to be used than one that focuses on connectivity. The digital economy is increasingly the economy and the pandemic showed that it has the attributes of a critical utility.

The pandemic also highlighted gaps in access and use within and between nations. Despite the investment in digital infrastructure, these gaps persist around access, adoption and use of online services. This is why CITC has identified rural coverage as a top priority and it is currently engaged in a number of initiatives to close the digital gap. In rural areas, coverage is often limited to just one operator and our national roaming initiative will enable end users to benefit from coverage from multiple operators while enabling operators to extend their coverage without inefficient duplication of network deployments in economically challenging areas.

Another lesson we have learned from the pandemic is that the digital transformation of the economy will lead to new business models, new value chains and new technologies that will revolutionize how sectoral and cross-sectoral regulators, policy-makers and industry stakeholders interact. This transformation will require regulatory bodies to evolve and adapt in terms of how they work, their toolkits and how they collaborate with each other and other players in the digital ecosystem.

Regulatory bodies also need to evolve their models of collaboration from a sector focused to a holistic model to ensure that areas of regulation such as licensing are both seamless and not duplicative. Such a model will also identify any gaps in protecting consumers and ensure a level playing field for competitors irrespective of technological changes.

To this end, the relevant regulatory bodies in Saudi Arabia including CITC have established a National Regulatory Committee that will bring together core regulators to collaborate on ICT and digital cross-sectoral topics like AI, FinTech, Blockchain, smart cities and the role of data in the business models of large digital platforms.

Insight from Commissioner Mr. Denis O'Brien (Digicel)

The Digital Divide - New frameworks can unlock the funding gap

As Commissioners we have all long known the problem of the digital divide. 3.5 billion people in the developing world remain unconnected to broadband networks.

The IMF reports that only 28 per cent of Africans use the Internet and Internet usage is as little as 17 per cent in some low-income countries according to the World Economic Forum. More of the same policies by governments and regulators will not change this. The Broadband Commission estimates that the cost to address the broadband gap in Africa alone is USD 100 billion.

Fundamentally, all stakeholders must play and pay their part. The growth of digital platforms over the past decade, and especially during the COVID-19 pandemic, is well documented. The platforms that dominate the Internet need to contribute a share of their revenues to solve the digital divide. Unfortunately, some prefer to live on another planet (or spend money trying to get to one) instead of helping to solve the problems on this planet.

The old funding model is broken as revenues from digital services do not flow back to infrastructure. The Broadband Commission's "Connecting Africa Through Broadband" report concluded that as digital services are increasingly provided by non-network operators, contributions from them to the USD 100 billion needed to fund new infrastructure costs (on a direct or indirect basis) are required to close the funding gap. As online platforms continue to side-line network operators, vital investment in building and maintaining infrastructure is becoming unsustainable.

The question then is how can we enable all players to play their part and contribute? Potential initiatives include:

- A portion of any new tax receipts from digital service providers should be earmarked for investment in critical digital infrastructure. The recent G7 proposal may only be part of the solution. Many jurisdictions, including countries such as Kenya and a number of US states, are introducing digital service taxes as they are no longer prepared to wait for the OECD process or do not believe that it will benefit them.
- In countries where the broadband gap is acute, agencies such as the World Bank, the EU, USAID and others could help frontload the investment in the infrastructure and receive a return over a 25-year period. In order to achieve this return governments, regulators, and tax authorities could require digital platforms to pay a 10 per cent revenue share of their local revenues.
- In Australia, digital platforms are required by law to negotiate and agree commercial terms with local companies for the use of locally-produced content. A similar approach could require digital platforms to agree commercial arrangements with local infrastructure partners.

Now is the time for bold and urgent action if we want to avoid a two-tier digital world and if we are going to bridge the digital divide by 2030. There are useful examples of frameworks that could be followed. Everyone who benefits economically or commercially from connecting the unconnected must contribute to making these connections.

Insight from Commissioner Mr. Erik Ekudden (Ericsson)

Education, digital skills and leveraging existing mobile network infrastructure are key to digital inclusion

COVID-19 underscored why digital connectivity is foundational to the United Nations 2030 Agenda for Sustainable Development. The pandemic showed that connectivity – increasingly enabled via mobile broadband – provides opportunities to learn, earn and socialize online. It also placed in sharp focus the experiences of the unconnected and the growing digital divide.

Pandemic experiences should spur efforts to provide connectivity and opportunities to people in developing and developed countries alike, whilst unlocking tools to provide sustainable economic growth.

The road to the 2030 Agenda

The Broadband Commission's 2025 targets provide milestones toward 2030. Hitting the targets requires affordable, ubiquitous and meaningful broadband connectivity, as well as sufficient access and applications. Where can we collectively deliver impact?

- Deliver affordable, ubiquitous networks by rolling out existing, proven and scalable network technology. Mobile broadband is forecast to provide network coverage to 95 per cent of the world's population by 2026. Where coverage shortfalls exist, a proven, affordable and ubiquitous solution is used the world over: radio base stations.

  Through selective investment in mature mobile broadband technologies, communications service providers can sustainably expand coverage by upgrading existing 2G (GSM) sites, as well as targeting uncovered areas with new 4G (LTE) and 5G deployments.

- Unlock access through education and digital literacy. Get with Giga. Literacy and skills represent the single biggest, self-reported barrier to Internet access with around one-third of people in Africa, Latin America, East and South Asia reporting it as their top barrier.

  Let us focus on empowering the next generation with digital skills, essential for their socio-economic development. Ericsson is playing a key role, for example through its Digital Lab Program (introducing children to digital skills and new technologies), as well as supporting initiatives such as Giga, which works to connect every school to the Internet. We urge others to support Giga and the fight to provide digital skills and education.

- Set the digital bar high for everyone, and always. People are taking advantage of 5G's possibilities, with 5G users, for example, using AR and VR applications more than people on 4G, whilst enterprises are unlocking novel uses putting them at a competitive advantage.

  If we are to ensure that the digital divide does not become a chasm, let's increase the pace of rolling out at-scale, proven, affordable, modern networks whilst ensuring people have the skills and education to access them.

Insight from Commissioner Mr. Kevin Martin, Vice-President (Facebook)

Preventing a new Internet Digital (Usage) Divide

During the COVID-19 pandemic, connecting with friends and family, work, entertainment and education shifted significantly to online channels. Without being connected to the Internet, people cannot participate in many of the essential elements of life that have gone online.

In a traditional sense, the world has made tremendous progress bridging the digital divide. According to the Inclusive Internet Index (3i), conducted by the Economist Intelligence Unit with support from Facebook, nearly 90 per cent of the world's population is covered by at least a 3G signal, and 76 per cent has access to 4G.

Yet barely half of the world uses the Internet. What was once a digital divide marked by disparities in network coverage has evolved in many places into a 'Digital Usage Divide' marked by people unable, unwilling, or uninterested in using the Internet.

According to GSMA's State of Mobile Internet Connectivity report, lack of literacy and digital skills are the biggest barriers to Internet adoption among people that are aware of the Internet. The report notes that in low- and middle-income countries (LMICs), almost a quarter of adults were not even aware of the mobile Internet. The 3i similarly reveals significant regression over the past year in Readiness, a function of digital skills and people's perceptions about trust and safety online; and a reduction in Relevance, a function of the value people derive from the content available to them online.

The greatest opportunity and need to expand connectivity now is to focus on the usage gap – the barriers preventing people who have access to the Internet from using it.

The Broadband Commission should recognize the barriers preventing people from accessing the Internet and endeavour to improve the affordability and relevance of the Internet, and the ability of people to draw value from it.

1) The Commission should focus its efforts on making broadband services and equipment more affordable for consumers by embracing, over time, a '2 for 2' goal – 2 GB of mobile broadband data available for 2 per cent or less of GNI per capita, up from the current '1 for 2' goal.
2) Government, private sector players, NGOs and other institutions should work together to raise awareness and improve the relevance of the Internet to people by further digitizing public services, health, and education resources, making more content available in local languages, and improving services for people with low levels of literacy or other accessibility challenges.
3) Government, private sector players, NGOs and other institutions should work together to support programs to enhance literacy and digital skills, particularly among women and girls, rural communities, and other traditionally marginalized populations.

Insight from Commissioner Mr. Mats Granryd (GSMA)

What will it take to connect the other half of the world?

