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The State of Broadband 2014:

# broadband for all

**A REPORT BY THE BROADBAND COMMISSION**
**SEPTEMBER 2014**



United Nations
Educational, Scientific and
Cultural Organization

## ABOUT THE COMMISSION

The Broadband Commission for Digital Development was launched by the International Telecommunication Union (ITU) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) in response to UN Secretary-General Ban Ki-moon's call to step up efforts to meet the Millennium Development Goals (MDGs). Established in May 2010, the Commission unites top industry executives with government leaders, thought leaders, policy pioneers, international agencies and organizations concerned with development.

The Broadband Commission embraces a range of different perspectives in a multi-stakeholder approach to promoting the roll-out of broadband, and represents a fresh approach to UN and business engagement. To date, the Commission has published a number of high-level policy reports, best practices and case studies.

More information about the Commission is available at www.broadbandcommission.org.

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# THE STATE OF BROADBAND 2014: BROADBAND FOR ALL

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## ACKNOWLEDGEMENTS

This Report has been written collaboratively, drawing on insights and rich contributions from a range of Commissioners and their organizations. It has been compiled and edited by the chief editor and co-author, Phillippa Biggs of ITU. The United Nations Educational, Scientific & Cultural Organization (UNESCO) contributed Chapter 5 on education and the Inter-American Development Bank (IADB) and World Bank contributed Chapter 6 on the changing economics of telecom network deployments. Design concepts were developed by Ahone Njume-Ebong of ITU, with support from Simon de Nicola and Stephane Rollet. Youlia Lozanova, Anna Polomska, Chelsea Silva da Mori and Nancy Sundberg provided regulatory analysis of National Broadband Plans. Doug Court provided additional research for Chapter 4. Esperanza Magpantay, Ola Amin, Vanessa Gray, Dr. Susan Teltscher and Ivan Vallejo provided statistical insight and data.

Contributors are listed in order and under their contribution. We wish to thank the following people for their kind review and comments (listed in alphabetical order of institution, followed by alphabetical order of surname):

Guillermo Alarcon, Florian Damas, Florence Gaudry-Perkins, Gabrielle Gauthey (Alcatel Lucent); John Garrity and Dr. Robert Pepper (Cisco); Dr Reza Jafari (e-Development International); Heather Johnson, Richard Möller and Elaine Weidman (Ericsson); Janet Emery-Jones, Christian Roisse and Estelle Schnitzler (EUTELSAT IGO); Dr. Anne Bouverot, Belinda Exelby and Arran Riddle (GSMA); Ivan Huang and Dr. Juan Rendon (Huawei); Mr. Antonio García Zaballos of the Inter-American Development Bank (IADB); H.E. Dr. Hessa Al Jaber, Minister of Information & Communication Technology, Qatar, and Dr Hoda Baraka (ICT Qatar); Dr. Esteban Pacha Vicente and Jenny Ray (IMSO); Justin Lee & Eunice Lim (Infocomm Development Authority, Singapore); John Davies, Krzysztof Janicki, Christoph Legutko, Carlos Martinez and John Roman (Intel); Renata Brazil-David and José Toscano (ITSO); Ola Amin, Doug Court, Gary Fowlie, Toby Johnson, Piers Letcher, Youlia Lozanova, Esperanza Magpantay, Sarah Parkes, Anna Polomska, Chelsea Silva da Mori, Nancy Sundberg, Dr. Susan Teltscher and Ivan Vallejo (ITU); H.E. Minister Ivo Ivanovski and Martin Todevski (Government of TFYR Macedonia); Paul Mitchell (Microsoft Corp.); Natalia Moreno (Telefonica); David Atchoarena, Indrajit Banerjee, Abel Caine, Cvetan Cvetkovski, Irmgarda Kasinskaite, Dov Lynch, Mariana Patru, Francesc Pedro, Zeynep Varoglu and Cédric Wachholz (UNESCO); Michele Woods (WIPO); and Natalija Gelvanovska (World Bank).

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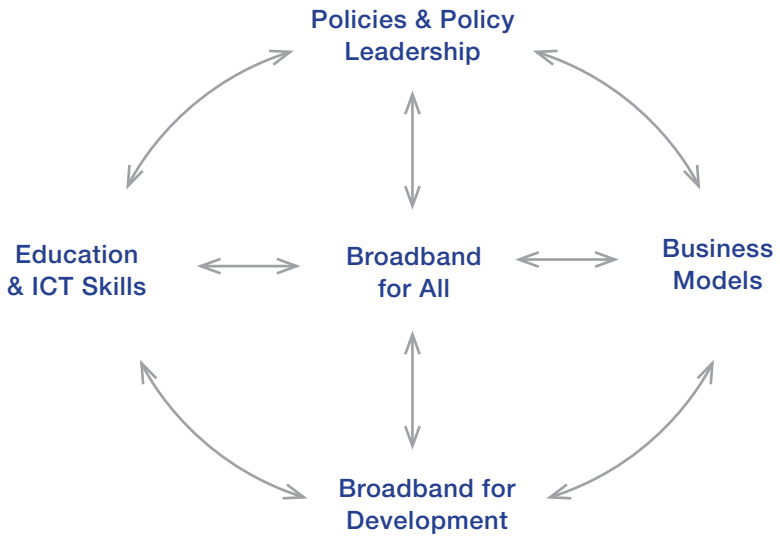
# 1 INTRODUCTION

High-speed, affordable broadband connectivity to the Internet is a foundation stone of modern society, offering widely recognized economic and social benefits. High-speed broadband is no longer just cutting-edge technology for an elite few; instead, the steady march of connectivity among the broader population is slowly but surely transforming our society with new ways of accessing services and information. Broadband does not just comprise infrastructure; today, widespread broadband connectivity offers the prospects of new services and an information revolution to change – and challenge – our very approach to development.

The Broadband Commission for Digital Development aims to promote the adoption of effective broadband policies and practices for achieving development goals, so everyone can benefit from the advantages offered by broadband. Through this Report, the Broadband Commission seeks to raise awareness and enhance understanding of the importance of broadband networks, services, and applications to guide international broadband policy discussions and support the

**Figure 1: The Structure of this Report**



expansion of broadband where it is most needed. This year, the Report includes a special focus on the importance of integrating ICT skills into education to ensure that the next generation is able to compete in the digital economy. This Report is structured around four main themes which can help us realize the potential of broadband for all (Figure 1).

Countries should use appropriate policies and strategies to make broadband available, affordable and accessible, as a vital development enabler for building inclusive, resilient and sustainable modern-day knowledge societies. It is increasingly essential to integrate everyone into modern life, with access to digital education services, culture, entertainment, healthcare, financial and commercial services. To achieve this, the public and private sectors have to work together in close partnership (Featured Insight 1). As the following chapters show, broadband for all can transform policy, social, and development outcomes around the world. Today, we stand on the cusp of fulfilling the potential of high-speed broadband. Indeed, broadband infrastructure and services are essential for national competitiveness and success in the modern economy – broadband is a key enabler of national competitiveness through greater efficiency.

## FEATURED INSIGHT 1: TELECOMMUNICATIONS ARE FUNDAMENTAL TO OUR CIVILIZATION

I believe that both the public and private sectors can, and should, work together to achieve broadband for all. In practice, this means the government acting with the regulator to pass legislation, establish appropriate competition and provide government services over the web, as well as education and public healthcare services online. Governments have to take advantage of the efficiencies and marginal cost savings offered by telecommunications. Private companies, for their part, should be investing in the latest generation networks, both in fixed and mobile.

Such collaboration is even more important in the case of marginalized populations in rural and remote areas. This is where I believe governments can play a vitally important role, by integrating all people into modern life by connecting them, whether via satellite or via existing, private networks. It is essential to integrate everyone into modern life to provide them with access to education services, culture, entertainment, healthcare, financial and commercial services, weather forecasts, the price of agricultural products and fertilizers, local weather services, etc.

We also need to move away from telephones that allow voice communication only, to intelligent phones that allow the full use of the network and broadband. In the past, the Internet could be accessed at 56 kbps, and in the beginning, broadband access speeds were 256 kbps, nearly five times faster. Then we moved to 1 Mbps, then 2, then 3 Mbps. The very definition of broadband has evolved. We are now talking of more than 10 Mbps, which is 200 times faster than dial-up service. That's an enormous change. In just two decades, we are doing things a hundred times faster, and – interestingly enough – at more or less the same price. The price that used to be charged for 56 kbps services is roughly the same as the price charged today for 5 Mbps services – that's very important.

Today, fourth-generation cellular telephony is already high-speed. 5G will be much faster, with very high speeds. It is also vital that, in parallel with this connectivity and these services, we develop a whole range of applications, and plenty of content. Among the most important apps and content are those related to education, online professional training and health. We have already developed 100 videos as a first stage of training, for job-seekers. In just two weeks online, over 10,000 people accessed these videos. Education is of paramount importance, and this is where I think the greatest focus should be, so people can receive education more easily at all levels – for work, jobs, and different activities. Obviously, broadband is also extremely important for healthcare, and for carrying out government administration tasks. And while it is obviously very important for people to be connected, it is also essential to develop many more applications offering people equal opportunities for development, depending on their vocation, profession and capacities.

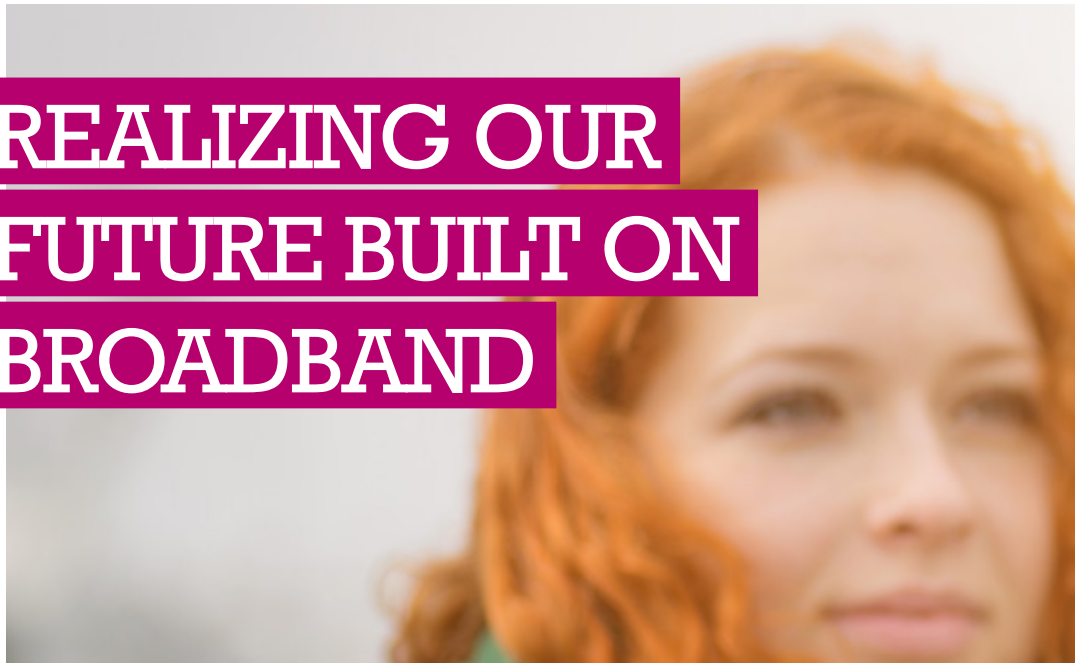
*Source: Mr. Carlos Slim Hélu, President, the Carlos Slim Foundation.*


*From left to right:*
*Mr. Carlos Slim Hélu, President of the Carlos Slim Foundation, receiving a WTISD Award from Dr Hamadoun I. Touré, ITU Secretary General, on the occasion of World Telecommunication and Information Society Day (WTISD).*

*From left to right:*
*Dr Hamadoun I. Touré, ITU Secretary-General and co-Vice Chair of the Broadband Commission for Digital Development; Paul Kagame, President of Rwanda and co-Chair of the Commission; Irina Bokova, Director-General of United Nations Educational, Scientific and Cultural Organization (UNESCO) and co-Vice Chair of the Commission; and Carlos Slim Helú, Chairman of Grupo Carso, President of the Carlos Slim Foundation and co-Chair of the Commission.*

# 2

# REALIZING OUR FUTURE BUILT ON BROADBAND

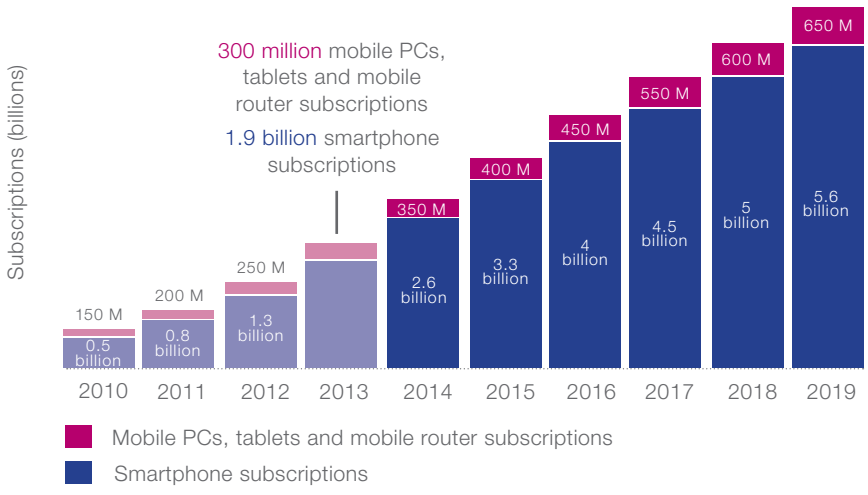


Ten years on from the World Summit on the Information Society (WSIS), the Information Society is today truly with us. By the end of 2014, some 2.9 billion people or 40% of the global population will be online (ITU, 2014[1]). At current growth rates, half of the world's population will be online by 2017. Technology commentators are often seduced by the promise of a hyper-connected world, focusing on embedded ambient intelligence, automated Machine to Machine (M2M) traffic, ubiquitous connectivity and the 'Internet of Everything'. However, the real information revolution may lie in the growing day-by-day use of Internet-enabled devices in all parts of our lives.

And it is this era of mass connectivity – delivering small, but incremental changes to the ways in which each individual does things – that promises to transform development and global welfare. Mass connectivity with broadband can improve our lives in a myriad of ways – by providing better access to health services, enabling financial inclusion through m-payments, empowering people through online education, and creating transparency in government, for example. Broadband can no longer be viewed as just another infrastructure, but is today a powerful force for change. Recent discussions have focused on a 'two-speed' Internet. Today, the Internet may be an Internet of 2.9 billion different 'speeds', in terms of how each individual Internet user relates to online networks and society as an online citizen. Taken cumulatively, these incremental changes add up to sweeping social transformation.

Worldwide, mobile phone subscriptions will exceed 6.9 billion by the end of 2014, with three-quarters of these subscriptions in the developing world and over half in Asia-Pacific (ITU, 2014[2]). The total number of unique mobile phone users may be around 3.4 billion people by 2014[3]. Today, the marriage of Internet with mobile promises greater Internet connectivity, at faster speeds, to more people than ever. Emarketer anticipates that 1.76 billion people will use smartphones by the end of this year[4], while Ericsson estimates that, by 2019, there could be 5.6 billion smartphone subscriptions (Figure 2a), of which 2.6 billion will relate to LTE (Figure 3).

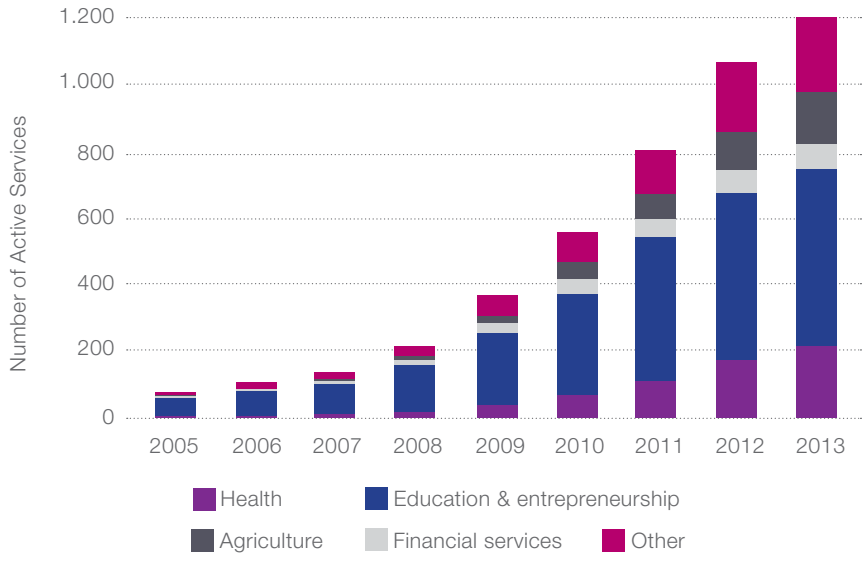
## Figure 2: Introducing our Future Built on Broadband




### Figure 2a: High-Speed Mobile

By the end of 2019, there may be 5.6 billion smartphone subscriptions.

*Source: Ericsson Mobility Report June 2014.*




### Figure 2b: Growth in Mobile Services

Mobile-enabled services, by vertical, 2005-2013.

*Source: GSMA, "Financing Innovation", July 2014.*

Back in 2005, the 'Internet of Things' was starting to figure in people's expectations[5], but it was impossible to predict how fast our environment would become connected. ITU predicts the number of networked devices could reach 25 billion by 2020[6].

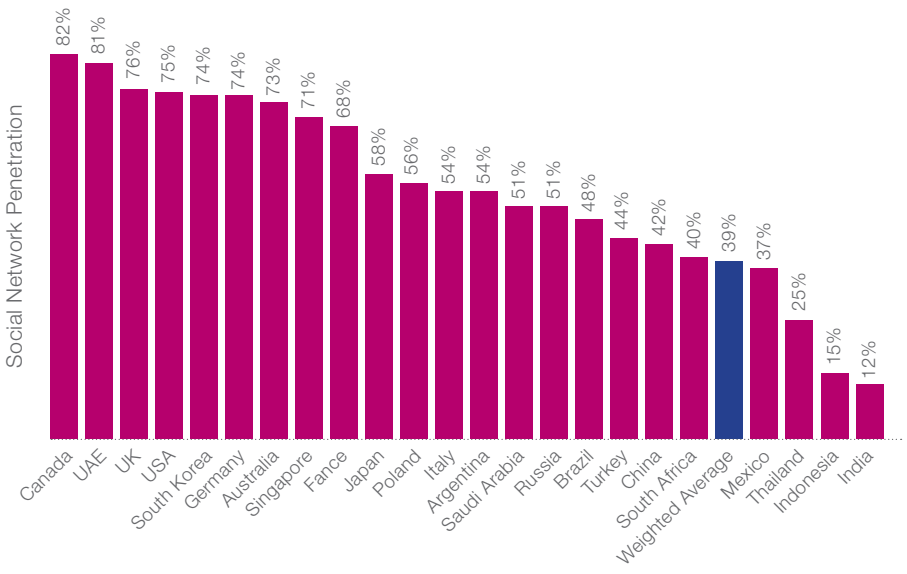
The content and services available online are exploding in line with connectivity. Chapter 5 by UNESCO examines how broadband is transforming education. A recent GSMA (2014) survey suggests that educational and entrepreneurial services are the fastest-growing mobile-enabled services (Figure 2b). Indeed, how people and consumers are using connectivity is changing. Services such as Voice over Internet Protocol (VoIP) and IPTV are increasingly common. Some sources suggest around 1.9 billion people now use social media actively[7], equivalent to a quarter of the world's population[8] or nearly 40% of total Internet users as a global weighted average, according to Global Web Index (Figure 2c). Want to know whether your friends in Europe or Asia have woken up yet? Check Twitter, Facebook or Akamai (Figure 2d). Bankers have long been used to the activity of global financial markets shifting west each day with the rising sun; now, Internet users will become accustomed to social activity following a similar pattern.

More sophisticated services (such as real-time geolocation-based services) make data privacy, security and consumer protection increasingly urgent issues. Regulation is striving to keep up with accelerating technological change; however, regulatory approaches towards networks, services, spectrum and content remain highly diverse (Figure 2e). Broadband is vital to underpin the growing global digital economy, and developing countries cannot afford to fall behind either in their roll-out or policy towards broadband networks and services, or they risk being excluded from the global economy, and the next stage of the information revolution.

**Figure 2c: Loud & Social**

Social Network Penetration, January 2014, for selected countries, as a % of active Internet users (based on national surveys of Internet users).

*Source: Global Web Index.*



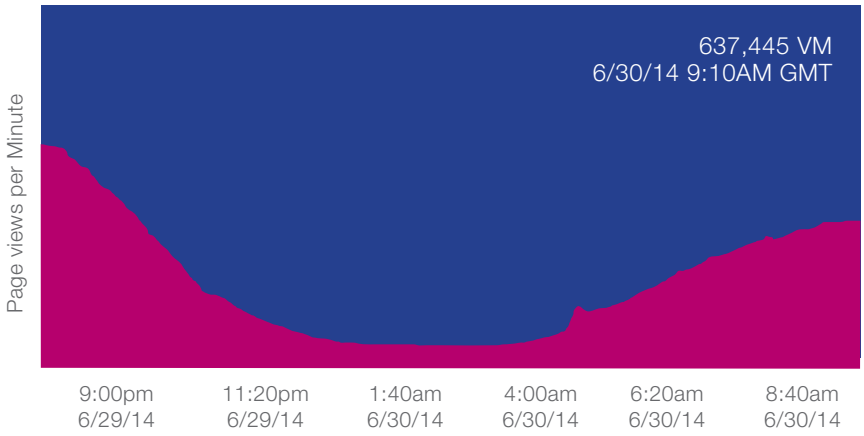



**Figure 2d: Real-time: Has Europe Woken Up Yet?**

Page views per minute, for the European region.

*Source: Akamai, http://www.akamai.com/html/technology/nui/industry/index.html.*

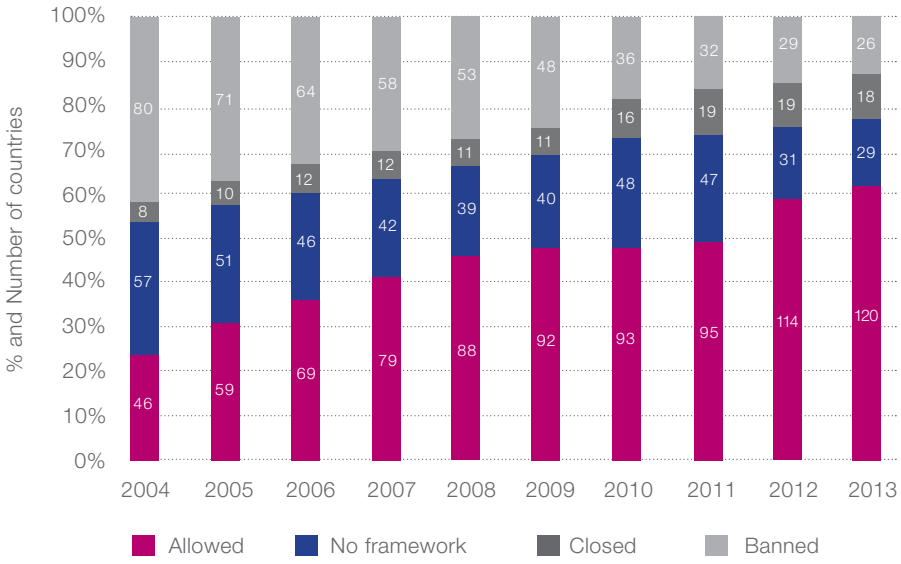



**Figure 2e: IP-enabled**

Worldwide regulation & legalization, VoIP 2004-2013 (number of countries; % total number of countries).

*Source: ITU World Telecommunication Regulatory Database.*

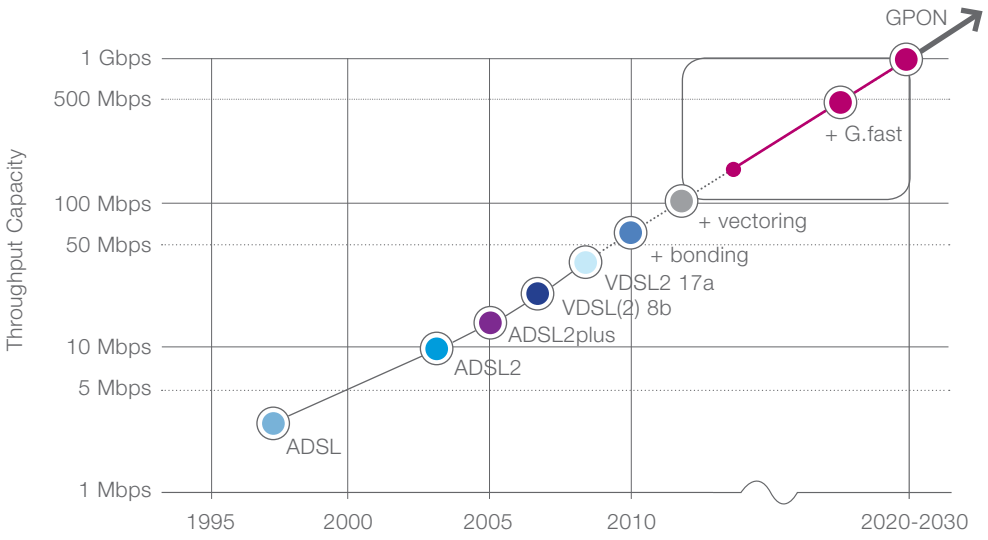
## 2.1 Defining Broadband

Analysis of the growth and current status of broadband depends partly on how broadband is defined, since the exact definition of broadband affects subscriber and growth statistics. ITU's Radiocommunication Bureau (ITU-R) maintains a categorical definition of clusters of wireless broadband terrestrial and satellite technologies as IMT-2000 (3G) and IMT-Advanced (encompassing most 4G technologies), while IMT-2020 will establish the technical criteria for 5G technologies[9].

The most salient requirement for IMT-Advanced included peak service rates of 100 Mbit/s for high mobility users and 1 Gbit/s for low mobility users. For the future IMT-2020, it is expected that the peak data rate will increase several times more compared with IMT-Advanced. Wireless broadband data traffic is projected to increase by a thousand-fold by 2020 and beyond. This continued increase in peak service rates is vital for wireless communication networks to meet the demands of future services. Even where consumers do not always need or want Gigabit speeds, the introduction of new services is fuelling demand, so countries and operators need to plan for the imminent broadband world (Figure 3).

Technological innovation is essential to successfully address growing user demand and service trends for 2020, but it is unlikely to be sufficient alone. For wireless, more dedicated and globally harmonized spectrum is another essential pillar for IMT development. Along with the growing demand for more spectrum for mobile broadband, there is also a need to enhance spectrum harmonization, economies of scale, affordability, and roaming capabilities. New regulatory tools and approaches to using radiofrequency spectrum and optimizing its use may play a complementary role in the future.

ITU and the OECD have defined broadband as a capacity of at least 256 kbps in the uplink or downlink speed. The Broadband Commission for Digital Development has defined broadband using a cluster of concepts, as high-speed Internet access which is always-on and capable of multiple service provision simultaneously[10]. In terms of speed, steady growth continues in both theoretical and actual access speeds or data throughput capacity. The maximum speeds obtainable via copper through xDSL have recently increased through vectoring and the introduction of new standards such as G.fast (Figure 3, top), while the use of small cells is boosting theoretical mobile speeds and consumers continue to upgrade their subscriptions. Ericsson forecasts that the total number of GSM/EDGE subscriptions is about to go into decline worldwide, as more subscribers adopt 3G[11] (Figure 3, bottom), although GSM/EDGE will still be used by 3G subscribers in areas without 3G coverage.



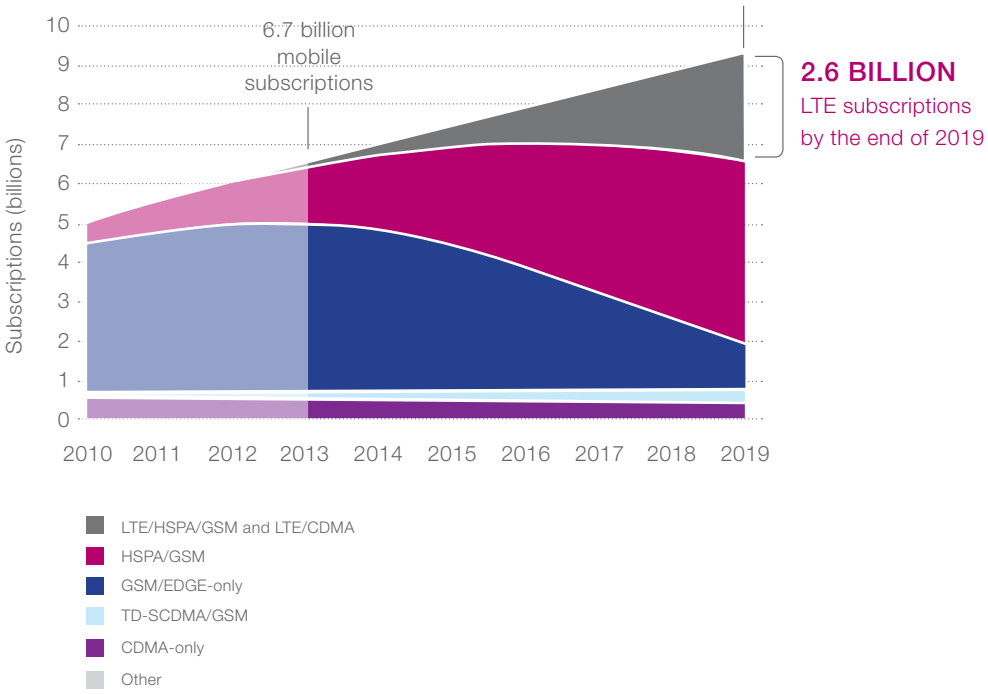




**Figure 3: Growth in Speeds for Fixed and Mobile Technologies**

The evolution of copper – bridging the gap between xDSL and fibre speeds (top); The shift in subscriptions towards mobile technologies with higher speeds (bottom).

