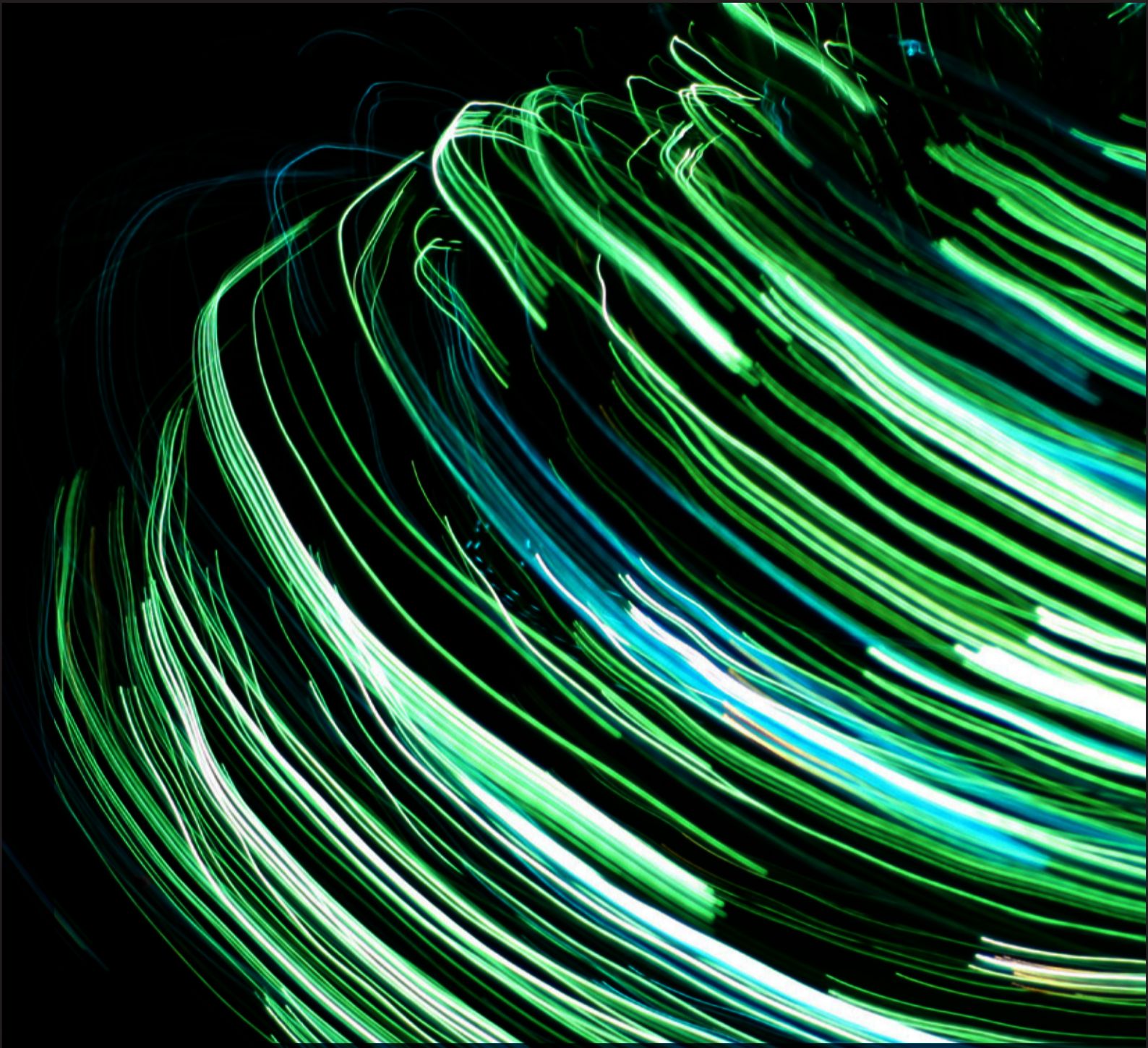

The State of Broadband:
Broadband as a Foundation for Sustainable Development

September 2019

BROADBAND COMMISSION
FOR SUSTAINABLE DEVELOPMENT

THE STATE OF BROADBAND 2019

Broadband as a Foundation for Sustainable Development

ITU/UNESCO Broadband Commission for Sustainable Development

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Executive Summary

Thoughtful Approaches Towards Meaningful Universal Connectivity

In 2019, the world crossed a number of major thresholds in global internet adoption. Back in 1969, when the very first data packets were transmitted over what is now known as the internet, the network comprised just four network nodes at US universities. Today, the latest data estimate 21.7 billion connected devices – and growing fast. And whereas the first data packets were only a few kilobits, today on average over 74,500 GB of data are sent over the internet every single second.

According to ITU, 2019 marks the first full year when more than half of the world has begun to participate online in the global digital economy. This year also marks the 30th birthday of the World Wide Web, and 25 years since the first e-commerce transaction.

Fifty years on, the internet's growth is maturing. Hundreds of millions of new users still are coming online every year, but overall growth is slowing, both as a function of the large existing user base, and because of significant challenges in reaching those not yet connected.

There has also been a realization that those individuals who *are* online do not necessarily fit into neat binary statistical categories (ie. users *vs* non-users). Instead, we observe a wide range of ways that individuals are interacting with, and benefiting from, the internet.

At the same time, there is a growing recognition of the downsides and potential risks of technology adoption, particularly for more vulnerable populations including women and children, who are at risk of cyber stalking, online aggression and hate speech, or internet-enabled child abuse, exploitation, or bullying.

The internet is at a crossroads. Growing acknowledgement of the challenges and risks highlights the need for more targeted policy and regulation, as well as new business approaches and industry initiatives aimed at curbing unintended effects and/or negative outcomes of internet adoption.

And yet in many respects the benefits of internet connectivity have never been greater. Broadband connectivity does not merely transform individual human potential, it also underpins national efforts to develop knowledge economies, foster digital transformation in government services and digital transition across economic sectors, expand opportunities for enterprises, and provide greater value for citizens and consumers.

Broadband connectivity is also widely recognized as a critical enabler of efforts to achieve the UN Sustainable Development Goals. The importance of digital technologies in international development efforts was emphasized by the UN Secretary-General's High-Level Panel on Digital Cooperation, which issued its findings earlier this year.

For nearly a decade now, the Broadband Commission for Sustainable Development has been advocating for policies and programmes to expand access and adoption of high-speed, high-capacity broadband connections, so that the entire world can take advantage of the benefits that broadband can offer.

Meaningful universal connectivity

The concept of ***'meaningful universal connectivity'*** has emerged as the focus of efforts to promote the benefits of online participation while mitigating the potential downsides of digital connectivity. It encompasses broadband adoption that is not just ***available***, ***accessible***, ***relevant*** and ***affordable,*** but that is also ***safe***, ***trusted***, ***empowering users*** and leading to ***positive*** impact.

Successful approaches to delivering meaningful universal connectivity are cognizant of the nuances that characterize barriers to access at local and regional levels. Internet users are as diverse as the global population itself. Users are not simply online or offline, but rather take myriad strategies to engage in the digital economy.

'Meaningful universal connectivity' strategies also recognize that non-technology and non-economic issues play a central role in decisions to participate online or not, such as lack of digital skills, linguistic and literacy barriers, social norms, and cultural attitudes.

This report reflects on the policies and recommendations that have made an impact in reaching the 51% adoption threshold, and considers different approaches that may better address the needs of the next 49%, including measures to ensure current internet users continue to see net positive returns from participating online.

'Meaningful universal connectivity' focuses not only on infrastructure and supply-side initiatives, but also on thoughtful approaches to demand-side issues, meeting the needs and expectations of those who aren't connected, while ensuring individuals who are already online continue to see value in continued participation.

A growing chorus of government officials, industry players and civil society participants recognize that the internet ecosystem needs to go beyond 'business as usual' to address these challenges. New strategies include: whole-of-government approaches that break down silos created by individual agencies or government ministries; truly innovative public-private partnerships – particularly targeting underserved and marginalized communities – that are sustainable and people-centric; and encouraging new modes of thinking, including welcoming and testing both sustaining innovations as well as disruptive kinds. And doing so while being candid and rigorous in tracking and measuring activities, clearly identifying what has worked and what hasn't.

This update of the State of Broadband report details the progress made towards the 2025 Broadband Commission Targets.

For Target 1, 164 countries have introduced national broadband plans, digital strategies or ICT plans that include broadband, an increase from 159 countries last year.

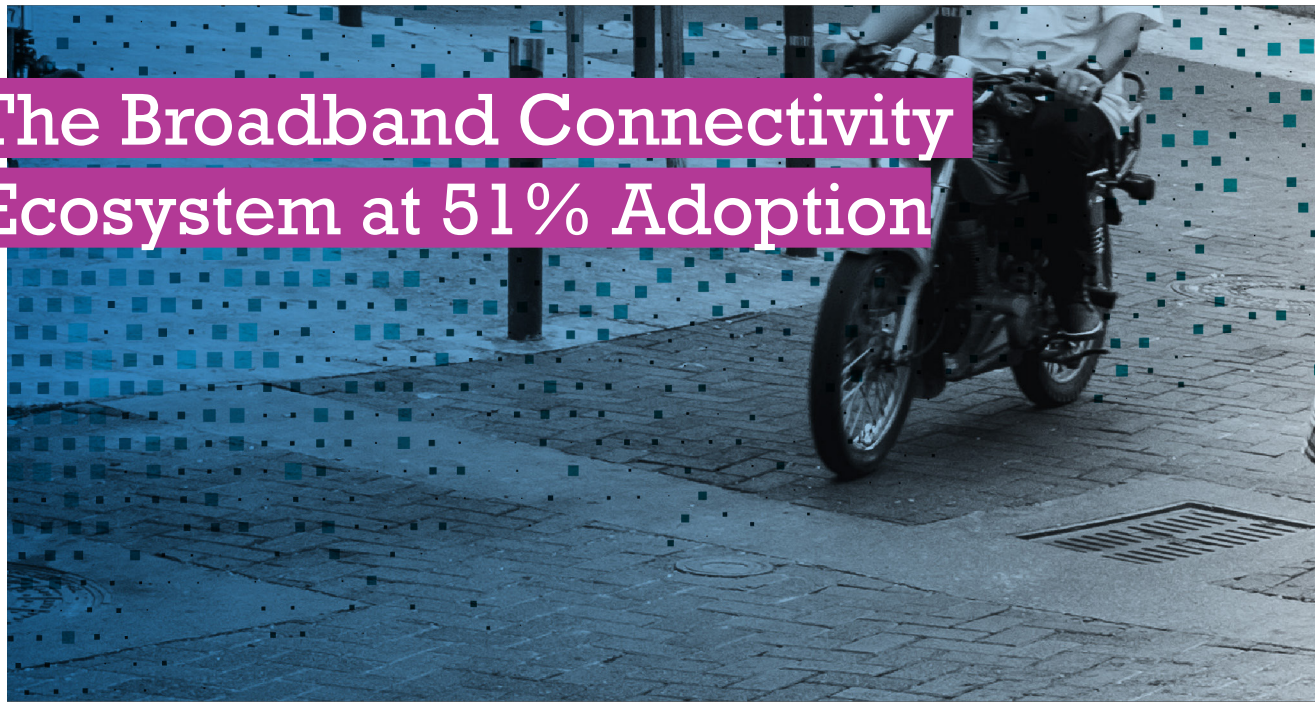
For Target 2, Broadband access prices continue to decline in developing countries, and at least 90 countries have entry-level mobile broadband prices below 2% of monthly Gross National Income (GNI) per capita, whereas 69 countries have entry-level fixed broadband prices below 2% of monthly GNIpc.

For Target 3, global broadband-internet user penetration is now at 51%, still some distance away from reaching the target of 75% by 2025 worldwide.

Significant progress is being made on the other four targets (on digital skills and literacy; adoption of digital financial services; getting businesses online; and achieving gender equality in access to broadband), though lack of statistical evidence from a broad range of countries makes this progress harder to quantify.

This report further includes additional actions and 10 recommendations that will help policy makers, the private sector and all participants in the connectivity ecosystem to accelerate efforts to reach the Commission's 2025 targets.

1 The Broadband Connectivity Ecosystem at 51% Adoption



1.1 Surpassing a critical threshold

In 2019, the world celebrates crossing major thresholds in global internet adoption. Fifty years ago, in 1969, when the very first data packets were transmitted over what is now known as the internet, the internet only comprised four network nodes at universities in the United States.[1] Today, the latest data from network equipment manufacturer Cisco Systems estimates 21.7 billion devices are connected. Whereas the first packets were only a few kilobits in order to send the letters 'L' and 'O' (for 'login', before the network crashed), today on average over 74,500 GB of data are sent every single second.[2]

In addition to being the 50th year celebration of the very first internet data transmission, 2019 also marks the 30th year of the World Wide Web (www) and the web browser, as well as the 25 years since the first online e-commerce transaction.[3] According to ITU data, 2019 also marks the first full year when more than half of the world (51.2%, or 3.9 billion people) has begun to participate in the global digital economy by logging onto the internet.[4] At a household level, most households in the world now have access to internet at home (57.8% in 2018, up from 18.9% in 2005).[5]

It is important to note however that internet adoption statistics belie the vast differences in type and extent of usage. Data for total internet users is estimated based on the individuals using the internet at least once in the past three months via any device, including mobile phones, and this necessarily captures a population with a very wide range intensities of internet use.[6]

Aggregate and averaging data obscures the substantial differences in usage levels. For example, Cisco's Visual Networking Index (VNI) estimates that, globally, the average internet user consumed 28.8 Gigabytes (GB) per month in 2017, with a range spreading from broadband-intensive economies such as the United States, where on average 98.7 GB of data was consumed per-month-per-user in 2017, compared to the countries of the Middle East and Africa (excluding Saudi Arabia and South Africa) where only 7.2 GB was consumed on average per-month-per-user.[7] The differences are even more dramatic when you consider that some of those counted as 'internet users' may only be going online (in extreme cases) once every three months; the benefit of broadband to those users will be markedly different from users who have multiple always-on high speed devices.[8]

In low- and middle-income countries, handheld wireless mobile devices are the primary means of internet access: in these countries, 57% of those who had used the internet in the previous three months accessed it exclusively via a handheld mobile device.[9]

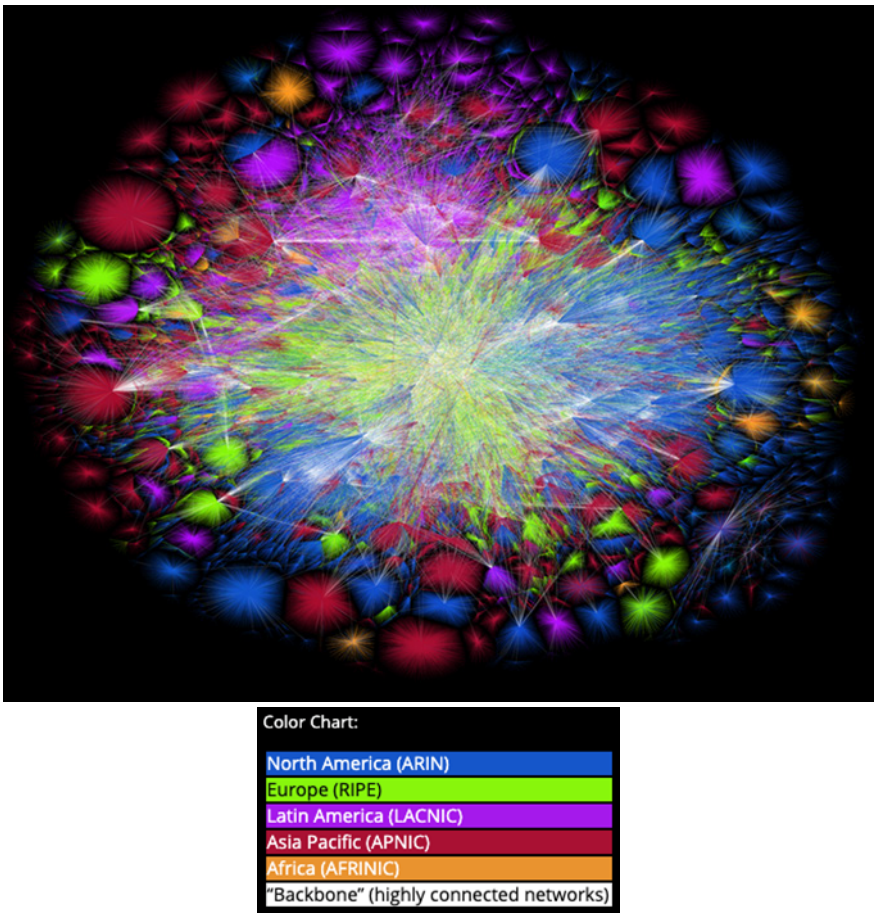
Figure 1: The early internet (ARPANET) 50 years ago in 1969

Source: UCLA, http://classes.design.ucla.edu/Spring06/161A/projects/camile/arpanet/

The active user count of some online social media communities is now larger than the populations of many sovereign nations. As of March 2019, Facebook's monthly active user community reached over 2.3 billion people worldwide, and over 1.5 billion people log into Facebook daily.[11] Google has over 1.5 billion active users just for its email product (Gmail) and WeChat (owned by Tencent) is by far China's biggest social media platform with more than 1 billion active monthly users.[12] Gaming platforms, too, garner the attention and participation of over 2 billion active users, with some individual games having tens of millions of daily active users.[13]

Telecommunications infrastructure spans the globe, including terrestrial wired and wireless networks, undersea fibre optic cables and communications satellite coverage. ITU estimates that in 2018 already 96% of the global population was living within the footprint of basic mobile cellular network services.[14] And the pace of network upgrades appears to be quickening: estimates suggest that it took nine years for basic network coverage (2G) to reach a 75% coverage threshold in lower-middle-income countries after reaching that 75% threshold in high-income countries, whereas it only took a six year time lag for 3G networks in

Figure 2: Depicting the internet in 2015



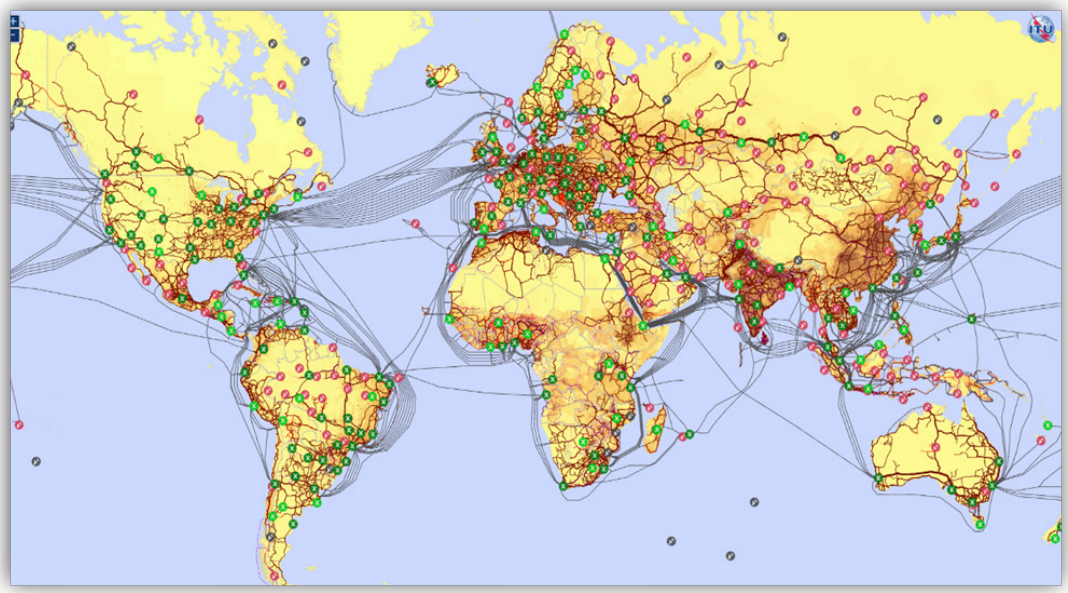
Note: Dated as of July 11, 2015, this image depicts links on the internet between edge routers using Border Gateway Protocol (BGP). Colors show communities of internet addresses and routes by their geographical region.
Source: "The Opte Project / Barrett Lyon" (http://www.opte.org/)), Opte Project www.opte.org (2015)

Figure 3: Global participation in the digital economy

Indicator:	2018 Data:	Penetration:	Source:
World Population	7.6 billion	-	UN
Mobile Broadband Subscriptions	5.3 billion	69%	ITU
Unique Mobile Subscribers	5.1 billion	67%	GSMAi
Unique mobile internet subscribers	3.5 billion	47%	GSMAi
Internet Users	3.9 billion	51%	ITU
Active Social Media Users	3.5 billion	45%	Datareportal / Hootsuite
Fixed Broadband Subscriptions	1.1 billion	14%*	ITU

**Note that fixed broadband subscriptions are generally accessed at the household. However this table calculates penetration for the total population and thus may undercount true penetration of fixed broadband when considering household access.*
Source: ITU[10]

Figure 4: Global submarine cable and broadband transmission map



Source: ITU broadband maps [18]

lower-middle-income countries to reach a similar threshold on par with high-income countries.[15] Coverage however, remains a challenge and connecting the remaining unconnected populations will become increasingly complex and costly with current technologies and business models.[16]

Undersea, there are now over 400 active cables comprising 1.2 million kilometres of fibre carrying approximately 99% of total global internet traffic.[17]

New cable investments and upgrades to existing systems have increased competition in undersea bandwidth significantly, resulting in dramatic decreases in the price of international undersea bandwidth. Total international internet bandwidth has grown more than six-fold in less than a decade from 2008 to 2016, rising from 30 Terabits per second (Tbps) to 185 Tbps in 2016.[19] International internet bandwidth prices for IP transit have dropped an average of 27 per cent on a Compounded Annual Average Growth Rate (CAGR) from 2015 to 2018, whereas for the more expensive traffic routes, annual price declines have been even greater as more undersea capacity comes online.[20]

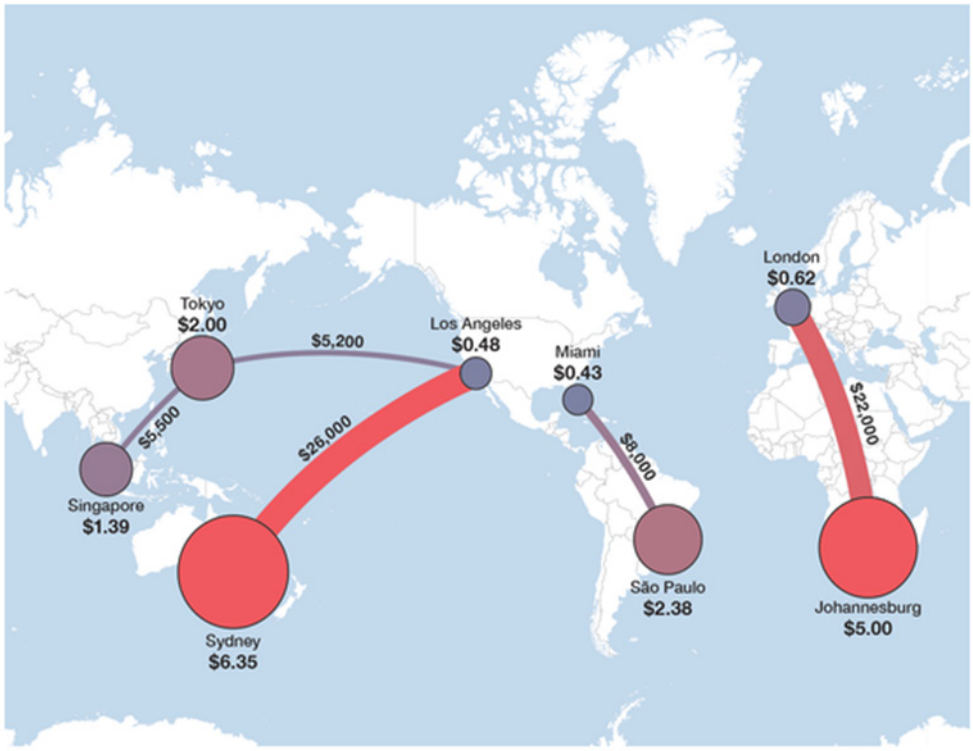
Considering geographic proximity to terrestrial fibre nodes, almost two-thirds of the global population (excluding North America) is within at least 50 kilometres of an operational fibre point-of-presence.[21]

While the vast majority of overall data traffic is carried by undersea and terrestrial fibre, in outer space, significant investments are being deployed to increase the capacity, coverage and capabilities of satellite telecommunications systems.

Currently there are over 4,980 satellites orbiting the earth, with over 775 of those satellites used primarily for communications functions.[22] These communications satellites differ widely in their ability to provide data throughput and in the quantity of network communications they provide, in part due to their design generation and their positioning above the earth's atmosphere, as distance impacts different service parameters, such as latency.

The number of new satellites launched into space in the past two years alone has been at an all-time high, with 453 in 2017 and 382 in 2018.[23] A focus by several companies, including some new entrants affiliated with major global technology groups, to establish low-earth orbit

Figure 5: Weighted median 10 Gbps IP transit & wavelength prices on major international routes, Q2 2018



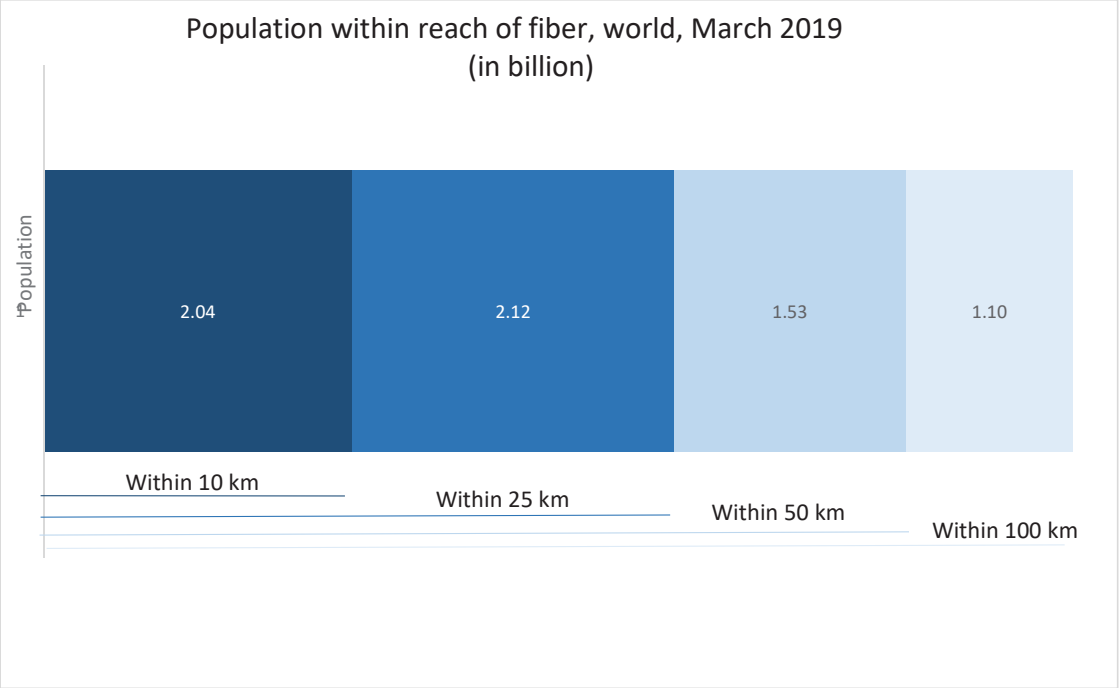
Notes: Each line represents the weighted median monthly lease price for an unprotected 10 Gbps wavelength on an individual route. Each circle represents the weighted median monthly price per Mbps for a 10 GigE IP transit port in the listed city. Routes and cities are shaded corresponding to price, from least expensive in blue to most expensive in red. Prices are in USD and exclude local access and installation fees. 10 Gbps & 10 GigE = 10,000 Mbps.

Source: TeleGeography / PriMetrica, Inc.

(LEO) communications constellations (some expressly targeted at currently under-served communities) will significantly expand the number of telecommunications satellites in operation.[24] Intelsat CEO and UN Broadband Commissioner Stephen Spengler discusses the role of satellite communications in heterogeneous network design for universal connectivity in his Commission Insight in Chapter 6 of this report.[25]

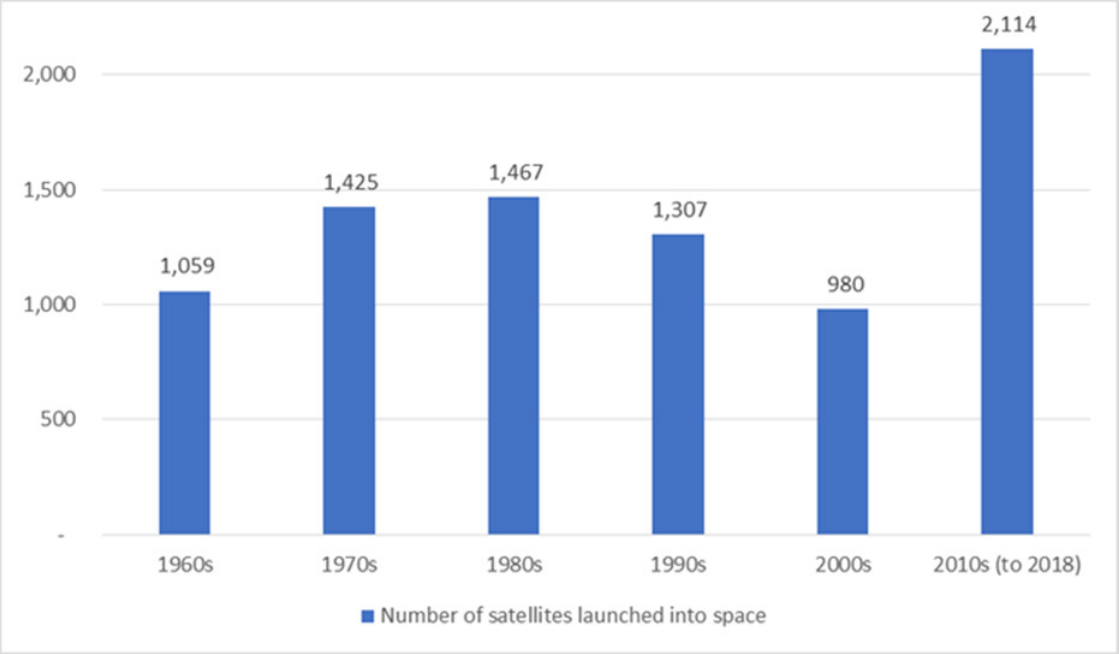
Capital investment in the global communications industry continues to rise and is larger than many countries' annual gross domestic product (GDP). In 2016 for example, global telecommunications capital investment (not including operating expenses), stood at USD 354 billion, an increase of four per cent from 2014 when global telecom capex was USD 340 billion.[26] Compared against data from the International Monetary Fund (IMF), only 31 countries in the world had a larger gross domestic product (GDP) in 2016.[27] This growth is driven by capital expenditure increases in emerging countries which have rapidly increasing internet user bases and demand for data consumption. Some USD 23.5billion of this increase occurred in low and middle-income economies, while capex dropped by USD 10 billion in high income countries. Mobile operators alone will invest around USD 480 billion worldwide between 2018 and 2020 in mobile capex to continue to extend the reach of mobile networks.[28] In addition, an increasingly significant source of investment is from OTTs and online service providers (OSPs). Online service providers are fast becoming major investors in digital infrastructure, with over USD 75 billion spent each year on data centres, submarine cables and other facilities during the period 2014-17[29].

Figure 6: Population within reach of fibre (billions of people worldwide, March 2019)



Note: Not cumulative; figure depicts population within category not inclusive of lower thresholds
Source: ITU

Figure 7: Number of objects launched into space since 1960, by decade



Source: https://www.pixalytics.com/satellites-orbiting-earth-2019/

1.2 Characteristics of the broadband connectivity ecosystem today

With the public internet reaching a stage of significant size, reach and age, growth is slowing in several respects as the internet, and internet adoption, matures. Several data points highlight how growth has slowed in overall internet adoption, as well as in subsets of the global population. The 2019 version of the Inclusive Internet Index, released by Facebook and the EIU in February, notes that growth in the percentage of households connected to the internet slowed, rising only slightly to 54.8% from a level of 53.1% in the previous year's report. For low-income countries, household internet adoption improved by a mere 0.8% on average. ITU data confirms a slowdown in aspects of overall adoption growth: the growth in penetration of households with internet access at home was flat between 2018 and 2017 (both growing at 8.9% over the previous year), and growth slowed in LDCs, at 17.5% growth in 2018 versus 19.1% growth in 2017. For individuals using the internet, growth slowed in 2018 for the aggregate world population, as well as across developing countries.[30] Mobile network coverage also improved much more slowly for low-income countries compared to other groups, demonstrating a mere 22% improvement in 4G coverage compared with a 66% increase in lower-middle-income countries.[31]

However, in 2018 mobile operators in Sub-Saharan Africa accelerated the expansion of 3G networks, with coverage increasing from 63% to 70%. More than 80 million people previously not able to access 3G networks are now covered. With 2G coverage currently standing at 85% in Sub-Saharan Africa, it is expected that operators will continue to upgrade their sites over the next few years, narrowing the gap between 2G and 3G coverage.[32]

As noted in Figure 3, wireless connections far outweigh fixed wired subscriptions. Globally, the number of fixed telephone connections as a percentage of total population peaked in 2006 at 19.2% worldwide (or 1.26 billion connections) and has been on the decline since.[33] However, mobile telephone adoption only continues to rise, with more connections globally in 2018 – at 8.16 billion (excluding cellular IoT connections) – than people on the planet. Given that individuals often own multiple mobile connections, this translates to an estimated 5.1 billion unique subscribers. Almost 1 billion new mobile subscribers have been added in the five years since 2013 (representing an average annual growth rate of 4.2%), but the speed of growth is slowing.[34] An average annual growth rate of 2.0% between 2018 and 2025 will bring the total number of mobile subscribers to 5.8 billion (70% of the population). Of the 730 million people expected to subscribe to mobile services for the first time over the next seven years, half will come from the Asia Pacific region and just under a quarter will come from Sub-Saharan Africa.

In 2018, 4G overtook 2G to become the leading mobile technology across the world, with 3.4 billion connections accounting for 44% of the total (excluding licensed cellular IoT). With growth continuing apace, particularly across developing markets, 4G will soon become the dominant mobile technology, surpassing half of all global mobile connections in 2019 and peaking at 62% in 2023. Meanwhile, 5G is now a reality, with Korea, the United States and Saudi Arabia at the forefront of 5G deployment and more major markets expected to launch 5G networks by the end of 2019.[35]

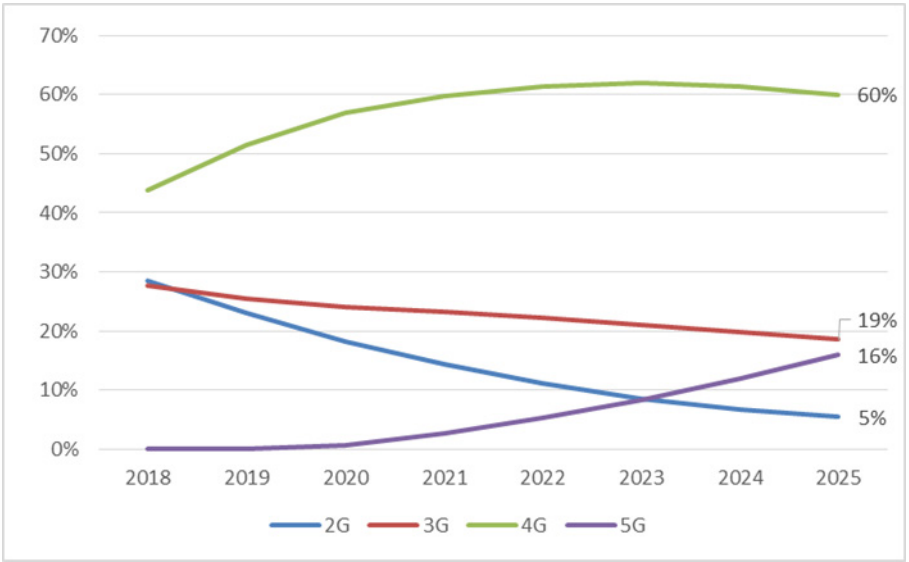
In parallel, the first 5G smartphones were released in the first half of this year. While it will take some time for 5G to hit critical mass, some markets will see relatively rapid growth (for example, South Korea, US and Japan). To support this generational shift and further drive consumer engagement in the digital era, mobile operators will invest around USD 1.3 trillion worldwide between 2019 and 2025 in mobile capex.[36] More than 75% of this will be spent on 5G. However at the same time, slowing subscriber growth, regulatory intervention and intense competition will continue to put pressure on operators' traditional mobile revenues. Korea Telecom's CEO, Commissioner Chang-Gyu Hwang, details Korea's experience with 5G in his Commissioner Insight in Chapter 6 of this report.[37]

The increase in mobile broadband subscriptions worldwide has been driven in part by falling retail prices, particularly in developing countries. Mobile data continues to become more affordable across all regions. Average affordability of data (1GB) is best in South Asia at 1.2% of monthly income and worst in Sub-Saharan Africa at 6.8%, though the latter represents a significant decline from 13.2% in 2016. While data has become cheaper, affordability of internet-enabled handsets remains a challenge and the cost of internet-enabled devices has not significantly fallen; it remains a key barrier to mobile ownership and mobile internet adoption in low- and middle-income countries (LMICs). In more than half of LMICs, the cost of an entry-level internet-enabled device is more than 20% of average monthly income.[38] According to the ITU *Measuring the Information Society Report 2018*, the price of a handset-based mobile-broadband basket including 500 MB per month followed a decreasing trend worldwide in the period 2013–2016 and plateaued in 2017. The global average was driven down by strong reductions in prices in developing countries (CAGR-24 per cent in USD terms from 2013 to 2016) and, in particular, in least developed countries, or LDCs, (CAGR-36 per cent in USD terms from 2013 to 2016).[39] This has made the Internet affordable for populations that were previously unable to purchase devices and service.

In most developing economies, mobile-broadband subscriptions have grown enormously, countering the slowdowns recorded in mobile-cellular subscription growth and supporting the growth in data revenues.[40]

Downside risks to market consolidation are emerging. In many countries, market concentration in various aspects of the connectivity chain continues to exist. For example, in the Philippines, the World Bank notes that a highly concentrated telecommunications sector is partly the cause of the high price of mobile phone service, which is four times higher than the average price of service in advanced economies, and the highest of all countries in East Asia.[41] In contrast, Singapore's consistent preference for a vibrant competitive telecommunications market has resulted in one of the lowest priced 1Gbps plans, at about USD 28 per month. Taxation also directly impacts internet affordability, and countries that have a higher level of taxes and fees as a proportion of sector revenues tend to have relatively low levels of readiness for mobile internet connectivity.[42] See Section 4.5 for more discussion on appropriate taxation of ICT goods and services.

Figure 8: Share of mobile connections by technology generation, global



Source: GSMA Intelligence

1.3 Increasing hesitancy to participate online

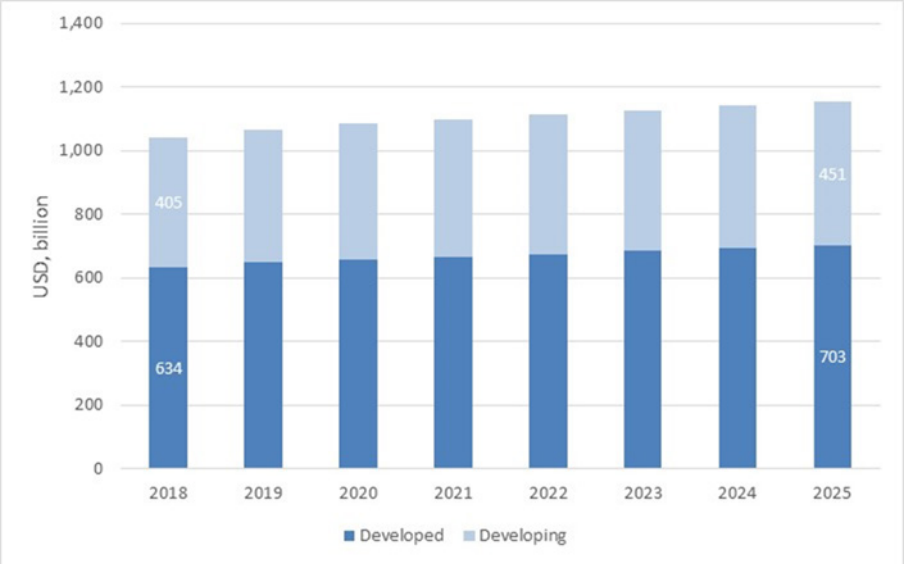
The internet has made communication quicker and easier, helping people keep in touch, obtain news and information, enhance their education and access financial services, health information, clean energy and water. Online technology contributes to the empowerment of citizens globally, including women and those who are most marginalized.[43] At the same time, concerns about the negative impacts of the internet are on the rise.