Earlier this year, as I was walking the exhibition halls of MWC21 Barcelona I was impressed to see the rapid progress made by the mobile industry to advance new technologies and the rollout of 5G. This is Connected Impact. We are entering a new era of possibilities, and this is really a time to recognize the unprecedented levels of connectivity we enjoy today. Across the world, 93 per cent of the population is covered by mobile broadband (87 per cent by 4G), resulting from more than USD 900 billion in CAPEX investment by mobile operators over the past five years. Not only has coverage expanded, but data consumption per user also continues to rise, enabled by ever increasing network capacity that saw average mobile download speeds go from 5 Mbps in 2014 to 17 Mbps in 2019.[2]

However, not everyone is benefitting equally. Mobile Internet adoption is not growing as fast as coverage is expanding, creating a significant usage gap. In fact, of the 4 billion people that do not use mobile Internet, 3.4 billion live in an area already covered by mobile broadband. People that remain offline are disproportionately poor, female, rural or have some form of disability.[3] For example, women are still 15 per cent less likely to use mobile Internet than men.[4] It is therefore crucial to reassess how we can now improve digital inclusion. Instead of primarily focusing on infrastructure, the approach must be people-centric, tackling the barriers that prevent people from adopting and using the Internet, including:

- Improving the affordability of Internet-enabled handsets and data services;
- Ensuring citizens have the required digital skills, literacy, awareness and understanding of the Internet and its benefits;
- Ensuring relevant content and services are available, including supporting the expansion of local digital ecosystems;
- Addressing safety and security concerns and building consumer trust; and,
- Expanding access to enablers such as electricity, formal identification, and accessibility features.

Addressing these barriers requires concerted and joint efforts by mobile operators, device manufacturers, Internet companies and civil society, as well as an enabling policy framework supporting those efforts. To help with this approach, we recently launched a report[5] that sets out a broad range of policy recommendations to increase mobile Internet adoption.

An investment-friendly policy framework for infrastructure will remain a top priority for enabling ever better mobile Internet experiences. However, a narrow focus on infrastructure policies will not be enough to address the digital divide. Only when we all work together to complement infrastructure initiatives with policies to accelerate adoption and use can we ensure we are not leaving anyone behind in an increasingly digital world.

Insight from Commissioner Ms. Sun Yafang (Huawei Technologies)

In 2020, COVID-19 spread across the globe, significantly impacting work, life, the global economy, and society at large. Public sectors, private sectors, and NGOs, among others, have taken many actions to mitigate the impact.

At Huawei, we actively apply ICT technologies to fight the pandemic. Drawing on our experience in China and Europe, we have developed a nine-step approach for fighting the pandemic: (1) building temporary hospital networks; (2) remote consultation; (3) pandemic control; (4) drug R&D; (5) 5G-powered healthcare; (6) online education; (7) quantitative medical analyses; (8) helping reopen government services; and, (9) assisting enterprises' work resumption.

Following the outbreak, we worked with telecom carriers in China, Europe, Asia-Pacific, and Africa to build ICT facilities for field and designated hospitals. We even deployed a network for one field hospital in 24 hours, allowing doctors to diagnose symptoms and treat patients over long distances. Despite the pandemic and conflicts in Cameroon, we worked with MTN to ensure normal network operation.

In early 2020, 50 million students in China attended classes online through Huawei cloud. Connectivity technologies, like 5G, have become crucial to AI-assisted diagnoses, remote consultations, and contactless medical services during the pandemic.

We have taken many measures to bridge the digital divide, laying the foundation to resume learning and work in underdeveloped regions. China has 2.5 million villages and 700 million farmers. By the end of 2020, 99 per cent of China's villages had network coverage, enabling a quick return to normal life. Digital infrastructure was also key for China to eliminate poverty by the end of 2020.

As part of the ICT industry, Huawei has aligned its sustainability efforts with the UN's Sustainable Development Goals, while continuing to focus on its own four sustainability strategies: digital inclusion; security and trustworthiness; environmental protection, and healthy and harmonious ecosystem.

Huawei proposed the TECH4ALL initiative to ensure no one is left behind in the digital world. Huawei has worked with over 20 global partners, including the UNESCO, to make progress in four crucial domains: equity and quality in education; environmental protection; inclusion and equity in health; and balanced development. For example, Huawei has partnered with over 1 500 universities worldwide via its ICT academies, and nearly 57 000 students have received Huawei certifications.

We call for enhanced global, cross-industry cooperation in e-health and online education.

Insight from Commissioner Mr. Rajeev Suri (Inmarsat)

Connectivity's Critical Role in Climate Action

Climate change is here and it is now.

For those who think it is something to come in the future, a new report from the World Meteorological Organization (WMO) sets the record straight. The WMO analysis shows that the world is now consistently 1 degree Celsius hotter than the late 1800s and that temperatures are rising fast. The authors say that the chance of the average annual temperature on Earth reaching 1.5 degrees Celsius of warming in the next five years has doubled since last year. Hope that reduced activity as a result of the COVID-19 pandemic would slow the pace of warming appears to be just that: hope, but not reality.

That is bad, really bad. 1.5 might sound like a small number, but when put in context of the fact that our planet was only 6 degrees Celsius colder during the last ice age, it is actually a very big number. The impact on our planet is already well underway. Hundreds of millions living in coastal areas at risk, more severe storms, prolonged droughts, and more frequent wildfires are just a few of the effects that we are already seeing. In the context of this human-created and truly existential threat, collective action is a must. No person, no organization, no business can be exempt from stepping up and doing their part.

Connectivity is one of the most important tools we have in our toolkit to help find new solutions to reduce the rate of warming. After all, some of the stunning macro trends we have been experiencing will not go away. Populations will continue to grow. Mega cities will continue to expand. Globalization will change but not go away. As these things happen, we need industries of all kinds to become smarter, more productive, and more efficient. Increased connectivity is an absolute must to make this happen.

Consider the example of a humble shipping container. It is part of a vast marine shipping ecosystem that is both necessary for human welfare and a large emitter of CO_2. In fact, some estimates have suggested that the sector emits more CO_2 every year than all of Germany's annual emissions.

While there is plenty of good work underway in the sector to address these challenges with new fuels, ships and engines, simply reducing waste can have a massive impact. Just-in-time vessel arrivals reduce idling at sea. Dynamic, AI-driven route optimization for ships, real-time data sharing to ensure prompt maintenance, and flawless value-chain collaboration can have a massive impact – and all need superb connectivity. Much of that must come from satellite communication providers like Inmarsat given the need for coverage where terrestrial solutions are not available and for truly seamless connectivity.

These gains can be real not just for the maritime industry but also for all industries including: aviation, automotive, rail, agriculture, mining and energy. In fact, ITU has estimated that the use of information and communications technology has the potential to reduce emissions in all sectors by 15 per cent or more. Satellites are an essential element of that and Inmarsat is committed to doing its part.

Insight from Commissioner Mr. Stephen Spengler (Intelsat)

Solving the Connectivity Divide with Space-Based Solutions and Collaboration

In today's increasingly connected digital world, access to reliable connectivity is still largely dependent on where you live. And the reality is that hundreds of millions of people living in remote, rural and hard-to-reach places around the world still struggle to access basic broadband services in 2021.

The global COVID-19 crisis put this connectivity gap front and centre. Connectivity proved essential for telemedicine and other important health resources. And, we all witnessed the lifeline that reliable connectivity has offered during a time when social interaction and traditional mobility have been significantly curtailed.

And, yet, during the pandemic, we have seen too many schoolchildren in rural and underserved areas struggling to access online lessons, and too many small businesses in remote localities unable to transition their products to online markets.

We know that providing broadband access and mobile network coverage to remote, rural, and hard-to-reach places is vital to the health, safety, welfare, and future of the hundreds of millions of people who live, work, and travel there. So, why do so many people in so many of these places around the world today still lack basic connectivity?

Put simply, there is a lack of communications infrastructure to support remote connectivity. This is largely due to an overreliance on terrestrial solutions for connecting remote cell sites, which can be cost-prohibitive and complicated to install over long distances or challenging terrain, such as mountains, dense forests, or islands. The fact is that most communications service providers see a limited return-on-investment for these types of terrestrial infrastructure build-outs, given the low subscriber fees obtained in low-population-density areas.

This is why satellites, and satellite communications solutions, are so important. Only satellites can quickly and cost-effectively bring reliable connectivity to hundreds of Wi-Fi access points and cell sites – no matter how rural or hard-to-reach the location. In fact, satellite network operators play a unique role in bringing voice and data services across vast geographic areas, and even entire countries or regions.

At Intelsat, we work with communications service providers (CSPs), government regulators, and non-governmental organizations to develop and implement new ways to address the need for broadband and mobile connectivity, especially in the numerous rural and hard-to-reach areas that remain unconnected today.