*Source: Alcatel Lucent (top chart), Ericsson Mobility Report, June 2014 (bottom chart).*

## 2.2 Growth in Broadband

Using the ITU definition of broadband, both fixed and mobile broadband deployments continue to grow around the world. ITU estimated that there were 673 million fixed broadband lines globally by the end of 2013 (a total in line with other estimates[13]), while ITU data suggest that this will rise to 711 million fixed broadband subscriptions by the end of 2014[14] (Figure 4, top).

In terms of technologies, fixed broadband subscriptions continue to grow via cable and fibre-optic platforms, although there is evidence to suggest that the total number of Digital Subscriber Lines (DSL) may have peaked and is now in decline. In terms of end-users, cable and satellite communications continue to grow annually at 1.8% and 1.5%, respectively[15]. It remains to be seen how the most recent developments in VDSL2 vectoring and new standards (such as the new G.fast standards being negotiated at ITU by operators including Deutsche Telekom, Telecom Italia and BT – see Featured Insight 17) will impact copper. These developments offer operators new prospects of prolonging the life of existing infrastructure[16] and could even halt or slow the decline in DSL lines.

Today, xDSL still accounts for over half or more than five out of every ten fixed broadband lines (denoted as copper or the pink area in Figure 4), with fibre optic FTTx and FTTH accounting for around a quarter of the total market for fixed broadband (in the blue and gray areas in Figure 4, bottom). Fibre is growing slowly but steadily – FTTH/FTTB account for over a fifth of all connected homes in just nine countries worldwide (of which one is in the Arab region, five are in Asia and three are in Europe[17]). The FTTH Council notes that high household penetration of broadband is a key indicator of market maturity for countries to develop adequate subscriber demand to sustain the development of new services.

The top ten countries in the world for fixed broadband penetration are all located in Europe, with the exception of the Rep. of Korea, in 6th place. In 2014, there are four economies where fixed broadband penetration exceeds 40%, up from just one (Switzerland) in 2013. See Annex 2 for national rankings for fixed broadband.

In contrast to the strong growth observed in new markets for fixed broadband up until 2011[18], fixed broadband growth may be flattening out globally at around 1.5% per annum in terms of subscriptions, with Q4 2013 growth lower than both the preceding quarter and year-on-year growth[19]. It is difficult to interpret this as fixed broadband transitioning from a strong growth market to a mass market, however, since different regional markets follow different dynamics. The locus of growth in household broadband connectivity is shifting eastward, with Asia-Pacific accounting for the strongest growth in household connectivity. There is some evidence that growth in fibre deployments in Europe may be slower than previously expected, with Point Topic revising its estimates downward. For example, in the UK, Point Topic cut its 2016 forecasts for DSL, FTTx and overall broadband subscribers by 10% based on its previous expectations from 2011 due to roll-out delays and the ongoing squeeze in consumer spending[20].

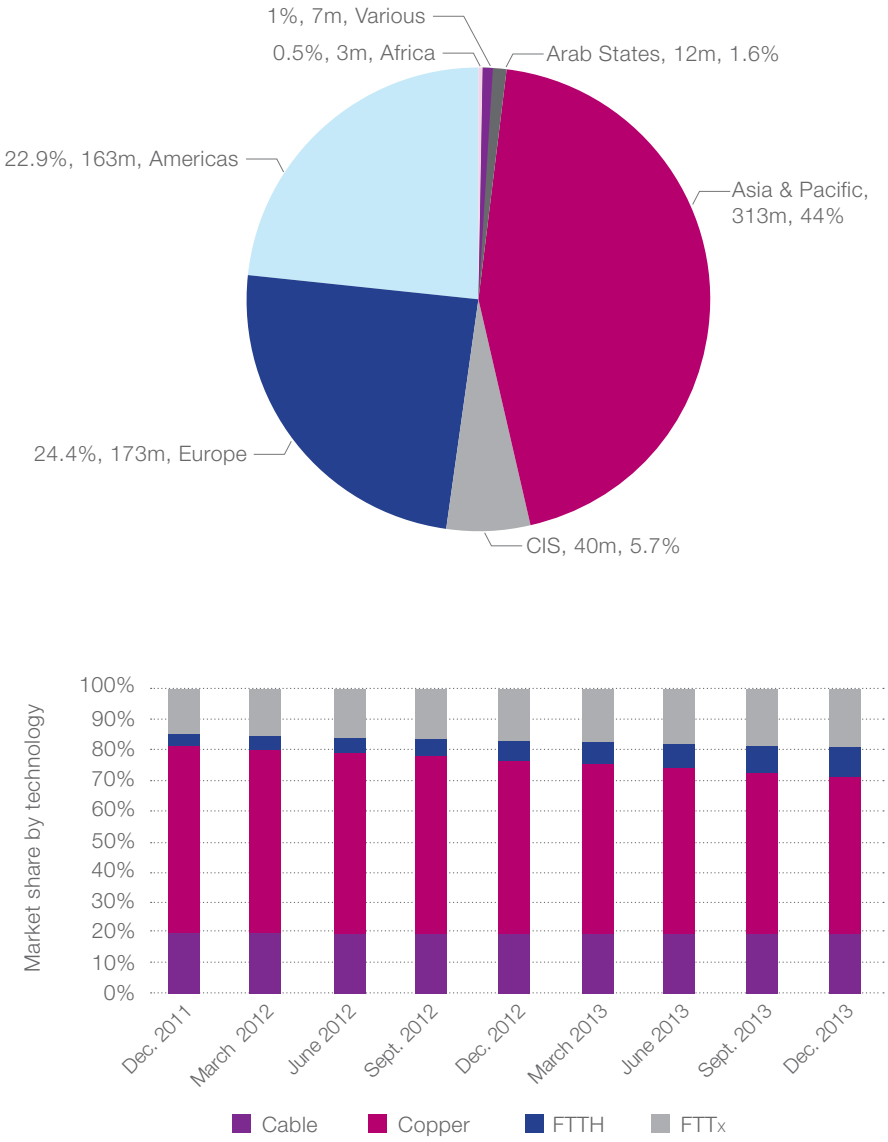



**Figure 4: Status of Fixed Broadband**

Geographical distribution of fixed broadband subscriptions by region (top); Evolution of fixed broadband subscriptions by technology, 2011- 2013 (bottom).

*Sources:*
*ITU (top); Point Topic (bottom).*

Mobile broadband (3G and 4G) continues to show the highest growth rate of any ICT, growing almost 20% during 2014. There were 191 LTE networks active by September 2013[21], while 4G Americas anticipates that there will be 350 LTE networks commercial by the end of 2014. Additionally, LTE-Advanced is now commercially deployed on 9 networks in 7 countries worldwide, expected to reach 40 networks by year-end 2014. The reasons for LTE deployment are diverse, with a wide range of drivers cited (Figure 5). ITU's data suggest that, in comparison with a stock of some 6.9 billion mobile cellular subscriptions worldwide by the end of 2014, there will be 2.3 billion mobile broadband subscriptions[22], although Ericsson's estimates are somewhat higher for both figures, at 7.1 billion and 2.9 billion, respectively. By the end of 2014, mobile broadband subscriptions will exceed fixed broadband subscriptions by a ratio of over 3:1 (up from 2:1, just three years ago).

Seven economies now have mobile broadband penetration in excess of 100 active subscriptions per capita (Singapore, Finland, Japan, Australia, Bahrain, Denmark and Korea ). By the beginning of 2014, 26 economies had mobile-broadband subscription penetration in excess of one subscription for every two inhabitants, compared with just 13 countries at the beginning of 2012 – see Annex 3.

Smartphones account for between a quarter and a third of all mobile subscriptions. Worldwide, smartphone shipments approached (Canalys[23]) or likely exceeded the one billion mark in 2013 (IDC, 2014[24]). Gartner (2014) reports that smartphone shipments exceeded shipments of feature phones for the first time ever for the full year 2013[25], while Ericsson (2014) estimates that, for Q1 2014, 65% of all mobile phones sold were smartphones, compared with around 50% in Q1 2013.

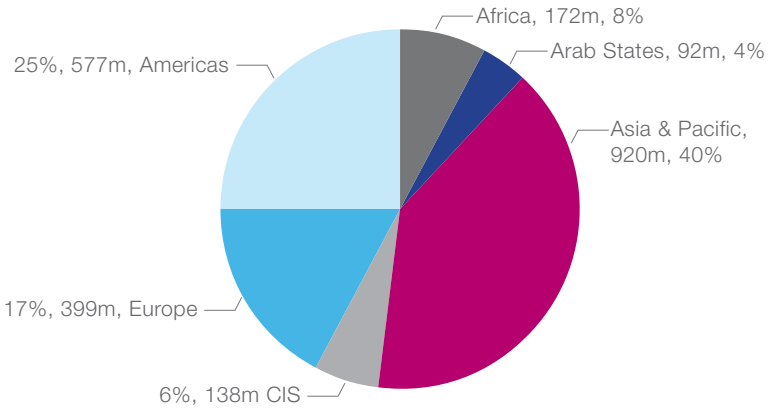
The OECD notes that smartphones can consume up to 35 times more data than feature phones, and predicts that consumers will adopt 4G more rapidly than 3G[26]. Informa agrees, noting that it took GSM technology 6.3 years to achieve its first 100 million users (from 1992-1998), whereas LTE (Rel.8) achieved the same milestone in just 4.2 years (between 2008-March 2013)[27]. The rapid growth of LTE in particular has overtaken all previous mobile technologies, and LTE is expected to grow even faster over the next few years, with 2013 proving a tipping point in the deployment of LTE[28].

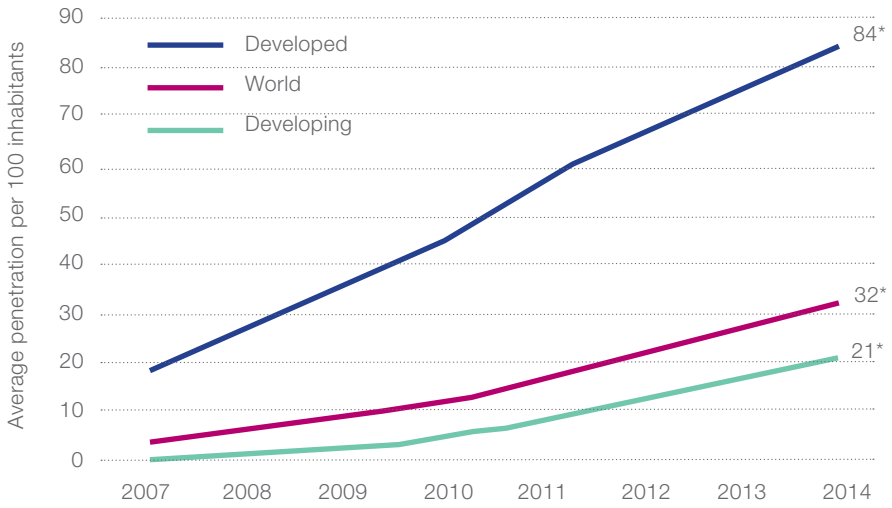
The total number of subscriptions is of course different from the number of subscribers. There is considerable uncertainty as to the actual number of unique mobile phone users. Cisco (2012) estimated that there were already around 4 billion unique mobile phone users as long ago as 2011, and that there will be 5 billion mobile users by 2016. Ericsson (2014) estimates that the milestone of 4.5 billion unique mobile users was achieved in 2013. GSMA (2013) estimated this number as lower and later, at around 3.4 billion unique mobile phone users by the start of 2014.

By these estimates, mobile phone subscriptions outnumber the actual number of unique phone users by a ratio of anywhere between 1.5-2.05 globally on average, although this ratio may be much higher for individual countries, due to multiple Subscriber Identity Module (SIM) card ownership (to take advantage of lower on-network pricing) and/or multi-device ownership, both of which are increasing dramatically. For example, in India, a GSMA survey suggested that consumers use 2.2 SIM cards each on average.

Estimates of growth in mobile broadband are generally higher than previously predicted. According to Ericsson's latest forecasts[30], by 2019, mobile subscriptions are expected to reach around 9.2 billion, of which global mobile broadband subscriptions could account for 7.6 billion, with 5.6 billion smartphones. These are significantly higher than 2012 predictions of 5 billion in 2017 (Ericsson, 2012[31]). The annual growth rate in mobile broadband subscriptions will decline from 40% in 2013 to 32% in 2014 (Ericsson, 2014).

However, these positive growth trends are mixed with a number of other factors and challenges,



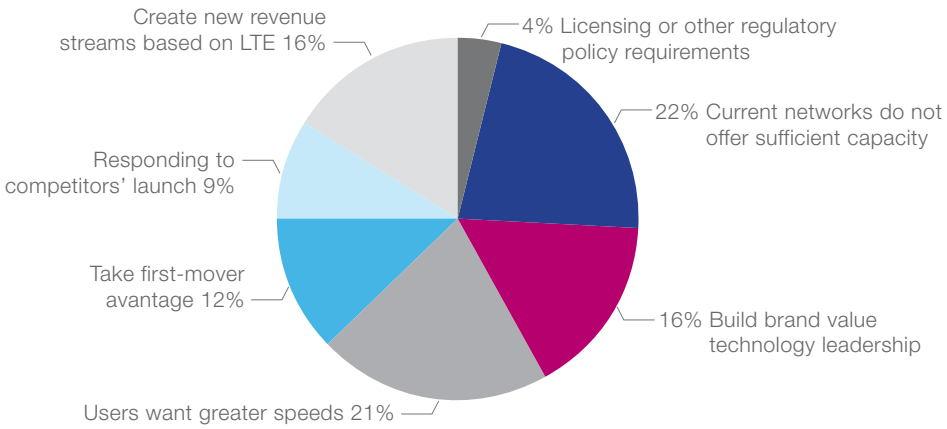




**Figure 5: Status of Mobile Broadband**

Geographical distribution of mobile broadband subscriptions by region (top); Evolution of mobile broadband, 2007-2014 (middle); Reasons for deploying LTE, mid-2014 (bottom).

*Source: ITU (top and middle); Informa Telecoms & Media LTE survey of 208 mobile executives, 2014[29] (bottom).*

*Note: * Estimate.*

**Table 1: Major Trends in the Mobile Sector Impacting Operators' Business Models**

| Driving Factors | Examples |
|---|---|
| **Market Maturity; Slowdown in Growth** | Mobile penetration is reaching saturation in some markets, with gross additions driven by second SIMs and churn.<br><br>Operators are coming under pressure to provide interoperable networks and services. |
| **Decline in Price of Voice** | Voice Average Revenue Per Minute (ARPMs) and Average Revenue Per User (ARPUs) are falling under pressure from competition.<br><br>Usage elasticity does not fully compensate for declines in price. |
| **Data Price Decline** | Data competition focuses mainly on transport.<br><br>Price declines to incentivize customer usage. |
| **Intensifying Competition** | Intensifying competition in mature markets.<br><br>New competitors (such as Mobile Virtual Network Operators, resellers) are emerging. |
| **Growing User Demand and Sophistication** | Majority of customers are increasingly experienced mobile users.<br><br>Operator purchasing decisions are increasingly independent and well-informed.<br><br>There is growing pressure on spectrum, with increased user demand necessitating more efficient use of spectrum, and demand for more spectrum to be allocated to mobile broadband. |

*Source: IADB/World Bank.*

as the mobile market consolidates and transitions from a high-growth market to a mass-market.

Table 1 highlights some key trends in the mobile market. In some countries, there is growing pressure for networks and devices to become interoperable, with consumers expecting to transfer seamlessly between networks – for example, Singapore is developing a Nationwide Heterogeneous Network (HetNet) to which users can connect seamlessly and operate their devices across different wireless networks, including cellular and Wi-Fi.

## Box 1: What do we really need all this broadband capacity for?

The debate continues as to whether or not consumers really need Gigabit speeds. Demand for faster speeds continues to grow. As speeds increase however (Figure 3), it is likely that new applications and services will adapt to utilize all the newly available bandwidth. Today, there are still not many consumer apps and services that really need Gigabit speeds, but such services will arise, judging by the number of accelerators popping up in Gigabit-enabled cities. Besides new, bandwidth-hungry services, another demand driver is simultaneous mass demand for existing services. According to Ciena, if 10% of New York City's 8 million residents wished to stream a movie simultaneously, the capacity of infrastructure needed would be around 1.6 Terabits per second[12], sufficient to overload existing networks. Meeting this demand with existing technologies can be costly. However, failure to provide Terabit capacity could result in lower quality playbacks with pixelation, stuttering, jitter and pauses – something that sophisticated modern Internet users may find unacceptable.

Various broadband mediums (e.g., copper, fibre, wireless, cable) offer significant upgrades in bandwidth, including Gigabit speeds. Some make more sense than others – for example, in terms of cost or time to market. Operators make network upgrade decisions based on the age of the existing network, cost, competition, and demand for which services. However, the number one priority for every operator should be to make broadband 100% available, whether fixed or mobile. The UN also calls for broadband to also be affordable, which may mean that not everyone needs, or should have, Gigabit broadband speeds. It is difficult to define a "universal" broadband speed target. History clearly demonstrates that technology typically moves faster than most people anticipate – so countries and operators need to start planning now for the imminent broadband world.

*Source: Teresa Mastrangelo, Voice of Broadband newsletter, November 2013; and Ciena at: www.gigaom.com/2014/02/15/the-need-for-speed-why-broadband-network-upgrades-are-critical-to-economic-growth/*

The majority of both mobile and smartphone sales over the next five years are likely to originate with the developing world, based on the growth of low-cost smartphones. ABI Research[32] notes that Asia-Pacific accounts for nearly half of all LTE subscriptions, due to its large population base, rapid LTE network deployment and cost-competitive smartphones. The second greatest contributor is North America with an 18% market share. Ericsson (2014) projects that China and India each accounted for around 20% of net additions[33]. Deloitte (2014) notes that in these regions, price-sensitive buyers are having an impact on average sales price (ASPs), with mobile phone ASPs decreasing overall by 4% in 2013.

This sales price threshold of US$150 has been hailed as a milestone for the smartphone (Deloitte 2014[34]). In reality, however, Deloitte (2014) observes that price is not always the predominant factor, except for the poorest consumers, and that other key factors in the purchase decision include size or form, weight, processor speed, and memory capacity (Figure 6).

Indeed, tablets and mini-tablets are the personal devices of choice with many youngsters and launching a mini-tablet costing US$ 50 could generate a very large market segment in some countries. There is evidence to suggest that sales of tablets may be flattening out – research consultancy IDC has projected that shipments of tablets will grow at 19.4% in 2014, less than half the growth in 2013, as more consumers remain content with the devices they already own[35].

## 2.3 Regulatory Frameworks for an Internet of Everything

The Internet of Things is another strong market generating demand for broadband. According to some sources, there could be as many as 9 billion connected devices by 2018, roughly equal to the number of smartphones, smart TVs, tablets, wearable computers, and PCs combined[36], including kitchen and home appliances, lighting and heating products, and insurance company-issued car monitoring devices that allow motorists to pay insurance only for the amount of driving they do. In a paper prepared for the GSM Association, Machina research forecasts that revenues for applications alone (such as toll-taking and congestion penalties) could amount to US$100 billion by 2020.

In the developed world, the vast majority of connected devices are likely to be industrial. In terms of wearable devices, the majority will be sports/activity trackers, closely followed by other healthcare devices, and smart watches (ABI Research 2014). In terms of the locations where sports, fitness and wellness devices will ship, North America (and the U.S. in particular) is likely to account for more than half of the market for the Internet of Things, with Europe in second place[37]. The applications of connected devices for health monitoring are enormous, including in the developing world, where connected devices could help monitor nutritional needs or the outbreaks of epidemics.


**Figure 6: Tablet Specification by Price Band**

*Source: Deloitte TMT Predictions 2014.*

*Note: the specifications refer to popular models in each price band.*

However, connected devices are only part of the story – the information yielded by these connected devices could prove even more valuable. For example, "Google Fit" aims to collect users' health data to enable more informed analysis of healthy habits and lifestyles, as well as potential symptoms. Microsoft is launching a smart watch. Indeed, the move from connected things to the 'Internet of Everything' may be a game-changer, which some observers are calling the biggest fundamental technological change since the development of the Internet (Featured Insight 2).

Embedding technology into our everyday environment is likely to translate into major social changes too, as it will become more possible to track people's movements, activity, interactions and interests, all of which raise major issues with regards to privacy, security and personal protection.

## FEATURED INSIGHT 2: THE INTERNET IS EVOLVING – FROM CONNECTED THINGS TO CONNECTED EVERYTHING

The rise of the Internet of Everything may be the biggest fundamental technological change since the development of the Internet. Already, the Internet of Everything is having a profound impact, as people, processes, data, things, communities, and countries become increasingly connected. The Internet of Everything represents a US$19 trillion global opportunity to create value over the next decade through greater profits for businesses, as well as improvements to citizen services, cost efficiencies, and increased revenues for governments and public sector organizations (Cisco, 2014). With the rise of cloud, mobility and big data and the Internet of Everything, the traditional role of IT is changing, and Internet Protocol (IP) networks are playing a central role in connecting disparate IT environments. The explosive expansion of direct M2M connections between context-aware machines and other physical objects is changing how we use devices to improve our daily lives. And the shift in data and analytics — from centralized, structured, and static towards distributed, mixed structured and unstructured, and real-time — is leading to a new era of real-time processing and decision-making.

The migration to IP networks and the ability to turn big data into valuable, actionable information offer major economic and social benefits. The network is a critical accelerator and enabler in all of these transitions, accelerating the utilization of data and transforming processes to increase efficiency and decrease costs. IP networks are now connecting billions of physical devices, while this accelerating volume of data is driven by four major trends:

- IP is fast becoming the common language for most data communication, especially proprietary industrial networks.
- Billions more people, things, places, processes and devices will come online over the next five years.
- Existing physically stored information is being digitized in order to record and share previously analogue material. For example, the digital share of the world's stored information has increased from 25% to over 98% over the last decade[38].
- The introduction of Internet Protocol version 6 (IPv6) now removes the technical limit on the number of devices connected to the Internet, allowing for trillions of trillions (i.e. $10^{38}$) of devices.

Improving the ability of IP networks to transmit data for processing, as well as enabling networks to create, analyze and act on data insights can accelerate the positive impact from big data. Building this capability will require improving network infrastructure, enhancing analytical capabilities and 'intelligence' in the network through distributed computing. Critical challenges will also need to be addressed, including robust industry standards for interoperability, privacy and security.

*Source: Dr. Robert Pepper, Vice-President for Global Technology Policy, Cisco Systems.*

As this hyperconnected environment grows around us and permeates our lives in the Internet of Things, and as the broadband ecosystem continues to expand and evolve to include non-traditional ICT and Internet players, as well as providers from other sectors (such as healthcare, education, energy and finance), there is an urgent and growing need for the re-thinking of ICT regulation to bring about a more flexible approach to regulating issues at different levels (networks, services and apps, etc.). Regulators can be seen as facilitators and partners in promoting development and social inclusion. Regulators can sponsor and oversee public-private partnerships (PPPs) among aid donors, governments, ministries and NGOs, particularly in meeting universal access goals for rural, remote and un-served areas.

Given the speed with which the ICT sector is evolving, countries need to update their legislative and regulatory framework to enable telecom operators and Internet companies to compete on a level playing-field, while ensuring proper consumer protection and the safety and security of personal data. Figure 7 shows how regulatory frameworks among ITU Member States differ significantly, according to the issue under consideration. Of the 162 regulators in existence by mid-2014, regulators retained an overview of 'traditional' telecom areas (such as universal access, licensing, spectrum monitoring and price regulation) in over half (between 50-65%) of all 193 ITU Member States. However, ITU Member States retained much more diverse regulatory frameworks with regards to IT, broadcasting content and Internet content (Figure 7).

In a converged ICT industry, it may prove difficult for operators and content providers to compete on a level playing-field, if they report to different authorities on different issues. There is a need for softer and smarter regulation, free from bias and led by out-of-the-box thinking. More recently, the growth of integrated communications is leading to calls for "regulatory rebalancing" (Featured Insight 3).

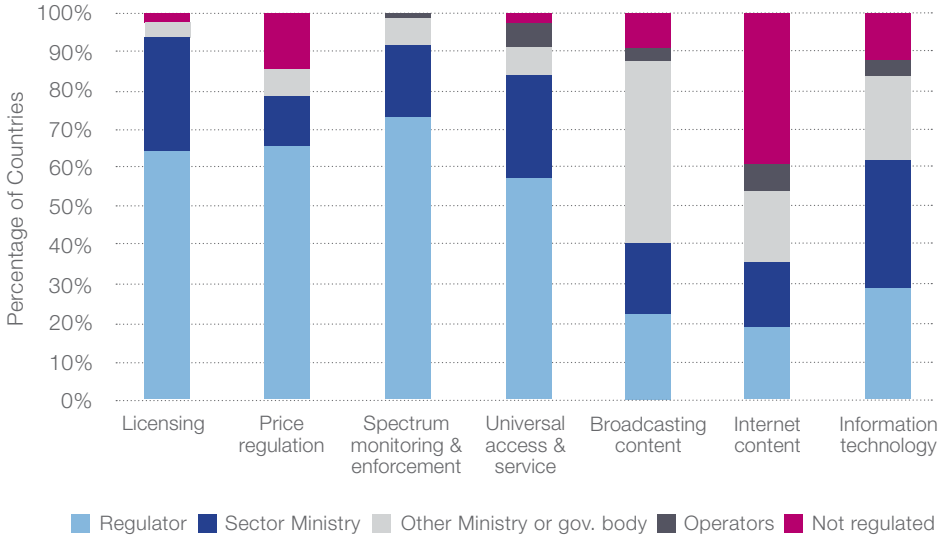



**Figure 7: Who Regulates What in ICT?**

Mandate of World Regulators, end 2013.

*Source: ITU Telecommunication Regulatory Database.*

## FEATURED INSIGHT 3: A CALL FOR REGULATORY REBALANCING

The state of broadband in 2014 cannot be fully reflected without acknowledging the still relatively new, and certainly disruptive, Internet-based voice and messaging services. Facebook's acquisition of WhatsApp this year and the announcement that voice calling will be added to WhatsApp services are indicative of a trend towards IP-based communications that are marketed to the public as free. The success of Tencent's WeChat, with nearly 400 million active users, has contributed to a significant decline in mobile operators' voice and SMS volumes in China. In a broadband-centric world, the business of telecommunications must adapt.

As communication technologies continue to evolve, the stakes are high for everyone — consumers, governments and industry. The mobile industry is not standing still; it is developing and introducing native IP-based services such as Voice over LTE and rich communication services — so-called 'green button' services. Competition is generating innovations that benefit consumers and society.

Unfortunately, regulation is not keeping pace with the changes in the market. The mobile sector is among the most intensively regulated industry sectors, subject not only to common rules governing consumer protection and privacy, but also to a raft of sector-specific rules related to interoperability, security, emergency calls, lawful intercept of customer data, universal service contributions and more. It is one of the most heavily taxed sectors around the world, facing various industry-specific taxes, levies and fees.

Internet players offering equivalent voice and messaging services are, by and large, subject to none of these requirements or the cost of compliance. A Skype call, for example, is not bound by the same rules as a mobile phone call, and this is the basis of the French regulator ARCEP's ongoing dispute with the company. Many anti-discrimination and data protection rules apply only to telcos and cable companies, despite an increasing amount of communication taking place via unregulated platforms. It is the GSMA's position that the same service should be subject to the same rules.

Consumer awareness reflects these regulatory double standards. GSMA research with over 11,500 mobile users around the world shows that the responsibilities of telecom operators and content providers for protecting privacy and personal data are not widely understood. When asked, for example, who is responsible for safeguarding personal information when they download an app, 58% answered the responsibility lies with the mobile operator. In reality, the mobile operator has no control whatsoever over which data a third-party app captures from that user's device.

Asymmetric regulation has resulted in an uneven competitive landscape for services, which heavily favours the Internet players. It is the responsibility of governments to level the playing field. A stable and sustainable mobile industry, shaped by healthy competition and market forces, is fundamental to the spread of broadband connectivity around the world. Today, the mobile sector is bearing the costs of market distortion created by outdated regulation. Equitable rules for business create an environment that, through competition and innovation, leads to the best outcomes for citizens everywhere.

*Source: Dr. Anne Bouverot, Director-General, GSMA.*

## Box 2: Fourth-Generation Regulation

Innovative and smart regulatory approaches can foster equal treatment of market players without placing an extra burden on operators and service providers. Some of these guidelines include:

- Adopt a "light-touch" regulatory approach, intervening only when necessary, while ensuring that market forces work without constraints and in favour of innovation;
- Ensure principles of fair, equal and non-discriminatory treatment of all market players for a level playing-field among regulated and unregulated players;
- Streamline procedures to facilitate market entry and stimulate competition and innovation;
- Conduct market analysis to assess the market situation in a converged environment;
- Adopt a regulatory framework that eliminates barriers to new entrants;
- Include competitive provisions that guarantee a healthy relationship between all authorized players in the relevant market (operators, Internet providers, OTT providers, etc.);
- Empower consumers to make informed decisions through the development of online tools to check download speeds, quality-of-service and prices for access and data plans;
- Monitor the use of traffic management techniques to ensure they do not unfairly discriminate between market players;
- Encourage network and facility sharing through "soft" measures (e.g. cross-sector mapping of infrastructure that enables the coordination of civil works).
- Ensure transparency and openness (e.g. by making market data and regulations available).
- Encourage multi-stakeholder consultation on policy and regulatory matters;
- Continue to ensure regulatory predictability and foster co-regulation wherever possible; and
- Work with all stakeholders to reduce or remove practical barriers to broadband deployment.

*Source: Chapter 1, Trends in Telecommunication Reform 2014 report, based on www.itu.int/bestpractices*

Regulatory frameworks need to be reviewed, and revisions need to be carefully considered in order to avoid sudden changes to ICT regulatory frameworks, which might jeopardize investment. A cost-benefit analysis can be used to evaluate each market and adapt regulation to the specific needs of the market. ITU hosts the annual Global Symposium for Regulators[39] (GSR) to keep Member States informed about the latest regulatory developments, and to assist them in reviewing and updating their ICT regulations. Box 2 above details key features of innovative regulatory approaches.

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# 3

# EVALUATING GLOBAL GROWTH IN BROADBAND: THE NEED FOR POLICY LEADERSHIP

How can the benefits of broadband be extended to the entire world's population? Over recent years, governments, policy-makers and regulators have made broadband a policy imperative, based on growing recognition of the impact of broadband on national goals. There is strong evidence to suggest positive benefits to broadband in greater economic growth (through productivity gains and employment), enhanced social inclusion and citizen engagement.