In terms of online safety, the number of cybersecurity breaches and cyber-attacks continues to increase. In 2017 alone there were at least 130 large-scale, targeted data breaches in the United States, including account information stolen at Friendfinder sites, Equifax and as a result of the Wannacry virus. This occurred after security incidents in 2016 at Yahoo and Uber.[44] These breaches are growing at estimates of over 25 per cent per year, and approximately 24,000 malicious mobile applications are blocked every day.[45] The latest edition of Nokia's Threat Intelligence Report highlights the increasing threat from IoT botnets (noting that in 2018, IoT bot activity represented 78% of the malware network activity, or detection events, in carrier networks) and noting that the average monthly infection rate in mobile networks was 0.31% (meaning one out of every 300 mobile devices had a high threat level of malware infection).[46] Another survey by GSMA Intelligence found that safety and security concerns represent one of the key barriers to mobile internet adoption in low- and middle-income countries – in Latin America it is the second biggest barrier after digital literacy and skills.[47]

Overall trust in technology is at less than two-thirds of the general population (64%), and at only half for emerging technologies (50%), which some have attributed to discussions on technology ethics.[48] Similarly, a recent survey of 25,000 internet users conducted on behalf of the Centre for International Governance Innovation in partnership with UNCTAD and the Internet Society found that nearly 80% of respondents are concerned about their online privacy, with over half (53%) stating they are more concerned than a year ago.[49]

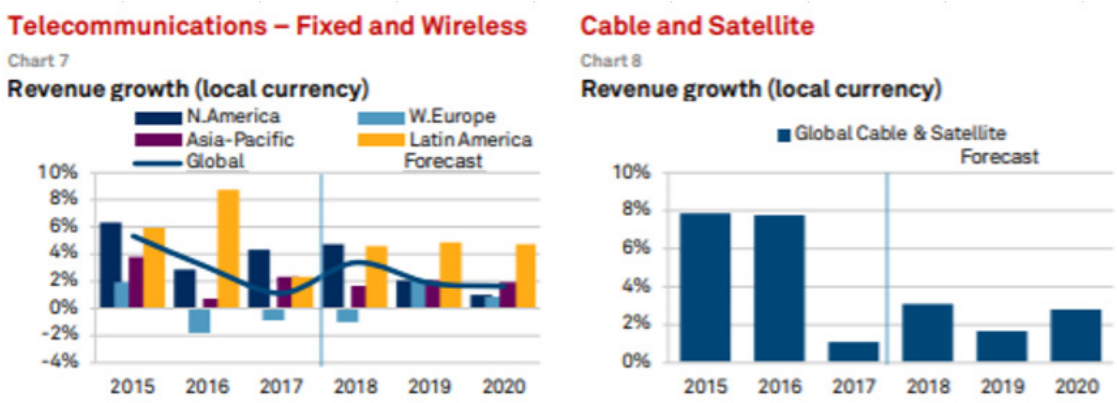
The threats are particularly acute for women. In the US alone, 75% of victims of cyberstalking are women, and women are far more likely to be sexually harassed online than men.[50] As such, women tend to be more concerned about privacy risks online.[51] Research work highlights the pervasive, and negative, use of ICTs to harass women. For example, in a large survey conducted in Pakistan, nearly half of women (48%) in the survey noted being sexually harassed through their mobile phone compared to only 18% of men.[52] This was

Figure 9: Mobile revenue forecasts, global



Source: GSMA Intelligence

Figure 10: Slowing growth in telecommunications revenue



Source: S&P Global Ratings

mostly through direct message and phone calls, but also through online social media.

The four main reasons why it was perceived that mobile phones were used to harass individuals were because of some ICT-specific features: the ease of sending multimedia content, the ability to communicate across large distances, the ease and quickness of use, and the ability for perpetrators to hide their identities. GSMA, the association of mobile network operators, also highlights that safety and security is a key issue causing a gender gap in mobile ownership and in mobile internet use.[53] Moreover, new research led by UNESCO through the EQUALS Global Partnership for digital gender equality suggests that the 'gendering' of technologies such as digital voice assistants may contribute to increased tolerance of sexual harassment and gender-based abuse, with many voice assistants being anthropomorphized as young, subservient women.[54] Safety concerns should not, however, be used as an excuse for denying women access. Instead, the opportunities mobile technology and internet offer in terms of empowering women should be emphasized.

These issues are leading to hesitancy to fully engage online, and at worst, contributing to decisions to withdraw from internet adoption. Privacy risks are of greater concern to women online and this is leading more women to share less on social media, keep their profiles and activities private, delete unwanted messages and share less regarding their political views and relationship statuses.[55] In the survey noted above, the consequences are even more grave; 53% of respondents noted they knew someone who tried to commit suicide because of online harassment and 52% knew someone who was killed because of a perceived 'loss of honour' as a result of sexual harassment through their mobile device. Non-consensual sharing of photographs and video has emerged as a considerable challenge. In sub-Saharan Africa, some anti-pornography laws criminalize all forms of electronic sexual expression, such that victims of revenge porn – or non-consensual pornography used to humiliate or blackmail women and men – may be subject to prosecution themselves if they report threats to authorities.

Opting out does not necessarily ensure safety, because even women who decide to avoid going online are vulnerable to ICT-facilitated abuse. Indeed, women who have disconnected are at particular risk if they are exposed to the empty threats and phishing schemes common in the digital world. Women lacking digital skills may also be unaware when technology is being used by men to control them. For instance, tracking applications commonly installed on mobile phones may be used by men to monitor women's movements and activities, often without their knowledge. The potential for abuse only increases as technology becomes more advanced. In countries where smart home devices are increasingly common, domestic violence responders have noted an uptick in the number of women reporting abuse cases involving internet-connected locks, thermostats, cameras and other devices. In many instances, the women do not initially understand what is happening when e-locks and other domestic technologies are deployed remotely, and they are unable to disable the

devices. Women need digital skills to be able to safeguard against ICT-facilitated violence, recognize abuse when it is occurring and take steps to protect themselves and access recourse and help.

Children, too, are particularly vulnerable to negative online interactions, such as child abuse, exploitation and bullying. Thirty years ago, the UN Convention on the Right of the Child codified the rights of children.[56] Today, the global community continues to deal with all forms of violence against children (as demonstrated by SDG 16.2), including online violence.

The threats are also grave for groups that could be placing themselves in physical risk if they share their views online. As the World Bank's 2016 World Development Report on "Digital Dividends" highlighted, a significant downside risk of digital technologies is the possibility for greater central control of political systems by governments seeking to suppress opposition views.[57]

1.4 Benefits of digital connectivity are more defined than ever

Despite the potential risks for users participating online, the benefits and opportunities provided by the internet have never been so clearly measurable. At a macroeconomic level, economic impact literature continues to demonstrate the significant impact of broadband connectivity. A landmark analysis conducted by ITU reviewed the impact of broadband, digital transformation and the interplay on ICT regulation on national economies. The analysis demonstrates, based on econometric modelling and quantitative analysis of large quantities of small data, that in the aggregate mobile broadband appears to have a higher economic impact than fixed broadband, and that the impact is greater in less developed countries than in more developed countries. As the model shows, globally an increase of 10 per cent in fixed broadband penetration yields an increase of 0.8 per cent in GDP, and an increase of 10 per cent in mobile broadband penetration yields an increase of 1.5 per cent in GDP. However, in more developed countries, the economic impact of fixed broadband is greater than in less developed countries (see Figure 11). A follow-up study focusing on the Africa region suggests a 10 per cent increase in mobile broadband penetration in Africa would yield an increase of 2.5 per cent of GDP per capita.[58]

Broadband connectivity underpins national efforts to develop knowledge economies, fostering digital transformation in government services and digital transitions across all sectors, expanding opportunities for enterprises and providing greater value for citizens and consumers. This is evident in the number of national digital economy efforts linking broadband connectivity to sectoral initiatives. High speed, ubiquitous broadband internet connectivity is the critical enabler for digital ecosystems that are necessary components of programmes aimed at development, economic transformation and income growth. Examples of these national digital programmes geared towards enterprises include: the National Productive Plan of Argentina; China Manufacturing 2025; Digitising European Industry Strategy for EU countries; Industrie du Futur in France; Industrie 4.0 in Germany; Make in India; Manifattura Italia in Italy; New Robot Strategy in Japan; National Strategy for Blockchain in Kenya; Manufacturing Innovation 3.0 in the Republic of Korea; Digital Economy Framework for Action in Singapore[60]; National Technology Initiative in Russian Federation; Industria Conectada 4.0 in Spain; to name a few.[61]

Furthermore, broadband connectivity is critical for efforts to achieve the Sustainable Development Goals, providing a basic building block in programmatic efforts in support of the 17 goals and 169 targets. Focusing just on the mobile industry, GSMA notes that since 2015 the mobile sector has been contributing towards increased progress across all 17 SDGs. This includes connecting 600 million more people to the internet in accordance with SDG 9; more than 250 million people starting to use mobile money services (SDG1); more than 1 million households installing solar home systems using mobile pay-as-you-go (PAYGO) services (SDG7); and 5 million more people using mobile-enabled agricultural services,

improving agricultural productivity and incomes (SDG2).[62] GSMA CEO and Broadband Commissioner Mats Granryd discusses tools to monitor broadband impact and progress towards the SDGs (as well as a cross-industry movement for CEOs to act ethically) in his Commissioner Insight in Chapter 6.[63]

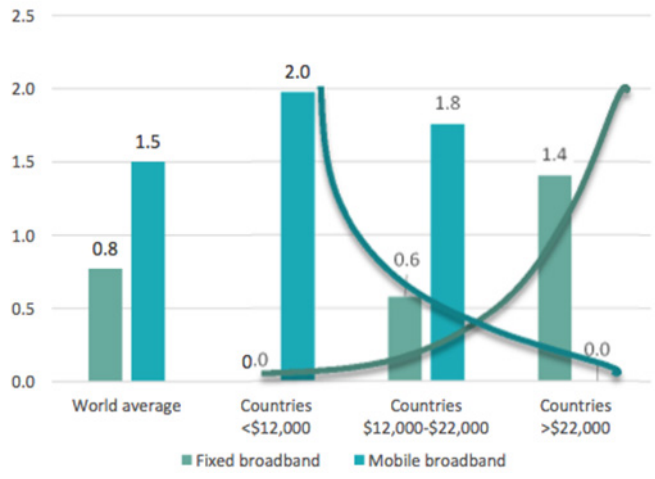
A 2019 report by USAID and Intellecap details the multisectoral impacts of internet connectivity, particularly for lower income communities, and highlights the opportunities for impact investors to reach their social impact goals through investments in internet to underserved communities.[65] (See Figure below and Figure 14 on the theory of change for how internet connectivity services provided by last mile connectivity (LMC) enterprises lead to social development outcomes, including income growth and community resilience.)

At a micro-level, recent research conducted by Gallup based on multi-country demand-side surveys reveals that mobile phone ownership and internet access are associated with an improvement in people's lives.[66] As an example of this, Broadband Commission Co-Chair Carlos Slim discusses the work that the Carlos Slim Foundation has been doing to improve health and education outcomes by leveraging broadband connectivity, detailed in his Commissioner Insight in Chapter 6.[67]

At the individual level, the consumer welfare benefits of connectivity are well noted, though harder to estimate, and differences in interpretation and study design lead to a wide range of estimates.[69] What is clear, however, is that the communications and entertainment aspects of internet use are what tends to encourage new users to come online.[70] Users in developing countries are more likely to use mobile internet for communications and social networking (instant messaging, social media, video calls, VoIP) than users in developed countries, whereas the latter are more likely to use other services such as e-commerce and accessing health information and e-government services (see Figure 15 below).

Internet adoption has expanded rapidly, giving individuals the power to communicate and build communities with ease and at a scale that was never previously possible. For many individuals, the primary purpose of online engagement is interacting with friends and family, so the concept of the internet, in many minds, is social media. For example, 94.5% of Brazilians recently surveyed stated that the primary reason for their using the internet was to exchange messages through platforms such as WhatsApp and Facebook.[71]

Figure 11: Economic impact of broadband worldwide



Note: **Y-axis** *reflects percentage impact on a country's Gross Domestic Product. Values express as impact on GDP of 10% increase in broadband penetration; for example, when broadband penetration increases from 10% to 11%, or from 20% to 22%*
Source: ITU (Katz and Callorda) 2018[59]

Figure 12: The Impact of the mobile industry across the 17 SDGs

Source: 2018 Mobile Industry Impact Report: Sustainable Development Goals

1.5 Understanding the heterogeneity of current and future online citizens

The remaining gaps in connectivity adoption are driven by divides across several types: geographies (urban vs rural), income levels (high vs low income groups), age and gender, among others. These divides highlight the characteristics of current offline populations that require targeted actions designed to increase adoption and participation online.

Offline populations tend to be in geographic areas that are under- or unserved by existing telecommunications networks. For communities and individuals who are poorest in terms of opportunity and livelihoods, lack of network infrastructure for connectivity is identified as one of the most significant barriers to access. A total of 43.5% respondents in low-income countries have pointed to poor connectivity as a barrier when trying to use the internet, compared to only 34.6% of those in upper middle-income and 25% in high-income.[73] In 2018, the "rural mobile internet gap" was 40% in low- and middle-income countries; those living in rural areas were 40% less likely to use the mobile internet than those in urban areas. In Sub-Saharan Africa, the rural-urban gap is 58%. (see Figure 17). In this regard, innovative solutions are particularly required to extend access infrastructure.

A significant portion of the remaining 49% of unconnected people have lower incomes, and for them affordability of devices and services is a major barrier. At least 1.3 billion people are living in countries where entry level mobile data plans (of 1GB per month) are not affordable.[76] As such, the Commission has adopted the "1 for 2" target, advocating that 1GB of mobile broadband data should be available for 2% or less of monthly GNI per capita, a target championed by the Alliance for Affordable Internet (A4AI).[77] Even in areas where average data service costs may be below notional affordability thresholds (such as 2% of monthly income) or where free public access is available (such as government sponsored free public Wi-Fi), the cost of devices can present a prohibitive barrier to adoption (see Figure 19). Indeed, evidence from the GSMAi consumer survey suggests that affordability, particularly the cost of a device, is the biggest barrier to mobile ownership (followed by literacy and skills).[78] When considering handset prices in US dollars, the median price in low- and middle-income countries since 2016 has been just over $45; in South Asia and Sub-Saharan Africa, it has been slightly less at $35-40.[79] Several efforts are underway, however, focusing on reducing the cost of entry level smartphones, or similar such devices to price points closer to $20.[80]

Figure 13: The multi-sectoral impact of connectivity

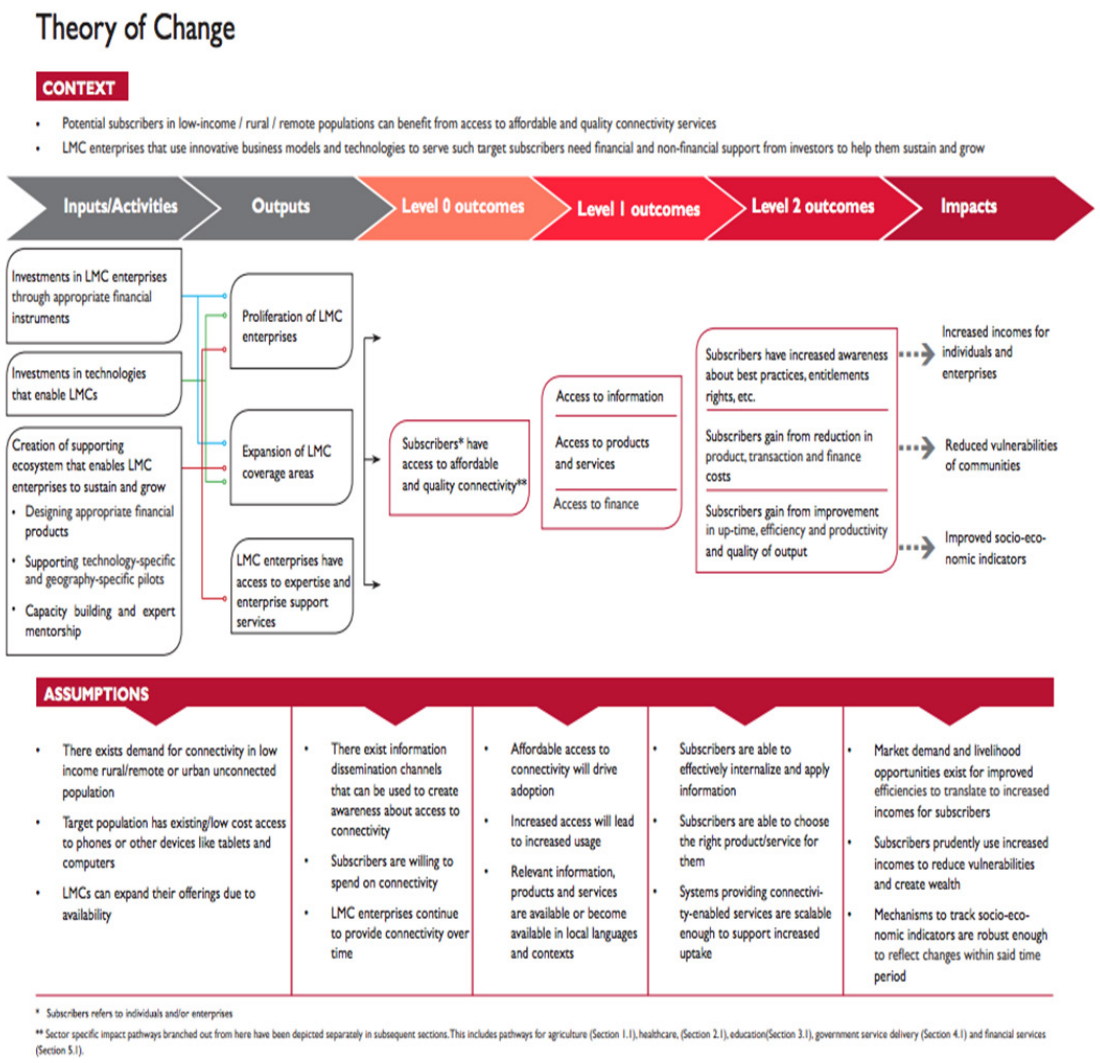
Note: This figure summarizes a meta-analysis and literature review of the sectoral impacts of internet connectivity. See the full report for more detail.
Source: USAID and Intellecap[64]

Age and education gaps exist, in advanced and emerging countries. Because of the reading and writing skills required to be able to participate online, most digital functions require basic literacy. Individuals without secondary education are less likely to use the internet or own a mobile phone.[82] The internet, and online resources, however, provide a crucial way to gain new skills and improve one's education, and this may be more important and beneficial for individuals who are under-resourced. For example, one survey indicated that 74.4% of respondents (of the Inclusive Internet Index) noted that the internet is more effective than other means for finding jobs and even more (76.5%) note that they have used the internet to develop job-relevant skills.[83]

Gaps in access to and adoption of digital technologies between sexes continue to proliferate around the world. Country level gaps appear to be widest where mobile adoption is the lowest and across ten countries in Africa, Asia and South America, women were found to be 30-50% less likely than men to use the internet to participate in public life.[84]

Gaps in access to the Internet by the sexes appear to be narrowing slightly at a global level, with decreases in the disparity between men and women in their access to the internet: in 2017 men were 31.5% more likely to have access to the internet, whereas the figure declined to 24.8% in 2018.[85] A significant driver of this reduction is the increase in women's use of the internet in low-income and

Figure 14: Theory of change relating internet connectivity to social development impacts

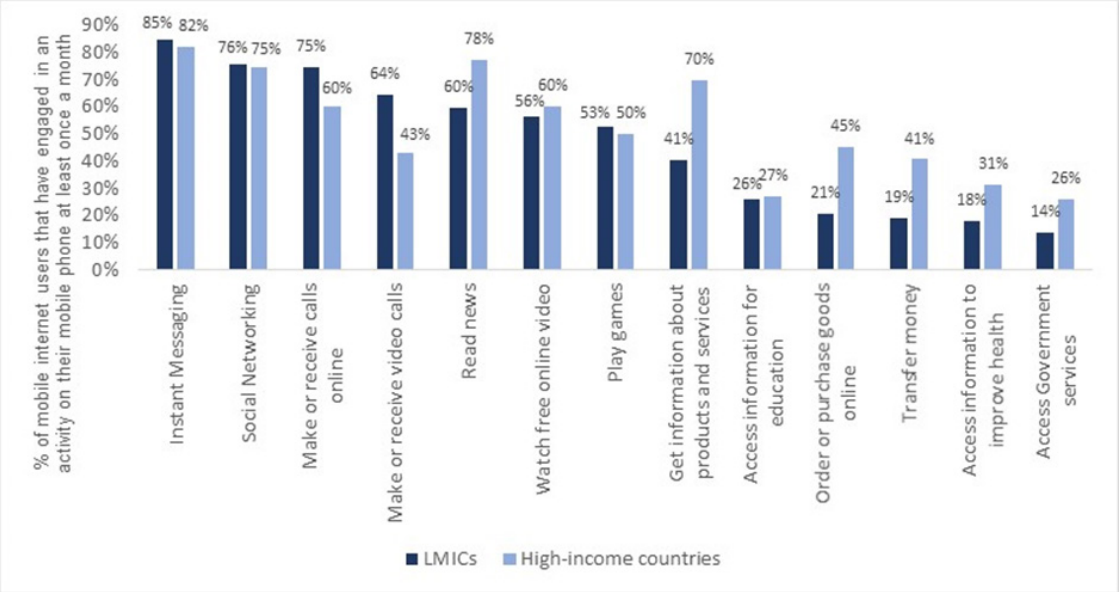


Note: This figure details the theory of change for last mile connectivity (LMC) enterprises' impact on social development outcomes. See the full report for more detail.
Source: USAID and Intellecap[68]

lower middle-income countries. There are a few countries where more women than men are participating online, such as in Argentina, China, Ireland and the Philippines. National e-inclusion policies to address the shortfall in women's internet access and adoption are in place in a range of countries around the world, however at least 28 nations with gender gaps in access still do not have them in place. Such strategies focus on digital skills programmes for women and targeted efforts to increase e-inclusion, promoting internet access and encouraging girls to participate in the STEM fields of study (science, technology, engineering and mathematics).[86]

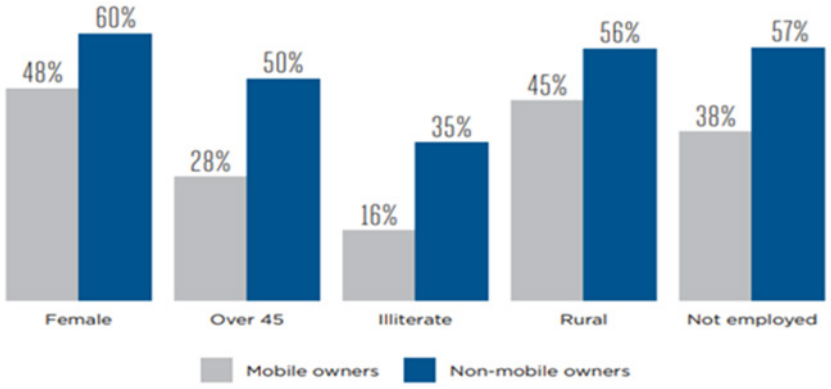
In recent years, due to the rapidly declining price of connectivity and hardware, skills deficits have eclipsed barriers of access as a primary driver of digital gender divides. For years, this divide was assumed to be symptomatic of technical challenges: The thinking went that women would catch up with men when the world had cheaper devices and lower connectivity prices, due to the limited purchasing power and financial independence of women compared with men. While the cost of ICT access remains an urgent and salient issue, this challenge is surpassed by educational gaps. In cross-national surveys, lack of understanding, interest or time was more commonly cited than affordability or availability as the reason for not using the

Figure 15: Activities undertaken on mobile internet, based on usage surveyed in low- and middle-income and high-income countries



Note: Based on whether respondents who had used mobile internet in the previous three months said that they undertook an activity on their mobile phone at least once per month, averaged across surveyed markets
Source: GSMA[72]

Figure 16: Percentage of mobile owners and non-owners by demographic trait

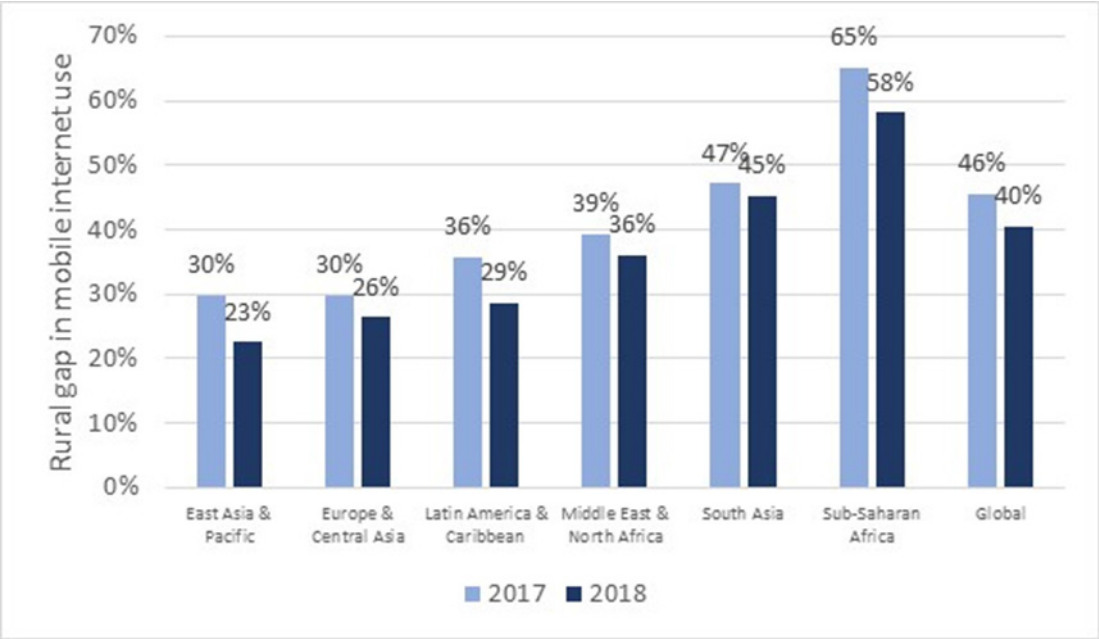


Note: Base values from mobile owners (aged 18+) and non-owners (aged 18+), average across 18 surveyed markets; mobile owner defined as a person who has sole or main use of a SIM card (or mobile phone that does not require a SIM), and uses it at least once a month; data has been averaged across the 18 countries surveyed.
Source: GSMA Intelligence Consumer Survey, 2018

internet, even in countries such as Colombia, where subscription prices were highest relative to average income.

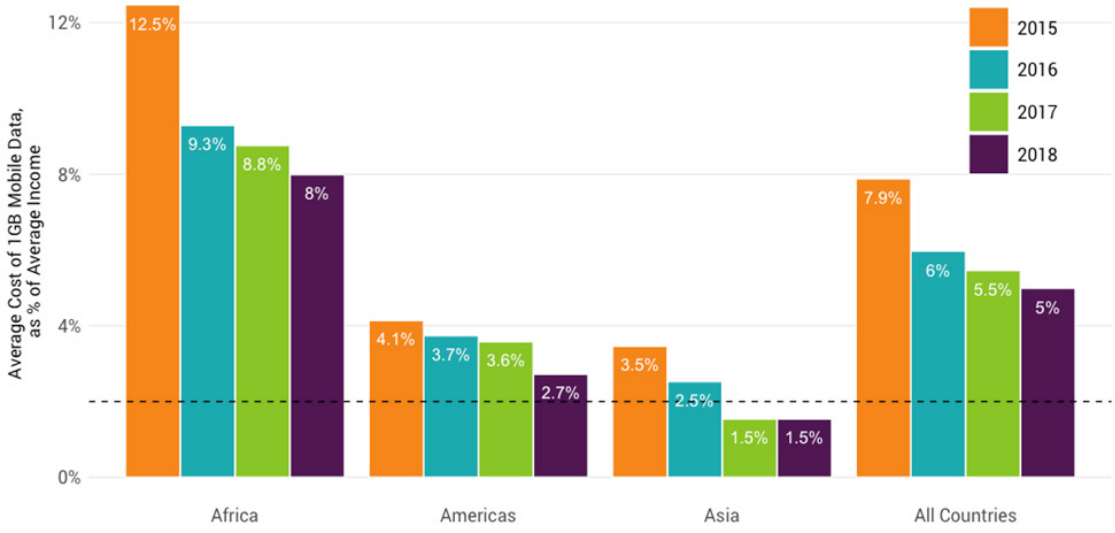
Eighty per cent of women in low- and middle-income countries own a mobile phone today (including basic 2G phones), and 48 per cent use mobile internet (data services). Despite growing uptake of mobile internet among both sexes, globally women are 23 per cent less likely than men to use it. Substantial differences in mobile internet use also exist across regions. This gap is widest in South Asia, where women are 58% less likely to use mobile internet than men, followed by sub-Saharan Africa where women are 41% less likely than men. The usage gap again widens for more specific use cases with high digital skills requirements – for example, IP messaging such as Whatsapp, and browsing the web. Also, as with mobile ownership, the rural gap is almost

Figure 17: Rural gap in mobile internet use in low- and middle-income countries



Source : GSMA, State of Mobile Internet Connectivity 2019[74]

Figure 18: Affordability of 1GB mobile prepaid broadband plan, by region (2015-2018)

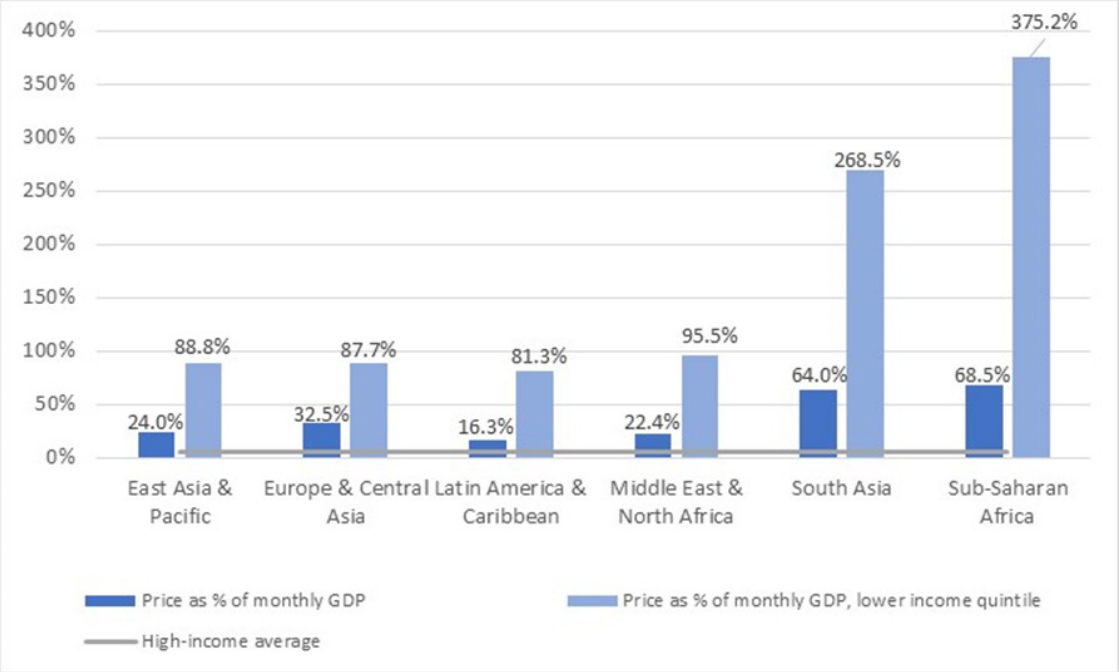


Note: As per A4AI, this regional comparison is based on 99 countries covered in their analysis and for comparability, the "All countries" bar is limited to the same 60 countries covered in the A4AI Affordability Reports.
Source: A4AI, based on ITU pricing data aggregated by A4AI. [75]

always wider – even when there is no urban gap at all.[87]

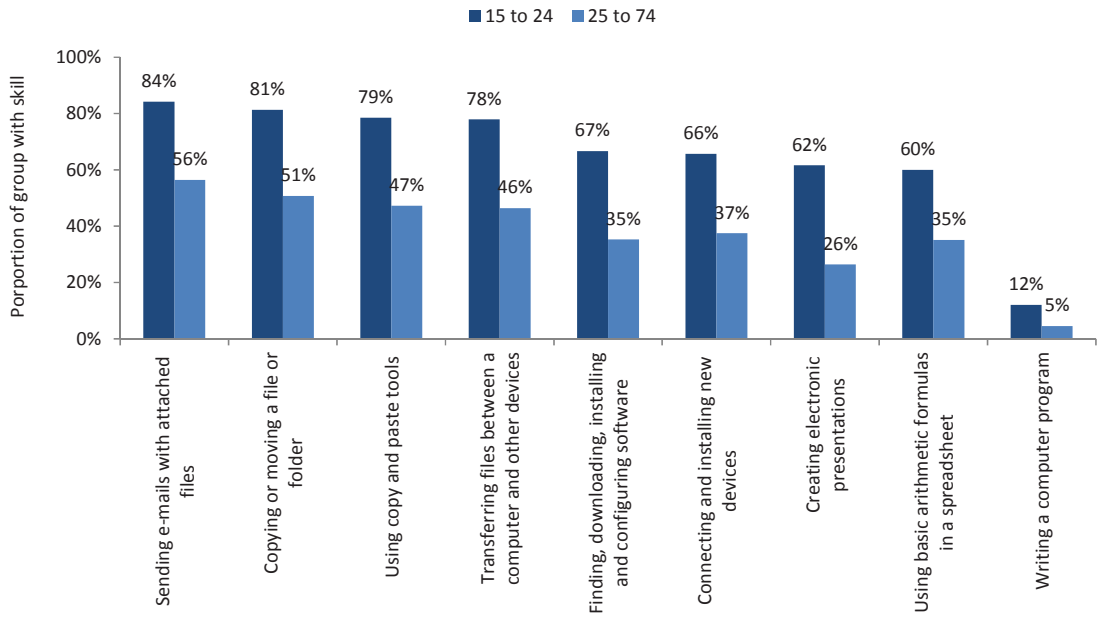
This results in differences in terms of usage patterns, modalities and other characteristics of how the next 49% may participate online. It is clear that not all internet use and adoption is equal. Intensities of use differ widely depending on a range of different factors including empowerment, income and familiarity. For example, while most individuals in low-income countries are familiar with making mobile phone calls, a much smaller percentage are familiar with other related digital activities, such as messaging, internet browsing, and using digital tools for finance.[88]

Figure 19: Affordability of entry-level device in low- and middle-income countries, by region (2018)



Source: GSMA, State of Mobile Internet Connectivity 2019[81]

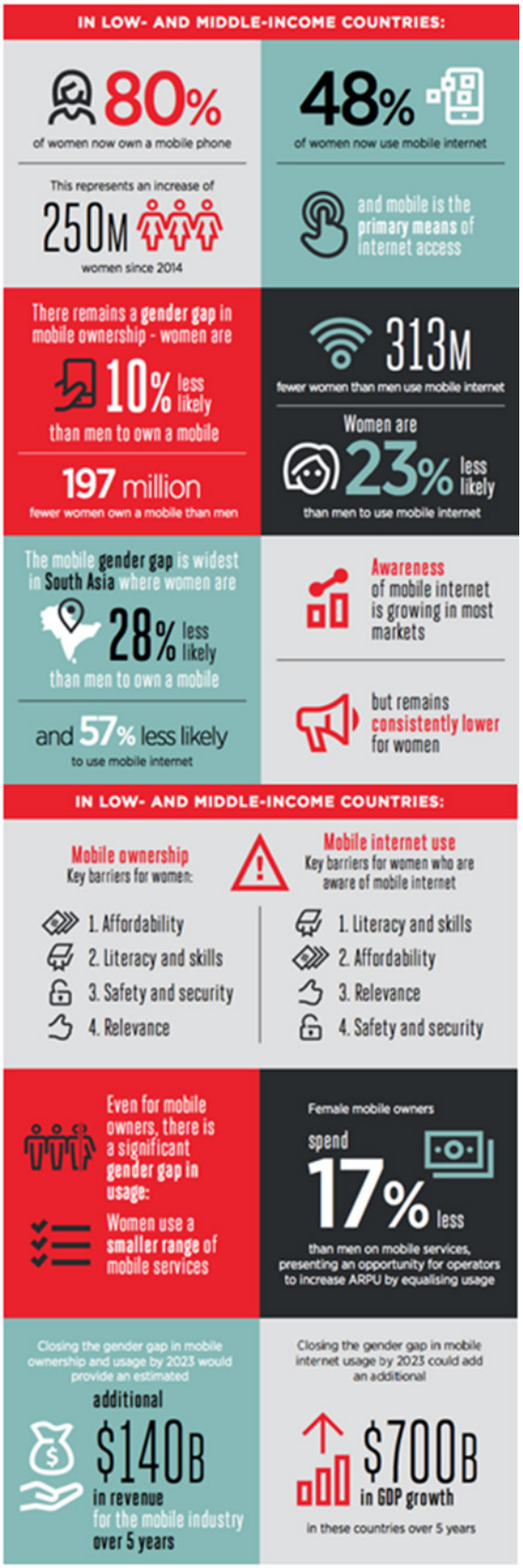
Figure 20: Age differences in specific skills, 2017



Source: ITU, Measuring the Information Society 2018

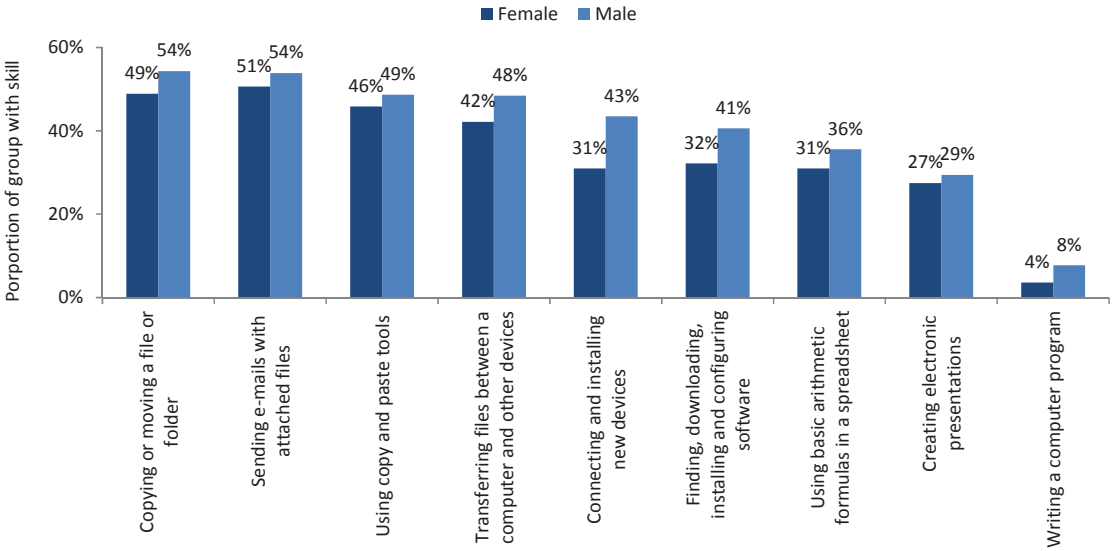
For many users, their internet connectivity is far from the goal of being "always-on" and "high-capacity". Rather, as Jonathan Donner notes in his book, "After Access: Inclusion, Development, and a More Mobile Internet", the majority of internet users in low and middle-income countries use pay-as-you-go services for voice and data, and are cost conscious about their data plans. Thus many low income users deploy strategies such as "sipping and dipping" (relying heavily on airplane mode to prevent unwanted data

Figure 21: Summary statistics of the gender gaps in mobile ownership and mobile internet use



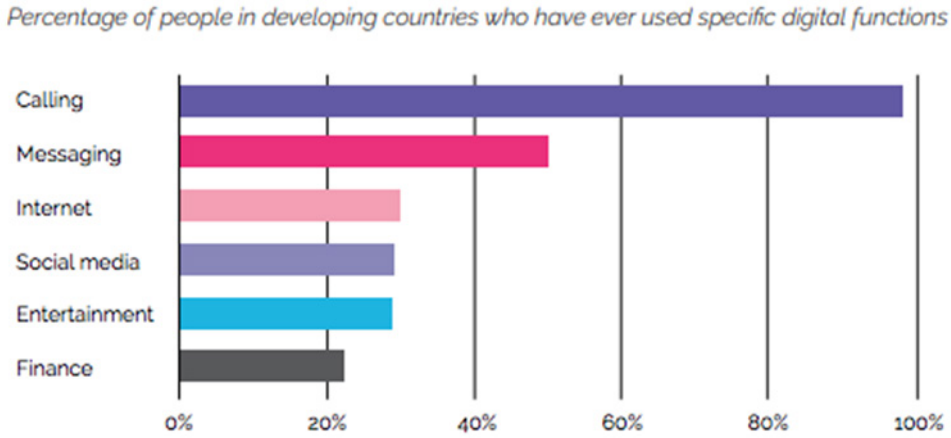
Source: GSMA Connected Women, "The Gender Gap Report 2019"

Figure 22: Gender differences in digital skills, 2017



Notes: All countries provided data on skills for men and women in each country (N=36). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017. Proportions are based on country averages for individuals with a certain gender who have the skill.
Source: ITU, MIS 2018

Figure 23: Differences in digital tool familiarity

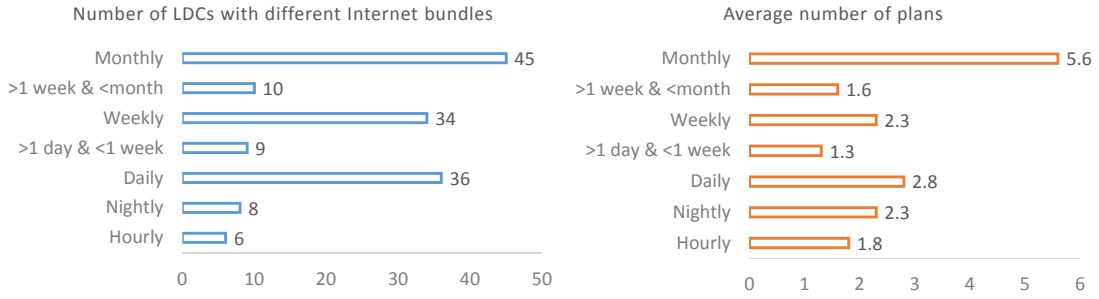


Note: These are average numbers from a dataset covering Kenya, Tanzania, Uganda, Nigeria, Bangladesh, Pakistan and India
Source: Financial Inclusion Insights (2017) & Pathways for Prosperity Commission, "Digital Lives: Creating Meaningful Connections for the next 3 Billion"[89]

charges) and employ a "metered mindset" with regard to when and how they participate in the digital economy.[90] Strategies to ensure greater affordability and more continuous connectivity for such users could result in greater impact of the internet for low income users.

