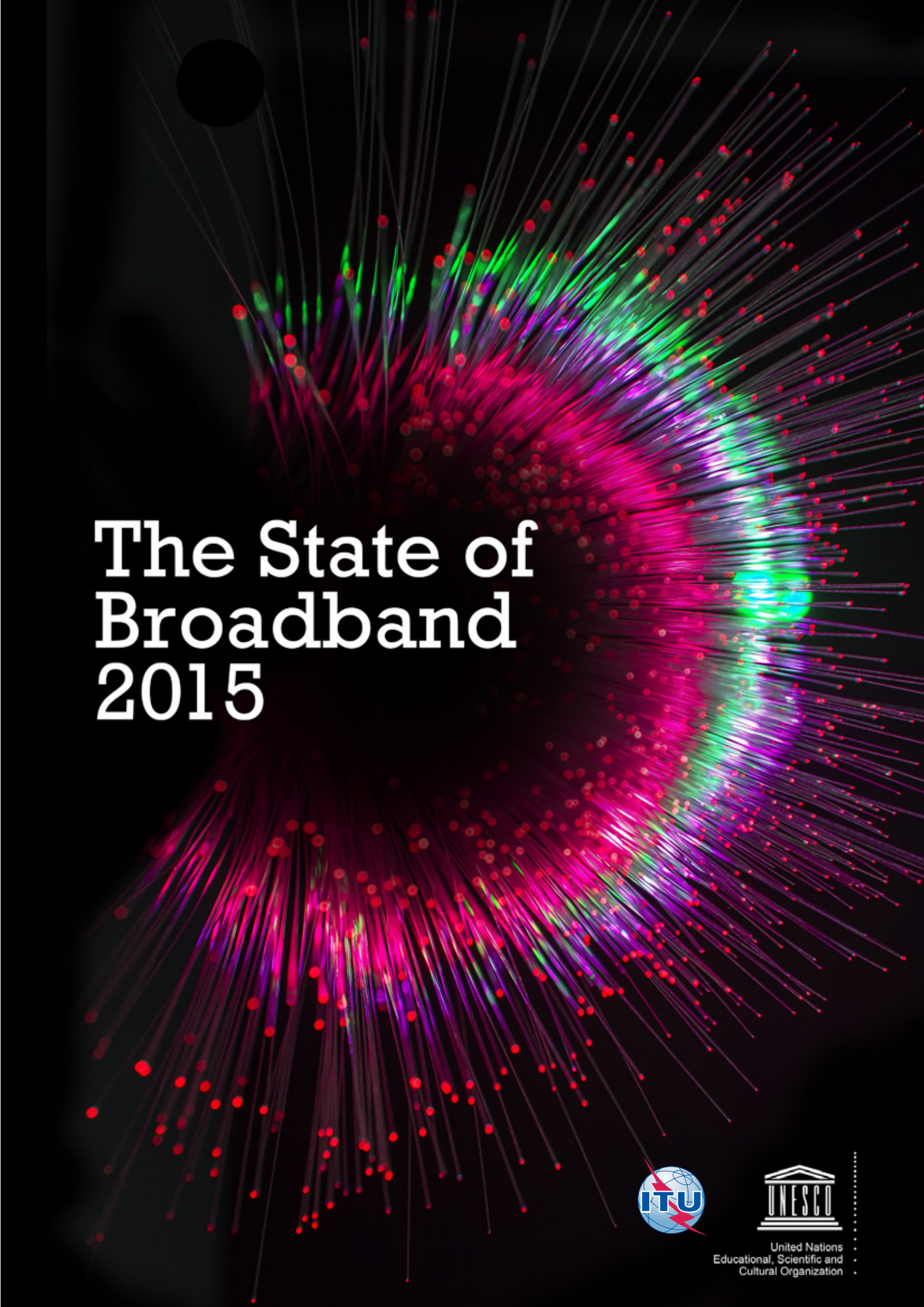

The State of Broadband 2015

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 government leaders, top industry executives, 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 and use of broadband for development, 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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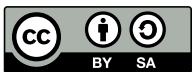

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THE STATE OF BROADBAND 2015: BROADBAND AS A FOUNDATION FOR SUSTAINABLE DEVELOPMENT

A REPORT BY THE BROADBAND COMMISSION
FOR DIGITAL DEVELOPMENT

SEPTEMBER 2015

United Nations
Educational, Scientific and
Cultural Organization

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1 INTRODUCTION

Since its establishment in 2010 by ITU and UNESCO, the *Broadband Commission for Digital Development* has sought to promote the adoption of effective and inclusive broadband policies and practices in countries around the world, with a view to achieving development goals and empowering every woman and man, and every society, through the benefits of broadband.

In late 2015, UN Member States will formally renew their commitment to promoting sustainable development[1] and eradicating poverty with a *New Agenda for Global Action*[2]. The UN Summit from 25-27 September 2015 in New York is being convened as a high-level Plenary Meeting of the UN General Assembly for the adoption of the agreed Sustainable Development Goals (SDGs). The outcome document, *'Transforming our world: The 2030 Agenda for Sustainable Development'*, acknowledges that 'the spread of information and communication technology and global interconnectedness has great potential to accelerate human progress' and to develop knowledge societies[3]. It sets out ambitious ICT development targets in the goals agreed for education, gender and infrastructure, with ICTs recognized as a 'means of implementation' for all SDGs.

A large body of evidence has now been amassed that affordable and effective broadband connectivity is a vital enabler of economic growth[4], social inclusion[5] and environmental protection[6]. Although global mobile cellular subscriptions will exceed 7 billion in 2015 (with nearly half of these subscriptions for mobile broadband), growth in mobile cellular subscriptions has slowed markedly. The total number of unique mobile subscribers is between 3.7-5 billion people (according to different sources), with some observers interpreting this as an indication that the digital divide may soon be bridged.

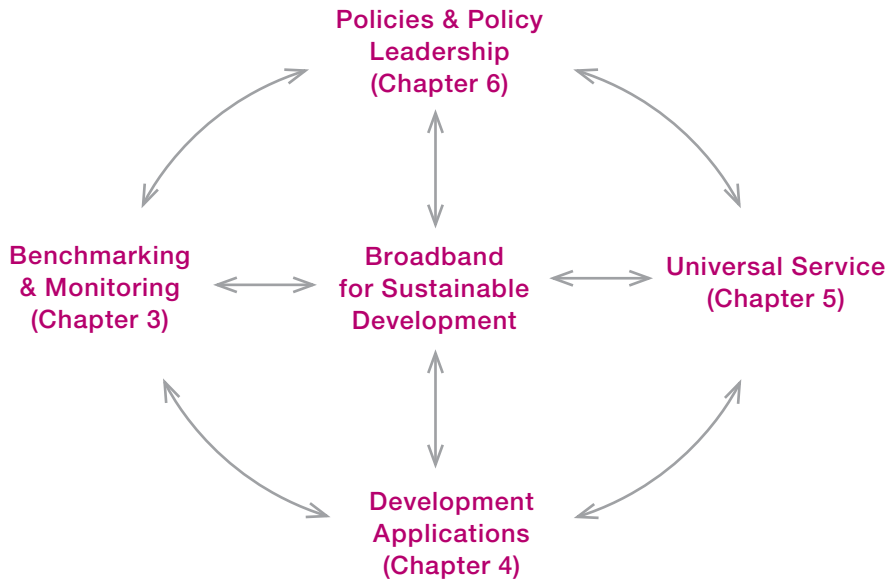
However, the digital divide is proving stubbornly persistent in terms of access to broadband Internet, including the challenge of extending last-mile access to infrastructure to remote and rural communities. According to ITU's latest data, 43% of the world's population is now online with some form of regular access to the Internet. This leaves 57% or some 4.2 billion of the world's people who still do not enjoy regular access to the Internet (ITU, 2015[7]). In the Least Developed Countries (LDCs), only one out of every ten

people is online. The gender digital divide is also proving incredibly difficult to overcome, reflecting broader social gender inequalities.

Alarmingly, there are indications that Internet growth is slowing, as broadband services extend out of urban areas to more remote, less densely populated areas. However, empowering people via broadband needs much more than infrastructure alone – extending access must be accompanied by the development of relevant content in different forms (e.g., print, audio, video) and new services (e.g., e-commerce and payments in local languages). Among the 4.2 billion people who are not online, many people may be unaware of the Internet's potential or cannot use it, because there is little or no useful content in their native language. It is vital to improve awareness of the Internet and its content, particularly in languages that are not well-represented online.

Further, access to technology and ICTs must also be combined with relevant skills, opportunities and capacities – another divide that is very visible in terms of its

Figure 1: The Structure of this Report



Source: Broadband Commission for Digital Development.

gender dimension. The lack of (or limited) Internet access in rural/remote areas is a major concern that requires innovative approaches and solutions. This report focuses especially on universal access/service as a means of reaching underserved areas and promoting digital inclusion for all (Figure 1).

Countries need to adopt effective policies and strategies to make broadband available, affordable and accessible, as a vital enabler of sustainable development in modern-day knowledge societies. It is increasingly vital to extend access to digital education services, new capabilities, culture, entertainment, healthcare, financial and commercial services, along with training and education. Chapter 4 focuses on some of the new services and applications being used to promote development.

An 'information revolution' is needed to help inform and improve policy-making. Public and private sectors must work together in close partnership to achieve broadband for all. A comprehensive and effective National Broadband Plan (NBP) can play an especially important role in coordinating public and private sector actions and in prioritizing and promoting national broadband development. In terms of NBPs, there is still some growth in the absolute number of Plans, with 148 countries now having a national Plan or strategy in place by mid-2015. The need for monitoring and benchmarking is also well-understood, with the majority of Plans including targets. This Report finds evidence that a number of other countries are moving into a phase of consolidation or revision of an existing Plan. A substantial number of Plans reach the end of their term in 2015, and the 'succession strategy' for many of these Plans is unclear i.e. whether countries will continue to 'maintain' the recently elapsed Plan, revise it, seek feedback on its achievements and/or introduce an altogether new Plan.

This report explores what constitutes an effective National Broadband Plan to boost the deployment of broadband and maximize its impact as a cross-sectoral driver underpinning progress. It is now more important than ever that developing countries prioritize digital development in order to enhance their national competitiveness and to deliver tangible improvements in their citizens' living standards and welfare, including closing gender gaps in access to ICTs and broadband.

Since 2010, the message of the Broadband Commission for Digital Development has remained clear. Investments in broadband must be combined with new investments in training and education to ensure that every woman and man has the skills and capabilities, as well as the opportunities, to make the most of ICTs and new technologies for human rights and dignity, for social inclusion, for poverty eradication and for sustainable development. This is necessary on the basis of equality, but also to help everyone achieve their potential, and to provide answers to some of today's most major and urgent challenges, including inequalities in income and opportunity.

ENDNOTES

1. Defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” according to the World Commission on Environment and Development (1987), available at: www.un.org/en/ga/president/65/issues/sustdev.shtml
2. “Zero draft of the outcome document for the UN Summit to adopt the Post-2015 Development Agenda: Transforming our World by 2030 – A New Agenda for Global Action”, available at: https://sustainabledevelopment.un.org/content/documents/7261Post-2015%20Summit%20-%202%20June%202015.pdf
3. Paragraph 15, “Transforming our world: The 2030 Agenda for Sustainable Development”, available at: https://sustainabledevelopment.un.org/content/documents/7891TRANSFORMING%20OUR%20WORLD.pdf
4. Annex 1 of “The State of Broadband 2012: Achieving Digital Inclusion for All” and “The State of Broadband 2013: Universalizing Broadband” and ITU, “The impact of broadband on the economy, 2011”. See also the reports of the Broadband Commission for Digital Development, “A 2010 Leadership Imperative: The Future Built on Broadband”, September 2010, available from: www.broadbandcommission.org/Reports/Report_1.pdf and “Broadband: A Platform for Progress”, from: www.broadbandcommission.org/Reports/Report_2.pdf.
5. “Technology Broadband and Education: Advancing the Education for All Agenda, 2013” available from www.broadbandcommission.org/publications/Pages/bb-and-education.aspx
6. “The Broadband Bridge: Linking ICT with Climate Action for a Low Carbon Economy”, available at: www.broadbandcommission.org/Documents/Climate/BD-bbcomm-climate.pdf
7. ITU “ICT Facts & Figures: The World in 2015”, at: www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx

2 REALIZING OUR CONNECTED FUTURE

2.1 Growth in Broadband

The telecom industry continues to grow strongly in terms of penetration and uptake. The consultancy IDC estimates that the total telecom sector was worth US$ 1.67 trillion in 2013, growing by 1-2% per year, driven mainly by expansion in China and emerging markets[1]. IDC projects that global IT and telecom spending will grow by 3.8% to around US$ 3.8 trillion for 2015 alone[2]. The research firm Infonetics estimates that mobile data services (including text messaging and mobile broadband) rose across the board in every region in 2014, thanks to the growing use of smartphones, and forecasts that the data communications market should continue to be healthy in 2015[3].

However, growth in telecoms is not consistent across different regions or different players (Figure 2). Figure 2 suggests trends in revenues and capex diverge widely for different industry players in Europe – incumbents, mobile, cable providers and 'altnets' (such as Mobile Virtual Network Operators or MVNOs)[4]. To take the case of Europe, some incumbents and mobile operators are starting to see revenues decline by at least 4% on average, while remaining stable for cable operators and increasing by 5-6% for 'altnets'. Indeed, European mobile revenues have declined for three years in a row, mainly due to regulatory-driven reductions in mobile termination and roaming rates. In contrast, revenue growth is now enjoyed by cable players and 'altnets', mainly because cable players are helped by the growth in TV revenues and 'altnets' are mostly smaller and more agile players, which can exploit new gains in market share. Meanwhile, capex commitments are increasing for all players except 'altnets'.

The mobile industry is also growing strongly, although not evenly. By the end of this year, the total number of mobile cellular subscriptions will nearly rival the total global population. ITU forecasts that there will be 7.1 billion mobile cellular subscriptions (as opposed to subscribers) by end 2015, equivalent to a global penetration rate of 97 mobile cellular subscriptions per 100 capita. According to Ovum, mobile cellular subscriptions will grow to 8.5 billion by 2019[5], of which 6.5 billion will be mobile broadband subscriptions. Indeed, mobile broadband is the fastest-growing ICT service in history, taking just five years to achieve one billion users (Figure 3).

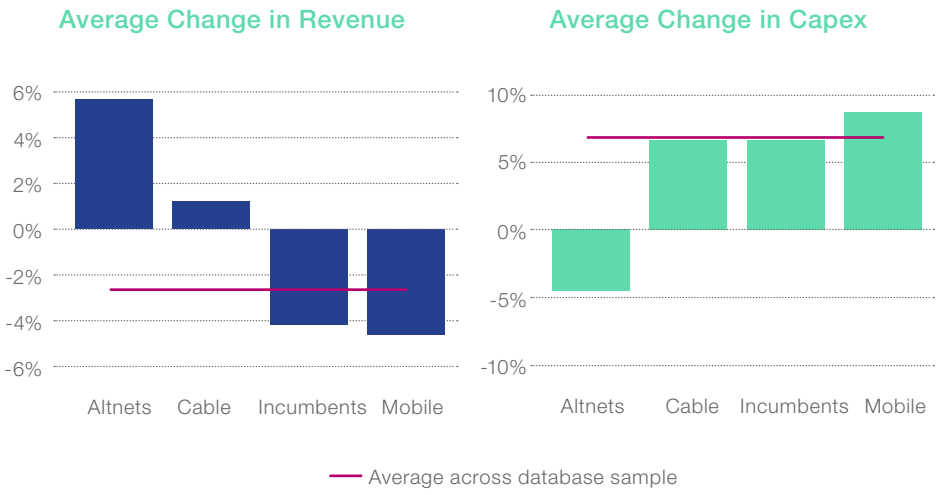


Figure 2: Disparities in Growth in Telecom Revenues & Capex for Different Players, 2013

European telecom revenues under pressure – average % change in telecom revenue by type of player (left); average % change in capex, which is increasing for all players except altnets (right).

Source: Megabuyte consultancy.

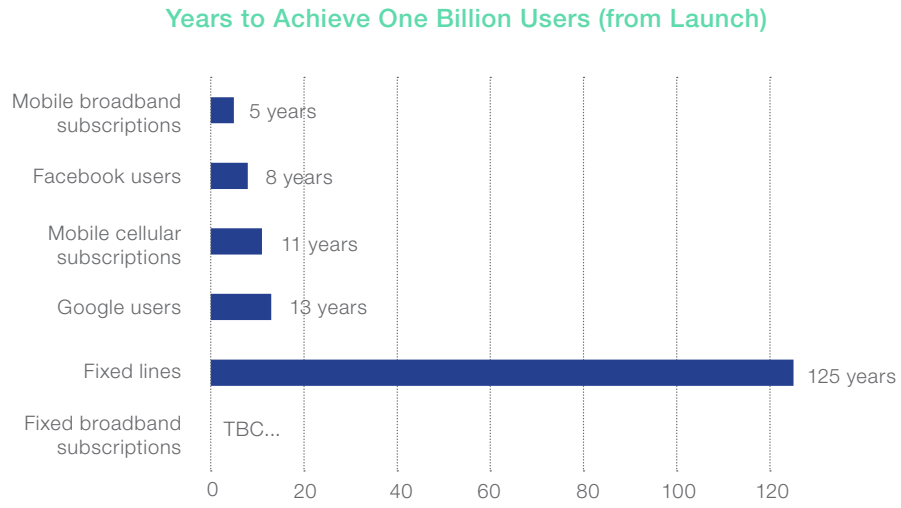


Figure 3: Mobile Broadband is the Fastest-Growing ICT Service in History

Source: ITU, based on various sources.

Many markets worldwide are now fully saturated with regards to mobile phone penetration – ITU estimates that there will be 121 countries with mobile cellular penetration in excess of 100% by end 2015. The number of unique subscribers continues to grow, while growth in global mobile cellular subscriptions is slowing due to saturation in some markets (Figure 4).

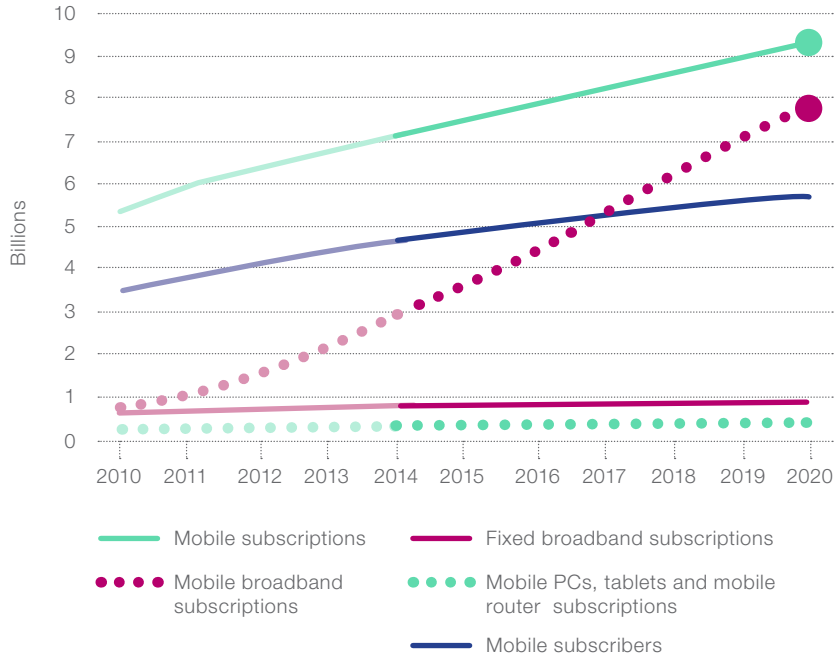
In developed saturated markets, many operators are now focusing on:

- migrating customers to 3G and 4G to stabilize Average Revenue Per User (ARPU);
- retaining customers in the face of competition from low-cost MVNOs; and/or
- investing in foreign markets through M&A activity to boost demand.

Growth in the mobile industry now relies more than ever on persuading existing subscribers to upgrade their subscriptions for new services and apps (including m-banking and m-payments). In this regard, Mary Meeker (2014) foresees plenty of room for future upgrades, with smartphones accounting for only 30% of the global total of mobile subscriptions in 2014. Ericsson estimates that this figure is around 40% of all mobile phone subscriptions associated with smartphones in 2015.

Some subscribers have multiple subscriptions (to minimize cost across different services and maximize coverage on different networks and/or subscriptions for different devices e.g. smartphones and tablets). According to the GSMA, mobile subscribers held an average of 1.78 active SIMs each (both voice and non-voice mobile Internet SIM cards) by the end of 2014.

Ericsson projects that the gap between subscriptions (connections) and subscribers (people) will widen (Figure 4, top), although Ericsson recently revised its forecasts for mobile broadband subscriptions downwards from 8.4 billion to 7.7 billion mobile broadband subscriptions by 2020.



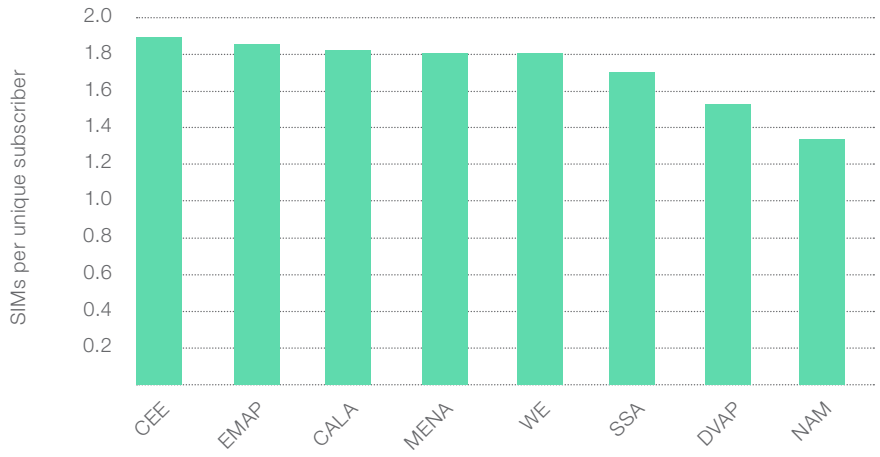


Figure 4: Comparing Global Subscriptions with Subscribers

Global totals of subscriptions and subscribers for mobile and fixed broadband (top); Total mobile SIMs per unique subscriber, end 2014 (bottom).

Sources: Ericsson Mobility report, June 2015 (top); the Internet Society's "Global Internet Report 2015", based on GSMA (bottom).

CEE: Central & Eastern Europe
EMAP: Emerging Asia-Pacific
CALA: Central & Latin America
MENA: Middle East & North Africa
WE: Western Europe
SSA: Sub-Saharan Africa
DVAP: Developed Asia-Pacific
NAM: North America

ITU's 2015 data suggest that, in comparison with a stock of over 7.1 billion mobile cellular subscriptions worldwide by the end of 2015, there will be 3.5 billion mobile broadband subscriptions[6], amounting to nearly half (48.8%) of all mobile subscriptions (Figure 4), although the inclusion of dongles means that a direct comparison cannot be drawn. Mobile broadband subscriptions now outnumber fixed broadband subscriptions by a ratio of 4.4:1 (up from 3:1 in 2014). Smartphones now dominate mobile broadband devices, and will continue to dominate for the foreseeable future. This means that, for many consumers in developing markets, their first experience of the Internet will be via a smartphone. Ericsson (2015) forecasts smartphone subscriptions will exceed those for 'basic' phones in 2016[7].

Table 1: Estimates of the Global Market, 2012-2015 and 2020

	2012	2013	2014	2015	2020
Mobile cellular subscriptions	6.23 bn (ITU)	6.67 bn (ITU)	6.95 bn (ITU) 7.1 bn (E)	7.09 bn (ITU)	9.2 bn (E)
Unique mobile phone users	--/--	5.2 bn (MM)	3.65 bn (WeAreSocial) 5 bn (Cisco)	3.7 bn mid-2015 (GSMA) 4.9 bn (E) 5.2 bn (World Bank)	--/--
LTE subscriptions	--/--	200m (E)	500m (E)	Q1 - 600m (E) Q4 - 1.37 bn (ABI Research) [8]	3.7 bn (E); 2.5 bn (GSMA); 3.5 bn (ABI)
Mobile broadband subscriptions	1.55 bn (ITU)	1.95 bn (ITU) 2.1 bn (E)	2.69 bn (ITU)	3.46 bn (ITU)	7.7 bn; 85% of all subscriptions (E)
Fixed broadband	635m (ITU)	710m (ITU)	748m (ITU)	794m (ITU)	--/--
Internet users	2.49 bn (ITU)	2.71 bn (ITU)	2.94bn (ITU)	3.17bn (ITU)	4 bn by 2020
Facebook users	1.06 bn MAU 618 DAU (Facebook, Dec 2012)	1.23 bn MAU 757 DAU (Facebook, Dec 2013)	1.393 bn MAU 890m DAU (Dec 2014)	1.44 bn MAU* 936 DAU* (Facebook)	--/--
Smartphone subscriptions	1.3 bn (MM)	1.7 bn (MM)	2.1 bn (MM)	40% total mobile subscriptions (E);	Equivalent to 70% world's population (E)
Smartphone stock	--/--	--/--	1.8 bn (Del) 2.7 bn (E); Q1/14 - 64% mobile phones (E)	2.2 bn (Del); Q1/15 - 75% of mobile phones (E)	6.1 bn subscriptions (E); 70% world's population (E)
Smartphone handset shipments or sales	712.6m (IDC)	30% of all mobiles (MM)	--/--	1 bn (IDC);	--/--

Source: Various. MM = Mary Meeker. E = Ericsson Mobility June 2015 report. Prior forecasts from November 2015 report. Del= Deloitte TMT Predictions 2015 report.

*Note: For Facebook figures, MAU = monthly average users; DAU = daily average users. *Q1 2015 figures.*

Nearly all major players are now investing heavily to capitalize on developments in broadband technology, with 4G mobile, VDSL vectoring, DOCSIS 3.0 and FTTx technologies offering higher transmission speeds. 4G is growing rapidly, with the GSMA expecting 4G network infrastructure to account for much of the US$ 1.7 trillion of expected investment by mobile operators during 2015-2020[9]. Despite some operators experiencing decreases in revenues, most operators are continuing to invest in upgrades to their infrastructure and network consolidation – ABI Research forecasts that investment in LTE infrastructure will grow by nearly 10% year-on-year[10]. Many operators are also deploying small cells or micro-base stations to improve network capabilities, and focusing on generating a Return on Investment (RoI) from their 3G and 4G networks by adapting pricing packages to make most efficient use of their networks.

In hindsight, 2014 is likely to prove a 'cusp year', as the year when growth in 3G started to slow, while growth in 4G – LTE subscriptions accelerated further (Figure 5, top chart). By the end of 2014, Telegeography reports that 2G networks had been deployed in 200 countries, active 3G networks were commercially available in 192 countries and 4G networks had been deployed in 102 countries (Figure 5, bottom). In July 2015, the Global mobile Suppliers Association (GSA) reported that 422 operators had launched commercial LTE systems in 143 countries[11], projecting 460 commercially launched LTE networks by end 2015[12].

Figure 5: Growth in Global 4G Subscribers

Trends in 3G and 4G LTE subscriptions (top); Number of countries with access to 2G, 3G and 4G networks (bottom).

Sources: GSMA Intelligence, "Understanding 5G: Perspectives on future technological advancements in mobile", December 2014 (top); The Internet Society's "Global Internet Report 2015", based on Telegeography (bottom).