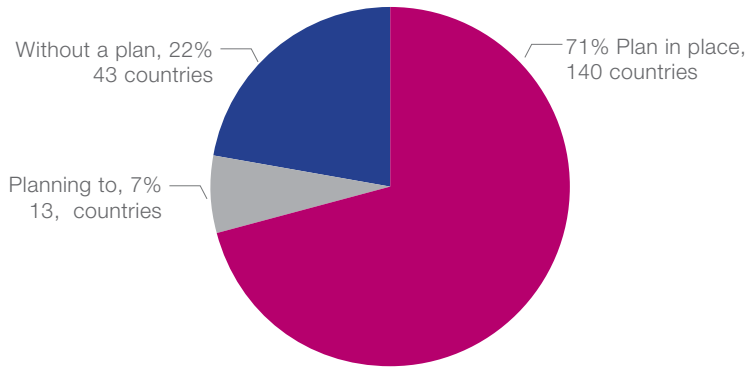
As part of its efforts to promote digital inclusion, the Broadband Commission approved four targets at the Broadband Leadership Summit in 2011 to monitor the progress of broadband network roll-out and the affordability of services around the world. A fifth advocacy target on gender equality in access to broadband was approved by the Commission in 2013. This chapter reviews international progress in achieving these five advocacy targets.

## 3.1 Advocacy Target 1: Making broadband policy universal – by 2015, all countries should have a national broadband plan or strategy or include broadband in UAS Definitions

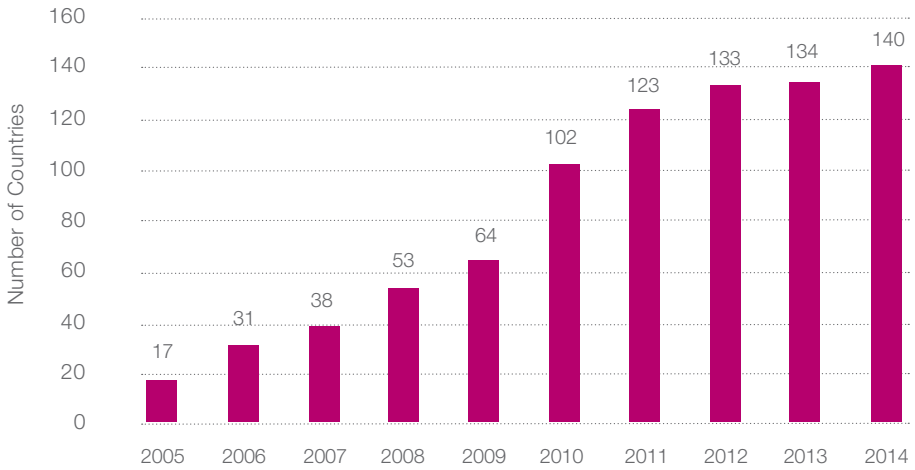
The importance of national policy leadership is now clearly understood by policy-makers and governments around the world. A clear statement of policy objectives and/or targets can boost understanding and facilitate the national roll-out of broadband. This statement may often (but not always) take the form of a National Broadband Plan[1]. Today, some 140 countries have developed a national plan, strategy, project or policy to promote broadband, while a further 13 countries are planning to introduce such measures in the near future (Figure 8, top).

However, 43 countries still do not have any form of broadband plan, strategy or policy in place. The number of National Broadband Plans has grown strongly since 2009, partly driven by the financial crisis, which spurred many Governments to respond with stimulus funding for broadband[2]. However, growth in the number of broadband plans and policies, as tracked by the ITU, has slowed since last year, as countries enter a phase of consolidation and assessment of national progress (Figure 8, bottom). Countries which recently approved a NBP

## Figure 8: Policy Leadership in National Broadband Plans




### Countries with National Broadband Plans, Strategies or Policies, World, mid-2014




### Number of Countries with National Broadband Plans, 2005-2014

*Source: ITU.*

*Note: Top chart based on data for 196 countries. 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.*

include Brunei in 2014, Nigeria (in July 2013), South Africa (December 2013 – Box 4) and Sierra Leone (currently developing its Plan). Canada launched an Economic Action Plan in 2014 to promote broadband roll-out in rural areas[3].

Smart public policies to foster broadband should always take into account both sides of the market – namely, supply (e.g., investments in broadband networks, adequate products & services, affordability of smart devices, etc.) and demand (through expanding ICT education, digital skills, entrepreneurship policies, support for start-ups etc.). Policies for broadband should also consider linkages with other sectors (Box 3).

However, many regulatory and policy institutions often still work in a 'silo' approach, making decisions in isolation from other sectors. Policy-makers need to come together to formulate common strategies on ICT policy aligned with other major policy areas to maximize the impact of ICTs on energy, health, education and climate[4]. Used wisely, national strategies can be a vehicle for cross-sector collaboration and cross-ministry coordination in support of a common vision for the development of broadband. A raft of vital factors need to be reviewed, including licensing reforms, competition regulation and streamlining local planning permission – plans are not developed in a vacuum, but alongside other key policies and laws.

Regardless of form, policy objectives should be consistent over the entire national territory and ensure coordination at regional and local levels, to better guarantee successful outcomes. Extending broadband planning to the community level is another question, however. A recent survey of economic planners in the U.S. reveals that only around half of respondent communities have an economic development plan that includes broadband strategies and tactics. 48% of local State economic development agencies either already have a plan with broadband or are in the process of writing one that will incorporate broadband (19%), while just over half (a total of 52%) do not have a plan including broadband infrastructure. 61% of rural respondent communities have or are writing a plan that includes broadband tactics[5].

All stakeholders in the ICT value chain must be taken into account if the full benefits of broadband are to be achieved. A policy focusing solely on one side of the market is unlikely to prove successful. A "one-size-fits-all" approach is ill-advised for the communications sector, where inappropriate national policies can foster or undermine crucial private investment in broadband infrastructure. A cost-benefit approach should be adopted before implementing any legal and regulatory changes in this dynamic sector.

Box 3 summarizes the key characteristics of good national broadband strategies. South Africa Connect provides an excellent example of a policy which focuses on both supply-side and demand-side considerations (Box 4). Once a Plan is in place, however, the emphasis must be all about implementation and moving from plans to action. Qatar provides an excellent example of a Roadmap identifying clear actions, with responsible counterparties (Featured Insight 4). China has also launched a succession of Plans focusing on implementation (Featured Insight 5).

## Box 3: Characteristics of a Good Plan

Best practice cases for national broadband plans are by now broadly well-established. According to research by ITU, a good Plan should broadly:

- Make the case for broadband, specific to the needs and economic structure of that country, based on thorough contextual market analysis and benchmarking;
- Escape 'silo thinking' and apply across a range of different sectors;
- Be developed in consultation with a broad range of stakeholders. To ensure effective implementation, there should be a coordinating agency responsible for implementing the plan overall, in conjunction with other involved bodies[6];
- Consider the vital issue of enforceability/execution. Who is responsible for enacting the Plan? Who will monitor progress? How will implementation be funded?
- Consider both demand and supply side considerations. This may mean supporting the development of human skills, literacy, and demand among, for example, schools and SMEs, as well as taking into account the role of Government in driving demand in many developing countries.
- Have a timescale of around 3-5 years, as longer time horizons are difficult to predict in a fast-changing industry.
- Be broadly technology-neutral. Plans should have no major implications in terms of favouring specific technologies.
- Contain detailed, measurable goals and strategies to allow evaluation of progress. Plans may often also contain consideration of 'special interest groups', such as schools, hospitals, universities, diverse languages and access by minorities or people with specific needs.
- Address related legislation – e.g. privacy and data protection, security and digital signatures, rights of way, interoperability.
- Strike a balance between high-level strategic direction and detail. Plans should allow implementing agencies some flexibility in how they should go about implementation.

*Source: ITU/Cisco (2013), "Planning for Progress: Why National Broadband Plans Matter", available from www.broadbandcommission.org*

## FEATURED INSIGHT 4: TOWARDS BROADBAND IMPLEMENTATION IN QATAR

Qatar's National Broadband Plan (QNBP) was released late in 2013. It provides the guidelines and actions Qatar needs to follow over the next decade to ensure the opportunities offered by broadband technology are maximized. The plan aims to support and promote broadband market development, involving multi-stakeholders from both the public and private sectors, to ensure both supply and demand sides are addressed. The Plan should help provide high-quality, affordable and high-speed broadband services to all, in order to support the human, social, economic and environmental development of Qatar, for the benefit of both the nation and its residents. To track the fulfilment of the National Broadband initiative, Qatar's Plan proposes four targets:

- Everyone should be able to choose between at least two broadband providers by 2016.
- 95% of households should have the ability to access affordable and high-quality broadband service of at least 100 Mbit/s effective download and 50 Mbit/s effective upload speeds by 2016.
- All businesses, schools, hospitals and government institutions are to have high-quality access to at least 1 Gbit/s effective symmetrical speeds by 2016.
- Digital literacy is to be expanded to the whole population by 2016, along with guarantees about users' digital privacy, protection of personal data, and freedom of opinion and expression.

Four action areas were identified as key to achieve the plan's targets: (1) supporting healthy competition; (2) efficient management of resources; (3) ensuring take-up; (4) maximizing the benefits of broadband. Forty detailed and stakeholder-specific policy actions have been defined in a Roadmap, with clear responsibilities defined for all stakeholders. Thirteen working groups will lead the implementation of specific policy actions in each sector, with cooperation from the dedicated Program Management Office, under the supervision of a high-level National Broadband Steering Committee to ensure that actions are implemented.

In addition, Qatar is introducing its 2020 E-Government Strategy & National Cyber Security Strategy, as well as a unique Strategy addressing the needs of people with disabilities for assistive technology through the Ministry's Center for Assistive Technology (Mada). Qatar realizes that, while increasing demand for broadband is vital for its economy, its unique position and characteristics make it a lucrative target for cyber-attacks, hence its focus on delivering a holistic and safe digital ecosystem. These strategies also contribute to the implementation of QNBP, as they address vital policy actions.

*Source: H.E. Dr. Hessa Al Jaber, Minister of Information & Communication Technology, Qatar.*

## FEATURED INSIGHT 5: THE STATE OF BROADBAND IN CHINA

China's national broadband network has experienced rapid growth over recent years. Fixed broadband subscribers increased by 11 million in the first six months of 2013 and totalled 181 million by mid-2013. Total investment for broadband network infrastructure in China will be 1.6 trillion RMB (c.US$ 250 billion), while total investment in relevant industries is expected to exceed 4.8 trillion RMB (US$ 700 billion) by 2015. Given China's changing demographics and the scale of investments needed, alongside rising speed and demand for capacity, the development of "Broadband China" to date has been significant. It has been achieved through government policy support, broadband service development and industrial innovation in technology and apps.

Key Government policies to boost the steady development of Broadband China have included:

- **Continuously improve broadband as a strategic national asset.** The China Development and Reform Commission, Ministry of Industry and Information Technology and other Ministries issued the "Advice of Implementing and Popularising Higher speed Broadband Project" in 2012 and "Advice of Implementing Broadband China 2013 Special Action" in 2013. The State Council issued "Broadband China Strategy & Implementation Plan" to promote broadband development in August 2013.
- **Implement FTTH network access in new buildings.** The Ministry of Housing and Urban China has issued several regulations to boost broadband deployment and application. "Residential and Residential Building FTTH Communications Facilities Construction Engineering Design Specifications" and "Residential and Residential Building FTTH Communications Facilities Construction and Acceptance Norms" aim to solve the difficulty of residential wiring projects. FTTH Communications for new building demand encourages carriers to share network access and optical fiber resources. The strategy is designed to break the existing monopolies of China Unicom in the north of China and China Telecom in the south by encouraging and supporting market competition.
- **Support rural and undeveloped regions.** Operators may show only limited enthusiasm about investing in broadband at the county level and in undeveloped regions due to low returns on investment. The government has implemented a universal service obligation (USO) and compensation scheme with tax incentives to boost broadband universal deployment. The "Broadband China" strategy classified broadband network construction and operation in "The Encouraged Industries Directory in western regions", and broadband service in the "Preferential Industrial Catalogue for Foreign Investment in middle and western regions" to promote broadband network investment in provincial regions.
- **Attract private capital funding**. Very soon, the Chinese government will open the broadband access market to private capital and encourage private capital to set up broadband access enterprises which cooperate with incumbent carriers to provide broadband services. These policies will promote broadband market competition and boost the development of "Broadband China".

*Source: Huawei.*

## Box 4: South Africa's New National Broadband Policy: South Africa Connect

In recognition of broadband's potential to drive economic growth and development, the Government of South Africa has developed a Broadband Policy, *South Africa Connect*, to create opportunities, while ensuring social and economic inclusion. This Policy was approved by the Government and gazetted by H.E. the former Minister of Communications, Mr Yunus Carrim, in December 2013. This Policy takes forward the National Development Plan of the country. It reflects the commitment of the Government of South Africa to creating an enabling environment for investment in the roll-out of broadband infrastructure and for the production of content, applications and services to drive demand.

The Policy identifies a range of demand- and supply-side policy interventions necessary to achieve ambitious, but achievable, targets. A universal average download speed of 100 Mbps by 2030 has been set. Progressive targets have been set for an average user experience speed of 5 Mbps to be available to 50% of the population by 2016, and to 90% by 2020, with quality of service and prices to be monitored by the regulator. Specific targets have also been set for schools and clinics and for public sector connectivity. These targets will be reviewed regularly, if necessary. The plan focuses on the need for effective partnerships between the public/private sectors. These policy interventions are reflected in a four-pronged strategy:

1. **The Digital Readiness pillar** addresses institutional and administrative impediments.
2. **The Digital Development pillar** aims to digitally enable government by identifying key activities.
3. **The Digital Future pillar** focuses on creating suitable conditions for to the development of next-generation infrastructure and services.
4. T**he Digital Opportunity pillar** is based on stimulating demand, including through general awareness and e-literacy campaigns, to formal skills development.

Through this policy, South Africa aims to mobilize the capabilities, resources and energy of its public and private sectors, together with civil society, to connect South Africans.

*Source: Former Minister of Communications, Yunus Carrim, Dept. of Communications of South Africa.*

## 3.2 Advocacy Target 2: Making broadband affordable – by 2015, entry-level broadband services should be made affordable in developing countries through adequate regulation and market forces

The price of broadband access is critical in expanding access to broadband in developing countries. Broadband is becoming more affordable around the world – over the past five years, fixed-broadband prices as a share of GNI per capita have dropped by 65%[7]. By 2013, the majority of countries had reached the Commission's target of offering basic fixed-broadband services at <5% of monthly GNI per capita, but broadband still remains unaffordable in many parts of the developing world. Affordability applies to service pricing, as well as other parts of the broadband value chain – for example, in the cost of smartphones, tablets or other devices allowing broadband access.

Huge discrepancies in affordability persist. By 2013, fixed broadband services remained expensive, accounting for 32.2% of average monthly incomes in developing countries (compared with just 1.5% in developed countries)[8]. The number of developing countries where broadband cost less than 5% of average income increased from 48 in 2012 to 56 in 2013 (with 26 developing countries in 0-2% and 30 in 2-5% in Figure 9). Assuming that people can afford fixed broadband if it costs less than 5% of their annual income, fixed broadband access is still unaffordable for 1.7 billion people, and mobile broadband unaffordable for over 2.6 billion people around the world[9]. More developing countries are approaching the target threshold, but there is still some way to go – there are 17 developing countries where broadband cost between 5-10% of average income in 2013 (and 43 developing countries where broadband cost >10% in Figure 9).

Competition is widely recognized as the most effective mechanism to date to lower prices, although policy-makers can also address affordability by regular monitoring, price regulation, potential subsidies, and tiered services. ITU's most recent research suggests that duopolies can realize some falls in prices, but that markets with at least three licensed operators experience the greatest falls in prices[10].

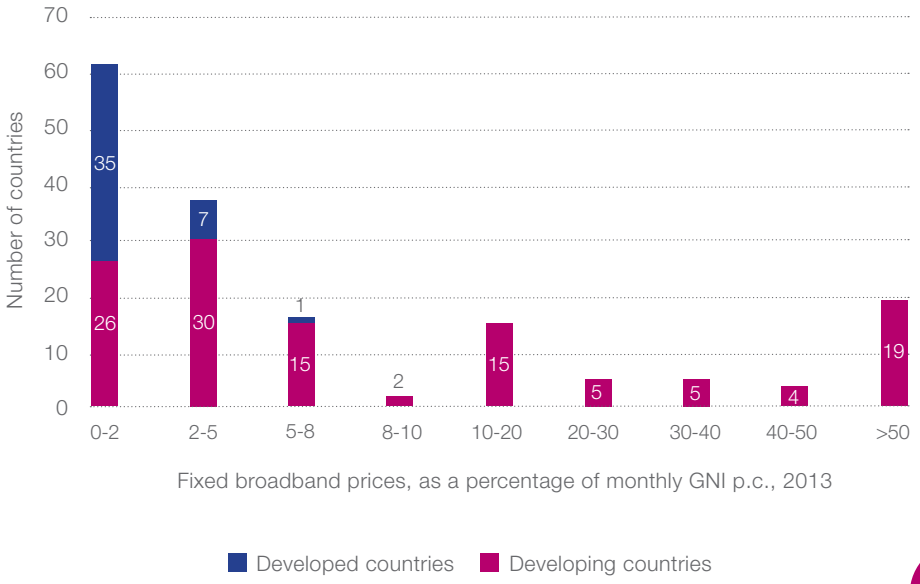



**Figure 9: Fixed broadband sub-basket for Developing Countries, 2013**

*Source: ITU.*

## 3.3 Advocacy Target 3: Connecting homes to broadband – by 2015, 40% of households in developing countries should have Internet access

Access to broadband or the Internet at home is one of the more inclusive ways of bringing people online. At home, all household members can have access – no matter whether they have jobs, go to school, are male or female, children, adults, or elderly. Research has shown that children with Internet access at home perform better in school. Children using the Internet at home are usually under parental guidance and better protected against online dangers.

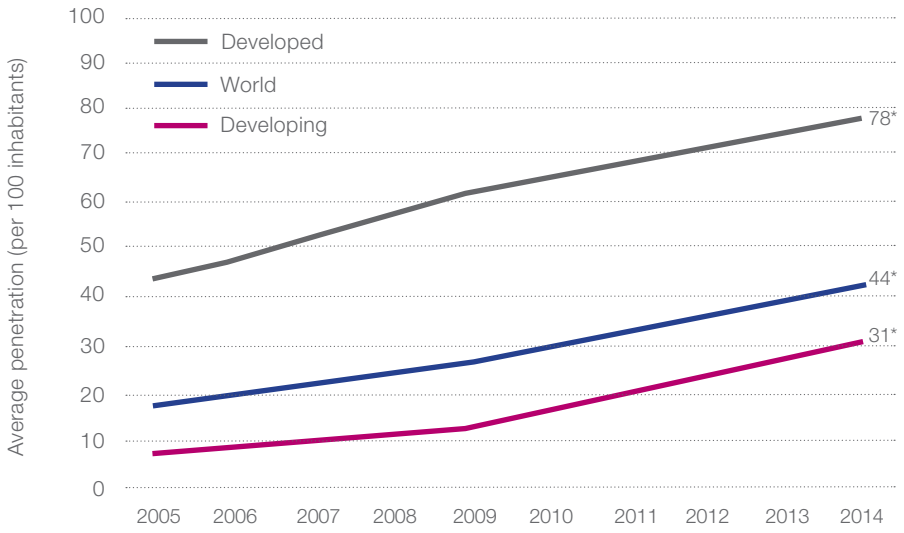
The Republic of Korea has the highest household Internet penetration in the world, at 98.1%. Household penetration is now above 50% in 27 developing economies worldwide. Global growth in household Internet access can be broken down into two opposing trends. Globally, 44% of total households will be connected by the end of 2014 (Figure 10). However, Internet access for households in developed countries has slowed in its growth since 2009, and is nearing saturation, with over three-quarters of households already connected to the Internet.

Although developing countries show an accelerating trend in Internet access from 2010 onwards, the proportion of households in developing countries with access to the Internet currently falls short of the target, at just 31.2%. By 2015, only 34% of households in developing countries are likely to be connected to the Internet, and the target of 40% only looks set to be achieved by 2017 at the earliest. This global average masks strong regional disparities in access – for example, in Africa, only one tenth of households have Internet access. For national rankings, see Annex 4.

**Figure 10: Proportion of households with Internet access, 2005-2014**

*Source: ITU World Telecommunication Development Indicators.*

*Note: * Denotes an estimate.*



## 3.4 Advocacy Target 4: Getting people online - by 2015, Internet user penetration should reach 60% worldwide, 50% in developing countries and 15% in LDCs

By the end of 2014, some 2.9 billion people or 40.4% of the world's population will be online[11], up from 2.3 billion people in 2011 (equivalent to 32% penetration). However, over two thirds of people in developing countries will still remain unconnected, as will over 90% of people in the world's 48 LDCs. The global target of 60% Internet user penetration is unlikely to be achieved by next year, even though Internet user penetration is approaching saturation in developed economies, at around 78%.

The top ten countries in the world for Internet usage at the beginning of 2014 are all located in Europe, and all have Internet penetration of over 90%. There are 77 economies where more than half the population now has access to the Internet. For national rankings, see Annexes 5, 6 and 7. According to ITU data, the milestone of 3 billion Internet users will be achieved in 2015, a full year ahead of the schedule estimated by Boston Consulting Group (BCG) back in 2012[12].

This implies that global growth in Internet usage is happening more quickly than previously anticipated. In the developing world, Internet penetration will reach 32.4% by the end of 2014 (compared with 24% in 2011) and under 10% in LDCs (Figure 11). Internet user penetration in developing countries is unlikely to achieve the target of 50% until 2020. Over half the world's population or more than 4 billion people are still not using the Internet regularly or actively yet, of whom more than 90% live in the developing world. For the national rankings of developing countries, see Annex 6. One way governments can get more people online is through the deployment of Universal Service Funds (USFs)[13].

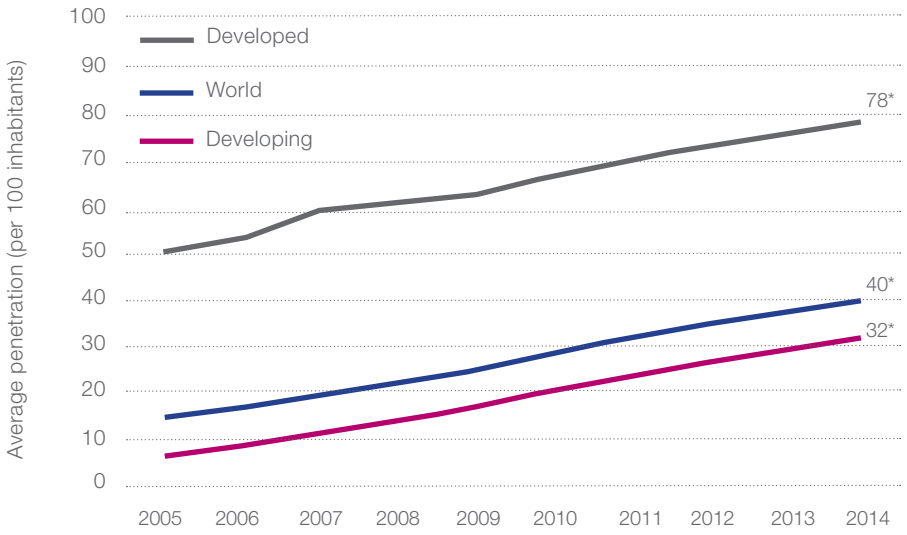



**Figure 11: Internet user penetration, 2005-2014**

*Source: ITU World Telecommunication Development Indicators.*

*Note: * Denotes an estimate.*

## 3.5 Advocacy Target 5: Achieving gender equality in access to broadband by 2020

Gender equality in access to broadband is essential for empowering women and girls through equal access to new technologies to acquire ICT skills and better-paid jobs, access information, and redress some of the inequalities they face in their everyday lives. If women and girls are unable to enjoy the same access to ICTs, and relevant content, they can find themselves at a serious disadvantage in becoming fully literate, learning about and exercising their rights, participating in public and policy-making processes and accessing skilled jobs[14].

Sex-disaggregated data are not yet widely available for broadband connectivity. Based on Internet usage data as a proxy, ITU (2013) estimated there were 1.3 billion female Internet users by 2013, compared with 1.5 billion men and boys online, equivalent to a global gender gap of some 200 million fewer women and girls online[15] in 2013. This gender gap was more pronounced in the developing world, where 16% fewer women than men used the Internet, compared with only 2% fewer women than men in the developed world (ITU, 2013[16]).

ITU's research suggests that, in many countries, women are coming online more slowly and later than men, impacting women's ability to use the Internet to access information and develop the vital ICT skills needed to participate on an equal footing with men in the digital economy. Without coordinated action among various sectors, it will be difficult to eliminate the gender digital divide, given entrenched cultural barriers prioritizing (or failing to prioritize) women's access to ICTs, education and knowledge. To be successful, these actions should tackle the root causes of the existing gender inequalities in societies, i.e. the range of factors of socio-economic and political nature which affect gender divides and biased attitudes and cultural beliefs.

ITU, its Members and NGOs are promoting concepts of m-learning and digital literacy. ITU and telecentre.org Foundation launched the Telecentre Women Digital Literacy Campaign in April 2011 with the goal of training one million women to become digitally literate. By January 2014, over one million poor and marginalized women have been empowered through this initiative[17].

UNESCO is assisting its Member States in formulating and implementing national information policies in a gender-inclusive manner, empowering women through access to information and knowledge and the use of ICTs. For example, the OER Declaration provides recommendations to Member States on gender equal perspectives in promoting and using OER to widen access to education.

These initiatives aim to raise awareness about girls' and women's role and participation in accessing information, and to increase the number of women accessing, using and developing ICTs, OERs, OA and FOSS materials. It is hoped that these activities will guide national stakeholders in adopting enabling policies with a strong gender equity perspective to reduce the digital gender gap.

ENDNOTES


1. See GSR 2011 Discussion Paper on "Setting National Broadband Policies, Strategies and Plans", by Dr Robert Horton, Senior Telecommunications Expert, available at: http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR11/documents/03-Broadband%20Policies-E.pdf
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5. "Community Broadband Snapshot Report: The Broadband-Driven Economy".
6. How to Plan It, Fund It, Measure It", IEDC (right chart), available at: http://cjspeaks.com/wp/wp-content/uploads/2014/04/IEDC-2014-report.pdf.
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8. ICT Facts and Figures 2013, ITU, Geneva.
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13. "Universal Service Funds and Digital Inclusion for All", Discussion Paper for GSR 2013, Lynne A. Dorward, available at: http://www.itu.int/en/ITU-D/Regulatory-Market/Documents/USF_final-en.pdf.
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17. http://women.telecentre.org

# 4

# BROADBAND FOR DRIVING SUSTAINABLE DEVELOPMENT

The real power of broadband lies in its potential to improve development outcomes in the developing world. There is today growing evidence that broadband is making a tangible difference in the lives of people around the world. Broadband and ICTs can play a fundamental role in giving people voice and access to knowledge, information and education and supporting the development of new skills and employment opportunities. The UN Rio+20 Conference in June 2012 recognized that "it is essential to work toward improved access to ICTs, especially broadband networks and services, and bridge the digital divide"[1].

One clear trend in this regard is the development of a more complex broadband ecosystem in trying to address the complex challenges of human development (Featured Insight 6). In seeking to use ICTs to help tackle complex problems of human development, more diverse stakeholders are involved. Broadband providers must work with health workers or with financial service providers (e.g. banks and money transfer services) to understand their needs and requirements, despite their different backgrounds.

### FEATURED INSIGHT 6: THE EXPANDING BROADBAND ECO-SYSTEM – AN ENGINE OF TRANSFORMATION AND PROGRESS FOR SUSTAINABLE DEVELOPMENT

Broadband has come a long way in a very short period of time. Four Exabytes ($4.0x10^{18}$) of information were generated in 2012, more than was produced over the past five thousand years[2]. "Digital", "Mobile", "e- and -m" are now an integral part of our language, as well as daily references to many products and services that serve our global community – e-Health, m-Health, e-Education and m-Education, to name a few. Business processes and business models of our organizations are continuing to transform and create a demand for knowledge workers.

Yet, we have a long way to go. Broadband has to be integrated into new business models for strategic success. Collaborative models are needed for innovation, commitments, resource-sharing and participation to serve the many diverse needs and demands of our societies. Job creation and economic empowerment are vital means of bridging development gaps.

The broadband ecosystem initially involved NGOs, network operators, academia, hardware and software providers, ICT policy-makers and regulators. As broadband spreads into more diverse sectors, publishers and content providers, social

networks, healthcare providers and major players in other vertical industries (such as finance, agriculture and manufacturing) have to be taken into account, in terms of their needs, expectations and influence in shaping the future of broadband. We have to promote and be willing to share the risks and the rewards in reconciling the sometimes different interests of diverse organizations. Collective business models must now include collaborative innovation and be focused on the changing socio-economic needs and demand.

For example, there is evidence to suggest that universities and colleges in the U.S. may not be able to create and produce the required number of nurses through traditional educational systems[3]. However, the use of broadband and online education in combination with telemedicine and in-person education could enable hospitals to reach their goals and boost capacity.

I am currently working with several universities in the U.S., which are using broadband and distance/online learning to train nurses. Other educational and healthcare organizations in Europe and Asia are involved in similar initiatives as well.

*Source: Dr. Reza Jafari, Chairman and CEO, e-Development International.*

ICTs are today promoting the achievement of all three pillars of sustainable development defined by the UN's framework for post-2015 development: social development; economic development; and environmental protection[4]. ICTs are empowering billions of people by helping them make more informed decisions, from providing access to education or health information to making electronic payments enabling people to set aside valuable savings and survive economic shocks.

Mobile phones are today increasingly powerful portals granting access to the online world, making people more informed and enabling them to exercise choice and make better decisions, improving their lives and livelihoods. Table 2 outlines some of the ways in which broadband, and especially mobile broadband, is making a difference and improving the lives of people around the world. Broadband connectivity is not a substitute or panacea, but when integrated with existing systems, it can enhance service delivery or facilitate new services and to help deliver the best results (Table 2).