We believe that with the right mix of investment, partnership, service, and innovation, the private and public sectors can work together to quickly develop and implement flexible, cost-effective – and profitable – solutions to close the global connectivity gap.

Insight from Commissioner Mr. Andrew Sullivan (Internet Society)

The COVID crisis has shed light on the importance of connectivity in a way that we never could have imagined. The question is no longer whether we need connectivity, but how fast we can extend connectivity for business to continue, for children to learn, and for families and people to stay in touch.

The very nature of the Internet – a layered architecture, a common protocol, a global routing system, and an architecture that supports innovation – has proven its importance.

Nevertheless, the pandemic taught us several things. There are lessons to be learned, but also calls to action for better preparedness. The Internet Society would suggest that the international community needs to:

Voice support for infrastructure providers and limit restrictions on them: A year ago, some had been wondering if the Internet could handle the strain of rapid traffic growth and increased latency. Would it cause a catastrophic failure of the Internet? The answer is that such a failure did not happen. Core Internet infrastructure providers have been able to absorb the increases in traffic and demand, and should continue to be able to do so over the coming days, weeks, and months. Cloud infrastructure providers should also have sufficient additional compute, storage, and bandwidth capacity to enable their customers, including the e-learning, messaging, and videoconferencing tool providers, to scale their systems as necessary. Content delivery infrastructure deployed in many last-mile networks, from companies including Akamai, Cloudflare, Google, Netflix, and Apple, is helping keep traffic local. This said, with the COVID crisis, **now is the time for Commissioners to call for more aggressive closure of the digital divide** – increasing the availability of affordable high-speed broadband connectivity to un-served and under-served users.

Support Internet exchange points (IXPs): Because IXPs help keep traffic local, giving local network providers a place to interconnect and exchange traffic with one another, as well as interconnecting with major content providers. IXP development is dependent on training local technical experts, building communities of interest, and working with policy-makers and regulators to support their development.

Support Community Networks (CNs): Because CNs offer a complementary access solution for connectivity, a lifeline for communities and to connect the unconnected. Governments can ease or eliminate barriers by easing regulatory requirements, providing tax and fee exemptions, expanding universal service and funding opportunities and enabling access to common resources such as spectrum.

Keep cross-communication channels and the Internet 'on' and call on policy-makers to allow providers to keep networks up and fully operational: Now is the time to anticipate short-term and long-term policy and regulatory changes that will continue to be required in the aftermath of the COVID-19 crisis. Some may be tempted to challenge the open and globally connected Internet model that we know. We would suggest that UN BBC members **issue a call to resist the temptation to close networks.** Keeping cross-border communication channels open is critical. Indeed, the Internet can only offer its full potential if it is locally and globally connected, and available, accessible, and affordable to all.

Insight from Commissioner Mr. Patrick Masambu (ITSO)

The Broadband Commission's work, through detailed compilation of data and elaboration of policy and regulatory recommendations, supports the global agenda for bridging the digital divide and reaching the global connectivity aspirations. One of the reasons the Broadband Commission has been able to achieve very commendable results is its guiding principles, especially the collaborative process. Under high-level leadership, the community of Commissioners, both current and former, represents a diversity of information and communication technologies (ICTs) stakeholders: top CEOs & industry leaders, civil society, international organizations, senior policy-makers that are uniquely positioned to drive the global broadband agenda.

The International Telecommunications Satellite Organization (ITSO) – which I represent within the Broadband Commission as a Commissioner – is an intergovernmental organization comprising of 149 member-states. It was created by the member-states to guarantee, through the ITSO Agreement, non-discriminatory access to international satellite communications while at the same time ensuring that through the use of satellite technology, their global broadband needs for connectivity and coverage can be met, especially in remote and hardest-to-reach areas. The international treaty also guarantees the use of highly-valued scarce resources, namely the Common Heritage assets, composed of a set of frequency assignments associated with orbital locations, to enable global connectivity.

Today, despite the diverse public-private partnerships that have been developed over time and the commitment of stakeholders, regional and international organizations, there is still a lot of work to be done to reach the goal of enabling access for the 3.6 billion people who remain unconnected. The necessity of reaching universal connectivity is more important than ever in order to give all the communities around the world more equitable access to sustainable development. Satellite communications resources have a key role to play towards achieving the targets of the Commission for 2025 and participation in meeting the UN Sustainable Goals by 2030. Reaching a Broadband-Internet user penetration of 75 per cent worldwide, with 65 per cent in developing countries and 35 per cent in least developed countries, will require the use of the three primary different technologies (satellite technology, fibre-optic cables, and terrestrial wireless systems) for the design, implementation and operation of broadband systems optimized on a case-by-case basis.

Over the years, ITSO has been advocating with the ITU and other partners to create awareness amongst policy-makers and regulators about the criticality of broadband access and in particular the use of satellite technology, as a major complement to other technologies for reaching the unconnected and achieving total access. The ITSO community's regular high-level meetings involving senior policy and regulatory officials have continuously offered unique opportunities for collaborative networking, policy development and creation of partnerships that address broadband issues.

The Broadband Commission's work is crucial, and as such, ITSO is committed to continued participation and playing an appropriate role in enabling the Commission to achieve its mission.

Insight from Commissioner Dato' Ir. Lee Yee Cheong (ISTIC Malaysia)

The UN Education Commission in its 2016 report "The Learning Generation: Investing in education for a changing world" states: "In 2016, a quarter of a billion children and young people are out of school. Millions more are simply denied the teachers and classrooms they need. Creating the Learning Generation requires closing the gap between today's USD 1.2 trillion in annual education spending and the USD 3 trillion level needed in low- and middle-income countries by 2030." Of particular relevance is the report's emphasis on digital learning. It emphasizes that a mindset shift is needed throughout the global education system to see technology not as an 'add-on' but as central to learning.

I do not believe that the world will be adopting more online virtual learning. Human beings are gregarious animals that have lived in communities since the dawn of civilization. Communal education in schools has been the norm. The communal education experience in school is amongst the happiest times in the lives of most humans and is very much valued. Advances and innovations in science and technology that underpin our civilization would continue to require STEM graduates who must hone their learning in physical experiments in physics, chemistry and biology laboratories in schools.

With broadband and related digital technologies and collective global political will, future epidemic outbreaks can be detected early and contained within the area of outbreak without it spreading to the rest of the world. Schools will remain open in future in most of the countries on Earth as during SARS, MERS and Ebola, etc. However, school buildings and the school ecosystem must be made safe for all stakeholders.

The current COVID-19 pandemic urgently requires all governments to make their existing and future school buildings safe against the current pandemic and future epidemics. They should also make their schools connected to broadband and their teachers and students accessible to all digital learning content for employment and wealth creation of their youth.

I would urge the Broadband Commission to come up with model designs of epidemic-safe schools for developing countries.

Insight from Commissioner Ms. Pamela Coke-Hamilton (ITC)

Now connectivity is everyone's business

In the years previous to 2020 we were working under implicit assumptions about connectivity. That it was a prerequisite for participation in the new era of digital trade, a necessary capability for individuals and enterprises to get online, market their products and services and get paid. That this would eventually ignite the economic growth of developing countries by increasing accessibility to new sources of demand. That this economic potential would be a motor for investment, drawing in funds to build more connectivity and so drive a virtuous cycle, eventually connecting the unconnected.

As an agency with a mandate in trade, we saw our role as a facilitator of this demand, a committed advocate alongside those tasked with building the connectivity. We shared in the frustration that broadband connectivity had only reached 50 per cent of the world's population, but at least there was a commitment to keep doing more.

Then COVID happened. Now, connectivity is everyone's business.

For us as an organization, digital capabilities turned out to be essential: the switch to remote working allowed us to maintain most of our development activities – we had a 50 per cent jump in enrolments on our e-learning portal and were able to launch new platforms for youth and ecommerce entrepreneurs, expand participation in our SheTrades platform, connecting many tens of thousands of businesses.

Connectivity has become essential to small enterprises and entrepreneurs in poor countries and in turn a determinant of economic recovery. It has spurred us to take more direct interventions. Installing a network of routers in Guinea. Subsidizing network access costs for IT sector entrepreneurs in Uganda. Delivering learning modules preloaded into off-grid access points in Iraq.

Like many others, we have been forced by circumstance into these innovations, but we have also learned a significant amount from it. Through online networks, we are able to link buyers and experts to communities and individuals who would normally not have met. As we come back to a new normal, with boots on the ground, we are excited to imagine how we can mix physical and virtual support in new and powerful ways.