Indeed, Asia-Pacific now accounts for half of all mobile broadband subscribers (Figure 6), up from 45% in 2014. For example, China Mobile has rolled out more than 700,000 TD-LTE base stations. China Mobile's 3G user base had actually declined over the first half of 2015, falling from 245.8 million at end-2014 to 214.8 million, while its 4G customer base had more than doubled from 90.1 million to 189.7 million by mid-2015[13]. China Mobile is now the largest mobile operator in the world by subscribers[14] (it had already overtaken U.S. provider Verizon in autumn 2014 to become the largest 4G provider in the world). The rapid expansion of Asia-Pacific is squeezing other regions in terms of regional market shares. For example, Europe and the Americas both saw declining proportional shares of mobile broadband subscribers from 2014 to 2015 – despite absolute increases in the number of subscribers, Europe's share fell from 16% to 14% and the Americas from 24% to 22%.

The story of mobile broadband is very much an Asian growth story. The market for LTE also remains highly concentrated, with the top five markets accounting for three-quarters or 76% of global LTE subscriptions by December 2014, while China remains the third-largest market in the world, after the U.S. as the largest market for LTE[15].

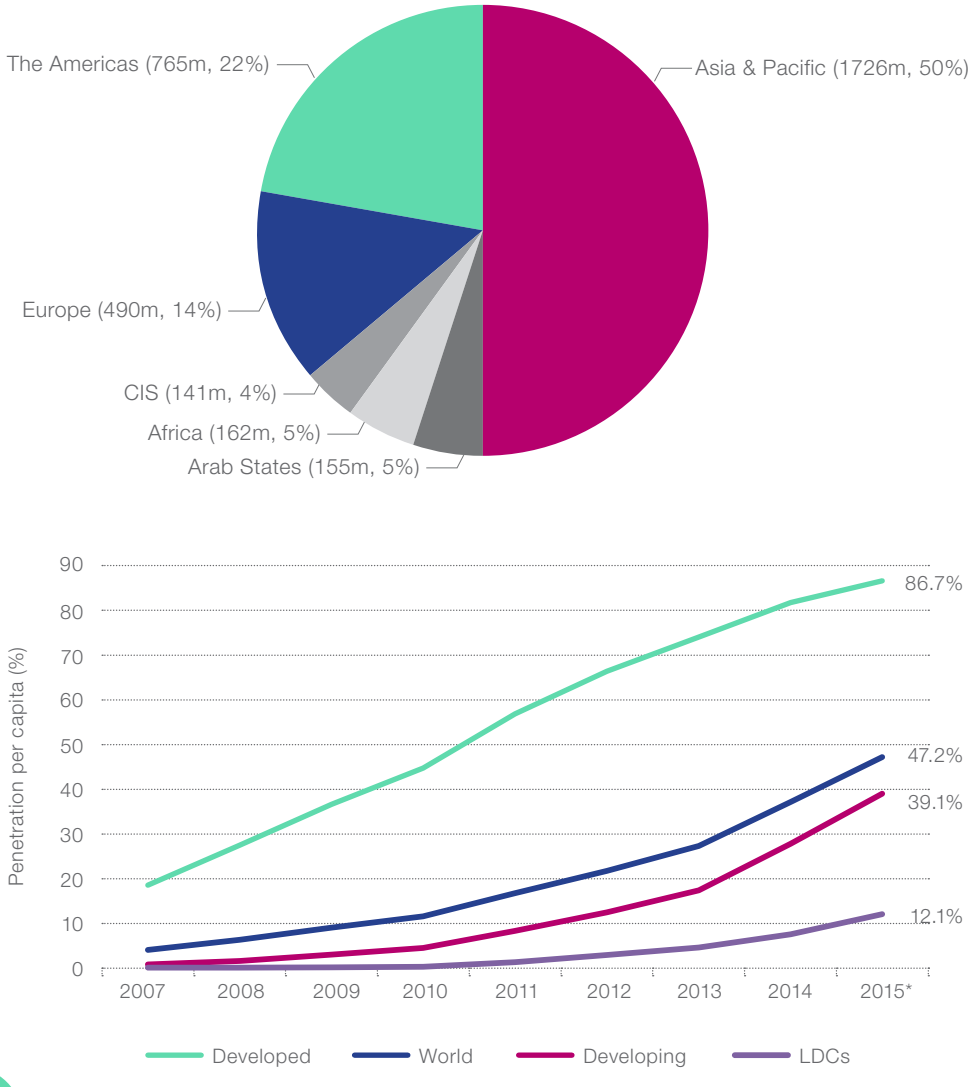


Figure 6: Status of Mobile Broadband subscriptions, 2015

Distribution of mobile broadband subscriptions by region (top), evolution of mobile broadband, 2007-2015 (bottom).

Source: ITU.
*Note: * Estimated.*

As mobile devices proliferate, Gartner[16] predicts that the focus will shift away from the features and functionality of devices to serving the needs of users in different contexts. Phones and wearable devices will form part of an expanded computing environment (including consumer electronics and connected screens). Technologies such as Network Function Virtualization (NFV), Software Defined Networking (SDN) and HetNets are being deployed by operators to help create a hyper-connected society, alongside the development of 5G.

Mobile broadband will play a complementary role alongside fixed broadband in some markets, but may increasingly dominate fixed broadband in other markets, although fixed technologies will still play a vital role in providing backhaul networks. ITU estimates that there will be 794 million fixed broadband subscriptions by end 2015, representing solid growth of 6% year-on-year, up from 748 million fixed broadband subscriptions at the end of 2014[17].

Growth in fixed broadband subscriptions roughly matches growth in overall Internet usage, meaning that fixed broadband has continued to maintain its overall share in Internet usage over the last four years. Ovum forecasts that global fixed broadband subscriptions will grow at 5% CAGR to achieve 920 million by 2019[18]. IHS/Infonetics Research puts the annual growth rate of fixed broadband higher at around 8%, and forecasts that fixed broadband subscribers (DSL, cable broadband, FTTH, and FTTB+LAN) will reach one billion worldwide in 2019, driven by growth in South Asia and key emerging markets (including China, Russia, Brazil, Mexico, Argentina, Indonesia, Thailand and Vietnam)[19].

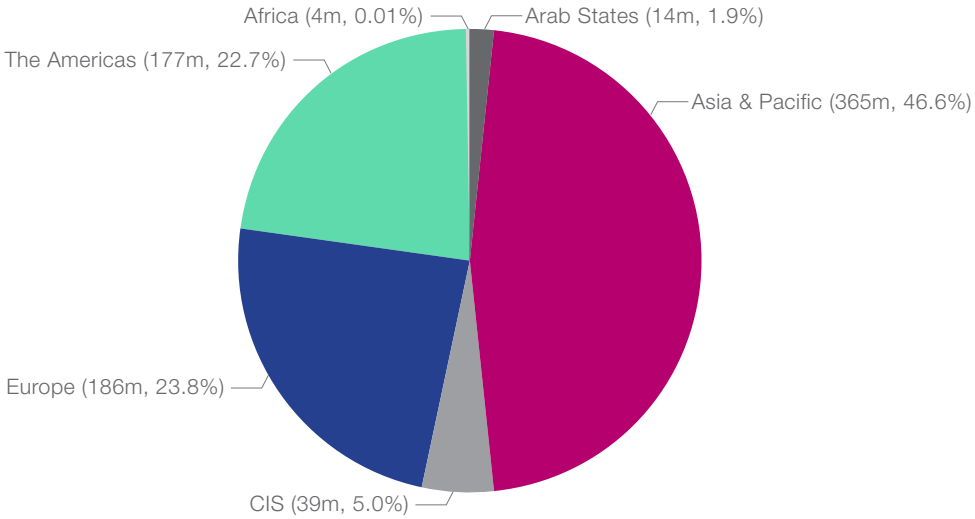
Some interesting trends are evident from the regional analysis. Asia-Pacific increased its share of the total global market for fixed broadband from 45.6% to 46.6% from 2014-2015, while the Arab States added 0.1% (Figure 7). All major regions will continue to see growth in fixed broadband for the foreseeable future, driven by consumer demand for Internet access at increasing speed, as well as a growing number of Internet-connected devices within the home and workplace. Europe and the Americas both lost market share as a regional proportion of the global total. The picture here is also a story of Asian growth.

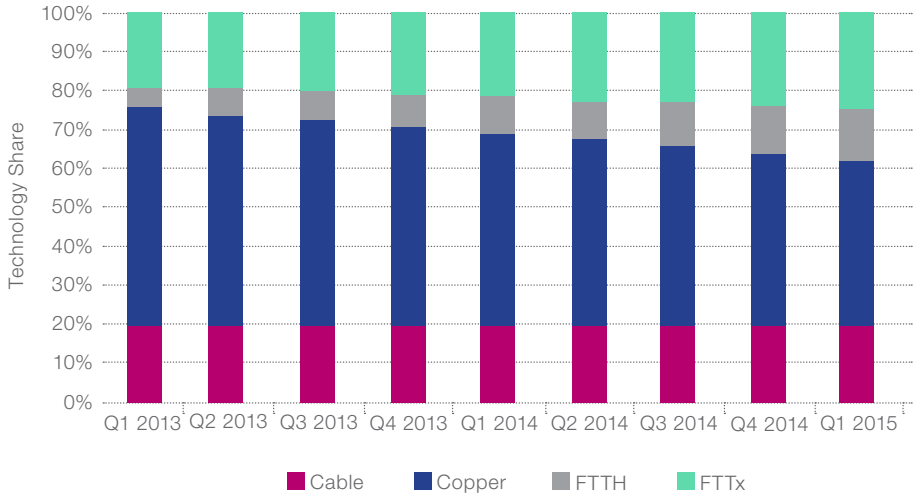
In terms of Internet usage, ITU predicts that the milestone of three billion Internet users will be surpassed during 2015[20], with 3.2 billion Internet users by end 2015. This represents year-on-year growth of 7.8%. After two decades of explosive growth, several commentators have noted that overall growth in the number of Internet users (but not traffic or volume) is slowing, as more markets reach maturity and/or saturation – for example, Facebook (2015) notes that growth in Internet users is below 10% for the fourth year in a row[21]. The growth of Facebook continues to outpace this, resulting in an increasing market share – nearly one in two Internet users is now a regular (monthly) user of Facebook, and Facebook exceeded one billion users in a single day for the first time in August 2015. The growth of mobile broadband will also help push Internet penetration beyond 50% of the world's

Figure 7: Status of Fixed Broadband Subscriptions, 2015

Geographical distribution of fixed broadband subscriptions by region (top); Market share of fixed broadband by different technologies, 2013-2015 (bottom).

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





population by 2018, by which time, the online audience will access 25 trillion digital data items created worldwide each day. Based on this slowing growth, the milestone of 4 billion Internet users is unlikely to be achieved before 2020 at the earliest. Future Internet users are likely to come from less well-educated, less urban backgrounds in other languages and dialects. Indeed, the challenge now is about connecting the next four billion people who will come online, in many more languages, via more platforms, using many more devices over a range of different networks.

2.2 The Demand-side Challenge – Towards a Multilingual Web

Among several major demand-side challenges in expanding the Internet and web to accommodate the next four billion people, one major barrier that must be overcome is the representation and use of the world's languages online. In order to connect everyone, it is also vital to increase the online representation of many of the world's languages, especially for regions and countries with high linguistic diversity (such as Africa, India and South-East Asia).

Today, only a fraction of the world's languages is present on the Internet – an estimated 5% of the world's languages (by number of languages). Linguistic diversity is an essential component of humanity's living heritage, social inclusion and empowerment, along with sustainable development. Language plays a vital role in the construction and expression of the individual and collective identity, as an intangible – and invaluable – resource which is tough to acquire but, once acquired, easy and rewarding to share.

Over a third of the approximate 7,100 languages spoken today are in danger of disappearing – Ethnologue reports that 1,519 languages are 'in trouble' and 915 are classified as 'dying', with a rate of loss of six languages per year[22]. At this rate, many languages will disappear in the near future, while others will lose their influence and relevance at global, national and local levels. UNESCO is undertaking a revision of its Atlas of World's Languages in Danger[23] which already includes nearly 2,500 languages in danger, in order to encompass all of the world's known languages. The new version will use ICTs to expand the knowledge base of the world's languages, and provide a feature monitoring 'language vitality' status.

Recent research by UNESCO found evidence that the current number of languages represented on the Internet is more than 300. It is very difficult to measure linguistic diversity by checking the number of websites and number of languages, range of information sources etc. There are some ongoing initiatives to measure linguistic diversity on the Internet; however, there is no single reliable, standard way of measuring diversity (which often needs to be done at the regional or even national level, due to the local knowledge needed).

Indeed, the Internet's content continues to be dominated by a few major languages, most significantly English. According to W3Techs' survey of the most popular 10 million websites, 55.2% are in English, with Russian, German, Japanese, Spanish and French being used by between 4.0-5.8% of websites.

A significant number of national languages (such as Hindi and Swahili) are used by less than 0.1% of these websites, and most of the world's languages are not represented at all in their data[24]. The large majority of languages are without a significant online presence matching their real world speaker base.

Another related factor is making existing online services available in more languages (Figure 8). These services may be 'multinational', but it is not clear that many of them are 'multilingual' in relation to the total 'language universe'[25] of between 7,102[26]-9,000[27] languages

in existence. Indeed, by measures of multilingualism, Wikipedia has consistently performed well in terms of number of languages over recent years, partly due to its reliance on user-generated content. However, growth in the languages available for some of the main online services is not matching the growth in Internet usage (Figure 8).

Facebook (2015) measured supply for content in local languages using the number of languages with content exceeding 100,000 Wikipedia pages as a proxy variable for the availability of local content in local languages[28]. Facebook found only 53% of the world's population has access to significant Wikipedia knowledge (and by extension, online content) in their primary language, and that making the Internet relevant to 80% of the world requires content in at least 92 languages (as opposed to the current 52 languages with >100,000 articles+[29]).

Another major issue relates to Internationalized Domain Names (IDNs). Historically, IDNs only included a limited number of characters, Latin "a" to "z", digits "0" to "9" and the hyphen "-". Many of today's 3.2 billion Internet users are unable to read or understand Latin text, making the names/words in domain names either meaningless or difficult to recall. A multilingual domain name environment can help ensure each end-user has the same rights to access content in their own language, and to experience the Internet without constraints.

The UNESCO/EURid World Report on Internationalized Domain Names[30] finds that:

- IDNs help enhance linguistic diversity in cyberspace;
- The IDN market is more balanced in favour of emerging economies; and
- IDNs are accurate predictors of the language of web content.

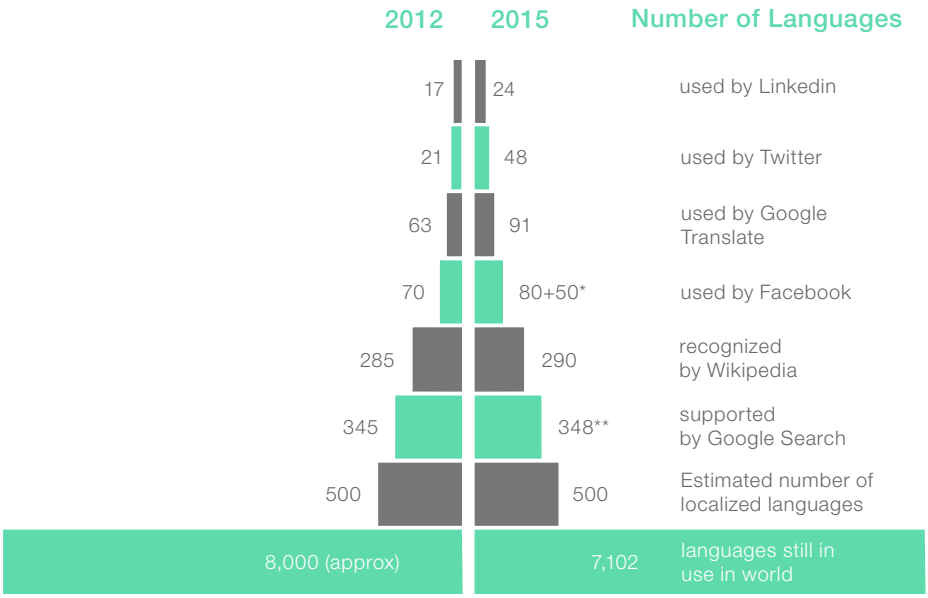
This evidence suggests that overcoming the Internet's language barriers will be a key determinant in helping drive demand for – and access to – Internet services and content.

Figure 8: Multinational online services, but are they multilingual?

Number of languages in which major online services and websites are available.

Source: ITU, from various sources including Ethnologue.

*Note: * Over eighty languages, with another fifty in translation, are available at the Facebook Community Translation Platform, which enables native speakers of any language open to translation to participate and help bring their language online. **Includes some humorous languages such as Elmer Fudd, Klingon, Pirate, and Bork! Bork! These are not the same as internationalized URLs – https://en.wikipedia.org/wiki/List_of_Google_domains*



2.3 The Supply-side Challenge – Extending into Rural Areas

Major supply-side challenges exist in expanding the Internet and web to accommodate the next four billion people – notably, extending present-day networks outside urban areas into rural or remote areas, and upgrading networks to cope with the growth in traffic. The challenge of universal access stems from steep increases in marginal costs of network deployments for less densely populated or more remote areas, jeopardizing the viability of service provision on a commercial for-profit basis.

As one example of just how steeply costs can rise, Analysys Mason (2015) recently calculated the commercial viability of deploying different technologies in different municipalities in The Former Yugoslav Republic of Macedonia by calculating the Net Present Value (NPV) of a roll-out over the period 2015–2023. Their estimates of viable coverage vary, depending on the broadband technology, but range from 44% coverage for FTTH (covering mainly urban/sub-urban areas – see Figure 9, top) to 51% for DOCSIS3.0 and 94% for LTE i.e. covering most of the territory. (These coverage levels vary, depending on the country and its geography, population distribution and terrain). Even in Europe, many countries still have a way to go to achieve these levels of coverage, with only four countries globally over 25% FTTH+FTTB and only six countries over 20% FTTH+FTTB coverage[31]. Globally, only four countries have achieved over 50% coverage (UAE, Rep. of Korea, Hong Kong (China) and Japan[32]).

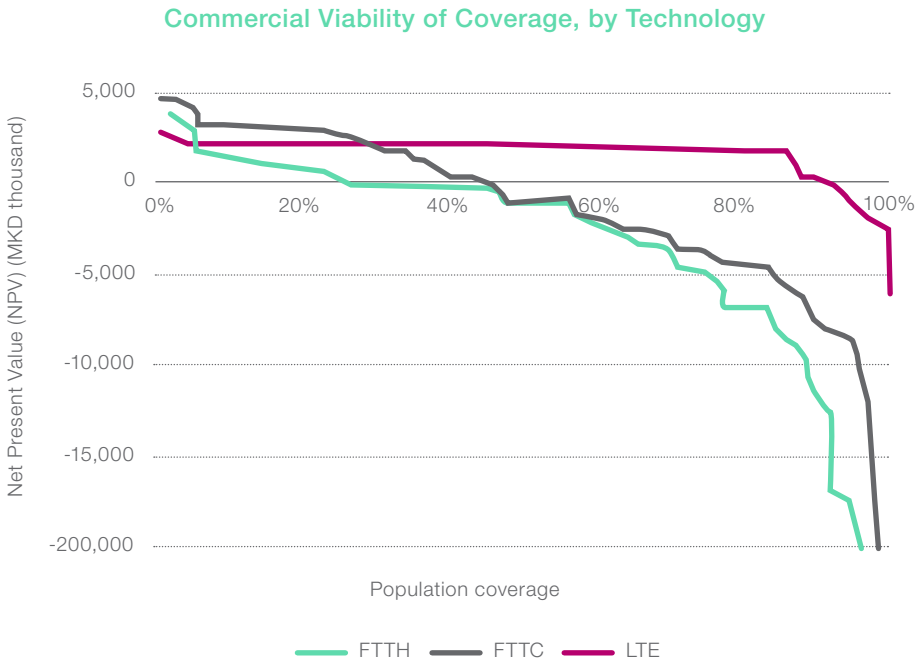
Capital expenditure (capex) per household or per capita also increases massively when reaching the last 10% or 20% of population in remotely populated areas. The equivalent level of capex for which FTTH remains commercially viable is just under 200 Euros per household for FTTH in The Former Yugoslav Republic of Macedonia, 30 euros per capita for LTE and 100 euros per household for DOCSIS 3.0 (Figure 9, bottom chart). After this, broadband coverage may become prohibitively expensive.

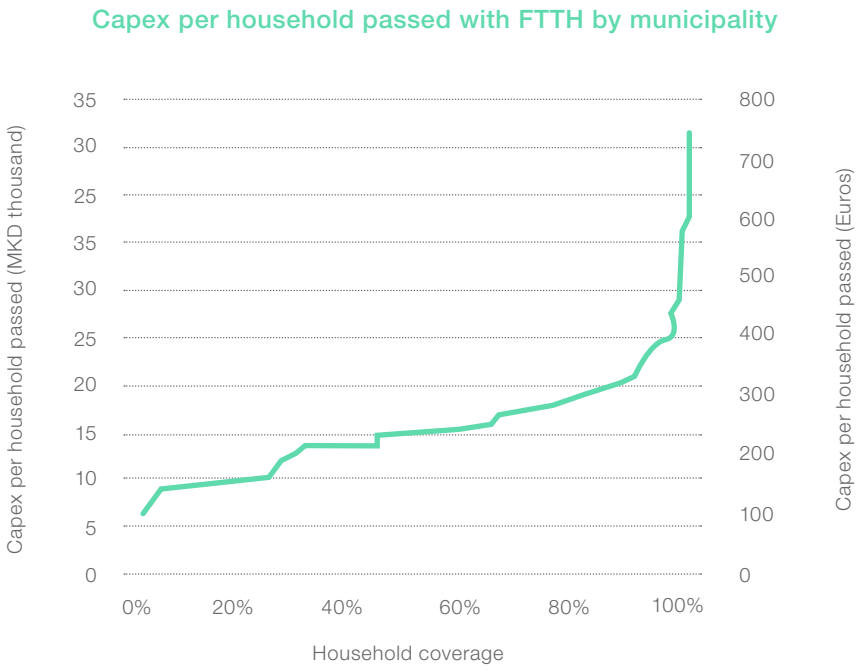
Where the business case is compelling, the World Bank calls for the private sector to take the lead in providing Internet infrastructure and services, but notes that “public investment or intervention is sometimes justified where the private sector is unable to provide affordable access”[33]. One factor contributing to the slowing of Internet growth is that the business case is less compelling for the areas in which the remaining 57% of unconnected people live. Chapter 5 deals with current approaches to Universal Access and Service (UAS), although in fact, entirely new approaches and innovative business models may be needed in addition to achieve universal coverage of broadband.

Figure 9: Commercial Viability of Broadband Coverage

Net Present Value per household of FTTH and FTTC deployment and Net Present Value per household of LTE deployment by municipality (top); Capex per household passed with FTTH by municipality (bottom).

Source: Analysys Mason.





2.4 Towards an Internet of Things, as well as People

It is not just the humans who are getting connected. Many analysts agree that the Internet of Things (IoT) is now coming of age, and foresee strong growth in the IoT in their predictions. Deloitte[34] forecasts that, in 2015, one billion wireless IoT devices will be shipped, up 60% on 2014, resulting in an installed base of 2.8 billion connected devices by the end of 2015[35]. There are currently five connected devices for every person connected with the Internet. ITU predicts that there will be 25 billion networked devices by 2020, by which time connected devices may outnumber connected persons by a ratio of six to one, transforming our concept of the Internet and our connected society forever[36].

According to Ericsson, mobile phones have so far been the largest growth segment among connected devices. However, looking forward, Machine-to-Machine (M2M) is expected to show strong growth driven by new use cases e.g., in cars, machines and utility metering, etc. Ericsson forecasts a total of 26 billion connected devices by 2020, of which almost 15 billion will be phones, tablets, laptops and PCs (excluding simple sensors and RFID)[37]. Cisco forecasts that there will be 3.2 billion M2M connections alone by 2018, connected via macro-cells[38]. Adding in other devices and connectivity technologies, Cisco forecasts 24.4 billion connected devices by 2019 (although this estimate excludes RFID)[39]. Indeed, the growth of the IoT may even introduce a new form of the digital divide, in terms of who has access to which connected devices (Featured Insight 1).

IDC predicts that IoT spending will exceed US$ 1.7 trillion, up 14% from 2014 (and may reach US$ 3 trillion by 2020). In contrast to many analysts, who foresee a large part of the IoT as comprising wireless sensor networks, IDC sees the “industrial Internet of Things” as a mainly fixed-line phenomenon for the immediate future, forecasting that fixed-line networks could carry as much as 90% of traffic for the industrial IoT.

Mobile traffic patterns, network loads and pricing packages will all have to alter in response to changing traffic patterns. Long-Term Evolution (LTE) networks and smartphones generally have much higher network-initiated service requests. The growing adoption of IoT technologies for development is likely to result in higher and changing demands on the networks for regular, more repeated, background usage of mobile and WiFi networks.

Mobile operators will have to review their network architecture, topology, and functionality to carry 4G and IoT traffic successfully, while providing good customer experience and bolstering their profit margins. The need for investments to build networks capable of handling all the expected future traffic will be significant, and should be taken into account in any public policy initiative. Clear policy support should be given to investments in robust and effective high-speed broadband networks. Chapter 4 considers the use of IoT technologies for helping achieve development.

FEATURED INSIGHT 1: A NEW AND GROWING DIGITAL DIVIDE IN CONNECTED DEVICES

Thirty years ago, a UN Commission published the Maitland Report to investigate in part concerns of a growing 'digital divide' in access to telecommunications between high-income and low-income countries. The Commission proposed that, given the already obvious economic benefits of telecommunications, by the early 21st century, every individual on the planet should "be within easy reach of a telephone" (defined at the time as people living within a one-day walk of a phone). Anyone suggesting back then that, in just three decades, over 90% of the world would be covered by mobile cellular signals – and that over half of the people on Earth would have a mobile phone in their pocket – would have been considered a crazy optimist.

Today, it is clear that the digital divide in basic ICTs, including telephones, is diminishing. The number of fixed telephone lines worldwide is falling and at an even faster rate in developed versus developing countries. Simultaneously, gaps in mobile phone penetration are closing rapidly. In 2005, mobile penetration in the developed world was over three times higher than in developing countries (82% versus 23%). By 2015, this gap has closed significantly, with mobile penetration at 121% in developed countries and 92% in developing countries. While larger gaps remain in mobile and fixed broadband subscriptions, higher growth rates for both technologies in developing countries point to the same conclusion: overall, developing countries are catching up with developed countries in a range of ICTs.

According to Cisco's 2015 Visual Networking Index (VNI), we now stand at a digital tipping point – by 2019, the number of people connecting to Internet will amount to 3.9 billion, reaching over 51% of the global population online. As nearly one billion additional people connect to the Internet, over 10 billion new devices (smartphones, tablets, sensors, etc.) will come online at the same time, growing in total number from 14.2 billion in 2014 to 24.2 billion in 2019.

However, this 'good news story' masks a growing digital divide in the next phase of the Internet, which will be characterized by a growing number of connected devices. For every new person connecting to the Internet over the next five years, ten times as many devices will connect. In North America, there were 6.1 networked devices per capita in 2014 with a forecast of 11.6 devices per capita by 2019 (a compound annual growth rate (CAGR) of 14%). In Western Europe, the number was 4.4 devices per capita in 2014, rising to 8.2 in 2019 (13% CAGR). However, in Latin America, there were only 2.0 connected devices per capita in 2014, with an expected rise to 2.9 by 2019 (9% CAGR), and in the Middle East/ Africa region, growth is expected to be even less substantial, with only 1.0 connected device per capita in 2014 rising to a meagre 1.4 by 2019 (9% CAGR as well).