Mobile operators in many developing countries are developing a wide range of low denomination options to cater to the varied demands, and conspicuous consumption thresholds of low-income internet users. These plans range from weekly bundles, daily and hourly plans, access to a certain set of popular social media and OTT applications in the region and even innovative metering options; for example the "night owl" packages in Cambodia where Smart sells 1 GB for USD 10 cents for use between 1am to 5am, or in Rwanda where a daily bundle is offered to students that

Figure 24: Mobile data packages in LDCs, by type of validity period, 2017



Source: ITU, MIS 2018

provides eight times the data of a regular plan, including unlimited WhatsApp.[91] The figure below provides a snapshot of the range of options provided by operators across LDCs for different consumption bundles.

1.6 Thoughtful approaches towards meaningful universal connectivity

The overall challenges that remain include ensuring the global community tackles the issues that are threatening current internet use, as well as identifying what strategies will need to be adjusted to drive the next 49% of global adoption. As noted above, various digital divides remain, and concerted and context-specific actions will be required to address each one. In many cases, these are "second level digital divides": gaps that persist, and/or may increase, even after coverage and access issues are addressed, as they are driven more by differences in embedded structures such as limitations in skills, literacy, user empowerment and availability of relevant content.[92] At the same time, the growing number of risks, real and perceived, need to be addressed with technology, policies and concrete actions to ensure that individuals who are currently online are not forced to curb their participation in the digital economy.

Income gaps are widening between online and offline individuals. The internet's impact on income inequality is mixed, and depends heavily on the circumstances in a particular country or sub-national region.[93] The Facebook/ EIU 2019 Inclusive Internet Index notes a divergent trend in affordability of broadband connectivity services between low-income countries versus others, and observes that continuation of such a trend would lead to deeper social and economic divides.[94] As such, 100% meaningful connectivity can be viewed as a global policy priority to limit the extent of such widening inequality driven by ICTs.

As noted above, actual internet usage is not a binary phenomenon. National and global data do not accurately capture the nuance in differences of adoption. Consequently, efforts to simply close digital divides through promoting infrastructure and access may miss the root causes and drivers of the wide range of differences in how people interact with, and benefit from, internet connectivity. Others have raised the point about a need to focus on meaningful, effective use of digital technologies, leading to a renewed focus on the concept of "meaningful connectivity".[95]

In this context, it is important to revisit the goal of universal connectivity and go beyond definitions and goals that focus solely on whether individuals have "accessed the internet" in some standardized time period, and rather focus on what kind of engagement would best result in full beneficial impacts accruing to individuals. How do we ensure that internet adoption goes beyond simply accessing the internet in the past three months, and put the focus instead on *meaningful universal connectivity*, where engagement with the digital economy is based on trusted access, building the skills of individuals and user empowerment, responding to local needs, and leading to positive impacts and outcomes?

Table 1: Defining thoughtful approaches to meaningful connectivity

Thoughtful Approaches	Meaningful Universal Connectivity
o Understanding the nature of different types of adoption – sipping and dipping, metered usage o Recognizing, and addressing, cultural and social norms as barriers o Focusing on marginalized communities and the users first o Recognizing that technologies can be used benevolently or maliciously o Focusing on demand drivers, not just supply/ network infrastructure o Promoting the development of basic digital skills o Encouraging and assessing sustaining (incremental) innovation, as well as disruptive innovations o Considers social impacts in addition to commercial returns when designing and evaluating new initiatives o Brave and strategic leadership, recognizing connectivity as a means to a greater shared outcome	o Trusted o User empowerment o Inclusive o Sustainable o Relevant o Enables adoption of useful digital platforms and services (by commercial entities and the public sector; G2C, B2C, B2B) o Responds to local needs o Leads to positive impacts (poverty alleviation, income growth, opportunities) and outcomes across sectors (education, health, agriculture, among others) o Supports efforts to achieve the SDGs

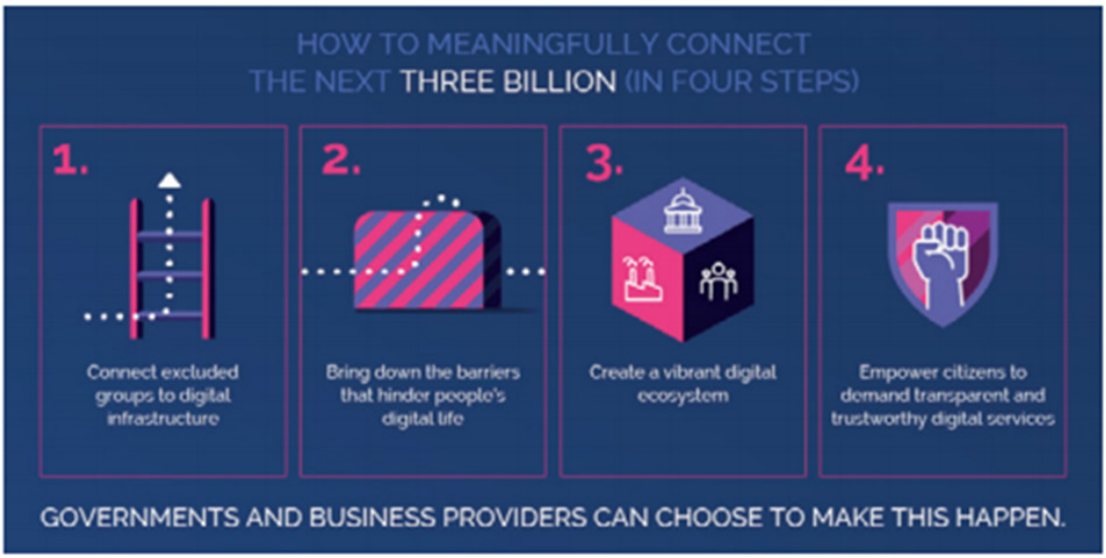
Source: Authors

Thoughtful approaches in this regard, by governments, service providers, digital platforms, and all participants in the connectivity ecosystem, embody an understanding of the complex nuances, take into account the nature of different types of current usage and adoption (such as the metered mindset and that of sipping and dipping, noted above), and recognize that cultural barriers and social norms may be influencing non-adoption (as in the case of the digital gender divide). These thoughtful policies, products and services place a primary focus on the digital inclusion of marginalized users and communities which are traditionally overlooked and underserved, including, but not limited to, individuals with disabilities, those who are low-income, or reside in rural or remote geographies, and women and girls. Policies such as national broadband plans that focus on promoting digital inclusion can start even with recognition of the "first billion" and "first-mile", rather than "bottom billion" or "last-mile" (placing priority on the least connected), and focus much more on both demand and supply issues to facilitate engagement, rather than solely considering infrastructure expansion.

Such approaches also include a recognition that technologies – hardware *and* software – can be used benevolently or maliciously. The impact of ICTs in society is a result of the interplay of technological trends with developments in broader social, political and economic spheres, of how technology is created and deployed, and how we act on the negative use of technology. Thoughtful approaches by actors in the ecosystem recognize that a business-as-usual approach will not be enough to make progress towards meaningful universal connectivity, and while adjustments and incremental innovations will be necessary, disruptive innovations (in technologies, business models and policies) may be just as needed to accelerate progress.

The Pathways for Prosperity Commission launched by the Bill & Melinda Gates Foundation proposes a focus on four concurrent elements of the connectivity ecosystem in order to ensure a positive, productive and fulfilling digital life for the next 3.9 billion users (and all of the current participants in the digital economy).[96] This vision includes extending access to all the unconnected by considering all available options for government and industry, including public subsidy, spectrum licensing, coverage

Figure 25: Pathways for Prosperity Commission recommendations



Source: Pathways for Prosperity Commission, "Digital Lives: Creating Meaningful Connections for the next 3 Billion", 2018

requirements, cross-subsidy between urban and rural areas, creative pricing structures, communal access, and considering alternative service models including limited bandwidth and offline content distribution.

Beyond network infrastructure, the Pathways for Prosperity Commission emphasizes demand-side actions to foster connectivity adoption and effective usage. This includes addressing fundamental socio-cultural barriers that prevent women from participating online and addressing educational constraints. Thirdly, the Commission highlights the role of developing a dynamic domestic ecosystem of digital services as a demand-pull for users to benefit from broadband internet. To do this, governments can encourage pro-competitive behaviour and ensure interlinkages between services, regulating to assure system interoperability and fostering an open and connected design philosophy.

Lastly, the Pathways for Prosperity Commission emphasizes the need for a greater push for transparent and trustworthy digital services – services that empower users, making sure they understand the benefits and risks, and can control their online digital lives. This includes encouraging the private sector to play a larger role on issues of ethics and implications of digital product design, and to consider ways to establish new advocacy entities representing users (such as unions of trusts) that have greater control over how an individual's data are managed and used; more defined duties for data holders/ users; and disclosure requirements that mandate transparency over how data is utilized. Figure 25 illustrates these suggestions.

As noted above, the characteristics of individuals and communities in the next 49% may be significantly different from those who were early adopters of the internet. As such, many of the policies, products and services, techniques and processes that were successful in facilitating access and participation online by the first 51% of users may not be as effective or appropriate in ensuring the next 49% are able to participate in the digital economy. Some existing methods may need to be adjusted and in other cases, completely new approaches may be warranted. In this regard, recognition of the differences between 'Sustaining Innovations' and 'Disruption Innovations' may be useful in considering potential approaches to reach the next 49%. As Clay Christenson has popularized, disruptive innovations are those that threaten to displace existing dynamics regarding products, services and markets, where sustaining innovations are much more incremental, merely making slight improvements.[97]

Table 2: Notional list of innovation examples, segmented, to achieve meaningful universal connectivity

	Sustaining Innovations	Disruptive Innovations
Technologies	High-Altitude Platforms (HAPs) Dynamic spectrum utilization LEO constellations Space optical laser backbone Civic APIs for access to government service	Personal data lockers / portability Open source telecommunications hardware and software Modular/ portable base-stations Innovative power-supply solutions Blockchain in mesh networks Offloading
Business Models	Ad-revenue supported for free public Wi-Fi Communal access initiatives Action-based payments Greater infrastructure sharing	Free universal connectivity (based on technology generation) Ultra-low-cost data packages and/ or extended free trial periods to 4G services
Policies	Public access facilities Greater infrastructure sharing Data ownership policies; The Digital Dividend for mobile expansion	Social purpose spectrum licensing

Source: Authors

Endnotes

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2 Meeting the 2025 Targets

The Broadband Commission Targets

In 2011, following the creation of the Broadband Commission for Digital Development (renamed 'Sustainable Development' in 2015 following the adoption of the UN Sustainable Development Goals), the Commission adopted four initial connectivity goals. These were expanded to five in 2013, with the addition of a gender equality goal.

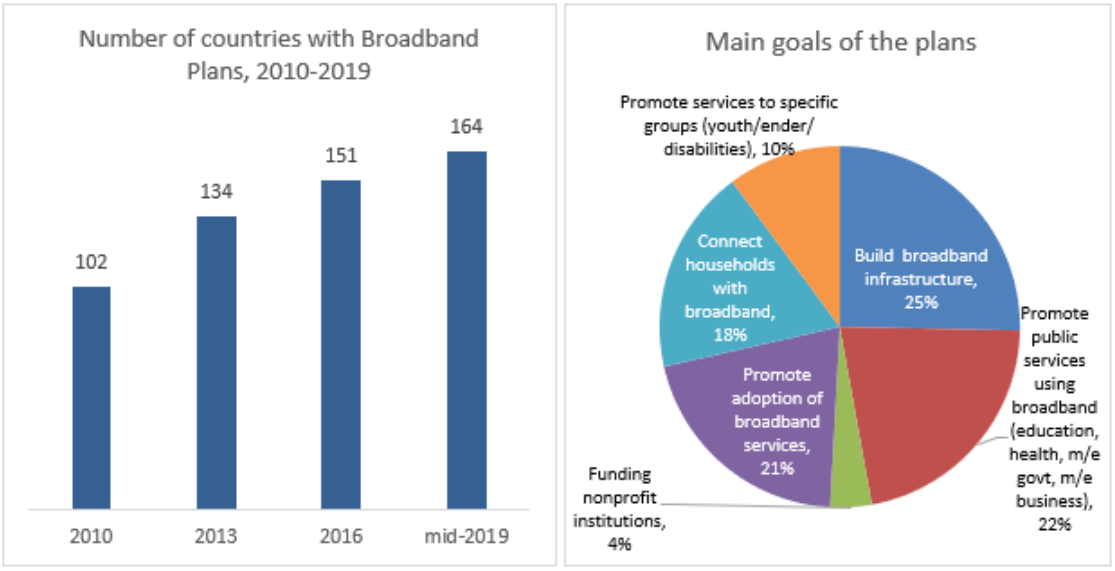
In January 2018, at its Special Session at the Annual General Meeting of the World Economic Forum, the Broadband Commission extended and updated its existing five broadband targets to a total of seven targets.[1] This report considers progress towards all seven targets.

2.1 Advocacy Target 1 Making broadband policy universal: By 2025, all countries should have a funded National Broadband Plan or strategy or include broadband in their Universal Access and Service (UAS) Definition.

Since the 2011, the Commission has been tracking the number of countries with a National Broadband Plan or strategy as the first of its four main targets. 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.

Since the 2008-2009 global financial crisis, national broadband plans have been growing in popularity, though the number of new plans has diminished most recently. Today,

Figure 26: Growth in national broadband plans and goals



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. A complete list of countries with NBPs is available on the Broadband Commission's website.
Source: ITU, Broadband Commission

164 countries worldwide have a broadband plan of some sort, with several countries currently in the process of adopting one. This is an increase from 159 countries in the 2018 State of Broadband Report. Additional other countries, however, are focusing less on a new plan, and rather looking to upgrade their UAS definitions or terms of service, or developing broader digital transformation strategies and plans in which connectivity is one of the core components.

The importance of national broadband plans was explored for the Commission in 2013 report co-authored by ITU and Cisco, "Planning for Progress: Why National Broadband Plans Matter".[2] That report demonstrated through econometric analysis that countries with a national broadband plan have higher fixed broadband penetration (2.5% higher) than countries without, when holding other major factors constant such as income per capita, market concentration and urbanization. The impact of national broadband plans on

mobile broadband adoption was even higher (7.4%) and demonstrated the impact of market competition on boosting broadband penetration, showing that competitive markets are associated with broadband penetration levels some 1.4% higher on average for fixed broadband, and up to 26.5% higher on average for mobile broadband.[3]

Ensuring that national broadband plans are designed to increase network availability, affordability and broadband adoption requires plans that are multifaceted, incorporating many of the recommendations that the Commission has been advocating since its inception. (See Chapter 3, The Impact of Policy Recommendations to Date, and specifically the 66 recommendations that the Commission has presented to date through the State of Broadband annual reports) These include, but are not limited to, plans that are focused on effective spectrum allocation (see Section 4.4 of this report on Improving Spectrum Allocation and Assignment), stimulating national fibre optic backbone and middle mile infrastructure, including potentially wholesale open access network infrastructure, as well as a focus on ancillary issues such as broadband network mapping; updating build code and regulations to ensure fibre ready civil works; ensuring gender-responsive broadband plans that specifically focus efforts on closing the digital divide; and considering embedding a focus on digital skills to increase child safety online, as well as relevant enforcement mechanisms to protect children online.

It is important to note too that while 164 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 being implemented and/or targets need to be revised in order to have impact on broadband adoption.

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

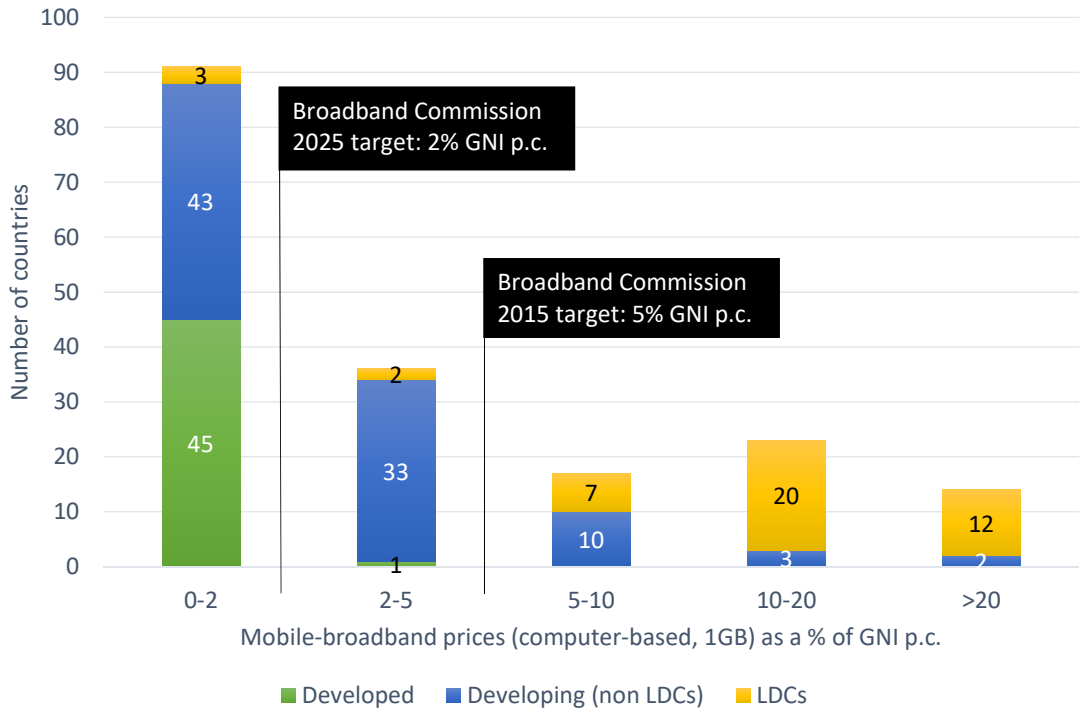
This target is now lower than the Commission's previous affordability threshold target, which was lowered from less than 5% to less than 2% of monthly gross national income per capita – enabling broadband services (fixed or mobile) to be affordable to a much greater number of people. While affordability has improved significantly since the Commission set its initial target in 2011, costs remain high in many countries. This new target will particularly assist lower income groups in developing and Least Developed Countries to gain connectivity.

In 2017, 90 countries worldwide had mobile broadband prices (computer-based, 1GB) below 2% of monthly GNI per capita, whereas 69 countries have entry-level fixed broadband prices below 2% of monthly GNI per capita.[4]

In terms of absolute values, several countries have witnessed a fall in the overall price levels of mobile cellular service, as measured by the ITU's mobile-cellular price basket. The table below highlights the lowest mobile cellular basket prices by region, and the countries that have seen the biggest declines in prices.

According to the Alliance for Affordable Internet's (A4AI) recent update to its mobile broadband pricing information, based on ITU data, of the 99 countries analyzed 1GB of mobile broadband costs on average 5.76% of monthly income. Only 31 of those countries meet the '1 for 2' affordability threshold, whereby 1 GB of mobile data is priced at no more than 2% of average monthly income. This results in at least 1.3bn people (in these 99 countries alone) living in countries with unaffordable entry level mobile data plans for 1GB (see Figure above in Section 1.5 on Affordability of 1GB mobile prepaid broadband plan, by region, 2015-2018).

Figure 27: Number of countries having achieved the Broadband Commission Targets with computer-based mobile-broadband services (1Gb per month), 2017



Source: ITU, MIS 2018

Table 3: Lowest mobile-cellular basket by region (2017), and largest price reductions (2016-2017)

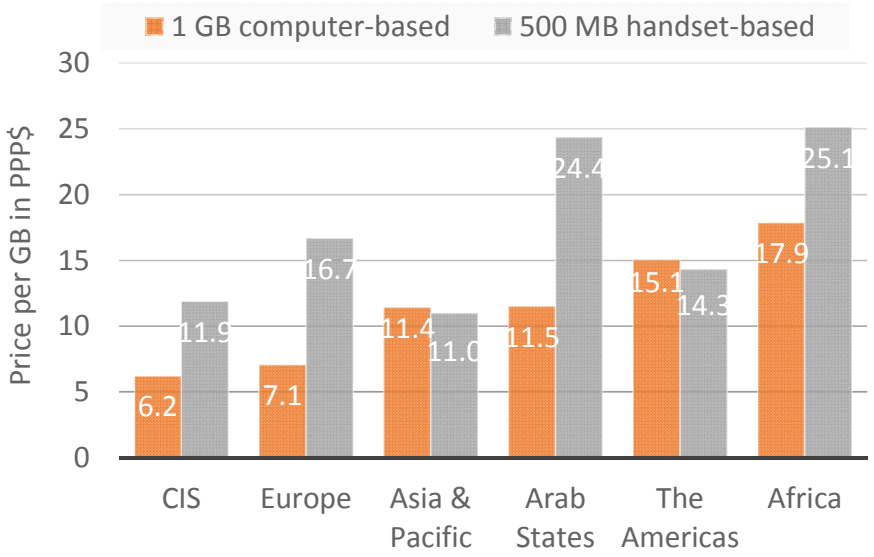
Economy	Lowest price, 2017		Largest price reduction, 2016-2017	
Africa	South Sudan, PPP$ 4.7	Kenya, PPP$ 5.6	Madagascar, PPP$-37.9	Sierra Leone, PPP$-10.5
Arab States	Tunisia, PPP$ 7.9	United Arab Emirates, PPP$ 8.0	Algeria, PPP$-5.3	Jordan, PPP$-5.2
Asia & Pacific	Sri Lanka, PPP$ 2.8	Iran (Islamic Republic of), PPP$ 4.3	Indonesia, PPP$-9.3	Samoa, PPP$-8.2
CIS	Armenia, PPP$ 7.5	Russian Federation, PPP$ 10.4	Azerbaijan, PPP$- 5.3	Tajikistan, PPP$-2.5
Europe	Estonia, PPP$ 5.0	Lithuania, PPP$ 5.6	Hungary, PPP$-14.9	Spain, PPP$-11.1
The Americas	Costa Rica, PPP$ 6.3	Jamaica, PPP$ 9.9	Chile, PPP$-11.0	Jamaica, PPP$-4.7

Source: ITU, MIS 2018

GSMA estimates that for low- and middle-income countries (LMICs), more than half are still falling short of the target of broadband services costing less than 2% of monthly income per capita.[5] And for the poorest quintile (or 20%) of the total populations, the cost of 1GB of mobile broadband is significantly higher than the 2% threshold. For example, in Sub-Saharan Africa, the cost of 1 GB of data for the poorest 20% of the population is almost 40% of monthly income (see Figure 29 below).

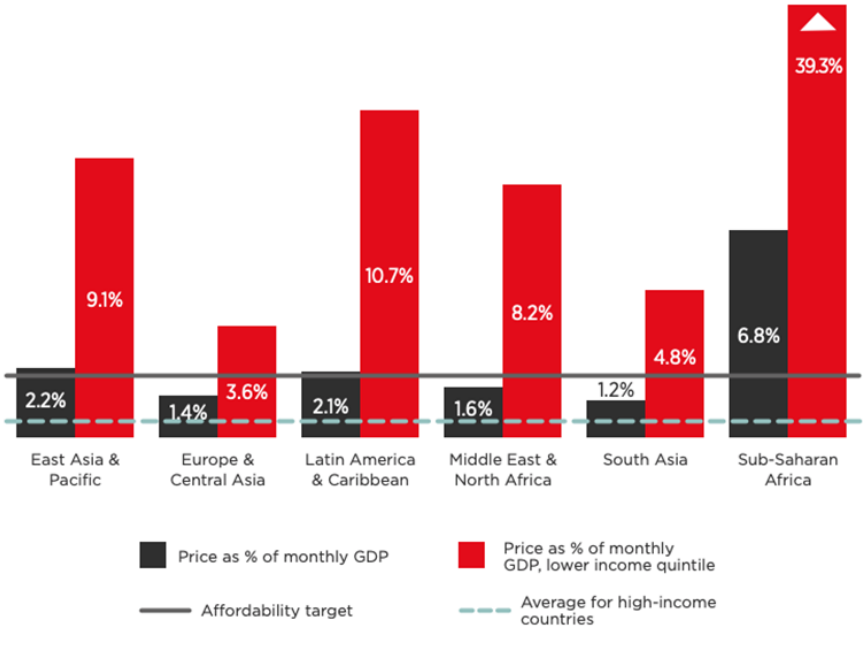
While Target 2 is focused on the affordability of entry-level services, a concurrent focus and appreciation of the cost of user devices is required. While the cost of entry-level internet-enabled (smart) phones continues to

Figure 28: Average mobile-broadband prices in PPP$ per GB, by region, 2017



Note: Simple averages. Based on 164 economies for which 2017 data on handset-based and computer-based mobile-broadband prices in PPP$ are available.
Source: ITU, MIS 2018

Figure 29: Affordability of 1 GB of data in low- and middle-income countries, by region (2018)

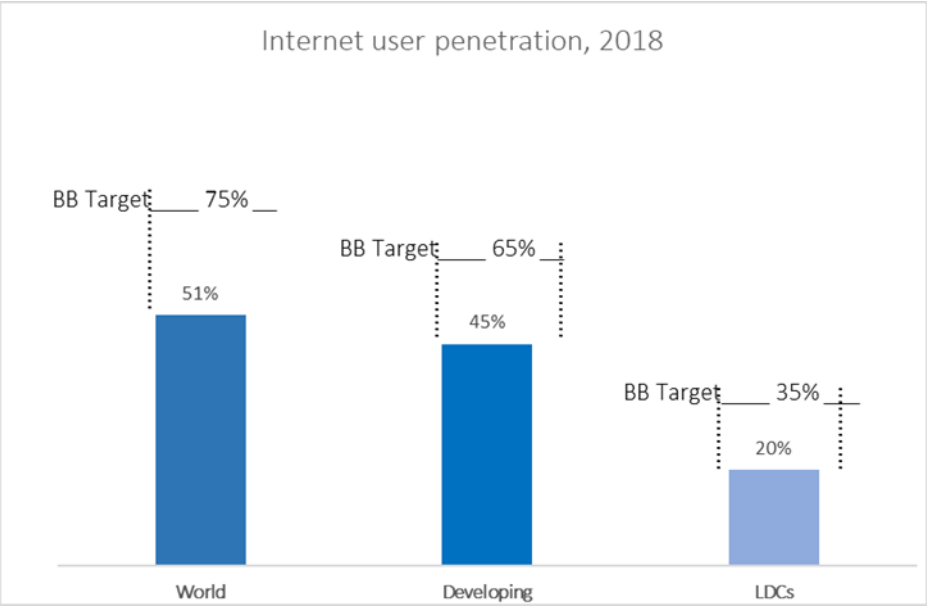


Source: GSMA Intelligence calculations based on pricing data from Tarifica. For each region, the mean average is taken based on the countries for which we have available data. Data on income distribution is sourced from the World Bank.

Note: GSMA Intelligence calculations based on pricing data from Tarifica. For each region, the mean average is taken based on the countries for which data is available. Data on income distribution is sourced from the World Bank. Source: GSMA 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

Figure 30: Global internet user penetration, and by region, vs Commission target, 2018



Note: For statistical purposes, broadband is defined as "everything greater than or equal to 256 kbit/s". See ITU Handbook for the Collection of Administrative Data on Telecommunications/ICT, 2011: https://www.itu.int/en/ITU-D/Statistics/Pages/publications/handbook.aspx.. Data will be updated in October 2019.
Source: *ITU*

decline rapidly, these costs remain prohibitive for some users. In some countries, lower per capita income levels combined with low population densities may require public sector support to ensure high network deployment costs do not result in prohibitive pricing of internet access.

2.3 Advocacy Target 3 Getting people online: By 2025, Broadband-Internet user penetration should reach: a) 75% worldwide b) 65% in developing countries c) 35% in Least Developed Countries

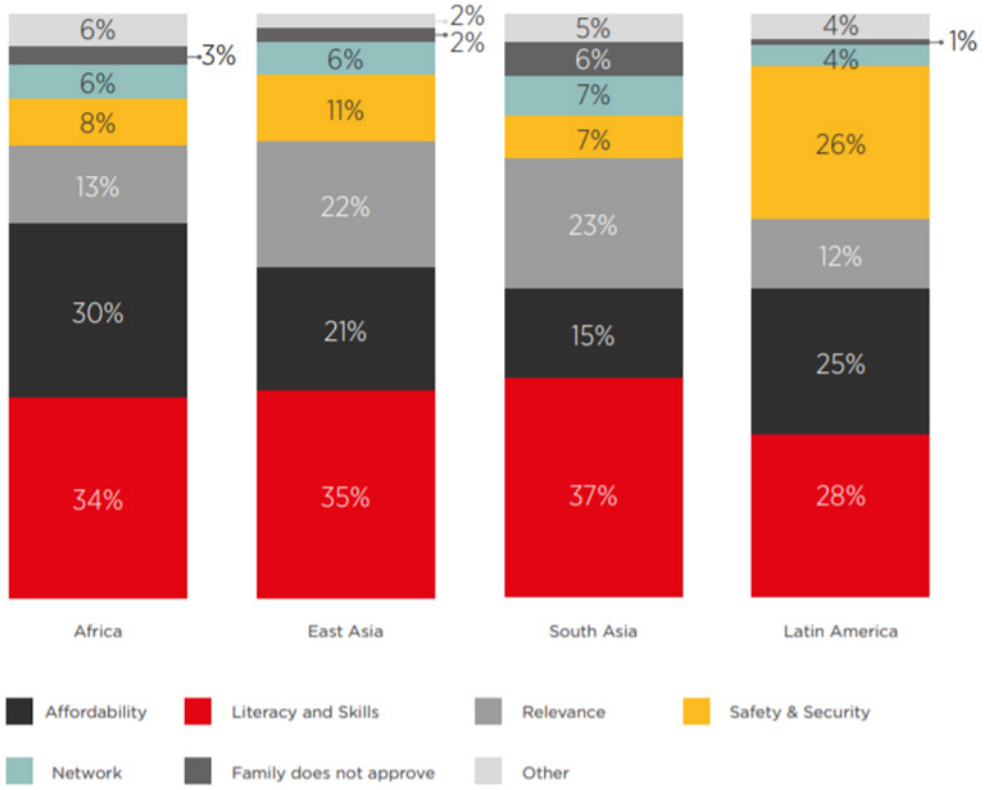
These ambitious values set targets aimed at connecting everyone, everywhere – with a special focus on developing country and least developed country populations, which are the most vulnerable to being unconnected.

As noted in the Section 1.1 figure on Global Participation in the Digital Economy, current estimates for internet users is 3.9 billion people, or 51% of the total population. Total unique mobile subscribers is higher at 5.1 billion people, while unique mobile internet subscribers is lower at 3.5 billion.

According to the latest ITU data, global internet user penetration currently stands at 51% – considerably below the 75% target. Internet user penetration is 45% in developing countries, well below the 65% target, and in LDCs, internet adoption is at 20%, again below the 35% target. (Note that ITU data defines broadband as a connection speed of more than 256 kbps or higher). See Figure 30 below.

Two regions have internet user penetration totals that are below the global average: Africa with internet user penetration of 24.4% and Asia & the Pacific with internet user penetration of 47% (2018 data).

Figure 31: The top barriers to mobile internet use in surveyed low- andmiddle-income countries, by region



Source: GSMA, State of Mobile Internet Connectivity 2019, https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/07/GSMA-State-of-Mobile-Internet-Connectivity-Report-2019.pdf

2.4 Advocacy Target 4 Digital skills and literacy: By 2025, 60% of youth and adults should have achieved at least a minimum level of proficiency in sustainable digital skills

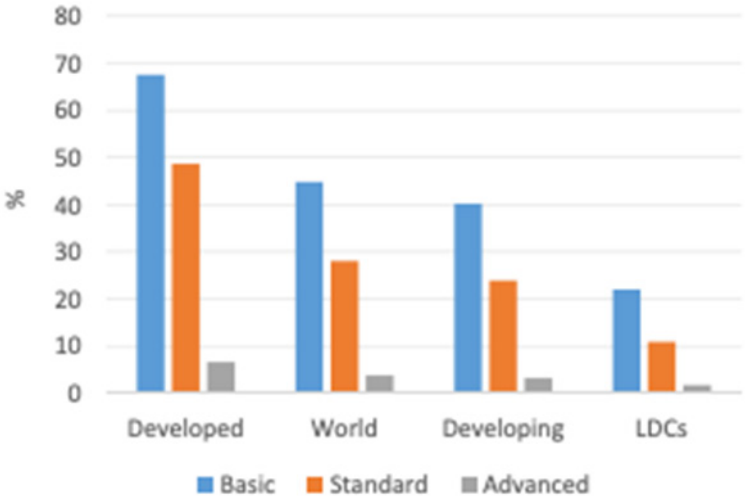
In order for individuals to benefit from broadband internet resources, familiarity with digital devices and applications, including mobile-related functions, is a necessary skill. Evidence from the GSMAi consumer survey shows that a lack of literacy and digital skills is the top reason preventing consumers in developing countries from using mobile internet (see Figure 31). Deliberate action will be required to improve basic digital skills. For example, embedding basic digital skills training in education and training initiatives is key.

Figure 32 demonstrates the progression from basic ICT skills (measured as a competency in at least one of four basic computer-based activities), to standard ICT skills (competency in at least one of four moderately skilled computer-based activities), and finally to advanced skills (ability to write a computer program).

The figure demonstrates that across the world in 2017, less than 30% of the world's population was proficient in at least standard ICT skills. Significant differences are also seen across different world regions (see Figure 33) .

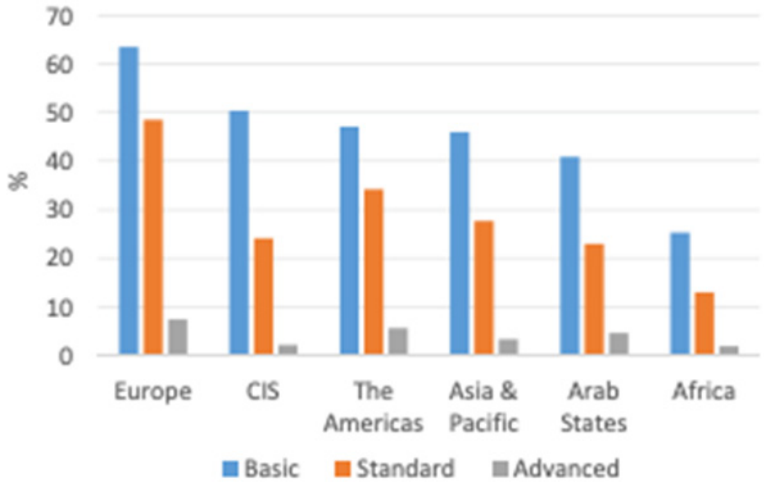
Note however that these data are only a proxy for proficiency in digital skills, as these measures are not comprehensive assessments of each individual's ability to engage in online activity. As part of the Global Alliance to Monitor Learning (GAML), the UNESCO Institute for Statistics (UIS) works with other partners towards establishing a framework and identifying assessment tools to monitor digital literacy skills.[6]

Figure 32: Percentage of individuals with ICT skills, by development status, 2017



Note: For each country, the value for basic skills is the highest value among the following four computer-based activities: copying or moving a file or folder, using copy and paste tools to duplicate or move information within a document, sending e-mails with attached files, and transferring files between a computer and other devices. The value for standard skills is the highest value among the following four computer-based activities: using basic arithmetic formula in a spreadsheet; connecting and installing new devices; creating electronic presentations with presentation software; and finding, downloading, installing and configuring software. The value for advanced skills is the value for writing a computer program using a specialized programming language.
Source: ITU.

Figure 33: Percentage of individuals with ICT skills, by region, 2017



Note: For each country, the value for basic skills is the highest value among the following four computer-based activities: copying or moving a file or folder, using copy and paste tools to duplicate or move information within a document, sending e-mails with attached files, and transferring files between a computer and other devices. The value for standard skills is the highest value among the following four computer-based activities: using basic arithmetic formula in a spreadsheet; connecting and installing new devices; creating electronic presentations with presentation software; and finding, downloading, installing and configuring software. The value for advanced skills is the value for writing a computer program using a specialized programming language.
Source: ITU.

Acquiring digital skills should be considered as a lifelong learning endeavour. With the ever more rapid pace of change in both technology and job requirements as well as the penetration of technology in our daily life, the set of digital skills is changing and will change in the future. An example is the data privacy skills or more recently the importance of engaging with artificial intelligence. Hence, the proficiency in digital skills should be a dynamic process and government, private sector and other stakeholders should consider strategies and programmes that offer individuals lifelong learning opportunities to acquire digital skills and to recognise and value digital skills acquired in different settings for example through recognition of prior learning schemes (RPL).

Additionally, digital skills are becoming increasingly critically important to accessing employment and entrepreneurship opportunities. This reflects an agreement that these skills are more likely to be relevant across a very wide set of socio-economic and labour markets and that equipping individuals with these skills contributes, among other things, to inclusive growth and decent work, as targeted in SDG8. In Chapter 6 of this report, Commissioner Nasser Marafih shares the experience of the Ooredoo Group in providing digital literacy training for users and customers across the world.[7] Similarly, Verizon CEO and Commissioner Hans Vestberg shares the experience of Verizon in delivering digital-based learning and educational content in his Commissioner Insight, also in Chapter 6.[8]

For policy makes, especially those charged with national broadband initiatives, recognition of the importance of digital skills, understanding that policies to encourage their development are needed, and a commitment to continual tracking of progress are all particularly important. Efforts such as the Web Foundation's eSkills4PolicyMakers workshops are one example of how to ensure good policy is designed by policy makers who are equipped with sufficient digital skills and understanding to be able to develop policies that ensure equal, affordable and meaningful access to the internet, particularly for women and girls.[9]

2.5 Advocacy Target 5 Digital financial services: By 2025, 40% of the world's population should be using digital financial services

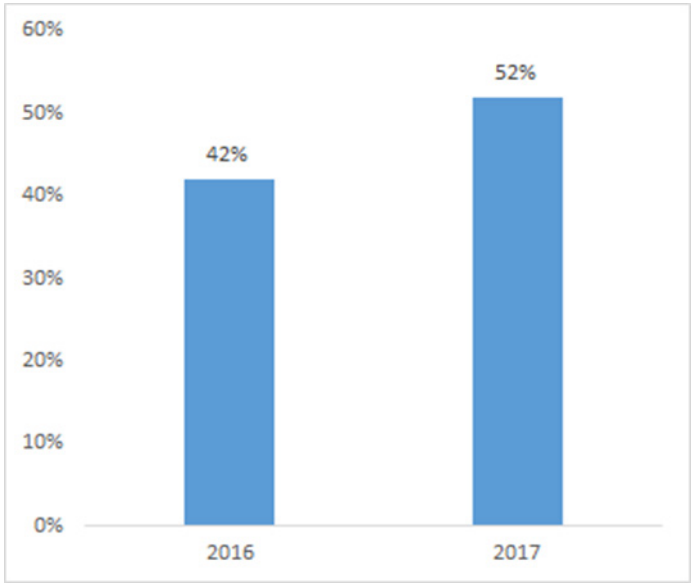
Digital financial services present a tremendous opportunity to swiftly increase the number of people using broadband and the internet and to realizing some of the social and economic benefits of these digital resources.

