Measuring the Information Society Report

2016

Measuring the Information Society Report

2016

International Telecommunication Union
Place des Nations
CH-1211 Geneva Switzerland

Original language of publication: English

ISBN:
978-92-61-21421-0 (paper version)
978-92-61-21431-9 (electronic version)
978-92-61-21581-1 (epub)
978-92-61-21591-0 (moby)

Foreword

It is my pleasure to present to you the latest edition of the *Measuring the Information Society Report*. This annual report presents a global and regional overview of the latest developments regarding information and communication technologies (ICTs), based on internationally comparable data and agreed methodologies. It aims to stimulate the ICT policy debate in ITU Member States by providing an objective assessment of how countries have performed in the field of ICT and by highlighting areas that need further improvement.

One of the core features of the Report is the ICT Development Index (IDI). This year's results show that nearly all of the 175 countries covered by the index improved their IDI values between 2015 and 2016. During the same period, stronger improvements have been made on ICT use than access, mainly as a result of strong growth in mobile-broadband uptake globally. This has allowed an increasing number of people, in particular from the developing world, to join the information society and benefit from the many services and applications provided through the Internet.

This year, for the first time, the Report also shows countries' rankings according to their improvement in IDI value. The results show strong improvements in performance throughout the world; a number of middle-income developing countries in particular are reaping the benefits of more liberalized and competitive ICT markets that encourage innovation and ICT uptake across all sectors.

Despite these encouraging developments, we need to focus on the countries that are among the least connected in the world. Urgent action is required to address this persistent digital divide if we want to achieve the Sustainable Development Goals (SDGs) enshrined in the 2030 Agenda for Sustainable Development. For example, the Report shows that in some low-income countries, between 20 and 40 per cent of people still do not own a mobile phone and that the gender gap in mobile phone ownership is substantially higher.

This year's Report takes a closer look at barriers to Internet uptake. New data show that while 84 per cent of the world's people live in an area where mobile-broadband services are offered, only 47 per cent are actually using the Internet. While infrastructure deployment is crucial, high prices and other barriers prevent people from entering the digital world.

The price of the service (and of the device) remains a critical determinant for whether people make use of ICTs. I am pleased to see that, globally, the prices for fixed and mobile communication services continued to fall over the past year. The reduction in mobile-broadband prices is particularly pleasing, as it leads not only to more people being connected to the Internet but also to more intense Internet usage among those who are already online.

The availability and affordability of high-speed fixed-broadband services nevertheless remain a challenge in the majority of low-income countries. In the world's least developed countries, a fixed-broadband plan with a minimum of 1GB of data per month still corresponds, on average, to over 60 per cent of GNI per capita. In addition, in those least developed countries where the service is offered, speed and quality are usually lower than in developed countries. This is a constraint not only for the domestic business sector but also in

terms of using ICTs to accelerate the achievement of the Sustainable Development Goals (SDGs), through e-agriculture, e-health, e-education, e-governance, gender equality, just to mention a few.

Education and income levels are strong determinants, not only of whether or not people use the Internet, but also of how they use it. The Report finds that Internet users with higher levels of education use more advanced services, such as e-commerce and online financial and government services, to a higher degree than Internet users with lower levels of education and income levels, who use the Internet predominantly for communication and entertainment purposes.

In line with the more integrated development approach adopted in the 2030 Agenda for Sustainable Development, ITU is working in close cooperation with other United Nations agencies and the private sector to raise awareness of and harmonize development policy approaches in order to create an enabling collaborative environment. This - with no doubt- will help us leverage the full potential of ICTs for the achievement of socio-economic development for all.

Brahima Sanou
Director
Telecommunication Development Bureau (BDT)
International Telecommunication Union

Acknowledgements

The 2016 edition of the Measuring the Information Society Report was prepared by the ICT Data and Statistics Division within the Telecommunication Development Bureau of ITU. The team comprised Susan Teltscher (Head of Division), Fredrik Eriksson, Vanessa Gray, Esperanza Magpantay, Lourdes Montenegro and Ivan Vallejo. David Souter, consultant to ITU, provided substantive contributions to Chapters 1, 2 and 3. Halvor Sannæs and Josie Sephton from Strategy Analytics Ltd. provided substantive inputs to Chapter 4. Joss Gillet from GSMA Intelligence, Mariama Deen-Swarray from Research ICT Africa, Alexander Moler from InterMedia and Shazna Zuhyle from LIRNEasia provided useful comments and insights for data used in Chapter 5. Helpful inputs were received from Daniela Pokorna during her internship at ITU. Nathalie Delmas provided statistical and desktop publishing assistance. The work was carried out under the overall direction of Cosmas Zavazava, Chief, Project Support and Knowledge Management Department, Telecommunication Development Bureau.

Halvor Sannæs and Josie Sephton from Strategy Analytics Ltd., André Wills, Fernando Callorda, Lisa Kreuzenbeck and Shazna Zuhyle contributed to the compilation of datasets on prices.

The report includes data from Eurostat, OECD, IMF, the UNESCO Institute for Statistics, the United Nations Population Division and the World Bank, which are duly acknowledged.

ITU also appreciates the cooperation of countries that have provided data included in this report.

The report was edited by the ITU English Translation Section, led by Bruce Granger. The desktop publishing was carried out by the ITU Publication Production Service, led by Simon De Nicola, and the cover was designed by Jesús Vicente.

Table of Contents

List of tables, figures, charts and boxes

Tables

Figures

Boxes

Charts

Chapter 1. The ICT Development Index (IDI) – Global Analysis

Key findings

The ITU ICT Development Index (IDI) is a unique benchmark of the level of ICT development in countries across the world. The IDI combines eleven indicators on ICT access, use and skills, capturing key aspects of ICT development in one measure that allows for comparisons across countries and over time. The IDI 2016, which covers 175 economies worldwide and makes comparisons to IDI 2015, highlights both progress and persistent divides in the global information society.

Nearly all countries improved their IDI values over the last year, but great disparities continue to exist between more and less connected countries. The average IDI value rose by 0.20 points to 4.94 points (out of 10), with smaller increases at the top and at the bottom of the list. The gap between the highest and lowest performing countries – one measure of the digital divide – remained almost unchanged, at 7.76 points in IDI 2016.

The Republic of Korea tops the IDI rankings in 2016 for the second consecutive year. The top 10 countries also include two other economies in the Asia-Pacific region, and seven European countries. This reflects the high level of ICT investment and innovation occurring in developed and high-income developing economies. The majority of high-performing countries have liberalized and competitive ICT markets that encourage innovation. They also have populations with relatively high incomes and the skills needed to make effective use of ICTs.

There is a strong association between economic and ICT development, with least developed countries at a particular disadvantage. The average IDI value for developed countries (7.40) is 3.33 points higher than that for developing countries (4.07), although developing countries improved their IDI value more than developed countries. There is also a strong association between least connected countries, countries that are in the bottom quartile of the IDI 2016 distribution, and least developed countries. Indeed, the bottom 27 countries are all least developed countries, and the gap in IDI values between these countries and higher-performing developing countries continues to widen.

There has been greater improvement in ICT use than access. The use sub-index rose by an average 0.37 points, compared with an increase of 0.13 points in the access sub-index, making ICT use a greater factor of change in IDI outcomes between 2015 and 2016. The increase in the IDI use sub-index was mainly a result of strong growth in mobile-broadband subscriptions across the world. In most regions, the increase in ICT access mainly related to progress made in connecting more households to the Internet, while in Africa improvements in mobile-cellular penetration had a greater impact on the value of the IDI access sub-index.

Countries from around the world showed strong improvements in performance. The greatest improvement was achieved by St. Kitts and Nevis, which rose from 54th place in 2015 to 34th place in 2016. Other countries showing substantial ICT progress include Myanmar, Algeria and Bhutan. The experiences in investment, policy and regulation of top-ranking and dynamic economies – discussed in further detail in this chapter – are a source of valuable insights for governments and businesses worldwide.