Why does this new divide matter? While developing countries are catching up in basic ICT penetration, this growing gap in the overall 'Internet of Everything' may point to big differences in how societies are utilizing, and benefitting from, the Internet. For example, network effects and externalities that multiply the impacts of ICTs require minimum adoption thresholds before those

impacts can begin to materialize, and the greater the intensity of ICT use, the greater the impact on economic growth (even beyond saturation levels of penetration). If intensive ICT use drives growth and development at faster levels than basic ICT use, these multiplier effects may be widening the overall digital divide at a greater rate than simple adoption numbers suggest (and in a way that narrowing gaps in telephony and broadband may fail to reflect).

Greater access and adoption of ICTs among lower-income groups will further accelerate income gains at the base of the economic pyramid. Policy actions should focus on bridging this new digital divide in connected devices – much more needs to be done to accelerate the adoption of basic ICTs and total connected devices and reverse this new gap between developed and developing countries.

Source: Dr. Robert Pepper, Cisco Systems.

World Map: A Growing Digital Divide in the Internet of Everything?
Connected Devices Per Capita from 2014 to 2019; Devices' Compound Annual Growth Rates (CAGR)

Source: Cisco VNI Global IP Traffic Forecast, 2014-2019.

ENDNOTES

1. IDC presentation at “The Great Telco Debate” workshop held in London, 7 November 2014.
2. www.mis-asia.com/tech/networking/idc-announces-predictions-for-telecom-industry-for-2015/
3. www.lightwaveonline.com/articles/2015/01/datacom-up-telecom-sluggish-in-2014-says-infonetics.html?cmpid=$trackid
4. “Europe – Thirty Years on from Liberalization”, Megabuyte analysis published in the March/April edition of ITU News, available at: https://itunews.itu.int/En/5778-Europe-Thirty-Years-on-from-Liberalization.note.aspx
5. “Ovum Telecoms, Media and Entertainment Outlook 2015”, available from: http://info.ovum.com/uploads/files/Ovum_Telecoms_Media_and_Entertainment_Outlook_2015.pdf
6. Mobile broadband subscriptions are not necessarily a sub-set of mobile cellular subscriptions, since mobile broadband subscriptions include dongles, which are not counted in mobile cellular subscriptions.
7. Ericsson Mobility report (June 2015) at: www.ericsson.com/res/docs/2015/ericsson-mobility-report-june-2015.pdf
8. “LTE Subscriber Base to Grow to 1.4 Billion Globally by Year-end 2015”, ABI Research, 12 June 2015, available from: https://www.abiresearch.com/press/lte-subscriber-base-to-grow-to-14-billion-globally/
9. GSMA Intelligence, “Understanding 5G: Perspectives on future technological advancements in mobile” (December, 2014).
10. “LTE Subscriber Base to Grow to 1.4 Billion Globally by Year-end 2015”, ABI Research, 12 June 2015, at: https://www.abiresearch.com/press/lte-subscriber-base-to-grow-to-14-billion-globally/
11. “GSA confirms 422 LTE networks launched, Cat 6 LTE-Advanced deployments setting the pace”, press release, 23 July 2015, available at: www.gsacom.com/news/gsa_430.php
12. “Update on LTE Global Subscriptions (Q1 2015 figures)”, available from the GSA website at: www.gsacom.com
13. https://www.telegeography.com/products/commsupdate/articles/2015/07/23/china-passes-225m-4g-users/?utm_source=CommsUpdate&utm_campaign=eecb753884-CommsUpdate+23+July+2015&utm_medium=email&utm_term=0_0688983330-eecb753884-11619241
14. https://www.telegeography.com/products/commsupdate/articles/2015/03/02/miit-awards-long-awaited-fdd-licences/?utm_source=CommsUpdate&utm_campaign=112ba57a5b-CommsUpdate+02+March+2015&utm_medium=email&utm_term=0_0688983330-112ba57a5b-11619241
15. “Smartphone & tablet usage trends & insights: 4G LTE and Wi-Fi powering data consumption”, Ovum/Mobidia report, March 2015.
16. “Gartner Identifies the Top 10 Strategic Technology Trends for 2015”, available from Gartner at: www.gartner.com/newsroom/id/2867917 Information about Gartner Symposium/ITxpo in Orlando, is available at www.gartner.com/us/symposium. Video replays of keynotes and sessions are available on Gartner Events on Demand at www.gartnerondemand.com.
17. See ITU aggregate data for fixed broadband subscribers, available at www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

18. Ovum, “Global Fixed Voice and Broadband Outlook: 2014-2019”, available from http://ovum.com/knowledge-center/
19. “FTTH, DSL, and Cable Subscribers report”, HIS/Infonetics Research, published 9 April 2015, available from: www.marketwired.com/press-release/-2008335.htm
20. Although WeAreSocial’s growth curves are higher, putting the achievement of this milestone earlier during November 2014 available at http://wearesocial.net/blog/2015/01/digital-social-mobile-worldwide-2015/
21. “State of Connectivity 2014” report, Facebook, February 2015, available at: https://fbnewsroomus.files.wordpress.com/2015/02/state-of-connectivity1.pdf
22. https://www.ethnologue.com/about
23. www.unesco.org/languages-atlas/ www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/news/recommendations_action_plan_atlas_languages.pdf
24. http://w3techs.com/technologies/overview/content_language/all
25. This is a very difficult number to estimate, mainly due to the difficulties of distinguishing a dialect from a language – www.linguisticsociety.org/content/how-many-languages-are-there-world
26. www.ethnologue.com/about
27. Chapter “Target 9: Encourage the development of content”, Monitoring the WSIS Targets, World Telecommunication/ICT Development Report (WTDR) 2010, published by ITU, Geneva.
28. “State of Connectivity 2014” report, published by Facebook, February 2015, available from: https://fbnewsroomus.files.wordpress.com/2015/02/state-of-connectivity1.pdf
29. https://en.wikipedia.org/wiki/List_of_Wikipedias
30. UNESCO/EurID World Report on Internationalized Domain Names (2015), forthcoming. The 2014 report is available at: www.eurid.eu/files/publ/IDNWorldReport2014_Interactive.pdf
31. www.ftthcouncil.eu/documents/PressReleases/2015/PR2015_FTTH_Subscribers.pdf
32. Ibid.
33. “World Development Report 2016: Digital Dividends”, World Bank, forthcoming.
34. http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Technology-Media-Telecommunications/gx-tmt-pred15-full-report.pdf
35. Deloitte “TMT Predictions 2015”, full report available from: http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Technology-Media-Telecommunications/gx-tmt-pred15-full-report.pdf Find out more about Deloitte’s TMT Predictions from http://www2.deloitte.com/ca/en/pages/technology-media-and-telecommunications/articles/tmt-predictions-2015.html
36. www.v3.co.uk/v3-uk/news/2207590/itu-predicts-25-billion-networked-devices-by-2020 via ACM TechNews on 9/28/12
37. Ericsson Mobility report at: www.ericsson.com/res/docs/2015/ericsson-mobility-report-june-2015.pdf
38. Cisco Virtual Networking Index, February 2015.
39. www.cisco.com/web/solutions/sp/vni/vni_forecast_higlights/index.html

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 all 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[1]. 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 was approved by the Commission in 2013. As the world readies to adopt the Sustainable Development Goals (SDGs) in 2015, this chapter reviews international progress towards achieving these five advocacy targets.

3.1 Advocacy Target 1: Making broadband policy universal – by 2015, all countries should have a national broadband plan

Research conducted for the Broadband Commission (2013) suggested that the introduction or adoption of a broadband plan is associated with 2.5% higher fixed broadband penetration, and 7.4% higher mobile broadband penetration on average[2]. This result is consistent with a National Broadband Plan focusing efforts across industry in coordination with policy-makers, emphasizing broadband as a national priority, and signaling national commitment to the roll-out of broadband.

NBPs move through successive phases (Table 2). Initially, many Plans focus on the national footprint for broadband network availability. The Broadband Commission has found that some 88% of Plans include consideration of infrastructure deployment, often including telecom Key Performance Indicators (KPI) to monitor progress (Broadband Commission, 2013[2]). In this initial phase, monitoring focuses on broadband network deployment to make services as widely available as possible, using standard indicators of coverage, capacity, technology take-up and price. Where public funding supports network deployment programmes,

more detailed performance indicators are required to ensure transparency and accountability.

In their second phase, many Plans include usage or adoption factors (Table 2) – e.g., digital literacy programmes or community access projects. Basic telecom indicators remain important, but the focus expands to include subscription rates, network resilience and quality. Projects and programmes promoting access and human capacity need to be monitored, along with performance indicators for each project to ensure targets and timelines are met. Plans in the third phase focus on evaluating the social, economic and institutional uses of broadband underpinning the wider use of ICTs in a range of sectors (including health, government, education, commerce, public information and the media). Indicators of speed, quality and reliability become more important.

According to Broadband Commission research, a fairly low proportion of Plans include cross-sectoral considerations of e-health, e-governance, e-education and e-commerce strategies in other sectors. In an interesting indication of future trends, Malaysia's Ministry of Science, Technology and Innovation and its research agency recently released a National Internet of Things (IoT) Strategic Roadmap in mid-2015[3].

The number of National Broadband Plans has grown strongly since

Table 2: Successive Phases of a National Broadband Plan

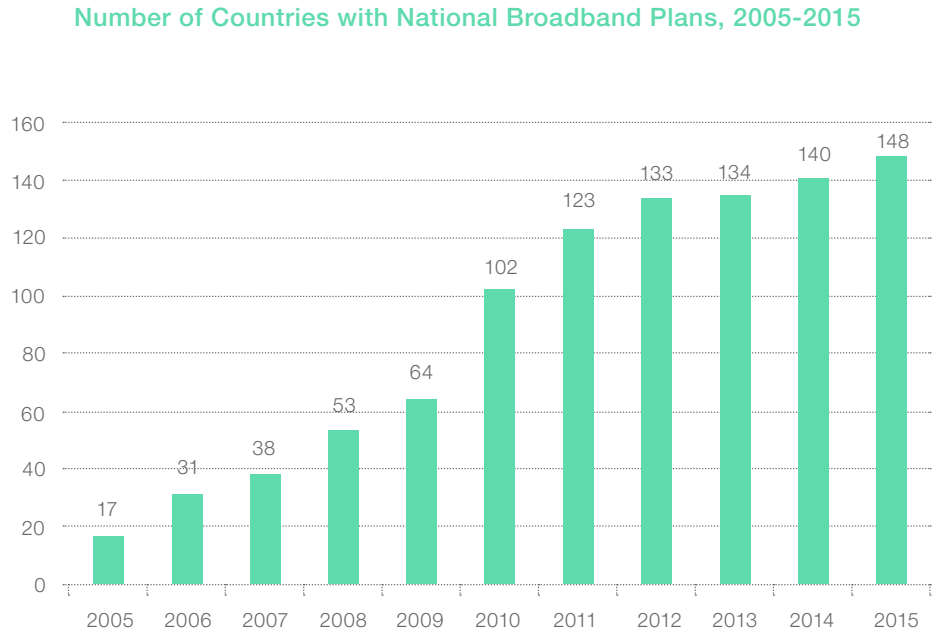
Phase	1) Deployment	2) Adoption	3) Integration
Focus	Broadband network availability	Broadband access & capacity building for effective use	Broadband integration in economy and society
Examples	Optical fibre cable and wireless broadband access networks	Digital literacy programmes; community access projects & programmes	e-health, e-governance. e-education and e-commerce strategies
Indicators	Telecom indicators	Performance indicators	Outcome/impact measures

Source: Colin Oliver, "Monitoring the Implementation of Broadband Plans and Strategies", Trends in Telecommunication Reform 2015.

2008, partly driven by the financial crisis, which spurred many Governments to respond with stimulus funding for broadband[4]. However, growth in the number of broadband plans and policies, as tracked by the ITU, has slowed recently (Figure 10, top). The number of countries with a NBP now stands at 148. Countries which have approved a National Plan most recently include Benin, Brunei Darussalam, Indonesia, Lesotho, Madagascar and Nepal in late 2014 (Appendix 1). A further six countries are planning to or in the process of introducing a National Broadband Plan (Cuba, Dominica, Iraq, Solomon Islands, Santa Lucia and Togo).

Although this target has not been fully achieved, there has been good progress in the number of countries that have introduced a Plan over the lifetime of the Commission. Indeed, a number of countries are now renewing their first NBP – for example, Brazil's Ministry of Communications announced a revised plan, National Broadband Plan 2.0 or "Broadband for All", in November 2014 with new objectives. Conversely, a substantial number of Plans (often introduced around 2010) actually reach the end of their term in 2015 (e.g. Finland, Belarus, Belgium, Croatia, Mongolia, Paraguay and Singapore). The 'succession strategy' for many of these Plans is unclear i.e. whether countries will continue to 'maintain' the recently elapsed Plan, revise it and seek feedback on its achievements and/or introduce an altogether new Plan. Italy is currently reviewing its Plan which expired in 2014, and is considering its revised Plan, the "Ultra-Broadband Strategic Plan".

In formulating its Broadband Plan, each country has to consider its conditions and priorities, taking into account overall national priorities, the socio-economic climate and geography, as well as levels of broadband awareness among key stakeholders (such as government agencies, business and community leaders and the public). Box 1 considers the key elements often found in Plans which have proved successful.



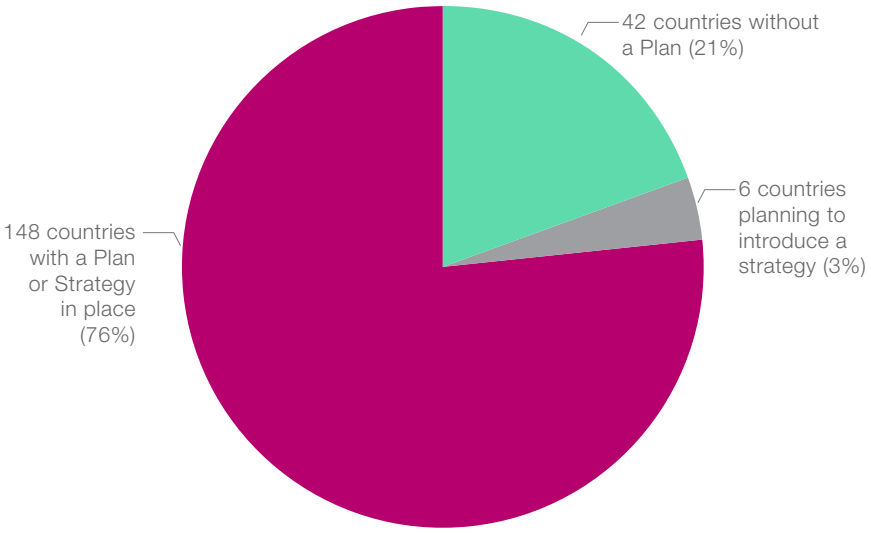


Figure 10: Policy Leadership in National Broadband Plans, 2005-2015

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.

Box 1: Fluid Ingredients for a Solid National Broadband Plan

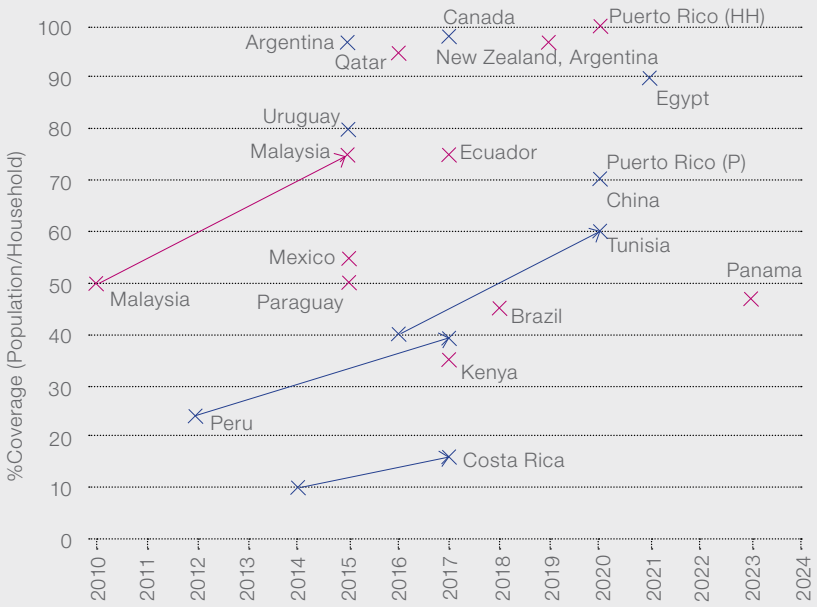
A monitoring and feedback framework is a necessary part of any comprehensive broadband plan. Ideally, a Plan should incorporate a manageable number of indicators that:

- relate to high-level goals;
- are practical to collect;
- are consistent across regions or countries as far as possible; and
- measure progress towards the achievement of measurable targets in the deployment and adoption of broadband services (including by gender and demography).

Many Plans set targets, and a large number of Plans monitor Internet penetration per capita population or per household. In fact, targets between Plans differ greatly in their ambition and timelines (see Box Figure below). Most Plans set timelines for targets of 5-10 years, a timeframe which is more than adequate for such a fast-moving industry (and which is in line with the lifetimes of the Plans themselves, which range in duration from 3-14 years, with an average age of seven years for the Plans in force in 2013).

The vast majority of Plans (86%) set some sort of targets, with population targets proving generally more popular (in 62% of all Plans surveyed) than household targets (in nearly half or 48% of all Plans surveyed). A considerable proportion (around 40%) of Plans set staged targets, with both a nearer term and a longer term target.

Box Figure: Targets set by National Broadband Plans



Source: ITU.

Note: Red data points indicate household (HH) targets; blue data points indicate population (P) targets.

It is vital that Plans clearly identify roles for oversight and implementation. Who is ultimately responsible for the Plan? Who will have oversight and/or coordination? Who is responsible for monitoring implementation and sharing information about progress? Is there a right of recourse in the absence of progress? These questions need to be reviewed regularly.

Regardless of the formal roles and responsibilities, it is clear that different stakeholders must be communicating their expectations and discussing the best strategies to move the broadband market forward. Best practices suggest that countries which have made the most progress in broadband benefit from constructive partnership and dialogue between policy-makers, government, regulators and industry, where parties can make issues known and work together to overcome challenges.

Increasingly, Plans should include cross-sectoral elements to escape 'silo thinking' and must consider ways to collaborate beyond the ICT sector to measure short, medium and long-term outcomes in sectors such as health and education. Improvements in capabilities and efficiency must be achieved in cost-effective ways after early hurdles in deployment, adoption and capacity-building have been overcome. Plans should also include a timetable for review and revision.

Source: Broadband Commission for Digital Development.

Besides a National Broadband Plan, many countries are reviewing and adapting their national legislation, updating and revising existing regulations, or developing more extensive financing packages. For example, there have been recent revisions of telecom legislation in Uzbekistan, Paraguay[6] and Switzerland[7]. New Zealand and Australia have reviewed the financing available for their existing Plans in 2015. The role of national broadband policy has been fully recognized by the group of Landlocked Developing Countries (LLDCs), with the adoption of the *Vienna Programme of Action for LLDCs for the Decade 2014-2024* with the specific objective that all LLDCs should make broadband policy universal. A major review of telecom regulation is about to start in Europe. As part of its Digital Single Market Strategy[8], the European Commission will present an ambitious overhaul of the EU telecom regulatory framework, including measures for: spectrum policies; investment incentives; the scope of regulations; and the institutional regulatory framework. This overhaul is likely to lead to a new generation of NBPs being developed in Europe.

In addition, effective projects also exist carried out by Governments, state-owned incumbents and/or private sector (or a combination of these). Featured Insight 2 details Korea Telecom (KT)'s GiGA Island Project launched in October 2014 aiming to connect and enable access to ICT services for remote islands and rural areas throughout the mainland in the Republic of Korea. This project represents the full cycle of the successive phases of NBPs shown in Table 2.

FEATURED INSIGHT 2: KOREA TELECOM'S GIGA ISLAND PROJECT

The GiGA Island Project is based on cooperation between Korea Telecom (KT), local government and residents to facilitate ICT infrastructure and solutions to help solve local problems. The GiGA Island Project aims to:

- allocate limited resources more efficiently with the help of ICT solutions;
- meet the Corporate and Social Values (CSV) of KT;
- improve the infrastructure of remote islands; and
- to create a new market for KT's business.

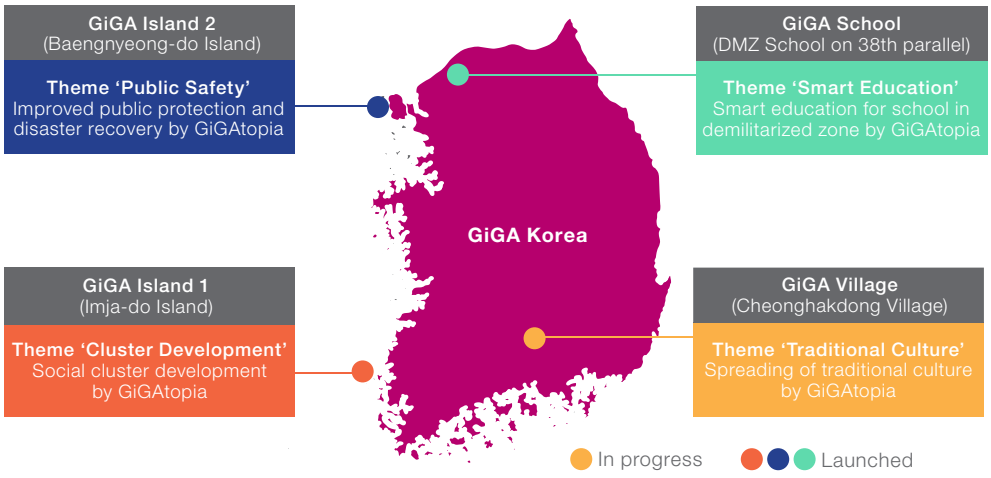
The GiGA Island project was first launched in October 2014 on Imja-do Island. The concept of the GiGA Island project as a universal social platform is based on collaboration between local operators, ICT solution providers and local government and can be applied elsewhere. With its tailored solutions, local government authorities and communities can benefit from enhanced lifestyles in various ways:

- **Education:** Children can enjoy exchanges with foreign teachers in Seoul 350km away via a video conferencing system;
- **Culture:** Residents can listen via a direct link-up to cultural lectures from a cultural center 66km away in Mokpo;
- **Health:** The elderly can receive health check-ups via mobile devices and send the results to medical institutions;
- **Farming:** Farmers can check on crops and control their facilities in real-time remotely; and
- **Media:** People can facilitate multimedia content for events such as screening movies in village halls.

With support from local society, government and the press, another GiGA Island was established on Baengnyeong-do Island in the north of the Korean Peninsula in March 2015. KT has established a triple network comprising a high-performance microwave, satellite and LTE-Advanced network. This GiGA-speed fixed and mobile broadband network makes communication with the outside world possible and can enable people to confirm the safety of their families through videophones at refugee shelters. For people who feel isolated and insecure away from the mainland, GiGA Island forms a 'connected community' to help people lead safe and comfortable lives on the island. Korea Telecom has now launched four GiGA Islands and Villages in the Rep. of Korea as shown in the figure below.

Source: Korea Telecom (KT).

Box Figure: Progress in the GiGA Island Project



Ultra-fast broadband service represents a leapfrog opportunity for many emerging markets. As a big emerging market, China is leveraging ultra-fast broadband to achieve technological advances. The Chinese Government is ambitious about bandwidth improvements and has carried out large-scale fibre deployment in urban areas. By May 2015, ultra-fast broadband services had been launched in Chinese cities (including Nanjing, Wuxi, Chengdu and Shanghai).

The ultrafast broadband era will greatly enhance user experience, revolutionize the way we work and live, and accelerate industrial innovation and economic development. For example, in education, there are by now a large number of education resources online; however, it is often still difficult for students to learn easily, due to a lack of interactivity or online video. China's new education network uses high-speed Internet to connect schools, so they can benefit from a single source. Featured Insight 4 describes China's Broadband Strategy, while Featured Insight 3 describes New Zealand's Ultra-Fast Broadband infrastructure initiative.

FEATURED INSIGHT 3: NEW ZEALAND'S ULTRA-FAST BROADBAND INFRASTRUCTURE

New Zealand has been on a journey to develop a national Ultra-Fast Broadband infrastructure to bring world-class broadband to its 4.5 million citizens. This initiative aims to increase New Zealand's competitiveness through significant efficiencies, cost savings, and economic benefits estimated by Bell Labs at US$ 21.6 billion over twenty years, while opening up a range of business, educational, community and other opportunities to unlimited innovation. Driven by the government, the initiative involves two new programmes – Ultra-Fast Broadband (UFB) enabling at least 75% of New Zealanders to access Fibre-To-The-Premises (FTTp) by 2020 and the Rural Broadband Initiative – both well underway with strong deployment and connectivity momentum across the country.

"Kiwis are early-adopters and have embraced fibre. It's encouraging to see uptake rising around the country with thousands of new connections every month. New Zealand has the fastest growth in fibre penetration in the OECD at 272%" said H.E. Ms Adams, Government Communications Minister in June 2015. Indeed, four years after roll-outs began, the Ultra-Fast Broadband programme reached the halfway point in its deployment with over 618,000 homes, workplaces and schools now able to access high-speed services. The Government is planning to extend this investment to reach 80% of New Zealanders, and help put New Zealand at the forefront of the global connectivity race.

Source: Alcatel-Lucent (www.alcatel-lucent.com/government/reference/new-zealand-ultra-fast-broadband)

FEATURED INSIGHT 4: CHINA'S BROADBAND STRATEGY

The Chinese Government has announced plans to expand full broadband coverage across the nation's rural and urban areas by 2020. The 'Broadband China Orientation' is based on seeing broadband construction as infrastructure and as a major foundation for transforming development, fostering strategic emerging industries and international trade.

The multi-pronged strategy aims for the milestone of bringing fixed broadband connections to half of Chinese households – about 400 million households – by 2015, with 80 million new added FTTx connections. The speed of urban and rural broadband accesses will reach 50 and 12 Mbps respectively by 2020. Broadband coverage in administrative villages is expected to reach 95% by 2015 and 98% by 2020.

In addition to expanding coverage, 'Broadband China' is also planning to bring Gigabit Internet speeds to major cities by 2020. China has the world's largest Internet population at close to 600 million, but average Internet speeds in the country currently reach 1.7 Mbps (compared, for example, with Rep. of Korea with an average speed of 14.2 Mbps and an average of 11.7 Mbps in Japan).

There are several projects specific to broadband:

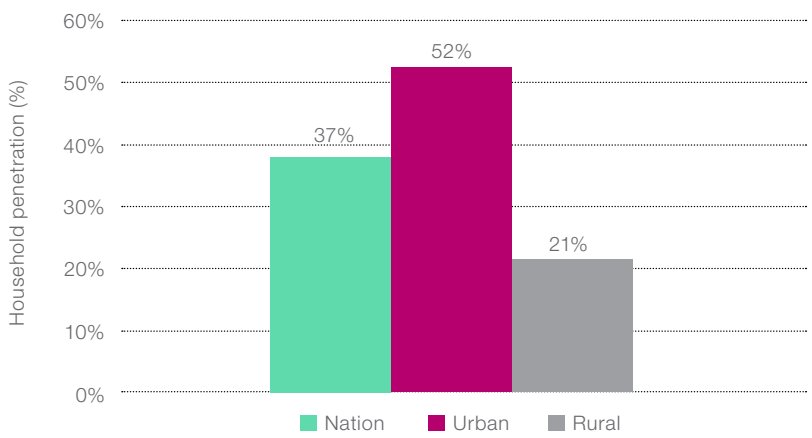
- "Broadband countryside" project.
- Broadband network optimization and acceleration project.
- Demonstration project of broadband applications for SMEs.
- Demonstration project of broadband applications for poverty-stricken schools and special educational organizations.
- Demonstration project of broadband applications for digital culture.
- Industrialization project of research and manufacturing of key broadband equipment.