We recognize that not only does demand drive connectivity, but connectivity also drives demand – especially for those who don't have it or can't afford it. To change the status-quo we need partnerships with network and technology providers that go beyond promises of action and start to deliver on the potential: connecting even the poorest and most remote to a means of making a living online.

Insight from Commissioner Dr. Hyeonmo Ku (Korea Telecom)

ESG management for the industries with ABC(AI, Big Data, Cloud)

Korea Telecom (KT) declared a transformation into a digital platform company (Digico) and implementing ABC (AI, Big Data, Cloud) technologies to solve environmental and social issues by promoting ESG management.

[Environment]

KT has been reducing greenhouse gases (GHGs) by optimizing network, A/C and heating system, converting vehicles to electric, and developing AI to save more than 10 per cent of energy. KT established a GHG monitoring system in 2018 and is reducing 40 000-50 000 tonnes of greenhouse gases annually. KT was the first MNO in Korea to enter the CDP Platinum Club by putting the company name up on the CDP Hall of Fame for four consecutive years.

KT-MEG (micro energy grid) is an energy management platform. Through an AI energy big data analysis engine E-brain, it can predict, manage, diagnosis and control power generation from production to transaction.

2021 is the first year of implementing RE100.[6] Six independent base stations that will run solely on renewable energy will be built as a pilot test and KT plans to expand power generation facilities for renewable energy as well.

One of cases that affected daily life for instance…

In 2017, KT started the Air Map Korea project to solve a nationwide concern – micro dust. Using KT's ICT infrastructure (power poles, base stations, public telephone booths, KT offices), up to 2 000 air quality measuring devices were installed. By securing micro dust data from the height of a person, KT provided micro dust information to all citizens through the application and IPTV in real-time.

[Social]

'KT e-mentoring' based on KT education platform provides jobs for college students (mentors) and reduces the learning gap for middle school students (mentees). 'KT Soaring Shop' provides information of commercial area analysis with sales tips to small business based on AI and big data. For 'Caring about you' campaign, AI was used to find voices for the hearing-impaired.

'Gwanghwamun One Team', brings together the capabilities of the government, social organizations, and companies to take a lead in building an ecosystem that solves problems in the local community by utilizing the various resources and capabilities. 'Warm Hearted Technology Plus', a social enterprise promotion provides funding, 1:1 tech and management consulting for selected companies that could create social value.

[Governance]

KT implemented the 'e-Voting System' for shareholders' convenient and transparent exercise. The board of directors is operated by external (eight out of 11) directors which exceeds the majority of the commercial law requirements. The CEO and the chairman of the board are separated, and the chairman of the board and the committee are appointed among external directors for the independent management.

KT maintained A+ in the ESG evaluation conducted annually by the Korea Corporate Governance Agency for listed companies. In the global evaluation, KT was selected as the number 1 group in the '2020 UN SDGs Business Index' announced by the 'UN SDGs Association' for the second year in a row.

Insight from Commissioner Mr. Paul Mitchell (Microsoft)

The COVID-19 pandemic has brought into stark relief the importance of broadband connectivity for everyday life, and the continuing digital inequity that exists today. Those with connectivity and the skills to use it have been able to adapt, continue school and work, communicate with friends and relatives, shop, and be entertained. But, for those not connected, it has been exponentially more difficult.

Addressing the inequities is critical to advancing global development priorities. Through the Microsoft Airband Initiative, we partner with Internet service providers, telecom equipment makers, nonprofits, and local entrepreneurs to advance digital equity – access to affordable Internet, affordable devices, and the digital skills to use them – as necessary for empowerment and digital transformation across the world. We've learned that this will require thoughtful, tailored approaches appropriate to local conditions, that there is no one-size-fits-all, and that programs and policies should consider the end-user's perspective, whether urban or rural, digitally literate or not.

Microsoft encourages a human-centric approach[7] to ensuring that global broadband is robust, ubiquitous, evolving, and affordable, with a particular focus on the unserved and the underserved. We recommend that stakeholders and policy-makers prioritize three pillars:

Internet adoption: Measure the breadth and equity of Internet usage and ensure all people have the devices, skills, and tools needed to reliably access basic human services, healthcare, economic development opportunities and education. More work remains to be done to have a fuller understanding of how and where to allocate resources. The international community needs more data on where connectivity gaps are greatest, the populations most impacted by a lack of connection, and those at greatest risk of being left behind.

Affordable technology: Ensure access to affordable infrastructure by taking a technology-agnostic approach – lowering cost while not sacrificing utility. Technology investments needed to achieve connectivity must incorporate the most cost-efficient technologies and consider alternative approaches when necessary and available, including Low Earth Orbit (LEO) satellites, shared spectrum, fixed Wireless/Wi-Fi, and fibre. ITU's Last-Mile Internet Connectivity Solutions Guide[8] offers a comprehensive guide to affordable alternative technologies.

Sustainable financing: The international community should pay particular attention to the sustainability of financing. Technologies and business models with the lowest cost that deliver the most value, both for investors and end-users, will differ per region. The path to sustainable connectivity for all must include blended financing partnerships between the private sector, multilateral organizations, governments, and local community networks where appropriate.

The momentum is now: stakeholders in government, industry, civil society, and international organizations have expressed renewed willingness to act – including in the April 2021 joint multi-stakeholder statement vowing to Leave No One Behind[9] – which has been intensified by the ongoing impacts of the COVID pandemic. At this moment, when connectivity has never been more crucial, we must take a human-centred and technology-agnostic approach to connect the unconnected now.

Insight from Commissioner Mr. Pekka Lundmark (Nokia)

The new normal is already here. And at Nokia, we are embracing the new ways of working enabled by technology during the pandemic to permanently move to a hybrid workplace.

What this means in practice is giving our employees greater choice and flexibility over their work. For some people this will mean they mostly work from home, for others this will be mainly working in offices redesigned to offer more collaborative spaces, and in other places we will secure the right facilities as and when required.

Virtual conferencing and collaboration tools, cloud platforms, and super-fast reliable connections will play a big part in the new Nokia hybrid workplace. And for many other organizations too.

Our experts [Nokia Deepfield] believe the demand for bandwidth and low-latency connectivity will continue to soar even when workplaces can fully reopen. To meet this rising demand and ensure fast, secure, reliable digital access for individuals and organizations we need to rapidly accelerate the rollout of new technologies like 5G and next-generation fibre to the home.

The new normal requires us to get to a gigabit world as fast as possible. But increasing digital inclusion and access to digital employment and education opportunities is also essential. As this report clearly illustrates, there is a danger of a new divide opening up between the types of workers who can perform their roles remotely and those working in industries, or living in countries, where that isn't possible. We need to continue working together on a global scale to achieve universal broadband connectivity for everyone.

We need to learn the right lessons from the pandemic. That means viewing the positive temporary changes forced on organizations and governments as possibilities to create permanently better ways of working, travelling and living.

Can we use tech-enabled ways of working to help spread employment opportunities outside of major cities?

Can we use digital tools and hybrid working to cut the need for unnecessary polluting car and plane journeys?

At Nokia, we believe the answer is yes to both. And we have committed to working with our partners to create technology, which helps provide more inclusive access to work, healthcare, markets and education for everyone.

Insight from Commissioner Ms. Ann Aerts (Novartis Foundation)

New online tool aims to help lower-income countries leapfrog AI-enabled health solutions

The Novartis Foundation has launched a free online assessment tool to help countries identify where to best invest resources to enable successful deployment of AI solutions in health. The tool translates the 2020 report from the Broadband Commission Working Group on Digital and AI in Health, Reimagining Global Health through Artificial Intelligence: The Roadmap to AI Maturity, into actionable insights for decision-makers.

COVID-19 makes the need for a digital and data-driven transformation in health even more critical, given that it has created a void in which other diseases are left potentially undiagnosed and untreated. Yet, most countries still need to build adequate and useable health datasets. A lack of sufficient skills in the field of digital technology and data science in our populations, workforces and leaders is compounding this challenge, as is the absence of strong governance and regulatory systems to safely deploy AI solutions in health for example.

However, knowing where to best invest resources for using technology to impact the health of the largest number of people is difficult. That was the reason behind Reimagining Global Health through Artificial Intelligence: The Roadmap to AI Maturity, which proposed a six-step roadmap for countries to advance their AI in health maturity. The six areas a country needs to invest in to advance on its readiness for using AI in health are: digital and data science skills of people and workforces; data and infrastructure; governance and regulatory systems; needs-driven and human-centred designs and processes for health system integration; multisector partnerships; and innovative business models.