## Table 2: Broadband ICTs and the Millennium Development Goals (MDGs)

| | |
|---|---|
|  End Poverty & Hunger | Growing evidence suggests that broadband can boost GDP incomes, helping combat poverty and hunger[5]. A number of studies have found that ICTs are a major driver of economic growth, as well as improved productivity[6], reduced transaction costs and job creation[7].The World Bank (2009) found that a 10% increase in broadband penetration may boost economic growth by between 0.43-1.38%[8]. Further country case studies suggest an even stronger impact of fixed and/or mobile broadband in individual countries, depending on their economic structure[9]. |
|  Universal Education | Broadband-powered applications and content can be powerful levers for achieving broader education goals – see Chapter 5. Many Governments and NGOs are now providing schools with PCs to foster a sound primary education – for example, the iSchool programme in Zambia is transforming learning through interactive ICT content – see Box 9. A number of countries (e.g. Turkey, Lebanon and Uruguay) are providing students and teachers with laptops as a tool for improving education. In Singapore, the 'NEU PC Plus Programme' offers new laptops bundled with broadband service to low-income students and people with disabilities. The Education Support Network (EsNET) of OneWorldAfrica is training primary school teachers in the use of ICTs to improve educational outcomes[10]. |
|  Gender Equality | Intel (2013) has estimated that closing the global digital gender gap could add US$13-18 billion to global GDP[11]. Various studies have reported that men and women are using ICTs differently, with men generally using ICTs more and using more sophisticated apps – for example, in a selection of Arab countries, men use ICTs more extensively for e-commerce than women[12]. For mobile telephony, the GSMA (2010) has estimated that closing the mobile gender gap could increase revenues for mobile operators by US$ 13 billion[13]. |
|  Child Health | The Millennium Villages have equipped Community Health Workers (CHWs) with mobile phones to improve access and quality of healthcare services. ChildCount+ is a community health platform aimed at registering patients, monitoring nutrition, and prompting immunizations to improve child survival and maternal health[14], which tracks vital signs such as weight, body mass index, white cell count etc. and issues automated SMS messages to prompt CHWs to provide treatments or take other action. ChildCount+ helps CHWs register children under five to monitor their health status[15]. A project funded by UBS helps provide Mobile Phones for Integrated Health and Early Childhood Care and Development in Kenya[16]. |
|  Maternal health | ChildCount+ has added support for maternal health by registering all pregnant mothers and providing support for antenatal care, as well as the launch of a software module in Ghana, aspiring to reduce mother-to-child transmission of HIV[17]. Hospitals connected via broadband networks are also enabling remote diagnosis and support for maternal health. For example, WE CARE Solar in Nigeria provides healthcare workers and midwives with mobile phones and reliable lighting using solar electricity to facilitate safer deliveries. |
|  HIV/AIDS | ACT 2015: Crowdout Aids[18] is a movement led by UNAIDS and civil society partners to develop a global community of activists to drive an online conversation about HIV/AIDS and encourage Governments to respond, by providing tools for young people to take action in their communities. ICTs can be used to bring information about HIV, treatments and access to confidential medical records closer to patients[19]. |
|  Environment | The ICT sector has been estimated to contribute 2-2.5% of GHG emissions, including radio communications systems and equipment – however, ICTs could enable energy efficiency across other sectors. ICTs have the capacity to deliver carbon savings five times greater than the sector's own total emissions – equivalent to more than 7.8 Gt by 2020 or 15% reduction of global emissions, for only a small increase in ICT emissions[20]. Smart electricity grids that adjust rates for peak energy usage could save US$200-500 billion per year by 2025, according to the McKinsey Global Institute[21]. |
|  Partnership | The benefits of new technologies, especially ICTs, should be made available in cooperation with the private sector[22]. In conjunction with public sector policy leadership, the private sector has driven expansion in the markets for fixed and mobile broadband. Many National Broadband Plans focus on the importance of PPPs for expanding access to broadband networks and services – in 2013, more than six out of ten Plans include reference to the role of PPPs[23]. |

In terms of health, broadband and ICTs are having real impact on the delivery of healthcare services in underdeveloped and rural areas, leading to improved response times in emergency situations, reduced isolation, and better training and equipment for healthcare workers. Broadband and ICTs are helping achieve real advances in healthcare (Featured Insight 7). On a national scale, broadband can help ensure that health systems or networks no longer work in isolation, and can help connect up these systems to national repositories and ministerial databases to provide national digital health records. Governments and health agencies are able to create accurate and reliable health records for growing numbers of citizens, leading to improved care and higher life expectancy. Even more importantly, ICTs may be engendering a whole new approach to healthcare by enabling people to be better informed and engage in prevention through better hygiene, rather than treatment. A Price Waterhouse & Coopers study estimated in 2013 that mobile health could potentially save 1 million lives by 2017 in Sub-Saharan Africa and could generate $400 billion of savings in developed countries in 2017[24].

Efficient cross-sector collaboration between health and ICTs is particularly important in the development and scaling of mHealth. The cooperation signed between ITU and WHO in 2012 to support countries in the development of mHealth projects and strategies around Non-Communicable Diseases ("Be He@lthy, Be Mobile) is an initiative which is already encouraging this cross-sector work to develop (see Featured Insight 8).

### FEATURED INSIGHT 7: BROADBAND AS A CATALYST FOR BETTER HEALTH

**ICTs and broadband are changing the world in ways we could not have imagined even ten years ago, while innovation and progress continue to accelerate. Broadband is bringing technological advances to the service of all humanity, and putting people at the centre, through the use of innovative real-life applications in fields such as healthcare.**

**In the 21st century, and in shaping the post-2015 development agenda, we cannot ignore the vital role that ICTs and broadband will play in improving the lives of every single person on the planet. Clearly, we all recognize this – so ICTs need to play a central role in the post-2015 development process. This is crucial, because so much development depends on healthcare-related goals and targets – and ICTs and broadband will play a gigantic role in achieving these. Without the power of ICTs, it is extremely difficult to combat HIV/Aids, malaria and other diseases.**

**Broadband services are enabling huge advances in the provision of healthcare services worldwide – and especially in the developing world, where the gap between healthcare availability and healthcare provision is widest. Key benefits which can be achieved through access to ICTs include:**

- **Improved access to health advice and emergency services;**
- **Training for healthcare workers, especially in remote areas;**
- **Better telemedicine, patient monitoring, patient information and management of records; and**
- **The tracking of epidemics, disease surveillance and data collection.**

**ICTs have the potential to save millions of lives a year. As smartphones become more widespread, a growing number of healthcare apps will be developed.**

These apps can make a real difference on the ground – even where there no Internet connections are available. For example, there are simple but revolutionary apps that can be used to diagnose malaria on the spot. These apps typically process a picture taken by the phone of a blood sample, detect malaria parasites, quantify how many parasites are in the sample, and even highlight the parasites in the photo. Once these data are uploaded online by phone, they can then be used to spot and monitor disease trends, helping to play a vital role in prevention as well as in treatment. Each week brings us new and ingenious apps, many of which have often been developed locally, to address local issues. However, using the Internet, the reach and impact of a single app may prove to be global, just as human innovation is virtually unlimited.

*Source: Dr. Hamadoun Touré, Secretary-General, ITU.*

### FEATURED INSIGHT 8: THE MDIABETES MULTI-STAKEHOLDER PARTNERSHIP IN SENEGAL

The "Be He@lthy, Be Mobile" initiative signed between ITU and WHO in the fall of 2012 has already helped trigger the beginnings of a large-scale ambitious mHealth project in Senegal to address diabetes. The "Be He@lthy, Be Mobile" initiative supports countries in setting up large-scale projects that use mobile technology (in particular text messaging and apps) to control, prevent and manage non-communicable diseases such as diabetes, cancer and heart disease. Launched in 2013, the initiative is also working on an mCessation for tobacco programme in Costa Rica, an mCervical cancer programme in Zambia and has plans to roll out mHypertension and mWellness programmes in other countries.

Diabetes has traditionally been viewed as a disease of rich countries. However, estimates of diabetes prevalence show that four out of five people with diabetes live in low- and middle-income countries[25]. Some estimates show that as many as 80% of cases are undiagnosed in lower income countries[26]. Many people may not even know that they have diabetes as they are unaware of the causes and symptoms of diabetes, and often have limited access to health services, particularly in rural areas. Lack of diagnosis and management of diabetes can trigger serious consequences (including heart disease, stroke, blindness, kidney failure and severe foot sores that may lead to amputation[27]).

The mDiabetes project in Senegal aims to address some of these challenges by using mobile phones to increase awareness among the population about diabetes symptoms and sending preventive messages, as well as educating patients about how to better manage their disease. An important part of the programme consists of educating health workers about the disease. The first phase of the project was launched in June 2014, sending free text messages that aim to increase awareness and help people with diabetes to avoid complications triggered by fasting and feasting during Ramadan.

What is unique about the project is the true cross-sector and multi-stakeholder nature of the partnership, which includes ITU, WHO, the Ministry of Health and the Ministry of Communication of Senegal, the local diabetes eco-system (such as ASSAD, the Senegalese diabetes patients' association), the diabetes expert Centre Marc Sankalé, as well as the private sector (including the mobile operator Sonatel, BUPA, Alcatel-Lucent and partners from the pharmaceutical industry). This multi-stakeholder partnership is a solid base to build a national project with financially sustainable models to ensure the long-term viability of solutions.

*Source: ITU and Alcatel Lucent.*

The deployment of broadband and ICT networks in remote and rural areas faces particular challenges, including low population density, challenging geography and lower incomes in rural areas, which can all eat into operating margins, making it difficult for networks to remain commercially viable (see Chapter 6). Some argue that the challenge for rural, and often less commercially viable areas (with low population density and lower market demand) lies not in implementation, but in the funding and investment in services.

In reviewing the history of Internet growth, there are several stages in the expansion of the Internet and access device affordability. Initially, subscription-based services helped the first two billion users to access the Internet. Prepaid-based services enabled nearly another one billion users to come online, for whom long-term broadband subscriptions were not easily affordable. As the focus shifts to bringing the next four (to seven) billion people online, their low income levels may need different strategies to connectivity.

One possible approach is very low-cost mobile phones. Another approach has been shared access which can occur in e.g. schools and community centers equipped with basic IT equipment (PCs, printers, scanners etc.). Both approaches can be facilitated and accelerated by the use of Universal Service Funds (USFs), many of which have funds collected but unfortunately still not utilized. One path to connect the next billion users is elaborated in Featured Insight 9, which examines the use of USFs for expanding the market and connecting more people. These challenges can be overcome successfully at the national level, as shown by the experience of TFYR Macedonia with rural broadband (Featured Insight 10).

### FEATURED INSIGHT 9: USFs AS A VALUABLE TOOL FOR CONNECTING BILLIONS AND ACHIEVING THE BROADBAND COMMISSION TARGETS

The social and economic benefits of broadband are by now well-known. Studies by ITU[28] show that the economic benefits of broadband increase with penetration, and there is a threshold to reach before the full benefits are achieved. The digital divide is therefore also an economic divide, which may be increasing over time. The Broadband Commission has established goals for countries to close these gaps, and good progress has been achieved; however, many communities still remain unserved, particularly low-income and remote populations. In fact, over 4 billion people still lack Internet connections (ITU, 2014), creating a formidable task ahead, as shown in the Box Figure overleaf.

Gaps in access, affordability, awareness, and skills still need to be addressed. Market mechanisms have done well to connect the first two billion, and new business models (including PPPs) are well on the way to connecting the third billion. For example, the pre-paid model along with facilities competition has made the cell phone nearly ubiquitous. Applying the pre-paid model to broadband has quickly brought millions more people online[29].

Connecting the remaining 4 billion people with broadband Internet access requires some public intervention, recognizing that market forces are not sufficient in the near term. USFs are a valuable tool to address these gaps, and best practices from around the world demonstrate viable uses. For example, in Malaysia, the USF provided netbooks and subscriptions to more than one million low-income students, which nearly doubled household Internet penetration in two years. Turkey is using USFs and other funds to transform the education system, providing electronic whiteboards, laptops, and tablets, along with a 21st century curricula and teacher training[30], which have increased broadband use.

However, the remaining billions in the lower tiers of the pyramid live in remote areas and have extremely low incomes, so shared access (i.e., through telecentres, libraries, and schools) remains an effective solution over the short-term. Shared access provides a number of benefits, including: low-cost access to devices and the Internet, digital skills training, and e-government services. Most successful USFs have established hundreds or thousands of telecentres in remote areas. In Colombia, Malaysia, Pakistan, or Ghana, telecentres are providing Internet access to millions of underserved villagers, along with essential skills and services. In India and Bangladesh, there are tens of thousands of Internet centres, some managed by villagers where they act as agents of the banks (with bill paying, and microloan financing) or agents of the Government.

Sadly, despite the benefits of USFs, many of the funds around the world remain underutilized. For example, one recent ITU study shows that, of 69 funds reviewed, the majority had little to no activity, and at the time, less than half permitted deployments for broadband. Additional factors impacting use include capacity to manage the fund, and autonomy and independence. In all, out of US$23.2 billion available in 2010/2011, US$11.8 billion remained unused. Connecting the masses will bring great benefits. We have the USFs and examples available to make a significant impact, so let's use them.

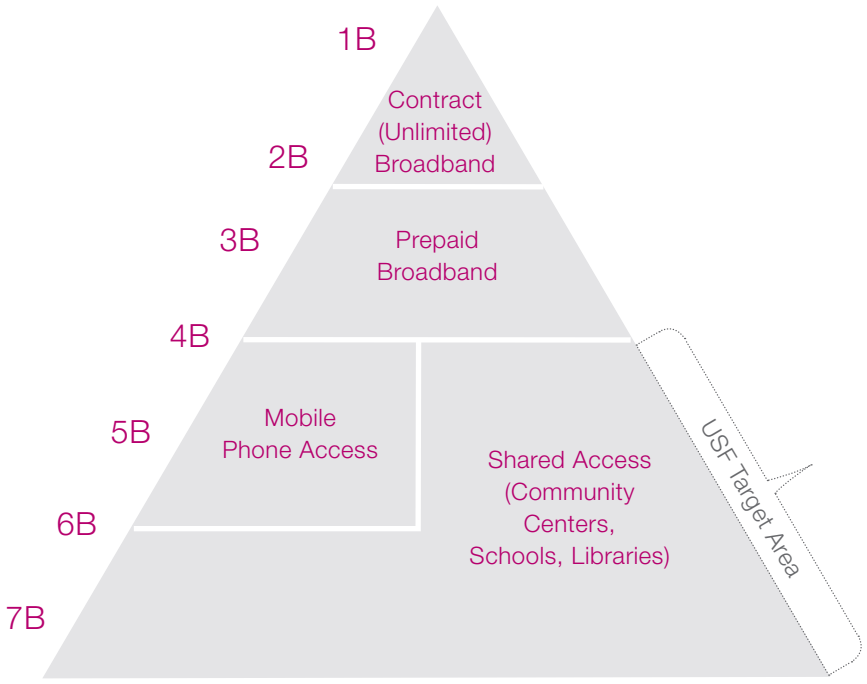
*Source: Intel Corporation.*

### FEATURED INSIGHT 10: RURAL BROADBAND IN TFYR MACEDONIA

The project, "Rural Broadband in 680 locations", is a Governmental programme for information society development in the country's rural regions with the main purpose of closing the digital gap. The project has been operational since 2009, and provides free Internet through 680 Wi-Fi kiosks in rural locations with undeveloped infrastructure. Its fundamental aim is to bridge the digital gap between urban and rural regions, as well as encouraging operators to invest in broadband and

**Box Figure 1: Extending Broadband Access to Everyone**

*Source: Intel.*



expanding infrastructure in areas where RoI is unsatisfactory.

The institution in charge for this project is the Ministry of Information Society and Administration. By providing 680 Wi-Fi kiosks in different rural municipalities, Internet is offered free for four years. The number of Wi-Fi kiosks per region ranges from 13 in the North to 84 in the South-East of Macedonia, with an average of 52 kiosks per region. The project intends to:

- Increase the percentage of Internet users in the country;
- Improve the business climate and increase FDI;
- Retain Macedonia's position as a regional innovator;
- Stimulate democracy, as well as benefits offered by ICTs in education and user mobility;
- Increase network infrastructure.

The project has proved very successful, according to an evaluation by a World Bank team in November 2013. It has enabled access to Internet for the first time for many settlements, and the benefits are far greater than originally expected. The Internet is increasingly used by residents in hard-to-reach and remote areas. This project enables citizens to obtain easily information in fields of interest: agriculture, farming, education etc. For example, they can simply access public online services, without any need to travel hundreds of kilometers. Furthermore, they can communicate with their relatives and friends living abroad.

*Source: H.E. Ivo Ivanovski, Minister of Information Society & Administration, Government of TFYR Macedonia.*

Different technologies offer different advantages, but it is clear that satellite communications offer major potential for deploying 'universal' broadband services rapidly to large numbers of people instantaneously. Satellite broadband connections can be deployed rapidly without large investments in terrestrial infrastructure – users only need a satellite antenna and a modem to obtain broadband access, at virtually zero marginal cost (Featured Insight 11).

The latest satellite technologies are very advanced in terms of their reliability, speed of deployment, and security, and the next generation will deliver higher transmission speeds competing with other broadband technologies in speed and costs (Featured Insight 11). Today, satellite communication systems are being used to offer telehealth and distance learning applications. Broadband ICTs can also play a major role in saving lives, especially in a world impacted by climate change, where up to 70% of the world's population lives in areas at risk of flooding near the coastline or river basins[31]. Satellite communications can provide swift response in disaster situations, where terrestrial infrastructure may have been destroyed and speed is critical. New innovations such as the development of cognitive radio and white space radio technologies can also play a role in saving lives (Featured Insight 12).

## FEATURED INSIGHT 11: THE ROLE OF SATELLITE FOR ACHIEVING "BROADBAND FOR ALL"

Many modern broadband applications (such as multimedia videoconferencing and software distribution) are now based on distributing information to numerous widely dispersed sites. Satellites are well-suited for carrying these services, as they offer widespread service provision, and can be used to service many users and solve the expensive 'last-mile' issue. Satellites are attractive for the interconnection of high-speed networks over large geographical areas. While much broadband communication is currently carried via terrestrial links, satellites will play a greater role in future[32].

Satellites are a powerful and relatively inexpensive tool, especially for video links between multiple users. Their costs are constantly decreasing and satellites are a tested and reliable means for broadband communication. Broadband satellite systems have developed enormously to meet fast-growing demand, and now play an important role in air-space-ground integrated communications networks[33].

Significant efforts have been made by European institutions and industry to deploy satellite broadband solutions to offer ubiquitous broadband, especially in rural areas, at subscription prices and with performance comparable to ADSL[34]. With the latest KA-SAT high throughput communications and spot-beam technology, end-users can benefit from 20 Mbps links downstream and 6 Mbps upstream, regardless of their location[35]. Very soon, the development of ground segment technology will enable Eutelsat to offer higher broadband speeds and services with the same capacity. European manufacturers are carrying out R&D in new generations of high-throughput satellites (HTS) capable of providing 50-100 Mbps by 2020 (Box Table 1).

Satellite communications can also be used in conjunction with or as a complement to terrestrial infrastructures to enable 100% broadband coverage of the planet. Subject to limits imposed by national laws, governments and industry should remain aware of satellite broadband services for citizens, institutions and firms to implement national ICT policies and public priorities for broadband.

Satellite can play a vital role in overcoming isolation due to the absence or limited extent of terrestrial infrastructure, thus providing connectivity to unserved and/or underserved regions. The European Commission announced in mid-October 2013 that every EU household was now able to have a basic broadband connection, given the pan-European availability of satellite broadband. Ms. Neelie Kroes, Vice-President of the European Commission, specifically referred to the use of satellite[36].

In Asia, satellite connectivity offers significant benefits across the region, especially in areas outside hubs (such as Hong Kong, Singapore, Tokyo and Seoul), where broadband costs remain high, fibre infrastructure remains poor and where there is a need for 3G cellular backhaul across large distances. Large areas across Africa, the Middle East, and Latin America are characterized by low population densities, poor infrastructure and high connectivity costs.

The role of satellite systems was recognized by ITU Member States at WTDC-2014 in three Resolutions acknowledging the benefits that satellites provide to remote areas, and in helping bridge the digital divide between urban, remote and rural regions with inadequate coverage via conventional fixed-line services. For example, in the Cook Islands, broadband, 3G/4G voice and video services delivered via O3b's satellite network mean that residents can now experience fibre-like Internet speeds via PCs and 3G mobile devices for the first time.

## Box Table 1: Advances in Satellite Broadband Technologies

| Timeline | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|
| Generation | Ku-band satellites | First generation multi beam Ka-band satellites | Second generation multi beam Ka-band satellites | Third generation multi beam Ka-band satellites |
| Service capability | Internet broadband | High speed Internet broadband | Superfast Internet broadband | Very high speed Internet broadband |
| Maximum service rate | 2-3 Mbps | 10-2 Mbps | 30-50 Mbps | 100 Mbps |
| Capacity per satellite | 5 | 50-100 | 150-200 | >500 |
| Users per satellite | 100.000 | Several 100.000s | Up to 1 million | >1 million |

*Source: ISI European Technology Platform.*

Almost 30 years ago, Intelsat began its Satellites for Health and Rural Education (SHARE) programme to provide telemedicine and education at a distance using satellite communications. Project SHARE offered free satellite capacity to test telehealth and rural and remote educational projects all over the world. Most dramatically, China began its national educational television programme under the auspices of Intelsat's Project SHARE. This network has over 90,000 antennae in operation in all parts of China and reaches over 3 million students. Indeed Project SHARE has supported some 20 projects and 43 countries around the world over its thirty-year lifetime.

Today, Intelsat is a founding partner in South Africa's Mindset Network delivering high-quality educational, health and vocational programming via web, off-line and mobile phone applications. Intelsat also helped establish a VSAT network in Morocco to support the mission of Children's National Telemedicine initiative.

Such networks provide a range of telehealth benefits including delivering health services to remote communities, reducing the need for travel, providing timely access to services and specialists, improving the ability to identify developing conditions and educating, training and supporting remote healthcare workers. For example, Intelsat's Epic next-generation satellites provide advanced, next-generation solutions for telemedicine and distance learning applications to improve health and educational outcomes in rural and remote communities worldwide. The O3b network offers wholesale broadband capacity for 'middle-mile' back-haul service provision to ISPs, government agencies, mobile & wireless operators (for backhaul to support 2G, 3G, and 4G) and firms (e.g. oil, gas and mining).

Today, the use of hybrid satellite and terrestrial systems is also being considered for broadband, where satellites are used to feed terminals at local centres and terrestrial retransmission via wireless is used for last-mile connectivity. While much broadband communication today is carried via terrestrial links, a new era of satellite connectivity is dawning.

*Source: Mr. José Manuel Do Rosario Toscano, Director-General, ITSO; Dr. Esteban Pacha, Director General, IMSO; Mr. Christian Roisse, Executive Secretary, Eutelsat IGO.*

## FEATURED INSIGHT 12: TVWS IN DISASTER RESPONSE – A BREAKTHROUGH FOR RAPID COMMUNICATIONS AFTER TYPHOON HAIYAN IN THE PHILIPPINES

In late 2013, the Philippine Government's ICT Office was working with local partners on the ECOFISH project to use TV white spaces (TVWS) and Windows tablets to improve fisherfolk registration and sustain biodiversity in Bohol province. After a magnitude 7.2 earthquake struck Bohol on October 15, the project's equipment was repurposed to help relief efforts and provide Skype calling and Internet access to hospitals, disaster relief centres, and the general public. Two weeks later, on 8 November 2013, Typhoon Haiyan struck as the deadliest typhoon on record in the Philippines, killing at least 6,268 people and the strongest storm recorded at landfall in terms of wind speed. Its impact was devastating, affecting around eleven million people, with many left homeless.

Relief efforts were hampered by the loss of communications infrastructure. The day after the typhoon, the ICT Office assembled a 'package' consisting of one VSAT, three TVWS radios, and two WiFi routers to be dispatched to Tacloban. Due to very difficult conditions, it was nine days before the team was able to reach Tacloban. The local team decided to install the TVWS equipment in Palo near Tacloban.

Once the equipment was in and the locations for network nodes established, the network was set up and switched on in hours. The resulting network provided immediate two-way voice and data wireless communications for anyone with a functioning device (such as a handset, laptop, tablet), who came within range of the network.

ECOFISH project equipment was deployed near Tacloban to create connectivity hotspots and provide free Skype calling for relief workers and survivors gathered in a school evacuation centre, as well as voice and data transfers (messaging, picture uploads, file transfers, etc).

The network initially covered a distance of 1 km, but eventually extended reach to between 3-5 km, providing speeds of 3-5 Mbps. Over the following weeks, its capacity and robustness were able to provide users with sufficient bandwidth and throughput, illustrating the potential for TVWS to be used in disaster response and the need to be prepared to deploy such solutions immediately after a disaster.

Prior to the deployment of the TVWS network, anyone who wanted to access communications had to attend a government centre to access the satellite link – a journey that was dangerous, challenging, and long in the wake of the typhoon. The network deployment extended this reach dramatically, at under a tenth of the cost of viable alternatives, and provided communications during disaster relief efforts.

A number of partners helped establish the TVWS network, including the firm Nityo Infotech, Microsoft, the development agencies, USAID and NetHope. The TVWS system has proved the potential of TVWS technologies as a solution to the "last-mile" problem of connecting far-flung communities to the Internet. Internet connectivity was vital to speeding up disaster relief and recovery efforts in both the Bohol and Haiyan events, enabling communication between NGOs and their home bases. The Internet connection is since being used by the school in lessons.

*Source: Microsoft.*

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5

# BROADBAND AND EDUCATION FOR ALL: LESSONS LEARNT

*This Chapter has been contributed by the United Nations Educational, Scientific & Cultural Organization (UNESCO).*

This Chapter by UNESCO reviews the contribution of broadband to education in developing countries in the context of the Education for All (EFA) agenda. The deadline of 2015 is fast approaching and the process is well-advanced for defining a new post-2015 development framework, including a specific goal for education. It is interesting to examine to what extent progress towards EFA goals has been successfully supported by broadband and ICTs. This chapter does not aim to provide a comprehensive assessment of educational achievement (which is already underway in the run-up to 2015). Rather, it showcases a number of promising initiatives, which provide important references for the ongoing discussions about the post-2015 educational landscape. This chapter offers indications as to how broadband and ICTs can work as enablers for a renewed push towards achieving good quality education for all.

## 5.1 The Dakar Vision: Harnessing ICTs for EFA

Since the advent of the Internet and the development of digital technologies, it has become increasingly clear that countries, including the Least Developed Countries (LDCs), cannot afford to overlook the importance of ICTs for improved access to, equity, quality and relevance of education. Policy-makers have realized that, in an increasingly globalized world, knowledge and skills pave the way for knowledge-based societies and economies.

In April 2000, at the World Education Forum in Dakar, 164 Governments committed to achieving EFA goals and targets for every citizen and for every society. They agreed on six EFA goals which were considered essential, attainable and affordable, given strong international and country commitment (see Box 5 below).

They unanimously adopted a strategy, "*Harness new ICTs to help achieve EFA goals*", stressing the links between education and technology as key enablers for sustainable development, and advocating the affordable use of ICTs to bridge the 'digital divide', and to reach specific groups, especially girls and women.

## Box 5: The Six Education For All (EFA) Goals

| | |
|---|---|
| **Goal 1: Early childhood care and education** | Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children. |
| **Goal 2: Universal primary education** | Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to and complete free and compulsory primary education of good quality. |
| **Goal 3: Youth and adult skills** | Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life skills programmes. |
| **Goal 4: Adult literacy** | Achieving a 50% improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults. |
| **Goal 5: Gender parity and equality** | Eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality. |
| **Goal 6: Quality of education** | Improving all aspects of the quality of education and ensuring excellence so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills. |

*Source: The Dakar Framework for Action, UNESCO 2000.*

This Chapter examines how the milestone vision established in Dakar has been translated by governments into national EFA policies and actions, particularly in developing countries and LDCs. It provides examples to illustrate how the use of ICTs is helping these countries to address issues of access, equity, quality and relevance, as part of their commitments in Dakar.

## 5.2 Where Do We Stand Now?

The present global education landscape is contrasting. UNESCO's 11th EFA Global Monitoring Report[1] provides an update on countries' progress towards the global education goals agreed in 2000. It highlights that, while progress has been made in achieving some of the goals, EFA largely remains an unfinished business. With new priorities likely to emerge beyond 2015, education should lie at the heart of the post-2015 global development agenda as a foundation for empowerment and advancement (Box 6).

### Box 6: EFA Global Monitoring Report 2013/14: Key Messages

- By 2015, many countries will still not have reached the EFA goals.
- There is a global learning crisis that is hitting the disadvantaged hardest.
- There were 31 million girls out of school in 2011, of whom 55% are expected never to enrol.
- Reflecting years of poor education quality and unmet learning needs, 493 million women are illiterate, accounting for almost two-thirds of the world's 774 million illiterate adults.
- Good quality education can only be achieved with good quality teachers.
- To achieve EFA by 2015, an additional 5.3 million teachers are needed to give every child around the world a quality education. This includes 1.6 million new teachers and 3.7 million additional teachers to replace those who will retire or leave the profession.
- Global education goals after 2015 must track progress of the marginalized.

*Source: EFA Global Monitoring Report 2013/14 Teaching and learning: achieving quality for all.*

## 5.3 ICTs and Broadband as Accelerators for Progress towards EFA

There are several strategies that have to be effectively implemented to generate the conditions for broadband and ICTs to contribute to educational development, including: the creation of holistic learning environments; capacity-building and empowerment of students and teachers to use technology in meaningful ways; content and curriculum development to facilitate the integration of ICTs; assessment of authentic learning; addressing the gender gap; and exploiting emerging opportunities such as mobile learning and the use of OERs. The following sections highlight a number of promising initiatives in these areas.

### 5.3.1 Creating an enabling learning environment

Access to quality education for all is an imperative for building inclusive and participatory knowledge societies helped by technological development and growing connectivity to the Internet. With ever faster connection speeds through broadband, a growing number of governments are recognizing the vast potential that broadband technologies carry to enhance learning opportunities, to transform the teaching and learning environment, to increase access to quality content that is linguistically and culturally diverse, and ultimately to rethink and transform their education systems.