Policies to support broadband construction include:

- "Telco first" as the fundamental principle of modernization, with support from economic policy, financial support, and human resources.
- Logistics and resource synergies to reduce engineering costs for the construction of broadband network facilities and municipal utility constructions, especially new roads.
- FTTH: The Ministry of Housing and Urban China has issued "Residential and Residential Building FTTH Communications Facilities Construction Engineering Design Specifications" to help solve the difficulties of residential wiring projects. These specifications for new buildings require that carriers share network access and optical fibre resources to the home.

Source: Huawei.

Figure: Chinese Home Fixed Broadband Penetration, 2014



3.2 Advocacy Target 2: Making broadband affordable – by 2015, entry-level broadband services should be made affordable in developing countries

Affordability is increasingly identified as critical in expanding access to broadband in developing countries, especially LDCs. Affordability describes both the price of services, as well as the cost of devices (smartphones, tablets or other devices allowing broadband access). Broadband is becoming more affordable – over the past four years, fixed-broadband prices as a share of Gross National Income (GNI) per capita have dropped by 41%[9]. By 2014, 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.

However, huge discrepancies in affordability persist. By most recent data for 2014, fixed broadband services remain expensive, costing an average of US$ 74.5 Purchasing Power Parity (compared with just US$ 22.5 in developed countries, less than a third of the developing country equivalent)[10]. This implies a huge disadvantage for the developing world, especially LDCs.

In 2014, a basic fixed broadband plan corresponded to less than 5% of average GNI per capita in 111 countries which had met the Broadband Commission target, of which 44 were developed countries and 67 were developing countries (Figure 11), up from just 57 developing countries in 2013 and 48 in 2012.

However, the cost of broadband is comparatively higher in vulnerable countries (such as LDCs, LLDCs and SIDS). Another major disadvantage that LLDCs face is that broadband costs as a share of GNI are much higher than in coastal countries with access to submarine communication cables. To address this, the *Vienna Programme of Action for the LLDCs for the Decade 2014-2024* aims to promote open and affordable access to the Internet.

Even in the United States, recent research published by the Pew Research Centre suggests that the main reason for people not having an Internet connection is cost – both the one-off price of the computer, tablet, smartphone purchases, but also the recurrent monthly connectivity bills[11].

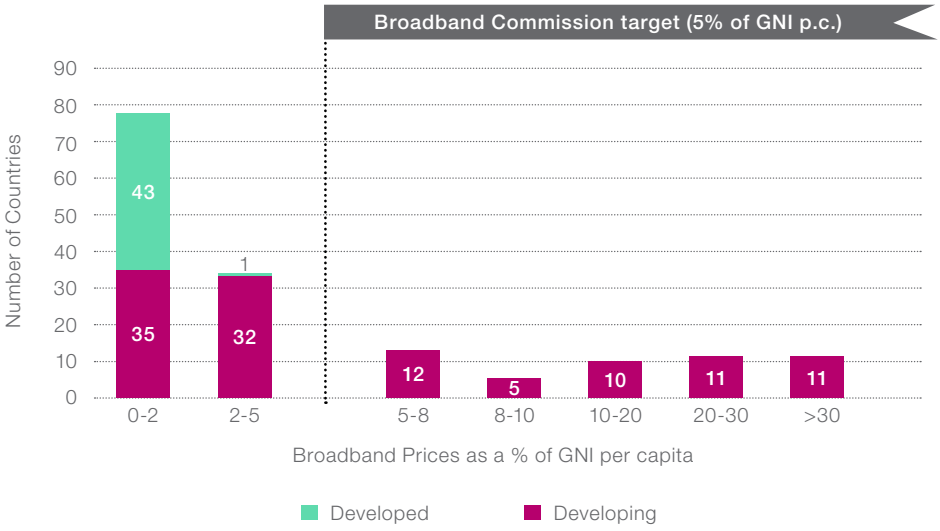
It is often difficult to compare prices and the affordability of broadband service across different countries. Firstly, there is a growing trend in some countries to package broadband services with other telecom and audiovisual services (e.g. fixed phone, mobile phone and TV). Standalone offers should not be compared with bundled offers to contrast the affordability of broadband services with other countries (e.g., in Spain, standalone offers represent less than 7% of the broadband subscriptions).

Further, although reliance on national averages can give a broad indication, they may be misleading

about the real affordability of broadband for specific parts of the population. Once income distribution and the spread of household incomes among a population are taken into account, the World Bank (2014) suggests that broadband may in fact be unaffordable for 3.5 billion people worldwide[12]. Although broadband was 'affordable' according to the 5% target for 75 countries in 2013, once household incomes are taken into account, broadband was affordable for the full 100% of the population in only 29 countries[13]. 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 achieve some falls in prices, but markets with at least three licensed operators experience the greatest falls in prices[14].

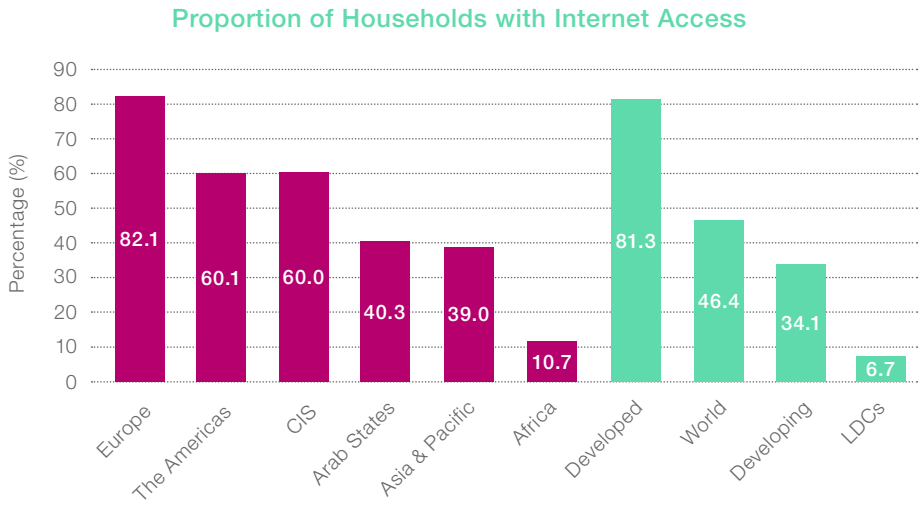
Figure 11: Fixed Broadband Sub-Basket for Developing Countries, 2014

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, household members may be able to access a household phone or connection, although socio-cultural norms often still represent a major barrier to girls' and women's access to broadband and other ICTs in many regions of the world. Globally, 46.4% of total households will be connected by the end of 2015, up by 2.4 percentage points from 44.0% in 2014 (Figure 12, top). Internet access for households in developed countries is close to saturation, with 81.3% or over four-fifths of households connected to the Internet. The proportion of households in developing countries with access to the Internet



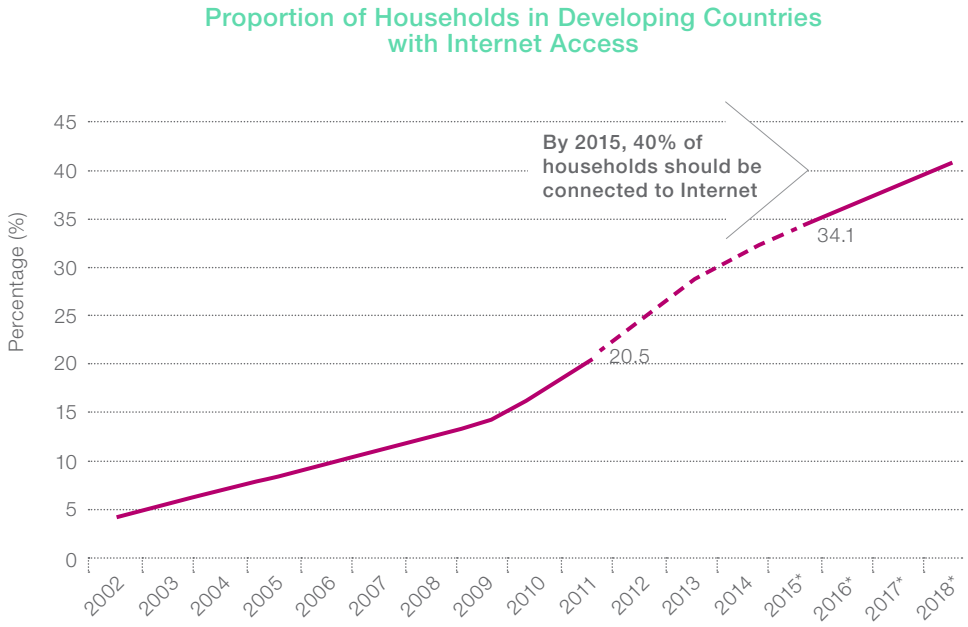


Figure 12: Proportion of Households with Internet Access by Region and Category, 2015

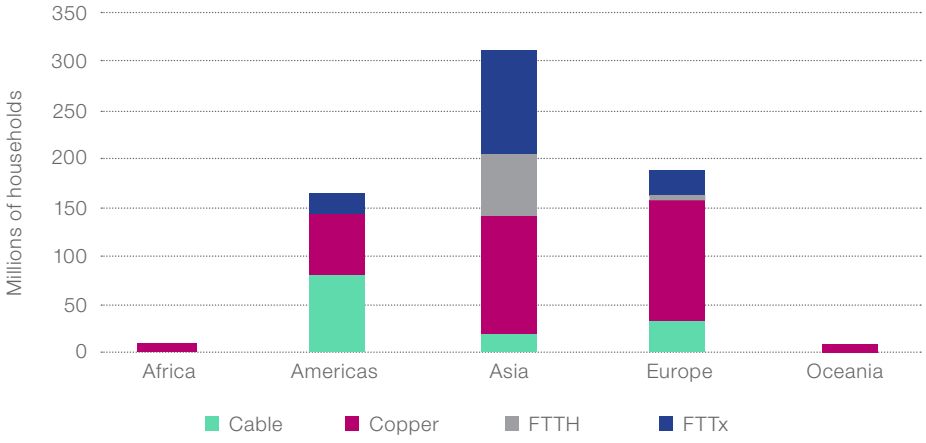
Source: ITU.
*Note: *Denotes an estimate.*

has increased by nearly three percentage points from 31.2% in 2014 to 34.1%, but falls short of the target. The target of 40% only looks set to be achieved by 2018 (Figure 12, bottom). This global average masks strong regional disparities in access – for example, only 6.7% of households in LDCs have Internet access, while in Africa, only 10.7% or nearly one in nine households have Internet access. There are still 43 developing countries with household Internet user penetration of under 10% (down from 50 in 2013).

Asia accounts for the largest absolute number of broadband-connected homes, nearly as many as Europe and the Americas put together (Figure 13). For homes connected via fixed broadband, copper still accounts for most of the connected homes in Europe, half of Asian connections and a third of all broadband connections in the Americas. Cable accounts for nearly half the market in the Americas. Africa and Oceania have fairly few broadband-connected households in absolute numbers. For national rankings, see Annex 4.

Figure 13: Broadband Homes by Region and by Technology, 2014

Source: Point Topic, quoted in Deloitte's Technology, Media & Telecoms (TMT) Predictions 2015.



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 2015, some 3.2 billion people or 43.4% of the world's population will be online[15], up from 2.9 billion people in 2014 (equivalent to 40.6% penetration). The global target of 60% Internet user penetration is unlikely to be achieved until 2021 at the earliest, assuming current growth rates continue. This is in fact unlikely to be the case – Internet growth is slowing, partly due to the 'small base' phenomenon, but also as operators extend networks outside easy-to-connect urban areas.

In the developing world, Internet penetration will reach 35.3% by the end of 2015 (compared with 24% in 2011), but still remains on average under 10% in LDCs (Figure 14). Internet user penetration in developing countries is unlikely to achieve the target of 50% until 2020. Over half the world's population – some 57% – or more than 4 billion people still do not use the Internet regularly or actively yet. 19 of the 20 countries with the lowest percentage of Internet users are LDCs. There are

still 31 countries with individual Internet user penetration of under 10% (down from just 35 in 2013). On the upside, there were 17 developing countries with over two-thirds of their population online (up from 13 in 2013).

According to a 2011 UNESCO[16] publication, "differences in access to computers and the Internet extend to groups within (and across) national boundaries including those based on income, education, minority status, age, and gender. These differences limit the ability of these groups to participate in and benefit from technology-based economic development". For national rankings, see Annexes 5, 6 and 7. For a set of measures Governments can adopt to promote the roll-out of broadband, see Chapter 6.

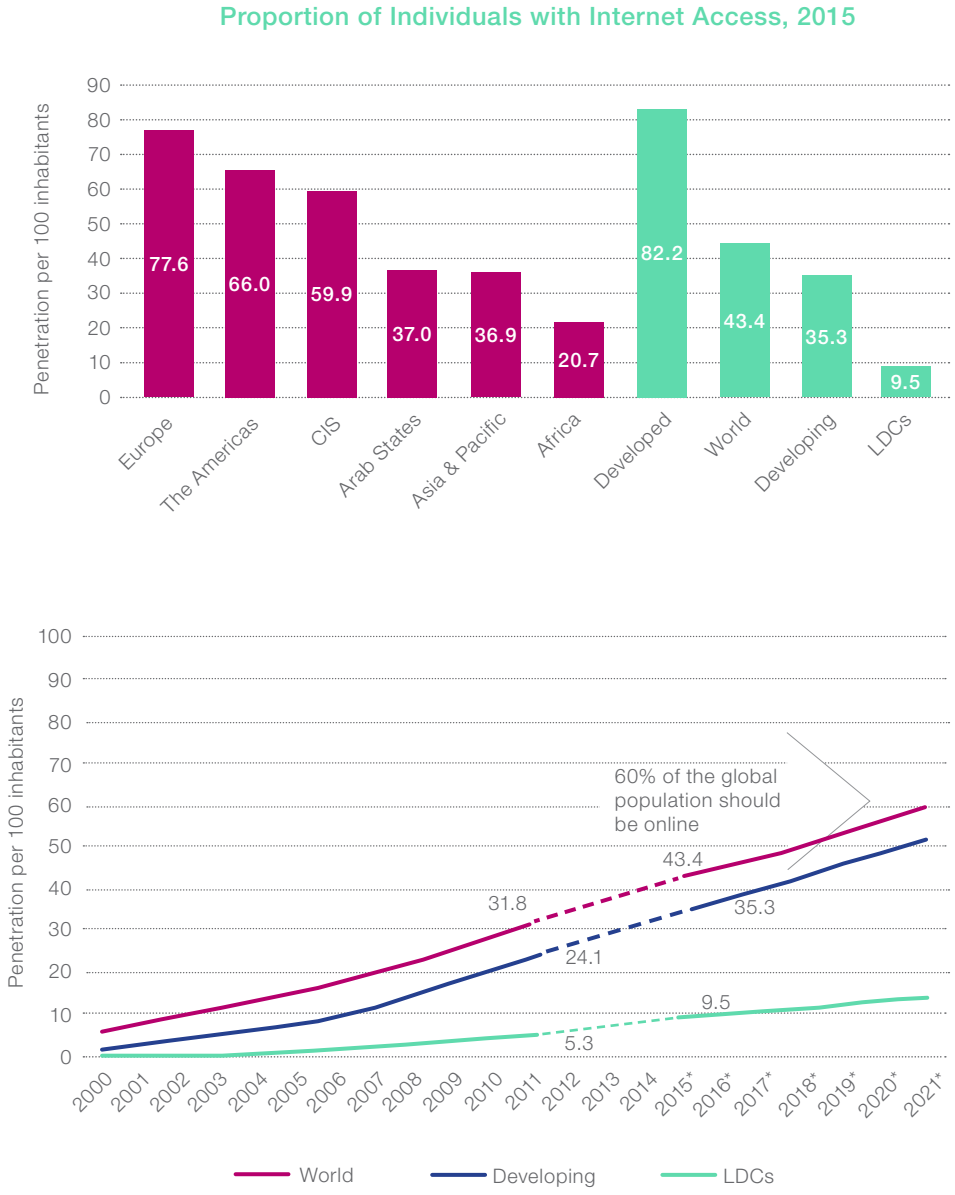


Figure 14: Internet User Penetration, 2015

Source: ITU.
*Note: * 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, to access information, to redress some of the inequalities women face in their everyday lives, and to enjoy the same opportunities as their male counterparts. Gender equality was recognized in the MDGs, and is recognized as both a principle and a stand-alone goal in the SDGs (SDG #5), as well as being integrated into all other SDGs as a vital enabler of true and equitable development.

In low- and middle-income countries, women are 21% less likely to own a mobile phone than men. Likewise, across the developing world, nearly 25% fewer women than men have Internet connectivity, and this gap rises to nearly 50% in some parts of sub-Saharan Africa[17]. These gaps limit the potential of ICTs for women and girls and perpetuate inequalities between boys and girls, some of which start from a very young age. Featured Insight 5 explores how technologies can help enhance gender equality in education.

If women and girls are unable to enjoy the same access to broadband and ICTs, including the availability of relevant content, they will find themselves at a serious disadvantage in becoming fully literate, accessing skilled jobs, learning about and exercising their rights, and participating as citizens in public and policy-making processes[18]. Sex-disaggregated data are not yet widely available for broadband connectivity, but based on Internet usage data as a proxy indicator, 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 digital gender gap of some 200 million fewer women and girls online in 2013[19]. 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[20]).

ICTs have the potential to alleviate some of the barriers faced by women, including illiteracy, poverty, time scarcity, lack of mobility, cultural and social norms, and limits on participation in decision-making. In some countries, cultural norms can include surveillance of women's physical and social mobility or preventing women from accessing and using ICTs, including relevant content. To achieve equality and combat these restraints, more girls and women need to be involved both as consumers and creators of technology.

It is critical to find ways to mobilize and empower girls and women to participate in designing, building and leading our shared digital future. Featured Insight 5 describes how progress towards gender equality in education is being achieved through the use of technology. Featured Insight 6 describes the experience of three female students with Alcatel Lucent's ConnectEd programme in India and Indonesia as they got to grips with ICTs, and now earn a living and are helping inspire other schoolchildren to learn about ICTs[21].

FEATURED INSIGHT 5: PROGRESS TOWARDS GENDER EQUALITY IN EDUCATION THROUGH TECHNOLOGY

Education empowers women and girls and provides them with the ability and knowledge needed to direct their own lives. The positive ripple effects of education for women and girls are so far-reaching that many people and organizations, including UNESCO, UNDP and UN Women, now argue that education for girls may be the single most effective tool for development. When girls receive education, they usually:

- marry later;
- have smaller and healthier families;
- gain skills needed to enter and succeed in the labour market;
- recognize the importance of health care and seek it for themselves and their children; and
- understand their rights and gain the confidence to insist on them.

UNESCO promotes the right of all women and men, girls and boys to a quality education that meets basic learning needs and enriches lives. While mobile phones have empowered women and girls in educational, social and economic ways, around 300 million more men own mobile phones in low- to middle-income countries than women (GSMA et al., 2010). Men are also more likely to know how to use mobile technology than women. The mobile phone gender gap is a symptom of broader gender inequalities apparent in education, as well as in the use and ownership of ICTs. Policy-makers should work to promote gender equality for mobile learning.

UNESCO's mobile learning programme examines directly how mobile technologies (via handsets or tablets) can help achieve greater gender equity, both in education and beyond it. Over the past decade, there has been a flowering of programmes that successfully use mobile devices to expand and improve educational opportunities available to women, especially in developing countries where gender inequalities are most severe. More specifically, UNESCO is exploring how gender-sensitive content and training, literacy support and skills development can advance the education of women and girls[22].

Opportunities for girls to receive education have expanded significantly over the past several decades. From 1970 onwards, female enrolments have increased faster than those for males at all education levels. Today, the proportion of girls enrolled in primary and secondary schools equals or surpasses the proportion of boys in many countries. Now, more women and girls are accessing education than ever before, and these gains are translating into improved social and economic opportunities – from 1980 to 2008, 552 million women joined the workforce, and today, 4 out of every 10 workers are female.

Yet despite this commendable progress, the quality of education remains unsatisfactory in many contexts, and access to education is still inequitable across gender lines. The character and extent of inequity vary, but the most serious problems tend to be concentrated in Africa and South Asia. Alarmingly, gender gaps in sub-Saharan Africa have widened at higher levels of schooling – a reverse of the global trend towards greater parity: from 1999-2010, the ratio of girls in secondary school fell

from 83 to 82 girls per 100 boys, and from 67 to 63 girls per 100 boys at the tertiary level. In primary schools, the impressive gains made in the early 2000s have levelled off. In several low-income countries, only 7 girls are enrolled in school per every 10 boys. The 2013/4 EFA Global Monitoring Report summed up the situation: worldwide, 'girls are more likely to miss out on primary education' than boys and are afflicted by the 'most extreme cases of inequality in secondary education'.

These disparities result in disproportional literacy rates for males and females. Globally, two out of every three illiterate adults are women. In several countries, the literacy rate for women has yet to exceed 50%. There are parallel problems in the youth population: of the 126 million youth who are illiterate, 61% are female. Solving the illiteracy crisis is, to a large extent, synonymous with strengthening learning for women and girls[23].

Gender inequalities in education are often exacerbated by socio-economic and geographic factors. Compared to men, women are far less likely to have access to quality education if they are poor and live in rural areas. In sub-Saharan Africa, 87% of male children from rich, urban families complete primary school, but only 23% of female children from poor, rural families do so. In South and West Asia, nearly 90% of rich, urban boys finish secondary school, versus only 13% of poor, rural girls. Girls are at a disadvantage relative to boys if they are poor and/or live outside cities.

Women in developing countries also face unique challenges when it comes to using ICTs to unlock educational opportunities, both in access and ICT training. While access to technology is important, the mere availability of ICTs does not always guarantee its productive use. Targeted training helps people use mobiles effectively, yet this training, where it exists at all, is often aimed at men or reflects male biases, putting women at a disadvantage. Today, ICT proficiency is a key skill and, increasingly, a prerequisite for a job. If girls are to leave school ready to participate equally in the knowledge economy, then they too [like boys] will require the benefits of ICT-assisted instruction, including the knowledge, skills and attitudes imparted by using these tools.

Even where girls and boys have equal access to ICTs and ICT training, girls tend to lag behind or lack confidence in science and math and may often fail to pursue better-paid careers in IT or computer science. Such problems in perceptions can be traced to gender stereotypes, cultural barriers, inappropriate pedagogical practices and a lack of gender-sensitive teaching and learning content. Solutions are needed urgently, particularly as employment prospects in STEM-related fields expand. Despite some recent progress, the goal of gender equality in education remains unfulfilled[24].

Source: UNESCO Mobile Learning Week Concept Note.

FEATURED INSIGHT 6: FROM STUDENT TO TEACHER, HELPING INSPIRE OTHERS

Anita's father worked as a landless farmer in West Bengal, India. Deep in debt and often without food, Anita's family decided to migrate to Delhi in search of work, and moved in with relatives in Tughlakabad village. Anita's father's poor health disrupted his work as a daily wage laborer, so her mother started work as a housemaid. Tragically, Anita's father passed away while she was still young, and the family struggled to make ends meet after his death.

Anita became very close to her mother and carried out all the household chores, but somehow still found time to come to ABHAS, part of the ConnectEd programme implemented by the Alcatel-Lucent Foundation and World Education. Anita joined the ConnectEd programme in 2011 and received a scholarship to continue her studies. Anita's favorite hobby in school was working on the computers in the ConnectEd ICT lab. Her classmates sometimes made fun of her, but now, they are very appreciative of the way she is able to support her family. Today, Anita is the ICT teacher at ConnectEd's Chhuriya centre, where her commitment to teaching ICTs has made her a role model.

In many such communities where Alcatel-Lucent Foundation's ConnectEd operates, access to computers and ICT proficiency are still associated with power, social status and, most often, men. The sight of female teachers, themselves recently disadvantaged and of low caste, going to work with a laptop in hand and committed to improving the lives of children in the community, has helped improve teaching and learning quality, and broken down 'gender norms' by providing visible key female role models.

As ICTs now become pervasive across many sectors, ensuring that girls get ICT knowledge is a priority to enable girls to access a large range of employment and economic opportunities. Manju, who joined ConnectEd in 2011 in India, describes how ICTs have opened up confidence and knowledge for her, and how she is able to get information from around the world: "The arrival of ConnectEd Programme has helped girls like me to learn ICTs, which now play a very important role in our lives. I am confident I can do anything with the help of technology".

Yuni, from ConnectEd in Indonesia, also capitalized on that opportunity: "Nowadays, the multimedia class is still dominated by boys. I want to learn multimedia skills because there are still only a few girls in the class. Since I can operate Adobe Photoshop application, there are so many friends who come to me and ask me to design or edit their photos. This is real additional income for me". Breaking down the social barrier of ICT access enables these young women to access a whole new range of learning and information opportunities, as well as gain the confidence to realize their ambitions for their own futures.

Source: Alcatel-Lucent.

ENDNOTES

1. "World Development Report 2016", World Bank, forthcoming.
2. "Planning for Progress: Why National Broadband Plans Matter", ITU/Cisco contribution to the ITU/UNESCO Broadband Commission for Digital Development, available from: www.broadbandcommission.org/documents/reportNBP2013.pdf
3. https://www.telegeography.com/products/commsupdate/articles/2015/07/14/malaysia-publishes-national-roadmap-for-iot/?utm_source=CommsUpdate&utm_campaign=9add5560b9-CommsUpdate+14+July+2015&utm_medium=email&utm_term=0_0688983330-9add5560b9-11619241
4. "Confronting the Crisis: ICT Stimulus Plans for Economic Growth" (ITU, 2009), ITU, Geneva.
5. "Planning for Progress: Why National Broadband Plans Matter", ITU/Cisco, a contribution to the Broadband Commission for Digital Development, available from: www.broadbandcommission.org/documents/reportNBP2013.pdf
6. https://www.telegeography.com/products/commsupdate/articles/2015/03/11/paraguays-conatel-set-to-overhaul-telecommunications-act/?utm_source=CommsUpdate&utm_campaign=3295c35c64-CommsUpdate+11+March+2015&utm_medium=email&utm_term=0_0688983330-3295c35c64-11619241
7. https://www.telegeography.com/products/commsupdate/articles/2014/11/20/council-green-lights-plans-for-amendments-to-telecoms-act/?utm_source=CommsUpdate&utm_campaign=cd4c94f73d-CommsUpdate+20+November+2014&utm_medium=email&utm_term=0_0688983330-cd4c94f73d-11619241
8. http://ec.europa.eu/priorities/digital-single-market/docs/dsm-communication_en.pdf
9. ITU "Measuring the Information Society 2014", Geneva.
10. ITU "ICT Facts & Figures: The World in 2015", at: www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx
11. "Fifteen per cent of US citizens are still without any Internet access, mainly due to poverty", TELECOM TV, 31 July 2015, available at: www.telecomtv.com/articles/network-economics/fifteen-per-cent-of-us-citizens-are-still-without-any-internet-access-mainly-due-to-poverty-12703/
12. "How affordable is broadband?", submitted by Arturo Muente-Kunigami, 23 October 2014, available at: http://blogs.worldbank.org/ic4d/how-affordable-broadband
13. Ibid.
14. ITU "Measuring the Information Society report 2014".
15. ITU "ICT Facts & Figures: The World in 2015", at: www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx
16. "Transforming Education: The Power of ICT Policies", UNESCO 2011. See also "Technology, Broadband & Education: Advancing the Education for All Agenda, 2013", available from: www.broadbandcommission.org/publications/Pages/bb-and-education.aspx
17. GSMA/Cherie Blair Foundation report, "Women & Mobile: A Global Opportunity", available from: www.gsma.com/newsroom/press-release/gsma-and-the-cherie-blair-foundation-for-women-publish-women-mobile-a-global-opportunity-report/

18. “Doubling Digital Opportunities: Enhancing the Inclusion of Women and Girls in the Information Society”, at: www.broadbandcommission.org/Documents/working-groups/bb-doubling-digital-2013.pdf
19. ITU ICT Facts & Figures 2013, available from www.itu.int
20. ITU ICT Facts & Figures 2013, available from www.itu.int
21. “Doubling Digital Opportunities” (2013), report of the Broadband Commision Working Group on Gender, available from: http://www.broadbandcommission.org/documents/working-groups/bb-doubling-digital-2013.pdf
22. Concept Note, Mobile Learning Week 2015, UNESCO, at: www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/MLW_2015_CONCEPT_NOTE1.pdf
23. UNESCO, “Policy guidelines: Mobile learning”, (2013), http://unesdoc.unesco.org/images/0021/002196/219641E.pdf
24. Concept Note, Mobile Learning Week 2015, UNESCO, www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/MLW_2015_CONCEPT_NOTE1.pdf
25. ConnectEd is a digital education partnership of World Education and the Alcatel-Lucent Foundation, designed to help disadvantaged youth, with a focus on girls and young women, achieve better learning outcomes, be better prepared for the world of work, and engage meaningfully in their communities. ConnectEd focuses on the use of technology to transform learning, work and life outcomes for its young participants. From April 2011 to June 2015, the programme provided training to 25,000 youth, 58% of them girls: https://www.alcatel-lucent.com/blog/2014/technology-and-role-models-enabling-new-life-trajectories-women
26. www2.alcatel-lucent.com/foundation/newstories/helping-girls-and-young-women-to-bring-meaningful-changes-to-their-lives.php

4

BROADBAND FOR DRIVING SUSTAINABLE DEVELOPMENT

The real power of broadband lies in its potential to improve development outcomes in the developing world on the basis of human rights, social inclusion and poverty eradication. It is now evident that digital inclusion is necessary for sustainable development. ICTs, in particular broadband, are a catalyst for enhancing economic growth, expanding productivity and competition, and aggregating knowledge[1].