Chapter 1. The ICT Development Index (IDI) – Global Analysis

1.1 Introduction and overview

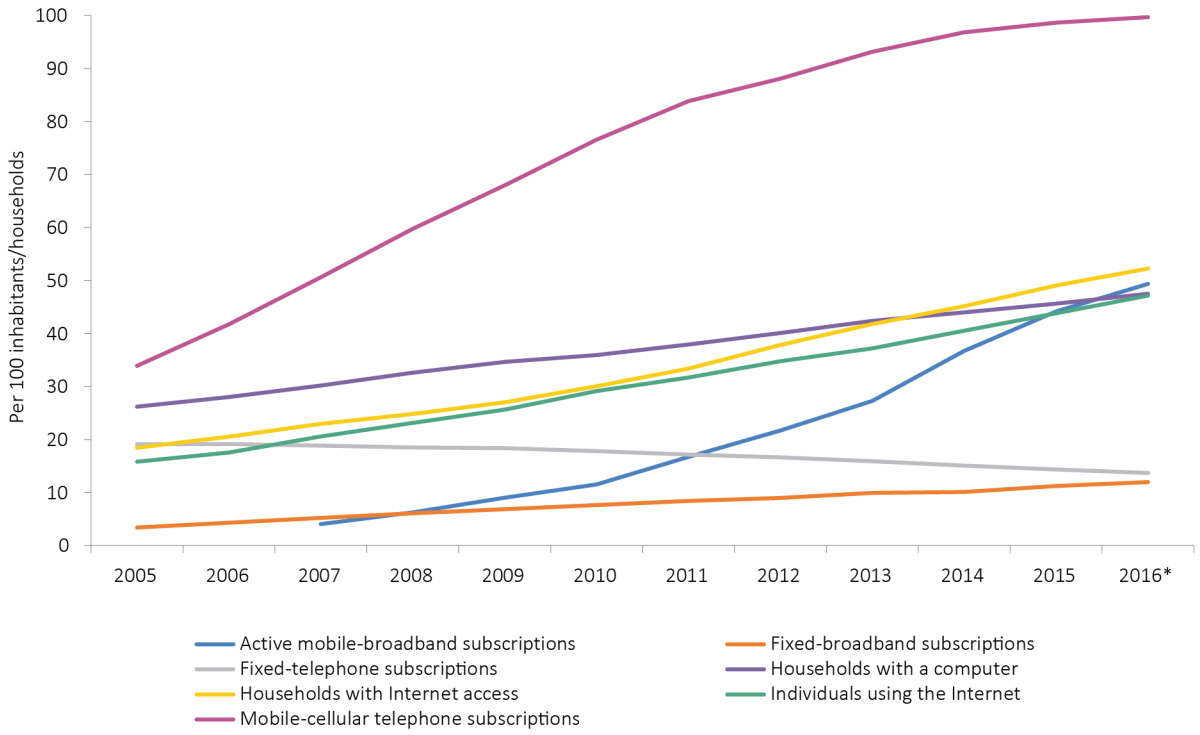
The period since the conclusion of the World Summit on the Information Society (WSIS) in 2005 has seen rapid growth in access to and use of information and communication technologies (ICTs) throughout the world. However, the potential impact of ICTs is still constrained by digital divides between different countries and communities. The International Telecommunication Union (ITU) documents the pervasiveness of ICTs and the extent of digital divides between regions and countries through its annual **ICT Development Index** (IDI), which aggregates quantitative indicators for ICT access, ICT use and ICT skills in the large majority of world economies.

The results of IDI 2016 are analysed in Chapters 1 and 2 of this report. This introductory section gives a brief overview of recent progress in the context of developments since 2005.[1]

Chart 1.1 illustrates the long-term trend in penetration rates for various ICTs since 2005.

It shows that the steep rise in mobile-cellular subscriptions worldwide, which began early in this century, is now tailing off, as the global penetration rate approaches 100 subscriptions per 100 inhabitants (although it should be noted that, because some people have multiple subscriptions, the proportion of unique mobile-cellular subscribers is significantly lower (GSMA, 2016c). At the same time, there has been a gradual decline in the penetration rate for fixed-telephone subscriptions, owing to fixed-mobile substitution

Chart 1.1: Global changes in levels of ICT uptake per 100 inhabitants, key ICT indicators, 2005-2016*



Notes: * ITU estimates.
Source: ITU.

and the tendency for new users to prefer mobile over fixed lines.

The growth in mobile-broadband subscriptions worldwide has also been marked, and has paralleled that of mobile-cellular subscriptions in the last five years, albeit at a lower level, rising from one fifth to one half of the penetration rate for mobile-cellular subscriptions between 2011 and 2016. This has helped to drive steady growth in the percentage of individuals using the Internet (defined as those who have used the Internet at least once in the last three months) and of households with Internet access. The latter indicator has now overtaken the percentage of households with a computer.

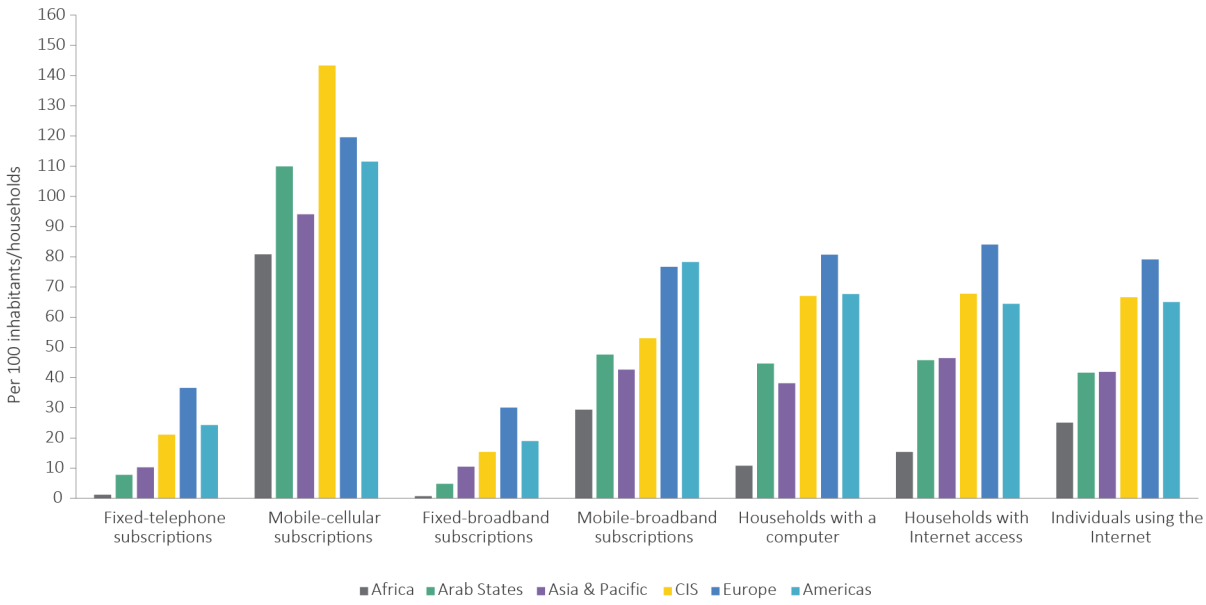
These global figures, however, mask substantial differences between countries in different regions and with different levels of development. Chart 1.2 compares the 2016 figures for the seven ICT penetration indicators in Chart 1.1 between the ITU's six geographic regions, while Chart 1.3 compares the figures for developed countries, developing countries and least developed countries (LDCs).

These charts illustrate the continued and significant digital divide between regions, between developed and developing countries, and between the majority of developing countries and LDCs. While penetration rates for mobile-cellular subscriptions are now high in all regions, and exceed 100 subscriptions per 100 inhabitants in four of them, they are still significantly lower in the Asia-Pacific and Africa regions, and in LDCs. (In analysing these charts, it should be noted that the developing-country category includes some OECD and high-income countries.) Internet and computer access as well as penetration rates for broadband networks are also higher in the Europe, CIS and Americas regions, which are predominantly composed of developed countries and middle-income developing countries, than in the other regions.