The Novartis Foundation has now translated this roadmap into an actionable self-assessment tool that helps countries identify which of the six areas require more investment to successfully integrate AI in health. This freely available, online AI in Health Maturity assessment tool helps countries assess their readiness, and identifies areas that need to be strengthened to realize the full potential of AI technology in health. The ultimate goal of the tool is to leave no country behind in realizing the potential of this transformative technology.

Shared data from the self-assessments can foster best practice-sharing, determine opportunities for collaboration on data- and AI-driven innovation in health, and inspire policy-makers around the world to design actionable roadmaps toward AI maturity in health.

Insight from Commissioner Mr. Stéphane Richard (Orange)

Innovative digital services are helping to achieve the UN Sustainable Development Goals (SDGs) by providing access to health, education, and financial services[10]. However, 4 billion people, or half of the world's population, still do not use the Internet even though 3.4 billion between them – the usage gap – live in an area covered by a mobile broadband network[11]. If we don't take action now, we run the risk of reinforcing existing inequalities in the digital world and further marginalizing vulnerable people in the post-pandemic world. Our three recommendations are:

1. We need to invest in digital skills as much as in network extension
2. We need regulatory frameworks stimulating investment and reducing connection inequalities
3. We need a multi-stakeholder approach to digital inclusion

We need to invest in digital skills as much as in network extension.

While the coverage gap fell under 600 million people with the continued expansion of 3G+ networks, the usage gap, 3.4 billion people, remains a global challenge, with significant regional disparities. The COVID-19 crisis has highlighted that digital skills are essential to access a large range of services, to keep learning at all ages and for employees across all economic sectors. Thus, it is important to tackle the digital skills gap, which remains high across all levels of skills and across all continents.[12]

Orange has been investing in digital skills in all its operating countries with a flagship initiative, Orange Digital Centers, which are free and innovative ecosystems dedicated to training people in digital technology, technology incubation, and start-up acceleration and financing. A partnership with the federally-owned enterprise GIZ, operating on behalf of the German Ministry of Economic Cooperation and Development (BMZ), has accelerated the project's deployment in the African and Middle Eastern region.[13]

We need regulatory frameworks stimulating investment and reducing connection inequalities. To accelerate digital inclusion, we need stable and forward-looking public policy and regulatory frameworks, able to adapt to innovative and dynamic markets, promoting policy measures to support increased network investments, through new or already existing business models, such as co-investments, open architectures of networks, and infrastructure sharing models helping to expand fixed and mobile coverage. A stable, predictable and fair regulatory and fiscal environment encourages investment and thus, digital inclusion.

We need a multi-stakeholder approach to digital inclusion.

The infrastructure investments needed are colossal and are largely assumed by telecom operators.[14]

Partnerships allow to pool funds and expertise: for example, through our partnership Orange AMN (Africa Mobile Networks) – which has received support from the European Investment Bank for rolling out mobile phone coverage in remote rural areas,[15] more than 700 sites have been deployed in Cameroon and the Democratic Republic of the Congo.[16] As a result, 2 million inhabitants, who previously had no connectivity, are now able to access digital mobile services (voice, data, and financial services).[17]

Multi-stakeholder partnerships such as the Broadband Commission involving private actors, state administrations and international organizations[18] are key to nurture innovative business models and advance digital inclusion.

Insight from Commissioner Prof. Mercedes Aráoz (Peru)

The COVID-19 pandemic had increased the number of poor people all over the world; the impact was higher in the rural areas in which 80 per cent of the poorest of the world live. Digital inclusion can enable vulnerable people to thrive and be resilient to external shocks such as pandemics and climate change related phenomena, among others. It is time for pushing forward digital inclusion to provide people instruments to avoid returning to poverty and improve their livelihoods. It is urgent to achieve 2025 targets.

First: Governments should imbed digital tools in their social programs, for example electronic wallets and other means of payments. At the same time, promote financial inclusion through digital savings, loans, and payments. During the pandemic, many developing governments couldn't reach their most vulnerable population with emergency subsidies because they were not connected or not able to use digital tools. Their social programs weren't prepared to use electronic transfers; as a result, there was a spread of COVID-19 related to the agglomeration of people collecting those subsidies. This could be avoided. For the poor in rural areas, use of these digital financial tools could achieve the benefits of financial inclusion, like market access, access to technical resources, etc.

Second: It is important to focus on digital education, especially for women and the youth, to improve their employment opportunities and their entrepreneurial skills. Unemployment has increased given the intermittent shutdowns; the informal sector has also grown. Those without digital skills probably will be left out of the labour markets, given the new demands of firms. Women usually have the greater burden. Governments, together with the private sector, can reduce digital illiteracy if they work together. There are good private public partnerships providing capacity building. These programs should be extended all over.

Third: Opportunities for SMEs are now in the digital world, given the changes in the way people trade, so connectivity should be our concentration, particularly in rural areas. The pandemic has shown that small farms are the main suppliers of food systems, but don't benefit from them, they receive very low prices given the multiple stages to get to the markets. The same is true for small crafters. This can be changed if they have connectivity. Governments must promote the investment in and the use of broadband to reduce poverty.

Insight from Commissioner Mr. Lacina Koné (Smart Africa)

The seven 2025 Advocacy Targets of the Broadband Commission provide a holistic approach towards achieving digital inclusions which will accelerate efforts towards achieving the SDGs by 2030.

From a Smart Africa perspective, the three key recommendations are as follows:

1. Promote and encourage innovative financing modules for sustainable broadband coverage in rural communities:

   Nearly 60 per cent of sub-Saharan Africa's population live in rural areas. The economic models that have been used for the deployment of broadband services in the cities have proved NOT to be applicable in rural areas generally due to low-income levels; low population densities; lack of resources and supportive infrastructure among others. The Commission needs to encourage the adoption of innovative economic and financing modules that will attract the right technical solutions and investment in these rural areas.

2. Promote and encourage basic digital literacy across all levels of the global socio-economic landscape.

   Lack of or inadequate basic digital literacy across all levels of society is another contributing factor to the high broadband usage gap or adoption gap globally, particularly in Africa. As indicated in the Commission's State of Broadband 2020 report, the self-reported reasons for persons not using the Internet include people who just cannot use the Internet, or do not see the need to use the Internet, or in some worse cases, people do not even know that the Internet exists. The Commission is encouraged to work with stakeholders to mobilize the required resources to promote and provide basic digital literacy across all levels. The Smart Africa Digital Academy (SADA) has the objective of providing digital literacy across all levels. We therefore call on all stakeholders to support this endeavour.

3. Promote and encourage basic online personal protection and cybersecurity:

   As we embrace digital transformation across the globe, there has been concerns about online personal and data protection of users of digital tools. To this end, users may be discouraged from using these tools and services if they do not feel safe and secure. And this can be a major threat to our efforts towards digital inclusion. The Commission is therefore entreated to give adequate attention to the promotion and encouragement of basic online personal protection and cybersecurity. Smart Africa has been working with stakeholders within the data protection and cybersecurity space to ensure the right policies are put in place by the Smart Africa Member States to ensure online personal and data protection of users.

Insight from Commissioner Mr. Bocar Ba (SAMENA Telecommunications Council)

Transformative Considerations for the 'Year of Recovery'

In response to the year 2020's challenges, the digital communications industry has demonstrated its resilience and power to support societal and business continuity by leveraging digital communications networks and technologies and their meaningful application in accordance with newest human life experiences that have made digital interaction and remote work the 'new normal'. Inspired by the Commission's Agenda for Action and various recommendations, the right to prosperity for all, with broadband now being recognized as a fundamental human right, has received a new level of recognition within the international community, lending life to the objective of connecting the unconnected and leaving no one behind.

SAMENA Council, taking the Commission's Agenda for Action and its spirit to execution, has over the last year, explored how to best catalyse technical, business, institution-level, and regulatory changes brought on by the epidemic across four fronts: *multi-stakeholder engagement*, *public-private priority alignment*, *evolution of the cyber ecosystem*, and *enablement of socio-economic digital transformation through advanced technologies*. To this effect, SAMENA Council has congregated ICT leaders driving change and setting into practice new norms in regulation and policy-making at its world-class stakeholder communication platform to focus on the need to transform policy to reality and thereby address the critical need to ensure cross-industry and cross-stakeholder collaboration, to be able to achieve the digital inclusion aspiration and to contribute to achieving the UN SDGs.

As part of the ITU's efforts in the region, the Council has stressed the *need to align public-private priorities coupled with the right incentives*, so that investment is maintained in building the required broadband infrastructure and in realizing an inclusive digital economy in the region. The Council has emphasized to regional regulators *the importance and availability of affordable spectrum* and rectification of signal interference issues with effective regulatory approaches to address the future connectivity requirements. The Council has also voiced the need for *devising mechanisms for reducing high industry fees and taxation* by taking into consideration international best practices and implementing the ITU's collaborative regulation model; *allowing for cross-border data flow* for network operators and immediate pilot projects to this effect; and *championing innovation in the creation and adoption of new digital services* by governments.