The developing world, and LDCs in particular, can benefit from greater integration and use of ICTs. The delivery of broadband in urban, as well as rural, regions has become a major political and regulatory objective for many countries. The availability of broadband infrastructure worldwide has been recognized by the UN as an essential prerequisite to the economic development of countries[2]. ICTs are today promoting the achievement of all three pillars of sustainable development defined by the UN's framework for post-2015 development: social inclusion; economic development; and environmental protection[3].

When combined with the relevant skills, capabilities and opportunities, ICTs are a driving force for empowering billions of people with knowledge and information. ICTs can help people 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 and new forms of learning and education, making people more informed and enabling them to exercise choice and make better decisions, improving their lives and livelihoods. Featured Insight 7 explores how mobiles are helping enhance education and empower learning.

Anecdotal evidence and numerous real-life examples around the world (see www.itu.int/wsis/stocktaking/) show that the use of mobiles in education is helpful. Today, mobile technologies are common, even where schools, books and computers are scarce. As the price of mobile phone ownership continues to fall, many more people, including in extremely impoverished areas, are likely to own and use a mobile device. A growing number of projects have shown that mobile technologies provide an excellent medium for extending educational opportunities to learners who may not have access to high-quality schooling.

FEATURED INSIGHT 7: THE USE OF MOBILES FOR ENHANCING EDUCATION AND EMPOWERING LEARNING

Personally owned mobile devices, by virtue of being highly portable and relatively inexpensive, have enormously expanded the potential and practicability of personalized learning in ways that shared and tethered technologies simply cannot. Applications on mobile phones and tablets can, for example, select among harder or easier texts for reading assignments, depending on the skills and background knowledge of any specific user. This technology helps ensure that students are not held back or left behind by larger groups. Additionally, as the amount and type of information mobile devices can collect about their users increases, mobile technologies will be better able to individualize learning.

A student with different learning preferences might be presented similar information in a very different way, such as via a historical timeline indicating important events with links to informational videos and primary-source documents. Over time, personalized technology will supersede one-size-fits-all models of education. Cumulatively, intelligent mobile devices can give students greater flexibility to move at their own pace and follow their own interests, potentially increasing their motivation to pursue learning opportunities.

A number of projects have demonstrated that mobile technologies can streamline assessments and provide learners and teachers with more immediate indicators of progress. While historically, learners had to wait days or weeks to get guidance regarding their comprehension of curricular content, mobile technologies can provide instant feedback, thanks to their interactive features. This allows learners to quickly pinpoint problems of understanding and review explanations of key concepts. A number of mathematics applications for smartphones and basic mobiles show learners how to solve questions step-by-step. Mobile technologies can also make teachers and educators more efficient by automating the distribution, collection, evaluation and documentation of assessments. For example, mobile apps now make it easy for teachers to administer short quizzes to test understanding instantaneously or synched with books – no paper, red pens or data entry are necessary.

As people carry mobile devices with them most of the time, learning can happen at times and in places previously non-conducive to education. Numerous experts are investigating how mobile learning can help break down the barriers between formal and informal learning. Mobile learning applications commonly allow people to select between short lessons

versus lessons needing concentration over a period of hours. Mobiles can enable people to study during long breaks or short bus rides. Mobile devices have a track record of reinforcing the retention of essential information.

Teachers are the foundation of any education system, and are best-placed to guide and mentor students. Mobiles offer a promising avenue to train new teachers, build their capacities, and support the work of educators, both inside and outside classrooms. A number of mobile learning projects have sought to support teachers' day-to-day work in classrooms.

First, the availability of online content, much of it accessible via mobile devices, gives teachers and students access to a vast array of educational materials to supplement classroom instruction. For example, the BridgeIT initiative in Latin America and Asia brings educational content to isolated schools via mobile networks. The Government of Colombia is providing cheaper mobile devices equipped with educational software to 250,000 people to reduce illiteracy. These projects do not replace, but rather complement, existing educational investments (such as textbooks, infrastructure, hardware, training and content).

Second, mobile phones can help improve administration and communications between schools, students, teachers and parents. Learners and educators are increasingly using mobiles to exchange information. Teachers can ask students to provide feedback on assignments, and parents can request up-to-the-minute information about the academic progress of a child. Additionally, a number of projects active in Asia, Africa and North America rely on mobile phones to streamline communications between classroom instructors who teach similar disciplines or groups of students.

Third, mobile phones can help mentoring and observation for training teachers, allowing teachers to participate in online professional communities. In South Africa, instructors in the Teaching Biology Project used social media platforms to share lesson plans and pedagogical ideas via mobile phones. Teachers involved in this project reported that it helped instil commitment and made it easier for them to seek help from peers who understood the day-to-day exigencies of the job.

Source: UNESCO (2013) Policy guidelines for mobile learning.

Mobiles can be used in developing countries for literacy training[6], numeracy training, interactive tutoring, using smartphones as e-books or e-readers, and for 'educative games'[7], unlocking the most valuable asset of many young students – their curiosity. For example, Microsoft Math, is a service from Microsoft, endorsed by South Africa's Department of Science and Technology and Nokia, which offers over 10,000 maths problems accessible via all types of mobile phone, with dynamic graphics and games to keep pupils engaged, as well as the option of comparing scores and usage time with peers, introducing an element of competition. Microsoft Math adds a social dimension to education, making it possible to collaborate and compete with other students. Teachers can use Microsoft Math to motivate, monitor, and track learning and skill levels, giving specific and individual feedback to students.

However, common obstacles to the use of mobile phones in education include 'legacy thinking' on the part of teachers, and concerns about the wisdom of bringing mobile phones into schools as a source of distraction.

Mobile phones also offer the potential to revolutionize healthcare. This includes developments in:

- hardware (including the devices and their technical capabilities);
- associated services, content and apps; and
- information gleaned from geolocation devices (e.g. the real-time tracking of diseases or the spread of an epidemic).

With regards to innovation, smartphones or FitBits connected to monitors and sensors can now collect health data on many physiological metrics (including heart rate, blood pressure, blood glucose, body temperature, sleeping habits, eye pressure or even brain-waves). An iPhone heart monitor pressed to the chest can perform a heart check-up. A new attachment for a smartphone can carry out an optometrist's auto refractor test. Sensors attached to smartphones can now detect HIV or malaria from a tiny drop of blood from your finger. Featured Insight 8 describes the benefits of one mobile app for improving maternal healthcare in Myanmar, while Featured Insight 9 describes the use of sensors for helping the elderly and infirm in Singapore.

FEATURED INSIGHT 8: BRIDGING THE MOBILE AND HEALTH SECTORS TO IMPROVE MATERNAL HEALTHCARE IN MYANMAR

Myanmar faces a number of issues in maternal health, including a high infant mortality rate and challenging levels of baby malnutrition. Over 70% of births occur outside clinics or medical services. It is hard for many women and their families to get information about maternal and child healthcare.

'Maymay' (meaning 'mother' in the Myanmar language) is a maternal healthcare app, making available a wealth of useful maternal, child health and wellness information to women during and after pregnancy. It sends information messages about maternal and child health regularly to expectant mothers, their partners, families, and parents of young children. The service also improves access to health professionals, and treatment as required, by allowing users to search a database of information on the location and contact details of healthworkers and clinics.

Powered by Ooredoo, the app was designed by local start-up, Koe Koe Tech, and developed with Population Services International (PSI), a global health organization dedicated to improving the health of people in the developing world, with funding from the GSMA Connected Women programme. MayMay is easy to use, with simple registration, bringing local content to those who sign up in the Myanmar language.

To ensure information is relevant, PSI's doctors localize texts from the Mobile Alliance for Maternal Action, supported by USAID and the UN. All messages are approved by Myanmar's Ministry of Health. By May 2015, the Maymay app had over 11,000 active users, and is being introduced to many more of Myanmar's communities. Maymay is one of many initiatives Ooredoo is introducing in Myanmar as it rolls out its services across the nation, and highlights the broader benefits of easy and affordable access to mobile Internet in a developing economy.

Source: Dr Nasser Mohammed Marafih, Chief Executive Officer, Ooredoo Group.

FEATURED INSIGHT 9: SMART HEALTH-ASSIST

Providing better and more affordable healthcare is a challenge for both developed and developing countries. In Singapore, up to 48% of the disease burden is related to chronic diseases and this proportion is set to grow. Coupled with Singapore's rapidly ageing society, this will put increasing pressure on healthcare infrastructure and resources.

The Infocomm Development Authority of Singapore ("IDA") aims to launch a pilot for Smart Health-Assist in late 2015. The Smart Health-Assist programme looks at the deployment of sensors in a patient's living environment to monitor his or her health. By deploying unobtrusive and easy-to-use sensors in the homes of the elderly or chronic disease patients, healthcare data can be recorded and sent securely to caregivers and healthcare providers to alert them whenever the elderly or patients require attention.

Smart Health-Assist will enable patients to manage their conditions from the comfort of their homes. Reducing the number of medical visits also frees up hospital resources and makes chronic disease management more sustainable in the long-run. With sensors and other related technological aids, it is possible that patients with chronic illnesses can live more independently. These technologies can also help seniors to age with dignity in their homes, close to their loved ones. Even individuals who have no existing medical problems can also use these aids to monitor their health.

Furthermore, the use of sensors will generate a huge amount of valuable data, which can be analysed and used as input to Decision Support Systems ("DSS") to help healthcare professionals recommend the right treatment and care plans for patients. This will lead to more consistent delivery of evidence-based care and monitoring of key clinical and service outcomes. Data collected by the sensors can also be collated with data in national health databases. These large datasets can help gather new insights into disease patterns and potentially contribute to future genomics research that leads to the early detection, diagnosis and treatment of the diseases.

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

Mobiles can also be used to expand financial inclusion. The World Bank reports that some 2 billion people are unbanked, the majority in emerging markets and developing countries[8]. And yet 70% of the world has access to a mobile phone and, with the rapid growth of smart devices, the demand for compelling financial services will only increase. Studies show that broader participation in the financial system can reduce income inequality, boost job creation and directly help people better manage risks and absorb financial shocks. Mobile financial services can also empower marginalized groups such as rural women by providing the confidentiality and convenience they require. In developing countries, 37% of women have access to a bank account, compared with 46% of men[9]. Featured Insight 10 describes how Ericsson and ASBANC are meeting the needs of the unbanked in Peru, while Featured Insight 11 describes how mobile phones are being used to expand financial inclusion in Kenya.

FEATURED INSIGHT 10: ASBANC AND ERICSSON MEET THE NEEDS OF THE UNBANKED IN PERU

In 2014, ASBANC (Peru's National Bank Association) selected Ericsson to design and implement its Mobile Money project, the country's largest private initiative for financial inclusion[10]. ASBANC estimates that 2.1 million Peruvians will own and benefit from a mobile wallet by 2019. In addition to 13 major banks in Peru, bank agents and mobile operators plan to use the Mobile Wallet Platform to create an m-commerce eco-system to address the financial needs of the unbanked population.

The Ericsson M-Commerce solution includes the development of the mobile money platform, systems integration, learning services, managed services and support. The platform features easy-to-use and secure next-generation mobile financial services, capable of hosting services from different financial and commercial institutions to secure interoperability. Peruvians will be able to use their m-wallets for banking, payments and remittances between banks, shops, employers, government institutions and customers. The solution is expected to be implemented in phases during 2015. Ericsson's M-Commerce solutions have already been deployed with mobile operator MTN in Uganda, Rwanda, Nigeria, Swaziland and Zambia, and Ericsson is also working with Millicom's Tigo platform in Senegal.

For m-commerce to gain traction in countries with low financial inclusion such as Peru, various factors must be addressed: regulation linking mobile operators and financial institutions, supportive government policy, consumer education and local system capacity.

Interoperability is a major hurdle for usability and service performance, while the need to work on standardization at the national and international levels is evident to harmonize telco and financial systems, as mobile phone numbers start to become the user identity for mobile financial transactions. ITU has launched a Focus Group on Digital Financial Services working towards enhancing interoperability and service perfomance. Another challenge is related to quality of service (QoS) and reach for remote consumers – mobile coverage and quality need to be in balance with the roll-out of mobile money services. A dropped call might be acceptable, but never a failed financial transaction.

Lastly, consumer costs for financial transactions and remittances need to come down according to the Global Remittances Working Group, coordinated by the World Bank, which aims to make financial services more accessible to migrants and to those who send/receive remittances in the developing world. With a clear objective to reduce the global average costs of transferring remittances from the present 10% to 5% in 5 years, the *5x5 initiative* could generate significant net increases in income for migrants and their families in the developing world.

Source: Ericsson.

FEATURED INSIGHT 11: MOBILES FOR EMPOWERING PEOPLE THROUGH FINANCIAL INCLUSION IN KENYA

Mobile money transfer subscriptions increased from 23.2 million in 2012 to 24.8 million in 2013, up by 6.8%, according to the Kenyan Communications Authority. Comparing 2012/13 and 2011/12, total number of mobile money transfer subscriptions rose by 27.3% overall, while Kenyans transacted US$19.6 billion via mobile phones in the first eleven months of 2013[11].

Safaricom, Kenya's largest mobile provider, was the first company to launch M-Pesa, a service enabling users to deposit, withdraw and transfer funds via any mobile phone. It caught on so quickly that Kenyan bankers lobbied their government to audit the service in 2008, hoping to stop the service, but the Government audit only endorsed the value of M-Pesa. From its first million users in November 2008, the service had grown to more than 17 million active users by February 2013, according to Safaricom's website[12].

M-Pesa announced that revenues grew by 29.5% in 2013, and will grow even more rapidly as mobile exposure grows. Bringing Kenyans into the formal banked economy has multiple spin-off benefits. One study of rural Kenyan households found that incomes were substantially higher for households that use M-Pesa. A 2013 survey by FSD Kenya showed that the number of adults in Kenya using mobile money services jumped to 62% in 2013, some 5.4 million people, up from just 28% of the population four years previously.

Source: Dr Speranza Ndege, Kenyatta University, quoting Human IPO and other sources.

The latest advances in satellite technology are playing a key role in helping deliver broadband to rural and isolated areas. Satellites have huge reach over massive areas, enabling the immediate connection of many subscribers to broadband and Internet backbone networks with just one launch, rather than point-by-point roll-out. Coverage is instantaneous, with only a modem and an antenna needed on the ground. Satellite-based systems are viewed as a flexible medium for last-mile technologies. Satellite broadband access is then available at any location within the satellite footprint, and service quality is independent of geographical factors[13].

Satellite broadband is also now a realistic choice for rural, isolated and low population density areas in relation to cost. Cyclical and non-recurring costs for satellite broadband transmission systems are constant and upfront and, since satellite broadband is now generally comparable in quality to DSL broadband, satellite is a completely viable alternative to terrestrial broadband. Where countries invest in satellite broadband infrastructure in order to reach rural and low population density, digital inclusion can be achieved with the right policy and regulatory mechanisms. Featured Insight 12 details some interesting projects and examples of how satellite broadband can enable digital inclusion in remote and underserved populations efficiently. Featured Insight 13 describes the use of another interesting technology – TV white spaces (TVWS) – for expanding access to Internet in schools and hospitals.

FEATURED INSIGHT 12: ENABLING DIGITAL INCLUSION THROUGH THE USE OF SATELLITE BROADBAND

There are many examples of how satellite broadband can enable digital inclusion in remote and underserved populations efficiently.

In August 2014, telecom operator **Orange Niger** announced that it would be utilizing Intelsat capacity to expand its cellular network to the rural regions of Niger. Under this agreement, Intelsat will provide C-band broadband capacity to Orange Niger to support its deployment of cellular backhaul services in Niger. Orange Niger plans to use its expanded network reach to offer high-quality, reliable broadband services to firms and provide mobile services to customers within Niger. Once Intelsat's EpicNG satellite Intelsat begins service in 2017, Orange Niger will be able to switch to a next-generation platform[14].

HughesNet® has launched a project to bring satellite broadband through the **SEDUC Project with the Administration of Educational Resources in Rural Brazil**, in partnership with the State of Amazonas, which has many remote communities. This project brings an interactive learning experience to 20,000 students in 300 rural schools and uses the Brazil-wide HughesNet® satellite service in addition to IPTV to transmit classes from a media centre in the State capital to 700 classrooms over the rural State of Amazonas[15].

The **SATMED e-health platform** is a joint effort by SES and the Government of Luxembourg to use satellite communications to improve public health in emerging and developing countries. It integrates a range of applications such as e-recordings, e-consultancy, e-learning, e-group, content management tools, picture archives, e-surveillance, e-health, finance and modern videoconferencing applications. It is a cloud-based system that will be more cost-efficient than on-the-ground ICT resources. In addition to providing e-health services, SATMED will also provide satellite broadband[16]. Although SATMED is still in the pilot phase, it has been used in Sierra Leone to support Ebola relief efforts[17].

In June 2014, Intelsat S.A. and Gilat Satellite Networks Ltd., a worldwide provider of satellite networking technology, agreed to provide satellite broadband for **Colombia's Kioscos Vive Digital 2 (KVDII) project**[18], headed by Colombia's Ministry of ICT, which will provide communal Internet access to more than 5,300 rural communities. The kiosks will be placed in rural schools so students can take advantage of ICT resources for their education. In addition, other community members will be able to use the kiosks to access social services[19].

Satellite broadband can be used to allow the connection of schools wherever they are at prices comparable to that of ADSL. In Turkey, Eutelsat connected around 4,000 schools in remote areas in June 2013, bringing broadband Internet to primary schools. In September 2014, the **"Connected Schools" programme** was launched in France to support 9,000 schools underserved by ADSL. Schools benefit from state support to fund the connection kit with up to Euro 400, the average grant awarded by French local authorities. Several hundreds of schools have used this programme to connect themselves with Eutelsat's satellite broadband solutions.

Eutelsat's satellite broadband services were used during the Ukrainian elections in October 2012 to connect 12,500 voting stations with 25,000 video feeds back to the national election supervisory centre to ensure an orderly election. Eutelsat's professional satellite broadband solutions have also been used in emergencies by public safety authorities and media during earthquakes in Italy and floods in Europe. Eutelsat's satellite broadband solutions are being used by oil and gas companies, nuclear power sites, national grids and wind farms across Europe and the Middle East for secure communications with hundreds of remote sites.

Source: José Manuel Do Rosario Toscano, Director-General, ITSO; Christian Roisse, Executive Secretary, EUTELSAT IGO.

FEATURED INSIGHT 13: THE USE OF WHITE SPACES FOR EXPANDING ACCESS TO THE INTERNET IN MALAWI

Active project highlights include the following:

- In September 2013, St. Mary's Girls Secondary School in Zomba, Malawi, was connected to the Internet at 2.4 km from the TVWS base station using radios. Senior pupils at this school are now able to access study materials from the University and National digital libraries and repositories using an infrastructure network called "White Spaces for DSpaces". The resulting quality education and career guidance supports the pupils in qualifying for tertiary education.
- On 21 May 2015, Mulanje Secondary School located in the tea-growing area of Mulanje launched its TVWS Internet connectivity (see image below). Team members teach senior secondary school students at Mulanje Secondary School on TVWS technology and how to maintain the TVWS network in 'citizen science-ship' (right image).
- Malawi's Seismology Department, responsible for seismic wave detection and analysis, can now access data in quasi real-time through a 1.7 km TVWS link, helping enhance capabilities for national early warning and disaster preparedness in Malawi. Previously, the department had to wait for a month to have data collected using 2 GB compact flash cards.
- The Pirimiti Community Hospital is connected via a 20 km TVWS link, the longest TVWS link on record worldwide. The link was tested in May 2014. It can support research and experiments in virtual diagnosis and real-time X-Ray image transport. The coverage of medical operations can support expert opinion from remote medical specialists.

Source: Microsoft Corporation.

Photo credits: Dr. Chomora Mikeka on a mast, mounting TVWS Yagi antenna and radio (left image). The team teaches senior secondary school students at Mulanje Secondary School about how to maintain the TVWS network in 'citizen science-ship' (right image).

More recently, it is the growth and development of the Internet of Things (IoT) which is causing some excitement in terms of new and innovative applications for development. IoT is not a single, unified network of connected devices, but rather a set of different technologies which can be put to work in coordination together at the service of, and to the ultimate benefit of, citizens in both developed and developing economies. This set of IoT technologies is realizing a vision of a miniaturized, embedded, automated environment of devices communicating constantly and automatically.

Wireless sensor networks (WSNs) are being used to monitor traffic patterns, informing city managers how to improve operations and communicating upcoming transport options to citizens. Similar information flows are improving hospitals and healthcare systems, education delivery and basic government services (such as safety, fire and utilities). Sensors are helping to raise production, lower costs and increase safety in manufacturing plants, mining operations and oil fields. A forthcoming report by Cisco/ITU[20] provides examples of how:

- IP-connected thermometers are helping to monitor critical vaccines;
- Moisture sensors in agricultural fields are alerting farmers to the needs of crops; and
- Acoustic sensors in protected rainforests are helping to curb illegal logging.

In addition to the data produced by operators, the broader ICT sector (including Over-the-top (OTT) service providers such as Google, Twitter, Facebook, Whatsapp, Netflix, Amazon and many others) is capturing a wide array of

behavioral data. Figure 15 depicts the intersection between IoT, M2M and Big Data, with examples from international development.

To give one example of the relevance of Big Data for development, UN Global Pulse, a UN initiative to use big data for sustainable development and humanitarian action, has been mining Twitter data from Indonesia (where Twitter usage is high) to understand food price crises. Global Pulse was able to find a consistent pattern amongst specific food-related tweets and the daily food price index. In fact, they were able to use predictive analytics on Twitter data to forecast the consumer price index several weeks in advance[21].

Table 3 outlines some of the ways in which the Internet of Things is improving the lives of people around the world and helping achieve the MDGs. Broadband connectivity is not always needed for the IoT – various connectivity options exist, including simple mobile cellular, Bluetooth and WiFi.

Figure 15: The Intersection between IoT, M2M and Big Data

Source: Cisco Systems.

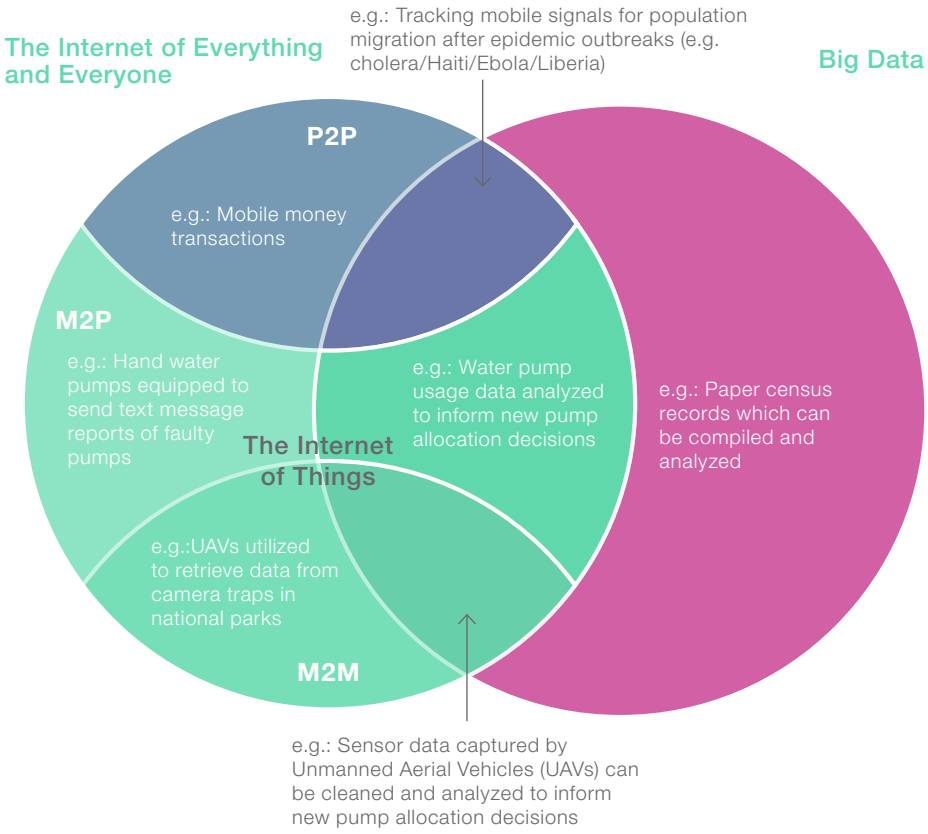


Table 3 – Use of IoT Technologies for Achieving the MDGs

End Poverty & Hunger	For food supply in India, an automated, RFID-based system is now in use for testing and tracking grain[22]. In Botswana, a Livestock Trace-back System is used to monitor and track livestock migration with RFID chips. In Senegal, the Daral project has helped some 2,000 farmers to monitor cattle, prevent theft and provide vaccination reminders using RFID chips. In Namibia, the Namibian Livestock Identification and Traceability System tracks cattle by RFID chips in ear tags[23]. In Kenya, the Edyn system helps farmers monitor water and fertilizer levels[24]. Sensor monitoring of greenhouses, automatic drip irrigation, and monitoring of milk production are helping improve agricultural production, transport and storage using GPS, RFID, sensors and GIS in China[25],[26]. In Xinjiang, wireless monitoring of greenhouses and wireless drip irrigation have been used to monitor water quality and save water in fresh water aquaculture[27]. In India, WSNs are used to monitor soil moisture and improve water management in arid areas[28].
Universal Education	In Argentina, the GEMA Project launched with technical cooperation from UNICEF has developed a system that monitors school data (e.g. attendance, drop-out rates) and notifies principals and officials via SMS and an online education information system. This initiative has improved decision-making and student results by making higher quality data available to administrators. In Nigeria, the Osun State Government has launched smart identity cards[29] with biometric features for all public school students to improve service. In South Africa, the Department of Basic Education is equipping 24,000 schools with biometric clocking devices in 2015 to provide the department with real-time data on any lack of teachers in classrooms[30]. In the UK, eight schools will take part in a pilot to enhance learning in science, technology and geography[31].
Gender Equality	Sensors and Big Data can be used to analyze how men and women respond to different situations, and whether they are treated differently, helping advance the case for gender equality. Alternatively, they can provide important evidence where gender equality has been breached.
Child Health	For vaccinations, in Benin, Kenya, Uganda and Zambia, fingerprint sensors are being used to manage vaccination programmes since March 2013[32]. In the diagnosis of pneumonia, Inspire Living is testing a two-tiered system in Ethiopia, Rwanda and Uganda that uses seven sensors to get a quick and accurate reading of a child's status based on heart rate and body activity[33].
Maternal health	In Uganda, software developers have designed the WINSENGA app to measure foetal heart rates remotely using mobile phones[34]. In Jakarta, a telehealth solution enables midwives to use a mobile phone app to build health profiles of pregnant women and identify high-risk pregnancies[35].
HIV/AIDS	A malaria-detection app (Matibabu) is in use in Uganda to detect malaria. In China, smartphones with ECG sensors are being used to detect, prevent and monitor cardiovascular disease[36]. In Cameroon, CardioPad tablets are used to take and analyze ECGs for cardio-diagnosis[37], while WSNs are used for remote telemedicine in Ethiopia[38]. In Malaysia, the ARES system and WSN are used to monitor the cold storage conditions of vaccines and expensive medicines[39]. For water and sanitation, in Rwanda, SWEETSense uses sensor technology to monitor pumps and notify by SMS[40]. In India, Sarvajal uses osmosis technology and smart meters to monitor water quality. Biosensors are also used to monitor water quality in Bangladesh[41] and monitor water and gas supply in Jiangsu, China[42].
Environment	Simpa Networks smart technologies use solar power systems in Africa. In India, cloud computing, big data and IoT are helping reduce car emissions and fuel use[43]. In Serbia, the EkoBus Smart City system has been deployed in Belgrade and Pancevo to monitor environmental parameters over large areas[44]. WSN are being used to monitor floods, water flow and precipitation in Thailand[45], Honduras and Brazil[47]. In China, IoT technologies are used to monitor data from 1,000 sites for signs of geological disasters in Pengshui, Kaixian and Fengjie counties[48].
Partnership	IoT projects are helping partners work together in new ways, including ISPs, data analytics firms and the development community.