Provided it is available and affordable to all, broadband-powered applications and quality content can be powerful levers for achieving EFA goals. Inclusive, universal and equitable broadband roll-out can be a tremendous accelerator for personal development. Around the world, there is a growing body of research, government initiatives and promising practices which support the view that, when technology is properly implemented in a systemic and coherent way with teachers' commitment and support, then students can develop meaningful knowledge, skills, values and attitudes, which can empower them for lifelong learning and gainful employment. However, access to broadband is only one part of the picture – developing human capacity is vital, especially for teachers and teacher trainers.

Several successful policy initiatives in support of EFA have been put in place in many countries, thanks to the rapid development of digital technologies. For example, Malaysia is committed to achieving an education system that serves the needs of its younger generation to meet the demands of the 21st century. Malaysia's Education Blueprint 2013-2025, launched in September 2013, focuses on five key pillars – access, quality, equity, unity and efficiency. Malaysia's nationwide Frog Virtual Learning Environment aims to deliver a holistic learning experience to all primary and secondary schools in the country (see Box 7).

## Box 7: Malaysia's Frog Virtual Learning Environment (VLE)

Malaysia is currently implementing its Frog Virtual Learning Environment (VLE) as a platform for teaching and learning in all primary and secondary schools. VLE is a part of the broader Malaysia Education Blueprint, 2013-2025, which aims to ensure that Malaysian students learn how to use ICTs, and can leverage them to enhance learning. Under the 1BestariNet initiative, all 10,013 schools in Malaysia must be provided with broadband access via either a 2-4 Mbps or 4-10 Mbps connectivity. The 2-4 Mbps bandwidth is for rural and remote schools via VSAT, while the 4-10 Mbps bandwidth uses wireless 4G technology.

Since this is a nationwide programme, there are many challenges such as: (i) ensuring the necessary infrastructure is put in place; (ii) ensuring all stakeholders are provided with access IDs; (iii) managing change; (iv) undertaking training programmes for school principals, teachers and students; (v) ensuring quality VLE resources; and (vi) constant monitoring and evaluation of the VLE.

The most challenging tasks are in training and managing change. A total of 17,000 school principals and teachers have been trained on the use of VLE in teaching and learning, while a substantial number of students have also undergone training since its implementation in January 2012. The Ministry of Education (MOE) has created a group of 451 Champion Schools, which are given more focus and provided with three levels of training to enable them to be effective change agents: Level 1 is the "Inspire and Enable" phase; Level 2 the "Empower" phase; and Level, 3 the "Immersion" phase. Each training phase is progressive and aimed at developing basic to advanced skills in the use of VLE. The training is also geared towards the development of a community of practitioners, whereby teachers are encouraged to develop training materials and learning sites. To date, some 4,000 learning sites have been developed by teachers.

As in any newly developed programme implemented on a national basis, continuous evaluation is undertaken to gauge programme effectiveness in delivering the desired goals and objectives. A live dashboard has been created to allow schools and decision-makers at the MOE to monitor the progress of infrastructure development and the use of VLE (http://www.frogasia.com/v3/aboutus/).

*Source: UNESCO Regional Office in Bangkok.*

## 5.3.2 Empowering learners with technology

The ability of broadband to connect the unconnected and improve education and students' learning experiences is undisputed. Digital inclusion still remains a big challenge, and countries are continuously looking for the best ways in which technology and ICTs can provide solutions to reach the unreached and enhance traditional delivery modes and pedagogies. Some examples can demonstrate how governments are striving to empower learners with technology, often with the contribution of the private sector.

The Broadband for All Initiative in South Africa is one example of a PPP between government, non-governmental organizations and industry, designed to address digital inclusion by narrowing the divide between the connected and unconnected. The project aims to build a novel ecosystem using wireless mesh networks for delivering broadband infrastructure in underserved areas. South Africa has around 26,500 primary and secondary schools, of which at least 17,000 are in remote rural villages without Internet connectivity. Providing broadband access to these schools could enhance education quality and reduce inequalities.

Today's learners live in an knowledge-based and globally interconnected society, largely driven by digital technologies. To acquire 21st century skills, students should be empowered as self-directed learners, critical thinkers, problem-solvers and independent lifelong learners. To achieve this vision, many countries, including developing countries, have initiated learner-centred programmes to motivate youth to learn and perform at school, and are introducing new literacy concepts such as media and information literacy (Box 8).

To reap the benefits of broadband in education, it is important that governments put in place consistent policies for education and technology, as well as sustained financial investments. For example, Rwanda's government has begun efforts to reform its education system to develop 21st century learning skills and to provide each of its 2.5 million children in primary schools with his or her own laptop. In the framework of the One Laptop per Child (OLPC) project, by the end of 2012, 210,000 laptops were deployed to 217 schools across the country. Capacity-building for heads of schools, teachers and local technicians has been the crucial priority for the OLPC Rwanda. Training of 981 teachers from 150 schools has been conducted in the initial phase.

Another example is Zambia, which, like other developing countries, faces significant challenges with delivering education. These include shortages of teachers, books and learning material, large class sizes and a continuing dependence on rote learning. The iSchool Zambia project (Box 9), a multi-stakeholder initiative between the Ministry of Education, Intel, Cambridge University and the University of Zambia, takes advantage of the rapid spread and growing use of Internet technologies to deliver education services. Featured Insight 13 describes how multi-stakeholder partnerships can provide innovative new approaches to education and entrepreneurship.

## Box 8: Media and Information Literacy to Harness the Power of Broadband

With rapid advances in ICTs, traditional notions of literacy have struggled to keep up with modern demands. The challenges are also linked to a growing influence of media and the need for better management of information and knowledge in the professional and societal spheres. Media and Information Literacy (MIL) represents a set of knowledge, attitudes and skills needed to access, analyse, evaluate, use, produce and communicate information, media content and knowledge in an ethical way in order to engage in personal, professional and societal activities. UNESCO believes that every citizen needs to learn more about the opportunities and threats coming from virtual world and manage resources.

A central component of UNESCO's Media and Information Literacy strategy, the Global MIL Assessment Framework (http://unesdoc.unesco.org/images/0022/002246/224655e.pdf) enables Member States to carry out comprehensive assessments of the information and media environment, and to monitor at the regional and national level the extent to which citizens have acquired MIL competencies, particularly targeting teachers in service and training. This evidence-based information subsequently helps Member States to monitor the implementation of education and ICT policies in developing 21st century capacities, and to design new strategies and plans to suit their needs.

*Source: UNESCO.*

## Box 9: iSchool – Transformative Learning in the Zambian Classroom

iSchool is a complete blended eLearning solution that covers the entire Zambian primary curriculum. It provides detailed lesson plans for teachers (some 6,000 in total) guiding them towards interactive enquiry-based learning. For students, there are thousands of fun, colourful, interactive multimedia lessons, available in English and in 8 local languages. For teachers, there is also a one-year professional development course guiding them towards the new style of learning.

iSchool uses the ZEduPad, a low-cost low-power tablet, which comes pre-loaded with all the iSchool learning content, and which can be run off solar power. The same iSchool content is also available via free-standing purpose-built netbook devices, or via the web. There are home, school and teacher versions. Broadband Internet can now bring modern eLearning to isolated schools. It is estimated that close to 160,000 of direct beneficiaries by 2015 will be children of low-income families, with around 50% of these beneficiaries being girls.

*Source: www.businessinnovationfacility.org/page/project-profile-ischool-internet-connectivity-in-zambian-schools*

**FEATURED INSIGHT 13: HOW ICTS CAN BOOST INNOVATIVE EDUCATION THROUGH A MULTI-STAKEHOLDER APPROACH – THE THINK BIG SCHOOL PROGRAMME**

The Think Big School is a pan-European programme that welcomes young people into a world of ideas and technology, giving them the opportunity to practise the principles of entrepreneurship by creating and expressing themselves on digital platforms. The programme aims to promote an entrepreneurial spirit among young people and to enable them to realize their ideas, as well as giving visibility to their endeavours and projects, so other young people may get inspired, thus creating a multiplier effect. It exposes young people from all backgrounds to the possibilities of technology. To accompany them, Telefónica provides support through its own employees and resources. This programme has been developed in collaboration with Telefónica Foundation, Junior Achievement Young Enterprise and the Mozilla Foundation. Think Big School operates across Europe engaging a wide range of stakeholders to ensure that the possibilities of digital education are open to all. Since 2010, the programme has supported over 6,500 projects and trained a total of 11,200 young people in six European countries (Spain, Germany, Slovakia, Ireland, the U.K. and the Czech Republic). Over 5,000 Telefónica employees are involved in the programme every year.

*Source: Fundación Telefónica.*

## 5.3.3 Making use of existing devices: paving the way to mobile learning

Uptake of ICTs is accelerating worldwide, with mobile broadband recognized as the fastest growing technology in human history. Much of the growth in mobile broadband has occurred in the developing world, which accounts for 90% of global net additions for mobile cellular and 82% of global net additions of total new Internet users since early 2010. Over recent years, the promise of one-to-one ICT solutions have shifted from laptops to newer and more mobile technologies, including tablet computers and mobile phones. Due to their convenience, ease of use, affordability and ubiquity, mobile technologies are being increasingly explored in an effort to support authentic and relevant learning and teaching.

In 2013, UNESCO published its *Policy Guidelines for Mobile Learning*[2], which help policy-makers understand the benefits of mobile learning to advance progress towards EFA. One programme which follows these guidelines closely is the Open Your Tomorrow programme (Box 10), an innovative initiative launched in May 2013 in Lebanon, which illustrates how mobile learning can be scaled up to serve the needs of the overall education system, particularly in the context of a nationwide effort.

## Box 10: Open Your Tomorrow – Transforming Lebanese Education through Mobile Learning

Open Your Tomorrow is an innovative initiative driven by the Minister of Telecommunications in collaboration with the Minister of Education and Higher Education and implemented by local solution provider, Triple C. The initiative will create a disruptive environment for successful educational transformation across Lebanon. Students will gain access to the quality education they deserve, while all the citizens of Lebanon can benefit from the economic opportunities generated in two phases:

Phase 1: The plan is to make 15,000 tablets available for students aged 6-18 (outside the schools), through the mobile operators Alfa and Touch at a subsidized fee. An additional 1,500 tablets should be given for free to public school students in grade 10 as part of their pilot for integrating classroom technology. The tablets will have a 3G data package and high quality educational and entertainment content for free.

Phase 2: An estimated number of 400,000 tablets will have been delivered in the first year.

The programme is designed to (i) transform teachers' mindsets; (ii) equip schools with integrated tablets and safe Internet access; (iii) enable students with high-quality content and technology to teach them 21st century skills; (iv) establish industries related to digital content and mobile app development.

*Source: http://www.intel.com/content/www/us/en/education-solutions/lebanon-open-your-tomorrow.html.*

## 5.3.4 Preparing digitally competent teachers

Teachers are central to achieving MDGs and EFA targets by 2015 and beyond. According to new global projections from the UNESCO Institute for Statistics, chronic shortages of teachers will persist beyond 2015 for decades to come, if current trends continue. The world needs an extra 3.3 million primary teachers and 5.1 million lower secondary teachers in classrooms by 2030 to provide all children with basic education[3].

Governments must step up efforts to recruit more than 1.6 million teachers to achieve universal primary education (UPE) by 2015. However, teachers cannot shoulder this responsibility alone. Teachers can only shine in the right context, with well-designed curricula and assessment strategies to improve teaching and learning. Without the buy-in of teachers as key players, any large-scale technology plan is doomed to fail. It is vital to articulate a clear and sustainable national plan for training and motivating teachers to adopt innovative uses of digital technologies inside and outside the classroom.

In order for teachers to facilitate digital, information, ICT and media literacy, teachers must themselves have multiple competencies. The use of broadband holds great expectations for teachers to access high-quality teaching resources and engage in collaborative professional development[4]. According to available research, the cost of broadband and information technology is falling year on year[5]. Any-time, any-place access to teaching and learning, thanks to the penetration of technology (including low-cost laptops, tablets, eReaders, and smartphones), has the potential to change the traditional delivery of education. Teachers must be trained on how to use these technologies, as there are no quick fixes to improving the quality of education and student performance.

As part of its efforts to help developing countries reach EFA Goal 6 (Improving all aspects of the quality of education and ensuring excellence of all), UNESCO has undertaken projects in Mexico, Nigeria, Pakistan, and Senegal, in partnership with Nokia, to integrate mobile technologies into teacher professional development in ways that enhance both teacher capacity and pedagogical practices. UNESCO is also working to improve the skills of teachers and to promote competency standards. Its flagship ICT Competency Framework for Teachers (ICT CFT[6]) sets guidelines to help teachers develop skills and competencies to make the most of ICTs to support better learning. This framework has become a well-known international reference in terms of empowerment of teachers and the pedagogical use of technology.

UNESCO's strong commitment to assisting developing countries formulate national policies to improve education quality and integrate ICTs in teacher training is illustrated by the ongoing UNESCO-China Funds-in-Trust project, "Enhancing Teacher Education for Bridging the Education Quality Gap in Africa", launched at the 2012 Global Education for All Meeting (Box 11).

## Box 11: Enhancing Teacher Education for Bridging the Education Quality Gap in Africa

This four-year project is being implemented in eight Sub-Saharan African countries: Congo, Côte d'Ivoire, the Democratic Republic of the Congo, Ethiopia, Liberia, Namibia, Tanzania and Uganda. It aims to boost the capacities of Ministries and teacher training institutes (TTIs) in pre-service and in-service teacher training through the use of ICTs, mobile learning, and knowledge production and sharing. More specifically, it seeks to enhance the capacity of existing key TTIs in:

- Providing quality pre-service programmes to increase the supply of qualified teachers, particularly through ICT-supported distance training programmes;
- Supporting in-service teachers' professional development, notably through blended learning modalities and programmes scaling up successful ICT-enabled innovations; and
- Training teachers in ICT competences to improve the quality of teaching and learning.

The project also supports networks of TTIs that are exchanging information on effective strategies and practices in teacher training with policy-makers, institutional leaders and other stakeholders.

*Source: https://en.unesco.org/enhancing-teacher-education-bridging-education-quality-gap-africa*

## 5.3.5 Technology as a game changer in bridging the gender divide

Despite recent advances in girls' education, a generation of young women has been left behind, who comprise around 61% of today's illiterate youth. The gender gap is especially wide in South and West Asia, where two out of three people who cannot read are young women. Comparisons reveal widespread illiteracy – in 9 of 41 low- and lower middle-income countries, more than half of 15- to 24-year-olds are not literate[7]. Broadband technology and services can help empower girls and women with literacy and life skills. UNESCO's Mobile Phone Literacy – Empowering Women and Girls project provides one good example of this (Box 12).

## Box 12: Mobile Phone Literacy – Empowering Women and Girls

In 2013, UNESCO conducted a series of regional studies to document challenges, lessons learned and good practices in initiatives from around the world aimed at empowering women and/or girls through education via innovative mobile technology-based learning and information programmes. On the basis of this work, successful and sustainable implementation of mobile technology-enabled literacy projects:

- recognize the potential and limitations of the use of mobile phones for women's and girls' literacy development in programme design, implementation and follow-up;
- ensure political commitment early on;
- establish strong partnerships with organizations with relevant expertise and an understanding of the local context;
- develop programmes which are simple and flexible, able to quickly assess, adapt and improve upon programme delivery methods;
- understand the educational (and other) needs of target beneficiaries;
- develop local and culturally appropriate content, relevant and useful to the women and girls beneficiaries;
- build a broader mobile learning eco-system and create the right conditions, structures and spaces for learning which take into consideration practical needs and infrastructure;
- engage with the local community and ensure support from the male community members; and
- embed ways to ensure sustainability beyond specific project timelines.

*Source: UNESCO.*

## 5.3.6 Enhancing the quality and relevance of education with Open Educational Resources

Broadband Internet has accelerated access to affordable, accessible and equitable education, as well as access to high-quality digital learning and teaching resources[8]. The "Open Educational Resources" (OER) movement is among the most extraordinary advances that access to broadband Internet has enabled over the last years. This term designates "teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions"[9].

The development of multilingual digital content and the creation of local content (as well as content in local languages) are critical for fostering a digitally inclusive society. High-quality OER can save teachers significant time and effort on resource development and help advance student learning inside and outside the classroom. Open sharing of resources can also expand collaboration, encourage the improvement of available materials, and aid in the dissemination of best practices.

UNESCO believes that there is a clear role for governmental support of OER. The Paris OER Declaration[10] of the World Open Educational Resources (OER) Congress (Box 13) calls on all governments to support the use of OER, particularly for publicly-funded educational materials. UNESCO has adopted an Open Access Policy granting irrevocable right of access to copy, use, distribute, transmit and make derivative works in any format. OER policies and practices are emerging, at both national and international levels. The European Commission's

### Box 13: Paris OER Declaration 2012

a) Foster awareness and use of OER;
b) Facilitate enabling environments for use of ICTs;
c) Reinforce the development of strategies and policies on OER;
d) Promote the understanding and use of open licensing frameworks;
e) Support capacity-building for the sustainable development of quality learning materials;
f) Foster strategic alliances for OER;
g) Encourage development and adaptation of OER in a variety of languages and cultural contexts;
h) Encourage research on OER;
i) Facilitate finding, retrieving and sharing of OER;
j) Encourage the open licensing of educational materials produced with public funds.

*Source: The Paris OER Declaration.*

Opening Up Education initiative looks to increase the use of digital technologies for learning and to encourage the development of OER and policies across the E.U. In France, this project is being implemented via satellite solutions, which offer considerable potential for connecting up a number of schools simultaneously (Featured Insight 14).

### FEATURED INSIGHT 14: SATELLITE COMMUNICATIONS FOR CONNECTING SCHOOLS

**The latest generation of satellites (including High-Throughput Satellites or HTS, such as Eutelsat's KA-SAT) are 'game-changers', as they have removed performance and cost barriers to the delivery of consumer-grade Internet access. Satellites can now complement or even replace terrestrial links where user experience, profitability, sustainability and affordability create a solid business case or social returns. Educational establishments (such as schools and universities) are important stakeholders, with clear social returns on connecting up these institutions simultaneously and efficiently with high-speed broadband access.**

**Providing all schools in E.U. countries with broadband is one of the new priorities of the European Commission, as shown by its recent "Opening up Education" initiative, which aims at connecting "every school, ideally including connectivity to individual classrooms". On 6 February 2014, the French Minister for the Digital Economy, announced a €5 million plan to connect 16,000 schools by the year end, referring in particular to the satellite broadband solution. The satellite industry is already strongly committed to bridging the digital divide in education. Indeed, the French Minister's plan builds on the successful pilot project Connect'Ecoles (22 French schools connected to Eutelsat Tooway services), which builds on the successful connection of 3,500 Turkish schools to Eutelsat Tooway services in 2013, a project recently extended to 15,000 schools. Initiatives of this nature could be made more widely available all over Europe and further afield.**

*Source: IMSO, ITSO and EUTELSAT IGO joint contribution.*

## 5.4 The Role of ICTs and Broadband in the Post-2015 Development Agenda: A Call To Action

This Chapter has highlighted six key strategies that have been used in a number of countries to create the conditions for more effective use of broadband and ICTs in education. However, what will the future bring? In the context of the ongoing discussions about the post-2015 development agenda, some challenges remain unaddressed.

For example, participants at the first African Ministerial Forum on ICT Integration in Education and Training (December 2013, Tunis) stressed that "Africa cannot permit itself to remain on the sidelines of the scientific, technological and media revolution that places knowledge economies and societies in a dominant position in the globalization process" and called on governments across the region to continue to invest in ICTs as a means of economic acceleration, notably by taking advantage of the continent's demographic dividend to train high-quality human capital.

Equity issues still persist in the provision of access for all to ICTs, including Internet connectivity. As we have seen, most of the actions initiated by governments in developing countries have so far addressed the digital divide as a largely technical challenge; however, there is a second digital

divide – the knowledge divide that separates those with the competencies and skills to make innovative use of technology from those without. With EFA and the MDGs remaining an unfinished agenda by 2015, developing and LDCs are increasingly under pressure to design and implement policies addressing this second digital divide. The post-2015 education agenda must concentrate and continue efforts to meet the commitments made in 2000, as well as subsequent targets, with greater attention given to quality and equitable learning, as well as to skills development, in order to prepare young people to be active and empowered citizens in increasingly interconnected knowledge societies[12].

Certainly, universal and affordable access to ICTs and broadband will play an important role in the implementation of the post-2015 global education agenda towards achieving "equitable, quality education and lifelong learning for all by 2030". Quality and relevant teaching and learning, as well as skills for life and work are among the five global objectives which are subject to further debate[11]. Such vision can only succeed with a strong consensus and broad social support from all stakeholders – public, private, industry, civil society, intergovernmental organizations – for further reforms, including the integration of broadband ICTs into education delivery, content and management.

What are the lessons learned so far from countries' efforts to harness the full potential of broadband and ICTs at the service of EFA goals? Can they inspire the discussions for the post-2015 agenda in education? Drawing on the review presented in this chapter, the following recommendations emerge:

- make ICTs, including broadband available, affordable and accessible, underpinned by appropriate policies and strategies, enabling developing and LDCs to address poverty and sustainable development challenges;
- foster digital inclusion supported by policies and initiatives which enable learners, including those with disabilities, to access quality digital education and digital content in local languages, including OER;
- develop and implement adequate policies to attract, recruit, train and support quality teachers, and prepare them well to make innovative and effective use of technology and digital resources for teaching and learning;
- make girls' and women's empowerment through ICTs, and particularly broadband, a priority to narrow the gender gap in terms of access to and use of technology[13];
- encourage PPPs to create synergies and mobilize adequate resources and expertise.

In conclusion, given the magnitude of the challenges to be addressed by and beyond 2015, the Dakar milestone vision of ensuring quality education for all remains as relevant as ever. The illustrations provided in this chapter reinforce UNESCO's conviction that education empowers people by helping them to acquire the skills, knowledge, values and attitudes critical to secure their needs and enable the sustainable development of their societies. Where there is political will and strong teacher engagement, broadband and ICTs hold the potential to help countries craft a new vision of education for the 21st century, and a vision for quality lifelong education, founded on equity and inclusion.

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13. The fifth advocacy target of the Broadband Commission agreed in March 2013 at the Eighth Meeting of the Broadband Commission calls for gender equality in access to broadband by 2020.

6

# THE CHANGING ECONOMICS OF TELECOM NETWORK DEPLOYMENTS

*This Chapter has been contributed by Mr. Antonio García Zaballos of the Inter-American Development Bank (IADB) and Ms. Natalija Gelvanovska of the World Bank.*

Previous chapters have shown how Governments around the globe are committed to increasing broadband penetration. A number of National Broadband Plans (NBPs) establish targets and prioritize fibre-based access networks as providing for "future-proof" high-speed Internet access for the simultaneous provision of broadband, video and telephony services. However, as telecom markets move from an era of high growth into an era of intensifying competition, market consolidation and maturity (Table 1), governments face challenges in convincing market players to invest at a time of changing business models or less favourable economic conditions.

According to ITU data, 88% of the 134 National Broadband Plans in mid-2013 referenced the deployment of nationwide infrastructure. It is clear that both governments and operators see network deployment as a top priority in extending the reach of and access to broadband networks and services. A number of NBPs refer to fibre as a more 'future-proof' investment capable of handling greater data throughput and simultaneous service provision. This has resulted in some very expensive estimates for next-generation network deployment for different countries and regions (Table 3).

Planning the deployments of telecom networks is also becoming much more complex, given fast-changing technologies and rapid shifts in consumer demand and expectations, as well as the change in business models, as revenues are increasingly displaced from operators to content players. Modern telecom networks are made up of several different layers (Table 4), each with a different payback period and time horizon. Passive infrastructure in the fixed access network can cost around 70-80% of the overall investment, with some estimates putting civil engineering works (such as the digging up of roads to lay down fibre broadband) at around 80% of the cost of deploying high-speed broadband networks[1]. The picture becomes even more complex when different technologies, and hybrid technologies are added in.

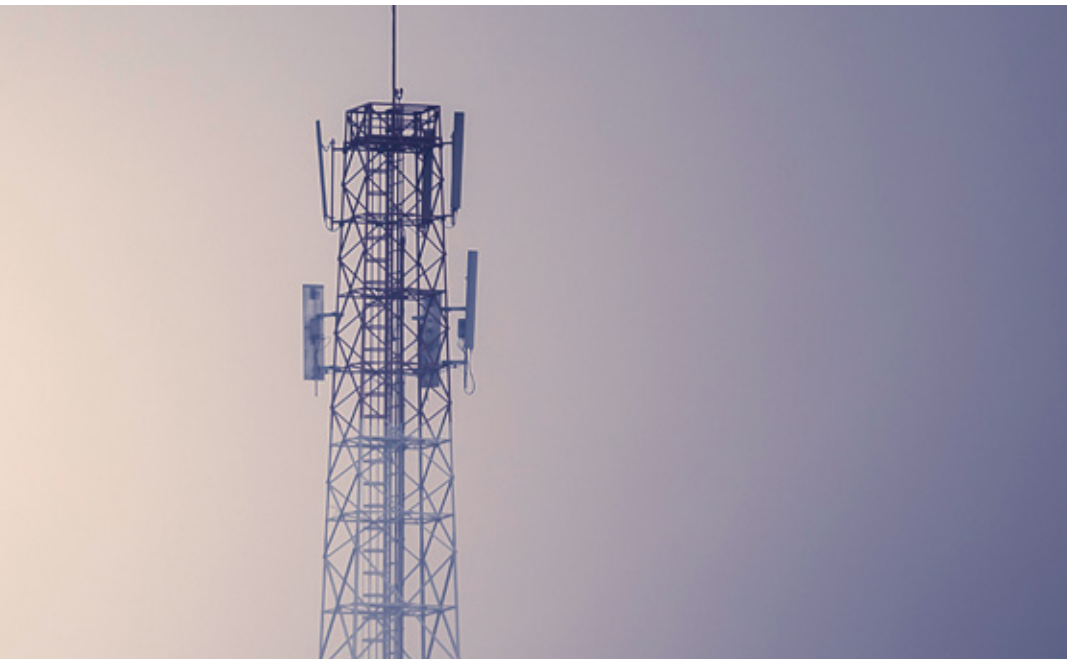


**Table 3: Estimates of Network Investment Needs for Different Regions**

| Region/ Country | Amount | Comments | Source |
|---|---|---|---|
| Latin America & Caribbean | US$ 340 million | Next-generation networks | AHCIET |
| MENA | EUR 20-25 billion | Estimated for 10 Mbps for 100% of population and 30 Mbps for 50% of population, using a combination of FTTC and LTE technologies. | World Bank |
| Europe | EUR180-270 bn | To achieve Digital Agenda targets | EC |
| Europe | €82 billion | Universal Next-Generation Access | Point Topic |

*Source: Report of the Broadband Commission Working Group on Financing and Investment (forthcoming, September 2014).*

**Table 4: Investing in Different Network Layers**

| | % of network costs | Payback period | Examples |
|---|---|---|---|
| Passive infrastructure layer | 70-80% | 15 years | Trenches, ducts, dark fibre, etc. |
| Active infrastructure layer | 20-30% | 5-7 years | Electronic equipment, OSS, BSS |
| Service layer | N/A | Few month – 3 years | Content, services and applications |

*Source: Alcatel Lucent, quoted in "The State of Broadband 2012: Achieving Digital Inclusion for All".*

The costs associated with network deployments vary significantly, according to such variables as:

- Age/structure of existing infrastructure;
- Industry structure;
- Population density (for common classifications such as urban, peri-urban and rural areas);
- Levels of ARPU;
- Service take-up;
- User demand requirements.
- Availability of civil engineering infrastructure; and
- Speed targets.

For example, population density and user requirements typically determine which technologies are the most cost-efficient for specific situations, enabling different technological solutions to be used across different areas. Markets generally become more competitive with higher Average Revenue Per User (ARPU), higher demand and greater availability of civil infrastructure. The choice of the most cost-efficient technology often depends on the objectives in terms of penetration that the Government is aiming to achieve, or the retail price set by the operator (or in some cases, the regulator). Strategic considerations vis a vis competitors (e.g. first-mover advantages) are also key.

The major factor resulting in the attractiveness of any particular area is average deployment cost, which can vary significantly. For instance, for FTTH in Europe, the cost per home passed lies between 150-540 EUR in urban areas (>500 inhabitants/km2), but increases to 2700 EUR per home passed in rural areas (<100 inhabitants/km2)[2]. In developing countries, deployment costs are significantly lower (largely due to lower costs of labour). For example, in Bolivia[3], running fibre to the home has been estimated to cost US$770 for each household connected with a FTTH access line. Nicaragua already had wider available cable infrastructure, so the most inexpensive way to speed up universal access was through DOCSIS 2.0 and the costs for this deployment is around US$300, with the cost per passed household around US$175.

Speed considerations are also important. For example, recent studies in the EU have revealed that the correlation between broadband network coverage and broadband adoption is stronger in case of high-speed broadband (30 Mbps and more), than in the case of lower speed broadband networks[4]. If the affordability threshold (market price) is defined as 25 euros, then FTTx solutions become feasible from penetration rates of 30% in the case of urban areas (Figure 12). Some market players may be more cautious and may not begin fibre deployment, unless 40% of subscribers in a given area sign up in advance for the service[5].