Currently, two billion adults are still without access to a bank account, but some 1.6 billion in this group have access to a mobile phone, presenting the opportunity to explore strategies that leverage the widespread use of mobile phones as platforms for financial inclusion.

According to the World Bank's Global Findex database, the number of people worldwide who have utilized digital financial systems in the previous 12 months increased from 42% of the global population (above the age of 15) to 52% in 2017 (with women representing 46% and men 54%). Specifically, this indicator shows the percentage of respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account, or report using the internet to pay bills or to buy something online, in the past 12 months. It also includes respondents who report paying bills, sending or receiving remittances, receiving payments for agricultural products, receiving government transfers, receiving wages, or receiving a public sector pension directly from or into a financial institution account or through a mobile money account in the past 12 months.

In many countries, the gender gap is lower with mobile money than with traditional financial services, and mobile money is closing the gender gap. Research in Kenya indicates that gender is not a significant variable in determining access to mobile money accounts – though it is for formal financial institution accounts.[10] There is evidence from the 2017 Global Findex that the mobile money gender gap has narrowed in 17 countries in Sub-Saharan Africa and in one country in Latin America (Bolivia). GSMA Global Adoption Survey data revealed a strong

Figure 34: Globally, percentage of the population that have made or received digital payments in the past year (% age 15+) (female and male)



Source: World Bank Global Findex Database https://globalfindex.worldbank.org/

positive correlation between the percentage of female agents in a provider's network and female customers.[11] As of July 2019, 24 mobile operators had already committed to reduce the gender gap in their mobile money customer base by 2020 through the GSMA Connected Women Commitment Partner Initiative.[12] UNDP Administrator and Commissioner, Achim Steiner, discusses the sustainable development dividend from digital finance in his Commissioner Insight in Chapter 6.[13]

2.6 Advocacy Target 6 Getting businesses online: By 2025, improve connectedness of Micro-, Small- and Medium-sized Enterprises (MSMEs) by 50%, by sector

This target is particularly ambitious for MSMEs in those sectors that remain largely unconnected and incentivizes well-connected sectors to close the final gap. As an example, a sector in which MSMEs are 80% unconnected will have only 40% unconnected by 2025, and a sector in which MSMEs are 30% unconnected will have only 15% unconnected by 2025.

Measuring progress against this target is highly specific to the unit of observation (i.e. by country, or by sector within a country) and therefore necessitates disaggregation. One relevant data source to track individual country progress is UNCTAD's database on core indicators on ICT use in business by enterprise size class, tracked annually, particularly indicator B3 (Proportion of businesses using the internet)[14]. This data source segments businesses by size (all; micro-enterprises with 0-9 employees; small enterprises with between 10-49 employees; medium enterprises with between 50-249 employees; and large enterprises with 250 or more employees). However, this data is more robust for developed economies, with more limited reporting for developing countries. For OECD countries, OECD's Measuring the Digital Transformation 2019 report measures the diffusion of select ICT tools and activities in large and small businesses, comparing between 2010 and 2018. This figure is indicative of the overall level of broadband access and ICT usage in large and small businesses in OECD countries.

Currently, MSMEs have lower levels of connectivity than large enterprises in the same sectors.

Figure 35: Diffusion of selected ICT tools and activities in large and small businesses, OECD, 2010 and 2018

Source: OECD, ICT Access and Usage by Businesses Database, http://oe.cd/bus, January 2019.

Making sure that MSMEs are connected improves their competitiveness in expanding digital economies, where online business transactions are increasingly the norm. A key barrier in this regard is the difference in skills between age groups, income levels, sexes and education levels noted above. Other measures to support greater adoption of broadband by MSMEs include adjusting building and civil works codes to include duct work for fibre optic cabling, and targeted training programmes for business use of broadband. UNCTAD Secretary-General and Commissioner, Mukhisa Kituyi, discusses the role that digital platforms can play in supporting opportunities for small enterprises in developing countries, in his Commissioner Insight in Chapter 6.[15]

2.7 Advocacy Target 7 Achieving gender equality in access to broadband by 2025: By 2025, gender equality should be achieved across all targets.

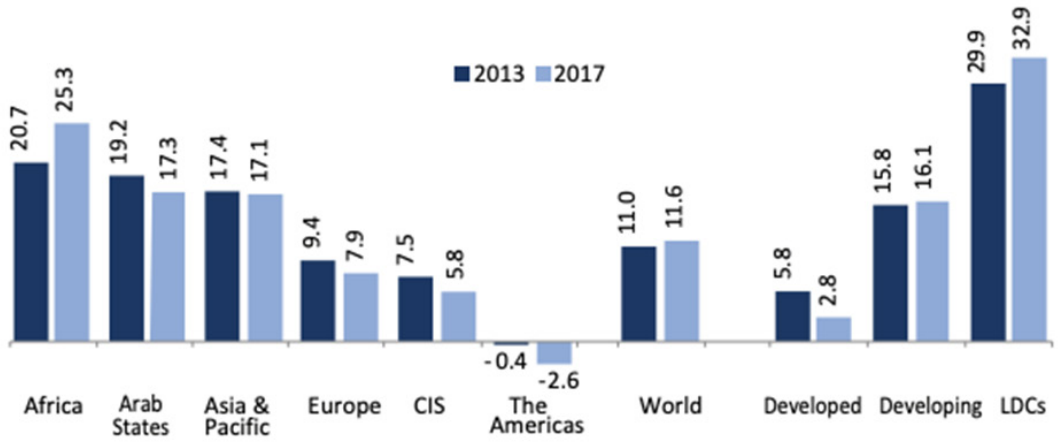
In all areas of broadband accessibility and use, women and girls are left behind. Gender equality must be realized in order to achieve all the 2025 Targets – including internet users, digital skills, digital financial services and MSMEs – and bring broadband and internet connectivity to everyone, everywhere.

In 2013, the Broadband Commission drew attention to the importance of gender equality among internet users by introducing an additional target, so that the benefits of broadband internet reach everyone. As a result, from 2013 onwards, important disaggregated data has been collected to inform effective decision-making by policy makers. While the gender gap has decreased in many developed countries, it has expanded in many developing economies – creating a specific need to support digital gender equality in these countries. Part of this effort also depends on ensuring that national broadband plans (as part of Advocacy Target 1) are gender responsive, building in a focus on programmes and policies designed to close the digital gender divide.

In 2018, ITU published robust comparisons of the gender gap in internet adoption around the world and progress between 2013 and 2017. That analysis showed that the gender gap appeared to have widened slightly, with the proportion of men using the internet versus women using the internet rising from 11% more males than females using the internet in 2013 to 11.6% more males than females using the internet in 2017.

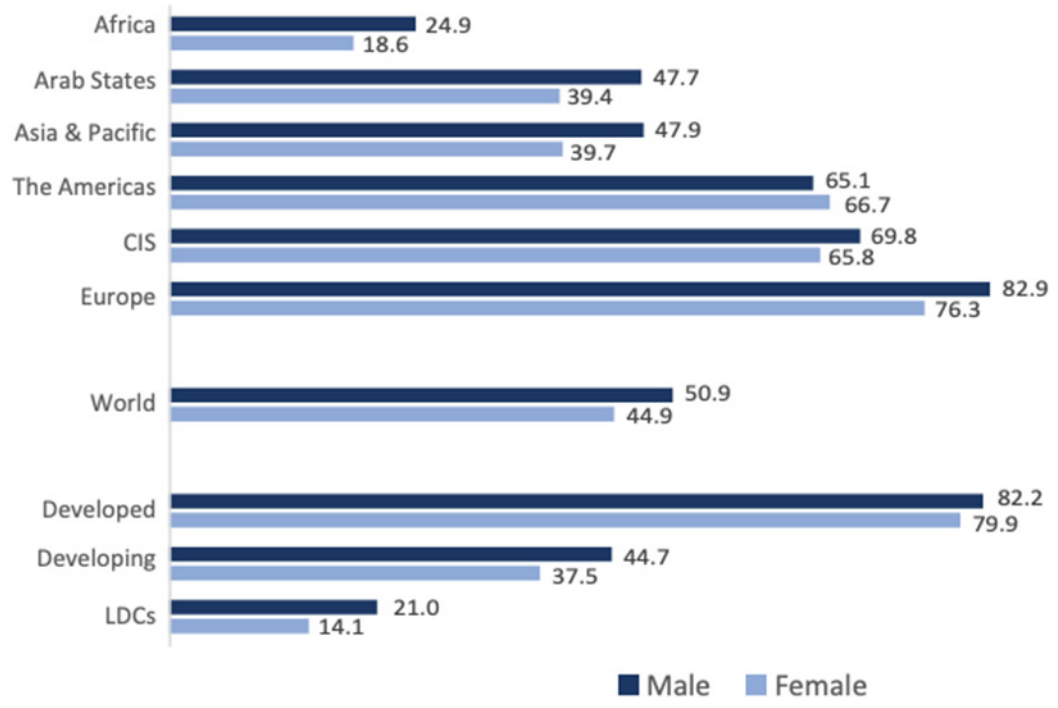
Across the world, the proportion of men using the internet is higher than the proportion of women using the internet in two-thirds of countries. The only region where a higher percentage of women than men are using the internet is in the Americas (see Figure below).

Figure 36: Internet user gender gap (%), 2013 versus 2017



Note: According to ITU, the gender gap represents the difference between internet user penetration rates for males and females relative to internet user penetration rate for males, expressed as a percentage.
Source: ITU: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf

Figure 37: Internet penetration rate for men and women, 2017

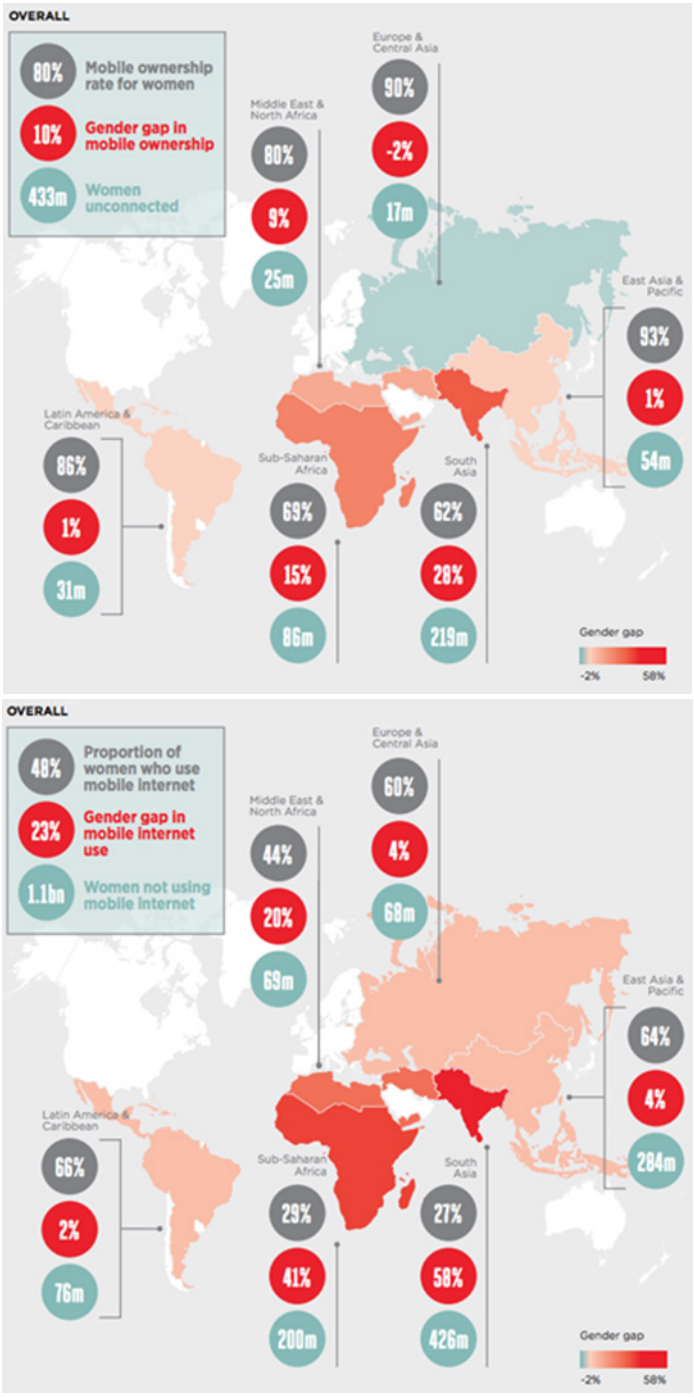


Note: According to the ITU, penetration rates in this chart refer to the number of women/men using the internet, as a percentage of the respective total female/male population.
Source: ITU, https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf

The figure below from the GSMA details the existing gender gaps in mobile ownership and internet use across regions of the world.

Women's mobile phone ownership has increased significantly in low- and middle income countries since 2014, and 80% of women in these markets now own a mobile phone. However, women are still 10% less likely than men to own a mobile, and 23% less

Figure 38: Gender gap in mobile ownership and internet use in low- and middle-income country, by region



Note: (Base = total adult population)
Source: GSMA Connected Women, "The Mobile Gender Gap Report 2019"

likely than men to use the mobile internet. The mobile gender gap varies by region and country, but is widest in South Asia, where women are 28% less likely than men to own a mobile and 58% less likely to use mobile internet.[16]

The usage gap is also reflected in mobile spending. Across low- and middle-income countries, female mobile owners spend on average 17% less than men on mobile services. This spending gap is evident even in countries where there is not a gender gap in mobile ownership or mobile internet use.

While mobile phone ownership and mobile internet use have increased significantly among women, there is still a persistent gender gap. Women's lower levels of mobile ownership and use not only reflect existing gender inequalities, but also threaten to compound them. If the mobile gender gap is not addressed, women risk being left behind as societies and economies digitize.[17] Considering Advocacy Target 3 (broadband-internet user penetration levels by 2025), the result of this target would be that by 2025 75% of women worldwide would be using the internet, as well as 65% in developing countries, and 35% in Least Developed Countries.

It is also important to note that while the available data focused on mobile access, ownership and internet use, Target 7 is also about access to affordable and meaningful broadband. Government policy can play a particularly impactful role in supporting gender equality in the digital economy. For example, a 2018 analysis by the Web Foundation, A4AI and UN Women found that Universal Service and Access Funds (USAFs) could be a mechanism to financially support targeted programmes to increase internet use by women.[18] In Africa, over 68% of countries had a USAF in place, however, only three of 37 countries with USAFs have universal access policies that explicitly aim to connect women and girls through the fund. Similarly, a 2018 report by the Web Foundation found that only a handful of countries are taking steps to meaningfully address issues of gender inequities online, and that even those actions that are in place are inadequate to advance true progress toward digital equality.[19]

The disparity in gender equality in broadband is emblematic of more systemic differences, both in terms of employment in digital sectors, as well as in the engagement of girls and young women in study related to ICT. For example, significantly more men than women are currently employed in the digital sector. Globally, women hold only 24 per cent of all digital sector jobs, and in developing countries, men are 2.7 times more likely than women to work in the digital sector.[20] In management roles in technology sectors, men are almost twice as likely to be in management positions and nearly four times as likely to be executives.[21] And at the frontiers of technology, the gap widens dramatically: in Silicon Valley, recruiters for technology companies report that the applicant pool for technical jobs in artificial intelligence (AI) and data science is often less than one per cent female.[22]

Over time, the proportion of women in the digital sector has been on the decline. In North America, the share of women in computing jobs (less than 25%) has been dropping over the past two decades – a period when women were making considerable advancements in other fields.[23] In programming and software development jobs, in the US women hold about 18% of jobs, down from 37% in the 1980s.[24] In the UK, women hold just 12% of programming and software development jobs – down from 15% a decade earlier.

At the same time, excess demand exists for employees to fulfill ICT jobs. In the EU for example, there will be a skills gap in excess of over 800,000 ICT jobs by 2020. Increasing the number of women pursuing ICT careers will help fill these gaps and strengthen countries' economies.[25]

More broadly, the EU estimates that 90 per cent of all jobs will require digital skills.[26] Women who do not have these skills are at risk of being left behind, and the OECD estimates that labour market returns for women with ICT skills are considerably higher than the returns generate by other skills, and that returns are also higher for women than for men.[27]

However, despite the excess demand for employment in the digital sector, women's enrolment in ICT studies has declined in the EU since 2011, even as related job opportunities have increased dramatically.[28] Evidence indicates that this shortfall actually begins at an earlier age. Across OECD countries only 0.5 per cent of girls aspire towards ICT-related careers at age 15, versus 5 per cent of boys.[29] However, at earlier ages such as in the primary and lower secondary education levels, the gender gap in actual digital competence is either non-existent or reversed in favour of girls. Results from the most recently completed International Computer and Information Literacy Study (ICILS), a computer-

based assessment of eighth grade students' skills conducted in 21 countries, showed that girls scored significantly higher than boys in all countries except two. Yet despite demonstrating promising early performance, girls had lower levels of self-efficacy, even when they outperformed or performed similarly to boys on measures of digital skills. On the ICILS assessment, girls' self-efficacy scores – that is, their *perceived*, as opposed to their *actual*, abilities – for advanced ICT tasks were significantly lower than boys' in all countries.[30] This suggests a real impact of gender stereotypes around technology due to a 'self-efficacy' gender gap (or the difference between girls' and boys' confidence and belief in their abilities).

A Note on Data Collection Challenges

Accurate and up-to-date data collection remains a challenge for some for the advocacy targets, as noted in the sections above. Much of the data series used for these targets comes from national statistical agencies, and the process of collecting data at these levels of granularity remains labour intensive and incurs cost burdens. Some of the data available for measuring progress against the targets are more robust for developed countries, and remain a challenge for some developing countries. There may be other methodologies to collect similar, or proxy, datasets, and/or reporting could be done on a semi-annual basis rather than annual. Further discussion on these challenges, possibilities and trade-offs is required. The ITU will be releasing its annual update of ICT data in October 2019, and the relevant data points mentioned in this report will be updated via an addendum to this report.

Endnotes

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3 The Impact of Policy Recommendations to Date

Since 2012, the Commission has been publishing the "State of Broadband" report, each report culminating in a set of recommendations on how to further advance universal broadband connectivity deployment. The State of Broadband reports build on the two original outputs of the Broadband Commission, the 2010 report, "A 2010 Leadership Imperative: The Future Build on Broadband", and the 2011 report, "Broadband: A Platform for Progress."[1]

3.1 State of Broadband Recommendations from 2012 to 2018

From 2012 to 2018, there have been 66 different recommendations put forth by the State of Broadband reports. Most of them (58), fall into one of ten categories:

1) Generalized recommendations around ICT policy and regulatory regimes
2) Improving data / statistics / monitoring
3) Increasing skills / human capital / capacity building
4) Universal Service approaches: USFs, USOs
5) Taxation
6) A focus on local: content, language, hosting, entrepreneurship
7) Financing and investment
8) Open access and infrastructure sharing
9) Spectrum policy
10) National broadband plans

The remainder of recommendations (eight), each have a unique focus across rights of way/ dig once, e-government initiatives, public consultation, affordability, sustainability/ climate change, intellectual property, Internet of Things and Smart Cities, and cross-border data flows.

The table below identifies the recommendations by category, from the most common category onwards, and includes the edition of the State of Broadband report in which the recommendation appeared. In some of the groupings, similar recommendations appear over multiple years, in part owing to the nature of policy change taking time, and requiring consistent and persistent advocacy.

Table 4: State of Broadband recommendations by category and year

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:

Table 4: State of Broadband recommendations by category and year (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
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
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	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
Others (Everything Else: Rights of Way / Dig Once, E-Government Initiatives, Public Consultation, Affordability, Climate Change, Intellectual Property, Internet of Things and Smart Cities 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

Source: State of Broadband Reports 2012 to 2018

3.2 Impact of State of Broadband recommendations

Measuring country progress through the ICT Regulatory Tracker

The ICT Regulatory Tracker is a recent tool created by ITU comprising a framework for monitoring and comparing the varying levels of ICT regulatory policy environments between countries. The tracker captures data from the previous nine years for over 185 countries across fifty different indicators, ranging from accountability to quality of service obligations and monitoring to competition in market segments, across four clusters: regulatory authority, regulatory mandate, regulatory regime and competition framework.[2] Based on country scores given for existence and features (but not on the basis of quality or performance), countries have been grouped into "generations" of regulations based on the maturity of the regulatory framework:

Generation 1: Regulated public monopolies; Command and control approach

Generation 2: Opening markets; Partial liberalization and privatization across the layers

Generation 3: Enabling investment, innovation and access; Dual focus on stimulating competition in service and content delivery, and consumer protection

Generation 4: Integrated regulation; Led by economic and social goals

Generation 5: Collaborative regulation; Inclusive dialogue and harmonized approached across sectors

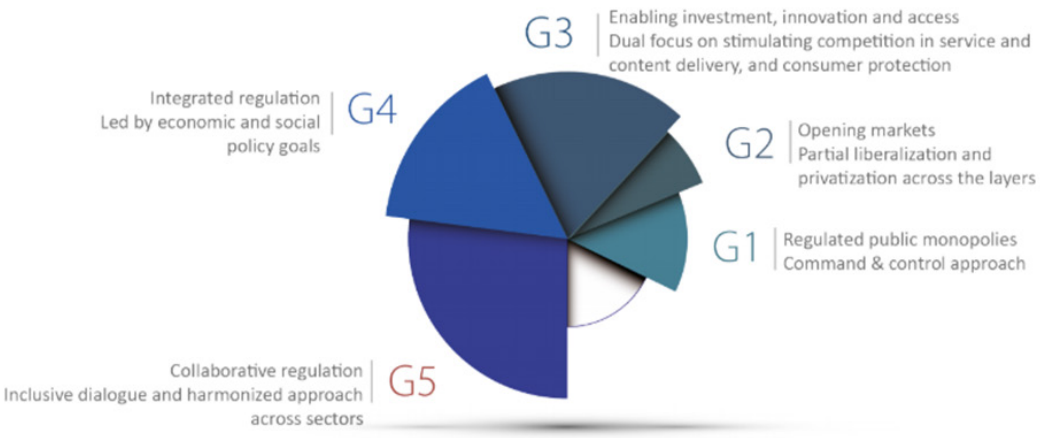
Since 2010, when the Commission was formalized, most countries have progressed from earlier stages to more advanced levels.

In 2010, the vast majority of the 188 countries in the tracker were at Generations 1 (G1) and 2 (G2) of ICT policy, with 46 countries and 67 countries respectively at each level. Fifty countries were at Generation 3 (G3), and only 25 had reached Generation 4 (G4).

By 2018, the number of countries in Generation 1 had dropped from 44 to 19, and countries in Generation 2 fell from 68 countries to 57. The number of countries in the transitional stage of Generation 3 remained nearly the same, at 52 compared to 54 in 2010 (though the composition of countries changed). And most notably, the number of countries in Generation 4 jumped from 24 in 2010 to 65 in 2018.

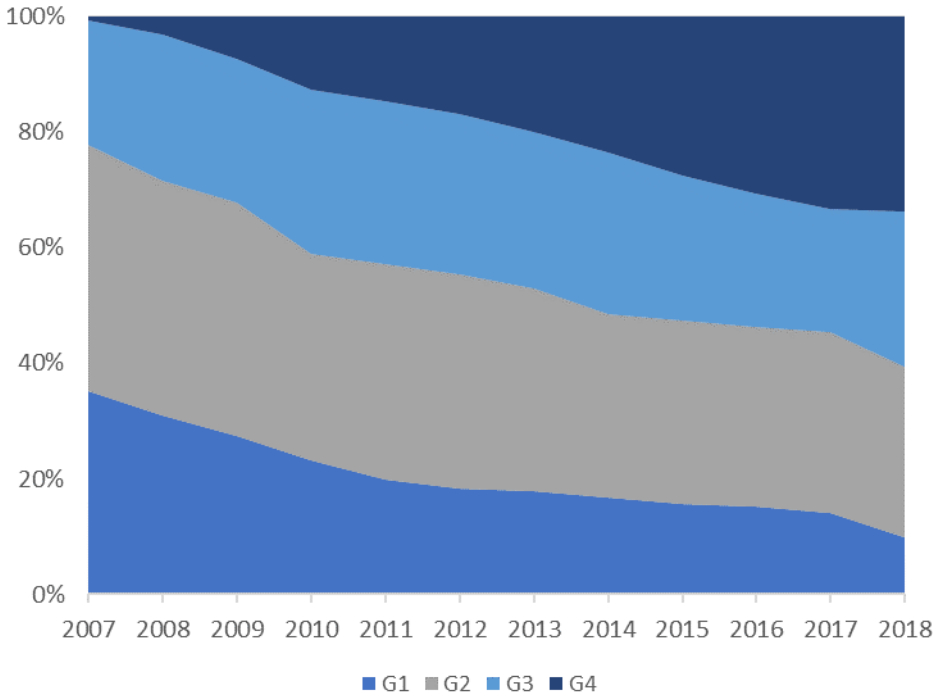
Across the world, while most countries and regions have been progressing, regulatory divides do persist, particularly between regions. Only ten per cent of countries in Africa, Asia-Pacific and the Commonwealth of Independent States (CIS) are at the G4 stage; comparatively, nearly 80% of regulators in

Figure 39: Conceptual framework of generations of ICT regulation



Source: ITU, "Global ICT Regulatory Outlook 2017"

Figure 40: Evolution of generations of ICT regulation, 2007 - 2018



Source: ITU Global ICT Regulatory Tracker 2018, https://www.itu.int/net4/itu-d/irt/#/generations-of-regulation

Europe have reached the G4 stage, and the figure is 40% in the Americas.

Across the regions, Africa itself displays much diversity, with countries represented in all four stages, and countries evenly split between G1/G2 versus G3/G4. Over the past ten years however, regulatory frameworks have evolved the most in Africa. In the Americas, less than one-third of countries remain in the G1 & G2 stages, while in the Arab States, progress has been slower than most other regions. There is much divergence between the sub-regions within Asia-Pacific, with South Asia having no countries in the G1 stage, but a third in East Asia and the Pacific at this level.

Under the new G5 benchmark for collaborative regulation developed by ITU[3], a small group of 16 countries (fourteen coming from G4 and two from G3) now classify as G5 for their holistic and forward-looking regulatory frameworks which are enabling digital transformation across their economies. These are also the countries with the lowest proportion of unconnected people, and all have thriving markets for ICT services. The majority – ten counties – are from Europe, with six from the other regions. A dozen countries are poised to join the G5 level soon.

Improvements in ICT policy and regulatory regimes around the world

These improvements have played a pivotal role in creating the conditions for the reduction of prices and the increase in, and use of, ICT services. For example, Zambia witnessed a sharp increase in internet users (up by two million people, or 25% of the previous total) in three months due to more aggressive competition in the market, facilitated by supportive regulatory policies.[4] In India, promotion of a competitive market for digital services, particularly for low-income consumers, saw the overall number of broadband subscribers reach 553.54 million as of April 30 2019.[5]

Policies to fast track rights of way (RoW), particularly through “Dig Once” policies, are starting to be implemented around the world. Since the 2012 recommendation to implement “Dig Once” policies, several groups have been spearheading the push for national adoption of such regulations in different parts of the world.

The organization Geeks Without Frontiers developed a model law with the intent for it be adopted and used in legislation across different countries.[6] In the United States, legislation was passed in 2018 directing states to oversee best practices in facilitating "Dig Once" type policies. And other countries such as the United Kingdom (Isle of Man), Canada and Argentina have been actively exploring "Dig Once" policies.[7]

Adoption of infrastructure sharing models and open access

Several recommendations by the State of Broadband reports in previous years focused on infrastructure sharing and open access. There are at least six different types of infrastructure layers that operators can share. These are:[8]

- Passive infrastructure sharing: covering physical facilities for network elements (backbone, backhaul or edge) of mobile and wired services. Six out of every seven countries in the world allows for some form of infrastructure sharing, and over two-thirds mandate sharing.

- Active infrastructure sharing: covering active data transmission over network elements (backbone, backhaul or edge) of mobile and wired services. Ninety-eight countries worldwide have had some sort of active network-sharing agreement announced.

- Spectrum sharing: between mobile network operators (MNOs); Definitions vary from the broadest sharing (operators permitted to use each other's spectrum and deploy shared networks) to roaming agreements, to sharing where operators may not be involved (i.e. TV White Space). As such, measures of spectrum sharing varying depending on definition.

- International sharing: covering both the physical infrastructure of international internet bandwidth at international gateways and submarine cable landing stations, as well as regulatory sharing or harmonization to facilitate international mobile roaming. Over half of all countries (close to 60%) have frameworks for international sharing, and over three-quarters have some sort of international gateway liberalization in place, up from less than half in 2007.

- Functional separation: a form of sharing where the same operator's infrastructure and service provision divisions are still operating under a business agreement. Accounting separation is on the decline, while functional separation has resulted in at least 56 countries where there is a dominant operator.

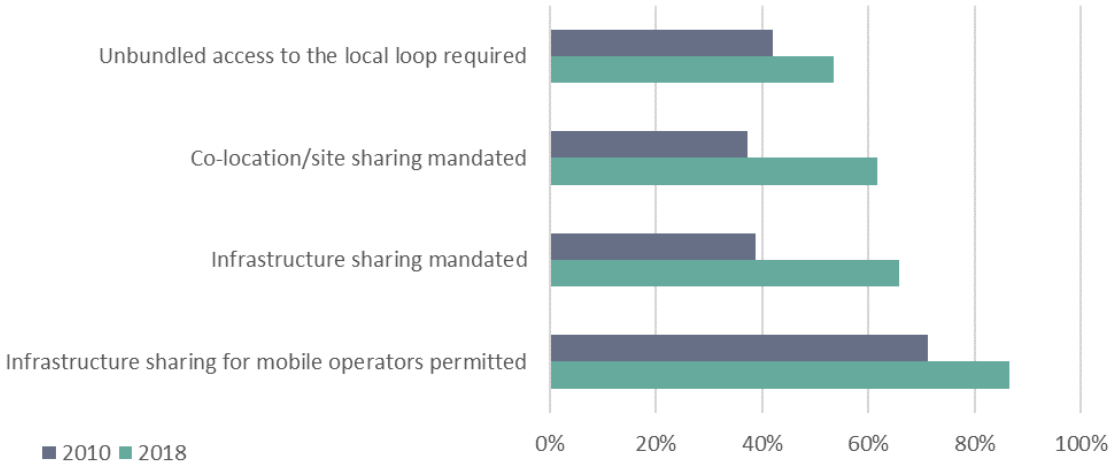
- End-user sharing: encompassing the sharing of both the access to digital platforms (and the sharing of content and offering of services) as well as sharing of devices and applications.

Since 2010, much progress has been made around the world regarding different degrees of infrastructure sharing.

Growth of universal access and service (UAS) policies worldwide

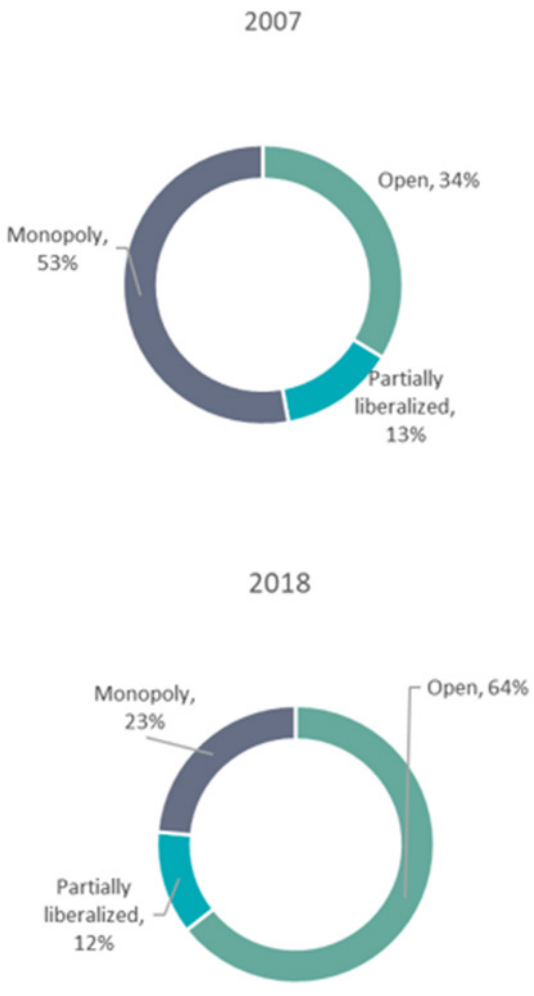
As noted in Section 2.1, 112 countries now have universal access and service (UAS) policies in place that include broadband. This is notable and important, as there are still significant population and geographic segments of many countries that are unconnected, or under-connected because of unreliable and/or intermittent communication services. In many of these instances, commercially oriented service providers do not have much incentive to build out their network infrastructure, as investment returns tend to be significantly higher in urban areas with higher per capita income consumers. As such, there remains a role for national policies that intervene and directly, or indirectly, support universal access and service. Ensuring universal access to broadband is made even more important by the 2017 declaration in Buenos

Figure 41: Growth in active and passive infrastructure sharing frameworks worldwide, 2010 and 2018



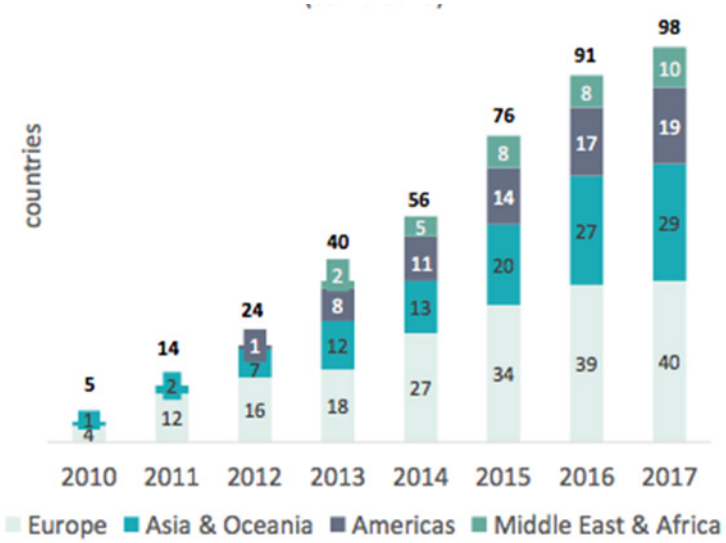
Source: ITU

Figure 42: Status of international gateway(s), worldwide, 2007 and 2018



Source: ITU

Figure 43: Active network-sharing agreements announced (cumulative)



Source: GSMA Intelligence, Ovum and McKinsey

Aires at the ITU World Telecommunication Development Conference pointing out that:

- universally accessible, secure and affordable telecommunications/ICTs are a fundamental contribution towards achievement of the WSIS action lines and the 2030 Agenda for Sustainable Development and towards the development of the global information society and the digital economy.

One approach to fund and institutionalize universal access and service policies is through Universal Service and Access Funds (USAFs). These funds, typically financed through mandatory contributions by network operators and telecommunications service providers, are then directed to support network expansion to geographies that may not support commercial investment, or to offset service costs for low-income individuals. A 2013 report by ITU identified 69 Universal Service Funds (USFs) (22 in Africa, 16 in Asia Pacific, 16 in the Americas, 8 in Europe/CIS and 7 in the Arab States).[9] Similarly, another study in the same year identified 64 USFs, with USD 11 billion in funds waiting to be disbursed.[10]

Implement Public Access Programmes

One element of universal service is the provision of public access facilities to ensure that even if network access is available in a given geography, costs of devices or service do not remain prohibitive for low-resourced individuals to participate online. Public access facilities include libraries and community centres with computers equipped to provide free internet access, as well as sites providing free public Wi-Fi.

The Republic of Macedonia was one of the first countries in the world to view broadband internet as basic national infrastructure. Back in 2005, a USD 3.9 million project funded by the US Agency for International Development (USAID) helped bring broadband connectivity to hundreds of remote villages in Macedonia. Called Macedonia Connects (MK Connects), the national network capitalized on Macedonia's hilly terrain, using mountains as wireless distribution points and creating a national mesh of 15km-wide 'hot-zones' to connect 460 primary and secondary schools, along with 680 WiFi kiosks providing free access to e-government services, news, social networks and web search, reaching even the most remote parts of the country. As a landlocked nation, Macedonia's vision was of broadband internet as a 'sea' of knowledge that would serve as the launch point for rapid modernization and accelerated

economic growth.[11] The country's Ministry for Information Society and Administration was one of the founder members of the Broadband Commission in 2010.

Recent examples of comprehensive national broadband plans with holistic universal service directives include that of Indonesia, where the country has embarked on a wide-ranging programme to provide universal service that includes network infrastructure development as well as public access facilities. The Ministry of Communications and Informatics in Indonesia (KOMINFO)'s Telecommunications and Information Accessibility Agency (BAKTI) manages a universal service fund with an annual budget in excess of USD 170 million.[12] This fund supports BAKTI's investments into the Palapa Ring undersea fibre optic cable circling the archipelago, direct subsidy of base transceiver stations (BTS) in remote locations, a multifunctional communications satellite that will be launched and operational by 2022, and public access internet facilities across many of the country's 17,000 islands.[13]

Singapore launched the Wireless@SG programme in December 2006 to promote the wireless broadband lifestyle among citizens and residents, and to catalyze the wireless broadband market in Singapore. The Wireless@SG programme adopts a federated model in which Wireless@SG hotspots are sustained commercially between venue owners and Wireless@SG operators. The federated model also enables seamless roaming across the Wireless@SG hotspots deployed by different operators. IMDA, as the programme owner, ensures consistent user experience by stipulating standards for identity management, login and security. Over the years, Wireless@SG has implemented several enhancements, including the introduction of EAP-SIM (using SIM card credentials to connect to the Wiress@SGx network), launch of the Wireless@SG app to facilitate easier log on and auto connection, faster surfing speeds (minimally 5Mbps), replacing login with SMS OTP (instead of user name and password) to support both local and foreign numbers, and provision of more hotspots.

In the neighbouring country of the Philippines, the government has an ambitious programme to provide free public Wi-Fi to all citizens in all public places in the country, underpinned by legislation that passed in 2017. Republic Act No. 10929, known as the Free Internet in Public Places Act of 2017, mandates the government's Department of ICT (DICT) to implement the Free Public Internet Access Program. Under the law, no fees shall be collected from users to connect to public internet access points installed in public places throughout the country, including public parks, plazas, libraries, barangay (village) centres, national and local government offices, public basic education institutions, state universities and colleges, public hospitals, health centres and rural health units, public airports and seaports, and public transport terminals. As of June 2019, 2,677 sites were operational in the Free Public WiFi for All programme and DICT launched a new partnership with the United Nations Development Program (UNDP) to add an additional 6,000 sites in the coming year.[14] This efforts builds on, and leverages, UNDP's experience working on numerous internet connectivity projects for partner governments since 1993, with outcomes focused on telecommunications infrastructure development, national ICT policy engagement, educational training and skills building, digital employment applications, support for local content development, support for e-government (including building digital capacities and e-services; enhancing effectiveness and efficiencies), and e-governance (enabling digital mechanisms and approaches to enhance participation and engagement in public processes, improve transparency and accountability in public institutions, empower citizens and enhance inclusion, enable access to public information, and widen access to economic opportunities).[15]

Governments around the world are supporting free public Wi-Fi deployments, at the national level down to the local. For example, in the EU, the WIFI4EU programme has awarded EUR 15K subsidies to 6,000 municipalities to cover the capex of providing free public Wi-Fi.[16] In the Dominican Republic, the government is installing 5,000 free Wi-Fi hotspots in public locations, while in Thailand the government

is rolling out connectivity to 4,000 villages at a cost of USD 325 million. The government of New Zealand is extending broadband to rural areas with an additional NZD 102 million programme, and in Madagascar, the government initiated an effort to connect schools and hospitals with free broadband, particularly in remote areas.[17]

Global efforts and partnerships to encourage a greater focus on public access continue, particularly centring on supporting communication services to libraries, support for offline (or cached) internet services, and community networks.[18] Sites where users are stationary and sedentary (not walking, commuting, etc.) tend to be where users consume more data, and it is these sites that tend to be locations where public Wi-Fi initiatives work well.[19]

Digital entrepreneurship and encouraging SMEs online

The experience of Lebanon demonstrates how concerted effort by government and industry can drive the emergence of a national digital hub. One step was the launch of a Ministry of Telecommunications-supported telco fund, MIC Ventures, seeded with USD 48 million with a 50% investment by a private telco, Alfa. The focus of the fund is investment in the ICT sector and other service sectors. Other public-private partnerships in the country are geared towards increasing the country's skills base and entrepreneurship, particularly among youth. For example, between Alfa and ITU, Ericsson and the Office of the Prime Minister, respectively, PPPs have been established to introduce women and girls to technology careers, awarding "Alfa and Ericsson IoT Award" prizes to encourage nascent IoT solutions and talent, and supporting the "Summer of Innovation 2018" series of programmes, including pitching competitions and business accelerators.[20] The Executive Director of the International Trade Centre (ITC) and Broadband Commissioner, Arancha González, details how ITC is carrying out the Commission's recommendations on increasing digital entrepreneurship in her Commissioner Insight in Chapter 6.