Source: "Harnessing the Internet of Things for Global Development", a report by Cisco/ITU (forthcoming).

ENDNOTES

1. ICT Regulation Toolkit. www.ictregulationtoolkit.org/1.1
2. “UN report shows broadband potential for economic and social development”. http://undesadspd.org/Home/tabid/40/news/113/Default.aspx
3. As defined by the Rio+20 Conference.
4. The future of mobile learning. The future for policy makers and planners. UNESCO. 2013. http://unesdoc.unesco.org/images/0021/002196/219637E.pdf
5. Mobile learning for teachers. Global themes. UNESCO Working Paper. 2012. http://unesdoc.unesco.org/images/0021/002164/216452E.pdf
6. www.urbanplanetmobile.com/mobiliteracy-uganda
7. “Four mobile-based tools that can bring education to millions: The ubiquity of mobile phones is providing a new low cost tool for teaching in some of the poorest communities”, The Guardian, 20 August 2014, available at: www.theguardian.com/sustainable-business/2014/aug/20/mobile-phones-smartphone-education-teaching
8. Global Findex report, World Bank (2015), available at: www.worldbank.org/en/news/press-release/2015/04/15/massive-drop-in-number-of-unbanked-says-new-report
9. GSMA Global Mobile Economy Report (2015), available at: www.gsmamobileeconomy.com/GSMA_Global_Mobile_Economy_Report_2015.pdf
10. Asbanc and Ericsson www.ericsson.com/news/1849532
11. to HumanIPO on 10 January 2014, www.humanipo.com/news/38693/mobile-transactions-in-kenya-hit-19-6bn-in-2013/
12. www.safaricom.co.ke/mpesa_timeline/timeline.html
13. ITU. The Regulation of Satellite Broadband. www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_RegulationBroadbandSatellite.pdf
14. Intelsat. “Orange Niger Expands Relationship with Intelsat, Extending the Reach of its Cellular Network in Rural Niger” – Retrieved from : www.intelsat.com/news/orange-niger-expands-relationship-with-intelsat-extending-the-reach-of-its-cellular-network-in-rural-niger/#sthash.HX4YEqBH.dpuf
15. HughesNet®. Distance Learning file:///C:/Users/ITSO-Intern/Downloads/DistanceEducation_H43019_HR.pdf
16. SATMED E-health platform. SES. www.ses.com/20513923/SATMED-ehealth-platform
17. Ibid.
18. Intelsat. Gilat Utilizes Intelsat Satellite Services to Deliver Broadband Connectivity to Schools and Communities in Rural Colombia, available from: www.intelsat.com/news/gilat-utilizes-intelsat-satellite-services-to-deliver-broadband-connectivity-to-schools-and-communities-in-rural-colombia/
19. ioscos Vive Digital. MinTIC. www.mintic.gov.co/portal/vivedigital/612/w3-propertyvalue-7059.html
20. “Harnessing the IoT for Global Development”, a joint report by Cisco/ITU (forthcoming).
21. Byrne (2013), quoted in the Measuring the Information Society 2014 report, available from www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2014.aspx

22. https://www.rfidjournal.com/purchase-access?type=Article&id=7455&r=%2Farticles%2Fview%3F7455
23. Page 17/18: http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1346223280837/Agriculture.pdf
24. http://newsroom.cisco.com/feature/1556125/Sensors-Change-Lives-in-Developing-Countries
25. http://insait.in/AIPA2012/articles/054.pdf
26. http://dimsums.blogspot.ch/2014/01/internet-of-things-for-chinas.html
27. www.chinamobileltd.com/en/ir/reports/ar2010/sd2010.pdf http://newsroom.hwtrek.com/?p=626
28. http://itidjournal.org/itid/article/viewFile/244/114 http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4085509
29. www.biztechafrica.com/article/osun-partners-chams-biometric-identification-smart/8598/#.VIlp_9LF-Sq
30. www.itweb.co.za/index.php?option=com_content&view=article&id=61785
31. www.telegraph.co.uk/technology/news/10255630/Eight-UK-schools-to-take-part-in-Internet-of-Things-pilot.html
32. www.mhealthnews.com/news/fingerprint-sensors-help-improve-vaccination-management-africa?page=0 http://vaxtrac.com/
33. www.projecthope.org/assets/documents/Inspire-Fact-Sheet_Final_GrandChallenges2014.pdf www.inspirelivinginc.com/ www.libelium.com/e-health-low-cost-sensors-for-early-detection-of-childhood-disease-inspire-project-hope/
34. http://winsenga.org/ www.dw.de/remote-african-heartbeat-app/av-16307805
35. www.newscenter.philips.com/main/standard/news/press/2014/20140311-mobile-obstetrical-monitoring-project.wpd#.VIINXdLF-Sp
36. http://mobihealthnews.com/13092/qualcomm-launches-ecg-smartphone-program-in-china/
37. www.rfi.fr/emission/20140629-le-cardiopad-premiere-tablette-medicale-africaine/
38. www.healthcareitnews.com/news/telehealth-takes-ethiopia
39. www.libelium.com/ehealth_monitor_medical_drug_preservation_waspmote/
40. http://newsroom.cisco.com/feature/1556125/Sensors-Change-Lives-in-Developing-Countries
41. http://users.ictp.it/~mzennaro/WSN4D.pdf
42. www.chinamobileltd.com/en/ir/reports/ar2010/sd2010.pdf
43. www.techonlineindia.com/techonline/interviews/298879/cloud-iot-playing-roles-automotive-industry-edoardo-merli-stmicroelectronics?utm_source=referrence_article
44. www.libelium.com/smart_city_environmental_parameters_public_transportation_waspmote/
45. http://rdo.psu.ac.th/sjstweb/journal/33-2/0125-3395-33-2-227-235.pdf
46. http://users.ictp.it/~mzennaro/WSN4D.pdf
47. www.academia.edu/3810397/Using_Wireless_Sensor_Networks_in_the_Sensor_Web_for_Flood_Monitoring_in_Brazil
48. www.chinamobileltd.com/en/ir/reports/ar2010/sd2010.pdf

5

MAKING BROADBAND SERVICE TRULY UNIVERSAL

This Chapter has been contributed by the Inter-American Development Bank (IADB) and the World Bank.

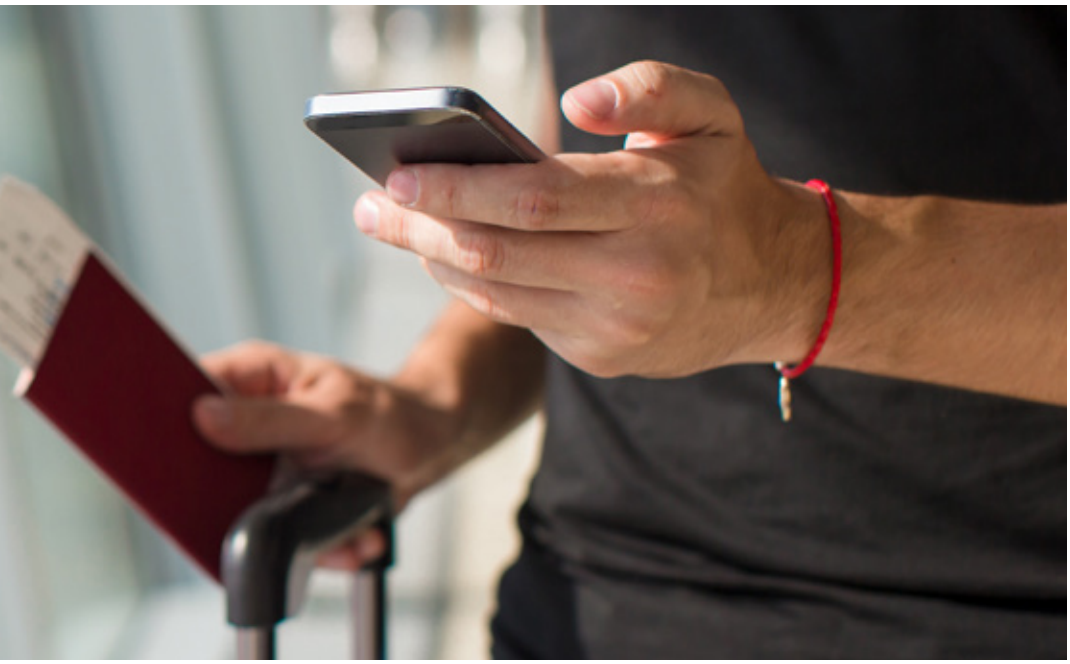
5.1. Defining Universal Service

Many countries now recognize that the benefits of broadband should not be enjoyed by only a fraction of the population – rather, everyone should enjoy them. ITU defines universal access as the situation where "everyone can access the service somewhere at a public place, also called public, community or shared access". Conversely, universal service is "the situation when every individual or household can have service, using it privately, either at home or increasingly carried with the individual through wireless devices" (ITU, 2012[1]).

Historically, the Universal Access and Service (UAS) concept was developed to specifically meet the needs of people in urban and remote areas for communication services recognized and required to be universal at the national level, e.g. fixed telephony and access to emergency services. Historical precedents include the United States Communications Act of 1934, which called for universal "wire and radio communication service" even in remote rural areas. Recently, these well-established concepts of UAS in telecommunications have been extended, so Internet access is now becoming part of targeted efforts of the policy and regulatory frameworks.

Indeed, by mid-2013, according to ITU data, around twenty Governments had defined Internet access or broadband access as a legal right, human right or a citizen's right for their country (including Costa Rica, Estonia, Finland, France, Greece, Spain and Switzerland[2]).

The importance of access to the Internet in public policy is broadly reflected in popular public opinion – for example, a Globescan/BBC poll (2010) found that nearly 80% of respondents agreed that the "Internet should be a fundamental right"[3], while an INSEAD/ World Economic Forum (2011) survey found that a comparable proportion of 70-80% of Internet users agreed or strongly agreed that Internet access should be "a fundamental right for all people"[4].



5.2. Approaches to Achieving Universal Service

A 2013 ITU study[5] explored a number of different approaches used by various jurisdictions to address universal service requirements, including: market-based reforms; mandatory universal service obligations (USOs); cross subsidies; access deficit charges; PPPs; and USFs. It found that, of the 69 USFs studied, 38% were highly active (with over 15 applications of the USF in progress or completed), 14% of Funds had a moderate activity level (between 6-15 projects), while 22% had a low activity level (with <5 projects implemented or disbursements made). A quarter (or 26%) were inactive (Figure 16, top). Of these 69 USFs, 27 included broadband or community telecentres. 24 Funds focused on the connectivity of anchor institutions or inclusion by people with disabilities. Only four Funds included provisions to encourage access by female Internet users (Figure 16, bottom).

Policy-makers are now updating UAS programmes with their vision of broadband service in terms of quality of service, affordability and establishing UAS objectives – ITU records 27 USFs that permit the deployment of broadband within their programmes (Figure 16, bottom). Many modern UAS policies define the regulatory framework for access and services. They cover issues specifically related to UAS within a broader ICT regulatory framework context that may include objectives of national broadband strategy. UAS policies generally cover the following key areas:

i) **Defining the services** that are to be included within the scope of UAS (e.g., traditionally voice telephony, and more recently, also broadband in a number of countries).

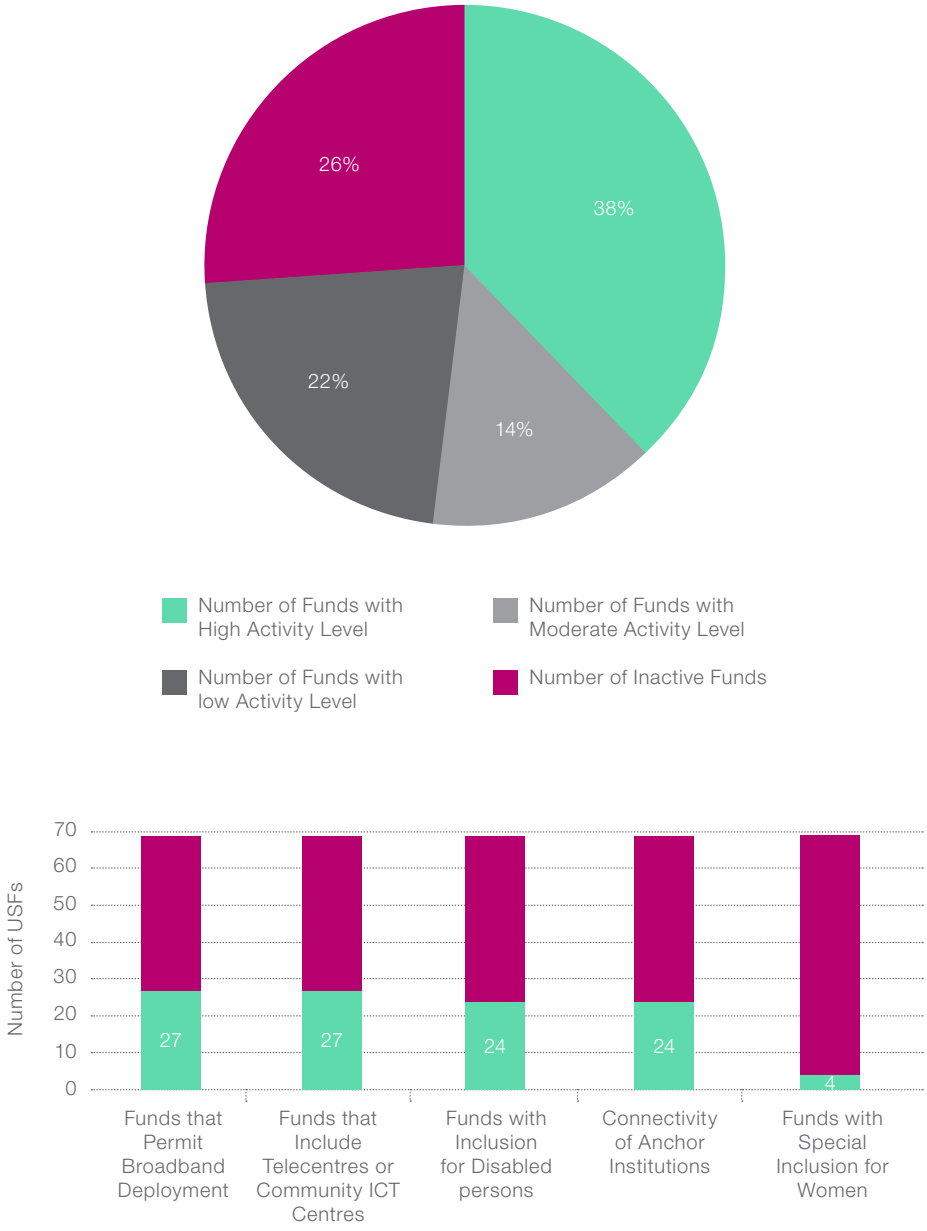
ii) **Presenting a vision of UAS,** often with a choice of targeted population groups (e.g., rural, poor or at-risk households, people with disabilities or special needs, and women).

iii) **Assigning entities** to oversee the implementation of the UAS policies (e.g., governance structure).

Figure 16: Universal Service Funds (USFs) and Broadband

Activity levels of USFs studied (top); Number of Funds addressing specific USF elements (bottom).

Source: "Universal Service Funds and Digital Inclusion for All", ITU (2013), available at: www.itu.int/en/ITU-D/Regulatory-Market/Documents/USF_final-en.pdf.



iv) **Including targets** for the services and the population groups in the UAS scope, with a defined timeframe for achievement.

v) **Presenting the approach and strategies** to be employed to achieve UAS targets (e.g., planning and implementation). For instance, USOs can be imposed on Universal Service Providers (USPs) seeking to ensure universal service, or coverage of rural and remote areas may be imposed on operators through licensing obligations.

vi) **Funding plans,** sources and disbursement methods. Funds may often typically be transferred to or via a USF. Planning for funds should be based on solid analytical grounds to ensure the goals of UAS policies are adequately funded. Other financing mechanisms can include PPPs, reverse subsidies or direct government financing. In some cases, governments may opt to introduce Pay or Play Mechanisms.

Establishment or adoption of existing UAS programmes for broadband delivery is one way to support the universality of broadband services. One of the principal objectives of broadband UAS is to minimize the digital divide between urban and rural areas and between affluent and poor areas. Projects are designed under the umbrella of programmes and may include the following:

i) Funding and the amount of financial resources to be used;

ii) The type (or a comprehensive list) of projects and their costs (e.g., demand stimulation projects or supply projects);

iii) The entities responsible for implementing UAS projects or the method used to select those entities; and

iv) The monitoring of activities.

The deployment of broadband services offers various investment options for the industry, according to different levels of service for end-users. The requirements for USOs are often concerned with technical quality parameters (such as coverage, up/download speeds) and operational performance factors (e.g. contention ratio, coverage, latency, jitter, and resilience), which are critical for the effective use of broadband.

Countries in Eastern Europe, Latin American and Caribbean (LAC) and other developing regions are sometimes subject to greater financial constraints and less favorable socio-economic conditions than other countries. Many of these countries may potentially benefit from the utilization of UAS; however, not all of them have been following this approach. UAS policies in these regions are generally more nascent, reflecting the need for objectives, strategies and capital investment. Countries in these regions are also prone to various barriers hindering demand for and supply of broadband.

A proposed 'Technology Bank for LDCs' is being reviewed for the development of modern ICT infrastructure and expansion

of Internet access into rural and remote areas, including via public-private partnerships (PPPs) for the development and maintenance of ICT infrastructure. This will help LDCs in their efforts to achieve the post-2015 target of providing universal and greater affordable access to the Internet in LDCs by 2020.

Efforts to achieve universality of broadband require greater political commitment, priority to broadband initiatives and relevant strategies that are well-planned and comprehensive. Table 4 summarizes challenges in the development of UAS programmes and strategies to overcome these challenges.

Table 4: Challenges to Universal Broadband Access and Strategies to Overcome Them

	Challenges	Strategies
Supply side	Limited financial resources, in general Limited in-country infrastructure, especially national fibre optic networks, and limited or very expensive infrastructure for international connectivity Limited amount of spectrum available for wireless broadband Inadequate coverage of wireless broadband networks Limited prospects for economic growth	Levies on operators to finance USFs Additional sources of funding (e.g., from international institutions) Grants to build infrastructure, mandatory infrastructure-sharing Prioritization of development programmes based on strict criteria Roll-out of public WiFi in public spaces Spectrum refarming
Demand side	Low levels of purchasing power, and relatively high service prices Low levels of education, especially regarding ICT skills Limited availability of (and high taxes on) consumer electronic equipment Limited availability of relevant local content	Subsidies for service fees or equipment purchases Mandated discounts for certain classes of end-users Reduced tax rates for broadband-related services and equipment ICT training (e.g. in schools or colleges), public telecentres

Source: IADB/World Bank.

A number of best practices can be taken into account to optimize the chances of success in achieving UAS:

i) **Policy and regulation:** The role of broadband UAS policies and strategies as an economic development tool and catalyst for social inclusion must be fully acknowledged. UAS policies should be designed in collaboration with relevant stakeholders, and include ambitious but achievable objectives. Excessively stringent mandatory USOs may not always prove an optimal way to achieve broadband UAS policy objectives.

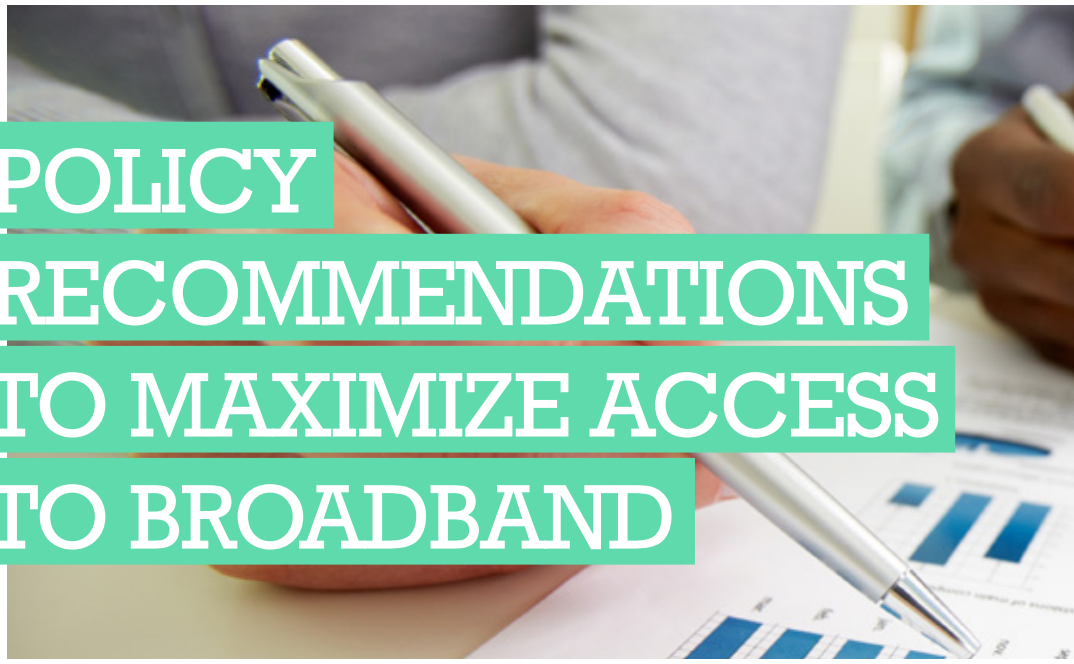
ii) **Planning:** A thorough gap analysis is required to understand the focus of UAS. UAS strategy and implementation, including its funding, should be adapted to local needs to ensure viability, integration, coordination, and that appropriate checks are in place. The sustainability of UAS projects over the long term is critical.

iii) **Funding:** The source of funding should be adapted to the strategic vision of the UAS policy and the enabling environment. The level of spending should be significant in order to achieve the best results, and requirements for UAS spending should be fair and transparent.

iv) **Implementation:** Cooperation between the public and private sectors is essential (e.g., PPPs). UAS programmes must address the supply side, as well as the demand side, with some degree of flexibility. Implementation requires some degree of centralized control to monitor progress.

Policy-makers should consider measures to expand and fully utilize UAS programmes to include broadband adoption, containing different elements to help get unserved or underserved people online (including the development of local content, subscriptions, subsidized devices and digital skills training).

6



POLICY RECOMMENDATIONS TO MAXIMIZE ACCESS TO BROADBAND

A range of policy options are available to maximize access to broadband, and to capitalize on its benefits. These policy options can broadly be divided into supply-side measures and demand-side measures, although some policy measures can promote both – for example, the adoption of a NBP promoting development of content and human capacities; monitoring; and tax reductions to reduce overall tariffs and promote affordability.

Examples of **supply-side measures** include:

- Promote co-deployment and infrastructure-sharing of telecom infrastructure and co-investment to reduce prices;
- Foster co-deployment with access to non-telecoms infrastructure (addressing key obstacles, such as limits on access and rights of way);
- Ensure sufficient availability of quality spectrum to deploy mobile broadband networks (e.g. via spectrum assignment and trading);
- Focus on expanding network coverage (e.g. via coverage obligations, rather than on spectrum proceeds);
- Develop effective technical standards to achieve economies of scale and enhance quality of services;
- Promote effective and functional wholesale and retail markets to lower prices.

Various policy measures exist on the **demand side**:

- Ensure the availability and affordability of broadband-enabled devices and services for poor or at-risk households and other vulnerable groups;
- Enable the development of local and relevant broadband applications and content, including in multiple languages;
- Improve broadband availability mapping to increase consumer awareness about choice of services and service providers;
- Enhance transparency and control of market information to inform consumers about market prices and their rights to enable them to make informed decisions;
- Undertake communication campaigns to increase trust and security;
- Engage in ICT literacy campaigns and digital skills courses to boost user capacities, awareness and interest.
- Promote effective ICT skills through training and education at all levels, formal and informal, with a special focus on girls and women.

In research recently carried out in 2015, the telecom consultancy Analysys Mason ranked supply and demand policy measures for promoting the roll-out of broadband by impact on future market development and difficulty of implementation for an emerging market economy (Figure 17). The 'quick wins' (with high impact, yet easy to implement) include making full use of USO coverage obligations (M4) and mandating wholesale NGN access at sustainable prices (M5). Analysys Mason concluded that providing subsidies or social tariffs (M8) for low-income citizens to boost demand is more difficult to implement.

M1: Mobile networking sharing

M2: Access to non-telecom infrastructure

M3: Spectrum assignment

M4: Coverage obligation

M5: Mandating wholesale NGN access at sustainable prices

M6: Public campaigns to promote digital economy

M6: Supporting the creation of digital content of high value

M7: Ensure everyone have opportunities, skills and knowledge to use online services

M7: Setting up public access points to information regarding use of digital services

M8: Providing subsidies or social tariffs to low-income citizens

M9: Cutting VAT for ICT services

Figure 17: Policy Measures ranked by Impact and Difficulty of Implementation

Policy measures for broadband ranked by impact on future market development and difficulty of implementation for a representative emerging market economy.

Source: Analysys Mason, in a policy briefing paper by the Broadband Commission (forthcoming).

Note: Policy measures in green font are demand-side measures; policy measures in purple font are supply-side measures.

On the basis of this report, the *Broadband Commission* believes that policy-makers may wish to consider addressing the following key measures as a means of promoting broadband as a foundation for sustainable development.

6.1 Review and update ICT regulatory frameworks, including regulatory approaches to spectrum

Governments and regulators should carry out a detailed review and analysis of the shortfalls in their own markets and the regulatory options available to address them. Countries with more innovative 'fourth-generation regulation' are generally associated with higher levels of mobile broadband penetration and growth – ITU has found that growth in services has happened most rapidly where regulatory enablers (e.g. industry consultations, infrastructure-sharing) have been put in place to leverage the latest technologies and innovations[1]. Consistent, forward-looking, updated and well-enforced regulation generally provides for a vibrant market and benefits both service providers and consumers. Policy-makers must regularly review and revise regulatory frameworks to encourage the development of broadband and ICTs.