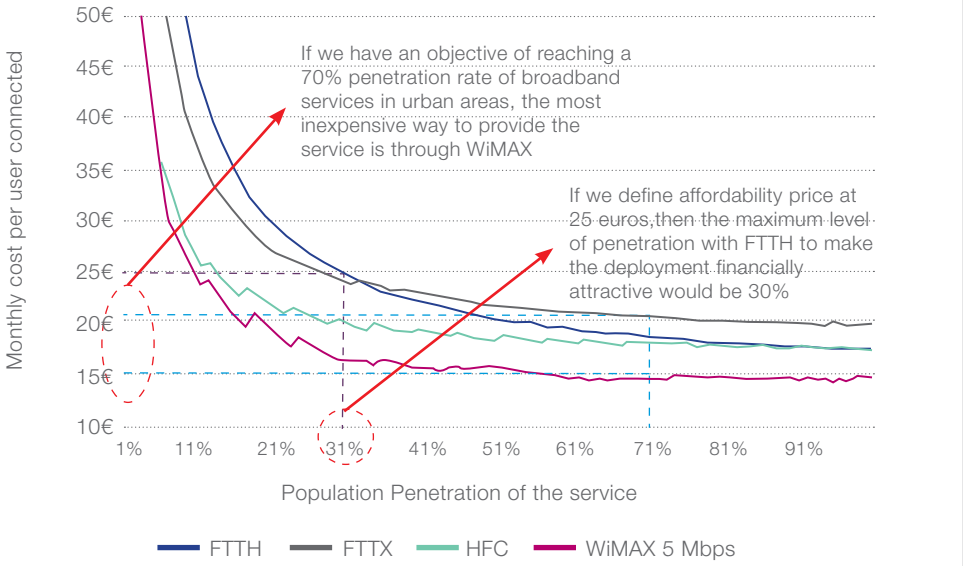



**Figure 12: Monthly Costs Associated with Different Access Technologies in Urban Areas**

*Source: IADB/World Bank.*

Fibre deployments can prove prohibitively expensive (see the estimates in Table 3). One solution to such cost barriers is the voluntary sharing of network infrastructure. Network sharing is a widely used deployment strategy which originally attracted major interest when mobile broadband revenues became decoupled from costs to support the exponential rise in traffic, and operators had to instigate new measures to actively reduce operational expenditures (opex)[6]. Informa (2014) notes that for network sharing to work best in a way that proves beneficial to all parties, all participants must have similar market power[7]. Informa forecasts that operators in developed markets will exercise passive-network sharing at best for their LTE networks. In developing markets or the later stages in developed markets, Informa suggests that network sharing may prove more suitable for LTE networks, but suggests that competitive issues could prevent network sharing from being as common for LTE as it is in 2G or 3G networks[8]. There is evidence to suggest that significant cost savings can be realized in both capex and opex through network sharing and infrastructure sharing (Featured Insight 15). Featured Insight 16 cites the experience of China in developing broadband infrastructure and services rapidly.

### FEATURED INSIGHT 15: NETWORK SHARING

**Network sharing** is a form of partnership between telecom operators aiming to decrease capital investment in infrastructure and lower operational costs through the roll-out and operation of shared network infrastructure. This model is used in a few fixed access network deployments and is increasingly popular in cases of 3G/4G network roll-out. Under the deal, separate networks of participating operators are transformed into a single network infrastructure that is shared by all the participants. In new deployments, each operator may be responsible for coverage of a certain geographic area.

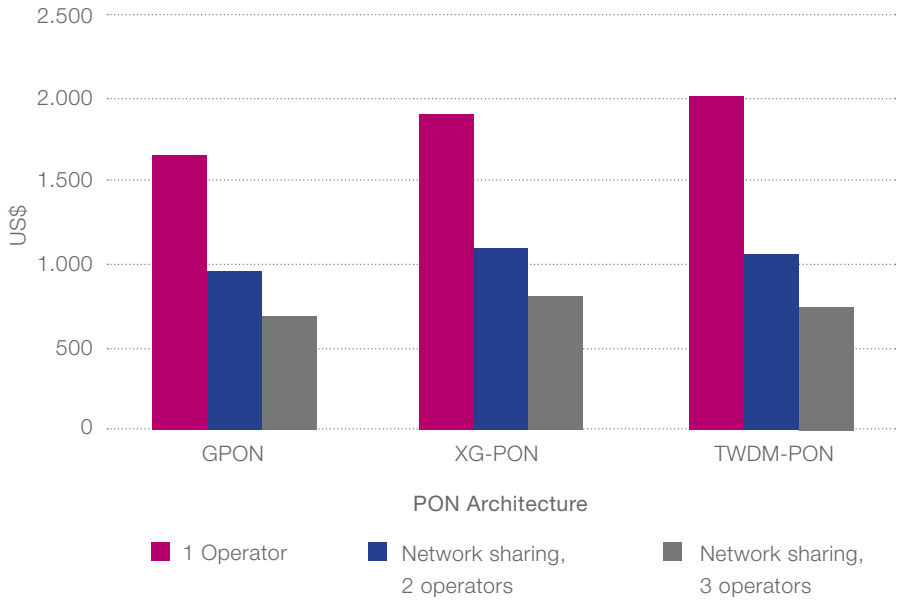
**Network outsourcing** is a partnership between a telecom operator and an equipment vendor under which the equipment vendor builds and operates network infrastructure over which a telecom operator purchases capacity needed to provide its services. This kind of partnership is also known as a managed capacity agreement and is well-established.

**Network outsourcing combined with network sharing** is a form of partnership between telecom operators and an equipment vendor under which an equipment vendor builds and operates network infrastructure that is shared by multiple operators. For instance, cost savings from network sharing are expected from both capex and opex, and can reach up to 40% (Figure 13).

*Source: Huawei.*

Figure 13: Cost per home passed, CAPEX, 50% market share overall, for an urban area

*Source: Huawei.*



## Table 5: Capex and Opex Savings for Different Network Deployment Models

| | Capex savings | Opex savings | Order of savings (to be scaled with reach of sharing) |
|---|---|---|---|
| **Site sharing** | • Site acquisition costs<br>• Site preparation costs (civil works, tower/pole, room/ container) | • Site rental costs<br>• Site administration costs<br>• Basic site maintenance costs (tower checks, cleaning etc.) | ~10% |
| **Infrastructure sharing** | • Above, and...<br>• Infrastructure costs (power, aircon, alarms, antennas, feeders) | • Electricity costs (aircon etc.)<br>• Further site maintenance costs (infrastructure) | ~16-20% |
| **Telco equipment sharing** | • Above, and...<br>• Telco equipment costs (cabinets, transmission equipment, TRAUs/BSCs)<br>• Opimization costs | • Electricity costs (telco equipment)<br>• Maintenance costs (telco equipment)<br>• Transmission costs<br>• Operation costs | ~25% |
| **National roaming** | • Above, and...<br>• Further telco equipment costs (cabinets, TRXs, TRAUs/BSCs)<br>• Opimization costs | • Electricity costs (telco equipment)<br>• Maintenance costs (telco equipment)<br>• Operations costs<br>• Possibly radio licence costs | ~30% |
| **Full sharing** | • Above, and...<br>• Further telco equipment costs (core network, core transmision network) | • Related rental, electricity, Maintenance costs<br>• Operation costs | ~40% |

*Source: IADB/World Bank.*

### FEATURED INSIGHT 16: RATIONAL CONSTRUCTION MODEL TO BOOST THE RAPID DEVELOPMENT OF BROADBAND CHINA

Broadband network construction requires huge capital investment with long periods before returns on investment (RoI) can be realized. Infrastructure-sharing across carriers can reduce costs and delivery time. The "Broadband China" strategy encourages infrastructure synergies between government agencies, enterprises and public institutions (such as public facilities, municipal facilities, roads, railways, airports, subways and other public facilities). Sharing resources (such as community & backbone fibre municipal pipelines, street cabinet and sites) makes FTTH deployment more cost-effective. Since broadband network equipment can offer commercial advantages and affect profitability, technology-sharing solutions are complex, so carriers still need to operate independently to maintain rational competition. This in turn will promote the sustainable and healthy development of the broadband market.

The strategy of synergy applies to various broadband access methods: the aim of national broadband network is to increase bandwidth access speeds and penetration. Infrastructure sharing need not be limited to FTTH. Various access methods should work in a coordinated way to match different requirements. During the early implementation of Broadband China, implementing faster broadband speeds required fibre networks, which created huge financial pressures and slowed development.

*Source: Huawei.*

Although national strategies and operators may be focusing on fibre-based networks as one 'future-proof' way to maximize the lifetime of their investments, recent developments in VDSL2 vectoring and new standards offer operators new prospects of prolonging the life of their existing infrastructure[9]. The new G.fast standards currently being negotiated at ITU offer the prospects of boosting the access speeds possible over a significant proportion of the world's 1.2 billion fixed copper lines (Featured Insight 17). Operators are able to benefit from a range of technological solutions in serving customers, where speed, cost and quality of service are just three of the factors needed for comprehensive customer service delivery.

### FEATURED INSIGHT 17: GEARING UP TO G.FAST - OPERATORS GET MORE BANG FOR THEIR BUCKS IN COPPER

G.fast is a suite of new ITU broadband standards capable of achieving high access speeds over very short distances, with speeds of up to 1 Gbps possible at less than one hundred meters using existing copper telephone wires. G.fast is optimized for short-range deployments within a range of 250 metres of a fibre terminal, which is connected to a dozen or more existing copper telephone lines leading to nearby premises. Consumers will have an over-the-counter solution, which they can self-install without a technician's assistance. This consumer-friendly equipment suite will be equipped to support bandwidth-intensive services such as Ultra-HD "4K" streaming

and IPTV, advanced cloud-based storage, and communication via HD video. G.fast could also be installed in apartment buildings already equipped with fibre terminals to increase access speeds via the existing telephone cables.

G.fast offers telephone companies and other operators the prospect of capitalizing on their existing bases of fixed lines. G.fast technology could bring speeds close, or equivalent, to fibre without requiring fibre installation in the last 250 metres to the home. It would save significant costs, time and civil engineering disruption. It would also complement fibre infrastructure strategies, because a combination of fibre and G.fast is likely to prove more cost-efficient than installing pure FTTH.

A large number of leading service providers, chip manufacturers, system vendors and other ITU members are actively involved in developing G.fast. Testing has confirmed the standard's gigabit-per-second capabilities through lab and field trials using prototype equipment based on mature drafts of the standard in a range of different scenarios. G.fast is designed to coexist with VDSL2, enabling service providers to play to the strengths of each standard in different environments, switching customers between G.fast and VDSL2 in line with dynamic business models.

The physical-layer protocol aspects of G.fast are defined by Recommendation ITU-T G.9701, "Fast Access to Subscriber Terminals - Physical layer specification", with one standard achieving first-stage approval in 2013. G.fast is likely to be standardized in two phases (up to 106MHz, and up to 212MHz). It is likely that G.fast will be implemented in combination with vectoring – similar to VDSL2, G.fast suffers from cross-talk if you connect multiple users / multiple lines, so vectoring is likely to be needed. Chip manufacturers will now scale-up G.fast chip design and testing efforts over the course of the coming year, feeding the results of this work into ITU-T Study Group 15.

*Source: ITU and Alcatel Lucent.*

This rapid evolution in telecommunication access technologies is making network planning even more complex than ever. Policy-makers and regulators should avoid making simplistic policy pronouncements, but work together in partnership with operators and private sector companies to make the best choices for their needs. They should also establish specific criteria to prevent crowding out of private sector investment.

Governments can also help foster initiatives that will contribute to expanding the frontier of commercial viability, new modes of infrastructure supply and measures to decrease deployment costs. For example, innovative models for PPPs between municipalities or utility companies and operators could address the deployment of FTTx access networks in urban areas or backbone deployments in more isolated regions. Similarly, more effective construction processes can save time and financial resources whenever infrastructure deployment is taking place with significant civil works associated. Table 6 summarizes some key policy interventions for addressing infrastructure deployment costs.

**Table 6: Key Policy Interventions for Addressing Infrastructure Deployment Costs**

| Intervention | Definition | Examples |
|---|---|---|
| 1. Site Acquisition | Purchase of sites for deploying (fixed and wireless) broadband networks | • Governments can identify and make available in a transparent and predictable way all sites that can accommodate telecommunication equipment in a database format for improved network design. |
| 2. Sharing of existing infrastructure | Provision of shared use of infrastructure for the purpose of deploying broadband networks | • Incentives for voluntary infrastructure-sharing via primary and secondary legislation;<br>• Review prices for infrastructure-sharing;<br>• Ensure effective resolution of disputes;<br>• Build awareness and capacity about frameworks for infrastructure-sharing for property owners, operators, national and local authorities. |
| 3. Co-deployment of new infrastructure / co-ordination of civil works | Sharing the costs of excavation between operators and/or utility companies | • Promote /mandate coordination of civil works;<br>• Develop a database where all planned civil works should be published;<br>• Develop Recommendations on possible cost-sharing models and reference agreements on co-deployment;<br>• Ensure effective resolution of disputes on coordination of civil works. |
| 4. Pre-conditions for cheaper deployment of infrastructure | Specific requirements for newly deployed infrastructure aiming to ensure sharing of infrastructure in future | • Mandate deployment of empty duct(s) where possible for roads, water supply etc.;<br>• Mandate specific diameters for empty ducts in areas with high demand for sharing;<br>• Mandate technical requirements for poles and antenna masts with the aim of ensuring sharing. |
| 5. Effective construction processes | Streamlining and making more transparent processes of granting the rights of way and construction permissions | • Review and simplify the rights of way process in cases where infrastructure is deployed over public and private property;<br>• Build awareness and capacity about rights of way among property owners, operators & authorities;<br>• Review and simplify permission procedures and associated administrative procedures. |
| 6. Review taxation | Streamline taxation and make it more transparent | • Review and simplify taxation structures[10] in terms of: tax holidays, investment allowances, corporation tax rates and VAT tax rates applicable to telecom services and equipment. |

*Source: IADB/World Bank.*

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9. http://www.lightwaveonline.com/articles/2013/08/worldwide-ftth-subscribers-to-grow-23-in-2013-says-abi-research.html
10. "Creating a Favourable Environment for Attracting Finance and Investment in Broadband Infrastructure", a Report By The Broadband Commission Working Group on Financing and Investment (September 2014, forthcoming).

# 7

# POLICY RECOMMENDATIONS TO MAXIMIZE THE IMPACT OF BROADBAND

Countries must prioritize both supply- and demand-side policies to develop a full range of broadband infrastructure, applications and services. National strategies to increase broadband adoption and use must take into account the full range of government actions or policies and their impact on the cost to consumers of services, devices and relevant apps.

## 7.1 Monitor, Review and Update ICT Regulations and regulatory approaches to spectrum

As noted in Chapter 2, policy-makers and regulators must review and update their ICT regulatory frameworks to take into account the provision of similar services by market players from different industries. They must also help create a supportive environment, encourage investment and ensure sufficient availability of quality spectrum. Governments and regulators and industry should work together to define harmonized approaches to infrastructure-sharing, and ensure that spectrum is released quickly to operators and new entrants. Optimizing approaches to spectrum policy, allocation, and management becomes an important aspect of governments' overall broadband policy portfolio. Today, policy-makers are also considering fresh approaches to spectrum management, including Dynamic Spectrum Access (DSA). Featured Insight 18 describes the experience of Singapore in launching its regulatory framework on TV white space.

While exploring fresh approaches to spectrum management, it is essential to take into account the needs of different services (e.g. mobile and satellite services, among others). Including coverage obligations in licenses can help fulfil universal service goals more efficiently. Depending on the current state of spectrum band assignation, simultaneous auctions of different bands (high and low bands) can also prove helpful, but these are unlikely to be available in many countries.

## FEATURED INSIGHT 18: SINGAPORE GAINS A SUPER-SIZED WIRELESS INNOVATION BAND WITH ITS REGULATORY FRAMEWORK ON TV WHITE SPACE

The exponential growth of wireless data traffic has created a strain on communications infrastructure. Over recent years, government bodies, policy-makers, researchers and industry players have been searching for more efficient and innovative spectrum management solutions and technologies. Singapore has been reviewing spectrum allocation to ensure the optimal use of spectrum resources and has also been looking at Dynamic Spectrum Access (DSA). Singapore is among the first countries to introduce a regulatory framework for the use of TV White Space (TVWS) technology in the TV broadcast band, which should make available approximately 180 MHz of spectrum on a licence-exempt basis when it comes into effect from November 2014.

The Singapore White Spaces Pilot Group was formed in April 2012 to pursue pilot projects using TVWS for innovative consumer and business services and applications in Singapore. In June 2013, IDA Singapore launched a public consultation exercise on its proposed regulatory framework for TVWS in the VHF/UHF bands. The final framework announced in 2014 took into account the outcomes from the public consultation and set out TVWS equipment requirements, the spectrum channels to be made available for TVWS use, and how TVWS equipment should communicate with geo-location databases to identify available spectrum channels to use, inter alia.

It is expected that TVWS should usher in wider access and extended coverage for wireless broadband. For example, TVWS radio can be used to enhance the Wireless@SG free Wi-Fi service across Singapore. In a TVWS trial undertaken by the Singapore White Space Pilot Group, TVWS was deployed as part of the Wireless@SG infrastructure in a public garden to provide free Wi-Fi access to visitors in a reliable and cost-efficient manner, without intrusive equipment and wiring build-ups over green spaces.

### Building a Smart Nation with TVWS

Singapore is currently working towards its seventh infocomm masterplan, "Infocomm Media Masterplan 2025", to become a Smart Nation. The TVWS regulatory framework is a step towards this, as the additional spectrum made available through the TVWS regulatory framework will ensure that Singapore efficiently allocates and uses this available bandwidth to support the growing demand for data communications.

**The framework will encourage and facilitate businesses and services providers to develop new wireless services and applications, or utilize TVWS to supplement and enhance existing networks. Business applications may include M2M communications, smart metering, outdoor environment and security monitoring services. Further opportunities which local SMEs and start-ups can explore through license-exempt use of TVWS spectrum include: TVWS components and device design and manufacturing; applications and services development; consulting; and system integration.**

*Source: Mr. Leong Keng Thai, Deputy Chief Executive/Director-General (Telecoms and Post), Infocomm Development Authority (IDA) of Singapore.*

## 7.2 Promote Education for All (EFA), including the use of broadband, as well as the skills and talents necessary for broadband

As explored in Chapter 5, in crafting their post-2015 development priorities, countries, and particularly developing countries and LDCs, should:

- foster digital inclusion by introducing policies and initiatives ensuring that every citizen has access to quality digital education and rich digital content in local languages and accessible formats, including to OER.
- Enable young people to acquire high-level skills and confidence to successfully develop smart mobile applications for achieving sustainable development, and increasing ICT-enabled youth employment.
- Assess competencies of countries to carry out Media and information literacy (MIL) initiatives and competencies of key professionals and teachers
- Put in place adequate policies to attract, recruit and support quality teachers, who are digitally confident and well-prepared to make innovative and effective use of ICTs and digital resources.
- Make girls' and women's access to ICTs, and particularly broadband, a key pillar of the post-2015 global development agenda, to narrow the gap in terms of access to and use of technology.
- Encourage PPPs in order to build capacity and ensure equitable access to technological innovations to foster sustainable socio-economic and human development.

The Broadband Commission also advocates the promotion of Science, Technology, Engineering and Mathematics (STEM) in primary and secondary education, as well as open education networks for innovators and entrepreneurs.

## 7.3 Reduce taxes and import duties on telecommunicationICT equipment and services

Imposing new or raising existing taxes on ICT services and equipment may be counter-productive and can impact broadband deployment and adoption adversely. There is significant evidence to suggest that reducing taxes and import duties on telecommunication/ ICT equipment and services could significantly boost levels of ICT uptake. Tax incentives can also be given by countries with low broadband penetration (such as double depreciation).

For example, in 2007, Colombia reduced its VAT rate from 16% to zero for the majority of PCs (both desktops and laptops) to foster consumer demand for PCs and spur national productivity and competitiveness. IDC (2013)[1] found that Colombia's PC tax reduction facilitated:

- A 110% increase in PC sales revenue from 2006-2008—more than twice the average of five other countries in the region.
- A 83% tax revenue benefit for 2007-2008, due to increased new PC purchases and complementary hardware, software, and Internet service purchases.
- A 466% growth in Internet use from 2005-2008 (compared with 161% growth across the region).
- Since 2007, PC unit sales in Colombia have continued to significantly outpace the regional average. Unsurprisingly, Colombia has extended the period for its VAT elimination.

## 7.4 Accelerate investment in broadband infrastructure

There has been a significant change in the level and balance of revenues between different players in the broadband ecosystem (OECD, 2013[2]). Telecommunication and broadband access providers need to explore business arrangements with Internet content providers that will accelerate global investment in broadband infrastructure, to the mutual benefit of all, including end-consumers. Internet companies and Internet content providers need to contribute to investment in broadband infrastructure by debating interconnection issues and agreeing fees/revenue shares with other operators and broadband access providers to accelerate global investment in broadband infrastructure (including IXPs, CDNs, data centres, backhaul fibre investments and other infrastructure) and by contributing to a healthy broadband ecosystem.

At the national level, this may mean authorizing new market entrants, eliminating red-tape, encouraging closer collaboration between the national investment promotion agency (IPA) and the telecom Ministry and/or telecom regulator, and working with potential new or existing operators to promote investments to help achieve national targets.

## 7.5 Enhance Demand for Broadband Services through new initiatives and local content

One key consideration for generating demand is to have governments take a more active role in helping to bridge the digital literacy gap through awareness campaigns, e-gov portals and programmes. For example, digital literacy programmes in libraries can help to match citizens with the skills and knowledge of e-gov programmes to enhance citizen participation and inclusion[3]. Governments should investigate ways to expand the demand for broadband services, as well as the participation of citizens online through, for example, E-Government programmes, digital literacy training, awareness campaigns and other initiatives to stimulate the development of local content.

## 7.6 Engage in Ongoing Monitoring of ICT Developments

Policy choices must be informed by reliable data and indicators on ICT developments in countries. Statistical indicators are also essential to assess the impact of broadband policies and to track progress towards achieving national and international broadband goals and targets (including the targets set by the Broadband Commission). Data collected at the national level should be based on internationally agreed standards and definitions, such as those developed by ITU and the Partnership on Measuring ICT for Development[4]. Data should be collected to monitor broadband infrastructure and access, price evolution and affordability, and broadband usage by individuals, businesses and public organizations (including governments, schools and hospitals).

## 7.7 Utilize Universal Service Funds (USFs) to Close the Digital Divide

USFs have been established in many countries to help connect marginalized and underserved populations. However, while many countries have established USFs, many of these funds remain underutilized. Originally estalished for telephone connectivity, funds are now being transitioned or developed to promote broadband adoption. According to the 2013 ITU report, “Universal Service Fund and Digital Inclusion for All”, of the 69 funds surveyed, almost 50% have a low or no level of activity. Additionally, of US$23.2 billion in funds potentially available, only US$11.4 billion have been dispersed[5]. Many beneficial examples of USF deployments for broadband exist, both for demand and supply side programmes. Governments must work more diligently to use these methods to disperse the funds collected, ensuring that the USFs meet their mandate of enabling marginalized and underserved citizens to get online. Funds should also work to improve their management capacity, autonomy and independence.

# 7.8 Review frameworks for Intellectual Property (IP)

Intellectual Property (IP) frameworks can help facilitate digital innovation and protect authors and content creators to ensure the health of the overall broadband ecosystem. In a converged ICT environment, it is vital to review and update frameworks for IP to ensure local content can flourish. Featured Insight 19 describes WIPO's work on IP and broadband.

## FEATURED INSIGHT 19: INTELLECTUAL PROPERTY (IP) AND UBIQUITOUS BROADBAND

In Africa, mobile telephony is proving a game-changer. According to ITU projected statistics, there will be 630 million mobile subscriptions in Africa by the end of 2014, 27% of which will be broadband. As a result, there has been a boom in digital innovation, with software application developers seizing a large portion of niche markets in business, humanitarian relief and education. For example, in Kenya, the mobile-based money transfer service M-Pesa, developed by Safaricom, has become the most lucrative digital innovation in Africa so far, with over US$ 650 million per month in transactions. Other apps are following this model in terms of both growth and popularity: in Uganda, Mafuta Go gives drivers the location of the nearest petrol station with the cheapest price. In Kenya, Ushahidi gives relief agencies real-time geographic mapping of events such as riots or earthquakes through SMS messaging. In Namibia, the Polytechnic provides an educational curriculum via mobile phones. Africa is an archetypal example where next-generation broadband and cloud-based ICT services have been gaining momentum steadily. All these digital innovations are empowered by IP, which plays a central role in the development of broadband-enabled infrastructures.

Current broadband-related efforts at WIPO focus on five main pillars:

1) WIPO promotes the development of content through effective copyright infrastructure and international legal frameworks for the stimulation and diffusion of creativity and knowledge in the broadband-intensive digital environment and 'Internet of things' or 'the Internet of everything', where content services delivered by mobile providers, as well as innovative solutions to deliver a variety of content and services, will be key.

2) WIPO enhances IP infrastructure for its Member States through the development of innovation ecosystems and networks.

3) WIPO raises IP awareness to promote creativity and innovation and the distribution and sharing of broadband-intensive content.

4) WIPO enables PPPs linking public and private sectors for end-to-end delivery of services, and developing collaborative networks for innovation through innovation platforms.

5) WIPO promotes the use of open innovation and collaborative development models for research. The recent WIPO Conference on Open Innovation: Collaborative Projects and the Future of Knowledge, held on 22-23 January 2014 in Geneva concluded that open innovation is not only consistent with IP but that most open innovation in the era of Big Data depends on robust IP regimes for the protection and diffusion of innovations produced through global collaborations and community-based efforts.

In summary, intellectual property drives broadband and ICT development, which in turn are drivers of intellectual property.

*Source: Mr. Francis Gurry, Director General, World Intellectual Property Organization (WIPO).*

# 8 CONCLUSIONS

This Report has summarized the various policy options open to governments and policy-makers to boost the roll-out and deployment of broadband networks and services and to position their country for future competitiveness in the growing digital economy. Broadband networks and services are more than simple infrastructure – they represent a set of transformative technologies that promise to change the way we communicate, work, play and do business.

Developing countries cannot afford to remain on the sidelines, as the digital revolution puts knowledge economies and societies into a dominant position with global globalization. The real information revolution lies in the growing day-by-day use of Internet-enabled devices in all parts of our lives. And it is this era of mass connectivity – delivering small, but incremental changes to the ways in which each individual does things – that promises to transform development and global welfare.

In terms of ultra-high-speed broadband, there are still not many consumer apps and services that need Gigabit speeds, but such services are on their way. Experience shows that technology typically moves faster than most people anticipate – so countries and operators need to start planning now for the imminent broadband world.

To help empower their populations and to cope with this challenges of capacity, Governments must initiate and prioritize their National Broadband Planning process and invest in ICTs and digital e-skills as an engine of economic growth and development. These Plans must take into account both supply and demand – equitable deployment of broadband cannot be accelerated by consideration of one side alone. In line with the Commission's targets, Governments should seek to make broadband available, affordable and accessible by both men and women alike.

Alongside the strong growth in the market, more complex challenges are emerging. Most notably, regulation is not keeping pace with the changes in the market – Internet players offering equivalent voice and messaging services are, by and large, subject to relatively limited requirements (including consumer protection, privacy, interoperability, security, emergency calls, lawful intercept of customer data, universal service). Asymmetric regulation has resulted in an uneven competitive landscape for services. Governments and policy-makers need to review and update their regulatory frameworks to take into account evolving models of regulation.

It is vital that every country prioritizes broadband policy into account to shape its future social and economic development and prosperity, emphasizing both the supply and demand sides of the market. Further, it is crucial to adequately evaluate the alternatives to be implemented in order to encourage private sector investment. A "one size fits all" policy to broadband roll-out could have negative implications for the ICT market. Finally, a detailed cost-benefit approach should be adopted when evaluating different public policies and regulatory options to promote the growth and development of broadband in different countries around the world.

ENDNOTES

1. IDC-Colombia, “Estudio Sobre la Exclusion del IVA a los PCs y su Impacto Economico, Competitivo y Fiscal,” Desarrollado para la Camara Colombiana de Informatica y Telecomunicaciones 2009, Carlos Villate and Ricardo Granados.
2. OECD Internet Economy Outlook 2013.
3. http://ipac.umd.edu/sites/default/files/publications/DigLitBrief2011_1.pdf
4. http://www.itu.int/ITU-D/ict/
5. “Universal Service Funds and Digital Inclusion for All”, Discussion Paper for GSR 2013, Lynne A. Dorward, available at: http://www.itu.int/en/ITU-D/Regulatory-Market/Documents/USF_final-en.pdf.