The results for LDCs on these ICT indicators are particularly poor, especially where fixed-telephone and fixed-broadband subscriptions are concerned. The lowly position of LDCs reflects the substantial digital divide between LDCs and other countries, which remains an important issue and has particular significance for efforts to use ICTs to support achievement of the Sustainable Development Goals (SDGs) adopted by the UN General Assembly in 2015 (see Chapter 3 of this report).

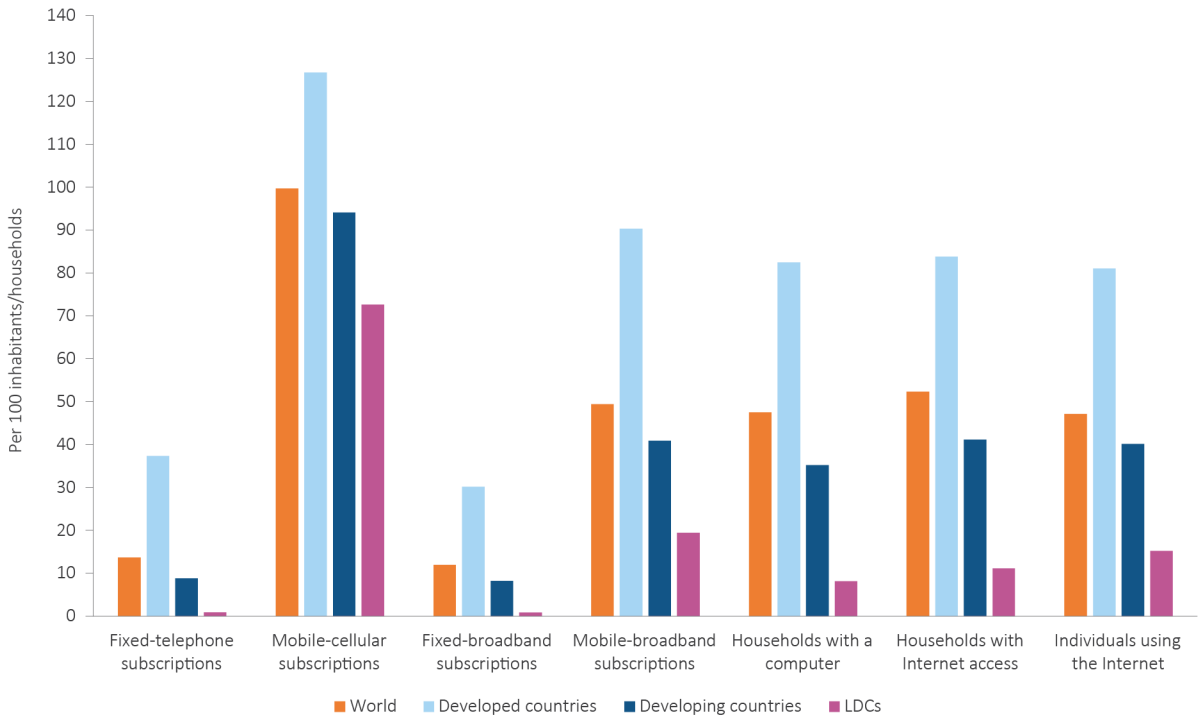
The remainder of this chapter analyses the IDI results for 2016.

Chart 1.2: ICT penetration levels, 2016*, by geographic region



Notes: * ITU estimates.
Source: ITU.

Chart 1.3: ICT penetration levels, 2016*, by level of development



Notes: * ITU estimates.
Source: ITU.

1.2 The ICT Development Index (IDI)

The IDI is a composite index that combines 11 indicators into one benchmark measure which can be used to monitor and compare developments in ICT between countries and over time. The IDI was developed by ITU in 2008 in response to ITU Member States' request to establish an overall ICT index, was first presented in the 2009 edition of the *Report* (ITU, 2009), and has been published annually since then.[2]

This chapter presents the findings for IDI 2016, which is calculated using data at end 2015, and assesses progress by comparing these data with those for IDI 2015 (calculated using data at end 2014).

- This section, 1.2, describes the objectives, conceptual framework and methodology of the IDI.
- Section 1.3 presents and analyses global findings for IDI 2016, highlighting high-performing countries and most dynamic countries (i.e. those displaying the largest improvements in their IDI over the year).
- Section 1.4 analyses the implications of IDI 2016 for measuring the digital divide, with reference to longer-term trends identified in the assessment of progress between 2010 and 2015 made in the 2015 edition of the *Report* (ITU, 2015). It relates the IDI to GNI p.c., and considers the particular contexts of LDCs and least connected countries (LCCs).
- Section 1.5 summarizes the chapter and draws conclusions.

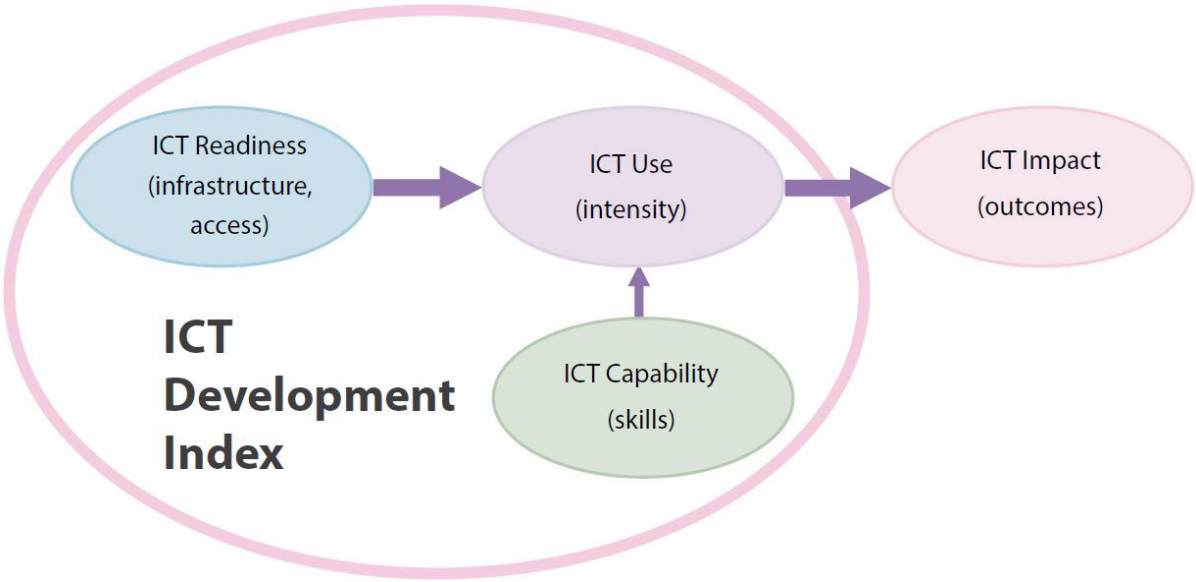
Regional outcomes from IDI 2016 are analysed in Chapter 2.

Objectives

The main objectives of the IDI are to measure:

- the *level and evolution over time* of ICT developments within countries and their experience relative to other countries;
- progress in ICT development *in both developed and developing countries*;

Figure 1.1: Three stages in the evolution towards an information society



- the *digital divide*, i.e. differences between countries in terms of their levels of ICT development; and

- the *development potential* of ICTs and the extent to which countries can make use of them to enhance growth and development in the context of available capabilities and skills.

The Index is designed to be global and to reflect changes taking place in countries at different levels of ICT development. It therefore relies on a limited data set which can be established with reasonable confidence in countries at all levels of development.

Conceptual framework

The recognition that ICTs can be development enablers, if applied and used appropriately, is critical to countries that are moving towards information- or knowledge-based societies, and is central to the IDI's conceptual framework. The ICT development process, and a country's transformation to becoming an information society, can be depicted using the three-stage model illustrated in Figure 2.1:

- **Stage 1: *ICT readiness*** – reflecting the level of networked infrastructure and ***access*** to ICTs;

- **Stage 2: *ICT intensity*** – reflecting the level of ***use*** of ICTs in the society; and

- **Stage 3: *ICT impact*** – reflecting the results/ outcomes of more efficient and effective ICT use.