According to ITU's *Trends in Telecommunication Reform Report 2015,* many countries have adopted or are in the process of adopting more flexible regulatory frameworks over the past decade (Figure 18). Analysis of countries' specific regulatory practices shows that a growing number of countries have adopted NBPs, and permitted the use of Voice over Internet Protocol (VoIP). Meanwhile, secondary trading of radio spectrum is still only permitted in a small number of countries (Figure 18). In particular, measures may be needed to level the playing-field among all the different players of the digital ecosystem, through adequate rules and the introduction of fair competition tools. Levelling the playing-field is critical to promote and maximize the investment capacity of all the agents in the digital value chain. Without a level playing-field, it can often prove difficult to meet targets for increasing the penetration of Internet at affordable prices.

Optimizing approaches to spectrum policy, allocation and management is a major part of Governments' overall broadband policy portfolio. ITU will host the World Radiocommunication Conference (WRC-15) in November 2015, which will see thousands of delegates convene over four weeks in Geneva, Switzerland, to examine, review and, where necessary, revise the Radio Regulations, the international treaty governing the use of the radio-frequency spectrum and satellite orbits. WRC-15 will see major debates on the growing needs for spectrum by different stakeholder groups, including the mobile and satellite industries, broadcasters, defense and security agencies, civil aviation, maritime and scientific communities. WRC-15 will consider the spectrum requirements of radiocommunication services and update the Radio Regulations to ensure that these services can face the growth of demand and develop in a harmonious and sustainable way, taking advantage of the most advanced, efficient and affordable technologies.

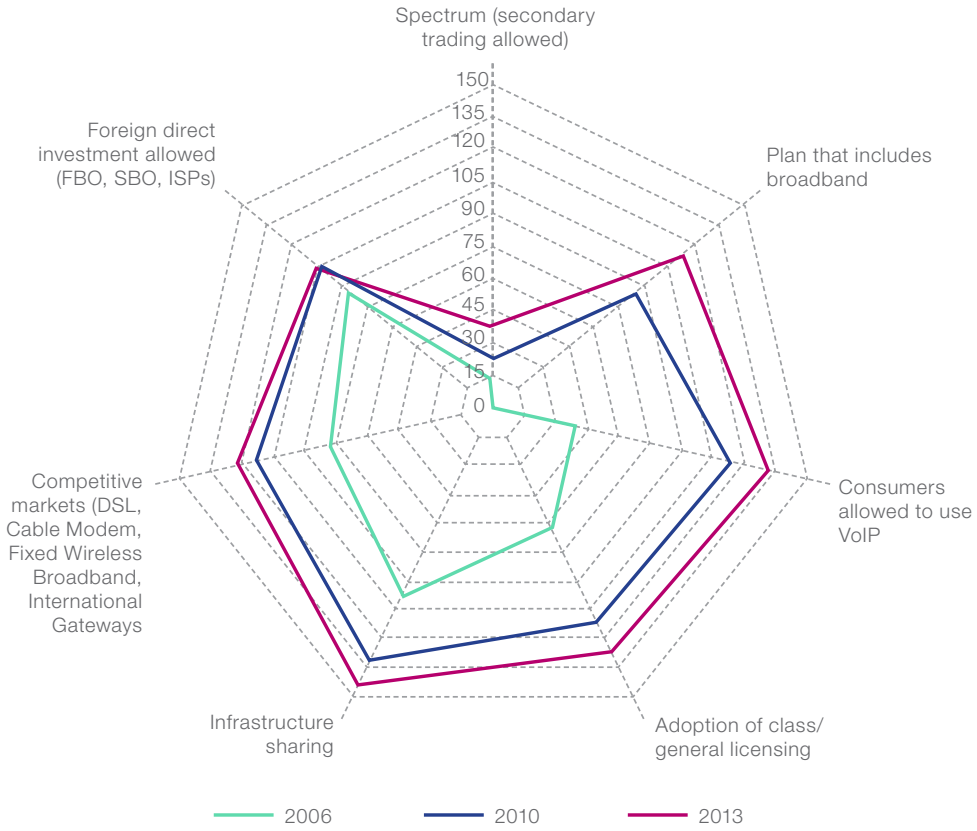


Figure 18: Which Regulations Shaped the ICT Sector from 2006 to 2013?

Source: ITU's Trends in Telecommunication Regulatory Reform Report, 2015.

6.2 Make Full Use of Universal Service Obligations (USOs)

Mobile telephony has already succeeded in giving ownership and direct access to ICTs to between 50-75% of the global population (Chapter 2). However, providing access to ICTs and broadband to the second half of humanity will require extra measures to overcome the very different marginal cost curves involved in reaching people living in remote and underserved areas (Chapter 2). Depending on geography and population density, making full use of USOs may be a 'quick win' (i.e. high impact, yet easy to implement) in some emerging markets.

Policy-makers should review their license coverage obligations, and work with industry to ensure service to more remote areas. USFs are one means of helping supplement coverage requirements for areas where service provision is less commercially viable.

According to Chapter 5, governments must work to ensure that the best possible use is made of USFs and of the funds they have collected to ensure that USFs meet their objectives of providing access to remote and underserved communities. Funds should work to improve their management capacity and ensure that their programmes are more effective, and should be part of a holistic approach towards UAS.

6.3 Consider infrastructure-sharing and open access approaches to publicly funded infrastructure

Policy-makers may wish to consider infrastructure-sharing and open access approaches for publicly funded infrastructure. Although various strategies for open access exist, it is vital that policy-makers ensure that access to new facilities is provided on fair, reasonable and equivalent terms. This may include both price factors (such as the wholesale price of access to infrastructure) and non-price factors (such as product specifications and service level agreements). Examples of open access include Local Loop Unbundling (LLU) and wholesale broadband access for ducts and submarine cables.

6.4 Consider measures to make broadband more affordable

As explained in Chapter 3, even where the national average cost of a broadband basket fulfils the Broadband Commission's affordability target of 5% of average Gross National Income (GNI), there may still be large segments of the population where the effective purchasing power means that broadband costs far exceed more than 5% of total household income. Regulators and policy-makers may wish to carry out a full and extensive analysis of the relative purchasing power of their population and consider working with operators to introduce targeted measures for specific districts or specific socio-economic grouping (e.g. subsidies for school pupils, college students, specific communities or pensioners).

6.5 Reduce taxes and import duties on telecommunication/ICT equipment and services

As part of the measures to make broadband more affordable, Governments may wish to consider reducing taxes, Value-Added Tax (VAT) and import duties on telecommunication/ICT equipment and services. There is by now a large body of evidence supporting the introduction of tax rebates and allowances (for operators and consumers) to make broadband more affordable, with positive results on broadband adoption[2]. Pakistan slashed SIM card sales tax rates to a quarter of their preceding levels from 2005-2009, over which period SIM card penetration increased significantly from 5% to 55%.

Sweden's 1998 tax rebate programme was credited in part with the country's rapid increase in computer penetration. Malaysia introduced successful and highly impactful tax relief programmes for broadband (in 2010) and smartphone usage (in 2011).

In his 2015 GSR Discussion Paper, Katz (2015) finds that "most developed and some developing nations reduce service taxes to promote universalization of service", but that "this pattern is not consistent across emerging countries, and this approach is significantly less prevalent in Latin America"[3].

6.6 Promote investment in broadband infrastructure

The telecom industry is a fast-moving industry, but there has been a significant recent rebalancing in the level of revenues between different players in the broadband ecosystem. As shown in Figure 2, trends in telecom revenues and capex are diverging for the different players in the industry – incumbents, mobile, cable providers and 'altnets' – in Europe[4]. For example, in Europe, revenues are falling for incumbents and mobile operators, stable for cable operators and increasing by 5-6% for 'altnets'. Meanwhile, capex commitments are increasing for all players except 'altnets'.

Telecommunication and broadband providers need to explore flexible business arrangements with 'altnets' and Internet content providers to accelerate investments in broadband (including IXPs, CDNs, data centres, backhaul fibre investments and other infrastructure) to the benefit of all, especially end-users. Internet companies and Internet content providers need to contribute to investment in broadband infrastructure by debating interconnection issues and revenue/fee sharing with operators and broadband access providers to increase investments in broadband infrastructure and energize the broadband ecosystem.

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

6.7 Promote training and measures to stimulate demand

Increased public awareness and the ability to use broadband services are critical to stimulate further growth and promote the take-up and use of the Internet. Supply measures are necessary, but not sufficient – investments in literacy and demand can go a long way to promoting effective use of broadband services, including awareness campaigns, dedicated training programmes, the development of local content, the digitization of government services and other critical services (e.g. in the health, education or energy sectors). Stimulating demand must also be accompanied by education in the use of ICTs both inside and outside schools, as well as skills training, to enhance access to all available opportunities. Training in digital skills must take priority in education systems, planning and policies, along with teacher training and development. This is essential for bridging the gender divide, and for providing girls and women with the skills and the opportunities to engage as fully as possible, using all available technologies. Examples of demand measures also extend into guidelines for mobile (Box 2) or programmes to promote broader concepts, such as electronic design (Featured Insight 14).

Box 2: UNESCO's Policy guidelines for mobile learning

In view of the strong growth of mobile broadband and the importance on the demand side to provide enhanced mobile learning opportunities, UNESCO's related Policy Guidelines recommend to:

1. Create or update policies related to mobile learning
2. Train teachers to advance learning through mobile technologies
3. Provide support and training to teachers through mobile technologies
4. Create and optimize educational content for use on mobile devices
5. Ensure gender equality for mobile students
6. Expand and improve connectivity options while ensuring equity
7. Develop strategies to provide equal access for all
8. Promote the safe, responsible and healthy use of mobile technologies
9. Use mobile technology to improve communication and education management
10. Raise awareness of mobile learning through advocacy, leadership, dialogue

Source: UNESCO (2013), "Policy guidelines for mobile learning".

FEATURED INSIGHT 14: JORDAN INTEL ELECTRONIC DESIGN PROGRAMME

A three-year public private partnership (PPP) has been launched to build technical skills in electronics design in Jordan. USAID, in partnership with Intel and with the collaboration of the Jordanian Ministry of ICT and other stakeholders, will conduct a technical training programme in ten ICT colleges and universities in Jordan. The programme covers students and professorial capacity-building and the purchase of the Intel® Galileo development boards for academia, organizing trainings and local competitions, participating in global competitions, mentoring, incubation, venture capital funding and acceleration.

The programme aims to build the HR talent for a new potential industry within ICT, create high-quality jobs in ICT, promote innovation and entrepreneurship and attract foreign investment. The project will train professors and technicians in new electronic design technologies with commitment for knowledge transfer, as well as graduates and senior university students on Intel related electronic design tracks. It will help create a pool of new talent for interested investors in the field, as well as creating a number of start-ups specialized in electronics design. Although the programme has only been launched recently, 16 prototypes have already been developed using Intel Galileo development boards in wearables, energy, smart homes, robotics, games and connected cars.

Source: Intel Corporation.

6.8 Invest in the creation of local content in local languages

Even where the supply of broadband is adequate, demand for Internet and broadband may prove a key stumbling block to building a vibrant local market and customer base for broadband. Stimulation of local content can also boost local job creation and entrepreneurship, with important spin-off benefits. Language barriers are real, and preventing people around the world from connecting and participating in the knowledge economy, especially in emerging markets, as noted in Chapter 2.

A range of different solutions exist[5]. Partnerships are needed for tech companies, mobile manufacturers, service providers, operators and ISPs to join together in a long-term commitment to making their devices available and accessible in, and compatible with, different languages and fonts. Technical solutions must be developed to deliver font support and input methods on mobile devices for various language scripts. Handset manufacturers should pre-install as many relevant languages as possible for given markets. Service providers must support language diversity, while language communities can get involved in translation crowd-sourcing to ensure that some language communities are not left behind. Language communities must be engaged and mobilized to ensure that meaningful content is available in many different languages.

6.9 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 broadband goals and targets (including the targets set by the Broadband Commission). The need for reliable data and targets seems to be well understood, with 86% of Plans including targets, as shown in Chapter 3. Data should be collected to monitor broadband infrastructure and access, prices and affordability, and broadband usage by individuals, businesses and public organizations (including Governments, schools and hospitals). 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[6]. ITU hosts an annual World Telecommunication/ICT Indicators Symposium to further the collection and dissemination of reliable and consistent data at the international level[7].

7 CONCLUSIONS

Every year, the *UN Broadband Commission* publishes its annual 'State of Broadband' report to take the pulse of the global broadband industry and to explore progress in connecting everyone on the planet via broadband. This year's report finds mixed messages about the growth of ICTs and the global state of broadband. Although strong growth rates continue for mobile broadband and Facebook usage, and mobile cellular subscriptions exceeded 7 billion for the first time during 2015, growth in global mobile cellular subscriptions and growth in Internet usage have slowed sharply. We have reached a transition point in the growth of the Internet.

The UN Broadband Commission's targets or best-estimate projections made in 2011 have not been achieved by 2015 (the target date) and most seem likely only to be achieved by 2020 at the earliest. The milestone of 4 billion Internet users is unlikely to be achieved before 2020. Future Internet users are likely to come from less well-educated, less urban backgrounds and from a base in other languages and dialects. Growth in the languages available online for some of the main web-based services is not keeping pace with growth in overall Internet usage.

Although there has been good growth in the number of countries with National Broadband Plans (NBPs) over the lifetime of the Commission, a substantial number of these Plans are reaching the end of their term this year, and the 'succession strategy' for many of these Plans is unclear (i.e. whether countries will 'maintain' the recently elapsed Plan, revise it, seek feedback on its achievements and/or introduce a new Plan).

To overcome this transition point and to achieve universally available and more affordable Internet access for all requires huge efforts, better coordination and more effective use of existing resources by all stakeholders. This report has explored the concepts and economics of universal service for the deployment of major broadband technologies (notably FTTH, FTTC and LTE). It has revisited some of the existing concepts of universal service to explore how they are being updated for most recent developments. It has also made a number of policy recommendations as to how investments in broadband can be generated to revitalize Internet growth and make it more relevant for development uses.

In this way, it is our hope that the *UN Broadband Commission for Digital Development* has made a worthy contribution to the debate on how best to expand broadband access and achieve digital inclusion for all. As the Commission concludes its work programme for 2010-2015, and enters into a new work programme for post-2015 onwards, we shall continue working with many different stakeholders to achieve digital inclusion for all towards the forthcoming sustainable development goals (SDGs).

ENDNOTES FOR CHAPTER 5

1. www.itu.int/dms_pub/itu-d/opb/stg/D-STG-SG01.07.3-2014-PDF-E.pdf
2. "Box 2: Should Broadband/Internet Access be considered a right?", "Planning for Progress: Why National Broadband Plans Matter", ITU/ Cisco, a contribution to the Broadband Commission for Digital Development, available from: www.broadbandcommission.org/documents/ reportNBP2013.pdf
3. http://news.bbc.co.uk/2/hi/technology/8548190.stm
4. "The New Internet World", INSEAD/World Economic Forum, available from: www3.weforum.org/docs/WEF_GITR_TheNewInternetWorld_Report_2011.pdf
5. "Universal Service Funds and Digital Inclusion for All", ITU (2013), available at: www.itu.int/en/ITU-D/Regulatory-Market/Documents/USF_final-en.pdf.

ENDNOTES FOR CHAPTER 6

1. ITU Trends in Telecommunication Reform 2015, available from: www.itu.int/pub/D-PREF-TTR
2. "The State of Broadband 2014: Broadband for All", available at www.broadbandcommission.org
3. "Taxation and the Digital Economy", GSR 2015 Discussion Paper by Raul Katz, available from www.itu.int/ITU-D/ict/
4. "Europe – Thirty Years on from Liberalization", Megabuyte analysis published in the March/April edition of ITU News, available at: https://itunews.itu.int/En/5778-Europe-Thirty-Years-on-from-Liberalization. note.aspx
5. These solutions are taken from "The Internet's Language Barrier", Iris Oriss, 2014, available at http://mitpressjournals.org/userimages/ ContentEditor/1415302178306/INNOVATIONS_DIGITAL-INCLUSION.pdf
6. www.itu.int/ITU-D/ict/
7. World Telecommunication/ICT Indicators Symposium, at: www.itu.int/en/ ITU-D/Statistics/Pages/events/wtis2015/default.aspx

Annex 1: Target 1 – List of National Broadband Policies

ECONOMY	POLICY AVAILABLE?	YEAR POLICY WAS ADOPTED	TITLE/DETAILS
Afghanistan	yes	2011	Optic Fiber Network Backbone Expansion Project (BBEP) - 2011-2013
Albania	yes	2013	National broadband plan
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	2014	Electronic Communications Sector Policy 2014
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	2010	La Belgique : Cœur de l'Europe numérique 2010-2015
Belize	yes	2011	ICT National Strategy
Benin	yes	2014	Projet de Développement des Infrastructures et des TIC
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	2014	Botswana's National Broadband Strategy
Brazil	yes	2014	National Broadband Plan 2.0 "Broadband for All"
Brunei Darussalam	yes	2014	National Broadband Policy
Bulgaria	yes	2009	National Strategy of Broadband Development in the Republic of Bulgaria
Burkina Faso	yes	2013	Le Backbone National en Fibre Optique
Burundi	yes	2011	Burundi/ ICT: National Projects for Broadband Connectivity Burundi Community Telecentre Network (BCTN)
Cambodia	yes	2014	Cambodia's ICT Master Plan 2020
Cameroon	no		
Canada	yes	2014	Digital Canada
Cape Verde	yes	2005	Programme Stratégique pour la Société de l'Information (PESI) accompagné du Plan d'Action pour la Société de l'Information (PAGE)
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	yes	2014	Loi N°14-031/AU du 17 Mars 2014, relative aux communications électroniques et Décret N°08-019/PR
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
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	2014	Plan Bienal de Proyectos 2014-2015 INDOTEL and US/A Policy
Ecuador	yes	2011	Plan Nacional de Desarollo de Banda Ancha 2011-2016
Egypt	yes	2012	eMisr National Broadband Plan
El Salvador	no		
Equatorial Guinea	yes	2012	Nuevas Tecnologias: national project aimed at the popularization of technologies Information and communication (TICGE)
Eritrea	no		
Estonia	yes	2006	Information Society Development Plan 2013
Ethiopia	yes	2013	National Broadband Master Plan
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	2014	National NGA Plan and National Strategy for Digital Growth
Grenada	yes	2006	Information and Communication Technology (ICT) 2006-2010 / A Strategy And Action Plan for Grenada
Guatemala	no		

Annex 1: Target 1 – List of National Broadband Policies

ECONOMY	POLICY AVAILABLE?	YEAR POLICY WAS ADOPTED	TITLE/DETAILS
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		
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	2014	Indonesia Broadband Plan 2014-2019
Iran (I.R.)	yes	2011	National Information Network
Iraq	planning		
Ireland	yes	2008	National Broadband Scheme
Israel	yes	2012	The Communication Initiative: fiber-based national broadband network
Italy	yes	2014	Ultra Broadband Strategic Plan and Italian Digital Agenda
Jamaica	yes	2007	National ICT Strategy
Japan	yes	2014	Japan Revitalization Strategy
Jordan	yes	2007	National ICT Strategy of Jordan
Kazakhstan	yes	2010	Programme of ICT Development
Kenya	yes	2013	National Broadband Strategy - Vision 2030
Kiribati	no		
Korea (Rep.)	yes	2009	Ultra Broadband Convergence Network
Kuwait	no		
Kyrgyzstan	yes	2006	Regional Arrangement concerning the planning of the digital terrestrial broadcasting service and the digital Plan (GE06)
Lao P.D.R.	no		
Latvia	yes	2012	Next generation broadband development strategy for year 2013-2020
Lebanon	yes	2011	National ICT Strategy Action Plan 2011-2012
Lesotho	yes	2014	National Broadband Policy 2014-2018
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	yes	2014	Loi n° 2005-023 du 17 octobre 2005
Malawi	yes	2013	National ICT Policy
Malaysia	yes	2010	National Broadband Initiative
Maldives	no		
Mali	no		

ECONOMY	POLICY AVAILABLE?	YEAR POLICY WAS ADOPTED	TITLE/DETAILS
Malta	yes	2012	Malta's Next Generation Broadband
Marshall Islands	yes	2011	National ICT Policy
Mauritania	no		
Mauritius	yes	2012	National Broadband Policy 2012 - 2020 (NBP2012)
Mexico	yes	2013	Red Publica Compartida de Telecomunicaciones
Micronesia	no		
Moldova	yes	2013	Digital Moldova 2020
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	yes	N/A	Nauru ICT Policy
Nepal	yes	2004	Telecommunication Policy, 2060 (2004)
Netherlands	yes	2010	Digital Agenda
New Zealand	yes	2015	Ultra fast broadband initiative, Five Point Government Action Plan for faster broadband
Nicaragua	no		
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 Broadband Plan 2013-2018
Norway	yes	2000	eNorway, Brodband requirements in Digital Divident Frequency Auction
Oman	yes	2014	The National Broadband Strategy (2014-2018)
Pakistan	yes	2007	National Broadband Programme 2007
Panama	yes	2008	Plan Nacional de Banda Ancha
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	2013	Qatar National Broadband Plan
Romania	yes	2007	The Regulatory Strategy for the Romanian Electronic Communications Sector for 2007-2010
Russian Federation	yes	2012	The Goals of the Ministry of Telecom and Mass Communications of the Russian Federation 2012–2018
Rwanda	yes	2006	Regional Connectivity Infrastructure Program (RCIP)
S. Tomé & Principe	no		
Samoa	yes	2010	Broadband Spectrum Plan

Annex 1: Target 1 – List of National Broadband Policies

ECONOMY	POLICY AVAILABLE?	YEAR POLICY WAS ADOPTED	TITLE/DETAILS
San Marino	no		
Saudi Arabia	yes	2007	National Communications and Information Technology Plan and E-Government Action Plan 2012–2016
Senegal	no		
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 data		
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	2013	Plan de Telecomunicaciones y Redes Ultra Rápidas
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	2010	National ICT Strategy and Action Plan 2010-2015
Sudan (Rep.)	yes	2012	Sudan's National Strategic Development Plan 2012-2016
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	2014	SMART TT Plan, National ICT Plan 2014-2018
Tunisia	yes	2015	Tunisie Digitale 2018
Turkey	yes	2009	Strategy of Transport and Communications, Target 2023, 2009-2013 Strategic Ministerial Plan

ECONOMY	POLICY AVAILABLE?	YEAR POLICY WAS ADOPTED	TITLE/DETAILS
Turkmenistan	no		
Tuvalu	no		
Uganda	yes	2009	Uganda Broadband Infrastructure Strategy National Position Paper
Ukraine	no		
United Arab Emirates	yes	2008	TRA Initiative - ICT Fund for ICT sector development
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	yes	2013	National Information and Communications Policy
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 Plans: 148

Countries planning on introducing National Broadband Plans: 6

Countries without National Broadband Plans (and no data): 42

Notes: National Broadband Policies include: National Broadband Plans and National Policy with broadband target adopted (development, ICT, etc).

Annex 2: Fixed-Broadband Subscriptions per 100 inhabitants, 2014

RANK	ECONOMY	FIXED-BROADBAND SUBSCRIPTIONS PER 100 CAPITA
1	Monaco	*46.8*
2	Switzerland	46.0
3	Denmark	41.4
4	Netherlands	*41.0*
5	Liechtenstein	*40.3*
6	France	40.2
7	Korea (Rep.)	38.8
8	Norway	38.1
9	United Kingdom	37.4
10	San Marino	*37.0*
11	Belgium	36.0
12	Iceland	35.9
13	Andorra	35.9
14	Germany	35.8
15	Malta	35.2
16	Canada	*35.0*
17	Sweden	34.2
18	Luxembourg	*33.3*
19	Finland	32.3
20	Lithuania	31.5
21	Hong Kong, China	31.2
22	New Zealand	30.5
23	United States	30.4
24	Japan	29.3
25	Belarus	28.8
26	Greece	28.4
27	Macao, China	28.0
28	Singapore	*27.8*
29	Czech Republic	27.6
30	Austria	27.5
31	Estonia	27.4
32	Hungary	27.3
33	Spain	27.3
34	Barbados	27.0
35	Ireland	26.9
36	Portugal	26.7
37	Slovenia	26.6
38	Israel	26.2
39	Australia	25.8
40	Latvia	24.7
41	Uruguay	24.6
42	Poland	*23.8*
43	St. Kitts and Nevis	*23.7*
44	Italy	23.5
45	Philippines	23.2
46	Croatia	23.0
47	Lebanon	22.8
48	Slovakia	21.8
49	Bahrain	21.4
50	Cyprus	21.1
51	Bulgaria	20.7
52	Azerbaijan	19.8
53	Romania	18.5
54	Grenada	*17.9*
55	Trinidad & Tobago	17.5
56	Russian Federation	17.5
57	TFYR Macedonia	16.2
58	Dominica	*15.8*
59	Serbia	15.6
60	St. Lucia	15.4
61	Montenegro	15.2
62	Antigua & Barbuda	*15.1*
63	St. Vincent & the Grenadines	14.9
64	Moldova	14.7
65	Argentina	14.7
66	Mauritius	14.6
67	China	14.4
68	Bosnia and Herzegovina	14.1
69	Chile	14.1
70	Kazakhstan	12.9
71	Seychelles	12.7
72	Georgia	12.2
73	Turkey	11.7
74	Mexico	11.6
75	United Arab Emirates	11.5
76	Brazil	11.5
77	Costa Rica	10.4
78	Saudi Arabia	10.4
79	Colombia	10.3
80	Malaysia	10.1
81	Qatar	9.9
82	Iran (I.R.)	9.5
83	Armenia	9.1
84	Tuvalu	9.1
85	Suriname	*8.5*
86	Ukraine	8.4
87	Thailand	8.2
88	Panama	7.9
89	Venezuela	7.8
90	Ecuador	7.8
91	Brunei Darussalam	7.1
92	Mongolia	6.8
93	Albania	*6.6*
94	Viet Nam	6.5
95	Peru	5.7
96	Dominican Rep.	5.7
97	Maldives	5.6
98	Guyana	5.6

RANK	ECONOMY	FIXED-BROADBAND SUBSCRIPTIONS PER 100 CAPITA
99	Jamaica	5.4
100	El Salvador	5.0
101	Jordan	4.7
102	Oman	4.5
103	Tunisia	4.4
104	Kyrgyzstan	4.2
105	Algeria	4.0
106	Cape Verde	3.8
107	Egypt	3.7
108	Bahamas	*3.6*
109	Bhutan	3.3
110	South Africa	3.2
111	Micronesia	3.0
112	Morocco	3.0
113	Belize	*2.9*
114	Sri Lanka	2.6
115	Marshall Islands	2.6
116	Nicaragua	2.5
117	Paraguay	2.5
118	Guatemala	2.4
119	Djibouti	2.3
120	Vanuatu	1.8
121	Namibia	1.8
122	Tonga	*1.7*
123	Syria	1.7
124	Botswana	1.6
125	Bolivia	1.6
126	Fiji	1.4
127	Honduras	1.4
128	Kuwait	1.4
129	Yemen	*1.4*
130	Uzbekistan	*1.3*
131	India	1.2
132	Bangladesh	1.2
133	Indonesia	1.2
134	Kiribati	*1.2*
135	Pakistan	1.1
136	Samoa	1.1
137	Zimbabwe	1.0
138	Libya	*1.0*
139	Nepal	0.8
140	Senegal	0.7
141	Gabon	*0.6*
142	S. Tomé & Principe	*0.6*
143	Somalia	*0.6*
144	Equatorial Guinea	0.5
145	Ethiopia	0.5
146	Angola	0.4
147	Swaziland	*0.4*
148	Benin	0.4
149	Uganda	0.3
150	Côte d'Ivoire	0.3
151	Myanmar	0.3
152	Ghana	0.3
153	Solomon Islands	0.2
154	Comoros	0.2
155	Cambodia	*0.2*
156	Mauritania	*0.2*
157	Kenya	0.2
158	Papua New Guinea	*0.2*
159	Tanzania	*0.2*
160	Lao P.D.R.	0.2
161	Zambia	0.1
162	Liberia	*0.1*
163	Gambia	0.1
164	Togo	*0.1*
165	Rwanda	0.1
166	Lesotho	0.1
167	Madagascar	0.1
168	Guinea-Bissau	0.1
169	Chad	0.1
170	Tajikistan	*0.1*
171	Cameroon	0.1
172	Timor-Leste	*0.1*
173	Cuba	0.1
174	Sudan	0.1
175	Malawi	0.1
176	Niger	*0.0*
177	Mozambique	0.0
178	Turkmenistan	*0.0*
179	Burkina Faso	0.0
180	Mali	0.0
181	Burundi	*0.0*
182	Congo (Rep.)	*0.0*
183	Nigeria	0.0
184	Guinea	*0.0*
185	Afghanistan	*0.0*
186	Eritrea	*0.0*
187	South Sudan	0.0
188	Congo (Dem. Rep.)	*0.0*
189	Haiti	0.0
	Central African Rep.	n/a
	D.P.R. Korea	n/a
	Iraq	n/a
	Nauru	n/a
	Sierra Leone	n/a
	Vatican	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.