## Annex 1: Target 1 – List of National Broadband Policies

| ECONOMY | POLICY AVAILABLE? | YEAR POLICY WAS ADOPTED | TITLE/DETAILS |
|---|---|---|---|
| Afghanistan | yes | 2008 | Afghanistan National Development Strategy: 1387 – 1391 (2008 – 2013) - ANDS in the chapter dedicated to the Information and Communication Technology |
| Albania | yes | 2008 | The bSEE memorandum (broadband South Eastern Europe) |
| Algeria | yes | 2008 | E-Algérie 2013 |
| Andorra | no | | |
| Angola | yes | 2010 | White Book of Information and Communication Technologies: Livro branco das Tecnologias da Informação e Comunicação – LBTIC |
| Antigua & Barbuda | yes | 2012 | GATE 2012 |
| Argentina | yes | 2010 | Plan Nacional de Telecomunicaciones - Argentina Conectada |
| Armenia | yes | 2008 | Government of Republic of Armenia Decree No35, on Approving The Information Technology Sector Development Concept Paper Road Map For ''Real-Time" Armenia: Egovernment, Esecurity, Ecommerce |
| Australia | yes | 2009 | The National Broadband Network (NBN) |
| Austria | yes | 2010 | Broadband Strategy 2020 - Breit Bandstrategie bbs2020 |
| Azerbaijan | yes | 2014 | "Azerbaijan 2020: Look Into The Future". National Strategy for Information Society Development in Azerbaijan for 2014-2020 |
| Bahamas | yes | 2003 | Policy Statement on Electronic Commerce and the Bahamian Digital Agenda |
| Bahrain | yes | 2010 | National Broadband Network for the Kingdom of Bahrain |
| Bangladesh | yes | 2009 | Broadband National Policy Act 2009 |
| Barbados | yes | 2010 | National Information and Communication Technologies Strategic Plan of Barbados 2010-2015 |
| Belarus | yes | 2011 | National programme on accelerated development of services in the field of information and communication technologies for 2011–2015. |
| Belgium | yes | 2009 | België : digitaal hart van Europa |
| Belize | yes | 2011 | ICT National Strategy |
| Benin | planning | | |
| Bhutan | yes | 2008 | National Broadband Master Plan Implementation Project (NBMIP) |
| Bolivia | no | | |
| Bosnia and Herzegovina | yes | 2008 | Decision On The Telecommunication Sector Policy Of Bosnia And Herzegovina For The Period 2008 – 2012 |
| Botswana | yes | 2004 | Botswana's National ICT Policy, Broadband Strategy |
| Brazil | yes | 2010 | National Broadband Plan (Plano Nacional de Banda Larga - PNBL) |
| Brunei Darussalam | yes | 2014 | National Broadband Policy |
| Bulgaria | yes | 2009 | National Strategy of Broadband Development in the Republic of Bulgaria |
| Burkina Faso | yes | 2006 | Lettre de politique sectorielle 2006-2010 |
| Burundi | yes | 2011 | Burundi/ ICT: National Projects for Broadband Connectivity Burundi Community Telecentre Network (BCTN) |
| Cambodia | yes | 2011 | 2015 ASEAN ICT Master Plan / Cambodia ICT development Strategy 2011-2015 |
| Cameroon | no | | |
| Canada | yes | 2014 | Economic Action Plan 2014 to promote broadband roll out in rural areas |
| Cape Verde | planning | | |
| Central African Rep. | yes | 2006 | Politique, Stratégies et plan d'actions de l'édification de la Société de l'Information en République Centrafricaine |

| ECONOMY | POLICY AVAILABLE? | YEAR POLICY WAS ADOPTED | TITLE/DETAILS |
|---|---|---|---|
| Chad | yes | 2007 | Plan de développement des technologies de l'Information et de la Communication au Tchad or (PLAN NICI) |
| Chile | yes | 2013 | Agenda Digital Imagina Chile |
| China | yes | 2011 | Telecom Industry Development Plan 2011-2015 |
| Colombia | yes | 2010 | Live Digital - Vive Digitale |
| Comoros | planning | | |
| Congo | yes | 2011 | Projet de Couverture Nationale (PCN), Projet West Africa Cable System (WACS), Projet back bone national en fibre optique |
| Congo (Dem. Rep.) | no | | |
| Costa Rica | yes | 2012 | Estrategia Nacional de Banda Acha |
| Côte d'Ivoire | yes | 2010 | Objectifs Strategiques du Government de Côte dÍvore en Matiere de Telecommunications et de TIC |
| Croatia | yes | 2011 | National broadband development strategy in the Republic of Croatia |
| Cuba | planning | | |
| Cyprus | yes | 2012 | Digital Strategy for Cyprus ( Digital Strategy for Cyprus which includes also the Broadband Plan) |
| Czech Republic | yes | 2013 | State policy in electronic communication: Digital Czech republic v.2.0 |
| D.P.R. Korea | no | | |
| Denmark | yes | 2010 | Digital work programme by the Minister of Science, Technology and Innovation |
| Djibouti | yes | 2004 | Plan d'action national pour l'exploitation des TIC en République |
| Dominica | planning | | |
| Dominican Rep. | yes | 2007 | Conectividad Rural de Banda Ancha / E-Dominicana |
| Ecuador | yes | 2011 | Estrategia Ecuador Digital 2.0 and Broadband Plan |
| Egypt | yes | 2011 | National Broadband Plan - A Framework for Broadband Development |
| El Salvador | no | | |
| Equatorial Guinea | yes | 2010 | GITGE (Gestor de Infraestructura de Telecomunicaciones de G.E.) |
| Eritrea | no | | |
| Estonia | yes | 2006 | Information Society Development Plan 2013 |
| Ethiopia | yes | 2005 | ICT Policy |
| Fiji | yes | 2011 | National Broadband Policy |
| Finland | yes | 2005 | Broadband 2015 Project: Laajakaista kaikkien ulottuville |
| France | yes | 2010 | Plan France Très Haut Débit |
| Gabon | yes | 2011 | Digital Gabon - Gabon Industriel, Gabon vert et Gabon des Services |
| Gambia | yes | 2008 | The Gambian ICT4D-2012 Plan |
| Georgia | no | | |
| Germany | yes | 2009 | Breitbandstrategie der Bundesregierung |
| Ghana | yes | 2010 | Broadband Wireless Access |
| Greece | yes | 2006 | Digital Strategy 2006-2013 |
| Grenada | yes | 2006 | Information and Communication Technology (ICT) 2006-2010 / A Strategy And Action Plan for Grenada |
| Guatemala | no | | |
| Guinea | yes | 2009 | Plan National de fréquences/ Plan de développement de l'infrastructure nationale d'information et de communication de la République de Guinée 2001 – 2004 |
| Guinea-Bissau | no | | |

## Annex 1: Target 1 – List of National Broadband Policies

| ECONOMY | POLICY AVAILABLE? | YEAR POLICY WAS ADOPTED | TITLE/DETAILS |
|---|---|---|---|
| Guyana | yes | 2011 | E-Guyana |
| Haiti | no | | |
| Honduras | yes | 2010 | Resolución NROOS/IO |
| Hong Kong, China | yes | 2008 | 2008 Digital 21 Strategy - Moving Ahead |
| Hungary | yes | 2010 | Digital Renewal Action Plan |
| Iceland | yes | 2012 | Telecom Policy Statement 2011-2014 |
| India | yes | 2011 | National Telecom Policy 2012 and National Optical Fibre Network Plan |
| Indonesia | yes | 2010 | Priorities Of The Ministry Of Communication And Information Technology Year 2010-2014 |
| Iran (I.R.) | yes | 2011 | National Information Network |
| Iraq | planning | | |
| Ireland | yes | 2008 | Ireland's Broadband Strategy |
| Israel | yes | 2012 | The Communication Initiative: fiber-based national broadband network |
| Italy | yes | 2010 | “Italia Digitale” Digital Italy Plan |
| Jamaica | yes | 2007 | National ICT Strategy |
| Japan | yes | 2010 | New Broadband Super Highway (Haraguchi vision II) |
| Jordan | yes | 2007 | National ICT Strategy of Jordan |
| Kazakhstan | yes | 2010 | Programme of ICT Development |
| Kenya | yes | 2006 | ICT Masterplan 2012-2017 |
| Kiribati | no | | |
| Korea (Rep.) | yes | 2009 | Ultra Broadband Convergence Network |
| Kuwait | no | | |
| Kyrgyzstan | yes | 2006 | Program of Information and Communication Technology Development |
| Lao P.D.R. | no | | |
| Latvia | yes | 2012 | Next generation broadband development strategy for year 2013-2020 |
| Lebanon | yes | 2008 | Lebanese Broadband Stakeholders Group (LBSG) |
| Lesotho | yes | 2005 | ICT Policy for Lesotho |
| Liberia | yes | 2010 | Policy for the Telecommunications and Information Communications Technology (ICT) 2010-2015 |
| Libya | no | | |
| Liechtenstein | yes | 2006 | Communications Act - Law on Electronic Communication |
| Lithuania | yes | 2011 | Lithuanian Information Society Development Program for 2011-2019 |
| Luxembourg | yes | 2010 | Stratégie nationale pour les réseaux à “ultra-haut” débit - “L’ultra-haut” débit pour tous |
| Macao, China | no | | |
| Madagascar | no | | |
| Malawi | yes | 2003 | Integrated ICT-led Socio-Economic Development Policy for Malawi |
| Malaysia | yes | 2010 | National Broadband Initiative |
| Maldives | no | | |
| Mali | no | | |
| Malta | yes | 2012 | Malta's Next Generation Broadband |
| Marshall Islands | yes | 2011 | National ICT Policy |
| Mauritania | no | | |

| ECONOMY | POLICY AVAILABLE? | YEAR POLICY WAS ADOPTED | TITLE/DETAILS |
|---|---|---|---|
| Mauritius | yes | 2012 | National Broadband Policy 2012 - 2020 (NBP2012) |
| Mexico | yes | 2011 | Digital Agenda |
| Micronesia | planning | | |
| Moldova | yes | 2010 | Hotărâre cu privire la aprobarea Programului de dezvoltare a accesului la Internet în bandă largă pe anii 2010-2013 |
| Monaco | no | | |
| Mongolia | yes | 2011 | National program on Broadband Network up to 2015 |
| Montenegro | yes | 2012 | Strategy for the Development of Information Society 2012-2016 - Montenegro - Digital Society |
| Morocco | yes | 2012 | Plan national pour le développement du haut et très haut débit au Maroc |
| Mozambique | yes | 2006 | National ICT Policy Implementation Strategy 2002 and 2006 - Digital Inclusion in Mozambique |
| Myanmar | no | | |
| Namibia | yes | 2009 | Telecommunications Policy for the Republic of Namibia |
| Nauru | no | | |
| Nepal | planning | | |
| Netherlands | yes | 2010 | Digital Agenda |
| New Zealand | yes | 2010 | Ultra fast broadband initiative, Five Point Government Action Plan for faster broadband |
| Nicaragua | planning | | |
| Niger | yes | 2005 | Plan de développement des Technologies de l'Information et de la Communication au Niger / Plan NICI du Niger |
| Nigeria | yes | 2013 | National Information and Communication Technology (ICT) final draft policy |
| Norway | yes | 2000 | eNorway, Brodband requirements in Digital Divident Frequency Auction |
| Oman | yes | 2012 | National Broadband Strategy: 10 years |
| Pakistan | yes | 2007 | National Broadband Programme 2007 |
| Panama | yes | 2008 | National ICT Strategy 2008-2018 / Red Nacional Internet (RNI) 2008 |
| Papua New Guinea | yes | 2011 | National ICT Policy and PNG LNG Fibre cable project |
| Paraguay | yes | 2011 | Paraguay 2013 Conectado y Plan Nacional de Telecomunicaciones - PNT |
| Peru | yes | 2011 | Plan Nacional para el Desarrollo de la Banda Ancha en el Péru |
| Philippines | yes | 2011 | The Philippine Digital Strategy, Transformation 2.0: Digitally Empowered Nation |
| Poland | yes | 2014 | Narodowy Plan Szeroko Pasmowy / National Broadband Plan |
| Puerto Rico | yes | 2012 | Puerto Rico Broadband Strategic Plan 2012 |
| Portugal | yes | 2012 | Agenda Portugal Digital |
| Qatar | yes | 2011 | Qatar's National ICT Plan 2015: Advancing the Digital Agenda |
| Romania | yes | 2007 | The Regulatory Strategy for the Romanian Electronic Communications Sector for 2007-2010 |
| Russian Federation | yes | 2010 | Information Society Strategy / Information Society Programme |
| Rwanda | yes | 2006 | Regional Connectivity Infrastructure Program (RCIP) |
| S. Tomé & Principe | no | | |
| Samoa | yes | 2010 | Broadband Spectrum Plan |
| San Marino | no | | |
| Saudi Arabia | yes | | National Initiative to provide broadband services |
| Senegal | no | | |

## Annex 1: Target 1 – List of National Broadband Policies

| ECONOMY | POLICY AVAILABLE? | YEAR POLICY WAS ADOPTED | TITLE/DETAILS |
|---|---|---|---|
| Serbia | yes | 2009 | Broadband Access Development Strategy in the Republic of Serbia until year 2012: Стратегију развоја широкопојасног приступа у Републици Србији до 2012. године |
| Seychelles | no | | |
| Sierra Leone | no | | |
| Singapore | yes | 2005 | Intelligent Nation 2015 (or iN2015) |
| Slovakia | yes | 2006 | Operačný Program Informatizácia Spoločnosti (Operational program- Information society) |
| Slovenia | yes | 2008 | Strategija razvoja širokopasovnih omrežij v Republiki Sloveniji |
| Solomon Islands | planning | | |
| Somalia | no | | |
| South Africa | yes | 2013 | National Broadband Policy |
| South Sudan | no | | |
| Spain | yes | 2010 | Plan Avanza: 2005, Plan Avanza 2 aprobado el 16/07/2010 |
| Sri Lanka | yes | 2012 | e- Sri Lanka |
| St. Kitts and Nevis | yes | 2006 | National Information and Communications Technology (ICT) Strategic Plan |
| St. Lucia | planning | | |
| St. Vincent and the Grenadines | yes | | |
| Sudan | yes | | |
| Suriname | no | | |
| Swaziland | no | | |
| Sweden | yes | 2009 | Broadband Strategy for Sweden |
| Switzerland | yes | 2012 | Stratégie du Conseil fédéral pour une société de l'information en Suisse |
| Syria | no | | |
| Tajikistan | no | | |
| Tanzania | yes | 2004 | National Information Communication and Technology Broadband Backbone (NICTBB) |
| TFYR Macedonia | yes | 2005 | National Strategy for the development of Electronic Communications with Information Technologies |
| Thailand | yes | 2010 | The National Broadband Policy |
| Timor-Leste | no | | |
| Togo | planning | | |
| Tonga | yes | 2011 | Tonga-Fiji Connectivity Project : Pacific Regional Connectivity Program (PRCP) |
| Trinidad & Tobago | yes | 2008 | Trinidad & Tobago's National Information & Communication Technology Strategy-Fastforward- Accelerating into the Digital Future |
| Tunisia | yes | 2012 | La Stratégie Tunisienne pour le Haut-Débit |
| Turkey | yes | 2009 | Strategy of Transport and Communications, Target 2023, 2009-2013 Strategic Ministerial Plan |
| Turkmenistan | no | | |
| Tuvalu | no | | |
| Uganda | yes | 2009 | Uganda Broadband Infrastructure Strategy National Position Paper |
| Ukraine | no | | |

| ECONOMY | POLICY AVAILABLE? | YEAR POLICY WAS ADOPTED | TITLE/DETAILS |
|---|---|---|---|
| United Arab Emirates | no | | |
| United Kingdom | yes | 2010 | Britain's Superfast Broadband Future, Broadband Delivery UK |
| United States | yes | 2010 | Connecting America: The National Broadband Plan |
| Uruguay | yes | 2011 | Agenda Digital 2011-2015 / Ceibal Plan (2007) |
| Uzbekistan | no | | |
| Vanuatu | planning | | |
| Vatican | no | | |
| Venezuela | no | | |
| Viet Nam | yes | 2010 | Master Plan of Viet Nam, from 2010 to 2015; Prime Minister's Decree 1755 on the approval of a National Strategy on Transforming Viet Nam into an advanced ICT country |
| Yemen | no | | |
| Zambia | yes | 2006 | National Information and Communication Technology Policy |
| Zimbabwe | yes | 2005 | National ICT Policy |

## Summary Notes

Countries with National Broadband Policies: 140

Countries planning on introducing National Broadband Policies: 13

Countries without National Broadband Policies: 43

*Notes: National Broadband Policies include: National Broadband Plans and National Policy with broadband target adopted (development, ICT, e.t.c.)*

## Annex 2: Fixed (wired)-Broadband Subscriptions per 100 inhabitants, 2013

| RANK | ECONOMY | FIXED BROADBAND PENETRATION 2013 |
|---|---|---|
| 1 | Monaco | **44.7** |
| 2 | Switzerland | **43.0** |
| 3 | Denmark | **40.2** |
| 4 | Netherlands | **40.1** |
| 5 | France | **38.8** |
| 6 | Korea (Rep.) | **38.0** |
| 7 | Norway | **36.4** |
| 8 | United Kingdom | **35.7** |
| 9 | Iceland | **35.1** |
| 10 | Germany | ***34.6*** |
| 11 | Andorra | **34.6** |
| 12 | Belgium | **34.4** |
| 13 | Luxembourg | **33.5** |
| 14 | Canada | ***33.3*** |
| 15 | Malta | **32.8** |
| 16 | Sweden | ***32.6*** |
| 17 | San Marino | **32.5** |
| 18 | Liechtenstein | ***32.5*** |
| 19 | Finland | **30.9** |
| 20 | Hong Kong, China | **30.8** |
| 21 | Belarus | **29.8** |
| 22 | New Zealand | **29.2** |
| 23 | Japan | **28.8** |
| 24 | United States | **28.5** |
| 25 | Macao, China | **26.8** |
| 26 | Estonia | **26.5** |
| 27 | Greece | **26.2** |
| 28 | Austria | **26.0** |
| 29 | Singapore | **25.7** |
| 30 | Israel | **25.7** |
| 31 | Spain | **25.6** |
| 32 | Australia | **25.0** |
| 33 | Slovenia | **25.0** |
| 34 | Latvia | ***24.7*** |
| 35 | St. Kitts and Nevis | ***24.5*** |
| 36 | Ireland | **24.2** |
| 37 | Hungary | **24.1** |
| 38 | Portugal | **23.8** |
| 39 | Barbados | **23.8** |
| 40 | Italy | **22.3** |
| 41 | Lithuania | **22.0** |
| 42 | Croatia | **21.5** |
| 43 | Uruguay | **21.1** |
| 44 | Cyprus | **19.9** |
| 45 | Bulgaria | **19.0** |
| 46 | Romania | **17.3** |
| 47 | Czech Republic | **17.0** |
| 48 | Azerbaijan | **17.0** |
| 49 | Grenada | **17.0** |

| RANK | ECONOMY | FIXED BROADBAND PENETRATION 2013 |
|---|---|---|
| 50 | Russian Federation | **16.6** |
| 51 | TFYR Macedonia | **15.7** |
| 52 | Poland | ***15.6*** |
| 53 | Slovakia | **15.5** |
| 54 | Dominica | **14.8** |
| 55 | Trinidad & Tobago | **14.6** |
| 56 | Serbia | **13.9** |
| 57 | Argentina | **13.9** |
| 58 | St. Lucia | **13.7** |
| 59 | China | **13.6** |
| 60 | Moldova | **13.4** |
| 61 | St. Vincent & the Grenadines | **13.4** |
| 62 | Bahrain | **13.2** |
| 63 | Seychelles | **12.9** |
| 64 | Montenegro | ***12.8*** |
| 65 | Mauritius | **12.5** |
| 66 | Chile | **12.3** |
| 67 | Bosnia and Herzegovina | **11.8** |
| 68 | Kazakhstan | **11.6** |
| 69 | Turkey | **11.2** |
| 70 | Mexico | ***11.1*** |
| 71 | United Arab Emirates | **11.1** |
| 72 | Georgia | **10.2** |
| 73 | Brazil | **10.1** |
| 74 | Lebanon | **10.0** |
| 75 | Qatar | **9.9** |
| 76 | Costa Rica | **9.7** |
| 77 | Colombia | **9.3** |
| 78 | Ukraine | **8.8** |
| 79 | Malaysia | **8.2** |
| 80 | Armenia | **7.9** |
| 81 | Panama | **7.7** |
| 82 | Thailand | **7.4** |
| 83 | Saudi Arabia | **7.3** |
| 84 | Venezuela | **7.3** |
| 85 | Tuvalu | ***7.1*** |
| 86 | Suriname | **6.9** |
| 87 | Ecuador | **6.3** |
| 88 | Maldives | **5.8** |
| 89 | Albania | **5.8** |
| 90 | Brunei Darussalam | **5.7** |
| 91 | Viet Nam | ***5.6*** |
| 92 | Iran (I.R.) | **5.6** |
| 93 | Peru | **5.2** |
| 94 | Mongolia | **4.9** |
| 95 | Tunisia | **4.8** |
| 96 | Jamaica | **4.8** |
| 97 | Dominican Rep. | **4.7** |
| 98 | Guyana | **4.6** |

| RANK | ECONOMY | FIXED BROADBAND PENETRATION 2013 |
|---|---|---|
| 99 | Antigua & Barbuda | 4.5 |
| 100 | El Salvador | 4.5 |
| 101 | Cape Verde | 4.3 |
| 102 | Bahamas | *4.1* |
| 103 | Algeria | 3.3 |
| 104 | Egypt | 3.3 |
| 105 | Belize | *3.1* |
| 106 | South Africa | 3.1 |
| 107 | Jordan | 2.8 |
| 108 | Bhutan | 2.7 |
| 109 | Oman | 2.6 |
| 110 | Philippines | *2.6* |
| 111 | Morocco | 2.5 |
| 112 | Nicaragua | 2.2 |
| 113 | Djibouti | 2.0 |
| 114 | Micronesia | 2.0 |
| 115 | Sri Lanka | 2.0 |
| 116 | Guatemala | 1.8 |
| 117 | Tonga | *1.6* |
| 118 | Paraguay | 1.6 |
| 119 | Syria | 1.6 |
| 120 | Kuwait | *1.4* |
| 121 | Bolivia | 1.3 |
| 122 | Indonesia | *1.3* |
| 123 | Namibia | 1.3 |
| 124 | Fiji | 1.2 |
| 125 | India | 1.2 |
| 126 | Kiribati | *1.1* |
| 127 | Botswana | 1.1 |
| 128 | Uzbekistan | *1.1* |
| 129 | Yemen | *1.1* |
| 130 | Libya | *1.0* |
| 131 | Kyrgyzstan | 1.0 |
| 132 | Honduras | 0.8 |
| 133 | Senegal | 0.8 |
| 134 | Nepal | *0.8* |
| 135 | Zimbabwe | 0.7 |
| 136 | Bangladesh | 0.6 |
| 137 | Pakistan | 0.6 |
| 138 | Somalia | 0.6 |
| 139 | Gabon | 0.5 |
| 140 | S. Tomé & Principe | 0.5 |
| 141 | Equatorial Guinea | 0.5 |
| 142 | Swaziland | *0.3* |
| 143 | Solomon Islands | 0.3 |
| 144 | Côte d'Ivoire | 0.3 |
| 145 | Ghana | 0.3 |
| 146 | Ethiopia | 0.3 |
| 147 | Angola | 0.2 |

| RANK | ECONOMY | FIXED BROADBAND PENETRATION 2013 |
|---|---|---|
| 148 | Cambodia | 0.2 |
| 149 | Mauritania | 0.2 |
| 150 | Myanmar | 0.2 |
| 151 | Comoros | *0.2* |
| 152 | Papua New Guinea | *0.2* |
| 153 | Lao P.D.R. | *0.1* |
| 154 | Kenya | 0.1 |
| 155 | Vanuatu | 0.1 |
| 156 | Sudan | 0.1 |
| 157 | Chad | 0.1 |
| 158 | Uganda | *0.1* |
| 159 | Lesotho | 0.1 |
| 160 | Tanzania | 0.1 |
| 161 | Samoa | *0.1* |
| 162 | Togo | 0.1 |
| 163 | Burkina Faso | 0.1 |
| 164 | Cameroon | 0.1 |
| 165 | Zambia | 0.1 |
| 166 | Tajikistan | *0.1* |
| 167 | Mozambique | 0.1 |
| 168 | Timor-Leste | *0.1* |
| 169 | Madagascar | 0.1 |
| 170 | Cuba | 0.0 |
| 171 | Benin | 0.0 |
| 172 | Niger | *0.0* |
| 173 | Turkmenistan | *0.0* |
| 174 | Gambia | 0.0 |
| 175 | Rwanda | 0.0 |
| 176 | Mali | 0.0 |
| 177 | Malawi | 0.0 |
| 178 | Congo | 0.0 |
| 179 | Nigeria | 0.0 |
| 180 | Congo (Dem. Rep.) | 0.0 |
| 181 | Guinea | *0.0* |
| 182 | Afghanistan | *0.0* |
| 183 | Eritrea | 0.0 |
| 184 | South Sudan | *0.0* |
| 185 | Burundi | 0.0 |
| 186 | Central African Rep. | *0.0* |
| 187 | Guinea-Bissau | *0.0* |
| 188 | Liberia | 0.0 |
| 189 | D.P.R. Korea | *0.0* |
| 190 | Nauru | *0.0* |
| | Haiti | n/a |
| | Iraq | n/a |
| | Marshall Islands | n/a |
| | Sierra Leone | n/a |
| | Vatican | n/a |
| | **World Average, 2013** | 9.4 |

*Notes: The table includes ITU Member States.*
*n/a - not available. Data in italics refer to ITU estimates.*
*Source: ITU World Telecommunication/ICT Indicators database.*

## Annex 3: Active Mobile-Broadband Subscriptions per 100 inhabitants, 2013

| RANK | ECONOMY | MOBILE BROADBAND PENETRATION 2013 |
|---|---|---|
| 1 | Singapore | **135.1** |
| 2 | Finland | **123.5** |
| 3 | Japan | **120.5** |
| 4 | Australia | **110.5** |
| 5 | Bahrain | **109.7** |
| 6 | Sweden | ***108.7*** |
| 7 | Denmark | **107.3** |
| 8 | Korea (Rep.) | **105.3** |
| 9 | Hong Kong, China | **95.4** |
| 10 | United States | **92.8** |
| 11 | United Arab Emirates | **89.0** |
| 12 | United Kingdom | **87.2** |
| 13 | Norway | **85.7** |
| 14 | New Zealand | **81.3** |
| 15 | Luxembourg | **80.5** |
| 16 | Estonia | **77.4** |
| 17 | Qatar | **76.8** |
| 18 | Iceland | **74.3** |
| 19 | Botswana | **74.1** |
| 20 | Costa Rica | **72.1** |
| 21 | Oman | **67.3** |
| 22 | Ireland | **67.2** |
| 23 | Spain | **67.1** |
| 24 | Croatia | **65.3** |
| 25 | Italy | **64.8** |
| 26 | Austria | **62.8** |
| 27 | Netherlands | **62.3** |
| 28 | Latvia | **61.2** |
| 29 | Russian Federation | **60.1** |
| 30 | Bulgaria | **58.3** |
| 31 | France | **57.1** |
| 32 | Kazakhstan | **56.6** |
| 33 | Serbia | **54.8** |
| 34 | Slovakia | **53.6** |
| 35 | Fiji | **53.5** |
| 36 | Thailand | **52.3** |
| 37 | Brazil | **51.5** |
| 38 | Lithuania | **49.9** |
| 39 | Saudi Arabia | **49.5** |
| 40 | Moldova | **47.2** |
| 41 | Belgium | **46.0** |
| 42 | Belarus | **45.9** |
| 43 | Czech Republic | **45.3** |
| 44 | Germany | **44.7** |
| 45 | Switzerland | **44.3** |
| 46 | Azerbaijan | **43.9** |
| 47 | Cape Verde | **42.6** |
| 48 | Lebanon | **41.8** |
| 49 | Slovenia | **41.8** |

| RANK | ECONOMY | MOBILE BROADBAND PENETRATION 2013 |
|---|---|---|
| 50 | Barbados | **41.5** |
| 51 | Malta | **40.6** |
| 52 | Ghana | **39.9** |
| 53 | TFYR Macedonia | **38.3** |
| 54 | Zimbabwe | **37.8** |
| 55 | Romania | **37.6** |
| 56 | Portugal | **36.7** |
| 57 | Greece | **36.1** |
| 58 | Chile | **35.6** |
| 59 | Namibia | **34.2** |
| 60 | Turkey | **32.3** |
| 61 | Cyprus | **31.6** |
| 62 | Egypt | **31.1** |
| 63 | Armenia | **31.0** |
| 64 | Antigua & Barbuda | **30.3** |
| 65 | Mauritius | **28.8** |
| 66 | Jamaica | **28.3** |
| 67 | Hungary | **26.3** |
| 68 | Ecuador | **26.3** |
| 69 | Tunisia | **26.1** |
| 70 | Maldives | **26.1** |
| 71 | Sudan | **25.5** |
| 72 | Dominican Rep. | **25.4** |
| 73 | Panama | **25.2** |
| 74 | Albania | **24.7** |
| 75 | Montenegro | **23.1** |
| 76 | Kyrgyzstan | **22.7** |
| 77 | Bosnia and Herzegovina | **22.2** |
| 78 | China | **21.4** |
| 79 | Philippines | **20.3** |
| 80 | Trinidad & Tobago | **18.9** |
| 81 | Georgia | **16.4** |
| 82 | Jordan | **16.1** |
| 83 | Bhutan | **15.6** |
| 84 | Senegal | **15.3** |
| 85 | Morocco | **15.0** |
| 86 | Bolivia | **13.9** |
| 87 | Nepal | ***13.0*** |
| 88 | Malaysia | **12.5** |
| 89 | Angola | **12.1** |
| 90 | Honduras | **11.7** |
| 91 | San Marino | **11.1** |
| 92 | Congo | **10.5** |
| 93 | Nigeria | **10.1** |
| 94 | Seychelles | **9.9** |
| 95 | Cambodia | **9.6** |
| 96 | Burkina Faso | **9.0** |
| 97 | St. Lucia | ***8.2*** |
| 98 | Solomon Islands | **8.0** |

| RANK | ECONOMY | MOBILE BROADBAND PENETRATION 2013 |
|---|---|---|
| 99 | Colombia | 7.9 |
| 100 | Sri Lanka | 7.8 |
| 101 | Lesotho | 7.4 |
| 102 | S. Tomé & Principe | 7.1 |
| 103 | Brunei Darussalam | 6.5 |
| 104 | El Salvador | 6.0 |
| 105 | Rwanda | 5.8 |
| 106 | St. Kitts and Nevis | *5.5* |
| 107 | Mauritania | 5.4 |
| 108 | Ethiopia | 4.8 |
| 109 | Paraguay | 4.8 |
| 110 | Guatemala | 4.4 |
| 111 | Malawi | 3.9 |
| 112 | Venezuela | 3.7 |
| 113 | India | 3.2 |
| 114 | Congo (Dem. Rep.) | 3.2 |
| 115 | Kenya | 3.0 |
| 116 | Syria | 3.0 |
| 117 | Peru | 2.9 |
| 118 | Tanzania | 2.7 |
| 119 | Mali | 1.8 |
| 120 | Nicaragua | 1.3 |
| 121 | Afghanistan | 1.2 |
| 122 | Iran (I.R.) | 1.2 |
| 123 | Myanmar | 1.0 |
| 124 | Grenada | *0.8* |
| 125 | Zambia | *0.7* |
| 126 | Pakistan | 0.5 |
| 127 | Madagascar | 0.4 |
| 128 | Bangladesh | 0.4 |
| 129 | Benin | 0.0 |
| 130 | Cameroon | 0.0 |
| 131 | Chad | 0.0 |
| 132 | Eritrea | 0.0 |
| 133 | Guinea-Bissau | *0.0* |
| 134 | Algeria | *0.0* |
| 135 | Cuba | 0.0 |
| 136 | Dominica | *0.0* |
| 137 | Guyana | 0.0 |
| 138 | St. Vincent & the Grenadines | 0.0 |
| | Andorra | n/a |
| | Argentina | n/a |
| | Bahamas | n/a |
| | Belize | n/a |
| | Burundi | n/a |
| | Canada | n/a |
| | Central African Rep. | n/a |
| | Comoros | n/a |
| | Côte d'Ivoire | n/a |

| RANK | ECONOMY | MOBILE BROADBAND PENETRATION 2013 |
|---|---|---|
| | D.P.R. Korea | n/a |
| | Djibouti | n/a |
| | Equatorial Guinea | n/a |
| | Gabon | n/a |
| | Gambia | n/a |
| | Guinea | n/a |
| | Haiti | n/a |
| | Indonesia | n/a |
| | Iraq | n/a |
| | Israel | n/a |
| | Kiribati | n/a |
| | Kuwait | n/a |
| | Lao P.D.R. | n/a |
| | Liberia | n/a |
| | Libya | n/a |
| | Liechtenstein | n/a |
| | Marshall Islands | n/a |
| | Mexico | n/a |
| | Micronesia | n/a |
| | Monaco | n/a |
| | Mongolia | n/a |
| | Mozambique | n/a |
| | Nauru | n/a |
| | Niger | n/a |
| | Papua New Guinea | n/a |
| | Poland | n/a |
| | Samoa | n/a |
| | Sierra Leone | n/a |
| | Somalia | n/a |
| | South Africa | n/a |
| | South Sudan | n/a |
| | Suriname | n/a |
| | Swaziland | n/a |
| | Tajikistan | n/a |
| | Timor-Leste | n/a |
| | Togo | n/a |
| | Tonga | n/a |
| | Turkmenistan | n/a |
| | Tuvalu | n/a |
| | Uganda | n/a |
| | Ukraine | n/a |
| | Uruguay | n/a |
| | Uzbekistan | n/a |
| | Vanuatu | n/a |
| | Vatican | n/a |
| | Viet Nam | n/a |
| | Yemen | n/a |
| | **World Average, 2013** | **26.7** |