Acknowledging that digital divide could still potentially exist, even in a highly connected nation, the Singapore Government convened a Digital Readiness (DR) Workgroup comprising leaders from private, public and people sectors in 2017. With a view to ensuring that no one is left behind in the nation's digitalization journey, the Workgroup published a list of recommendations in June 2018 that seek to: a) develop a basic digital skills curriculum for daily living to help those who are less digitally-savvy; b) improve Singaporeans' information and media literacy, especially in the area of discerning fake news and scams; c) develop deep partnerships between businesses, community and government to meet the needs of all Singaporeans; and d) equip students with necessary digital skills to contribute gainfully in the increasingly digitalized society.

The renewed effort builds on Singapore's existing initiatives that sought to promote inclusive digital access for all segments of the population, for example the "NEU PC Plus" and "Home Access" programmes for low-income families, as well as "Enable IT" for persons with disabilities. Recognizing that closing the digital gap could be achieved sooner through public-private collaboration, the Digital Participation Pledge (DPP) was launched in March 2019 that encourages organizations, including both private and public entities, to pledge their support in one or more of the four following areas: (i) equipping employees with digital skills, (ii) educating customers/clients/stakeholders on the use of their digital services, (iii) offering and designing digital services to be inclusive and safe; and (iv) volunteering or giving resources to support the nation's Digital Readiness efforts. To date, more than 400 organizations have signed on to the DPP.

Global advocacy for broadband and digital economy issues

In recent months, several high-level groups have launched reports advocating for greater attention and emphasis on policy issues that focus on ensuring that the digital economy works in favour of everyone. Most notably, the UN Secretary-General's High-Level Panel on Digital Cooperation released its report,

"The Age of Digital Interdependence", in June 2019.[21] The report advocates for five main recommendations:

1. Create an inclusive digital economy
2. Strengthen human and institutional capacity
3. Protect human rights and human agency
4. Ensure digital trust, security and stability
5. Foster global digital cooperation.

These recommendations, and the end goal of the Panel to "address the social, ethical, legal and economic impact of digital technologies in order to maximize their benefits and minimize their harm," parallel much of the work and recommendations that the Broadband Commission has been espousing since its formation in 2010. Notably, the Commission's seven targets and recommendations over the last decade map directly into the Panel's recommendations.

Similarly, in June 2019, the European Union-African Union Digital Economy Task Force released its final report, "Accelerating the Achievement of the Sustainable Development Goals", and presented four main recommendations:[22]

1. Accelerate universal access to affordable broadband
2. Guarantee essential skills for all to enable citizens to thrive in the digital age
3. Improve the business environment and facilitating access to finance and business support services to boost digitally enabled entrepreneurship
4. Accelerate the adoption of eServices and the further development of the digital economy for achieving the Sustainable Development Goals.

These recommendations also track well with the targets and recommendations of the Broadband Commission.

Endnotes

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2 The Tracker is based on self-reported information gathered yearly via the ITU World Telecommunication Regulatory Survey and the ITU Tariff Policies Survey as well as desktop research and direct outreach to national telecom/ICT regulatory authorities. The matrix with the detailed methodology of the ICT Regulatory Tracker is available in Annex 2 and can be downloaded online at itu.int/ go/ tracker, (About the Tracker).

3 This new benchmark for fifth generation collaborative regulation complements and builds on the ICT Regulatory Tracker; it focuses on the G5 generation of regulation and identifies what is needed to facilitate digital transformation across economic sectors. The G5 Benchmark is composed of 25 indicators clustered under three tracks corresponding to processes and practices facilitating digital transformation: collaboration, policy design principles and G5 regulatory toolbox. The Benchmark covers 84 countries. For more detailed information see: https://www.itu.int/en/ITU-D/Conferences/GSR/2019/Documents/G5-Benchmark_atGSR19.pdf

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4 Policy and Regulatory Gap Analysis

4.1 Remaining gaps in fulfilling the State of Broadband recommendations

While countries are progressing along the ICT Regulatory Tracker and improving their overall level of ICT regulatory policy, at the individual level there is still much progress to be made on specific issues. Below are examples of where actions are still required to fulfil some of the 166 recommendations from 2012 to 2018.

4.2 ICT policy and regulatory regimes

The largest group of recommendations from past reports focused on generalized ICT policy and regulatory reform. The progress that countries are making in the policy generations of the ICT Regulatory Tracker demonstrate the improvements being made. However, there are still 72 countries that are either at a basic level of ICT regulatory policy (Generation 1, with regulated public monopolies, and a command-and-control approach), or reaching nascent progress (Generation 2, with markets starting to open, partially liberate and some privatization across layers).

On a related note, ITU has also identified a "Winning Five" – that is, a set of five regulatory measures that are closely correlated with a dynamic fixed broadband market. These are:

- competition in DSL/cable
- fixed number portability enabled (implemented and available to consumers)
- infrastructure sharing/ co-location and site sharing mandated
- a converged licensing framework in place
- a national broadband plan adopted.

Adopting all these measures is associated with a considerably higher level of fixed-broadband service adoption. However, only 40 countries to date have done so.[1]

By mid-2019, ICT regulators worldwide numbered 168, and the trend of creating new, separate regulatory agencies seemed to have reached a plateau, although a new wave is being anticipated.[2]

While most digital policies currently focus on stimulating investment in broadband networks and connecting uneconomic areas, a fast-growing community of countries is looking ahead and gearing up for 5G, IoT, AI, and beyond, requiring more holistic approaches to harness the benefits of the digital economy. Collaborative regulation, referring to regulators

working closely with peer regulators in other sectors, is the next frontier, incorporating digital platform regulation.

There are various benefits and challenges of collaborative regulation, as well as lessons learned from the front-runners for new technology paradigms to help countries leap forward to the next level of regulation. The breadth and depth of the collaboration will reflect the relationships, and the interplay of institutions and regulatory frameworks in regulating digital markets.

4.3 Improving data, statistics and monitoring of progress

Over the past five years, a plethora of reports and data trackers focusing on global broadband connectivity have emerged (see for instance the running list tracked by Steve Song's Global Connectivity Index and Connectivity Reports Github page).[3] However, while more reports and telecommunications adoption data is emerging, there are still significant gaps in the availability and accuracy of timely data that can help to inform policy decisions, commercial investments and consumer choice.

National statistical agencies – and not just in developing countries – could utilize more resources to better capture data in their countries. For example, even in the United States, there are questions regarding the accuracy of access and coverage data. As Microsoft recently noted, the company's own estimates of the number of Americans without broadband access appears to be much higher than the estimates presented by the US Federal Communications Commission, throwing into question overall statistical reliability.[4]

This issue takes on greater importance internationally where a lack of accurate network infrastructure data not only hampers efforts to expand access, but also diminishes the ability of the international community to use digital infrastructure to provide humanitarian and disaster support. The United States Agency for International Development (USAID) has highlighted the challenges with publicly available mobile network coverage data.[5] Increasingly, more attention is being directed to this issue and the United Kingdom's Department for International Development (DFID) has joined efforts with GSMA's Mobile for Development's Connected Society Programme to improve publicly available network coverage maps.[6]

Such efforts to make more telecommunications infrastructure data available to the public is similar to the open government data approach that has been championed by many organizations and governments. Steve Song highlights the rationale, potential and current state of this nascent "Open Telecommunications Data" effort, and tracks countries and companies that are models in

their transparency and sharing of network infrastructure availability.[7] In terms of fibre infrastructure, this includes Dark Fiber Africa in South Africa and the regional operator, Liquid Telecom.[8] ITU also tracks fibre deployments with its Transmission Map.[9]

In terms of spectrum assignment, Nigeria stands out in terms of how it shares assignment data.[10] Regarding mobile cellular tower location, only the Canadian regulator publishes a machine readable and downloadable Comma Separated Value (CSV) file with the location of every tower in Canada.[11] In terms of publishing pricing publicly, in Botswana the regulator publicly shares the public rate card for access to the national fibre optic backbone.[12]

More examples are emerging such as crowd-sourced data for tower location, such as OpenCellID and Mozilla's Location Service.[13] Airtel in India has also published a database showing all its 2G and 4G tower and network coverage data.[14]

However, these examples are unique, and not the norm across countries and companies. The more disclosure of spectrum assignments, terrestrial and undersea fibre maps and points of presence, mobile network tower locations and coverage mapping, and pricing data for middle mile and core infrastructure connectivity, the more targeted policy and investment can be to help fill in gaps.

In addition, more efforts need to be made to gather and collect data on the development of digital skills at a global level. Measuring digital skills across countries remains a significant challenge due to a lmaterial lies with the reader. In no event shall ITU or UNESCO be liable for damages arising from its use.

4.4 Improving spectrum allocation and assignment

Spectrum allocation through auction to the highest bidder, or through direct assignment based on qualifications (so called "beauty contests"), has successfully enabled the high levels of private sector investment in mobile network infrastructure and connectivity adoption that we see today. However, while these methods have mostly ensured that the most efficient market players are able to acquire spectrum and recoup their investment by providing services that consumers have sufficient willingness to pay for, there are situations where such allocation and assignment approaches can leave sizable communities underserved.

One significant gap occurs when national spectrum assignments are made but rights holders only deploy infrastructure in urban or peri-urban areas, leaving rural communities unserved. This can be caused by a variety of factors, including short-term spectrum licenses and the high cost of spectrum. There is evidence linking expensive spectrum assignments with worse mobile broadband coverage and more expensive services.[15] This problem is especially pronounced in developing countries, where average spectrum prices are around three times higher than in developed countries, once income differences are considered.[16]

A prime cause of high prices are policy decisions that prioritize maximizing spectrum revenues for the state above improved access to affordable mobile broadband. Notably, there is a link between countries with high levels of national debt and high per capita spectrum prices.[17] One such policy measure is setting high auction reserve prices which mean either the spectrum fails to sell or sells at such a high price that operators are less able to invest in their networks, including in rural areas. Reserve prices in developing markets are on average five times higher than in developed when income differences are considered. Even when additional measures are included in auction conditions, such as coverage obligations, failures can still occur such as delayed, or non-existent, rollout.

Improvements in spectrum utilization include ensuring a flexible regime that allows for spectrum repurposing, secondary-market transactions, spectrum leasing, spectrum sharing, and license-exempt spectrum, particularly as new generations of wireless communications technology become available along with new wireless applications, such as smart systems, Internet of Things and

more.[18] Accelerating the release of sub 1GHz coverage spectrum is also critical to driving rural coverage, and innovations in spectrum management could also enable underserved communities and other marginalized groups to develop connectivity solutions where retail service providers are not extending service.[19]

4.5 Appropriate taxation of ICT goods and services

Appropriate levels of taxation for ICT/digital goods and services remains a fluid debate. The type of taxes that countries apply to the sector vary widely, and there is no uniform approach. This results in varying service costs and end-user consumer prices. The 2018 *Global ICT Regulatory Outlook* identifies at least eight different types of taxes that countries are applying to telecommunication/ICT services.[20] These include:

- Value added taxes (VAT) on ICT goods
- Sales taxes
- Corporate taxes on profits
- Property taxes – based on physical assets
- Specific spectrum or license fee taxes
- Customs taxes on the import of devices or telecommunication equipment- import duties (on equipment and/or handsets)
- Content taxes
- Sector-specific taxes

The table below details the types of different taxes (VAT, Sector Specific, Sales and Import Duties) applied to different ICT related service, and the ranges of taxes applied in 2018 across the world.

Sector-specific telecommunications taxes, fees and other levies have a significant impact on affordability of ICT services and lead to a reduced take up of broadband.[21] Research has also demonstrated that sector-specific taxes can have a counterproductive effect, reducing overall tax intake because of slowing economic growth and reduced investment.

Nevertheless, while greater recognition has been paid to the issues of affordability of ICT goods and services, and the role that taxation plays in improving affordability, in some cases, there have been notable increases in sector-specific taxes that have impacted adoption and use of connectivity services. GSMA research highlights that there have been 120 introductions or increases of mobile sector-specific taxes from 2011-2017, a third of which have been observed in Sub-Saharan Africa.[22] As a result, mobile-specific taxation is now present in 41% of the examined countries,[23] representing, on average, approximately 30% of total mobile tax payments and 7% of total market revenue. These developments are generating increased affordability concerns and make the achievement of the "1 for 2" target considerably more challenging, as discussed above in Section 1.5.

Recent examples of sector-specific taxes include a 10% increase in corporation taxes for telecommunications companies in Antigua & Barbuda, while the Government of Papua New Guinea also announced that it is considering a turnover tax on telecommunications companies. Uganda is another case in point: the introduction of a new tax on mobile money in 2018 had immediate negative impact on the mobile money business, with the value of P2P transactions declining by 50 per cent within two months of implementation; 100,000 agents saw their earnings drop by around 35 to 40 per cent and 30,000 went out of business completely.[24] Such taxes are likely to deepen digital inequality between the rich and the poor and tend to particularly impact women's ability to access the internet.[25]

Much debate continues on appropriate taxation of online digital content and services. The OECD has been working for some years on an Inclusive Framework on Base Erosion and Profit Shifting (BEPS).[26] In this context in May 2019 the OECD set out a roadmap for resolving the tax challenges arising from the digitalization of the economy, and committed to continue working toward a consensus-based long-term solution by the end of 2020.[27]

Table 5: Types of taxes and ranges of rates applied to each ICT-related service, worldwide in 2018

	Types of taxes			
	VAT	Sector Specific	Sales	Import Duties
Content Services	5%- 27%	0.1%- 17%	3.5%- 25%	7.7%- 41%
Incoming international voice services	4.5%- 27%	0.1%- 15%	3.5%- 27%	7.7%- 20%
International Data Services	4.5%- 27%	0.1%- 13%	3.5%- 25%	7.7%- 40.55%
International Mobile Roaming	4.5%- 27%	0.5%- 49.77%	3.5%- 27%	7.7%- 15%
Internet Services	4.5%- 25%	2%- 40%	3.5%- 27%	7.7%- 15%
National Data Services	4.5%- 27%	0.1%- 40%	3.5%- 27%	7.7%- 15%
National Mobile Roaming	4.5%- 27%	0.1%- 27%	3.5%- 27%	7.7%- 15%
National Voice Services	4.5%- 27%	0.1%- 49.77%	3%- 27%	7.7%- 15%
OTT Content Services	4.5%- 27%	0.5%- 13%	8%- 25%	7.7%- 15%
Outgoing International Voice services (IDD)	5%- 27%	1%- 17%	4%- 27%	7.7%- 15%
Pre-paid mobile top-up cards	1%- 27%	0.1%- 49.77%	3.5%- 27%	5%- 15%

Source: ITU ICTEye Tariff Policies Database

The European Commission also developed proposals to apply a 3% rate to online advertising, digital intermediary activities (including social platforms or e-commerce) and the sale of data, which was expected to raise around €5 billion per annum.[28] However this initiative has not yet progressed as there is disagreement among the EU Member States as to whether to implement it at EU level. Some countries are acting in advance of outcome of the OECD discussions. For example, a number of EU Member States have announced that they wish to proceed with the proposal unilaterally, including Austria, Italy, the Czech Republic and Spain.[29] France moved ahead and adopted a new 3% tax on digital giants' turnover in July 2019[30]. The UK will also introduce a 2% digital service tax in April 2020[31] which will apply to the revenues of specific digital business models whose revenues are linked the participation of UK users (search engines, social media platforms, and online marketplaces). Elsewhere, India[32] and New Zealand are among counties that have announced that they are considering introducing a similar tax.[33]

4.6 Encouraging greater investment in internet connectivity infrastructure

Because of existing limits to network coverage, and shortfalls of core and middle-mile infrastructure to extend high-speed connectivity to underserved populations, greater capital investment is required to meaningfully connect more people to the internet. In the past, basic calculations of the total capital requirement necessary based on general assumptions include the 2016 Broadband Commission estimate of USD 450 billion needed to connect 1.5 billion people around the world, at an estimated USD 300 per person.[34] Other models, such as the World Economic Forum's analysis of the investment needed to ensure universal connectivity in the Northern Corridor set of countries in East Africa pegged the per person cost at USD 115.[35]

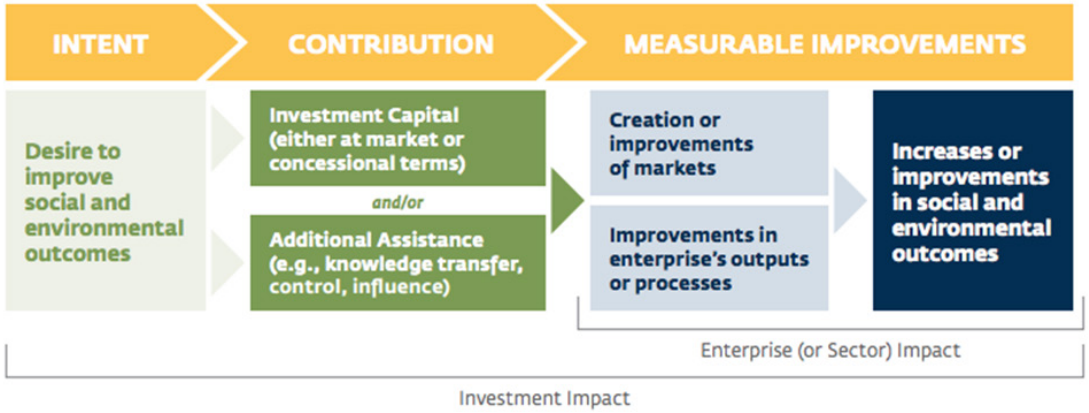
In many cases, private capital will not have the economic incentive to invest in network infrastructure, particularly to deliver connectivity to lower income, less densely populated geographies where the return on investment is below the cost of capital. In these cases, because the social returns in

ensuring disadvantaged communities benefit from connectivity are greater than the private returns, there will continue to be a role for public financing in whole or in part. Some national governments are demonstrating how to effectively fund national connectivity infrastructure, such as in Indonesia where the government is supporting the rollout of a national undersea fibre optic cable network, called the Palapa Ring, with the final stage (East Ring) to be completed in mid-2019.[36] In Brazil, the government is taking the approach of using satellite connectivity where fibre and cellular backhaul is unavailable, in order to connect remote regions, and is launching a satellite as part of the Banda Larga para Todos, or Broadband for All, project.[37] The government of Indonesia, too, is launching its own satellite as part of its universal access programme, targeted for 2022. Indeed, there are a number of initiatives in developing countries using satellites and/or balloons to extend broadband to rural areas. For example, in May 2018, a pilot project carried out by the International Telecommunications Satellite Organization (ITSO) and the Ugandan Communications Commission (UCC) in collaboration with operator MTN and Intelsat was launched to provide high-speed data and voice to two rural communities in Uganda (Kibuku in Ntoroko and Bufundi in Rubanda). The project created a public wireless access network using the Intelsat satellite system. This remote connectivity project demonstrated the importance of satellite technology in the quest to provide high speed internet in rural or hard to reach areas, and could provide a template for providing connectivity to refugee camps, both in Uganda and elsewhere.[38]

International development agencies and donors are also demonstrating how to direct targeted, one-time subsidies to encourage private capital to invest, such as the case of the metro fibre ring infrastructure build for the city of Monrovia, Liberia, whereby USAID provided partial grant support to a joint venture of commercial investors.[39] Digicel Chairman and Broadband Commissioner Denis O'Brien highlights the importance of innovating financing arrangements in order to extend networks that may not be commercial viable with current funding models, in his Commissioner Insight in Chapter 6.[40]

Other sources of "patient capital", such as impact investment, with potentially more favourable terms and/or a focus on social development outcomes, can play a role in providing more investment for the sector. The International Finance Corporation (IFC) recently noted that the development finance community continues to support impact investment activities because of the potential for the sector to positively impact global development challenges such as poverty, inclusion and climate change. Impact investment offers incremental capital, particularly as it opens new sources of capital that can play a role in supporting progress towards the 2030 Sustainable Development Agenda. The IFC notes that there is potentially USD 5 trillion in private markets, and USD 21 trillion in public markets (excluding development finance institutions,

Figure 44: The impact thesis of impact investing



Source: International Finance Corporation (IFC)[41]

Box 1: Working Group on Digital Infrastructure Moonshot for Africa

Achieving many of the Sustainable Development Goals (SDGs) will require the intensive use of information and communication technologies (ICTs). Underlying the SDGs is target 9c: to significantly increase access to ICTs and strive to provide universal and affordable access to internet in Least Developed Countries (LDCs) by 2020. While significant progress has been made, there is a danger that in Africa, where many of the LDCs are located, this target will be missed on both access and affordability.

In 2018, the "Broadband for All: Digital Infrastructure Moonshot for Africa" Working Group was established, under the leadership of the World Bank Group. It works towards achieving universal and affordable broadband access for Africa. This requires a sustained effort from all stakeholders including governments, private sector, civil society, led by the African Union with support from the World Bank Group, which aims to ensure that all individuals, businesses and governments in Africa are internet-enabled by 2030. A key interim goal is to double broadband connectivity in the continent by 2021.

While Africa's Digital Transformation requires concentrated efforts to build up all core foundations of the digital economy, the Working Group is focused on the digital infrastructure pillar. The Group has engaged in a multi-stakeholder consultation, convening public and private stakeholders, to discuss investment requirements, policy and regulatory issues, and coordination and cooperation to maximize the impact of activities. The Working Group is set to publish a report in October 2019, outlining the strategy and action-oriented roadmap for the infrastructure pillar of digital transformation in Africa.

or DFIs), that make up the impact investor market of those investors who "take criteria other than financial return into account in their investment process."[42] The figure below articulates how these investment managers base their decisions and seek additional non-financial outcomes from their investments.

An increasingly significant source of investment is from OTTs/online service providers (OSPs). Online service providers are fast becoming major investors in digital infrastructure, with over USD 75 billion spent each year on data centres, submarine cables and other facilities over 2014-17, double the 2011-13 average. OSPs are making significant investments to extend their networks, moving ever closer to end users. This includes spending on new data centres in more locations, and a diversification of data centre investments to smaller and more localized cloud facilities. To reach these facilities and exchange traffic in ever more places with ever more operators globally, OSPs lease, purchase or invest in terrestrial and submarine fibre networks. OSPs are also driving investment in delivery networks, to support quality of service by bringing content as close as possible to end users.[43]

Infrastructure and funding gaps remain an issue particularly for low-income communities and/or low-population density geographies, and further efforts to support infrastructure investment by all parties in the broadband ecosystem would serve in the goal of universal meaningful connectivity.

Already, impact investors are investing in connectivity initiatives, particularly in situations where commercial capital may not be as interested because of sub-commercial levels of return.[44]

4.7 Improving trustworthiness and transparency of digital services

A greater awareness has developed of the potential negative aspects of being online. As noted above, survey data shows that individuals are more and more concerned with how data on them is being used and misused. High profile incidents of data breaches, the profiling and targeting of individuals to affect the democratic process, and the sharing of personal data in unexpected ways has reduced trust in the digital ecosystem. Society and individuals are moving to hold companies and governments accountable for the commitments and actions – or inaction – they take on issues of online privacy and personal data security. Several countries have put into place clearly defined personal data protection legislation, and a growing number of countries are also establishing special authorities to focus on data protection, and imbuing them with enforcement power.

For example, Singapore's Personal Data Protection Act ("PDPA") governs the collection, use, and disclosure of personal data by the private sector. It strikes a balance between the need to protect individuals' personal data and organisations' need to use personal data for legitimate purposes. The PDPA is currently being reviewed to ensure that it keeps pace with evolving needs of businesses and individuals in the digital economy, and remains relevant in supporting Singapore's digital economy goals. It seeks to strengthen consumer trust through greater accountability, while enabling organizations to harness data to deliver innovative products and services. Some of the key amendments which the Personal Data Protection Commission ("PDPC") is proposing to include: (i) enhancing the framework for the collection, use and disclosure of personal data, (ii) introducing an enhanced practical guidance (EPG) framework for PDPC to provide organizations with regulatory certainty on their compliance with the Data Protection Provisions of the PDPA, (iii) introducing a mandatory data breach notification framework, and (iv) introducing accountability measures as part of the PDPA's shift towards accountability (e.g. requirement for organizations to conduct risk and impact assessments when relying on "legitimate interests" or "deemed consent by notification and opt-out" approaches to collect, use or disclose personal data).

Deputy Chief Executive of the Infocomm Media Development Authority of Singapore and Broadband Commissioner Keng Thai Leong discusses the evolution of Singapore's approach further in his Commissioner Insight in Chapter 6.[45] And Samena's Telecommunications Council's Working Group on Digital Services has developed a reference framework, as discussed in further detail by Samena's CEO and Broadband Commissioner, Bocar Ba, in his Insight, also in Chapter 6.[46]

Beyond data protection, governments are further able to shape digital architectures by regulating when and how providers deliver internet services, supporting the broader ecosystem of products and services, and firmly protecting citizens' interests when they are impacted by digital issues. While companies can do more to design with privacy, diversity and security in mind, to ensure their profit motive efforts do not sacrifice human rights, public safety, democracy, or truth and facts, governments can also play a role in ensuring that companies act within bounds.

As former European Commission Vice President Andrus Ansip notes in his Commissioner Insight in Chapter 6, the EC has drafted a code of conduct in partnership with various online platforms to combat hate speech online, as one component of the Digital Single Market project.[47] And at the national level, Germany, for example, has introduced a law designed to tackle online hate speech and "fake news".[48] This imposes a duty on large social media companies to enforce existing statutes in the German criminal code on matters such as "incitement to hatred," "dissemination of depictions of violence," "forming terrorist organizations," and "the use of symbols of unconstitutional organizations."[49] The law requires large social network platforms having more than two million users located in Germany to provide a mechanism for users to submit complaints about illegal content and to remove "manifestly unlawful" content within 24 hours, and other illegal content within seven days. Platforms that fail to comply risk

fines of up to EUR 50 million.[50] The United Kingdom has recently published an Online Harms White Paper, which proposes a package of legislative and non-legislative measures and will make companies more responsible for their users' safety online, especially children and other vulnerable groups.[51] While innovative, however, these national proposal to regulate speech online have also drawn questions from UN experts and others as to how freedom of expression will be respected under similar such proposals.[52]

The right to freedom of expression – as set out in the International Covenant of Civil and Political Rights – is an incentive for broadband uptake. In turn, it helps to contribute to the SDG 16.10 target which calls for "public access to information and fundamental freedoms". Disinformation impacts directly on the dual character of this target, as well as against other SDG aspirations concerning peace, health, education, gender equality and internet connectivity. Digital skills and literacy link inextricably with how internet users are able to engage with the spread of disinformation online. Multiple responses to the perceived problems of "disinformation" are unfolding worldwide that merit attention. Initiatives around digital skills seek to empower Internet users to avoid becoming either victims or unwitting distributors of disinformation and hate speech.

Social media companies have also called for more regulation to address key concerns.[53] Following collaboration between the French authorities and some of the large digital companies, France has proposed an independent regulator to police the efforts of large tech companies to deal with hate speech – an approach welcomed by some social media companies.[54] In the Commissioner Insights in Chapter 6 of this report, Commissioner Kevin Martin details Facebook's view on a multi-stakeholder approach, with a more active role for policymakers in shaping regulatory frameworks, particularly on election integrity, harmful content, privacy and data portability.[55]

Box 2: Working Group on Child Safety Online

How can we ensure that children across the world, and in particular in developing countries, benefit from the expansion of broadband while protecting them against the negative consequences and risks of access to connectivity? How can we mobilize the will and action of critical stakeholders around child protection issues: regulators, mobile network operators, social media and messaging platforms, technology providers, private sector leaders, and law enforcement agencies, to name a few?

The Broadband Commission Working Group on Child Safety Online, composed of more than 20 Commissioners and 20 subject-matter experts, firmly believes that access to broadband connectivity is essential for the healthy and robust flourishing of societies across the globe. However, considering the fact that at least one third of all the internet users are children and considering that millions more children will come online in the coming years in developing countries in Sub-Saharan Africa, Asia and Latin America, we need to ensure that those children will benefit from the transformative power of connectivity without exposure to risks and threats of online violence, abuse and exploitation. That means that we need a proper ecosystem in place that affords protection mechanisms to all children accessing the internet.

The WG recognizes that workable solutions require that all stakeholders (governments, regulators, private operators, internet service providers, social media and gaming platforms, law enforcement and civil society) work together and be fully committed to achieving SDG 16.2 – ending abuse, exploitation, trafficking and all forms of violence against and torture of children by 2030.

Box 2: Working Group on Child Safety Online (continued)

Conclusions and Recommendations:

- Prioritize and improve child online safety on a national and transnational level to harness the benefits of the broadband expansion in developing countries, where majority of the world's children live, without increasing the risks to those populations, and to fuel the achievement of the SDGs.
- By 2021, fully Integrate into national broadband plans (164 countries) and other national planning mechanisms strategies for child online safety, including accountability and remediation processes.
- Create national mechanisms, such as Task Forces that are inclusive and have equitable representation of key stakeholders, to guide and support the implementation of these strategies.
- Empower youth (as in support of the UN Generation Unlimited initiative for adolescents) through education (including digital literacy and occupational skills) and accelerate the achievement of SDG 16.2 through collaboration and collective action among global stakeholders such as ITU, GSMA, WEF, UNICEF, WPGA, the private sector, civil society and others.
- Define what "good" looks like; intensify the development and implementation of technology-driven solutions (safe per design) for child online safety and support dissemination and scaling up of best practice.
- Measure progress toward reaching the goal of "child online safety" by using benchmarking tools such as The Economist Intelligence Unit Index that tracks the response of the ICT sector to Child Sexual Abuse and Exploitation. And report efforts to enhance child online safety in the annual reports of companies and agencies, and in the annual State of the Broadband report.
- Develop, in collaboration with related stakeholders, a set of KPIs specific to child online safety.

The Universal Declaration on Child Online Safety

Organizations and governments are encouraged to sign the Declaration of Intent to demonstrate their commitment to prioritizing child online safety by following the WG's recommendations and implementing concrete strategies/actions.

4.8 Addressing environmental impacts from the digital economy and leveraging ICTs to tackle climate change

In the 2012 State of Broadband report, the Commission presented recommendation 7.11 "incorporate sustainability principles into ICT regulations and policies." Part of the impetus for this recommendation came from the 2012 Broadband Commission report, "The Broadband Bridge, linking ICT with climate action for a low carbon economy." That report examined the role of broadband in efforts to move towards a low-carbon economy, and included recommendations promoting the adoption and delivery of environmentally-focused broadband policies. These included

development of long-term broadband plans that incorporate climate-related applications of ICT services, incentivizing low carbon solutions, overcoming regulatory uncertainties and ministerial silos that hinder efforts to focus on environmental sustainability, and funding scalable trials and proof of concepts of low-carbon solutions.

To date, climate change only continues to grow as a threat for humanity and the ecosystem in which we live, and its impacts are already felt across the planet. Forecasts remain dire, as last year the Intergovernmental Panel on Climate Change noted in its report the urgent need to slow down current trajectories to stabilize global warming within 1.5 °C.

A recent report, the Exponential Climate Action Roadmap, co-authored by Ericsson, Future Earth, Sitra, WWF, Stockholm Resilience Centre, Mission 2020 and several other organizations examines the possible role of ICTs in halving global CO2 emission by 2030.[56] The report finds that reaching the target of halving global emissions by 2030 is possible. In order to stabilize global temperatures below a 2°C increase, extensive use of digital technologies will be required, as one third of solutions identified in the report's road map are enabled by existing ICT solutions.

The ICT industry's own footprint has stayed flat for several years at a level of 1.4% of global emissions, despite significant growth in the sector.[57] Several emerging solutions present opportunities to further curb carbon emissions – for example, over one million communities rely on mobile cellular base stations that are in "off grid" or "bad grid" environments, with limited or no connection to the formal electricity grid. GSMA estimates that the cost of diesel fuel to power these towers amounts to USD 19 billion a year by 2020, and that this diesel consumption releases approximately 45 million tons of carbon dioxide a year.[58]

Mobile operators are already taking steps for transitioning off-grid base stations to renewable energy sources. For example, Cellcard in Cambodia already uses solar hybrid technology in 56% of its mobile sites, reducing CO2 emissions by 100,000 metric tonnes over a 10-year period.[59]

It may also be that biomass based fuels systems can help replace diesel generation, particularly in low income rural communities in developing countries, as evidenced by efforts in Sri Lanka and Sub-Saharan Africa, where tree-based biomass and crop production by-products (such as rice straw and rice husk) are already being used for power generation.[60] However, access to renewable sources of energy remains a challenge for mobile operators, and this is an area that will require support and attention, and where governments also have a role to play in facilitating access to alternative sources of energy.

One example of the innovative use of ICT tools – in this case Artificial Intelligence – to address environmental and livelihood issues can be found in Cameroon. There, the Green Girls Organization trains women and girls from African rural communities on how to generate energy from the sun and biowaste using a unique AI-based model. The organization has created a unique AI algorithm (MNKB92) that enables Green Girls to provide specific clean energy solutions to match the needs of each rural community. The Green Girls training programme in solar energy, biogas, assembly of portable solar reading lamps and sale of packaged organic fertilizer is also equipping rural women and girls with skills that help them earn an income and become economically empowered.[61] Since 2015, 772 girls and 100 rural women have been trained from 33 communities across three African countries: Cameroon, DRC Congo and Central African Republic. Some 3000 rural households have been provided with biogas, 100 solar installations providing electricity have been installed, and over 272 portable solar reading lamps have been assembled. In addition, 33 Green Girls clubs have been created in rural communities to deliver training and installation of solar and biogas systems.

Many leading technology firms are also doing their part to tackle climate change. For example, Facebook designs, builds, and operates some of the most sustainable data centres in the world. Its Open Compute Project servers can operate in a higher-temperature environment, with greater efficiency, than traditional equipment. This

lowers the amount of energy needed to keep its servers cool and makes it possible for Facebook data centres to use outdoor air for cooling instead of energy-intensive air-conditioning units. In addition, by 2020, Facebook will have committed to enough new renewable energy resources to equal 100 per cent of the energy used by every data centre built by Facebook, and always in the same state or power grid as the data centre itself. Its data centres are also 80% more water efficient than the average data centre.

In April 2019, Verizon CEO and Broadband Commissioner Hans Vestberg announced that Verizon will be carbon neutral by 2035 in its Scope 1 and Scope 2 emissions. This will be achieved through a combination of reducing emissions directly, migrating energy procurement in favour of renewable and clean energy, and through the purchase of carbon offsets. Verizon is already working toward reducing its carbon intensity by 50% by 2025, and in 2019 was also the first US telecom company to launch a USD 1 billion green bond to spur even more sustainable investment.[62]

Commissioner Börje Ekholm from Ericsson and Commissioner Rajeev Suri of Nokia both address, in their respective Commissioner Insights in Chapter 6, the critical role that ICTs and broadband connectivity play in enabling solutions to address climate change.[63] Commissioner Rupert Pearce from Inmarsat also details the role that the satellite-enabled Industrial Internet of Things (IIOT) can play in supporting environmental sustainability efforts.[64] Consideration is also due to efforts to curb waste and the environmental impact of discarded electronics and devices. The useful life of many ICT products remains only a few years, after which they are relegated to electronic trash.[65] Policies can be developed to support sustainable design, recycling, and reuse of as much hardware and devices as possible.

4.9 Global efforts to provide broadband connectivity access to the growing number of refugees and internally displaced individuals.

In 2016, the UNHCR, the UN Refugee Agency, released a landmark report, "Connecting Refugees: How Internet and Mobile Connectivity can Improve Refugee Well-Being and Transform Humanitarian Action", detailing the importance and availability of broadband internet connectivity to the then almost 69 million refugees and forcibly displaced people around the world.[66] The report highlighted the vitally important role that communications, and communications technology such as broadband internet, plays for refugees in helping them access basic services, connect to information about their local, national and global communities, communicate with loved ones, and obtain vital information to aid in their survival. The report detailed not only the importance of connectivity in refugee situations, but also the challenges and disadvantages that refugee communities face in accessing services. This includes a lack of ICT infrastructure, particularly in refugee camps in rural areas, the high cost of access in areas where coverage *is* available, and the lower proportion of refugees (versus the general population) owning an internet-enabled phone. The report segments remedial interventions across **availability** (advocating for increased infrastructure investment by MNOs, governments, ISPs and alternative technology companies), **affordability** (negotiating refugee-specific service plans and discounts, subsidizing devices and plans, and deploying/expanding community internet access centres) and **usability** (developing and implementing training programmes, enabling ecosystems for digital service delivery, and facilitating development of refugee specific content).

As one example, Mercy Corps, with support from Cisco Systems, has been providing Wi-Fi connectivity to refugees and displaced persons in camps and community centers in Italy, as well as partnering with NetHope in Greece and Serbia, helping refugees and migrants stay connected to their loved ones and to vital information.[67]

GSMA has also played a key role in accelerating the delivery and impact of digital humanitarian assistance through the GSMA Mobile for Humanitarian Innovation programme (M4H) funded by the UK Department for International Development. The programme aims to provide 7 million people with improved access to and use of life-enhancing mobile-enabled services during humanitarian and disaster preparedness, response and recovery by 2021. The programme is catalysing partnerships, investing in cutting edge innovation (through an Innovation Fund), unlocking policy barriers[68] and delivering original research to strengthen the role and sustainability of mobile-enabled services in humanitarian contexts.

GSMA M4H seeks to ensure that the transformational benefits of mobile internet are inclusive to all, especially the most vulnerable, and brings together humanitarian organizations, policymakers and other key stakeholders to design inclusive, equitable interventions. Recent joint GSMA and UNHCR research found that in Bidi Bidi (the largest refugee settlement in Africa), women are 89% less likely to use mobile internet compared to men.[69] Closing the mobile gender gap in humanitarian contexts is a complex challenge, but also an opportunity for stakeholders involved. "Business as usual" will not solve the many issues, so M4H is catalyzing partnerships to develop inclusive digital interventions, and driving concerted action, leveraging the power of mobile technology to improve the lives of people affected by crises.

In 2019, a group of experts with the support of the Zolberg Institute on Migration and Mobility released the "Global Broadband Plan for Refugee Inclusion."[70] The plan focuses on five strategic initiatives, including improving information collection, sharing of market information, analysis, and dissemination among stakeholders; improving purchasing power related to devices and services for refugees and the support ecosystem; improving the economics of network deployment; improving the utilization by refugees and by service providers through developing a platform and other tactics that facilitate innovation, constant improvement, and more efficient service delivery mechanisms and a digital-first service delivery framework; and reducing legal barriers to refugee access to devices and internet services. Each of the initiatives includes several tactical recommendations for implementation.

Ongoing research by Mercy Corps and the Populations & Mobile Technology team at the Harvard Humanitarian Initiative is exploring the effects of access to connectivity on the safety, security, health and psychosocial well-being of crisis-affected populations. The effort aims to develop an in-depth understanding of how ICT interventions in humanitarian contexts affect displaced populations in urban and camp settings. The Director General of ITSO, Commissioner Patrick Masambu, discusses the Global Broadband Plan for Refugee Inclusion and the use of satellite technology to reach coverage, in his Commissioner Insight in Chapter 6.[71]

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5

Policy recommendations for thoughtful approaches towards meaningful, universal connectivity

5.1 Embed a focus on digital inclusion in broadband plans and digital economy efforts, paying attention to the challenges of marginalized communities and vulnerable populations, particularly women and children.

Thoughtful approaches are needed that focus on digital inclusion and account for the nature of different types of current usage and adoption, and recognize that cultural barriers and social norms may be influencing non-adoption. These are approaches that place a primary focus on the digital inclusion of marginalized users and communities which are traditionally overlooked and underserved, including, but not limited to, individuals with disabilities, individuals who are low-income, and individuals who reside in rural or remote geographies, and including women and children. Policies (such as in national broadband plans) that focus on digital inclusion can start with simple changes of perspective, such as recognition of the "first billion" and "first-mile", rather than "bottom billion" or "last-mile", and can focus much more on both demand and supply issues to facilitation engagement, rather than solely considering infrastructure expansion dimensions.

5.2 Amplify efforts to improve digital skills – including basic digital skills – to help users, SMEs and public sector agencies make the most of digital opportunities, as well as skills to distinguish online disinformation and other threats to the right to information, and so empower Internet users to avoid becoming either victims or unwitting distributors of disinformation.