Annex 3: Active Mobile-Broadband Subscriptions per 100 inhabitants, 2014

RANK	ECONOMY	MOBILE BROADBAND SUBSCRIPTIONS PER 100 CAPITA
1	Macao, China	**322.2**
2	Singapore	***156.1***
3	Kuwait	**139.8**
4	Finland	**138.5**
5	Bahrain	**126.2**
6	Japan	**121.4**
7	Estonia	**117.0**
8	Sweden	**116.3**
9	Denmark	**115.8**
10	United Arab Emirates	***114.0***
11	Australia	**112.2**
12	Luxembourg	***111.3***
13	Korea (Rep.)	**108.6**
14	Barbados	**106.8**
15	Qatar	**106.3**
16	Hong Kong, China	**104.5**
17	Saudi Arabia	**99.0**
18	United Kingdom	**98.7**
19	United States	**97.9**
20	Norway	**93.0**
21	New Zealand	**92.7**
22	Costa Rica	**86.9**
23	Iceland	**85.3**
24	Ireland	**81.0**
25	Libya	**80.6**
26	Thailand	**79.9**
27	Brazil	**78.1**
28	Spain	**77.1**
29	Switzerland	**76.6**
30	Oman	**73.7**
31	Latvia	**71.7**
32	Suriname	***71.6***
33	Italy	**70.9**
34	Netherlands	**69.1**
35	Croatia	**68.5**
36	Kyrgyzstan	**68.5**
37	Austria	**67.2**
38	Bulgaria	**66.4**
39	France	**66.2**
40	Russian Federation	**65.9**
41	Germany	**63.6**
42	Monaco	**63.2**
43	Czech Republic	**62.8**
44	Poland	***62.3***
45	Serbia	**61.1**
46	Uruguay	**59.8**
47	Canada	***59.8***
48	Kazakhstan	**59.8**
49	Ghana	**59.8**
50	Slovakia	**59.5**
51	Lithuania	**58.6**
52	Malaysia	**58.3**
53	Belgium	**57.8**
54	Mongolia	**57.6**
55	Belarus	**55.0**
56	Argentina	***53.6***
57	Lebanon	**53.5**
58	Israel	**52.2**
59	Cape Verde	**51.3**
60	Chile	**50.5**
61	Botswana	**49.7**
62	Malta	**49.7**
63	Romania	**49.4**
64	Moldova	**49.4**
65	Maldives	**48.9**
66	TFYR Macedonia	**47.7**
67	Tunisia	**47.6**
68	Azerbaijan	**46.8**
69	South Africa	**46.7**
70	Slovenia	**46.7**
71	Portugal	**45.3**
72	Colombia	**45.1**
73	Venezuela	**43.9**
74	Egypt	**43.5**
75	Turkey	**42.7**
76	Fiji	**42.3**
77	Cyprus	**42.1**
78	China	**41.8**
79	Greece	**41.0**
80	Zimbabwe	**39.2**
81	Mexico	**37.5**
82	Andorra	**36.6**
83	Namibia	**35.5**
84	Indonesia	***34.7***
85	El Salvador	**34.4**
86	St. Vincent & the Grenadines	**34.4**
87	Armenia	**34.2**
88	Hungary	**34.0**
89	Jamaica	**33.1**
90	Antigua & Barbuda	***33.0***
91	Lesotho	**32.8**
92	Mauritius	**31.8**
93	Viet Nam	**31.0**
94	Montenegro	**31.0**
95	Albania	**30.9**
96	Ecuador	**30.9**
97	Dominican Rep.	**30.1**
98	St. Lucia	**29.8**

RANK	ECONOMY	MOBILE BROADBAND SUBSCRIPTIONS PER 100 CAPITA
99	Panama	**29.5**
100	Trinidad & Tobago	**28.3**
101	Bhutan	**28.2**
102	Bolivia	**28.1**
103	Philippines	**28.0**
104	Bosnia and Herzegovina	**27.8**
105	Sudan	**27.2**
106	Morocco	**26.8**
107	Vanuatu	**26.2**
108	Côte d'Ivoire	**24.6**
109	Uzbekistan	**23.9**
110	Senegal	**23.7**
111	Georgia	**21.8**
112	Algeria	**20.8**
113	Tonga	**19.3**
114	Jordan	**19.1**
115	Nepal	***17.4***
116	Samoa	**16.4**
117	Angola	**16.4**
118	Honduras	**16.3**
119	Myanmar	**14.9**
120	Uganda	**14.7**
121	Comoros	***14.5***
122	Mauritania	***14.4***
123	Cambodia	***14.0***
124	Peru	***13.7***
125	Sierra Leone	***13.0***
126	Sri Lanka	**13.0**
127	Solomon Islands	**13.0**
128	Bahamas	***12.9***
129	Seychelles	**12.7**
130	Nigeria	**11.7**
131	Mali	**11.3**
132	D.P.R. Korea	***11.2***
133	Rwanda	**11.1**
134	Turkmenistan	***10.9***
135	Congo (Rep.)	***10.8***
136	Iran (I.R.)	**10.7**
137	Belize	***10.2***
138	S. Tomé & Principe	***9.8***
139	Burkina Faso	**9.6**
140	Tajikistan	***9.5***
141	Guatemala	**9.4**
142	Kenya	**9.1**
143	Gambia	**8.0**
144	Swaziland	***8.0***
145	Congo (Dem. Rep.)	**7.9**
146	Liberia	**7.6**
147	Ethiopia	**7.5**
148	Ukraine	***7.5***
149	Bangladesh	**6.4**
150	St. Kitts and Nevis	***6.4***
151	Brunei Darussalam	**6.3**
152	Madagascar	**6.1**
153	Papua New Guinea	***5.8***
154	Syria	**5.7**
155	India	**5.5**
156	Pakistan	**5.1**
157	Yemen	***4.8***
158	Lao P.D.R.	**4.6**
159	Paraguay	**4.2**
160	Dominica	***4.1***
161	Togo	***4.1***
162	Malawi	**4.1**
163	Iraq	**3.6**
164	Djibouti	***3.2***
165	Afghanistan	***3.2***
166	Tanzania	***3.0***
167	Mozambique	**3.0**
168	Benin	**2.8**
169	Guinea	***2.2***
170	Nicaragua	**1.4**
171	South Sudan	**1.3**
172	Grenada	***1.2***
173	Somalia	***1.0***
174	Zambia	**1.0**
175	Niger	***0.9***
176	Timor-Leste	***0.6***
177	Burundi	***0.5***
178	Central African Rep.	***0.3***
179	Guyana	**0.2**
180	Haiti	**0.2**
181	Cameroon	**0.0**
182	Chad	**0.0**
183	Equatorial Guinea	***0.0***
184	Eritrea	***0.0***
185	Gabon	***0.0***
186	Guinea-Bissau	***0.0***
187	Marshall Islands	**0.0**
188	Tuvalu	***0.0***
189	Cuba	**0.0**
	Kiribati	**n/a**
	Liechtenstein	**n/a**
	Micronesia	**n/a**
	Nauru	**n/a**
	San Marino	**n/a**
	Vatican	**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.

Annex 4: Percentage of Households with Internet, Developing Countries, 2014

RANK	ECONOMY	% OF HOUSEHOLDS WITH INTERNET
1	Korea (Rep.)	98.5
2	Qatar	98.0
3	Saudi Arabia	94.0
4	United Arab Emirates	90.1
5	Singapore	88.0
6	Oman	86.2
7	Macao, China	84.3
8	Hong Kong, China	82.4
9	Bahrain	81.0
10	Brunei Darussalam	79.2
11	Kuwait	75.4
12	Israel	71.5
13	Barbados	70.5
14	Cyprus	68.6
15	Lebanon	68.4
16	Malaysia	65.5
17	St. Kitts and Nevis	62.8
18	Turkey	60.2
19	Jordan	60.0
20	Kazakhstan	58.8
21	St. Vincent & the Grenadines	58.5
22	Uruguay	57.4
23	Belarus	57.1
24	Costa Rica	55.1
25	Seychelles	55.0
26	Azerbaijan	54.6
27	Chile	53.9
28	Antigua & Barbuda	52.0
29	Argentina	52.0
30	Morocco	50.4
31	Trinidad & Tobago	50.0
32	Brazil	48.0
33	Mauritius	47.5
34	China	47.4
35	Armenia	46.6
36	Iran (I.R.)	44.7
37	Maldives	44.5
38	Panama	41.6
39	Georgia	41.0
40	Syria	40.9
41	St. Lucia	38.9
42	Colombia	38.0
43	South Africa	37.3
44	Dominica	37.0
45	Egypt	36.8
46	Tonga	35.7
47	Mexico	34.4
48	Venezuela	34.2
49	Thailand	33.8
50	Grenada	32.6
51	Sudan	32.2
52	Ecuador	32.0
53	Indonesia	29.1
54	Fiji	29.0
55	Ghana	29.0
56	Mongolia	29.0
57	Tunisia	28.8
58	Vanuatu	28.8
59	Philippines	26.9
60	Bhutan	26.3
61	Algeria	25.9
62	Jamaica	25.7
63	Cape Verde	24.8
64	Paraguay	24.6
65	Guyana	24.2
66	Peru	23.5
67	El Salvador	23.3
68	Samoa	21.9
69	Dominican Rep.	21.1
70	Belize	21.0
71	Suriname	20.5
72	Honduras	19.6
73	Viet Nam	18.6
74	Swaziland	18.4
75	Libya	18.1
76	Namibia	17.3
77	Bolivia	17.0
78	Iraq	17.0
79	Kenya	16.9
80	India	15.3
81	Sri Lanka	15.3
82	Guatemala	15.0
83	Pakistan	13.2
84	Senegal	12.6
85	Côte d'Ivoire	12.2
86	Botswana	12.1
87	Kyrgyzstan	12.0
88	Nicaragua	11.6
89	Uzbekistan	10.5
90	Gabon	9.7
91	Angola	8.6
92	Gambia	8.5

RANK	ECONOMY	% OF HOUSEHOLDS WITH INTERNET
93	Equatorial Guinea	*8.5*
94	Nigeria	*8.5*
95	Burkina Faso	*8.3*
96	Tajikistan	*7.2*
97	Djibouti	*7.1*
98	Cambodia	*7.0*
99	Zambia	*6.9*
100	Mali	6.7
101	Bangladesh	*6.5*
102	Cameroon	*6.5*
103	Lesotho	*6.5*
104	Malawi	*6.2*
105	Mozambique	*6.2*
106	Mauritania	*6.2*
107	Uganda	*6.2*
108	Zimbabwe	*5.8*
109	Nepal	5.6
110	Solomon Islands	*5.6*
111	Lao P.D.R.	*5.2*
112	Yemen	*5.1*
113	Madagascar	*4.7*
114	Comoros	*4.2*
115	Cuba	4.1
116	Tanzania	4.1
117	Haiti	*4.0*
118	Rwanda	*3.8*
119	Benin	*3.5*
120	Togo	*3.3*
121	Papua New Guinea	*3.1*
122	Myanmar	*3.0*
123	Ethiopia	*2.9*
124	Chad	*2.7*
125	Central African Rep.	*2.7*
126	Liberia	*2.5*
127	Afghanistan	*2.3*
128	Niger	*2.2*
129	Congo (Dem. Rep.)	*2.0*
130	Congo (Rep.)	*1.9*
131	Guinea-Bissau	*1.9*
132	Guinea	*1.5*
133	Eritrea	*1.5*
	Bahamas	*n/a*
	Burundi	*n/a*
	D.P.R. Korea	*n/a*
	Kiribati	*n/a*
	Marshall Islands	*n/a*
	Micronesia	*n/a*
	Nauru	*n/a*
	S. Tomé & Principe	*n/a*
	Sierra Leone	*n/a*
	Somalia	*n/a*
	Timor-Leste	*n/a*
	Turkmenistan	*n/a*
	Tuvalu	*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.

Annex 5. Percentage of Individuals using the Internet, 2014

RANK	ECONOMY	% OF INDIVIDUALS USING INTERNET
1	Iceland	98.2
2	Norway	96.3
3	Denmark	96.0
4	Andorra	95.9
5	Liechtenstein	95.2
6	Luxembourg	94.7
7	Netherlands	93.2
8	Sweden	92.5
9	Monaco	92.4
10	Finland	92.4
11	United Kingdom	91.6
12	Qatar	91.5
13	Bahrain	91.0
14	Japan	90.6
15	United Arab Emirates	90.4
16	United States	87.4
17	Canada	87.1
18	Switzerland	87.0
19	Germany	86.2
20	New Zealand	85.5
21	Belgium	85.0
22	Australia	84.6
23	Korea (Rep.)	84.3
24	Estonia	84.2
25	France	83.8
26	Singapore	82.0
27	Austria	81.0
28	Slovakia	80.0
29	Czech Republic	79.7
30	Ireland	79.7
31	Kuwait	78.7
32	Bahamas	76.9
33	Barbados	76.7
34	Spain	76.2
35	Hungary	76.1
36	Latvia	75.8
37	Lebanon	74.7
38	Hong Kong, China	74.6
39	Malta	73.2
40	Chile	72.4
41	Lithuania	72.1
42	Slovenia	71.6
43	Israel	71.5
44	Russian Federation	70.5
45	Oman	70.2
46	Macao, China	69.8
47	Cyprus	69.3
48	Brunei Darussalam	68.8
49	Croatia	68.6
50	TFYR Macedonia	68.1
51	Malaysia	67.5
52	Poland	66.6
53	St. Kitts and Nevis	65.4
54	Trinidad & Tobago	65.1
55	Argentina	64.7
56	Portugal	64.6
57	Antigua & Barbuda	64.0
58	Saudi Arabia	63.7
59	Greece	63.2
60	Dominica	62.9
61	Italy	62.0
62	Uruguay	61.5
63	Azerbaijan	61.0
64	Montenegro	61.0
65	Bosnia and Herzegovina	60.8
66	Albania	60.1
67	Belarus	59.0
68	Brazil	57.6
69	Venezuela	57.0
70	Morocco	56.8
71	St. Vincent & the Grenadines	56.5
72	Bulgaria	55.5
73	Kazakhstan	54.9
74	Seychelles	54.3
75	Romania	54.1
76	Serbia	53.5
77	Colombia	52.6
78	Turkey	51.0
79	St. Lucia	51.0
80	Dominican Rep.	49.6
81	Costa Rica	49.4
82	China	49.3
83	Maldives	49.3
84	South Africa	49.0
85	Georgia	48.9
86	Viet Nam	48.3
87	Moldova	46.6
88	Armenia	46.3
89	Tunisia	46.2
90	Panama	44.9
91	Mexico	44.4
92	Jordan	44.0
93	Uzbekistan	43.6
94	Kenya	43.4
95	Ukraine	43.4
96	Ecuador	43.0
97	Paraguay	43.0
98	Nigeria	42.7

RANK	ECONOMY	% OF INDIVIDUALS USING INTERNET
99	Fiji	*41.8*
100	Mauritius	*41.4*
101	Jamaica	*40.5*
102	Cape Verde	*40.3*
103	Peru	*40.2*
104	Suriname	*40.1*
105	Tonga	*40.0*
106	Philippines	*39.7*
107	Iran (I.R.)	*39.4*
108	Bolivia	*39.0*
109	Belize	*38.7*
110	Grenada	*37.4*
111	Guyana	*37.4*
112	Thailand	*34.9*
113	Bhutan	*34.4*
114	Egypt	*31.7*
115	Cuba	*30.0*
116	El Salvador	*29.7*
117	Micronesia	*29.7*
118	Kyrgyzstan	*28.3*
119	Syria	*28.1*
120	Swaziland	*27.1*
121	Mongolia	*27.0*
122	Sri Lanka	*25.8*
123	Sudan	*24.6*
124	S. Tomé & Principe	*24.4*
125	Guatemala	*23.4*
126	Yemen	*22.6*
127	Angola	*21.3*
128	Samoa	*21.2*
129	Zimbabwe	*19.9*
130	Honduras	*19.1*
131	Ghana	*18.9*
132	Equatorial Guinea	*18.9*
133	Vanuatu	*18.8*
134	Botswana	*18.5*
135	Algeria	*18.1*
136	India	*18.0*
137	Libya	*17.8*
138	Uganda	*17.7*
139	Senegal	*17.7*
140	Nicaragua	*17.6*
141	Tajikistan	*17.5*
142	Zambia	*17.3*
143	Indonesia	17.1
144	Marshall Islands	*16.8*
145	South Sudan	*15.9*
146	Gambia	*15.6*
147	Nepal	*15.4*
148	Namibia	*14.8*
149	Côte d'Ivoire	*14.6*
150	Lao P.D.R.	*14.3*
151	Pakistan	*13.8*
152	Kiribati	*12.3*
153	Turkmenistan	*12.2*
154	Haiti	*11.4*
155	Iraq	*11.3*
156	Cameroon	*11.0*
157	Lesotho	*11.0*
158	Djibouti	*10.7*
159	Mauritania	*10.7*
160	Rwanda	*10.6*
161	Gabon	*9.8*
162	Bangladesh	*9.6*
163	Burkina Faso	*9.4*
164	Papua New Guinea	*9.4*
165	Cambodia	*9.0*
166	Solomon Islands	*9.0*
167	Congo (Rep.)	*7.1*
168	Mali	*7.0*
169	Comoros	*7.0*
170	Afghanistan	*6.4*
171	Mozambique	*5.9*
172	Malawi	*5.8*
173	Togo	*5.7*
174	Liberia	*5.4*
175	Benin	*5.3*
176	Tanzania	*4.9*
177	Central African Rep.	*4.0*
178	Madagascar	*3.7*
179	Guinea-Bissau	*3.3*
180	Congo (Dem. Rep.)	*3.0*
181	Ethiopia	*2.9*
182	Chad	*2.5*
183	Sierra Leone	*2.1*
184	Myanmar	*2.1*
185	Niger	*2.0*
186	Guinea	*1.7*
187	Somalia	*1.6*
188	Burundi	*1.4*
189	Timor-Leste	*1.1*
190	Eritrea	*1.0*
191	D.P.R. Korea	*0.0*
	Nauru	n/a
	Tuvalu	n/a
	San Marino	n/a
	Vatican	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.

Annex 6: Percentage of Individuals using the Internet, Developing Countries, 2014

RANK	ECONOMY	% OF INDIVIDUALS USING INTERNET
1	Qatar	91.5
2	Bahrain	91.0
3	United Arab Emirates	90.4
4	Korea (Rep.)	84.3
5	Singapore	82.0
6	Kuwait	78.7
7	Bahamas	76.9
8	Barbados	76.7
9	Lebanon	74.7
10	Hong Kong, China	74.6
11	Chile	72.4
12	Israel	71.5
13	Oman	70.2
14	Macao, China	69.8
15	Cyprus	69.3
16	Brunei Darussalam	68.8
17	Malaysia	67.5
18	St. Kitts and Nevis	65.4
19	Trinidad & Tobago	65.1
20	Argentina	64.7
21	Antigua & Barbuda	64.0
22	Saudi Arabia	63.7
23	Dominica	62.9
24	Uruguay	61.5
25	Azerbaijan	61.0
26	Belarus	59.0
27	Brazil	57.6
28	Venezuela	57.0
29	Morocco	56.8
30	St. Vincent & the Grenadines	56.5
31	Kazakhstan	54.9
32	Seychelles	54.3
33	Colombia	52.6
34	Turkey	51.0
35	St. Lucia	51.0
36	Dominican Rep.	49.6
37	Costa Rica	49.4
38	China	49.3
39	Maldives	49.3
40	South Africa	49.0
41	Georgia	48.9
42	Viet Nam	48.3
43	Armenia	46.3
44	Tunisia	46.2
45	Panama	44.9
46	Mexico	44.4
47	Jordan	44.0
48	Uzbekistan	43.6

RANK	ECONOMY	% OF INDIVIDUALS USING INTERNET
49	Kenya	43.4
50	Ecuador	43.0
51	Paraguay	43.0
52	Nigeria	42.7
53	Fiji	41.8
54	Mauritius	41.4
55	Jamaica	40.5
56	Cape Verde	40.3
57	Peru	40.2
58	Suriname	40.1
59	Tonga	40.0
60	Philippines	39.7
61	Iran (I.R.)	39.4
62	Bolivia	39.0
63	Belize	38.7
64	Grenada	37.4
65	Guyana	37.4
66	Thailand	34.9
67	Bhutan	34.4
68	Egypt	31.7
69	Cuba	30.0
70	El Salvador	29.7
71	Micronesia	29.7
72	Kyrgyzstan	28.3
73	Syria	28.1
74	Swaziland	27.1
75	Mongolia	27.0
76	Sri Lanka	25.8
77	Sudan	24.6
78	S. Tomé & Principe	24.4
79	Guatemala	23.4
80	Yemen	22.6
81	Angola	21.3
82	Samoa	21.2
83	Zimbabwe	19.9
84	Honduras	19.1
85	Ghana	18.9
86	Equatorial Guinea	18.9
87	Vanuatu	18.8
88	Botswana	18.5
89	Algeria	18.1
90	India	18.0
91	Libya	17.8
92	Uganda	17.7
93	Senegal	17.7
94	Nicaragua	17.6
95	Tajikistan	17.5
96	Zambia	17.3

RANK	ECONOMY	% OF INDIVIDUALS USING INTERNET
97	Indonesia	**17.1**
98	Marshall Islands	***16.8***
99	Gambia	***15.6***
100	Nepal	***15.4***
101	Namibia	***14.8***
102	Côte d'Ivoire	***14.6***
103	Lao P.D.R.	***14.3***
104	Pakistan	***13.8***
105	Kiribati	***12.3***
106	Turkmenistan	***12.2***
107	Haiti	***11.4***
108	Iraq	***11.3***
109	Cameroon	***11.0***
110	Lesotho	***11.0***
111	Djibouti	***10.7***
112	Mauritania	***10.7***
113	Rwanda	***10.6***
114	Gabon	***9.8***
115	Bangladesh	***9.6***
116	Burkina Faso	***9.4***
117	Papua New Guinea	***9.4***
118	Cambodia	***9.0***
119	Solomon Islands	***9.0***
120	Congo (Rep.)	***7.1***
121	Mali	***7.0***
122	Comoros	***7.0***
123	Afghanistan	***6.4***
124	Mozambique	***5.9***
125	Malawi	***5.8***
126	Togo	***5.7***
127	Liberia	***5.4***
128	Benin	***5.3***
129	Tanzania	***4.9***
130	Central African Rep.	***4.0***
131	Madagascar	***3.7***
132	Guinea-Bissau	***3.3***
133	Congo (Dem. Rep.)	***3.0***
134	Ethiopia	***2.9***
135	Chad	***2.5***
136	Sierra Leone	***2.1***
137	Myanmar	***2.1***
138	Niger	***2.0***
139	Guinea	***1.7***
140	Somalia	***1.6***
141	Burundi	***1.4***
142	Timor-Leste	***1.1***
143	Eritrea	***1.0***
144	D.P.R. Korea	***0.0***
	Nauru	**n/a**
	Tuvalu	**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.

Annex 7: Percentage of Individuals using the Internet, Least Developed Countries (LDCs), 2014

RANK	ECONOMY	% OF INDIVIDUALS USING INTERNET
1	Bhutan	*34.4*
2	Sudan	*24.6*
3	S. Tomé & Principe	*24.4*
4	Yemen	*22.6*
5	Angola	*21.3*
6	Samoa	*21.2*
7	Equatorial Guinea	*18.9*
8	Vanuatu	*18.8*
9	Uganda	*17.7*
10	Senegal	*17.7*
11	Zambia	*17.3*
12	South Sudan	*15.9*
13	Gambia	*15.6*
14	Nepal	*15.4*
15	Lao P.D.R.	*14.3*
16	Kiribati	*12.3*
17	Haiti	*11.4*
18	Lesotho	*11.0*
19	Djibouti	*10.7*
20	Mauritania	*10.7*
21	Rwanda	*10.6*
22	Bangladesh	*9.6*
23	Burkina Faso	*9.4*
24	Cambodia	*9.0*
25	Solomon Islands	*9.0*
26	Mali	*7.0*
27	Comoros	*7.0*
28	Afghanistan	*6.4*
29	Mozambique	*5.9*
30	Malawi	*5.8*
31	Togo	*5.7*
32	Liberia	*5.4*
33	Benin	*5.3*
34	Tanzania	*4.9*
35	Central African Rep.	*4.0*
36	Madagascar	*3.7*
37	Guinea-Bissau	*3.3*
38	Congo (Dem. Rep.)	*3.0*
39	Ethiopia	*2.9*
40	Chad	*2.5*
41	Sierra Leone	*2.1*
42	Myanmar	*2.1*
43	Niger	*2.0*
44	Guinea	*1.7*
45	Somalia	*1.6*
46	Burundi	*1.4*
47	Timor-Leste	*1.1*
48	Eritrea	*1.0*
	Tuvalu	*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

ARPU	Average Revenue Per User
CAGR	Compound Annual Growth Rate
FTTH	Fibre-to-the-Home
GIS	Geographical Information System
GNI	Gross National Income
GSA	Global mobile Suppliers Association
GSMA	Groupe Spéciale Mobile Association
IP	Internet Protocol
IPA	Investment Promotion Agency
IPTV	Internet Protocol Television
ISPs	Internet Service Providers
ITSO	International Telecommunications Satellite Organization
ITU	International Telecommunication Union
LDCs	Least Developed Countries
LLDCs	Landlocked Developing Countries
LLU	Local Loop Unbundling
LTE	Long-Term Evolution
M2M	Machine-to-Machine
MDGs	Millennium Development Goals
MVNO	Mobile Virtual Network Operator
NBP	National Broadband Plan
NFV	Network Function Virtualization
NGN	Next-Generation Network
OTT	Over-The-Top
PPP	Public Private Partnership
QoS	Quality of Service
RFID	Radio-Frequency Identification
RoI	Return on Investment
SDGs	Sustainable Development Goals
SDN	Software Defined Networking
SIDS	Small Island Developing States
SMS	Short Message System
STEM	Science, Technology, Engineering and Mathematics
TVWS	TV White Spaces
UAS	Universal Access and Service
UAV	Unmanned Aerial Vehicle
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USFs	Universal Service Funds
USO	Universal Service Obligation
USP	Universal Service Provider
VAT	Value-Added Tax
VoIP	Voice over Internet Protocol
WSN(s)	Wireless Sensor Network(s)

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