Advancing through these stages depends on a combination of three factors: the availability of ICT infrastructure and *access*, a high level of ICT *usage*, and the capability to use ICTs effectively, derived from relevant *skills*. These three dimensions – ***ICT access, ICT use*** and ***ICT skills*** – therefore form the framework for the IDI.

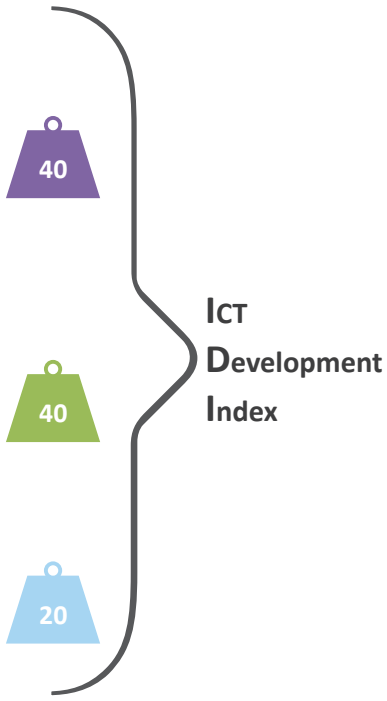
- The first two stages correspond to two major components of the IDI: ***ICT access*** and ***ICT use***.

- Reaching the final stage, and maximizing the impact of ICTs, crucially depends on ***ICT skills***. ICT – and other – skills determine the effective use that is made of ICTs, and are critical to leveraging their full potential for social and economic development. Economic growth and development will remain below potential if economies are not capable of exploiting new technologies and reaping their benefits. The IDI therefore also includes indicators concerned with capabilities within countries which affect people's ability to use ICTs effectively.

A single indicator cannot track progress in all three of these components of ICT development. It is therefore necessary to construct a composite index, which aims to capture the evolution of the information society as it goes through its different

Figure 1.2: ICT Development Index: indicators, reference values and weights

ICT access	Reference value	(%)
1. Fixed-telephone subscriptions per 100 inhabitants	60	20
2. Mobile-cellular telephone subscriptions per 100 inhabitants	120	20
3. International Internet bandwith (bit/s) per internet user	976'696*	20
4. Percentage of households with a computer	100	20
5. Percentage of households with Internet access	100	20
ICT use	**Reference value**	**(%)**
6.Percentage of individuals using the Internet	100	33
7. Fixed-broadband subscriptions per 100 inhabitants	60	33
8. Active mobile-broadband subscriptions per 100 inhabitants	100	33
ICT skills	**Reference value**	**(%)**
9. Mean years of schooling	15	33
10. Secondary gross enrolment ratio	100	33
11. Tertiary gross enrolment ratio	100	33



Note: * This corresponds to a log value of 5.99, which was used in the normalization step.
Source: ITU.

stages of development, taking into consideration technology convergence and the emergence of new technologies.

Based on this conceptual framework, the IDI is divided into the following three sub-indices, which are illustrated, with their component indicators, in Figure 1.2:

- ***Access sub-index*:** This sub-index captures ICT readiness, and includes five infrastructure and access indicators (fixed-telephone subscriptions, mobile-cellular telephone subscriptions, international Internet bandwidth per Internet user, households with a computer, and households with Internet access).
- ***Use sub-index*:** This sub-index captures ICT intensity, and includes three intensity and usage indicators (individuals using the Internet, fixed-broadband subscriptions, and mobile-broadband subscriptions).
- ***Skills sub-index*:** This sub-index seeks to capture capabilities or skills which are important for ICTs. It includes three proxy indicators (mean years of schooling, gross secondary enrolment, and gross tertiary enrolment). As these are proxy indicators, rather than direct measures of ICT-related skills, the skills sub-index is given less weight in the computation of the IDI than the other two sub-indices.[3]

The choice of indicators included in these sub-indices reflects the corresponding stage of transformation to the information society. The indicators in each sub-index may therefore change over time to reflect technological developments related to ICTs and improvements in the availability and quality of data. For example, subscription to what was considered basic infrastructure in the past – such as fixed-telephone lines – is fast becoming less essential because of the growth in mobile networks and fixed-mobile substitution. Similarly, while broadband has historically been considered an advanced technology, and is therefore included as an indicator in the use sub-index, it is increasingly considered essential and may become more appropriate to the access sub-index.

Methodology

The IDI includes 11 indicators. A detailed definition of each indicator is provided in Annex 1.

The indicators used to calculate the IDI were selected on the basis of the following criteria:

- *The relevance of a particular indicator in contributing to the main objectives and conceptual framework of the IDI.* For example, the selected indicators must be relevant to both developed and developing countries, and should reflect, so far as possible, the framework's three components as described above.

- *Data availability and quality.* Data are required for a large number of countries, as the IDI is a global index. There is a shortage of ICT-related data, especially on usage, in the majority of developing countries. In addition, as indicators which are directly related to ICT skills are not available for most countries, it has been necessary to use proxy rather than direct indicators in the skills sub-index.

- *The results of various statistical analyses*. Principal components analysis (PCA) is used to examine the underlying nature of the data and explore whether their different dimensions are statistically well-balanced.

An assessment of the statistical approach taken to the IDI was undertaken for ITU during 2015 by the Composite Indicators Research Group of the European Commission's Joint Research Centre. The main goal of the exercise was to ensure that the IDI is a transparent, statistically credible and legitimate tool for improved policy-making.

The results of the assessment were summarized in the 2015 edition of the *Report* (ITU, 2015).[4] It found that the IDI was developed using international quality standards and tested using state-of-the-art statistical analyses. The three-level structure of the IDI was found to be statistically sound in terms of coherence and balance and the IDI had high statistical reliability. Its added value was seen to lie in its ability to summarize different aspects of ICT development in a more efficient and economical manner than would be the case with eleven separate indicators.

While the core methodology of the IDI has remained the same since it was first published, adjustments are made year on year in accordance with the criteria listed above, while also reflecting the dynamic nature of the ICT sector and related data availability.

The indicators included in the IDI and its sub-indices are therefore regularly reviewed in ITU, in consultation with experts. Indicator definitions and the IDI methodology are discussed in the ITU Expert Group on Telecommunication/ICT Indicators (EGTI) and the ITU Expert Group on ICT Household Indicators (EGH) (see Box 1.1). In 2015, EGTI amended the skills sub-index of the IDI by substituting the indicator 'mean years of schooling' for the indicator 'adult literacy rate'. As a result, the IDI values and rankings for 2015 and 2016 included in this year's report are not directly comparable with those published in previous editions of the annual *Measuring the Information Society Report*.

Box 1.1: The ITU Expert Groups on Telecommunication/ICT Indicators and on ICT Household Indicators

Much of ITU's work in the area of indicator definitions and methodologies is carried out through its two expert groups: the Expert Group on Telecommunication/ICT Indicators (EGTI)[5] and the Expert Group on ICT Household Indicators (EGH).[6] Created in 2009 and 2012, respectively, these expert groups review and revise ITU's supply-side and demand-side statistics, and discuss methodological issues and new indicators. Both groups, which are open to all ITU members and to experts in ICT statistics and data collection, work through online discussion forums and occasional face-to-face meetings. They periodically report to the World Telecommunication/ICT Indicators Symposium (WTIS), ITU's main forum on ICT statistics. Interested experts are invited to join the EGTI and/or EGH discussion to share experiences, contribute to discussions and participate in the decision-making process.

Data for IDI 2016 were collected at the beginning of 2016, and refer to the situation at end 2015. Data for IDI 2015 used for comparative purposes in this report have also been adjusted to take account of corrections and updates to data previously reported.

IDI 2016 was computed using the same methodology as in the past, applying the following steps (see also Figure 1.2 and Annex 1):

- *Preparation of the complete data set.* This step included filling in missing values using a variety of statistical techniques.
- *Normalization of data*. This is required in order to transform the values of IDI indicators into the same unit of measurement. The chosen normalization method is the distance to a reference value, either 100 or a value obtained through an appropriate statistical procedure.
- *Rescaling of data*. The data were rescaled on a scale from 0 to 10 in order to compare the values of the indicators and the sub-indices.
- *Weighting of indicators and sub-indices*. Indicator weights were chosen based on PCA results. The access and use sub-indices were given equal weight (40 per cent each), while the skills sub-index was given lesser weight (20 per cent) as it is based on proxy indicators.