Universal Digital Access and Services are the fundament for a resilient and inclusive digital future and its enablers need to be at the top of governments' agendas. While the private sector is the key engine of innovation and change, only in collaboration with the public sector and other key stakeholders including UN agencies and NGOs, academia and civil society can we ensure that no one is left behind going forward and that we can achieve the Broadband Commission's connectivity goals and the UN's SDGs.

Insight from Commissioner Mr. Roberto Sanchez (Secretary of State for Telecommunications and Digital Infrastructures, Ministry of Economic Affairs and Digital Transformation, Spain)

Connectivity infrastructures are at the cornerstones of the digital society. People´s lives, business activities, education, health and social services are highly dependent on the quality and the resilience of the digital networks. During the COVID-19 pandemic in Spain we have focused on keeping the country connected. Guaranteeing the continuity of services, not leaving anyone behind, preventing cuts, and preserving our lives already altered by the COVID-19 health crisis.

Our department, the Secretariat for Telecommunications and Digital Infrastructures, reinforced the ordinary supervision activities to ensure that essential services were not disrupted. We adopted extraordinary[19] regulatory measures to keep the connectivity service fully operational, and we signed an agreement with the telecommunication operators to guarantee connectivity for people and business within the recommendation's framework established by health authorities.

The pandemic has introduced changes that 64 per cent of Spanish believe will remain.[20] In 2008, only 18 per cent of Spanish people considered that Internet was 'essential' in their life; nowadays this percentage has risen to 60 per cent. In fact, 90 per cent use the Internet on a daily basis and one-third affirms to be connected almost all day long. The most noted example is teleworking, which has almost doubled from 16 to 30 per cent. We must say that telecommunications infrastructures in Spain responded without incident to the unprecedented increase in demand.

Many of these changes will remain. The need for broadband extension, quality and adequate services to cover the demands of the society are now evident for all the population, and this issue is rising on the social agenda. Consequently, the policy agenda needs to focus on this challenge, including filling the gaps for those who do not have access, skill or affordability to be in the digital world. The new agenda, 'Digital Spain 2025', establishes resources and means to achieve the digital transformation that will lead us to social well-being, more inclusive, resilient and cohesive.

The COVID-19 health crisis has established a new starting point in the digital transformation process, not only for the economy, but for the society as a whole. Digital networks allowed us to resist and will now pave the way for sustainable growth. 5G technology, with its disruptive capacities will start a new generation of services, uses and tools for consumer and business, making us more resilient for future crisis.

Insight from Former Commissioner Ms. Fekitamoeloa Katoa 'Utoikamanu (UN-OHRLLS)

The COVID-19 pandemic has exposed and exacerbated the considerable inequalities within and between countries and shown the deep divide between the digital 'haves and have-nots'.

Least developed countries (LDCs), landlocked developing countries (LLDCs) and small island developing states (SIDS) lag far behind. In 2019, a mere one-quarter of the population used the Internet in LLDCs, an estimated 50 per cent in SIDS, and in LDCs, only 19 per cent of the population have access to and use the Internet. When we look at in-country access data, this divide is even more severe for rural areas and usage by women (ITU, 2018).

In short, once more the most vulnerable are left behind and cannot benefit from the opportunities digital technologies offer.

For an estimated 800 million people in LDCs left without Internet access, virtual classrooms, accessing of e-government services, working remotely, conducting business online, and communicating with colleagues, friends, and families – which has become a routine for most people in developed and advanced developing countries during the pandemic – is a faraway dream!

To achieve the 2025 targets and 2030 SDGs, the Broadband Commission and the international community must increase their focus on ensuring digital inclusion for the people of the LDCs, LLDCs and SIDS. We need to accelerate action to create comprehensive digital ecosystems in those countries.

I recommend accelerated investment in broadband and energy infrastructure, particularly in hard-to-reach and remote areas in LDCs, LLDCs and SIDS, which may require satellite broadband as an available alternative.

Second, promoting a competitive market for operators offering a variety of plans that cater to different income levels, and thereby addressing the high costs of Internet access and usage. In areas or communities where the provision of broadband services is economically unviable for commercial operators, there may be a need to use universal service funds to bring the costs to affordable levels.

And finally, it is necessary to invest much more in developing digital literacy and skills, development of local content available in local languages, and this would go hand-in-hand with increased school enrolment and targeted programs for those out-of-school.

It is undisputable that in the 21st century, access to and literacy in the use of the Internet is an essential skill and public service. Let us focus our efforts on digitally including the people in LDCs, LLDCs and SIDS, to achieve the 2025 targets and the 2030 SDGs.

Insight from Commissioner Mr. Filipo Grandi (UNHCR)

There are more than 80 million people around the world who have been forced from their homes. Uprooted from friends and family, their connections with home are tenuous while at the same time, additional challenges, like a new language or culture, can inhibit their ability to bond with and be included in their host community.

Connecting, for them, is more than something nice to have, but an essential tool to retain a sense of identity; of inclusion; of belonging.

With the COVID-19 pandemic accelerating technological change and an increasing number of services – including basic services like education – moving online, digital connectivity is even more important. If vulnerable people, including refugees and internally displaced people, are not able to access these opportunities, they and their children are at risk of being left behind.

The Broadband Commission gets this and has made universal connectivity a cornerstone of its work. Yet to truly achieve this goal for refugees and other forcibly displaced people, we need to ensure that the Broadband Commission's 2025 targets prioritize them and others often on the margins of society.

UNHCR therefore encourages the Broadband Commission to consider three interrelated approaches that would further refugee and others' connectivity.

First – the Broadband Commission can provide greater support and expertise to national initiatives that seek to expand digital inclusion of refugees, displaced, stateless people and their hosts.

Second – the Broadband Commission can continue its own drive to include less connected and marginalized communities and users. By listening directly to refugees, internally displaced and stateless people, including youth, women, and others such as the disabled, the Broadband Commission can provide space for their voices and ensure that their hopes and aspirations are also championed.

Third – in order to achieve digital inclusion of the most marginalized, new approaches and techniques need to be applied. The Broadband Commission could create space for innovators around the world to share their experiences so we can all learn from and share best practice.

As we work towards a post-COVID-19 world, we must ensure that digital connectivity – like vaccines – reaches everyone, including refugees, displaced and stateless people around the globe.

Insight from Former Commissioner Ms. Phumzile Mlambo-Ngcuka (UN Women)

Acting on transformative commitments to achieve connectivity and equal access to technology for women and girls

Around the world, there are millions of women and girls who could right now be working, learning and accessing critical information from wherever they are, if only they were connected. From distance learning that links women and girls to career-boosting knowledge and skills development, to digital finance that enables them to open their own bank accounts, and Femtech that helps women monitor their health – for instance by tracking their menstrual cycles – the potential of technology and innovation to bridge gender inequalities is vast. And with research showing that the COVID-19 crisis could this year push 47 million more women and girls into extreme poverty and keep an additional 11 million girls out of the classroom for good, the time to act is now.

This is why UN Women made technology and innovation a key focus of the Generation Equality Forum, which culminated in Paris in July with nearly USD 40 billion in confirmed investments, as well as ambitious policy and program commitments to empower women and girls in all their diversity. This includes pledges to a dedicated Action Coalition on Technology and Innovation for Gender Equality – of which many Broadband Commission colleagues are also members – which aims to ensure that women and girls have equal access to digital tools, are protected from online gender-based violence and can become the new generation of innovators.

The commitments we saw from governments, philanthropies, civil society, youth organizations and the private sector were diverse and inspiring. For instance, the Government of Finland committed EUR 150 million to bridge the gender digital divide over the next five years; the Government of Bangladesh pledged to increase women's participation in the ICT sector to 25 per cent by 2026 and to 50 per cent by 2041; and the Government of Rwanda committed to target smartphone ownership, access to digital financial services and STEM studies at the upper secondary level. Facebook, Google, Twitter and TikTok announced commitments to tackle online gender-based violence and to improve women's safety on their platforms, while the Global Fund for Women pledged to mobilize USD 5 million to fund gender justice movements and campaigns advancing feminist technology and innovation. These are the kinds of bold steps that we need to ensure a digital transformation that benefits everyone.