As noted above, digital skill gaps remain between age groups, income levels, sexes and educational attainment, and efforts to better develop digital skills (along with basic educational skills) are needed to ensure all members of a society can benefit from the digital economy. Furthermore, in efforts to improve the delivery of government services (and citizen adoption of those services), as well as in programmes to encourage more small and medium enterprises to expand their markets by going online, greater emphasis on digital skills-building is necessary, as well as user empowerment and awareness-building of the risks posed by participating in the digital economy. Governments should also focus on conveying and fostering content in local languages as well as empowering citizens, particularly children, with digital skills to protect against online threats.


Source: Shutterstock

5.3 Add public access policies into universal access and service (UAS) initiatives and national broadband plans, such as ensuring UAS policies explicitly include sites and locations (such as libraries, community centres, and areas of public gathering) where low-cost internet access may be facilitated.

While national broadband plans and universal access directives continue to be adopted and implemented by countries around the world, a subset of universal access initiatives – public access policies – play an outsized role in ensuring underserved and under-resourced communities are able to benefit from internet connectivity as well. While some universal access initiatives embed network coverage obligations and/or targeted subsidies for network expansion, these programmes still may not lead to internet adoption and use because costs for some users may still be prohibitive, even if they are nominal or near-zero. For many users, only free-to-the-user options provide the opportunity and on-ramp to participate in the digital economy, and therefore public access programmes that support free internet access in public places, community centres, libraries, etc. remain a crucial way to disseminate access to information and the public internet.

5.4 Support effective and innovative spectrum policies to improve broadband availability for underserved and marginalized groups.

There are still significant pockets of populations and communities that have yet to benefit from communication access and efforts to reach those underserved individuals would be aided by considering effective and innovation in spectrum allocation. Improvements in spectrum use include ensuring a flexible regime that allows for spectrum repurposing and re-farming, particularly as new generations of communications technology become available and new applications of technology emerge, such as smart systems, Internet of Things and more. Additionally, innovations in spectrum management would enable underserved communities and other marginalized groups to develop their own connectivity solutions in situations where commercial retail service providers are failing to extend service to them, including encouraging governments and regulators to adopt support pro-investment spectrum policies. These include licensing sufficient amounts of coverage (e.g. sub-1GHz) and capacity (e.g. above 1 GHz) spectrum, use of license-exempt spectrum, providing exemptions for non-profit operators, normalizing transparency in the assignment of spectrum frequencies, and issuing long-

term, technology-neutral licenses with a clear process of renewal.

5.5 Expand initiatives to map network coverage and infrastructure needs, developing priority lists for investment, including where subsidies are required.

A lack of comprehensive and up-to-date market data on pricing and network infrastructure availability hampers the ability to better inform policy decisions, commercial investments and consumer choice. Furthermore, a lack of accurate network infrastructure not only hampers efforts to expand access, but also diminishes the ability of the international community to leverage digital infrastructure to provide humanitarian and disaster support.

One approach that would provide policy makers, investors, service providers and entrepreneurs with accurate information to base allocative resource decisions would be in making more telecommunications infrastructure data available to the public in a model similar to the open government data approach that has been championed by many organizations and governments. Such an "Open Telecom Data" approach covering the extent of various elements of network infrastructure (spectrum assignments, terrestrial fibre and points of presence, mobile towers and network coverage) as well as pricing in key aspects of the telecom value chain beyond retail (backhaul, international gateway) would only serve to accelerate deployments and adoption.

5.6 Include measures to protect children online in national broadband plans.

Children are particularly vulnerable to exploitation in the digital economy, and all players in the connectivity ecosystem can play greater roles in ensure the safety and security of children as they engage online.

5.7 Support international and national efforts to provide broadband connectivity to refugees and displaced individuals.

Refugees and displaced individuals are in particularly dire need of basic services and information to assist them in their survival. Communication, and communications technology such as broadband internet, play a critical role in helping refugees access basic services, connect to information about their local, national and global communities, communicate with loved ones and obtain vital information to aid in their survival. There are now more than 70 million refugees around the world, many of whom are in rural areas with limited infrastructure, facing prohibitively high access fees, or lacking in internet-enabled devices. These people in urgent need of connectivity. While various international and national efforts are underway to enhance access to these communities, more multi-stakeholder partnerships are needed to accelerate progress.

5.8 Include a focus on limiting environmental impacts and addressing climate change in national broadband plans.

The ICT sector and digital economy initiatives must play a central role in global efforts to curb environmental impacts and address climate change. Including a focus on these issues in national broadband plans is a first step in building effective responses. Other measures include supporting the deployment of renewable energy solutions to substitute for carbon-emitting power generation for off-grid mobile towers, implementing concrete roadmaps and strategies for deep decarbonization, ensuring digitalization and climate strategies are aligned, and creating and adopting digital tools that focus on decarbonization.

5.9 Encourage and evaluate both sustaining, as well as disruptive ICT innovations across technologies, business models, and regulations.

The characteristics of the individuals and communities in the next 49% are different from the individuals who were the early adopters of the internet. As such, many of the policies, products and services, techniques and processes that were successful in facilitating online access and participation by the first 51% of users will not be appropriate or effective in supporting the next 49% of users' paths to participating in the digital economy. Some of these methods will need to be adjusted and tweaked, through the process of sustaining innovation. In other cases, completely new approaches may be needed – including those that threaten to displace existing dynamics regarding products, services and markets. Both should be encouraged and continuously evaluated.

5.10 Promote the affordability of broadband by adopting appropriate policy and regulation.

Sector-specific telecommunications taxes, fees and other levies have a significant impact on affordability of ICT services and lead to a reduced take-up of broadband. Research has also demonstrated that sector-specific taxes can have a counterproductive effect, reducing overall tax intake because of slowing economic growth and reduced investment (See Section 4.5).

Commissioner Insights

(Arranged alphabetically by organization)

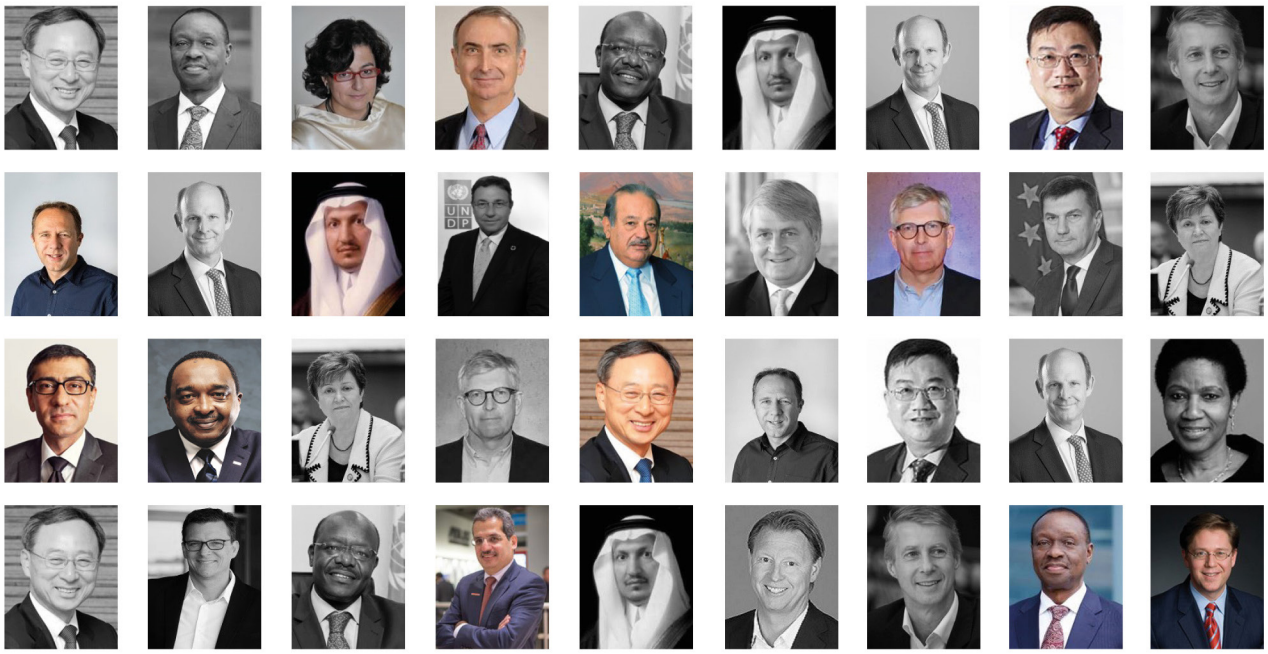
Insight from Co-Chair Mr Carlos Slim (Carlos Slim Foundation)

Health is at the centre of the public agenda as a basis for social and economic development amongst countries. In particular, Sustainable Development Goal (SDG) 3.8 promotes universal health coverage including quality essential health care services, and access to safe, effective, quality and affordable essential medicines and vaccines for all.

The Broadband Commission has placed consistent focus on the interaction between technological advances and health coverage through its Working Group on Digital Health, calling governments to adopt digital health interventions within their national health plans. This is in line with recent World Health Organization efforts to position Digital Health as the main public health paradigm to follow.
Consistent with this view, Carlos Slim Foundation has been promoting Digital Health as a catalyser of social inclusion, modifying the current paradigm of healthcare by strengthening health interventions that target those at greatest need, thus democratizing effective access to health services. In addition, Digital Health empowers citizens to demand quality of care services, and transforms the way health professionals, the health systems and patients interact.

Since 2007, Carlos Slim Foundation has devoted its work in the design, development and scale up of innovations as public health interventions aimed at strengthening health services delivery whilst reengineering primary care in two dimensions with the support of Digital Health: proactive prevention and timely detection through personalized public health and strengthening of quality of care throughout the continuum. In particular, the Foundation has worked around three main areas:

- **CASALUD.** Targeting SDG 3.4, 3.A and 3.B, it is an innovative model that enables proactive prevention and timely detection of Non-Communicable Diseases through MIDO™, a strategy that enables precision profiling through a series of algorithms embedded in a digital platform. In addition, health professionals can perform systematic risk and disease management with SIC™. CASALUD has demonstrated its success in Mexico and is now in an expansion phase in Latin America and the Caribbean.



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

- **AMANECE.** Aimed at SDGs 3.1, 3.2 and 3.7, it assures delivery of services throughout the maternal continuum, from the pre-conception at the community, to systematic risk assessment during prenatal care at the primary care clinic and the hospital, to obstetric care and monitoring of high-risk pregnancies. It currently operates in the most underserved communities in Mexico.
- **Digital Vaccination Platform**. Supporting efforts of SDG 3.2 and 3.B, it strengthens the different actions of an immunization program to catalyse its effectiveness. Through the Digital Vaccination Platform, it enables health professionals to register and monitor all applied vaccines in children and adults, creating a nominal follow up that ensures vaccination schedules are completed in a timely manner, alongside the monitoring of vaccines inventories, cold chain and supply chain. The Digital Vaccination Platform currently operates in Mexico and is now in expansion phase in Latin America.

Finally, these three models support SDG 3.C by strengthening the competences of health professionals and community health workers through an innovative online/offline platform.

Secondly, the Carlos Slim Foundation created Aprende.org with the purpose to contribute to eradicate the roots of poverty and the factors that make it hereditary, by bringing open borderless access to knowledge that become capacities to transform lives, while promoting reliable and evidence-based tools and solutions to reach health and well-being, access to free high quality education and job training to develop prosperity.

Through a paradigmatic model it integrates Contents, Competencies Certification, Zero Cost Access and Connectivity for everyone, everywhere, anytime.

Training for employment - We make available the next generation job competencies of the digital transformation that all industries will require in the next 10 years, through free online high-quality training for all productive sectors. The Program offers Training, Competencies Certification and Job opportunities as well as Professional certificates and Diplomas.

PruébaT- Educational platform aimed to strengthen knowledge and the essential cognitive skills to be learnt throughout life, as well as familiarizing students, teachers, and parents with standardized tests.

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

PruébaT provides open access to a personalized educational experience, that allow everyone to set specific goals to understand oneself and the world through math and language.

Health- Human Health as a fundamental requirement for a fulfilling life, that´s why in Aprende.org you will find core topics on preventive actions to preserve health, online courses, tools to check your health status and general information by age group and gender.

It is inherited to human condition the right for education and health in order to develop capacities to work and generate prosper nations, this is our conviction.

Insight from Commissioner Dr Abdulaziz Al Ruwais (CITC, Saudi Arabia)

ICT Simultaneously Served 2.5 Million People in a Congested Area

The Hajj. For many of the world's more than 1.6 billion Muslims, this is their chance to join the annual holy pilgrimage to Makkah, marking one of the most special moments of their lives. It's a time of devotion, spiritual regeneration – and for many it is also a once-in-a-lifetime opportunity. The Saudi government aims to serve these pilgrims and enable them to perform their rituals easily and comfortably. Information and communications technologies (ICT) plays a vital role in ensuring that reliable services are provided to millions of pilgrims performing the Hajj each year. In 2019 Saudi Arabia continued its efforts to provide a high quality ICT services during the Hajj season and during the holy month of Ramadan, where there is increasing demand for services in the vicinity of the two Holy Mosques and the Holy Places.

In advance of the 2019 Hajj season, the Saudi government authorities tasked with this responsibility began preparations early, in cooperation with telecom providers, to develop plans and build robust networks. This helped operators to keep pace with the increasing demand during the Hajj. 2,489,406 pilgrims availed of high quality ICT services during this year's pilgrimage. Key elements of the Hajj include holy ceremonies where large numbers of pilgrims gather in small areas in and around Makkah, requiring a massive logistical effort to meet the acute demand for ICT services. Network infrastructure and capacity for the Hajj season are provisioned to serve millions of pilgrims, most of whom are equipped with smartphones and mobile devices, so that they can document each moment and share the experience with family and friends, through phone calls or posting photos and videos on social media.

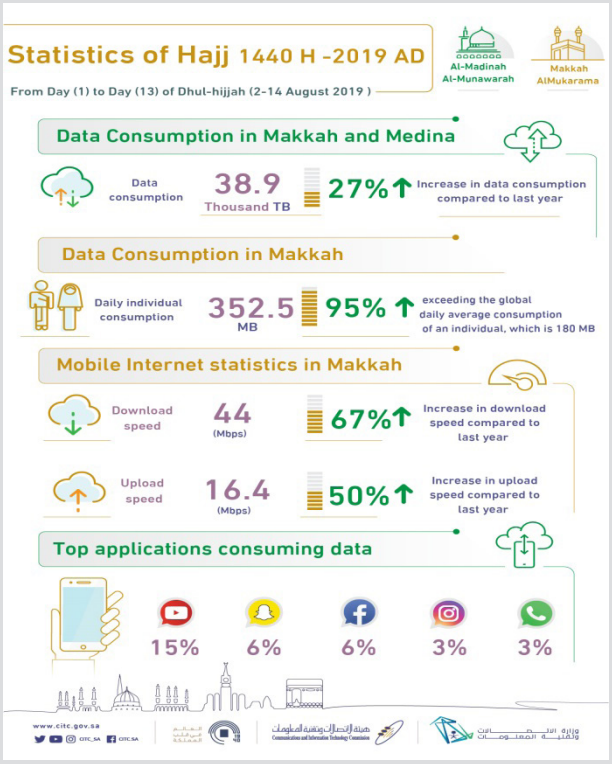
Over 7,000 ICT professionals participated in this year's effort to deliver ICT services, by conducting field measurements in hundreds of locations and using sophisticated network and test equipment in line with international best practice.

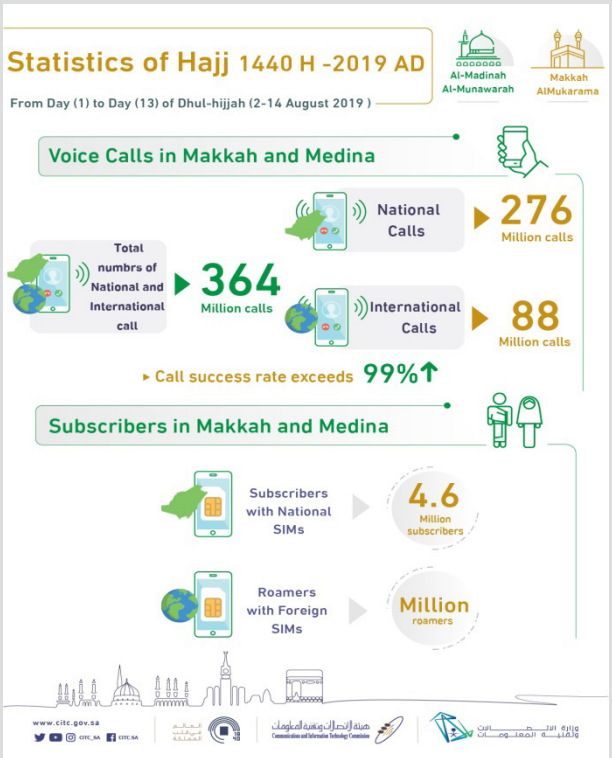
During 2019 Hajj, unprecedented records have been reached:

- More than 32,500 terabytes of data was consumed by pilgrims – equivalent to watching over 13.3 Million hours of HD 1080p video. This is an increase of 26% on the previous year.
- 44.83 Mbps average download speed – an increase of 69% on last year.
- The daily individual consumption of data was 352.5 megabytes, exceeding the global average of daily individual data consumption by 95%.
- More than 32,500 terabytes of data was consumed by pilgrims – equivalent to watching over 13.3 Million hours of HD 1080p video. This is an increase of 26% on the previous year.
- 44.83 Mbps average download speed – an increase of 69% on last year.
- The daily individual consumption of data was 352.5 megabytes, exceeding the global average of daily individual data consumption by 95%.
- More than 309 million calls, both national and international, were made by pilgrims with a 99% success rate.

Insight from Commissioner Dr Abdulaziz Al Ruwais (CITC, Saudi Arabia) (continued)

Preparing the necessary ICT infrastructure in advance was vital to meeting this demand. More statistics for this year's Hajj season are presented below.





Insight from Commissioner Dr Abdulaziz Al Ruwais (CITC, Saudi Arabia) (continued)

The Saudi government also increased the total radio spectrum allocated for providing mobile services Kingdom wide from 260 MHz to 1110 MHz, raising it to 2nd place for this metric amongst the G20 group of countries. It also implemented more than 5,400 Wi-Fi access points to accommodate additional demand for data. Cutting-edge technologies were also deployed during this Hajj season, including 5G and virtual reality. One of the 5G applications deployed for the Hajj was the use of artificial intelligence to manage crowds by analyzing photos and videos, parcel transport and logistical service and facilitating communications between government sectors. In addition, the 5G network was also used to support holograms and drones.

These are just some examples of the many ICT-enabled innovations that Saudi Arabia implemented for the 1440/2019 Hajj, to coordinate critical services and to provide millions of holy pilgrims with reliable communications and a safe visit to the Kingdom.

Insight from Commissioner Mr Denis O'Brien (Digicel)

All stakeholders must play their part to address unacceptable digital exclusion

The report of the Expert Group to the Broadband Commission on 'A New Deal' in 2018 made a number of important policy recommendations on how to close the broadband gap and called for "*a major concentrated effort by policy makers, regulators and international institutions … to address this unacceptable, persisting digital exclusion*".

In the Caribbean, Digicel was delighted to be selected as the partner to roll out high speed broadband networks across three countries as part of a World Bank supported 'Carcip' project. The project is a great example of how collaboration by different funders can bridge the digital divide and will position the three countries involved (St Lucia, Grenada and St Vincent & the Grenadines) to be full participants in the digital economy with network speeds currently enjoyed by only a small set of the global population.

World Bank funding was a key enabler as the 'Carcip' project would not have been possible on a purely commercial basis. Around the world, the core issue is that the digital divide is widening is because it is not commercially viable to roll out networks in many areas with current funding models. This is a global problem as half of the world – 3.7 billion people- is still not connected to the internet.

The ITU estimates that connecting the next 1.5 billion people will cost in the region of $450 billion. If we want to solve this there can be no sacred cows – new innovative funding models must be on the table as without these connections it will be impossible for this huge number of digitally disenfranchised global citizens to participate in the digital economy.

The trend towards the disaggregation of services from the recovery of infrastructure cost is making this problem more acute – recovery of the cost of networks from services offered over the networks has always been an important part of the network investment model. As the economy moves online more and more services will be provided over networks by digital service providers who are often based overseas.

The standalone business case for the rollout of broadband infrastructure to the unconnected 3.7 billion people does not stack up without contributions from the businesses that benefit most from the use of broadband by providing Over-the-Top services. In order to close the circle and link the funding of infrastructure to those who derive the benefit from providing services over that infrastructure financial models must be adapted to include contributions from the large digital economy players to the cost of broadband infrastructure networks. Bridging the global connectivity gap will only be possible if the large global players such as Facebook, Google and others radically change their hands-off approach to the last mile and start to meaningfully co invest in wireless and fibre access infrastructure.

Governments recognize that as the economy moves online, they are facing declining tax revenues under current taxation structures as locally based businesses are displaced by online competitors based overseas. To address this, important work is ongoing internationally to adapt taxation models to the digital future in order to ensure a fair contribution by all actors in the economy. Earmarking a percentage of new digital taxation revenues for infrastructure funds has to be considered. New financial models could also recognize different forms of contributions. Some digital economy payers are working on innovative infrastructure solutions and a "Pay or Play" model that recognizes such solutions could encourage more by way of contributions and engagement from them. Such an approach might suit some digital economy players who are already looking at partnerships in this space. New financial models could also recognize partnership & co-investment as well as commercial arrangements between digital service providers and network owners.

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

The current approach is not working, and new and radical thinking is required. The online economy is already worth many hundreds of billions of dollars annually, if not more, and this is set to grow exponentially. Contributions from online services that run over broadband networks could radically improve the business case for investing in those networks. Unless this happens, we will fail in our objective to connect the unconnected.

Collaboration and partnership between networks and service providers are key to bridging the digital divide. We speak about a digital economy but unfortunately it does not exist everywhere. We need to focus on the foundation of the digital economy – the broadband infrastructure. If we are really serious about a global and inclusive digital economy then in order to connect the unconnected all stakeholders who benefit economically from these connections need to play, and pay, their part.

Insight from Commissioner Mr Börje Ekholm (Ericsson)

Tackling climate change is one of the greatest challenges facing humanity. Any major report published in 2019 must thus consider the reduction of global greenhouse gas emissions. This is particularly true in the case of broadband. Over the next decade, the technologies of the Fourth Industrial Revolution – particularly 5G, the Internet of Things (IoT) and artificial intelligence (AI) – will provide us essential tools for increasing efficiency in the economy and preparing for a post-fossil society.

The key questions are: Can we do it? And if so, how?

Since the release of last year´s edition of ***The State of Broadband***, the Intergovernmental Panel on Climate Change has delivered its special report on the impacts of global warming of 1.5 °C and above. The report clearly lays out the difference between 1.5 °C and 2°C and emphasizes the urgent need to avoid crossing tipping points in Earth´s life support systems.

To give us a chance to limit global warming to this level, global greenhouse gas emissions need to peak by 2020 and then fall by half every decade, corresponding to seven percent annual reductions as a global average. We must take unprecedented action to achieve this at all levels of society, including nations, cities, industries and individuals.

We recently joined forces with organizations such as Future Earth, the Finnish future fund Sitra, WWF, Stockholm Resilience Centre, Mission 2020 and several others to explore if halving global CO2e emissions by 2030 is possible, and if so, what would be the possible role of ICT.

The resulting report –the Exponential Climate Action Roadmap – was launched at the Global Climate Action Summit in 2018 and explores how a 50 percent reduction of greenhouse gas emissions can be implemented across key sectors of the global economy, specifically energy supply, industry, buildings, transports, food consumption and agriculture and forestry. We conclude that halving of emissions by 2030 is indeed achievable and that the digital technology sector is critical to achieving the goal both through its capacity to directly reduce emissions and as an influencer.

Of the solutions identified in the roadmap, one-third are enabled by existing ICT solutions. These solutions correspond to 15 percent of global emissions, which is more than the footprint of the EU and the US combined. This can be compared to the ICT industry's own footprint, which has stayed flat for several years at a level of 1.4 percent of overall global emissions in spite of exponential data growth.

In contrast to more tech-centric reports, the Exponential Climate Action Roadmap embeds technology in a much wider societal framework. We believe that technology, when applied in climate solutions, has the power to transform society. But achieving decarbonization at sufficient speed and scale – while limiting negative societal side effects – will require new policy frameworks, financing models, business models, coherent demand and supply side transformation and climate leadership at all levels.

An important part of the Exponential Climate Action Roadmap is therefore its policy study. One of the important inputs to this study was the 2012 Ericsson-led Broadband Commission report on climate: The broadband bridge Linking ICT with climate action for a low carbon economy.

Insight from Commissioner Mr Börje Ekholm (Ericsson) (continued)

In the roadmap, key policy messages include both general and sector-specific items. The most important ones from a broadband perspective include:

- It's time to shift from visions to concrete roadmaps and strategies at all levels. This means implementing coherent policy packages that support technologies and business models for deep decarbonisation, while suppressing emissions and carbon intensive processes.
- Digitalization and climate strategies must become one and the same thing, with extensive mutual reinforcement.
- Circular economy, digital economy and sharing economy models should be optimized and incentivized for climate.
- Exponential roadmaps for industries, businesses, cities, regions and nations should be developed.

As companies, we need to set sharp targets and cut the emissions of our own operations and products, as well as working with our supply chains and investing in renewable energy supply. The ICT industry is already the world´s largest purchaser of renewable electricity, making it an important demand-side player.

But while society´s focus is still to a large extent on suppressing activities with high emissions, we must keep raising our ambition to develop solutions to replace them. These solutions often bring huge societal benefits in terms of health, achieved global development goals and increased security and independence. They also create huge business opportunities.

Ericsson has long been an advocate for the low-carbon society. As a company, we have cut our own emissions by 50 percent and are working to meet further reduction targets, as well as demonstrating solutions to make halving global emissions achievable.

Now we urge other companies and policymakers to join the quest. The time to act is now. In just over a decade, we must cut the world's carbon emissions by half, and our industry needs to show the way.

Insight from former Commissioner Mr Andrus Ansip (European Commission)

The European Digital Single Market – an inspiration for a human centric global digital economy

As digitalization and new technologies revolutionize the way we live and work, the European Commission has over the past 5 years been engaged to complete a fully functioning European Digital Single Market to create optimal conditions for unleashing the welfare-generating potential of digital technologies in Europe. Under this strategy, a combination of policy, investment and regulatory initiatives have given Europe the framework to empower citizens and companies alike, and further develop its competitiveness in the digital world, while maintaining and protecting its core values.[1] In turn, the DSM ensures the free movement in the EU of persons, services and capital, and makes it possible for individuals and businesses to seamlessly engage in online activities under conditions of fair competition and a high level of consumer and personal data protection, irrespective of their nationality or place of residence.

For **European citizens**, **roaming tariffs** in the EU have been abolished. Citizens have responded very positively by using their mobile devices over 5 times more for data and almost 2.5 times more for calls while travelling in the EU in summer 2017 as compared to summer 2016 – an increase of 435%. Additionally, from 15 May 2019, international calls within the EU will cost at most EUR 0.19 per minute. The DSM has also meant stronger consumer protection rules including better protection for consumers subscribing to bundled service packages and better tariff transparency and comparison of contractual offers. New rules are improving **consumer access to online content** across EU borders. Online content portability rules now allow Europeans travelling in other EU countries to access the digital content that they have subscribed to at home, including films and sports programs. When it comes to online shopping, the **rules against geo-blocking** will end discriminatory practices preventing online customers from accessing and purchasing products or services from websites in other Member States. Consumer protection has also been enhanced for broadcast and online media. This is especially the case for children who tend to watch more and more on-demand and online videos.

Against a number of serious privacy breaches**, data protection** has been a significant public concern. Since May 2018, with the entry into application of the **General Data Protection Regulation (GDPR)**, European citizens know that their data is now covered by the highest protection standards in the world.

In order to combat hate speech online, a code of conduct has been developed by the Commission, together with Facebook, Microsoft, Twitter and YouTube (subsequently joined by Instagram, Google+, Snapchat and Dailymotion). The code sets parameters for investigation and takedown, while fully observing the right of freedom of expression. To defend the core value of freedom of expression on the internet and to protect European citizens from **disinformation,** the EU is taking action by setting effective policy measures to regulate online content and service providers, innovative communication to build resilience against disinformation, and the continued defence of media freedom and pluralism**.** We have established a code of practice and an action plan against disinformation.

As for the **business community**, a number of Digital Single Market measures should encourage more businesses to trade online, domestically and cross-border, thus expanding their customer base. More consistent rules for ***eCommerce*** transactions and simplified procedures help start-ups and SMEs to scale up faster, a critical skill for businesses in the digital economy. The **improved legal framework** outlined above has clarified consumer rights, addressed geo-blocking and increased consumer protection. It has also improved complaint handling, simplified procedures for VAT, and strengthened regulatory oversight of parcel delivery. All this benefits business operating in one single digital environment.

Insight from former Commissioner Mr Andrus Ansip (European Commission) (continued)

The harmonized set of rules on **platform-to-business relations** guarantees both businesses and online platforms a transparent and predictable business environment. The new rules provide businesses using online platforms to reach consumers with a safety net guaranteeing fair treatment.

Data powers a wide array of online services and, increasingly, real world services such as design, manufacturing and logistics. Data flows have re-shaped trade relations, created new large-scale infrastructures and led to new and very successful business models. To promote data-driven innovation and market growth, new rules have been adopted to boost the free flow of non-personal data within the EU, while others provides for better access and reuse of public sector data and scientific data and for facilitating private sector data sharing in business-to-business and business-to-governments contexts.

European governments have identified the digitization of the public sector as one of the main pillars of a strong digital economy. One of the major achievements in the area of digital government at European level is the adoption of the **eIDAS Regulation**. eIDAS is the 'toolset' that will increase trust for citizens and businesses when digitally interacting with public administration but also with the private sector. This can support the implementation of the digital by default principle in the public sector and help create an internal market for trust services.

Another key example is the area of **eHealth,** where measures have been taken to secure citizens' access to their own health data and introduced the ability to access their data across border in the event of an accident or illness while in another Member State. When used in conjunction with High Performance Computing, improved health data will provide personalized medical treatment plans. In addition, the use of larger anonymized health data sets will enable entirely new or improved medical treatments, and better research results in areas like epidemiology for disease prevention and protection.

The importance of **cybersecurity** as a vital strategic pillar will increase further as connected objects of all types provide many millions more access/attack points. 86% of Europeans believe that the risk of becoming a victim of cybercrime is increasing. On the EU level these issues have been addressed by taking steps to improve resilience, coordination and response in the event of cyberattack and streamline the market for EU cybersecurity products.

Education and **digital** skills are normally handled by each national government in the EU, but Member States' efforts are continuously supported at European level through several initiatives to advance digital skills. Examples include the **Digital Opportunity traineeship initiative**, providing cross-border traineeships for up to 6,000 students and recent graduates between 2018 and 2020 and the **Digital Skills and Jobs Coalition,** which brings together EU Member States, companies, social partners, non-profit organizations and education providers to boost digital skills in Europe. The Coalition has currently over 100 pledges from close to 400 members all over the EU.

Looking towards the 2030 horizon, it is clear that the digital sector will continue to evolve at a very fast pace. We are now in a critical phase, during which new technologies (AI, blockchain, 5G) and data-based decision making will influence all areas of the physical world, with profound economic and social effects. Regulatory initiatives and ambitious investment will be necessary to preserve Europe's competitiveness and ensure that businesses and citizens continue to gain demonstrable benefits in their day-to-day activities and lives.

We are also convinced that these initiatives can inspire other parts of the world to take the right steps to benefit from the digital transformation but also to face the challenges in the digital age. We are working with our partners both in the developed and the developing world to ensure that the global digital economy and society remains democratic open and human-centric for all.

Insight from Commissioner Mr Kevin Martin (Facebook)

Driving demand through smart regulation

The 2018 State of Broadband report included a Recommendation to "Review and adapt legal frameworks to take into account digitalization", citing specifically the need for new digital laws and safeguards to ensure privacy and safeguard personal data. We at Facebook support this Recommendation and a more active role for governments and policymakers in shaping regulatory frameworks for the future of the internet.

Technology is a major part of our lives, and companies that provide that technology have immense responsibilities. Every day, they make decisions about what speech is harmful, what constitutes political advertising, and how to prevent sophisticated cyberattacks. We believe that companies should not be asked to make these decisions alone.

How we got here

In the early days of the internet, companies were mostly left to develop their own rules and governance structures. This delivered tremendous economic and social benefits, innovation, enhanced productivity and economic growth, and created new social and educational opportunities for users around the world. However, it also led to genuine concerns about the operation of internet companies. Some governments have in turn imposed internet shutdowns, banning of websites and applications, discriminatory taxation, and indiscriminate censorship of online content because they lack modern legal frameworks and regulations to address their concerns in a balanced manner.

Internet companies recognize their responsibility to their users and society at large as well as the legitimate public policy aims of governments around the world. Facebook believes strongly that a multistakeholder movement among technology companies, governments, and users alike to develop sensible new rules and governance structures will help guide a safe and prosperous future for the internet. Facebook CEO Mark Zuckerberg wrote in an op-ed in the *Washington Post*, "By updating the rules for the internet, we can preserve what's best about it — the freedom for people to express themselves and for entrepreneurs to build new things — while also protecting society from broader harms."

Four primary issues

Facebook has identified four issues that are most in need of government attention.

1. Election integrity: Legislation should be updated to reflect the reality of threats to free and fair elections and set common standards for verifying political actors.
2. Harmful content: Industry standards could establish what type of content is prohibited and companies could build systems for keeping harmful content online to a bare minimum.
3. Privacy: Privacy regulation should protect users' rights to choose how their information is used — while enabling companies to use information for safety purposes and to provide services.
4. Data portability: If someone shares data with one service, they should be able to move it to another. Regulation should guarantee the principle of data portability and include clear rules about who is responsible for protecting information when it moves between services.

Insight from Commissioner Mr Kevin Martin (Facebook) (continued)

Practical application

Addressing these issues presents a tremendous challenge. We believe that employing an open and inclusive multistakeholder approach will be the only way to develop creative, flexible, and lasting solutions. The strength and power of collaborative multistakeholder processes arise from the engagement of all interested parties, which is vital to developing legitimacy on cross-cutting policy matters.

For example, Facebook and the government of France recently concluded a project, led by a small working group of French government officials and Facebook employees, to explore the practicality of creating a co-regulatory approach for dealing with hate speech on our platforms.

Conclusion

As this year's *State of Broadband* report has noted, 2019 marks the first year when more than half of the world's population will be connected to the internet. This is a momentous achievement of which the Broadband Commission should be immensely proud. Yet it is also a time for reflection, because connecting the second half of the world will entail overcoming a variety of challenges altogether unlike the first.

Expanding connectivity is not merely a function of supply. It is also a function of demand. People will not use the internet if they feel unsafe, insecure, or unengaged online. For example, the 2019 *Value of the Internet* survey, commissioned by Facebook and conducted by the Economist Intelligence Unit, revealed that a majority of people worldwide are not confident about their privacy on the internet and, as a result, are adapting and restricting their online activities. Sensible regulation can stimulate greater demand for broadband connectivity by fostering an online environment in which people feel safe and empowered.

It is clear that bringing the next 4 billion people online is not simply a matter of building more cables, switches, and handsets. It is equally a matter of building more confidence, security, and empowerment in the online experience.

A third of the world's population, 2.7 billion people, use Facebook products every month. We understand the immense responsibility we have to our community and the power we have to influence the way the internet is used and governed. We believe that proper attention to the difficult issues facing the internet, along with the partnership and support of governments, will not only help drive more people online, but on to a better and more enduring internet.

Insight from Commissioner Mr Mats Granryd (GSMA)

Responsible leadership means delivering measurable impact as well as a compelling vision

Social, technological, political and economic currents are combining to create a perfect storm of disruption across all industries. A new form of responsible leadership is needed to successfully navigate this era. As efforts are made by governments and the private sector to close the digital divide, ethical and responsible leadership is paramount. We are on the cusp of a new era of intelligent connectivity shaped by 5G, IoT and big data, which will spark exciting new possibilities for consumers and transform virtually every business. In the face of this disruption, leaders should strive for business success in ways that seek a better future for their consumers and societies. Those that do not adapt can expect to suffer a backlash from shareholders, regulators and consumers.

As we enter the fourth industrial revolution, it is no longer the case that a company's social responsibility is the sole concern of CSR departments, but rather something that makes business sense and therefore must be on the CEO's agenda. Ensuring sustainability in business should be something understood and evangelised by employees across all departments and at all levels starting at the very top of any organisation. Industry is playing a key role in achieving the UN's Sustainable Development Goals (SDGs), the mobile industry has been ahead of the curve on this shift in attitudes. In 2015, the sector became the first to fully commit to the SDGs. Four years on, we are increasing our impact across all 17 SDGs, transforming the industry's commitment into real-world initiatives from mobile operators that are delivering measurable results.

The GSMA monitors progress every year in its annual 'SDG Impact' report. This study uses a proprietary 'impact score' methodology: each SDG is given a score out of 100, with a higher score representing an increased industry impact on that particular goal. For example, in 2018, SDG 1 (No Poverty) scored 42, meaning that the industry is achieving 42% of its potential impact.

Source: https://www.gsma.com/betterfuture/2018sdgimpactreport/

Insight from Commissioner Mr Mats Granryd (GSMA) (continued)

Another key tool the GSMA uses to monitor the state of the industry is the Mobile Connectivity Index (MCI). Originally launched in 2016, it rates 163 countries on how advanced their mobile internet ecosystem is (expressed as a score between 0-100). The overall score is made up of four enablers, representing the key measures of mobile internet access and usage: infrastructure, affordability, content and services, and consumer readiness. These are themselves built upon 35 discrete indicators.[2]

The MCI is unique in that it is focused solely on mobile technology. This matters as mobile is now the primary way in which internet users in low- and middle-income countries are coming online.

These tools are critical to supporting the pledge of responsible leadership. Business leaders are increasingly measured on the contribution they make to society; by their investors, their employees, and their customers, and proof of impact is required. Evidence suggests consumers are increasingly showing greater brand loyalty to visionary businesses that bring value to society and respond to the challenges facing the world. Our role at the GSMA has been to equip mobile CEOs and their teams with the tools and skills they need to pursue a sustainability agenda and advance sustainable and responsible business models, whilst not compromising on long-term commercial returns. Our industry has also united behind a single vision: to *Intelligently Connect Everyone and Everything to a Better Future.* Leadership also means reaching out and building alliances with other stakeholders, including other industry sectors and the public sector.

One example is the Digital Declaration, a cross-industry movement of CEOs who are committing to a series of principles that serve as a guide to acting ethically in the digital era. The movement was formed on the premise that a new form of responsible leadership is needed to successfully navigate a new age of technology disruption – and at a time while trust in many businesses and institutions is being tested.

The Digital Declaration calls on signatories to respect the privacy of digital citizens; handle personal data securely and transparently; take meaningful steps to mitigate cyber threats; and ensure everyone can participate in the digital economy without the threat of online harassment. To date, more than 50 CEOs from a wide range of industry sectors have signed up, taking personal responsibility for the companies that they lead to adopt and promote the principles.

I am proud that my sector, the mobile industry, has provided powerful tools for achieving the SDGs, not from a philanthropy perspective but because it is at the core of a future business strategies, and an enabler to reduce poverty, improve healthcare and education, and drive sustainable economic growth. The challenge now is for companies from all sectors to come together and put delivery of the SDGs at the very top of their agendas.

Insight from Commissioner Mr Keng Thai Leong (Infocomm Media Development Authority of Singapore, IMDA)

The recommendations of the Expert Group Report "A New Deal: Investing in our common Future. Policy recommendations to close the broadband gap" released in February 2018 are particularly relevant. Singapore started our telecommunications liberalization journey in 1993 when SingTel was privatized which ended the company's monopoly in the telecommunications market. Singapore believes that liberalization, light regulation, and competition offer a more viable approach to ensure the provision of innovative and high-quality services, at a highly competitive price.

In 2008, Singapore embarked on the journey to create a pervasive and competitively priced ultra-fast fixed broadband network capable of delivering broadband speeds of 1 Gigabit per second and more. The network has since achieved a nationwide coverage by 2012. In addition, the open access framework that was put in place to support the network has spurred greater market vibrancy and helped lower the price of a typical 1 Gbps plan to about US$28 per month, one of the lowest priced globally. Singapore hopes that our efforts will support the Commission's 2025 Target of ensuring that countries provide affordable and high-quality broadband connectivity.