*Notes: The table includes ITU Member States.*
*n/a - not available. Data in italics refer to ITU estimates.*
*Source: ITU World Telecommunication/ICT Indicators database.*

## Annex 4: Percentage of Households with Internet, Developing Countries, 2013

| RANK | ECONOMY | HOUSE HOLD INTERNET PENETRATION 2013 |
|---|---|---|
| 1 | Korea (Rep.) | 98.1 |
| 2 | Qatar | 96.4 |
| 3 | Singapore | 86.0 |
| 4 | Macao, China | 82.6 |
| 5 | Bahrain | 82.0 |
| 6 | Oman | 80.1 |
| 7 | Hong Kong, China | 79.9 |
| 8 | United Arab Emirates | 76.1 |
| 9 | Brunei Darussalam | 75.8 |
| 10 | Saudi Arabia | 72.7 |
| 11 | Israel | 71.1 |
| 12 | Kuwait | 71.1 |
| 13 | Aruba | 69.6 |
| 14 | Barbados | 66.7 |
| 15 | Lebanon | 66.2 |
| 16 | Cyprus | 64.7 |
| 17 | Malaysia | 64.7 |
| 18 | St. Kitts and Nevis | 60.0 |
| 19 | Kazakhstan | 55.0 |
| 20 | St. Vincent & the Grenadines | 54.1 |
| 21 | Argentina | 53.9 |
| 22 | Uruguay | 52.7 |
| 23 | Azerbaijan | 51.5 |
| 24 | Seychelles | 50.6 |
| 25 | Chile | 49.6 |
| 26 | Turkey | 49.1 |
| 27 | Antigua & Barbuda | 48.2 |
| 28 | Costa Rica | 46.7 |
| 29 | Morocco | 46.0 |
| 30 | Trinidad & Tobago | 45.0 |
| 31 | Jordan | 44.9 |
| 32 | Mauritius | 44.5 |
| 33 | China | 43.9 |
| 34 | Brazil | 42.4 |
| 35 | Maldives | 39.4 |
| 36 | Syria | 39.4 |
| 37 | South Africa | 39.4 |
| 38 | Iran (I.R.) | 35.8 |
| 39 | Colombia | 35.7 |
| 40 | Armenia | 35.6 |
| 41 | Dominica | 35.0 |
| 42 | St. Lucia | 34.9 |
| 43 | Georgia | 34.6 |
| 44 | Egypt | 34.5 |
| 45 | Palestine* | 33.4 |
| 46 | Ghana | 31.8 |
| 47 | Panama | 31.5 |
| 48 | Venezuela | 31.5 |
| 49 | Grenada | 31.0 |
| 50 | Mexico | 30.7 |
| 51 | Sudan | 29.3 |
| 52 | Ecuador | 28.3 |
| 53 | Fiji | 26.7 |
| 54 | Paraguay | 26.6 |
| 55 | Algeria | 23.8 |
| 56 | Jamaica | 23.5 |
| 57 | Philippines | 22.9 |
| 58 | Cape Verde | 22.8 |
| 59 | Thailand | 22.7 |
| 60 | Peru | 22.1 |
| 61 | Guyana | 20.6 |
| 62 | Tuvalu | 19.7 |
| 63 | Suriname | 19.0 |
| 64 | Dominican Rep. | 18.6 |
| 65 | Tunisia | 18.2 |
| 66 | Viet Nam | 17.1 |
| 67 | Honduras | 16.4 |
| 68 | Namibia | 16.0 |
| 69 | Libya | 15.9 |
| 70 | Iraq | 15.6 |
| 71 | Bhutan | 15.5 |
| 72 | Kenya | 14.2 |
| 73 | Mongolia | 14.0 |
| 74 | Swaziland | 13.4 |
| 75 | India | 13.0 |
| 76 | Sri Lanka | 12.7 |
| 77 | El Salvador | 12.7 |
| 78 | Tonga | 12.0 |
| 79 | Bolivia | 11.5 |
| 80 | Botswana | 10.6 |
| 81 | Uzbekistan | 9.5 |
| 82 | Nicaragua | 9.4 |
| 83 | Guatemala | 9.3 |
| 84 | Gabon | 8.8 |
| 85 | Pakistan | 8.3 |
| 86 | Angola | 7.9 |
| 87 | Nigeria | 7.8 |
| 88 | Kyrgyzstan | 7.7 |
| 89 | Gambia | 7.6 |
| 90 | Turkmenistan | 7.5 |
| 91 | Senegal | 6.3 |
| 92 | Djibouti | 6.1 |

| RANK | ECONOMY | HOUSE HOLD INTERNET PENETRATION 2013 |
|---|---|---|
| 93 | Malawi | *6.0* |
| 94 | Zambia | *5.9* |
| 95 | Indonesia | *5.7* |
| 96 | Cambodia | *5.5* |
| 97 | Zimbabwe | *5.3* |
| 98 | Uganda | *5.2* |
| 99 | Lao P.D.R. | *5.1* |
| 100 | Nepal | *4.9* |
| 101 | Yemen | *4.7* |
| 102 | Bangladesh | *4.6* |
| 103 | Mozambique | *4.6* |
| 104 | Cameroon | *4.5* |
| 105 | Lesotho | *4.3* |
| 106 | Mauritania | *4.3* |
| 107 | Tajikistan | *4.3* |
| 108 | Solomon Islands | *4.2* |
| 109 | Comoros | *3.8* |
| 110 | Haiti | *3.7* |
| 111 | Tanzania | *3.7* |
| 112 | Madagascar | *3.7* |
| 113 | Cuba | *3.4* |
| 114 | Burkina Faso | *3.2* |
| 115 | Mali | *3.0* |
| 116 | Benin | *2.9* |
| 117 | Papua New Guinea | *2.9* |
| 118 | Rwanda | *2.9* |
| 119 | Central African Rep. | *2.4* |
| 120 | Chad | *2.3* |
| 121 | Ethiopia | *2.3* |
| 122 | Myanmar | *2.2* |
| 123 | Afghanistan | *2.1* |
| 124 | Guinea-Bissau | *1.8* |
| 125 | Niger | *1.8* |
| 126 | Congo | *1.6* |
| 127 | Congo (Dem. Rep.) | *1.6* |
| 128 | Côte d'Ivoire | *1.5* |
| 129 | Liberia | *1.5* |
| 130 | Guinea | *1.4* |
| 131 | Togo | *1.4* |
| 132 | Eritrea | *1.3* |
| | Bahamas | *n/a* |
| | Belize | *n/a* |
| | Burundi | *n/a* |
| | D.P.R. Korea | *n/a* |
| | Equatorial Guinea | *n/a* |
| | Kiribati | *n/a* |
| | Marshall Islands | *n/a* |
| | Micronesia | *n/a* |
| | S. Tomé & Principe | *n/a* |
| | Samoa | *n/a* |
| | Sierra Leone | *n/a* |
| | Somalia | *n/a* |
| | South Sudan | *n/a* |
| | Timor-Leste | *n/a* |
| | Vanuatu | *n/a* |

*Notes: The table includes ITU Member States.*
*n/a - not available. Data in italics refer to ITU estimates.*
** Not an ITU member, see ITU Resolution 99.*
*Source: ITU World Telecommunication/ICT Indicators database.*

## Annex 5. Percentage of Individuals using the Internet, 2013

| RANK | ECONOMY | INTERNET USER PENETRATION 2013 |
|---|---|---|
| 1 | Iceland | 96.5 |
| 2 | Norway | 95.1 |
| 3 | Sweden | 94.8 |
| 4 | Denmark | 94.6 |
| 5 | Andorra | 94.0 |
| 6 | Netherlands | 94.0 |
| 7 | Liechtenstein | 93.8 |
| 8 | Luxembourg | 93.8 |
| 9 | Finland | 91.5 |
| 10 | Monaco | 90.7 |
| 11 | Bahrain | 90.0 |
| 12 | United Kingdom | 89.8 |
| 13 | United Arab Emirates | 88.0 |
| 14 | Switzerland | 86.7 |
| 15 | Japan | 86.3 |
| 16 | Canada | 85.8 |
| 17 | Qatar | 85.3 |
| 18 | Korea (Rep.) | 84.8 |
| 19 | United States | 84.2 |
| 20 | Germany | 84.0 |
| 21 | Australia | 83.0 |
| 22 | New Zealand | 82.8 |
| 23 | Belgium | 82.2 |
| 24 | France | 81.9 |
| 25 | Austria | 80.6 |
| 26 | Estonia | 80.0 |
| 27 | St. Kitts and Nevis | 80.0 |
| 28 | Ireland | 78.2 |
| 29 | Slovakia | 77.9 |
| 30 | Kuwait | 75.5 |
| 31 | Latvia | 75.2 |
| 32 | Barbados | 75.0 |
| 33 | Hong Kong, China | 74.2 |
| 34 | Czech Republic | 74.1 |
| 35 | Singapore | 73.0 |
| 36 | Slovenia | 72.7 |
| 37 | Hungary | 72.6 |
| 38 | Bahamas | 72.0 |
| 39 | Spain | 71.6 |
| 40 | Israel | 70.8 |
| 41 | Lebanon | 70.5 |
| 42 | Malta | 68.9 |
| 43 | Lithuania | 68.5 |
| 44 | Bosnia and Herzegovina | 67.9 |
| 45 | Malaysia | 67.0 |
| 46 | Croatia | 66.7 |
| 47 | Chile | 66.5 |
| 48 | Oman | 66.5 |
| 49 | Macao, China | 65.8 |
| 50 | Cyprus | 65.5 |
| 51 | Brunei Darussalam | 64.5 |
| 52 | Trinidad & Tobago | 63.8 |
| 53 | Antigua & Barbuda | 63.4 |
| 54 | Poland | 62.8 |
| 55 | Portugal | 62.1 |
| 56 | Russian Federation | 61.4 |
| 57 | TFYR Macedonia | 61.2 |
| 58 | Saudi Arabia | 60.5 |
| 59 | Albania | 60.1 |
| 60 | Argentina | 59.9 |
| 61 | Greece | 59.9 |
| 62 | Dominica | 59.0 |
| 63 | Azerbaijan | 58.7 |
| 64 | Italy | 58.5 |
| 65 | Uruguay | 58.1 |
| 66 | Montenegro | 56.8 |
| 67 | Morocco | 56.0 |
| 68 | Venezuela | 54.9 |
| 69 | Belarus | 54.2 |
| 70 | Kazakhstan | 54.0 |
| 71 | Bulgaria | 53.1 |
| 72 | St. Vincent & the Grenadines | 52.0 |
| 73 | Colombia | 51.7 |
| 74 | Brazil | 51.6 |
| 75 | Serbia | 51.5 |
| 76 | San Marino | 50.8 |
| 77 | Seychelles | 50.4 |
| 78 | Romania | 49.8 |
| 79 | Egypt | 49.6 |
| 80 | South Africa | 48.9 |
| 81 | Moldova | 48.8 |
| 82 | Armenia | 46.3 |
| 83 | Turkey | 46.3 |
| 84 | Costa Rica | 46.0 |
| 85 | Dominican Rep. | 45.9 |
| 86 | China | 45.8 |
| 87 | Jordan | 44.2 |
| 88 | Maldives | 44.1 |
| 89 | Viet Nam | 43.9 |
| 90 | Tunisia | 43.8 |
| 91 | Mexico | 43.5 |
| 92 | Georgia | 43.1 |
| 93 | Panama | 42.9 |
| 94 | Ukraine | 41.8 |
| 95 | Ecuador | 40.4 |
| 96 | Bolivia | 39.5 |
| 97 | Peru | 39.2 |
| 98 | Kenya | 39.0 |

| RANK | ECONOMY | INTERNET USER PENETRATION 2013 |
|---|---|---|
| 99 | Mauritius | **39.0** |
| 100 | Uzbekistan | ***38.2*** |
| 101 | Nigeria | **38.0** |
| 102 | Jamaica | ***37.8*** |
| 103 | Cape Verde | ***37.5*** |
| 104 | Suriname | ***37.4*** |
| 105 | Fiji | ***37.1*** |
| 106 | Philippines | ***37.0*** |
| 107 | Tuvalu | ***37.0*** |
| 108 | Paraguay | **36.9** |
| 109 | St. Lucia | ***35.2*** |
| 110 | Tonga | ***35.0*** |
| 111 | Grenada | ***35.0*** |
| 112 | Guyana | ***33.0*** |
| 113 | Belize | ***31.7*** |
| 114 | Iran (I.R.) | **31.4** |
| 115 | Bhutan | ***29.9*** |
| 116 | Thailand | **28.9** |
| 117 | Micronesia | ***27.8*** |
| 118 | Syria | ***26.2*** |
| 119 | Cuba | **25.7** |
| 120 | Swaziland | ***24.7*** |
| 121 | Kyrgyzstan | ***23.4*** |
| 122 | El Salvador | **23.1** |
| 123 | S. Tomé & Principe | ***23.0*** |
| 124 | Sudan | ***22.7*** |
| 125 | Sri Lanka | ***21.9*** |
| 126 | Senegal | ***20.9*** |
| 127 | Yemen | ***20.0*** |
| 128 | Guatemala | ***19.7*** |
| 129 | Angola | ***19.1*** |
| 130 | Zimbabwe | ***18.5*** |
| 131 | Honduras | **17.8** |
| 132 | Mongolia | ***17.7*** |
| 133 | Algeria | ***16.5*** |
| 134 | Libya | ***16.5*** |
| 135 | Equatorial Guinea | ***16.4*** |
| 136 | Uganda | ***16.2*** |
| 137 | Tajikistan | ***16.0*** |
| 138 | Indonesia | **15.8** |
| 139 | Nicaragua | ***15.5*** |
| 140 | Zambia | ***15.4*** |
| 141 | Samoa | ***15.3*** |
| 142 | India | ***15.1*** |
| 143 | Botswana | ***15.0*** |
| 144 | Gambia | ***14.0*** |
| 145 | Namibia | ***13.9*** |
| 146 | Nepal | ***13.3*** |
| 147 | Lao P.D.R. | ***12.5*** |
| 148 | Ghana | **12.3** |
| 149 | Marshall Islands | ***11.7*** |
| 150 | Kiribati | ***11.5*** |
| 151 | Vanuatu | ***11.3*** |
| 152 | Pakistan | ***10.9*** |
| 153 | Haiti | ***10.6*** |
| 154 | Turkmenistan | ***9.6*** |
| 155 | Djibouti | ***9.5*** |
| 156 | Gabon | ***9.2*** |
| 157 | Iraq | ***9.2*** |
| 158 | Rwanda | ***8.7*** |
| 159 | Solomon Islands | ***8.0*** |
| 160 | Congo | ***6.6*** |
| 161 | Comoros | ***6.5*** |
| 162 | Bangladesh | **6.5** |
| 163 | Papua New Guinea | ***6.5*** |
| 164 | Cameroon | ***6.4*** |
| 165 | Mauritania | ***6.2*** |
| 166 | Cambodia | **6.0** |
| 167 | Afghanistan | ***5.9*** |
| 168 | Malawi | ***5.4*** |
| 169 | Mozambique | ***5.4*** |
| 170 | Lesotho | ***5.0*** |
| 171 | Benin | ***4.9*** |
| 172 | Liberia | ***4.6*** |
| 173 | Togo | ***4.5*** |
| 174 | Burkina Faso | ***4.4*** |
| 175 | Tanzania | ***4.4*** |
| 176 | Central African Rep. | ***3.5*** |
| 177 | Guinea-Bissau | ***3.1*** |
| 178 | Côte d'Ivoire | ***2.6*** |
| 179 | Chad | ***2.3*** |
| 180 | Mali | ***2.3*** |
| 181 | Congo (Dem. Rep.) | ***2.2*** |
| 182 | Madagascar | ***2.2*** |
| 183 | Ethiopia | ***1.9*** |
| 184 | Niger | ***1.7*** |
| 185 | Sierra Leone | ***1.7*** |
| 186 | Guinea | ***1.6*** |
| 187 | Somalia | ***1.5*** |
| 188 | Burundi | ***1.3*** |
| 189 | Myanmar | ***1.2*** |
| 190 | Timor-Leste | ***1.1*** |
| 191 | Eritrea | ***0.9*** |
| | D.P.R. Korea | ***n/a*** |
| | Nauru | ***n/a*** |
| | South Sudan | ***n/a*** |
| | Vatican | ***n/a*** |
| | **World Average, 2013** | **37.9** |

*Notes: The table includes ITU Member States.*
*n/a - not available. Data in italics refer to ITU estimates.*
*Source: ITU World Telecommunication/ICT Indicators database.*

## Annex 6: Percentage of Individuals using the Internet, Developing Countries, 2013

| RANK | ECONOMY | INTERNET USER PENETRATION 2013 |
|---|---|---|
| 1 | Bahrain | 90.0 |
| 2 | United Arab Emirates | 88.0 |
| 3 | Qatar | 85.3 |
| 4 | Korea (Rep.) | 84.8 |
| 5 | St. Kitts and Nevis | 80.0 |
| 6 | Kuwait | 75.5 |
| 7 | Barbados | 75.0 |
| 8 | Hong Kong, China | 74.2 |
| 9 | Singapore | 73.0 |
| 10 | Bahamas | 72.0 |
| 11 | Israel | 70.8 |
| 12 | Lebanon | 70.5 |
| 13 | Malaysia | 67.0 |
| 14 | Chile | 66.5 |
| 15 | Oman | 66.5 |
| 16 | Macao, China | 65.8 |
| 17 | Cyprus | 65.5 |
| 18 | Brunei Darussalam | 64.5 |
| 19 | Trinidad & Tobago | 63.8 |
| 20 | Antigua & Barbuda | 63.4 |
| 21 | Saudi Arabia | 60.5 |
| 22 | Argentina | 59.9 |
| 23 | Dominica | 59.0 |
| 24 | Azerbaijan | 58.7 |
| 25 | Uruguay | 58.1 |
| 26 | Morocco | 56.0 |
| 27 | Venezuela | 54.9 |
| 28 | Kazakhstan | 54.0 |
| 29 | St. Vincent & the Grenadines | 52.0 |
| 30 | Colombia | 51.7 |
| 31 | Brazil | 51.6 |
| 32 | Seychelles | 50.4 |
| 33 | Egypt | 49.6 |
| 34 | South Africa | 48.9 |
| 35 | Palestine* | 46.6 |
| 36 | Armenia | 46.3 |
| 37 | Turkey | 46.3 |
| 38 | Costa Rica | 46.0 |
| 39 | Dominican Rep. | 45.9 |
| 40 | China | 45.8 |
| 41 | Jordan | 44.2 |
| 42 | Maldives | 44.1 |
| 43 | Viet Nam | 43.9 |
| 44 | Tunisia | 43.8 |
| 45 | Mexico | 43.5 |
| 46 | Georgia | 43.1 |
| 47 | Panama | 42.9 |
| 48 | Ecuador | 40.4 |
| 49 | Bolivia | 39.5 |
| 50 | Peru | 39.2 |
| 51 | Kenya | 39.0 |
| 52 | Mauritius | 39.0 |
| 53 | Uzbekistan | 38.2 |
| 54 | Nigeria | 38.0 |
| 55 | Jamaica | 37.8 |
| 56 | Cape Verde | 37.5 |
| 57 | Suriname | 37.4 |
| 58 | Fiji | 37.1 |
| 59 | Philippines | 37.0 |
| 60 | Tuvalu | 37.0 |
| 61 | Paraguay | 36.9 |
| 62 | St. Lucia | 35.2 |
| 63 | Grenada | 35.0 |
| 64 | Tonga | 35.0 |
| 65 | Guyana | 33.0 |
| 66 | Belize | 31.7 |
| 67 | Iran (I.R.) | 31.4 |
| 68 | Bhutan | 29.9 |
| 69 | Thailand | 28.9 |
| 70 | Micronesia | 27.8 |
| 71 | Syria | 26.2 |
| 72 | Cuba | 25.7 |
| 73 | Swaziland | 24.7 |
| 74 | Kyrgyzstan | 23.4 |
| 75 | El Salvador | 23.1 |
| 76 | S. Tomé & Principe | 23.0 |
| 77 | Sudan | 22.7 |
| 78 | Sri Lanka | 21.9 |
| 79 | Senegal | 20.9 |
| 80 | Yemen | 20.0 |
| 81 | Guatemala | 19.7 |
| 82 | Angola | 19.1 |
| 83 | Zimbabwe | 18.5 |
| 84 | Honduras | 17.8 |
| 85 | Mongolia | 17.7 |
| 86 | Algeria | 16.5 |
| 87 | Libya | 16.5 |
| 88 | Equatorial Guinea | 16.4 |
| 89 | Uganda | 16.2 |
| 90 | Tajikistan | 16.0 |
| 91 | Indonesia | 15.8 |
| 92 | Nicaragua | 15.5 |
| 93 | Zambia | 15.4 |
| 94 | Samoa | 15.3 |
| 95 | India | 15.1 |
| 96 | Botswana | 15.0 |

| RANK | ECONOMY | INTERNET USER PENETRATION 2013 |
|---|---|---|
| 97 | Gambia | *14.0* |
| 98 | Namibia | *13.9* |
| 99 | Nepal | *13.3* |
| 100 | Lao P.D.R. | *12.5* |
| 101 | Ghana | 12.3 |
| 102 | Marshall Islands | *11.7* |
| 103 | Kiribati | *11.5* |
| 104 | Vanuatu | *11.3* |
| 105 | Pakistan | *10.9* |
| 106 | Haiti | *10.6* |
| 107 | Turkmenistan | *9.6* |
| 108 | Djibouti | *9.5* |
| 109 | Gabon | *9.2* |
| 110 | Iraq | *9.2* |
| 111 | Rwanda | *8.7* |
| 112 | Solomon Islands | *8.0* |
| 113 | Congo | *6.6* |
| 114 | Bangladesh | 6.5 |
| 115 | Comoros | *6.5* |
| 116 | Papua New Guinea | *6.5* |
| 117 | Cameroon | *6.4* |
| 118 | Mauritania | *6.2* |
| 119 | Cambodia | 6.0 |
| 120 | Afghanistan | *5.9* |
| 121 | Malawi | *5.4* |
| 122 | Mozambique | *5.4* |
| 123 | Lesotho | *5.0* |
| 124 | Benin | *4.9* |
| 125 | Liberia | *4.6* |
| 126 | Togo | *4.5* |
| 127 | Burkina Faso | *4.4* |
| 128 | Tanzania | *4.4* |
| 129 | Central African Rep. | *3.5* |
| 130 | Guinea-Bissau | *3.1* |
| 131 | Côte d'Ivoire | *2.6* |
| 132 | Chad | *2.3* |
| 133 | Mali | *2.3* |
| 134 | Congo (Dem. Rep.) | *2.2* |
| 135 | Madagascar | *2.2* |
| 136 | Ethiopia | *1.9* |
| 137 | Niger | *1.7* |
| 138 | Sierra Leone | *1.7* |
| 139 | Guinea | *1.6* |
| 140 | Somalia | *1.5* |
| 141 | Burundi | *1.3* |
| 142 | Myanmar | *1.2* |
| 143 | Timor-Leste | *1.1* |
| 144 | Eritrea | *0.9* |
| | D.P.R. Korea | *n/a* |
| | Nauru | *n/a* |
| | South Sudan | *n/a* |
| | **Average Developing, 2013** | *29.9* |

*Notes: The table includes ITU Member States.*
*n/a - not available. Data in italics refer to ITU estimates.*
** Not an ITU member, see ITU Resolution 99.*
*Source: ITU World Telecommunication/ICT Indicators database.*

## Annex 7: Percentage of Individuals using the Internet, Least Developed Countries (LDCs), 2013

| RANK | ECONOMY | INTERNET USER PENETRATION 2013 |
|---|---|---|
| 1 | Tuvalu | *37.0* |
| 2 | Bhutan | *29.9* |
| 3 | S. Tomé & Principe | *23.0* |
| 4 | Sudan | *22.7* |
| 5 | Senegal | *20.9* |
| 6 | Yemen | *20.0* |
| 7 | Angola | *19.1* |
| 8 | Equatorial Guinea | *16.4* |
| 9 | Uganda | *16.2* |
| 10 | Zambia | *15.4* |
| 11 | Gambia | *14.0* |
| 12 | Nepal | *13.3* |
| 13 | Lao P.D.R. | *12.5* |
| 14 | Kiribati | *11.5* |
| 15 | Vanuatu | *11.3* |
| 16 | Haiti | *10.6* |
| 17 | Djibouti | *9.5* |
| 18 | Rwanda | *8.7* |
| 19 | Solomon Islands | *8.0* |
| 20 | Bangladesh | 6.5 |
| 21 | Comoros | *6.5* |
| 22 | Mauritania | *6.2* |
| 23 | Cambodia | 6.0 |
| 24 | Afghanistan | *5.9* |
| 25 | Malawi | *5.4* |
| 26 | Mozambique | *5.4* |
| 27 | Lesotho | *5.0* |
| 28 | Benin | *4.9* |
| 29 | Liberia | *4.6* |
| 30 | Togo | *4.5* |
| 31 | Burkina Faso | *4.4* |
| 32 | Tanzania | *4.4* |
| 33 | Central African Rep. | *3.5* |
| 34 | Guinea-Bissau | *3.1* |
| 35 | Chad | *2.3* |
| 36 | Mali | *2.3* |
| 37 | Congo (Dem. Rep.) | *2.2* |
| 38 | Madagascar | *2.2* |
| 39 | Ethiopia | *1.9* |
| 40 | Niger | *1.7* |
| 41 | Sierra Leone | *1.7* |
| 42 | Guinea | *1.6* |
| 43 | Somalia | *1.5* |
| 44 | Burundi | *1.3* |
| 45 | Myanmar | *1.2* |
| 46 | Timor-Leste | *1.1* |
| 47 | Eritrea | *0.9* |
| | South Sudan | *n/a* |

*Notes: The table includes ITU Member States.*
*n/a - not available. Data in italics refer to ITU estimates.*
*Source: ITU World Telecommunication/ICT Indicators database.*

## List of Acronyms and Abbreviations

| | |
|---|---|
| ADSL | Asymmetric Digital Subscriber Line |
| AIDS | Acquired Immuno-Deficiency Syndrome |
| ARCEP | French regulator |
| ARPM | Average Revenue Per Minute |
| ARPU | Average Revenue Per User |
| ASP | Average Sales Price |
| CDN | Content Distribution Network |
| CHWs | Community Health Workers |
| CIS | Commonwealth of Independent States |
| DSA | Dynamic Spectrum Access |
| DSL | Digital Subscriber Line |
| EU | European Union |
| EFA | Education For All |
| FDI | Foreign Direct Investment |
| FOSS | Free and Open Source Software |
| FTTB | Fibre-To-The-Building |
| FTTH | Fibre-To-The-Home |
| FTTx | Fibre-To-The-X |
| GB | Gigabyte |
| GDP | Gross Domestic Product |
| GHG | Green House Gas |
| GHz | Gigahertz |
| GNI | Gross National Income |
| GPON | Gigabit Passive Optical Network |
| GSM | Global System for Mobile Communications |
| GSMA | GSM Association |
| GSR | Global Symposium for Regulators |
| HIV | Human Immunodeficiency Virus |
| HTS | High-Throughput Satellite |
| IADB | Inter-American Development Bank |
| ICTs | Information and Communication Technologies |
| IDA | Infocomms Development Authority of Singapore |
| IMSO | International Maritime Satellite Organization |
| IMT | International Mobile Telecommunications |
| IP | Internet Protocol |
| IPA | Investment Promotion Agency |
| IPv6 | Internet Protocol version 6 |
| IT | Information Technology |
| ITSO | International Telecommunications Satellite Organization |
| ITU | International Telecommunication Union |
| LDCs | Least Developed Countries |
| LTE | Long-Term Evolution |
| MEO | Medium Earth Orbit (satellite) |
| MHz | Mega-Hertz |
| MIL | Media and Information Literacy |

| | |
|---|---|
| MP | Megapixel |
| MVNO | Mobile Virtual Network Operator |
| M2M | Machine-to-Machine |
| NBP | National Broadband Plan |
| NGO | Non-Governmental Organization |
| OA | Open Access |
| OER | Open Educational Resources |
| OTT | Over-The-Top |
| PC | Personal Computer |
| PPPs | Public-Private Partnerships |
| QNBP | Qatar's National Broadband Plan |
| RMB | Chinese renminbi currency |
| RoI | Return on Investment |
| SIM | Subscriber Identity Module |
| SME | Small- and Medium-sized Enterprise |
| STEM | Science, Technology, Engineering and Mathematics |
| SWSPG | Singapore White Space Pilot Group |
| TTIs | Teacher Training Institutes |
| TV | Television |
| TVWS | Television White Spaces |
| UAE | United Arab Emirates |
| UAS | Universal Access/Service |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UPE | Universal Primary Education |
| USF | Universal Service Fund |
| USO | Universal Service Obligation |
| VDSL | Very high bit-rate Digital Subscriber Line |
| VLE | Malaysia's Virtual Learning Environment |
| VoIP | Voice over Internet Protocol |
| VSAT | Very Small Aperture Terminal |
| WIPO | World Intellectual Property Organization |
| WTDC | World Telecommunication Development Conference |
| 3G | Third-generation mobile systems |
| 4G | Fourth-generation mobile systems |

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