Such commitments are strongly aligned with those made by the Broadband Commission members to achieve gender equality in Internet users, digital skills, digital financial services and to bring broadband and Internet connectivity to everyone, everywhere by 2025. UN Women invites all Broadband Commission members to join the Generation Equality Action Coalition by making a commitment and uniting towards a gender-diverse digital evolution, so that over the next five years we take steps together to ensure every woman and girl can have access to meaningful connectivity and the financial resources, equipment and digital skills needed to get online. When we work together towards our shared goals, we can create a better-connected, innovative and more inclusive digitalized world for all.

Insight from Commissioner Mr. Hans Vestberg (Verizon)

The Time Is Now

2020 was a year like no other. The COVID-19 pandemic presented unparalleled challenges, including devastating health and economic impacts for our society. As a company, Verizon navigated obstacles that forced us to alter our ways of working, communicating and operating to keep people connected. Collectively we saw how broadband networks and services are vital to so many aspects of our daily lives, including our health, education, work and safety.

We leapfrogged 5-7 years forward in the digital revolution in just one calendar year, proving that mobility, broadband and cloud services are the 21st century infrastructure on which everything will operate. This has created unprecedented opportunity, but it has also created incredible vulnerability for those who are not currently connected. This challenge will be enduring unless we act *now*.

Verizon is working with communities and the government to help tackle this issue by expanding digital access with affordable and usable products and services, promoting digital literacy with innovative programs directed toward underserved communities, and urging holistic and broad solutions to address the digital divide.

For instance, we immediately recognized the urgency for school districts to quickly and seamlessly secure connectivity for students to participate in remote learning during the pandemic. We launched a new national Verizon Distance Learning program, where we have partnered with independent school districts and state departments of education to deliver 4G LTE wireless connectivity, devices and other solutions to students in the United States. In particular, we are providing K-12 institutions with reliable connectivity, devices (i.e. hotspots/MiFi units), mobile device management and other security/ compliance apps that school districts rely on to support distance learning at significantly discounted rates. By the end of 2020, discounted Internet access, devices and security solutions were available for purchase by school districts to support distance learning across 41 states and the District of Columbia.

No single actor can address this challenge alone. Strong, multi-stakeholder leadership and partnership is needed if we are to make progress. The UN Broadband Commission has championed connectivity as fundamental to a sustainable and inclusive world and must continue in this important work to strengthen the digital foundation for the 2030 Global Goals.

Verizon is also leading the World Economic Forum to establish the EDISON Alliance, of which the Broadband Commission is a foundational part, to mobilize all sectors of the economy to address access, affordability and usability of digital services. This Alliance draws on cross-industry, cross-sector and cross-jurisdictional perspectives to drive ideas for impact, identify leading practices, and scale existing partnerships and initiatives across health, education and finance.

Our most important work is still ahead. It is imperative that we work collectively to accelerate digital inclusion and a sustainable future for all. The time is now.

Insight from Commissioner Mr. Nick Read (Vodafone)

In 2021, 51 per cent of the world are not using mobile Internet, and 44 per cent live within broadband coverage that they do not use. That is 3.4 billion people globally who have mobile broadband coverage, but do not use it. It is essential that we move from talk to action to close the digital divide for good, and accelerate progress towards the SDGs. To do so, Vodafone makes three recommendations to the UN Broadband Commission:

1. First of all, the broadband community must mobilize around lowering the cost of 4G devices in the least developed countries (LDCs). Our collective efforts to increase network coverage, digital skills and data affordability will have limited impact if citizens cannot afford 4G devices. Nearly 2.5 billion people live in countries where the cheapest smartphone costs over a quarter of the average monthly income. In Africa, this cost rises to 63 per cent of the average monthly income. To overcome this challenge, operators, device manufacturers and governments must come together to implement targeted policy reform that reduces the cost of devices for the long-term. These interventions could include import duty relief on 4G devices, the use of Universal Service and Access Funds (USAFs) to subsidize devices, and policy reform to allow operators to provide device financing to customers without a formal credit-rating.

2. Second, we believe every government should create a comprehensive National Digitization Plan. These plans can provide a clear roadmap to closing the digital divide and achieving the Commission's 2025 targets, as well as forming a core part of pandemic recovery strategies. Plans should address all barriers to digitization from broadband coverage, to regulation, to gaps in digital skills. These plans can also drive private sector investment and partnerships by providing a long-term vision for the country's digitization, and contribute towards closing the USD 428 billion investment gap to achieve meaningful connectivity globally.

3. Finally, we propose a comprehensive digital financing strategy for Africa, led by international financial institutions (IFIs). To bring meaningful connectivity to all Africans by 2030 requires USD 109 billion in additional investment. We know that scaled, regional investment plans can deliver faster, better outcomes for populations. However, Africa is falling behind the global trend by not having a financing plan. We will simply not overcome the digital divide in Africa until we find answers on how to close the digital investment gap.

Insight from Commissioner Mr. Ziyang Xu (CEO of ZTE Corporation)

First of all, I would like to extend my sincere gratitude to the leadership of the Broadband Commission and all Commissioner colleagues for the superb attitude, impeccable professionalism, coupled with incomparable passion in handling their responsibilities. All of this directly contributed to the achievement of significantly meaningful milestones in the way to push forward digital inclusion, implement Sustainable Development 2025 targets and the 2030 Agenda for Sustainable Development.

It was observed that one crucial common driving factor underpins both the 2025 targets and 2030 SDGs, which came from the urgent need to accomplish a couple of goals, e.g. entry-level broadband services should be made affordable in developing countries by 2025, broadband/ Internet user penetration worldwide, developing countries and the least developed countries should reach a certain level by 2025, build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The common driving factor that underpins the above goals, from my perspective, is the unprecedented need for information infrastructure at a more advanced, more effective and more reliable level based on the revolutionary convergence of Information Technology (IT), Communication Technology (CT) and Operation Technology (OT).

None of the above goals will be achievable in the absence of the foundational capacities. For instance, thanks to the commercial deployment of more than 819 000 5G base stations by May 2021, along with the promising practice of diversified Cloud, Net and Edge ecosystems, China effectively brought 280 million 5G handset connections to 1.41 billion people. All of this was achieved while keeping the monthly mobile ARPU to as little as USD 5.94 – which is the price of a cup of entry-level coffee in many nations. The 5G+ Industrial Internet, which is strongly believed to be one the forces to revolutionize industries by paving the path for the digital economy, will harness the OICT capabilities like never before. I am pleased to propose a few ways forward to continue the success of implementing the agenda of the 2025 targets and 2030 SDGs in Broadband Commission by using the power of example.

- Advocate the benign and rule-based OICT ecosystem under the framework of the United Nations with international consent aiming for safeguarding a fair, non-discriminatory and reliable global industrial supply chain which is the key to ensuring sustainable development in all nations.
- Harness the strength of best practices which demonstrate the conducive changes that enable progress in terms of facilitating the accomplishment of the missions under the agenda of the 2025 targets and 2030 SDGs.
- Work closely with more international stakeholders of various organizations, sectors, countries and regions to identify and apply the paradigm of implementing the 2025 targets and 2030 SDGs in the world.

Endnotes

1 The Commissioner Insights reflect the views of their authors alone and do not reflect the views of the Broadband Commission.

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Annex 1: Full list of recommendations presented in the State of Broadband reports 2012 – 2021

Category	Recommendation
ICT Policy and Regulatory Regimes	2012 – 7.4 Consider reviewing and updating ICT regulations 2012 – 7.5 Consider a unified licensing regime; 2012 – 7.6 Consider converged regulation 2012 – 7.11 Incorporate sustainability principles into ICT regulations and policies 2013 – 7.1 Promote market liberalization 2013 – 7.2 Review and update regulatory service obligations 2013 – 7.6 Review licensing schemes 2016 (6.1) & 2017 (5.1) Review and update regulatory frameworks for broadband 2018 – 5.7 Review and adapt legal frameworks to take into account digitalization
Improving Data / Statistics / Monitoring	2012 – 7.10 Monitor ICT developments, based on statistical indicators 2013 – 7.10 Support accurate and timely statistical monitoring 2014 (7.6) & 2015 (6.9) Engage in ongoing monitoring of ICT developments 2016 – 6.12 Benchmark and monitor developments in telecom and ICT 2017 – 5.4 Benchmark trends and developments in telecom and ICTs 2018 – 5.3 Benchmark and monitor ICT developments
Increasing Skills / Human Capital / Capacity-Building	2012 – 7.12 Promote the skills and talents necessary for broadband 2014 – 7.2 Promote Education for All (EFA), including the use of broadband, as well as the skills and talents necessary for broadband 2015 (6.7) & 2016 (6.8) & 2018 (5.2) Promote training and measures to stimulate demand 2018 – 5.5 Strengthen digital skills & literacy
Universal Service Approaches: USFs, USOs	2012 – 7.3 Use Universal Service Funds and other financial mechanisms to develop broadband 2013 – 7.5 Update and utilize Universal Service Funds 2014 – 7.7 Utilize Universal Service Funds (USFs) to close the digital divide 2015 (6.2) & 2016 (6.4) Make full use of Universal Service Obligations (USOs) 2018 – 5.4 Review Universal Service Measures, including RoW regulations