1.3 Global IDI analysis

The IDI 2016 results show that there continue to be significant differences in the levels of ICT development between countries and regions around the world. IDI values range from a low of 1.07 in Niger to a high of 8.84 in the Republic of Korea (within a possible range from 0 to 10).

The average IDI value among the 175 economies included in IDI 2016 was 4.94.

Summary data for the IDI and its three sub-indices in 2016 and 2015 are set out in Tables 1.1 to 1.5. Data for IDI 2015 in these and subsequent tables have been recalculated to accommodate changes in the Index as described in section 1.2.

Table 1.1 shows that the average IDI value increased by 0.20 points over the year, from 4.74 to 4.94, with a higher rate of growth in the average use sub-index value (which rose by 0.37 points, from 3.54 to 3.91) than in the average access sub-index value (which rose by 0.13 points, from 5.45 to 5.58). The skills sub-index remained unchanged at 5.74, since, for reasons of data availability, the same data have been used for both 2016 and 2015 in this sub-index.

The IDI results for all economies included in the Index in 2015 and 2016 are set out in Table 1.2, while results relating to the access, use and skills sub-indices are set out in Tables 1.3, 1.4 and 1.5, respectively. The economies listed in Table 1.2 have been divided into four quartiles according to their IDI rankings, as follows:

- The high quartile includes the 44 top-ranked countries, from the Republic of Korea with an IDI value of 8.84 to Portugal with an IDI value of 6.94.
- The upper-middle quartile includes the next 42 countries in the rankings, from Saudi Arabia with an IDI value of 6.90 to Maldives with an IDI value of 5.04.
- The lower-middle quartile includes the next group of 45 countries, from Seychelles with an IDI value of 5.03 to Nicaragua with an IDI value of 2.88.

Table 1.1: IDI values and changes in value, 2015-2016

	IDI 2016						IDI 2015						Change in average value 2016-2015
	Average value*	Min.	Max.	Range	StDev	CV	Average value*	Min.	Max.	Range	StDev	CV	
IDI	4.94	1.07	8.84	7.76	2.22	44.95	4.74	1.00	8.78	7.78	2.23	47.01	0.20
Access sub-index	5.58	1.34	9.54	8.21	2.16	38.71	5.45	1.28	9.49	8.21	2.18	40.08	0.13
Use sub-index	3.91	0.12	8.91	8.78	2.47	63.23	3.54	0.06	8.84	8.78	2.48	69.88	0.37
Skills sub-index	5.74	1.01	9.18	8.17	2.19	38.15	5.74	1.01	9.18	8.17	2.19	38.15	0.00

Note: *Simple averages. StDev= Standard deviation, CV= Coefficient of variation
Source: ITU.

Table 1.2: IDI rankings and values, 2016 and 2015

Economy	Rank 2016	IDI 2016	Rank 2015	IDI 2015
Korea (Rep.)	1	8.84	1	8.78
Iceland	2	8.83	3	8.66
Denmark	3	8.74	2	8.77
Switzerland	4	8.68	5	8.50
United Kingdom	5	8.57	4	8.54
Hong Kong, China	6	8.46	7	8.40
Sweden	7	8.45	6	8.47
Netherlands	8	8.43	8	8.36
Norway	9	8.42	9	8.35
Japan	10	8.37	11	8.28
Luxembourg	11	8.36	10	8.34
Germany	12	8.31	13	8.13
New Zealand	13	8.29	16	8.05
Australia	14	8.19	12	8.18
United States	15	8.17	15	8.06
France	16	8.11	17	7.95
Finland	17	8.08	14	8.11
Estonia	18	8.07	18	7.95
Monaco	19	7.96	20	7.86
Singapore	20	7.95	19	7.88
Ireland	21	7.92	21	7.73
Belgium	22	7.83	22	7.69
Austria	23	7.69	24	7.53
Malta	24	7.69	25	7.49
Canada	25	7.62	23	7.55
Spain	26	7.62	27	7.46
Andorra	27	7.61	29	7.39
Macao, China	28	7.58	26	7.47
Bahrain	29	7.46	28	7.42
Israel	30	7.40	30	7.25
Belarus	31	7.26	33	7.02
Czech Republic	32	7.25	31	7.20
Slovenia	33	7.23	32	7.10
St. Kitts and Nevis	34	7.21	54	6.23
Barbados	35	7.18	39	6.87
Greece	36	7.13	40	6.86
Italy	37	7.11	36	6.89
United Arab Emirates	38	7.11	35	6.96
Lithuania	39	7.10	34	7.00
Latvia	40	7.08	37	6.88
Croatia	41	7.04	41	6.83
Slovakia	42	6.96	44	6.69
Russian Federation	43	6.95	42	6.79
Portugal	44	6.94	45	6.64
Saudi Arabia	45	6.90	38	6.88
Qatar	46	6.90	43	6.78
Uruguay	47	6.79	49	6.44
Hungary	48	6.72	46	6.60
Bulgaria	49	6.69	50	6.43
Poland	50	6.65	47	6.56
Serbia	51	6.58	51	6.43
Kazakhstan	52	6.57	52	6.42
Kuwait	53	6.54	48	6.45
Cyprus	54	6.53	53	6.28
Argentina	55	6.52	56	6.21
Chile	56	6.35	57	6.11
Costa Rica	57	6.30	59	6.03
Azerbaijan	58	6.28	55	6.23
Oman	59	6.27	58	6.04
Romania	60	6.26	60	5.92
Malaysia	61	6.22	66	5.64
Montenegro	62	6.05	64	5.76
Brazil	63	5.99	65	5.72
Bahamas	64	5.98	63	5.80
TFYR Macedonia	65	5.97	62	5.82
Lebanon	66	5.93	61	5.91
Trinidad & Tobago	67	5.76	68	5.48
Moldova	68	5.75	67	5.60
Dominica	69	5.71	77	5.14
Turkey	70	5.69	69	5.45
Armenia	71	5.60	71	5.34
Georgia	72	5.59	72	5.33
Mauritius	73	5.55	73	5.27
Grenada	74	5.43	82	4.97
Antigua & Barbuda	75	5.38	70	5.41
Ukraine	76	5.33	76	5.21
Brunei Darussalam	77	5.33	74	5.25
St. Vincent and the Grenadines	78	5.32	78	5.07
Venezuela	79	5.27	75	5.22
Bosnia and Herzegovina	80	5.25	80	5.03
China	81	5.19	84	4.80
Thailand	82	5.18	79	5.05
Colombia	83	5.16	81	4.98
Suriname	84	5.09	83	4.89
Jordan	85	5.06	89	4.67
Maldives	86	5.04	88	4.68
Seychelles	87	5.03	85	4.77
South Africa	88	5.03	86	4.70
Iran (I.R.)	89	4.99	90	4.66
Mongolia	90	4.95	93	4.54
Albania	91	4.92	92	4.62
Mexico	92	4.87	96	4.45
Panama	93	4.87	91	4.63
St. Lucia	94	4.85	87	4.68
Tunisia	95	4.83	95	4.49
Morocco	96	4.60	98	4.26
Cape Verde	97	4.60	99	4.23
Ecuador	98	4.56	94	4.54
Jamaica	99	4.52	101	4.20
Egypt	100	4.44	97	4.26
Peru	101	4.42	100	4.23
Fiji	102	4.41	102	4.16
Algeria	103	4.40	112	3.74
Dominican Rep.	104	4.30	105	4.02
Viet Nam	105	4.29	104	4.02
Palestine	106	4.28	103	4.12
Philippines	107	4.28	106	3.97
Botswana	108	4.17	109	3.79
Paraguay	109	4.08	107	3.88
Uzbekistan	110	4.05	110	3.76
Bolivia	111	4.02	117	3.49
Ghana	112	3.99	111	3.75
Kyrgyzstan	113	3.99	108	3.85
Tonga	114	3.93	114	3.63
Indonesia	115	3.86	115	3.63
Sri Lanka	116	3.77	116	3.56
Bhutan	117	3.74	122	3.12
El Salvador	118	3.73	113	3.64
Belize	119	3.66	119	3.32
Namibia	120	3.64	121	3.20
Guyana	121	3.52	118	3.44
Syria	122	3.32	120	3.21
Guatemala	123	3.20	123	3.09
Gabon	124	3.12	126	2.81
Cambodia	125	3.12	127	2.78
Honduras	126	3.09	124	3.00
Vanuatu	127	3.08	131	2.73
Timor-Leste	128	3.05	125	2.92
Kenya	129	2.99	129	2.78
Samoa	130	2.95	128	2.78
Nicaragua	131	2.88	130	2.74
Côte d'Ivoire	132	2.86	139	2.43
Zimbabwe	133	2.78	132	2.73
Lesotho	134	2.76	138	2.47
Cuba	135	2.73	133	2.64
Swaziland	136	2.73	136	2.49
Nigeria	137	2.72	137	2.48
India	138	2.69	135	2.50
Sudan	139	2.60	134	2.56
Myanmar	140	2.54	153	1.95
Senegal	141	2.53	140	2.41
Nepal	142	2.50	142	2.32
Gambia	143	2.46	141	2.40
Lao P.D.R.	144	2.45	144	2.21
Bangladesh	145	2.35	143	2.27
Pakistan	146	2.35	145	2.15
Zambia	147	2.22	148	2.05
Cameroon	148	2.16	146	2.07
Mali	149	2.14	149	2.00
Rwanda	150	2.13	158	1.79
Mauritania	151	2.12	154	1.90
Kiribati	152	2.06	147	2.07
Solomon Islands	153	2.04	150	1.99
Angola	154	2.03	152	1.95
Yemen	155	2.02	151	1.96
Liberia	156	1.97	161	1.73
Uganda	157	1.94	155	1.86
Benin	158	1.92	156	1.83
Togo	159	1.86	159	1.78
Equatorial Guinea	160	1.85	157	1.82
Djibouti	161	1.82	160	1.73
Burkina Faso	162	1.80	163	1.60
Mozambique	163	1.75	164	1.60
Afghanistan	164	1.73	162	1.62
Guinea	165	1.72	166	1.57
Madagascar	166	1.69	165	1.57
Tanzania	167	1.65	167	1.54
Malawi	168	1.62	168	1.49
Ethiopia	169	1.51	172	1.29
Congo (Dem. Rep.)	170	1.50	169	1.48
Burundi	171	1.42	173	1.16
South Sudan	172	1.42	170	1.36
Guinea-Bissau	173	1.38	171	1.34
Chad	174	1.09	175	1.00
Niger	175	1.07	174	1.03