In recent years, the game has shifted from broadband as a critical infrastructure to how broadband and technology can transform businesses, industries and economies. It has opened unprecedented opportunities for innovative SMEs and start-ups to compete. Against this backdrop, we are pleased to note that the importance of digitalization and the digital economy has been recognized in the June 2017 Report of the Broadband Commission Working Group on the "Digitalization Scorecard: Which policies and regulations can help advance digitalization" and the September 2018 Report of the Working Group on "Digital Entrepreneurship". In May 2018, Singapore launched the Digital Economy Framework for Action. The Framework serves to guide the development of Singapore's digital economy, and how Singapore can facilitate companies, workers and communities to tap the opportunities brought about by digitalization. As part of the enablers of the Framework, and aligned with the recommendation of the Working Group on "Digital Entrepreneurship" to strengthen trust by implementing reliable consumer protection rules, Singapore has initiated an early review of its Personal Data Protection Act (PDPA), which was first enacted in January 2013, to ensure that it keeps pace with evolving needs of business and individuals, and remains relevant to support Singapore's digital economy goals. The review seeks to strengthen consumer trust through greater accountability and enable organizations to legitimately harness data to deliver innovative products and services. Data plays a crucial role in a digital economy where rapid adoption of cloud computing, Big Data, Internet of Things and Artificial Intelligence increase the need for data to flow across geographical boundaries. It is therefore important to create a conducive regulatory ecosystem to allow innovation, while still focusing on safeguarding individuals' interest, and at the same time minimize restrictions that would impede cross-border data flows.

Insight from Commissioner Mr Keng Thai Leong (Infocomm Media Development Authority of Singapore, IMDA) (continued)

Singapore is cognizant on the need to ensure that its people have necessary digital skills to thrive in a digital economy, and that businesses also have the skills and understanding to innovate, adapt quickly and scale up, which is aligned with the Commission's target of ensuring that 60% of the youth and adults are digitally-ready. With these purposes in mind, Singapore is exposing our students to computational thinking, coding and digital making fundamentals, to prepare our students to be digitally literate and be productive members of the future digital economy workforce. Collectively, since 2014, more than 321,000 students (from pre-school to pre-tertiary) have benefited from these programs. In addition, with industry digitalization taking place across various key economic sectors, there is an urgent need to develop and place skilled ICT professionals to support the new growth areas. Hence, Singapore has put in place various programmers (e.g. scaled up TechSkills Accelerator (TeSA), Digital Learning Guide, and SkillsFuture) to address the training needs of the existing ICT professionals, the non-ICT professionals, and the general masses.

New and emerging technologies will continue to disrupt traditional businesses and innovation will drive emerging digital economies. This requires innovation in policy thinking and regulatory approaches. Singapore is excited about the opportunities and challenges ahead and will continue to share and contribute to the success of the Commission.

Insight from Commissioner Mr Rupert Pearce (Inmarsat)

Satellite-enabled industrial Internet of Things (IIoT) and environmental sustainability

Communications technologies today are being called on to do more—to solve more important problems on a larger scale—than ever before. Nowhere is this more true than in the area of two of the greatest planetary challenges facing humanity: preservation of our natural resources and protection of the global environment.

Climate change, a growing population and concerns around environmental sustainability are challenging all industries to produce more, while inflicting less damage on the world around us. Satellite technologies are, and will increasingly be, a key component to meeting these challenges.

Across diverse sectors such as energy, agriculture, and transportation, satellite communications are enabling Industrial Internet of Things (IIoT) solutions that are enabling companies to collect and leverage data about their operations to improve efficiency and realize new capability, while also improving their stewardship of our shared environment.

Energy

The energy industry is in an unprecedented state of transformation. Satellite-enabled IIoT applications are helping the industry meet increasing demands from governments, consumers and activists to reduce non-renewable energy consumption and humanity's impact on the environment. The sector also has a great deal to gain in terms of increased outputs and profitability by harnessing smart technologies such as IIoT.

IIoT technologies are useful in all phases of the energy production and distribution supply chain. In the exploration phase, IIoT can help accelerate and enhance seismic data acquisition and analysis to improve production performance, leading to the faster and safer extraction of gas or oil. In the extraction and drilling process, IIoT can enable real-time process monitoring and predictive maintenance improving the efficiency of operations and reducing harmful environmental impacts.

Energy distributors build and operate vast networks of pipelines, from which they can gather datasets to monitor the integrity of pipes and deploy a rapid response if they detect a leak, through pressure monitoring sensors. IIoT sensors can similarly help to optimise supply and demand forecasting, as well as pipeline operations. As oil and gas is distributed across continents through expansive pipelines, IIoT-connected sensors can immediately alert authorities to leaks and accidents, reducing the risk of environmental harm and impact.

Research conducted by Inmarsat has shown that over half of distribution companies expect to use the data generated by their IIoT solutions to monitor and improve productivity (57 per cent). And crucially, extraction companies are strongly focused on the opportunity to use IIoT data to better monitor environmental changes (38 per cent) and to improve health and safety (43 per cent).

Insight from Commissioner Mr Rupert Pearce (Inmarsat) (continued)

Agriculture

IIOT solutions are also helping agricultural businesses use natural resources more efficiently while also reducing the harmful byproducts of their activities. One way that satellite technologies are helping these organisations do this is through the delivery of projects that involve the installation of IoT sensors monitoring soil and leaf humidity.

Utilising a Low Power Wide Area Network to connect the sensors with a satellite gateway, the resulting data allows farmers to make more intelligent decisions about their water usage and can even be used to automate water delivery to ensure it is only delivered for irrigation as needed. This prevents depletion of fragile water supplies, ensuring that ecosystems remain intact.

Another function that IoT sensors can provide is carbon dioxide monitoring. As governments are under greater international pressure to restrict some agricultural activities such as burning, placing sensors in areas where burning has traditionally occurred will indicate those farming organisations playing by the rules, and those who are not.

Transportation

The transportation sector is also driving down its carbon footprint and minimizing negative environmental impacts using satellite-enabled IoT. The International Transport Forum estimates that heightening travel demands could see global CO2 emissions from transport increase by 60 per cent by 2050. Without significant progress with the adoption of greener technologies, that figure could be considerably higher.

IoT could have a considerable impact on the emissions of logistics companies today. Using diagnostic sensors, smart telematics, and other technologies to gather engine status data and automatically notify fleet managers of anomalies can help limit CO2 emissions due to faulty equipment, engine damage and even poor route planning. This data can also help extend the lifespan of vehicles, reducing emissions and minimizing wastage.

But the defining challenge of the transportation industry is that vehicles can go everywhere, even places where other network technologies are not especially into the skies and onto the seas which only satellite technology can reach. Making informed decisions in real-time depends on having data available at all times. To achieve that requires the continuous and reliable connectivity made possible by mobile satellite communications. Utilising satellite-enabled IoT to make strategic adjustments will enable transport organisations to realize significant gains in environmental sustainability and for the global logistics industry to benefit from seamless, pervasive situational awareness as material moves from its centre of production to its final destination across road, rail, air cargo and even ship.

Energy, agriculture, and transportation are just three examples of industrial sectors that are leveraging the impressive ubiquity, capability, and reliability of connectivity and specifically satellite-enabled IIoT technologies to reduce harmful environmental impacts and take better care of our natural environment. As demands for such measure continue to grow, these connectivity technologies will continue to innovate to meet them.

Insight from Commissioner Mr Stephen Spengler (Intelsat)

A connected plan within our reach

Infrastructure gaps, including infrastructure supporting the power grid, remains a primary reason for people not connecting to the internet. In countries where mobile internet penetration rates are below 50%, a lack of infrastructure remains the biggest barrier. In countries with mobile internet penetration rates below 20% it is a severe challenge.

Fibre and microwave backhaul

The most common and preferred means of delivering Internet connectivity is through fixed and wireless broadband networks backhauled over fibre. However, running fibre over long distances to connect rural and remote areas is costly, and when factoring in low population density in these areas, the return on investment (ROI) can be very low even non-existent, leading mobile operators and other service providers to choose not to expand coverage into these areas at all. Another challenge to backhauling rural and remote networks over fibre has to do with the geographic location and topographical limitations associated with many of these areas, increasing the risk of the fibre being cut or damaged and, in many cases, making running fibre infeasible altogether. Finally, running fibre over long distances is extremely time-consuming, and in some cases can take six months to a year just to cover 10kms.

Even using microwave to backhaul rural and remote networks can be challenging and time-consuming, since reaching these areas can require multiple costly hops over long distances and around dense forests or mountainous terrain due to frequency and line-of-sight restrictions. Also, providing reliable microwave backhaul requires mobile operators and other service providers to license spectrum.

The case for space-based connectivity

While fibre-based and microwave-based networks are ideal in many scenarios, only space-based backhaul is suitable from a cost and practicality standpoint for connecting networks in hard-to-reach rural and remote areas. The primary advantage of connecting sites over space-based backhaul is that satellite coverage is ubiquitous – it's everywhere. In fact, constellations in geosynchronous orbit cover 99% of the world's populated areas. Combined with a global fibre-based terrestrial network, the ubiquitous coverage provided by space-based platforms means network infrastructure can be located anywhere and fully operational in far less time than if backhauled over fibre or microwave.

Using space-based technologies to connect rural and remote communities over fixed and wireless networks is often overlooked due to outdated perceptions of satellite being too costly, too slow, and too complex. However, advances in space-based platforms and terrestrial network technologies (including antennas and modems), along with managed services and turnkey installations, have made connecting people, places and things everywhere economical, efficient, simpler to deploy, and capable of meeting quality of service (QoS) requirements.

Satellite technologies have advanced significantly over the past decade. Space-based platforms themselves continue to evolve, with today's high-throughput satellites (HTS) utilizing small multi-spot uplink and downlink beams covering the desired area, delivering more bandwidth, better performance, and higher throughput. Technological advances also include much smaller antennas, known as very small aperture terminals (VSAT), which significantly reduce the cost and increase the scalability of connecting rural and remote sites over space-based backhaul.

Insight from Commissioner Mr Stephen Spengler (Intelsat) (continued)

Other advances include modems capable of optimizing and accelerating the signal to ensure a high-quality experience for end users.

The advantages and technological advances of today's space-based networks mean mobile operators, service providers and even multinational corporations and nongovernmental organizations around the world can reach further, connecting more people, places and things than ever before. Space-based backhaul and end-to-end connectivity solutions enable mobile operators to expand broadband coverage into rural and remote areas where fibre and microwave backhaul are not practical, bringing Internet connectivity for the first time to remote communities. Mobile operators and even multinational corporations can connect more Internet-of-Things (IoT) sensors and devices for remote monitoring and smart commercial farming in hard-to-reach areas. Space-based connectivity can also be deployed to provide reliable backup when terrestrial backhaul fails, ensuring continued connectivity for end users.

In addition to traditional cellular networks for providing broadband connectivity in rural and remote areas, space-based connectivity can also be utilized to provide low-cost quickly deployed Wi-Fi service as a community hotspot or fixed wireless deployment. Wi-Fi is an ideal solution for introducing internet services to ultra-remote communities, especially in areas where mobile operators have not reached. This has been implemented successfully in ICT lab deployments by the UNHCR (United Nations' refugee agency), as well as Coca-Cola's EKOCENTER kiosk, which has now evolved into remote village marketplace installations.

Limited access to power

Another infrastructure challenge in rural and remote areas is power. Today, roughly 1.2 billion people worldwide live off-grid. In Africa, for example, there are approximately 650 million people who live in rural and remote areas that do not have access to electricity, and McKinsey forecasts that 500 million will still not have access to electricity by 2040. Expanding electricity access into hard-to- reach areas can be as challenging and costly as deploying fixed and wireless networks using fibre and microwave. Added to this is the fact that large cellular network deployments require electricity to operate, resulting in limitations to providing broadband connectivity.

To address this challenge, cellular networks can be deployed using space-based backhaul and small cell antennas. A small cell is a low-cost radio access point with low radio frequency (RF) power output requiring less power than a macro cell. Small cells are sufficient for most all rural and remote site coverage requirements, and support 2G, 3G, 4G and even 5G technologies. And because small cells have a low power requirement, alternative low-cost power options such as solar can be used for providing coverage to off-grid communities.

The role of regulations in overcoming barriers

Regulators and Administrations play an important role in overcoming barriers to broadband connectivity deployment. Regulations can foster infrastructure investment, affordability, consumer readiness and relevant content or hinder it.

One tool to address not only infrastructure, especially in rural and remote areas, but also affordability is the inclusion of satellite technology options in any National Broadband Plan. Many national broadband plans are not designed with all available technologies in mind and prevent decision makers from choosing solutions that are a mix of technologies. Satellites can extend the reach of mobile networks in an affordable way, if this option is provided for and supported in the national broadband plan.

Insight from Commissioner Mr Stephen Spengler (Intelsat) (continued)

Affordability is key to increasing the broadband penetration rate. It is therefore critical that licensing fees be waived or limited to recovering the cost of regulating this service to the administration. Licensing fees should not be looked upon as a source of revenue to the administration. Any licensing cost will need to be passed on by the operator to the customer and eventually the end-user.

Lastly, in order to foster the establishment and adoption of broadband in rural and remote areas, administrations and regulators might consider establishing and implementing financing policies which utilize Universal Service Funds, tax incentives or provide government funding for pilot projects. While ultimately, the aim of the broadband solutions is to be sustainable, some seed funding and other initial support can go a long way towards overcoming barriers such as infrastructure, affordability and consumer readiness.

Conclusion

At Intelsat, we believe every possible means should be employed for connecting people everywhere. We need to be mindful that the 5G era does not just bring higher download speeds to people in urban areas while at the same time leaving behind people in rural and remote areas, thus exacerbating the digital gap.

And while many technology options exist today to deliver connectivity to unconnected areas,

including fibre and microwave, space-based technology is still the optimal solution from an economic and feasibility standpoint for deploying wireless access to hard-to-reach areas such as rural and remote communities.

Intelsat would like to launch a call to action for technologies to be seamless and interoperable. We need to employ new business models to accelerate the infrastructure expansion. Fostering common sense regulations are a critical tool in overcoming today's barriers to a connected world.

Insight from Commissioner Ms Arancha González (ITC)

Recommendation 9 - Develop digitally. By 2020, Donors and developing countries commit to development assistance targets in support of digital entrepreneurship - and deliver on them by 2025.

In the area of Digital Entrepreneurship, ITC's tech sector development work started around 2010, in Bangladesh and then in Sri Lanka, Kenya, Uganda and now with the Netherlands Trust Fund IV in Senegal and with the EU-funded YEP in The Gambia. In 2018, ITC launched the eTrade for Impact strategy. One of the three pillars of the strategy is "tech entrepreneurship", which focuses on growing entrepreneurial potential with digital business models.

Those three areas correspond to ITC's seven strategic objectives to support the development of tech entrepreneurship in developing countries in the following manner:

STRENGTHENING ECOSYSTEMS

1. Smart regulation in the tech sector supported through Private-Public Dialogues
2. Business-friendly entrepreneurial ecosystems are nurtured
3. Effective and sustainable tech hubs are built, scaled up and networked

SCALING DIGITAL ENTREPRENEURSHIP

4. Startup founders are equipped with essential business skills to boost startup survival rates
5. Digital skills of current and future startup staff are developed in partnership with innovative TVETs

LINKING WITH INVESTORS AND CLIENTS

6. Tech startups are exposed to pioneering sources of funding, in particular angel investment, venture capital, crowdfunding
7. Tech startups are connected with potential partners and clients for business and investment

Since January 2018, ITC has supported 56 IT & ITES companies and 63 tech start-ups in Uganda, as well as 60 IT & ITES companies and 53 tech start-ups in Senegal. From January 2019, tech start-ups are being supported in the Gambia too. Training has also been offered to freelancers in Kenya, the Gambia and Palestine.

The tech start-ups were segmented into:

1. Growth Phase (Gold): New markets, new products
2. Entrepreneurship Phase (Silver): Minimum Viable Product (MVP) confirmed, customer acquisition and retention
3. Ideation Phase (Bronze): research and implementation of a market-oriented solution

How ITC supports tech entrepreneurs:

Advanced start-ups will receive specialist advice and access to market opportunities. For example, African start-ups were sponsored by ITC to attend the 2019 Mobile World Congress in Barcelona, which was picked up on Deutsche Welle TV.[3] Another delegation was accompanied to VivaTech in Paris in mid-May. In early 2019, around 40 start-ups in the Gambia participated in training sessions on the Value Proposition and Business Model Canvases, facilitated by our international experts.

Insight from Commissioner Ms Arancha González (ITC) (continued)

ITC combines its efforts with different partners, including partners on the ground, to benefit from local expertise. An example is the close cooperation with Innovation Village in Uganda. ITC also consults with international partners such as Seedstars and Funzi to extend the type of support provided to the beneficiaries.

Challenges

The tech ecosystem in in developing countries is still small. Few start-ups have achieved substantial results on the domestic market, fewer even abroad. The funding situation is improving but is still under-resourced in the amount of venture capital. There has not been a great deal of external investor attention for African start-ups; the lack of local venture capital prevents young entrepreneurs and start-ups from accessing seed and growth funding. At the same time, established companies, which have a record of accomplishment in exports, are not able to scale up, due to limited resources and expertise, which hampers opportunities for their business development.

Another issue that must be addressed is the type of work done by women. Based on observations and discussions with industry stakeholders, women tend to be concentrated in lower-skilled BPO jobs – such as data entry and image tagging. They make up a small percentage of managerial, maintenance and design personnel in networks, operating systems, or software design. Thus, it is crucial to ensure wider participation of women in digital entrepreneurship.

All the above factors ultimately need to be addressed to allow digital entrepreneurship to reach a critical mass and make the African entrepreneurs visible and successful internationally.

Startup services offered by ITC based on level of maturity

Start-up services \ Maturity	Ideation	Entrepreneurship	Growth
Access to e-learning courses through the SME Academy	✓	✓	✓
Training on business-model and value-proposition canvases with an internationalisation focus (or domestic for pre-incubation)	✓	✓	✓
Access to ITC Procurement Map	✓	✓	✓
Advisory in the design of marketing materials (brochure, one-pager ...)		✓	✓
Promotion through various online and offline channels (directory, social media, articles)		✓	✓
Acess to various training sessions		✓	✓
Preparation of a sales pitch with a focus on international investors (domestic investors for pre-incubation)			✓
Showcasing to potential investors (venture capital, business angels)			✓
Participation in national and international startup events (CEBIT, SLUSH, 4YFN...)			✓

Insight from Commissioner Mr Patrick Masambu (ITSO)[4]

The Global Broadband Plan for Refugee Inclusion and the use of satellite technology to reach coverage

An unprecedented 25.9 million refugees and 41.3 million internally displaced people around the world have fled their homes in search of safety, and often struggle to access the basic means of survival.[5] In 2016, the United Nations High Commission on Refugees (UNHCR) set out a new goal of universal connectivity for refugees. The UNHCR Goal aligns with International Goals for Refugees and Development and with the United Nations 2030 Agenda for Sustainable Development, in which there is an international consensus on the importance of connectivity for refugees and development. A Global Broadband Plan for Refugee Inclusion was developed during 2018 and early 2019.[6]

As UNHCR noted, connectivity is critical for refugees, not only to obtain vital information and access to basic services, but also to communicate with families and friends and link to the social, national, and global communities around them. Universal connectivity to the internet can also provide access to education, job training and even jobs themselves in some countries. For example, the Instant Network Schools program (a joint project of the Vodafone Foundation and UNHCR) aims to integrate technology in classrooms by providing training, solar power, connectivity and tablets with offline content.[7]

To reach UNHCR's Connectivity Goal, there are three gaps to focus the efforts on: (i) an access gap; (ii) an adoption gap (when refugees have access to a network but do not connect, generally because costs are too high or there are legal barriers to obtaining service); and (iii) a utilization gap (when refugees, supporting organizations and host countries do not fully use the opportunities created by the internet to improve service delivery and prospects for self-reliance). If one of the three gaps is closed it will be easier to close the other two gaps.

Role of satellites to reach the Connectivity Goal for refugees

Satellite can play an important role in overcoming the first infrastructure gap regarding access, when refugees are in locations without a network capable of offering an internet connection. During the first phase of an emergency situation, the initial equipment is often mostly satellite based, to allow quick access to connectivity. On a long-term view, satellites need to be part of the solution planned when trying to find the best combination of technologies to lead to the most effective technical and financial solution.

Satellite technology's reliability helps to ensure that critical services (emergency aid and first response, utility networks, transportation systems, border control and security, etc.) are available at the beginning of the immediate crisis period (first sixty days) and facilitate the coordination of crisis management and the work in the field units. As such, satellite broadband should be regarded as part of a country's critical national infrastructure.

In addition, when it comes to the long-term crisis period, in order to overcome the gaps in connectivity, it is essential to improve infrastructure coverage and quality, and to use a combination of technologies to connect the most remote and marginalized communities. Refugees face this access gap, which is particularly acute in rural areas. Only 17 per cent of rural refugees have 3G coverage and 20 percent of refugees have no mobile coverage at all. Many refugees living in rural camps have no, or very limited, access to electricity, further hindering access to connectivity.[8]

Insight from Commissioner Mr Patrick Masambu (ITSO) (continued)

Terrestrial technologies, like fiber optic cables, require investments in infrastructure that are costly in regions of low population density and remote regions where refugee camps are often implemented. Therefore, satellite broadband can play a crucial role in connecting these low population density areas, where terrestrial broadband is not cost effective. The broadband framework for these regions needs to adopt a mixed broadband ecosystem with both terrestrial and satellite technology.

Most of the populated world is already covered by satellites, so the primary investment needed is for the ground equipment and the cost of usage (which is independent from distance or number of subscribers). Due to the fact that satellites are point-to-multipoint systems, they can reach all geographic targets within a given area.

The use of satellite technology is also helping in the management of refugee camps through camp mapping, to ensure the camps are being built and maintained efficiently and sustainably (location of shelters, water sources, etc.). Satellite mapping also enables humanitarian workers to plan the best strategy for the deployment of aid and facilitates the monitoring of the growth of refugee camps.

Conclusion

There are similarities between the challenges faced by refugees and developing regions of the world in accessing and utilizing connectivity. After the emergency response to a crisis during its first period, an essential coordination mechanism needs to be developed to improve access to connectivity for both refugees and populations living in underserved areas. All stakeholders and communities — host countries, donors, international institutions, technical experts, policy experts, nongovernmental organizations (NGOs), civil society and private sector — have a role to play to close the connectivity gaps and mitigate many problems faced by refugees and their host countries. Therefore, to reach universal connectivity for refugees, it is essential to strengthen partnerships between refugees and host communities and between governments, civil society and the private sector, taking into account any existing strategies or National Broadband Plans in the host countries. We have a collective responsibility to take advantage of information and communication technologies (ICTs) to provide essential services to refugees, and beyond this, to underserved populations.

Insight from Commissioner Dr Chang-Gyu Hwang (Korea Telecom)

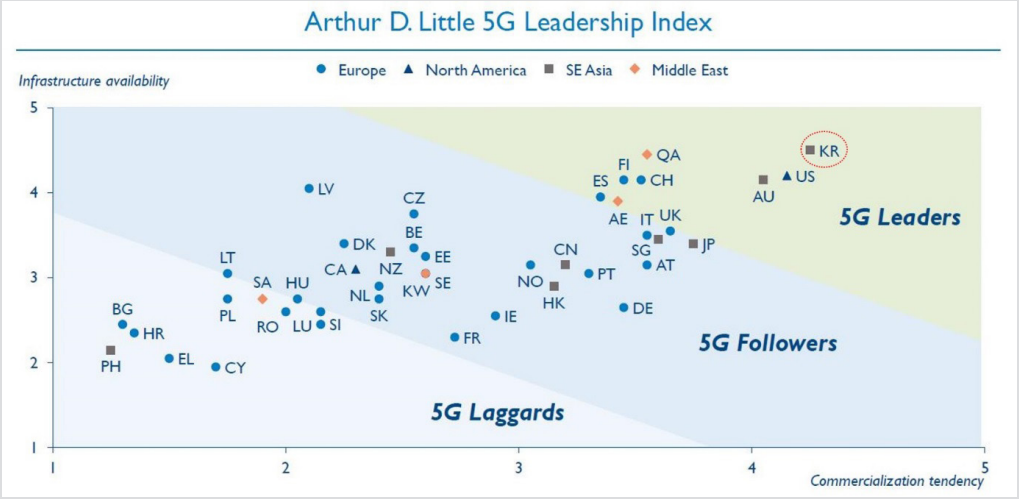
5G commercialization and the future economic impact

On April 3rd, 2019, South Korea has launched smartphone-based 5G commercial service. The 5G commercialization, realized earlier than expected, brought more than 300,000 subscribers in the first month and one million subscribers in 69 days. Looking ahead, it is forecast to reach 3.8 million connections by the end of this year and 41 million connections by 2025.[9]

As for Korea Telecom (KT), the Chairman and CEO, Dr. Chang-Gyu Hwang, first announced the vision of 5G at Mobile World Congress (MWC) Barcelona 2015, and KT has successfully showcased 5G trial services in 2018 PyeongChang Olympic Winter Games, leading to a nationwide 5G service in April 2019.

In March 2019, Arthur D. Little (ADL) has evaluated and reported on over 40 countries' level of 5G implementation and/or readiness. The 5G Leadership Index was based on detailed analysis of technical infrastructure and tendency for 5G commercialization. South Korea ranked first in a global evaluation of 5G.

Arthur D. Little 5G Leadership Index (Source: ADL)

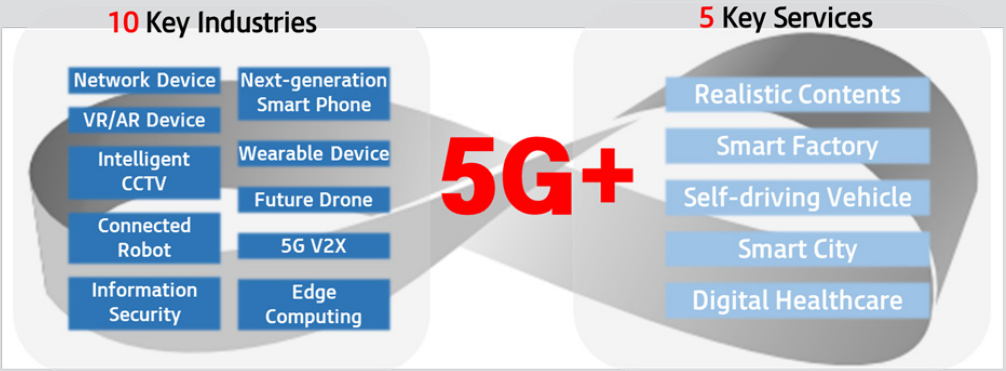


"The 5G Leadership Index is based on detailed analysis of technical infrastructure and tendency for 5G commercialization. 5G Leaders have 5G spectrum allocated, high performance backhaul infrastructure deployed, have announced ambitious goals for 5G launch or launched already, and have successfully trialled multiple use-cases. They demonstrate a willingness to adopt new services and have the right level of competition to foster commercialization, stated ADL.

Insight from Commissioner Dr. Chang-Gyu Hwang (Korea Telecom) (continued)

In April 2019, the Korean government announced the "5G+ Strategy", to promote "Strategic Industries" which would contribute to the creation of 600,000 jobs, to an increase of USD 151 billion in production and USD 73 billion worth of goods and services exported by 2026. The Strategic Industries consist of ten "key industries" and five "key services". The ten key industries are network device, next-generation smartphones VR•AR device, wearable devices, intelligent CCTV, future drones, connected robots, 5G vehicle-to-everything (V2X), information security and edge computing, while the five key services include realistic contents, smart factories, self-driving vehicles, smart cities and digital healthcare. The Korean government is going to promote 5G+ Strategy through its "Big Projects" in two stages. The first stage will focus on developing "primary services" in five industries; the second phase, will encourage the projects to be spread in general, by 2025.

5G+ Strategies: Ten "Key Industries and Five "Key Services" (Source: MSIT)



According to the KT Economic Management Research Institute, analysis indicates that in ten industry verticals – vehicles, manufacturing, healthcare, transportation, security and safety, media, energy, logistics, financial services – and four surrounding environments – smart city, smart office, smart home, rural areas – will roughly equate to USD 40.1 billion by 2030 which are expected to take 2.08 percentage point of GDP in 2030.

5G-based smart factories in manufacturing fields, for example, is expected to be one of the most impactful innovations, transforming traditional industries. The human-centric factory floor is being converted to fully-integrated automatic manufacturing through emerging technologies, such as IoT and AI, and through data-based decisions and insights. Mobile operators and solution developers are creating various use cases; predictive maintenance based on IoT sensor data, labour augmentation and management, automated guided vehicles and VR training for manufacturing. By reducing potential for human error and maximizing production capabilities, the manufacturing industry will bring value of less than USD 13.1 billion.

Insight from Commissioner Dr Chang-Gyu Hwang (Korea Telecom) (continued)

5G-based self-driving car, which KT has shown in 2018 PyeongChang Olympic Winter Games and is license-testing in Pangyo city in South Korea, is another key sector. 5G mobile networks, allowing self-driving vehicles to send data at high-speed and low-latency with hyper-connectivity, enable data communication, including pedestrians and vehicles identification information and modified navigation routing when accidents occur, in a real-time. 5G will create safer self-driving environments; KT Economic Management Research Institute predicts that the smart automotive market is estimated to be valued at USD 6 billion.

Looking further ahead, it is forecasted that the media industry which needs massive amount of data processing using VR and AR will grow at a rapid pace. Wireless VR games and contents based on 5G, especially, is likely to accelerate growth of the media market. Through its technology such as immersive media, the media industry will generate USD 3 billion USD by 2030.

5G economic impact estimation

Year	5G Beneficial Impact (est. in billion U.S dollars)		GDP Ratio (est.)
2025	**Total**	**25.4**	1.51%
	Industry	21.2	
	Environment	4.2	
2030	**Total**	**40.1**	2.08%
	Industry	35.6	
	Environment	4.5	

- Ten Industry Verticals: vehicles, manufacturing, healthcare, transportation, security and safety, media, energy, logistics, financial services / Four Surrounding Environments: smart city, smart office, smart home, rural areas (Source: KT Economic Management Research Institute).
  USD 1 = KRW 1190.5

The estimated numbers from KT Economic Management Research Institute are assessed on the basis of predictable key services indicators. New markets are is expected to show huge socio-economic impact, globally.

Insight from Mr Rob Shuter (MTN)

Improving digital inclusion requires us to ensure that people have access to reliable networks and affordable internet-enabled devices. Consistent with the Broadband Commission's focus on digital skills, literacy and local content it is also important that they understand how to use digital communications effectively to enhance their lives.

MTN's approach to enabling access and affordability is positioned within the growth through digital and data, and the technology excellence pillars of the BRIGHT strategy.

To connect more people and achieve our objective of growth through data and digital services, we adopt a dual data strategy. This strategy is aimed at reducing the digital divide between urban-based customers and those in rural areas more effectively. High-value customers, an established market predominantly in major cities, generally have more disposable income to invest in smartphones and can access networks more easily than other customer segments. Reliability, network performance, 24/7 connectivity and speed are some of the critical aspects required by these customers. Customers who have lower incomes or who may be based in rural areas (MTN's volume segment) comprise approximately 70% of our market. These customers value basic affordable connectivity on internet-enabled phones. Attracting these customers requires MTN to offer the types of services and content that are most relevant to their needs.

The MTN Approach

We developed the CHASE framework to address the needs of lower-income segments and customers based in rural areas. These customers generally face five key barriers to internet access, namely coverage, handsets, affordability, service bundling and education.

MTN CHASE Framework

Implementing and realising the shared benefits of CHASE is a medium to long-term goal. We commenced implementation of programmes designed to improve network coverage in rural and low-income markets and identified ways to increase the affordability of mobile handsets and data services. We simplified how some of the services that we offer are bundled to enable customers to manage their costs and access their desired data services more easily. Digital literacy, or the ability of our customers to find and effectively use the internet and social media services, is key in closing the digital divide. While we commenced work on this, more needs to be done.

Insight from Mr Rob Shuter (MTN) (continued)

Co-operative partnerships with vendors and other organisations that share our vision of digital inclusion as a means of driving social and economic transformation in our markets are fundamental to the realisation of our CHASE objectives.

Coverage

We aim to connect the unconnected. Some of the constraints that hamper connectivity include distant locations and scattered areas of settlements, the lack of energy, road infrastructure and security in remote areas, the cost of civil engineering and radio and transmission equipment, and site maintenance access and costs. We partnered with Facebook on the Telecom Infra (TIP) OpenCellular Project and Rural Africa programme to explore the application of cost-effective network technologies from start-up vendors working to meet the connectivity and data coverage requirements of people in sparsely populated and low-income areas.

Laboratory trials with partners on 2G and low capacity infrastructure to address some constraints have proved promising. Technologies appear to deliver what rural customers require, reliably and affordably. In Nigeria and Zambia, 60 trial sites in each country testing 2G, 3G and 4G technologies are now in place. Piloting different models and technologies in rural areas will provide us with insights into technical feasibility, service performance and customer requirements. The objective of these trials is to determine if new networks can meet the requirements of customers in rural areas and can be rolled out commercially. Plans are underway to extend similar solutions to seven additional countries in the near-term.

> *We implemented cost-effective, quick-deployment, solar-powered sites in remote rural areas in Ghana, Nigeria and South Africa. Anecdotal feedback from customers indicate their relief in no longer having to walk long distances to areas with network sites to make calls and access the internet.*

It is critical that the partners we work with ensure a lasting socio-economic impact on the communities where our solutions are implemented. This is achieved by training local people to build and maintain sites, and to manufacture some of the equipment or resources needed to operate sites.

Internet-enabled affordable handsets

One of the achievements we were pleased to realise in 2018 was the development of a 3G smart feature phone through a partnership with China Mobile, UNISOC and KaiOS technology, for launch in 2019. For the majority of MTN's customers, the cost of traditional smartphones is out of reach. At US$20 the MTN Smart 3G feature phone offers several smartphone-type services and functions enabling internet connectivity, is more affordable than other smart feature phones and has a long battery life.

Combined with our coverage plan for rural areas, enabling people to use data services on affordable connected devices such as the MTN Smart 3G feature phone, instead of relying on handsets that allow voice and text services, only can open a world of opportunities for people to transform their daily lives. We aim to ensure that 10 million more people can use MTN's smart feature phones to connect to the internet in the next three years.

Insight from Mr Rob Shuter (MTN) (continued)

Affordability

The reasons for the affordability challenges with the cost of data are complex and interrelated and include the cost of capital and other network investments, the availability of radio frequency spectrum required for coverage and speed of connectivity, the need to ensure universal access to digital communications, and other aspects. Despite such challenges, we continue to actively seek ways to reduce costs and enhance access to data and related mobile services.

We are currently reviewing how we price and package our data services, especially on entry-level data bundles. Our objective is to increase affordability of broadband access and facilitate access to content that is specific to the needs of our customers. For instance, we now offer Facebook Flex, an entry-level service that allows people to browse Facebook for free, even if their data has been depleted. This allows people to tangibly and affordably experience the benefits of connectivity.

Service bundling

Our objective is to bring the most relevant content to the communities we serve in the most affordable manner. This includes simplification of how data and services are bundled. We introduced app-specific bundles and time-based bundles that are easier to understand and use in several markets.

Structuring access by listing the most popular social media services that people use makes it easier to understand communication costs (compared to selling data by describing the megabytes or gigabytes that people can purchase). Time-based data bundles allow customers to manage their budgets by purchasing access to services for defined time periods, eg one hour's worth of access to Facebook and Instagram or WhatsApp. This also allows customers to only pay for the services they most wish to use.

Education

Digital literacy is an understanding of how to use computers, tablets and cellular phones effectively, improving how people connect, live and enhance their lives. In 2018, our focus on education included marketing campaigns, educational events and upskilling our on-the-ground sales force. We have more work to do on educating our connected customers and we intend to focus more closely on this aspect going forward. We have partnered with GSMA on the Connected Society programme to localise their Mobile Internet Skills Training Toolkit (MISTT) for our markets. The MISTT is a visual, easy-to follow curriculum that helps trainers demonstrate the functionality and value of the internet on internet-enabled mobile phones.

Insight from Commissioner Mr Rajeev Suri (Nokia)

Connectivity: the word's great green hope

Climate change is happening – and humans are accelerating it.

Research suggests that if greenhouse gas emissions continue at their current rate, global temperatures are likely to rise by between three and five degrees centigrade in the next 80 years. This would lead to tens of thousands of species extinctions, millions of human deaths and trillions of dollars of economic damage.

Quite rightly, the UN has made it clear that things need to change. That is why it included action on climate change as one of its Sustainable Development Goals.

The Broadband Commission too has been vocal on this issue. In 2016, for example, we released a statement during the Marrakech Climate Change Conference explaining how broadband technologies can help economies to cut emissions. And we have mentioned many times that digitalization of economies can help increase productivity while decreasing waste.

But this is crunch time. We must do more. We must speak louder.

My view is that our own guidance compels us.

The Broadband Commission's first target is that "by 2025, all countries should have a funded national broadband plan or strategy, or include broadband in their universal access and services definition".

People tend to read this as a simple appeal for better connectivity. But given what we now know about climate change, and about the power of digitalization to combat it, I believe that this target has a second, arguably more important interpretation: that national broadband plans have a critical role to play in averting climate catastrophes.

Research shows that information and communications technology, including broadband, could enable a 20% reduction of global CO2 emissions by 2030.

The ultimate aim is for entire sectors and nations to digitalize. But the telecommunications sector needs to lead by example. And I am proud that Nokia is taking this responsibility seriously.

We believe that environmental impact must be considered across the life-cycle of all our products, from design to end-of-life. Designing key components in-house makes things more efficient, whereas our end-to-end portfolio means that we also have a good view of energy wins in the field – so, for example, many of our products use components that 'go to sleep' during off-peak periods.

Further gains can be found at the cutting edge of technology. Look at base stations. They are vital for linking user equipment, such as mobile phones and laptops, to a network. But they can also be energy-intensive. In an industry first, our new 5G model is liquid-cooled – meaning it delivers a 30% cut in energy expenses and an 80% cut in CO2 emissions compared to older models. One of the base stations, installed on an apartment block close to our Finnish HQ, is even hooked up to the building's central heating system, so the waste heat is put to good use.

The rapid, almost exponential increase in data traffic presents further opportunities for efficiency. As 5G ramps up and more and more connected devices enter our workplaces, streets and homes, we expect data transmission to hit 163 zettabytes annually by 2025, up from about five in 2014. Just to put that into context, a zettabyte is one sextillion bytes. Or a one with twenty-one zeroes.

This need not mean an equally rapid increase in energy use. For example, a small cell close to a user, with a clean line of sight, taking advantage of several antenna elements to improve the quality of the radio channel, can achieve much higher spectral efficiency than a large,

Insight from Commissioner Mr Rajeev Suri (Nokia) (continued)

high-power cell. In other words, you can transmit more data while consuming less energy.

Also, 5G is natively green technology. Its technical definition includes new features such as 'lean carrier' – a way to reduce signalling interference, meaning data travels quicker and more reliably. Technologies like this make 5G about 50-60% more energy-efficient than 4G.

But what about sectors other than telecommunications? What environmental benefits can they glean from better connectivity?

The answer is: plenty. Particularly in asset-intensive industries.

In the agricultural sector alone, digital technology could increase crop yields by 30%, saving over 300 trillion litres of water and 25 billion barrels of oil per year while at the same time accelerating economic growth.

Or look at manufacturing. We have built our own 'conscious factory' in Oulu, Finland, and found that greater connectivity has led to radical improvements in efficiency and waste. Some examples include:

- Maintenance and training carried out via augmented and virtual reality, reducing the need for engineers to attend locations in person. This allowed us to avoid about 120 flights in 2018, which saved us around €220,000 and of 79 metric tons of CO2 emissions.
- Automatically optimising every stage of the manufacturing process by building a 'digital twin' of the entire production line, with artificial intelligence and machine learning built in, requiring less stockpiling and transportation.
- A 'conscious supply network' which has been able to remove 2,500 cubic meters from the supply network, saving €500,000 in the past six months.
- Predictive maintenance, where the performance of mechanical assets is monitored remotely. Artificial intelligence and machine learning software predicts the point at which the asset starts to lose efficiency, so it can be maintained ahead of time.
- An intelligent power-off system that shuts down facilities wherever possible. In 2018 this reduced the conscious factory's electricity costs by about 10%. We expect these gains to double as we use the cloud to make our processes more efficient.

Every other sector, from mining to aviation, could see its own gains along these lines. Making physical assets more efficient, reducing waste and ultimately enabling simultaneous economic growth and emission reductions: the holy grail of green business.

But it isn't a given.

We need governments to recognise, and legislate for, the role that telecommunication plays in greening economies. We need forward-looking regulation. We need new rules and incentives that make it easier to invest in connectivity.

Most of all, we need co-operation.

I am optimistic. In September of this year, UN Secretary-General António Guterres will convene a Climate Summit. Government leaders, the private sector, academics and representatives from across civil society will all be there. The ambition is to come up with a plan to increase and accelerate climate action.

The Broadband Commission will meet again around the same time. As leaders in our field, we have a responsibility to pull our weight. Every Commissioner should think about how our expertise and experience could inform the wider debate, at the U.N. and elsewhere.

We don't have much time. Climate change is real. But so are the weapons to fight it. Let's stop prevaricating – and start using digitalization to save our planet.