(continued)

Category	Recommendation
Taxation	2012 (7.7) & 2014 (7.3) & 2015 (6.5) & 2016 (6.7) & 2018 (5.8) Reduce taxes and import duties on telecommunication/ ICT equipment and services 2013 – 7.7 Review & reduce taxation
A Focus on Local: Content, Language, Hosting, Entrepreneurship	2012 – 7.8 Stimulate the creation of local content in local languages 2013 – 7.9 Spur demand and introduce measures to stimulate the creation of local content 2014 – 7.5 Enhance demand for broadband services through new initiatives and local content 2015 – 6.8 Invest in the creation of local content in local languages 2018 – 5.6 Support local e-businesses and local entrepreneurship 2016 – 6.9 Encourage local innovation through strategic local hosting
Financing and Investment	2014 – 7.4 Accelerate investment in broadband infrastructure 2015 – 6.6 Promote investment in broadband infrastructure 2016 – 6.3 Encourage investment by both the public & private sectors 2016 – 6.11 Promote advanced market commitments for rural broadband access 2017 – 5.3 Encourage investment in Internet infrastructure 2021 – Increase funding levels and address issues of fragmentation
Open Access and Infrastructure Sharing	2013 – 7.3 Consider open-access approaches to infrastructure 2015 – 6.3 Consider infrastructure-sharing and open-access approaches to publicly funded infrastructure 2016 (6.5) & 2017 (5.5) Consider infrastructure-sharing

(continued)

Category	Recommendation
Spectrum Policy	2012 – 7.1 Explore fresh approaches to spectrum management 2013 – 7.8 Review policy frameworks for spectrum 2014 – 7.1 Monitor, review and update ICT regulations and regulatory approaches to spectrum 2015 – 6.1 Review and update ICT regulatory frameworks, including regulatory approaches to spectrum
National Broadband Plans/strategies	2013 – 7.4 Introduce and develop a national broadband plan 2017 – 5.2 Develop and enhance national broadband plans 2018 – 5.1 Build National leadership for broadband 2019- Include in broadband plans: Digital inclusion, measures to protect children online, a focus on limiting environmental impacts and addressing climate, public access initiatives 2021 – Adopt a people-centric approach
Additional issues: Rights of Way / Dig Once, E-Government Initiatives, Public Consultation, Affordability, Climate Change, Intellectual Property, Internet of Things and Smart Cities, trust, and Cross-Border Data Flows	2012 – 7.2 Implement 'Dig Once' policies & expedite rights of way and construction permits 2012 – 7.9 Enhance demand for broadband through e-gov initiatives 2013 – 7.11 Consider undertaking public consultations on policy 2015 (6.4) & 2016 (6.6) Consider measures to make broadband More affordable 2014 – 7.8 Review frameworks for Intellectual Property (IP) 2016 – 6.2 Improve policy frameworks for IoT and smart cities 2016 – 6.10 Promote free flows of information 2021 – Address environmental impacts of digital infrastructure and the potential of connectivity's contribution to addressing the climate emergency 2021 –Ensure public confidence in participating online by considering increasing efforts to prevent cybercrime and cybersecurity incidents

Acronyms

3G	Third Generation of wireless mobile telecommunications technology
4G	Fourth Generation
5G	Fifth Generation
A4AI	Alliance for Affordable Internet
AE	Advanced Economies
AI	Artificial Intelligence
AIM	ASEAN ICT Masterplan
AMN	Africa Mobile Networks
AR	Augmented Reality
ARPU	Average Revenue Per User
ASEAN	Association of Southeast Asian Nations
BITAG	Broadband Internet Technical Advisory Group
BMZ	German Ministry of Economic Cooperation and Development
BWA	Broadband Wireless Access
CAGR	Compounded Annual Average Growth Rate
CAPEX	Capital Expenditure
CATV	Cable Television
CDN	Content Delivery Network
CDR	Call Detail Records
CIS	Commonwealth of Independent States
CITC	Communications and Information Technology Commission (Saudi Arabia)
COVID-19	Disease caused by the coronavirus SARS-CoV-2
CPE	Consumer Premise Equipment
CRM	Customer Relationship Management
CSF	Carlos Slim Foundation
CSP	Communication Service Provider
DEF	Digital Empowerment Foundation
DRB	Digital Resilience Bonus
DSL	Digital Subscriber Line
EBS	Educational Broadband Service
EMs	Emerging Market Economies

(continued)

EO	Earth Observation
ERP	Enterprise Resource Planning
EUTELSAT IGO	European Telecommunications Satellite Organization
EV	Electric Vehicle
FAO	Food and Agriculture Organization of the UN
FAS	Financial Access Surveys
FCS	Fundación Carlos Slim/Carlos Slim Foundation
FinTech	Financial Technology
FTE	Full-Time Employment
FTTH	Fibre-To-The-Home
FWA	Fixed Wireless Access
G2P	Government-to-Person
G20	Group of Twenty
GB	Gigabyte
GEC	Global Education Coalition
Gbps	Gigabyte per second
GDP	Gross Domestic Product
GEO	Geosynchronous/Geostationary Orbits
GHG	Greenhouse Gas
GNI	Gross National Income
GNSS	Global Navigation Satellite System
GPA	Grade Point Average
GPON	Gigabit Passive Optical Networks
GPT	General Purpose Technology
GSMA	GSM Association
HIC	High-Income Country
HTS	High-Throughput Satellite
IATA	International Air Transport Association
ICT	Information and Communication Technology
IDB	Inter-American Development Bank
IEEE	Institute of Electrical and Electronics Engineers

(continued)

IFC	International Finance Corporation
IGO	Intergovernmental organization
ILO	International Labour Organization
IMDA	Infocomm Media Development Authority (of Singapore)
IMF	International Monetary Fund
IoT	Internet of Things
ISP	Internet Service Provider
ISTIC	International Science, Technology and Innovation Centre for South-South Cooperation (Malaysia)
ITC	International Trade Centre
ITSO	International Telecommunication Satellite Organization
ITU	International Telecommunication Union
IXPs	Internet Exchange Points
KT	Korea Telecom
LCO	Local Cable Operators
LEO	Low Earth Orbit
LDCs	Least Developed Countries
LIDC	Low-Income Developing Country
LLDCs	Landlocked Developing Countries
LMICs	Low- and Middle-Income Countries
LTE	Long-Term Evolution
MBB	Mobile Broadband
Mbps	Megabytes per second
MEG	Micro Energy Grid
MEO	Medium Earth Orbit
MIMO	Multiple Input Multiple Output
MNOs	Mobile Network Operators
MSMEs	Micro-, Small- and Medium-Sized Enterprises
NBP	National Broadband Plan
NBPD	National Broadband Plan for Development
NGO	Non-Governmental Organization

(continued)

NGN	Next-Generation Network
NRA	National Regulatory Authority
NRM	Natural Resource Management
OECD	Organisation for Economic Co-operation and Development
OPGW	Optical Ground Wire
OTT	Over The Top (or OSPs)
PDPA	Personal Data Protection Act
PPP	Purchasing Power Parity, in USD
QoS	Quality of Service
R&D	Research and Development
RoW	Right of Way
SADA	Smart Africa Digital Academy
SAMENA	Subcontinent, Asia, Middle East and North Africa
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SMBs	Small and Medium Businesses
SMSEs	Small- and Medium-Sized Enterprises
SOEs	State-Owned Enterprises
SSA	Sub-Saharan Africa
STEM	Science, Technology, Engineering and Mathematics
Tbps	Terabyte per second
TRA	Telecommunications Regulatory Authority
UAE	United Arab Emirates
UAS	Universal Access and Service
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United National Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund

(continued)

UN-OHRLLS	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States
USAF	Universal Service and Access Funds
USAID	United States Agency for International Development
USD	United States Dollar
USF	Universal Service Funds
VAT	Value-Added Tax
VDSL	Very High-Speed DSL
VHTS	Very High Throughput Satellites
WEF	World Economic Forum
WEO	World Economic Outlook
WFH	Work from Home
WHO	World Health Organization
WMO	World Meteorological Organization

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