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

Table 1.3: IDI access sub-index rankings and values, 2016 and 2015

Economy	Rank 2016	IDI 2016	Rank 2015	IDI 2015
Luxembourg	1	9.54	1	9.49
Iceland	2	9.42	2	9.35
United Kingdom	3	9.24	4	9.18
Hong Kong, China	4	9.16	3	9.20
Germany	5	9.09	5	9.17
Malta	6	9.04	6	9.01
Netherlands	7	9.02	9	8.94
Korea (Rep.)	8	8.99	8	9.00
Switzerland	9	8.95	7	9.00
Japan	10	8.80	11	8.75
Singapore	11	8.70	14	8.61
France	12	8.70	12	8.67
Sweden	13	8.69	10	8.77
Denmark	14	8.52	13	8.65
Austria	15	8.35	20	8.16
Belgium	16	8.34	15	8.34
New Zealand	17	8.32	22	8.08
Israel	18	8.28	19	8.18
United States	19	8.27	21	8.11
Barbados	20	8.24	28	7.86
Australia	21	8.23	17	8.24
Norway	22	8.21	18	8.19
Ireland	23	8.19	16	8.24
United Arab Emirates	24	8.14	25	7.94
Monaco	25	8.12	23	8.03
Andorra	26	8.06	31	7.84
Estonia	27	8.02	29	7.85
Canada	28	7.99	24	7.98
Slovenia	29	7.93	27	7.88
Portugal	30	7.93	33	7.77
Spain	31	7.92	32	7.80
Bahrain	32	7.91	34	7.76
Qatar	33	7.91	26	7.90
Greece	34	7.85	38	7.60
Macao, China	35	7.83	30	7.85
Belarus	36	7.80	36	7.68
St. Kitts and Nevis	37	7.72	40	7.50
Italy	38	7.69	37	7.64
Finland	39	7.69	35	7.73
Hungary	40	7.62	41	7.49
Croatia	41	7.58	44	7.33
Kazakhstan	42	7.56	42	7.46
Czech Republic	43	7.46	43	7.44
Kuwait	44	7.40	45	7.31
Latvia	45	7.38	46	7.20
Oman	46	7.37	51	7.12
Saudi Arabia	47	7.29	39	7.51
Uruguay	48	7.25	50	7.15
Russian Federation	49	7.23	47	7.19
Slovakia	50	7.22	53	7.08
Serbia	51	7.22	48	7.18
Brunei Darussalam	52	7.21	49	7.16
Poland	53	7.09	52	7.11
Lithuania	54	7.08	54	7.01
Trinidad & Tobago	55	7.03	58	6.72
Cyprus	56	7.02	55	6.97
Romania	57	6.90	60	6.65
Mauritius	58	6.86	65	6.59
Bulgaria	59	6.86	56	6.85
Montenegro	60	6.85	57	6.74
Chile	61	6.81	61	6.65
Seychelles	62	6.81	66	6.58
Azerbaijan	63	6.78	59	6.68
Bahamas	64	6.77	64	6.62
Argentina	65	6.77	62	6.63
Malaysia	66	6.75	69	6.53
TFYR Macedonia	67	6.68	63	6.63
Moldova	68	6.64	70	6.50
Lebanon	69	6.57	67	6.57
Armenia	70	6.57	73	6.29
Ukraine	71	6.48	71	6.43
St. Vincent and the Grenadines	72	6.47	74	6.28
Costa Rica	73	6.44	72	6.31
Brazil	74	6.42	75	6.28
Dominica	75	6.40	78	6.06
Antigua & Barbuda	76	6.34	68	6.56
Grenada	77	6.30	77	6.14
Georgia	78	6.29	76	6.25
Iran (I.R.)	79	6.26	81	5.97
Maldives	80	6.22	79	6.04
Turkey	81	6.20	80	6.00
Jordan	82	6.10	82	5.91
Morocco	83	6.07	87	5.64
Panama	84	5.99	83	5.72
Suriname	85	5.88	86	5.67
Colombia	86	5.83	85	5.70
Bosnia and Herzegovina	87	5.78	84	5.71
St. Lucia	88	5.65	88	5.52
Thailand	89	5.50	92	5.24
South Africa	90	5.46	90	5.26
China	91	5.45	91	5.26
Venezuela	92	5.42	89	5.44
Palestine	93	5.35	95	5.12
Egypt	94	5.30	93	5.20
Tunisia	95	5.29	96	5.01
Mongolia	96	5.12	100	4.77
Mexico	97	5.08	99	4.82
Algeria	98	5.03	105	4.56
Cape Verde	99	5.02	97	4.89
Fiji	100	4.97	101	4.68
El Salvador	101	4.95	98	4.88
Ecuador	102	4.90	94	5.16
Jamaica	103	4.83	103	4.65
Peru	104	4.80	102	4.66
Ghana	105	4.74	107	4.51
Albania	106	4.73	108	4.48
Indonesia	107	4.71	106	4.53
Philippines	108	4.70	109	4.46
Syria	109	4.66	104	4.58
Viet Nam	110	4.60	111	4.42
Paraguay	111	4.59	110	4.45
Uzbekistan	112	4.53	116	4.22
Sri Lanka	113	4.51	115	4.26
Guatemala	114	4.47	113	4.34
Tonga	115	4.43	117	4.20
Dominican Rep.	116	4.38	121	4.12
Bolivia	117	4.37	120	4.13
Guyana	118	4.33	118	4.19
Botswana	119	4.33	114	4.27
Namibia	120	4.25	112	4.35
Kyrgyzstan	121	4.25	119	4.16
Cambodia	122	4.21	124	3.93
Honduras	123	4.17	122	4.04
Nicaragua	124	4.08	123	4.00
Bhutan	125	4.02	128	3.75
Gabon	126	3.98	125	3.88
Timor-Leste	127	3.91	126	3.87
Gambia	128	3.90	127	3.85
Côte d'Ivoire	129	3.79	131	3.44
Belize	130	3.69	129	3.62
Vanuatu	131	3.66	132	3.40
Senegal	132	3.59	130	3.51
Kenya	133	3.54	136	3.30
Samoa	134	3.43	137	3.27
Lesotho	135	3.41	138	3.26
Pakistan	136	3.39	135	3.30
Zimbabwe	137	3.35	139	3.22
Sudan	138	3.33	133	3.35
India	139	3.32	140	3.15
Mali	140	3.30	134	3.31
Swaziland	141	3.28	141	3.11
Lao P.D.R.	142	3.21	142	3.03
Nepal	143	3.16	144	2.91
Myanmar	144	3.08	159	2.45
Bangladesh	145	3.06	143	2.91
Mauritania	146	2.99	145	2.88
Nigeria	147	2.96	147	2.82
Mozambique	148	2.90	146	2.82
Burkina Faso	149	2.87	154	2.63
Benin	150	2.86	151	2.72
Zambia	151	2.84	152	2.66
Cameroon	152	2.77	148	2.82
Equatorial Guinea	153	2.77	149	2.76
Angola	154	2.76	150	2.75
Liberia	155	2.76	155	2.59
Solomon Islands	156	2.73	156	2.59
Yemen	157	2.66	153	2.65
Tanzania	158	2.65	161	2.42
Rwanda	159	2.65	158	2.54
Togo	160	2.59	157	2.55
Guinea	161	2.57	162	2.41
Djibouti	162	2.55	160	2.44
Afghanistan	163	2.51	163	2.39
Guinea-Bissau	164	2.41	165	2.29
Madagascar	165	2.39	166	2.21
Uganda	166	2.37	164	2.34
Cuba	167	2.17	169	2.00
Burundi	168	2.14	172	1.84
Kiribati	169	2.11	167	2.14
Ethiopia	170	2.11	171	1.85
Niger	171	2.04	170	1.99
Malawi	172	2.03	168	2.01
Chad	173	1.94	174	1.74
Congo (Dem. Rep.)	174	1.83	173	1.83
South Sudan	175	1.34	175	1.28