Insight by Commissioner Dr Nasser Mohammed Marafih (Ooredoo Group)

Advocacy Target 3: Getting People Online & Advocacy Target 4: Digital Skills and Literacy

Becoming digital enablers

A philosophy Ooredoo shares with the Broadband Commission for Sustainable Development is that access to broadband is vital for sustainable development.

Ooredoo is passionate about mobile technology as a tool to bring positive social and economic change across the communities in which we operate. Across our global footprint we are working to become digital enablers, empowering our customers through digital services.

Our networks are the key infrastructure of knowledge-based economies, easing access to financial services and facilitating innovation. They support new approaches to social interaction and aid the delivery of healthcare, education and public services.

Connecting the unconnected

Our investments in infrastructure and innovation aim to bridge the digital divide and change lives for the better around the world.

This means investing to help our networks reach the most remote and underserved communities that we operate in as well as working to overcome gender and cultural norms to bring more people online and help create fair and equal access for all.

For example, in Myanmar we are rolling out 2G and 4G in parallel to help bring more people online in Myanmar. Ooredoo Myanmar's "rural IVR" service is especially designed to provide farmers and Myanmar's rural population (which accounts for 65% of its total population) with a digital solution that can help them on a daily basis.

In Palestine the launch of our operations in Gaza, and subsequent launch of 3G, helped connect communities to the global digital economy, and the opportunities and progress this represents.

The digital divide: Equal opportunities in education and healthcare

Efforts to reduce digital illiteracy in the communities we serve often starts with reducing inequality for children's access to education. We work to break down the barriers which prevent children and students from accessing education.

In Iraq to help reach children affected by the conflict, we partner Ericsson and the International Rescue Committee (IRC) on a Connect to Learn project in schools in Domiz Refugee Camp. Connect to Learn is a public-private partnership that uses ICT solutions to promote universal access to quality education.

In Myanmar we support the Tech Age Girls initiative which aims to empower girls with access to information, books, materials and digital skills. In Indonesia we launched a digital learning programme called Indonesia Belajar and in the Maldives we are the co-founders of a Smart Campus which enables students and teachers to connect and collaborate from anywhere within the archipelago.

Insight by Commissioner Dr Nasser Mohammed Marafih (Ooredoo Group) (continued)

In communities with poor access to healthcare our services can be a lifeline to professional medical care. In addition, Ooredoo's mobile health clinics initiative provides basic healthcare services to people in remote and rural areas, with a focus on mothers and infants. Ooredoo's mobile health clinics support local communities in Algeria, Indonesia, Myanmar and Tunisia. In line with this commitment, Ooredoo Myanmar has partnered with United Nations Office for Project Service (UNOPS) to address high rates of childhood mortality and bring better primary healthcare to people in need, with a focus on women and infants.

Beyond access; Building digital skillsets

As new digital economies continue to emerge, it is important to help people build the digital skills, confidence and ability to succeed in these new economies, as well as equipping people to reach their full potential. Ooredoo works with partners to develop initiatives which help people build their digital skillsets as well as developing sustainable and transferable skills which ultimately help them to get the most out of the internet.

For example, in Myanmar Ooredoo has contributed to the development of the first 5G-ready Technology Centre. Launched last December in collaboration with the Yangon Technological University and Nokia, the Nokia Technology Centre was equipped with advanced network solutions to support the latest 5G technology and will offer postgraduate diploma programmes alongside internships to provide education and exposure to the technology industry.

In addition, Ooredoo Myanmar's digital libraries project connected 90 libraries to the internet as well as providing training programmes, Ooredoo Oman launched free digital education to all through the Oman Digital Tutorial App; Indosat Ooredoo's INSPERA helps digitally empower women; Asiacell has partnered with Wikipedia in Iraq; and Ooredoo Tunisia's Najjahni service connected more than 400,000 people to new digital learning and employment opportunities in 2018.

Connected communities: Making sure we don't leave anybody behind

Accessing communications is not only about geographical coverage. We want all members of the community to be able to access the opportunities provided by mobile services.

For example, in Ooredoo Oman, since 2014 we have offered a Mousbak prepaid package called 'Freedom' to customers with an Omani Disability Card issued by the Ministry of Social Development. This gives cheaper calls and data and is available nationwide.

In communities across our global footprint, one of the biggest barriers to connectivity is a lack of digital literacy. In our markets Ooredoo works to reach underserved communities and help them access the technology which is all around them.

A campaign we recently launched in Myanmar aims to inform and educate first time and new internet users in the country, through one-on-one training at Ooredoo retail points and exclusive stores across the country, particularly in rural areas. This initiative aims to guide people through the multiple uses and benefits of the internet and help them to do so responsibly – to be safely connected, well informed and benefit from the internet.

Insight by Commissioner Dr Nasser Mohammed Marafih (Ooredoo Group) (continued)

In Oman Ooredoo runs a digital literacy Springboard programme which looks to empower women by helping them to leverage the full potential of the internet, discover the benefits smartphone technology, filter online content to protect children from spam and maximize the digital landscape for educational purposes.

In the Maldives Ooredoo has taken a citizen-centric approach to helping make the community as a whole more tech savvy, increasing awareness of digital solutions and teaching people how to make the best use of these technologies. This has included digital literacy programs to teach digital skills to senior citizens.

Working hand-in-hand with governments and other stakeholders, Ooredoo is committed to continue its delivery of universal and affordable broadband services to developing regions and nations. As we deploy the power of digital technology to give people access to the services and support they need, we urge governments, operators and regulators to work closely together to harness the power of next-generation networks and address the deepening digital inequality in global connectivity.

Insight by Commissioner Mr Bocar Ba (SAMENA Telecommunications Council)

Since 2012, the UN Broadband Commission for Sustainable Development has made a number of valuable recommendations to address demand-side internet adoption barriers, including recommendations on the review and updating of ICT regulations, considerations of converged regulations and unified licensing regimes, reductions in taxes and import duties on ICT equipment, stimulation of local content and enhancement of broadband demand through e-government initiatives, as well as the encouragement of cross-border content flow.[10] Key recommendations on how to enhance demand to close the broadband gap were also made by the Expert Group to the UN Broadband Commission in its report "A new Deal: Investing in our Common Future – Policy recommendations to close the broadband gap".

To ensure that digital services can flourish, an appropriate enabling environment is needed. In this regard, SAMENA Telecommunications Council's Working Group on Digital Services has developed a proposal of a high-level Policy, Legal, and Regulatory ("PLR") framework for digital services to (1) provide an overview of key policy / regulatory enablers needed with the ultimate aim of achieving a level playing field for all ICT stakeholders to provide digital services, and (2) identify the best governance model, i.e. at what level, within what type of structure, and which body can drive, implement and monitor the proposals. The framework's main purpose is to serve in a contextual capacity to provide high-level guidance to governments and regulatory authorities across the SAMENA region (and beyond) in creating a thriving and supportive digital ecosystem that drives the development and emergence of innovative and meaningful digital services and can help push meaningful connectivity to 100%.

SAMENA Council proposes that a digital services framework be embedded in the National Digital Agenda through specific policies, frameworks and laws as well as regulations and guidelines. It is proposed that the key enabling blocks at the policy level, together with their supporting laws, regulations and guidelines, cover a framework on overall digital services provisioning, comprising frameworks on cross-sector licensing, harmonized spectrum, cross-border data flows, data privacy, cyber-security and penalties for cybercrimes, and legitimizing online transactions through electronic authentication and corresponding internationally recognized standards (personal ID, documents and sources). Also, such a framework should include horizontal policies in areas including competition, data- and consumer protection, and child online protection. Moreover, to make such a framework effective and useful, it should include a governance component to ensure that policies and frameworks and their implementing laws and regulations are executed, and that qualitative evaluation of progress in the proliferation of services is possible.

From a policy perspective, SAMENA countries, especially in the GCC region, are largely on track, having adopted Economic Visions and Digital Agendas with horizons up to 2040, that set out key objectives and steps to be taken to further digital transformation toward building Digital Economies. These include, for example, Saudi Arabia's Vision 2030, UAE 2021-2030 Vision, Oman Vision 2040, Jordan 2025[11], and others. Moreover, efforts are being made in reviewing and adapting current regulatory frameworks, including on topics such as general competition law, consumer protection and data privacy, and introducing new regulatory frameworks with regards, for example, cloud services or IoT (see Saudi Arabia).

However, more needs to be done in order to allow and facilitate, e.g., telecommunications operators to lay the groundwork for digital services provision, including upgrading their networks and rolling out 5G capabilities, transforming and scaling their operations beyond national boundaries through virtualizing their networks to offer digital services with the help of remote service provisioning, which may, for example, include the storing and processing of data outside the home country.

Insight by Commissioner Mr Bocar Ba (SAMENA Telecommunications Council) (continued)

While digital services can constitute bespoke local solutions, their underlying deployment models can have global dimensions, where elements of the value chain can be spread across different countries and regions, as otherwise service provision in smaller, local markets can be uneconomical. This is particularly important in the context of some of SAMENA's sub-regions, such as the GCC, where market sizes are relatively small. Other impediments include legacy standards and regulation, narrow licensing requirements (siloed approaches), strict national data localization requirements or the absence of a cross-border approach to data privacy and management, as well as the lack of coordinated cross-border cybersecurity approaches. Therefore, global dimensions need to be reflected in a digital services framework to facilitate a thriving digital services ecosystem that can support the achievement of national transformation plans and economic visions.

With the creation of a policy, legal and regulatory framework for digital services, which will be published in due course, SAMENA Council takes a step forward that can help better focus efforts in terms of industry priorities, and enhance or accelerate co-operation building efforts not only between the private and the public sectors, but also to shift the focus to adopting a broader than national view when it comes to digital services ecosystems, that do not stop at national borders. As highlighted above, digital services deployment models hinge on scale and may therefore be broader in scope. Governance and policy frameworks in the digital age need to reflect this too.

Insight by Commissioner Ms Kristalina Georgieva (The World Bank)

It is well understood that meaningful, universal connectivity can unlock complex challenges across a broad range of government services, industries, and citizens' basic needs- from health and education to transport, disaster risk management, or agriculture. Broadband internet has now become an essential service for individuals, businesses, and governments. It serves as the backbone of global digital economy. Yet, digital dividends – the broader development benefits from using new technologies – remain unrealized as the digital divide across and within countries remain wide. So, supporting universal, affordable, safe and inclusive digital connectivity is a key corporate priority for the World Bank Group (WBG).

To connect the roughly half of the global population which still lacks broadband access, special attention should be given to the lagging regions including countries facing conflict and violence as well as people in rural or remote areas. To meet this challenge, a holistic approach is needed that builds the foundations of the digital economy.

The World Bank Group is working across this agenda, bringing knowledge and financing in different areas.

Supporting policy and institutional reforms: Government commitment is a key success factor ahead of any major infrastructure investment. The WBG is therefore helping governments, companies, and other stakeholders implement agile regulations and sector reforms that lower barriers to entry in the telecoms sector, promote competition, and encourage investment. With the increasing concerns around privacy and data security, the WBG also supports governments to build the regulatory foundations that help create safe and inclusive digital economy.

Maximizing Finance for Development (MfD): One of the many requirements to achieve universal connectivity is closing the gap between investment needs and actual investment. Engaging the private sector is critical for this, as it increases access to capital, allows off-balance sheet borrowing, promotes innovation, and help transfers risks from the public sector. The World Bank is helping scale up partnerships with the private sector by emphasizing the Maximizing Finance for Development approach, which increases the role of the private sector as a source of finance, innovation, and expertise.

Financing large regional projects: Given the cross-border dimensions of digital connectivity, regional approaches generate economies of scale and scope as well as maximizing impacts and catalysing private investment. The WBG is supporting large regional projects to build digital connectivity across borders, and helping countries harmonize regional legal and regulatory frameworks, to lay foundations for regional digital economies. This includes ensuring regional interoperability of digital IDs, and harmonized policies and regulations based on common systems and standards.

Promoting cross-sector infrastructure sharing: While the cost to build or extend the networks is significant, sharing assets can dramatically reduce the cost and increase the efficiency of infrastructure development. The World Bank supports infrastructure sharing across sectors and among broadband service providers to leverage unused fibre optics and passive infrastructure. We are also supporting public and private partnerships for roads, railways, pipelines, and electricity transmission lines to achieve rapid and lower-cost development of long-haul fibre links for broadband.

Investing in digital skills and content: The digital divide also reflects barriers to productive use of technologies. Significant investment in digital skills and local content development is needed to increase the uptake of technology. Digital literacy allows people to use the internet, and more sophisticated digital skills are becoming critical to access jobs and help build local digital ecosystems. The WBG is committed to helping develop basic and higher-level skills to encourage the spread of digital technologies.

Insight by Commissioner Dr Mukhisa Kituyi (UNCTAD)

Digitalization and the rise of the platform economy are redefining how firms connect to their customers, suppliers, and the wider world at large. This makes it increasingly necessary for micro, small and medium enterprises (MSMEs) in developing economies, and especially in LDCs, to have affordable and reliable access to broadband ICT infrastructure and to make effective use of such access.

Most micro and small firms lag far behind large ones in terms of ICT use. This poses a significant problem to their effective integration into global value chains, which are becoming increasingly reliant on digital solutions. In most countries for which data are available, a lower proportion of small enterprises makes use of the Internet than large companies. And fewer smaller enterprises generally engage in complex tasks online. In countries where ICTs are less widely available, the share of smaller enterprises performing more complex online tasks also tends to be lower.

In the right circumstances, digital platforms can expand the opportunities for small enterprises in developing countries to reach new customers. However, access to global platforms and apps markets still varies tremendously. Participation in online platforms is generally more useful for those firms that compete in specific, well-defined market segments, such as niche trading in tourism and in value-added food products (e.g. ethical goods) as well as in regional and emerging market value chains. While such segments and markets may seem small, online platforms can help producers reach more clients and achieve sufficient scale and income generation.

UNCTAD's Rapid eTrade Readiness Assessments for LDCs offer concrete policy recommendations on how to create a more conducive environment for MSMEs to participate and take advantage of e-commerce and the evolving digital economy.[12]

Source:

UNCTAD (2017). Information Economy Report 2017: Digitalization, Trade and Development (United Nations: New York and Geneva).

Insight by Commissioner Mr Achim Steiner (UNDP)

Digital financing to achieve the Sustainable Development Goals

The 17 Sustainable Development Goals (SDGs) have captured the imagination of a global family increasingly concerned with the health of the planet and the well-being of its people. Nations, sectors and communities around the world have rallied behind the SDGs' inspiring vision- embracing it as a call for all to respond to; and not a mandate just for governments and development partners to fulfil.

The challenge lies in the execution- not least the question of how to finance the strategies and efforts necessary to achieve the vision by 2030. As the SDGs are fundamentally about driving transformational change, it is only natural to examine what has been the driver of great transformation across societies and economies and to explore how it could also move the needle on the SDGs-digital technologies.

The digital revolution has changed the world. The potential of digital technologies, including broadband connectivity, to propel progress is obvious. Whole industries have been reshaped and new ones formed as we enter what is being referred to as the "Fourth Industrial Revolution", marked by the prospect of higher productivity and improved quality of life. The world's financial systems have also evolved with this sweeping change, raising the potential for new mechanisms and tools; as well as new actors and new ways of doing business.

This is the backdrop to UN Secretary-General António Guterres' speech during the General Assembly in September 2018 in which he called for the creation of a United Nations Task Force on Digital Financing of the Sustainable Development Goals. The charge was to shed light on how the technology that is increasingly driving finance can steer it toward more sustainable investments and outcomes. At his request, I had the privilege to bring together this Task Force, with my co-chair, Maria Ramos, former CEO of Absa Group Limited. Together, we convened an impressive "brain trust", composed of chief executives of large commercial banks, mobile money operators, market disruptors, economic ministers, central bank governors and UN Executive Directors.

Since our inaugural meeting at the World Economic Forum in Davos in January 2019, we have engaged and mobilized stakeholders all over the world, convening "ThinkShops" and panels of experts and entrepreneurs in finance, technology and government in cities around the world. We issued a call for contributions yielding close to 100 papers full of ideas and experiences that we are analysing and distilling. We are less than halfway to our desired completion date in early 2020 and we already can discern important findings and insights.

Achieving the SDGs is less a matter of increasing the quantum of finance, and more a matter of reducing the barriers that constrain its optimal use. Trillions of dollars are needed annually to finance the SDGs. With global financial assets standing at US $300 trillion, we have ample financial resources. Redirecting just two per cent of those assets toward the SDGs would put us in good stead towards achieving our global goals. The evidence is clear that there is growing interest in investing to achieve the SDGs. Ordinary people want their pensions and savings divested from companies that do harm and invested in companies that do good, whether it is donating a pair of shoes or eyeglasses for every pair sold; or developing clean energy sources; or delivering high quality universal education.

Bigger investors share that sentiment, as evidenced by the recent launch of the Standard & Poor's 500 ESG Index, which includes "environmental, social, and governance" metrics into its rankings. We learned that we need more effective mobilization of public finance through digital efforts paired with better accountability in its use.

Insight by Commissioner Mr Achim Steiner (UNDP) (continued)

Digitalization is already supporting innovative financing for the SDGs.

Cheaper and faster data have supported progress in this area.[13] Billions of individuals and millions of small businesses have better access to financial services due to mobile connectivity, digital IDs and the use of big data and artificial intelligence in reducing costs of assessments and payments. Health and educational solutions are reaching remote locations because of increased ease of access and lower service costs. Pay-as-you-go solar energy units financed through crowd-sourcing and powered by mobile payment platforms are now in the hands of millions of low-income households, inspiring similar models around water and other essential services. Renewable energy finance overall is now 90 per cent funded by the private sector, propelled by financial and "green" data that prove it is a solid financial as well as environmental investment. The agriculture sector is also seeing an innovation boom, as digital technologies put more information on smart and sustainable farming in the hands of smallholders, enabling them to track crops across the value chain and meet the demand for fair trade and organic produce.

The sustainable development dividend from digital financing is neither inherent in the technology nor a guaranteed outcome of market innovation. Digitalization also brings uncertainty, risks and potential negative consequences. For instance, artificial intelligence could enable exclusionary profiling as well as enhance productivity; and high-speed connectivity could facilitate illicit financial flows as well as enhance transparency. Digital currencies could undermine countries' ability to manage their own monetary and economic affairs, just as easily as they could facilitate payments and catalyse productive financial innovations. More data do not automatically guarantee that what can now be measured will in fact be counted in financing decisions. Reducing the digital divide does not result automatically in reduced inequality and ensure no one is left behind as our economies becoming increasingly digital.

All these point to the need for *digital governance* to ensure that the benefits we envision from digital financing are realized and equitably shared, including the guarantees of citizens' access and control over financing decisions and thus their capacity to improve their own lives. The work of the Broadband Commission is helping inform policy decisions in this sphere, as governments and development partners increasingly see broadband connectivity as critical in SDG implementation. We have heard from the central bank governors on the Task Force that their work has taken on an existential dimension, requiring them to think deeply about what constitutes "a bank" or a financial institution, and to create safe spaces for innovation in a digital finance world without compromising their historic obligation of protecting the soundness of their countries' financial systems. International bodies for knowledge-sharing, not only within the Bretton Woods system but also newer entities such as the Network for Greening the Financial System and the Alliance for Financial Inclusion, become more critical as regulators consider new mandates.

Development is going digital and more about building a sustainable, inclusive digital future. Among UNDP's many efforts in this area is the roll-out of the Free Wi-Fi Internet Access in Public Places Project, which is a collaboration with the Department of Information and Communications Technology (DICT) of the Republic of Philippines. It is designed to help close the digital divide with a focus on the unserved and underserved communities. Our associated programme, the United Nations Capital Development Fund (UNCDF), which serves as the Secretariat for the Task Force, has enabled financial inclusion for millions of individuals; it is working with companies that provide jobs to youth in West Africa, financing for schools in Uganda, motorbike taxis in Nepal, and pensions for aging workers in the Solomon Islands. We have also launched a Finance Sector Hub, which includes a pillar that links digital financing with digital transformation as sustainable development pathway.

Insight by Commissioner Mr Achim Steiner (UNDP) (continued)

Ultimately, the measure of financial systems' success is how well they express and act on the will of citizens.

Historically, even when they have access to financial services, ordinary citizens have been at distinct disadvantage in navigating a financial system that is complex and opaque, often by design. In a system controlled by large, often monopolistic financial intermediaries, citizens are denied transparent information and thus deprived of meaningful choice, whether as savers, borrowers, consumers, owners of capital, or as holders of pensions or insurance policies.

By empowering people to be at the core of tomorrow's financial system, we can help to create a more sustainable world for all. The barriers between people and our money are often so great that we forget the US $300 trillion is collectively our money. What we need to overcome is a classic market failure of supply not meeting demand. It is a world which we can achieve by removing barriers and distorting subsidies to ensure a level playing field which puts a focus on citizens as the driving force For our financial system. Financial technologies developed strategically can help us to achieve this goal.

Insight by Commissioner Ms Phumzile Mlambo-Ngcuka (UN Women)

The potential of connected women

We live in an era of new frontiers for learning, employment and entrepreneurship in everything from information and environmental technology, to engineering and biotechnology. These changes create significant opportunities for women to thrive – but only if they are connected.

Connectivity and information and communications technology (ICT) can offer life-changing benefits to women and girls. Mobile money has transformed the lives of millions of women previously thought to be "unbankable", by enabling them to directly access financial products and services. Mobile technology has the potential to facilitate access to education for some of the 32 million girls who are out of school at the primary level and the 68 million at the upper secondary level,[14] and can be a lifeline for women who are elderly, dealing with disabilities or living in remote areas. Connectivity and ICT can also elevate women from being simply users of technology to becoming producers and leaders in the tech sector, ensuring that women influence the direction of the digital revolution.

Yet, half of the world's people remain unconnected[15], with women and girls in developing countries at higher risk of being left behind, given the fast-changing nature of digital assets and services, and their relevance for future employment and income.

As we prepare for a milestone year in 2020, we must ensure they are not left behind.

Looking ahead to Generation Equality

Next year, UN Women will mark the 25th anniversary of the Beijing Declaration and Platform for Action, our transformative blueprint for women's rights, with our new campaign: "Generation Equality: realizing women's rights for an equal future". Co-chaired by the Governments of France and Mexico, in partnership with civil society organizations and supported by other countries, the campaign will be an intergenerational celebration of the power of activism, feminist solidarity and youth leadership.

To fulfill the goals of Generation Equality, we need to fully harness the power of innovation and technology as "drivers of change" with unprecedented opportunities to break trends and reach those who are the most likely to be left behind. We need people of all ages and genders, and from all sectors and locations to be able to engage with the campaign, contribute to its advocacy and share ideas and information. The massive Generation Equality forums that we will be hosting in Mexico (May 2020) and France (July 2020) need to offer simultaneous satellite sessions, so that women and men can take part no matter where in the world they are. We will also need the expertise of the tech sector in forming "Action Coalitions" around the remaining barriers to gender equality to ensure that we are addressing issues such as connectivity, digital inclusion and digital equality.

I invite leaders from ICT and STEM industries around the world to join UN Women's Generation Equality campaign and work together to consciously target women and girls and ensure their connectivity and access to mobile devices and frontier technologies; to change gender stereotypes around women in tech industries; and to equip women with the skills they need to thrive in today's economy.

Insight by Commissioner Ms Phumzile Mlambo-Ngcuka (UN Women) (continued)

We know that when we work together, we can drive real change. We have seen this through the EQUALS partnership – with GSMA, ITC, ITU and the UN University – where we have been able to harness the power of ICTs and connectivity to accelerate global progress and close the gender digital divide. UN Women is also part of the Task Force on Digital Financing of the SDGs, which is critical to ensuring that the digital revolution reshapes finance in a way that brings opportunities for women and girls, while understanding and countering the threats to gender equality that technology can often amplify.

As leaders who can advocate for actions in the broadband field, each of us can work to ensure that Generation Equality kicks off progress that is irreversible and accessible to all women and girls. Let us bring our minds and collective resources together to make sure that connectivity is a human right, and that women's rights are connected rights.

Insight by Commissioner Mr Hans Vestberg (Verizon)

Education is the fuel that powers innovation and creates a more sustainable future. It is also critical to the effort to close the digital divide. The Broadband Commission through its recommendations and working groups has recognized this and placed consistent focus on the important role that digital skills and literacy play in generating demand for the Internet and in increasing the use of broadband globally. In the United States alone, millions of students lack access to technology in the classroom and at home. Without those resources they run the risk of being left behind in a world that grows ever more digital by the day.

Consistent with the Broadband Commission's focus on digital skills and literacy, and in recognition that Verizon's technology assets can have unique impact in addressing UN Sustainable Development Goal 4's call to provide young people with relevant skills for good jobs and entrepreneurship, Verizon has made significant, long-term investments in Science, Technology, Engineering and Mathematics (STEM) education in schools across the United States – supporting innovative programs that reach students in underserved areas.

Since 2012, Verizon and its non-profit foundation have collectively committed a total of $400 million to help under-resourced communities bridge the digital divide, impacting nearly 1.7 million students through education initiatives such as Verizon Innovative Learning. Verizon Innovative Learning has launched a number of programs since its creation that provide free technology, free internet access, and hands-on learning experiences to help give under-resourced students across the United States the education they deserve. These programs are powered by a next-gen, technology-infused curriculum that fundamentally changes the way teachers teach and students learn.

One of those programs, the Verizon Innovative Learning schools program, aims to transform middle schools with digital technology. This program launched in eight schools in 2014 and has grown steadily each year. During the school year that began in 2018, the number of schools that have participated reached 100. That same year, Verizon began creating Innovative Learning labs in select Verizon Innovative Learning schools. These labs are placed within the schools so that students can leverage next-gen technology to create and build products to further their interests in STEM and to positively impact their communities through social innovation. To date, 15 schools have been outfitted with technology and equipment, including video editing and production, 3D design and printing, Augmented Reality, Virtual Reality, robotics, circuitry, and more.

Recent recommendations of the Broadband Commission have emphasized the importance of empowering and supporting teachers to be digitally confident and prepared to train the next generation. Verizon has made investment in training for teachers an important component of Verizon's Innovative Learning programming. In 2012, Verizon began working in partnership with the International Society for Technology in Education (ISTE) to develop and deliver training and professional development for teachers in under-served communities on how to integrate technology into their classrooms. More recently in partnership with the national non-profit Digital Promise, Verizon provides professional development to middle school teachers to help them effectively leverage mobile technology to increase student STEM engagement and achievement. Teachers in schools with Verizon Innovative Learning labs are also provided with a specialized curriculum that helps them make the most of the labs in their schools.

Insight by Commissioner Mr Hans Vestberg (Verizon) (continued)

The Broadband Commission has also long-advocated for the promotion of STEM in primary and secondary education and in particular the importance of ensuring access for girls to study Information and Communication Technologies (ICT), and build skills in technology. Two Verizon Innovative Learning programs have been designed with these issues in mind. Focused on the needs of groups that are significantly under-represented in STEM fields: young men of colour and girls in rural communities, these programs introduce middle school students to next gen technologies such as Augmented Reality, Virtual Reality, 3D design and printing and more. The program for young men launched in 2015 in partnership with four Historically Black Colleges and Universities (HBCUs). By 2018, the program expanded to include 24 HBCUs and Hispanic Serving Institutions, and had reached 2,177 middle school boys. The program for girls launched in 2017 in partnership with 16 community colleges. It reached 1,297 girls in 2018.

Students in these programs collaborate on projects that solve for the challenges addressed by the United Nations Sustainable Development Goals. They also attend summer immersion on campus at partner community colleges and universities, as well as weekly enrichment sessions year-round. Also, they are connected with mentors and exposed to the career opportunities that STEM, technology and entrepreneurship hold for their futures.

Efforts to build skills and leverage the talent of young people will contribute to the ability of nations around the globe to increase economic prospects and to be globally competitive. These efforts also are critical to closing the digital divide. Verizon recognizes its opportunity to play a role in this important effort especially as commercial 5G has become a reality in 2019. On April 3, 2019, Verizon began offering for sale to consumers a commercial 5G mobile network using commercially available 5G-enabled smartphone. This launch, delivered ahead of schedule, was the first in a series of launches Verizon is rolling out in 2019 which will allow Verizon customers to have the power of 5G in their hands. We remain committed to the power of technology to drive economic and social development.

Insight from Mr Adrian Lovett (World Wide Web Foundation)

The last year has been marked by celebration but also contemplation. We've celebrated the world wide web's 30th birthday and the "50/50 moment", with more than half the world now online. However, we must also contemplate that IF the benefits of internet access are clearer than ever, so are the threats to our privacy, our democracy and our rights.

The State of Broadband 2019 report recognizes these challenges by focusing on meaningful universal connectivity, one that builds agency and can lead to positive impact. This considers the different ways in which people use the internet, the social and cultural norms that mediate how they use it, while addressing the challenges that the marginalized in society face when trying to get online. It calls for a combination of innovative demand and supply side strategies to achieve this kind of connectivity for all. Such strategies are also critical to achieving the 2025 Commission's Targets.

At the World Wide Web Foundation, created by the web's inventor Sir Tim Berners-Lee, we are working to address these challenges. In November 2018, the Web Foundation launched the Contract for the Web. The Contract recognises that the challenges facing the web demand commitments from the companies building web technologies, the policymakers defining laws and regulations, and the billions of people using the web every day. The Contract brings these actors together to collectively define our responsibilities towards ensuring a free, open and fair web for everyone.

The Contract for the Web is underpinned by a set of Contract Principles. These principles are high-level guiding statements that serve as the foundation of the Contract (see Figure 1). Backing these principles means endorsing the overall vision for an open web that is a public good and a basic right for everyone, everywhere, and also committing to engage in the process of building the full Contract by working openly and in good faith with other stakeholders who hold the same overall vision for the future of the web.

Contract for the Web Principles

Governments will:	Corporates will:	Citizens will:
• **Ensure everyone can connect to the internet** So that anyone, no matter who they are or where they live, can participate actively online. • **Keep all of the internet available, all of the time** So that no one is denied their right to full internet access. • **Respect people's fundamental right to privacy** So everyone can use the internet freely, safely and without fear.	• **Make the internet affordable and accessible to everyone** So that no one is excluded from using and shaping the web. • **Respect consumers' privacy and personal data** So people are in control of their lives online. • **Develop technologies that support the best in humanity and challenge the worst** So the web really is a public good that puts people first.	• **Be creators and collaborators on the web** So the web has rich and relevant content for everyone. • **Build strong communities that respect civil discourse and human dignity** So that everyone feels safe and welcome online. • **Fight for the web** So the web remains open and a global public resource for people everywhere, now and in the future.

So far over 250 companies (such as Google, Facebook and Microsoft) and 100 civil society organisations have signed on in support of the Contract principles, along with thousands of citizens from around the world. Six national governments, including France, Germany, Ghana and the UK, are also engaged in the process.

Insight from Mr Adrian Lovett (World Wide Web Foundation) (continued)

Since January, representatives from all these different sectors have been working together in five groups (Access, Openness, Privacy and Data Rights, Positive Tech, and Public Action) to turn the principles into a full Contract for the Web. These five working groups are wrestling with many of the same issues highlighted in the State of Broadband report. More specifically, the work of these groups is in direct support of the 2025 targets. For example, the latest draft of the full Contract requires that signatories and specifically governments will commit to the 2% affordability target (Target 2). Similarly, the draft includes clauses on promoting digital skills in the population (Target 4), and several clauses on effective broadband policies (Target 1).

In July the first draft of the full Contract for the Web was published for public consultation. While many agreements and declarations stop at high-level principles, the detail included in this draft makes clear that the Contract for the Web will go much further. More than just a statement of ideals, it will offer a roadmap of responsibilities and provide clear policy guidelines for companies and governments, as well as actions for citizens to participate actively and positively on the web.

The public consultation feedback will inform the drafting of the final version of the Contract, to be launched by the end of the year, along with the foundations of an ongoing accountability mechanism to ensure that the commitments made under the Contract are kept.

I'm proud of the role the Web Foundation is playing to help build a Contract for the Web. But alongside this work, we continue our evidence-based research and policy advocacy to bring more unconnected people online, working closely with local, regional, and global stakeholders. We host the Alliance for Affordable Internet, a coalition of governments, companies and civil society working in eight countries to drive down the cost to connect. Our work has helped drive policy changes that have brought affordable internet access closer for 628 million people – but there is still much more we need to do to ensure that the web is accessible and beneficial for all.

We back our engagement and advocacy with rigorous research. This includes research on the digital divide and the widening digital gender gap and how it manifests across urban, rural, age and geographical divides. This year we are producing:

- Representative household surveys in four countries, each of which sheds further light on how men and women access and use the web, their perceptions on digital rights, digital skills and content creation as well as affordability of internet access available to them
- Digital Gender Gap Audits (scorecards) that highlight key actions for all stakeholders (governments in particular) to address the barriers to universal, affordable access and those that specifically affect women and girls
- Regional and country snapshots, based on our Affordability Report, that highlight the progress being made in policies and regulatory reform and in targeting interventions such as public access solutions to close the digital divide.

We also support the report's recognition of the importance of thoughtful approaches towards meaningful, universal connectivity. We are developing a standard for meaningful broadband connectivity that will be critical for closing the digital divide.

There's never been a more important time to ensure that everyone has the opportunity to connect to a web that is empowering and respects their human rights. As the State of Broadband Report shows, there's still much work to do. I'm optimistic that working together, we can rise to the challenge.

Endnotes

1 Open trade, privacy, human dignity and a social model based on fairness and wealth distribution

2 A number of organizations have agreed that these are the principal barriers to digital inclusion, including: McKinsey, Huawei, Facebook, WEF, Ericsson and GSMA. See more in: USAID, Connecting the Next Four Billion (Feb 2017)

3 https://www.dw.com/en/mwc-in-barcelona-african-start-ups/av-47734922

4 Commissioner Patrick Masambu is the Director General of ITSO and participated as a Member of the Advisory group set up to support the Project team which recently developed the "Global Broadband Plan for Refugee Inclusion on behalf of the UNHCR".

5 Source: UNHCR https://www.unhcr.org/en-us/figures-at-a-glance.html

6 Source: Global Broadband Plan for Refugee Inclusion – Winter 2019. The full Plan can be viewed at https://www.broadband4refugees.org/plan

7 More information: https://www.un.org/partnerships/content/instant-network-schools-programme-united-nations-high-commissioner-refugeesunhcr and; https://www.vodafone.com/content/foundation/instant-network-schools.html

8 Source: Global Broadband Plan for Refugee Inclusion – Winter 2019. The full Plan can be viewed at https://www.broadband4refugees.org/plan

9 GSMA Intelligence, Global 5G Landscape (Q2 2019)

10 See recommendations contained in State of Broadband Reports: 2012 recommendations 7.4- 7.9; 2013 recommendations: 7.6-7.9; 2014: 7.3 and 7.5; 2015 recommendations: 6.4, 6.5, 6.6, 6.8; 2016 recommendations: 6.6-6.10; 2018: 5.7.

11 See http://www.jordanembassyus.org/blog/jordan-2025-national-vision-and-strategy

12 See https://unctad.org/en/Pages/Publications/E-Trade-Readiness-Assessment.aspx.

13 For instance, over the last five years, it has supported the issuance of half a trillion dollars of green and sustainable development bonds that has underpinned the emergence of carbon trading systems in dozens of countries.

14 UNESCO, Fact Sheet 48, available here http://uis.unesco.org/sites/default/files/documents/fs48-one-five-children-adolescents-youth-out-school-2018-en.pdf

15 "Half of the world's people are still offline. How do we connect them as quickly as possible?", Web Foundation, February 2019.

Annex 1: The Working Groups of the Broadband Commission

Since 2011, the Broadband Commission has supported and encouraged Commissioners to self-organize around additional and related topics to the Commission's focus on sustainable digital development. As such, 22 such Working Groups have emerged and developed research and policy position papers, presented on key issues and helped to spur additional programmatic efforts incubated in the respective Working Group.

This year, two Working Groups (on the Digital Infrastructure Moonshot for Africa, and on Child Safety Online) are currently in mid-stream of their efforts, with additional Working Groups forming.

- Broadband and Science (WG-Sci)- Chaired by VP European Commission- Ms Neelie Kroes-2011-2011
- Multilingualism (WG-M)- Chaired by President of CIPSH- H.E. Adama Samassekou- Since 2011
- LDCs (WG-LDCs)-Co-chaired by USG OH-RLLS- Mr Sidi Diarra- Since 2011
- Health 1 (WG-H)- Director the Earth Institute-Prof. Jeffrey Sachs-2011-2013
- Climate Change (WG-CC)- Chaired by President & CEO Ercisson- Mr Hans Vestberg- 2011-2012
- E-Government and PPPs (WG-EGov)- Chaired by former minister of Telecommunications Finland- Ms Suvi Linden-2011-2012
- Education 1 (WG-E)- Chaired by DG UNESCO- Ms Irina Bokova- 2011-2013
- Youth (WG-Y)- Chaired by Co-vice chair of the Commission and SG ITU- Dr Hamadoun Tour-2011-2015
- Broadband and Gender (WG-BG)- Co-chaired by Administrator of UNDP & USG of UN Women- Ms Helen Clark & Ms Phumzile Mlambo Ngcuka-2012-2015
- Financing & Investment (WG-FI)- Chaired by President IDB- Mr Luis Alberto Moreno-2013-2014
- Task Force (WG-TF)- Chaired by President & CEO Ericsson- Mr Hans Vestberg-2013-2014
- Platforms and Content In Support of the SDGs (PC-SDGs)- Director the Earth Institute-Prof. Jeffrey Sachs-2015
- Demand (WG-D)- Chaired by VP government and education of Intel- Mr John Galvin-2015-2016
- Digital Health 2 (WG-DH)- Co-chaired by CEO & President of Nokia and Head of Novartis Foundation- Mr Rajeev Suri & Dr Ann Aerts-2015-2017
- Digital Gender Divide (WG-DGD)- Co-Chaired by DG of GSMA & DG of UNESCO- Mr Mats Granryd & Ms Irina Bokova-2016-2017
- Technologies in Space and the Upper-Atmosphere (WG-Space)- Chaired by CEO of Inmarsat- Mr Rupert Pearce-2016-2017
- Education 2 (WG-EDU)- Co-Chaired by DG UNESCO & VP Government and education of Intel- Ms Irina Bokova & Mr John Galvin-2016-2017

- Digitalization Scorecard (WG-DS)- Chaired by CEO & President of Nokia- Mr Rajeev Suri-2016-2017
- Epidemic Preparedness (WG-EP)- Chaired by CEO KT Corporation- Dr Chang-Gyu Hwang-2017-2018
- Digital Entrepreneurship (WG-DE)- Chaired by VP European Commission- Mr Andrus Ansip-2017-2018
- Digital Health 3 (WG-DH3)- Co Chaired by Intel and Head of Novartis Foundation-Dr Ann Aerts-2017-2018
- Vulnerable Countries (WG-VC)- chaired by USG OHRLLS-Ms Fekitamoela Utoikamanu-2017-2018
- Expert Group on a New Deal: Investing in our common future 2018

Acronyms

A4AI	Alliance for Affordable Internet
AI	Artificial Intelligence
AR	Augmented Reality
ARPU	Average Revenue Per User
B2B	Business to Business
B2C	Business to Consumer
CAGR	Compounded Annual Average Growth Rate
CIS	Commonwealth of Independent States
DAU	Daily Active Users
DFID	UK Department for International Development
EIU	Economist Intelligence Unit
FCS	Fundación Carlos Slim/Carlos Slim Foundation
FTTC	Fibre-To-The-Cabinet
FTTH	Fibre-To-The-Home
FTTS	Fibre-To-The-Street
G2C	Government to Citizen
GB	Gigabyte
GDP	Gross Domestic Product
GNI	Gross National Income
GSMA	GSM Association
HTS	High-Throughput Satellite (satellite system)
ICT	Information and Communication Technology
IIOT	Industrial Internet of Things
IFC	International Finance Corporation
IoT	Internet of Things
IMF	International Monetary Fund
ITSO	International Telecommunication Satellite Organization
ITU	International Telecommunication Union
LDCs	Least Developed Countries
LMC	Last Mile Connectivity
LMICs	Low- and Middle-Income Countries
LEO	Low Earth Orbit
M2M	Machine To Machine
MAU	Monthly Active Users
MLC	Media Literacy Council (of Singapore)
MNOs	Mobile Network Operators
MSMEs	Micro-, Small- and Medium-Sized Enterprises
MVNOs	Mobile Virtual Network Operators
NBP	National Broadband Plan
NCDs	Non-Communicable Diseases
NGSO	Non-Geostationary Satellite Orbit
OECD	Organization for Economic Cooperation and Development
OSP	Online service providers
OTT	Over The Top (or OSPs)
QoE	Quality of Experience
QoS	Quality of Service

RoW	Right of Way
SMEs	Small- and Medium-Sized Enterprises
SDGs	Sustainable Development Goals
TCO	Total Cost of Ownership
UAS	Universal access and service
UHC	Universal Health Coverage
UNHCR	The UN Refugee Agency
USAID	United States Agency for International Development
VNI	Visual Networking Index

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