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

Table 1.4: IDI use sub-index rankings and values, 2016 and 2015

Economy	Rank 2016	IDI 2016	Rank 2015	IDI 2015
Denmark	1	8.91	1	8.84
Switzerland	2	8.67	6	8.17
Korea (Rep.)	3	8.57	2	8.42
Norway	4	8.48	3	8.33
Iceland	5	8.44	7	8.11
Sweden	6	8.36	4	8.31
Finland	7	8.18	5	8.21
Japan	8	8.14	10	7.96
United Kingdom	9	8.09	8	8.09
Luxembourg	10	8.05	9	8.05
New Zealand	11	8.03	16	7.66
Hong Kong, China	12	7.94	13	7.74
Monaco	13	7.92	11	7.78
Estonia	14	7.87	12	7.75
Netherlands	15	7.77	14	7.68
Australia	16	7.70	15	7.67
France	17	7.61	20	7.23
United States	18	7.57	19	7.45
Singapore	19	7.54	18	7.45
Macao, China	20	7.53	21	7.22
Germany	21	7.49	22	6.98
Bahrain	22	7.48	17	7.54
Ireland	23	7.38	23	6.85
Belgium	24	7.10	24	6.76
Spain	25	6.93	27	6.65
Canada	26	6.85	25	6.68
United Arab Emirates	27	6.82	26	6.66
Malta	28	6.75	31	6.28
Andorra	29	6.74	30	6.41
Austria	30	6.67	28	6.48
Czech Republic	31	6.55	29	6.43
St. Kitts and Nevis	32	6.53	64	4.31
Lithuania	33	6.40	32	6.23
Slovakia	34	6.38	37	5.86
Qatar	35	6.32	33	6.03
Saudi Arabia	36	6.32	35	6.03
Latvia	37	6.27	36	5.94
Italy	38	6.25	40	5.73
Uruguay	39	6.20	45	5.43
Kuwait	40	6.15	34	6.03
Croatia	41	6.13	38	5.85
Israel	42	6.02	39	5.75
Barbados	43	5.88	44	5.47
Belarus	44	5.88	47	5.40
Russian Federation	45	5.87	42	5.52
Malaysia	46	5.86	61	4.63
Bulgaria	47	5.84	49	5.21
Costa Rica	48	5.80	48	5.24
Slovenia	49	5.71	46	5.43
Azerbaijan	50	5.70	41	5.66
Portugal	51	5.67	53	5.07
Brazil	52	5.60	54	5.07
Lebanon	53	5.51	43	5.48
Serbia	54	5.50	50	5.15
Cyprus	55	5.46	58	4.89
Greece	56	5.46	55	5.05
Argentina	57	5.45	60	4.81
Oman	58	5.39	56	5.05
Poland	59	5.35	51	5.13
Hungary	60	5.28	52	5.12
TFYR Macedonia	61	5.17	59	4.85
Kazakhstan	62	5.15	57	4.90
Romania	63	5.08	63	4.48
Chile	64	4.91	62	4.48
Dominica	65	4.82	76	3.72
Montenegro	66	4.61	70	3.99
China	67	4.58	73	3.79
Trinidad & Tobago	68	4.53	68	4.13
Suriname	69	4.48	66	4.20
Bahamas	70	4.46	67	4.17
Thailand	71	4.33	65	4.27
Maldives	72	4.30	77	3.59
Moldova	73	4.26	69	4.02
Mexico	74	4.24	82	3.43
Bosnia and Herzegovina	75	4.21	75	3.74
Turkey	76	4.18	74	3.77
Cape Verde	77	4.03	88	3.24
Antigua & Barbuda	78	4.02	71	3.89
South Africa	79	4.00	86	3.37
Georgia	80	4.00	83	3.40
Venezuela	81	3.95	72	3.80
Tunisia	82	3.95	85	3.37
St. Vincent and the Grenadines	83	3.89	79	3.47
Albania	84	3.88	84	3.40
Armenia	85	3.85	80	3.47
Colombia	86	3.85	78	3.52
Grenada	87	3.78	99	2.79
Mauritius	88	3.78	87	3.36
St. Lucia	89	3.72	81	3.43
Mongolia	90	3.64	92	2.97
Jamaica	91	3.55	94	2.94
Viet Nam	92	3.51	90	3.01
Dominican Rep.	93	3.41	91	2.97
Bhutan	94	3.40	110	2.13
Morocco	95	3.40	93	2.95
Seychelles	96	3.37	95	2.94
Ecuador	97	3.31	89	3.01
Botswana	98	3.26	106	2.37
Panama	99	3.24	96	2.92
Fiji	100	3.23	97	2.88
Jordan	101	3.20	104	2.44
Egypt	102	3.14	100	2.78
Ghana	103	3.03	101	2.64
Brunei Darussalam	104	2.97	98	2.81
Paraguay	105	2.96	102	2.61
Peru	106	2.94	103	2.61
Philippines	107	2.93	105	2.42
Algeria	108	2.92	119	1.75
Namibia	109	2.91	121	1.73
Iran (I.R.)	110	2.74	108	2.19
Bolivia	111	2.72	123	1.65
Tonga	112	2.59	112	2.07
Uzbekistan	113	2.58	109	2.17
Ukraine	114	2.57	107	2.31
Belize	115	2.55	117	1.79
Nigeria	116	2.28	115	1.81
Palestine	117	2.25	111	2.08
Kyrgyzstan	118	2.25	113	2.00
Vanuatu	119	2.21	124	1.60
Indonesia	120	2.19	116	1.79
Cambodia	121	2.09	126	1.53
Côte d'Ivoire	122	2.08	131	1.34
Kenya	123	2.05	118	1.76
Gabon	124	1.92	134	1.23
Zimbabwe	125	1.91	114	1.91
Sudan	126	1.87	120	1.73
El Salvador	127	1.87	122	1.72
Lesotho	128	1.80	135	1.22
Myanmar	129	1.73	146	0.89
Timor-Leste	130	1.70	128	1.42
Sri Lanka	131	1.70	127	1.44
Guyana	132	1.65	125	1.57
Senegal	133	1.64	129	1.42
Swaziland	134	1.61	136	1.19
Syria	135	1.52	130	1.35
Rwanda	136	1.47	151	0.73
Guatemala	137	1.40	133	1.25
Honduras	138	1.38	132	1.29
Nepal	139	1.35	137	1.15
Mauritania	140	1.29	147	0.85
Uganda	141	1.27	138	1.10
India	142	1.25	143	0.95
Samoa	143	1.23	142	0.97
Zambia	144	1.17	144	0.93
Yemen	145	1.12	140	0.99
Lao P.D.R.	146	1.11	152	0.70
Angola	147	1.10	145	0.91
Pakistan	148	1.09	153	0.69
Bangladesh	149	1.06	139	1.02
Cuba	150	1.04	141	0.97
Nicaragua	151	1.00	150	0.73
Mali	152	0.97	156	0.61
Gambia	153	0.91	148	0.83
Burkina Faso	154	0.90	155	0.63
Liberia	155	0.89	162	0.44
Malawi	156	0.86	159	0.56
Cameroon	157	0.84	160	0.55
Ethiopia	158	0.82	161	0.54
Equatorial Guinea	159	0.74	154	0.66
Solomon Islands	160	0.73	149	0.75
Djibouti	161	0.71	157	0.59
South Sudan	162	0.65	158	0.57
Guinea	163	0.62	164	0.42
Mozambique	164	0.62	170	0.30
Togo	165	0.49	169	0.32
Afghanistan	166	0.47	166	0.34
Kiribati	167	0.45	163	0.44
Madagascar	168	0.44	167	0.33
Burundi	169	0.42	175	0.06
Congo (Dem. Rep.)	170	0.41	165	0.36
Benin	171	0.40	168	0.32
Tanzania	172	0.30	171	0.27
Chad	173	0.14	173	0.10
Niger	174	0.14	174	0.10
Guinea-Bissau	175	0.12	172	0.12

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

Table 1.5: IDI skills sub-index, rankings and values, 2016 and 2015

Economy	Rank 2016	IDI 2016	Rank 2015	IDI 2015
United States	1	9.18	1	9.18
Australia	2	9.10	2	9.10
Korea (Rep.)	3	9.08	3	9.08
Greece	4	9.01	4	9.01
Belarus	5	8.96	5	8.96
Denmark	6	8.87	6	8.87
Slovenia	7	8.87	7	8.87
New Zealand	8	8.77	8	8.77
Norway	9	8.70	9	8.70
Finland	10	8.65	10	8.65
Ukraine	11	8.57	11	8.57
Netherlands	12	8.56	12	8.56
Lithuania	13	8.55	13	8.55
Russian Federation	14	8.55	14	8.55
Estonia	15	8.54	15	8.54
Ireland	16	8.48	16	8.48
Canada	17	8.44	17	8.44
Andorra	18	8.43	18	8.43
Spain	19	8.41	19	8.41
Iceland	20	8.40	20	8.40
Austria	21	8.38	21	8.38
Israel	22	8.38	22	8.38
Germany	23	8.36	23	8.36
Poland	24	8.35	24	8.35
Chile	25	8.30	25	8.30
Belgium	26	8.27	26	8.27
Czech Republic	27	8.25	27	8.25
Argentina	28	8.18	28	8.18
United Kingdom	29	8.18	29	8.18
Sweden	30	8.17	30	8.17
Switzerland	31	8.15	31	8.15
Latvia	32	8.12	32	8.12
Hong Kong, China	33	8.11	33	8.11
Bulgaria	34	8.04	34	8.04
Japan	35	7.97	35	7.97
France	36	7.94	36	7.94
Hungary	37	7.82	37	7.82
Croatia	38	7.79	38	7.79
Turkey	39	7.72	39	7.72
Monaco	40	7.70	40	7.70
Italy	41	7.69	41	7.69
Barbados	42	7.69	42	7.69
Cyprus	43	7.68	43	7.68
Venezuela	44	7.63	44	7.63
Slovakia	45	7.57	45	7.57
St. Kitts and Nevis	46	7.55	46	7.55
Portugal	47	7.51	47	7.51
Serbia	48	7.48	48	7.48
Bahamas	49	7.43	49	7.43
Kazakhstan	50	7.41	50	7.41
Romania	51	7.37	51	7.37
Albania	52	7.36	52	7.36
Georgia	53	7.34	53	7.34
Montenegro	54	7.34	54	7.34
Saudi Arabia	55	7.30	55	7.30
Singapore	56	7.27	56	7.27
Cuba	57	7.25	57	7.25
Mongolia	58	7.23	58	7.23
Macao, China	59	7.19	59	7.19
Armenia	60	7.17	60	7.17
Costa Rica	61	7.04	61	7.04
Uruguay	62	7.02	62	7.02
Grenada	63	6.99	63	6.99
Moldova	64	6.97	64	6.97
Iran (I.R.)	65	6.96	65	6.96
Kyrgyzstan	66	6.96	66	6.96
Malta	67	6.86	67	6.86
Jordan	68	6.68	68	6.68
Peru	69	6.60	69	6.60
Luxembourg	70	6.59	70	6.59
Bahrain	71	6.50	71	6.50
Azerbaijan	72	6.47	72	6.47
Mauritius	73	6.45	73	6.45
Colombia	74	6.44	74	6.44
Sri Lanka	75	6.41	75	6.41
Ecuador	76	6.37	76	6.37
Brunei Darussalam	77	6.31	77	6.31
Bosnia and Herzegovina	78	6.27	78	6.27
South Africa	79	6.23	79	6.23
Thailand	80	6.21	80	6.21
Palestine	81	6.18	81	6.18
Antigua & Barbuda	82	6.17	82	6.17
TFYR Macedonia	83	6.13	83	6.13
Philippines	84	6.11	84	6.11
Dominica	85	6.11	85	6.11
Algeria	86	6.10	86	6.10
Uzbekistan	87	6.04	87	6.04
Qatar	88	6.03	88	6.03
Dominican Rep.	89	5.90	89	5.90
Bolivia	90	5.89	90	5.89
Brazil	91	5.89	91	5.89
China	92	5.89	92	5.89
Panama	93	5.89	93	5.89
Malaysia	94	5.87	94	5.87
St. Vincent and the Grenadines	95	5.86	95	5.86
Oman	96	5.83	96	5.83
Jamaica	97	5.83	97	5.83
Belize	98	5.81	98	5.81
Mexico	99	5.74	99	5.74
Botswana	100	5.69	100	5.69
Fiji	101	5.68	101	5.68
Tunisia	102	5.68	102	5.68
Trinidad & Tobago	103	5.67	103	5.67
Guyana	104	5.66	104	5.66
United Arab Emirates	105	5.63	105	5.63
Tonga	106	5.61	106	5.61
Kuwait	107	5.59	107	5.59
St. Lucia	108	5.52	108	5.52
Indonesia	109	5.48	109	5.48
Lebanon	110	5.46	110	5.46
Samoa	111	5.44	111	5.44
Egypt	112	5.33	112	5.33
Paraguay	113	5.28	113	5.28
Viet Nam	114	5.25	114	5.25
Kiribati	115	5.18	115	5.18
El Salvador	116	5.02	116	5.02
Cape Verde	117	4.89	117	4.89
Seychelles	118	4.79	118	4.79
Suriname	119	4.72	119	4.72
Ghana	120	4.44	120	4.44
Honduras	121	4.36	121	4.36
India	122	4.29	122	4.29
Guatemala	123	4.29	123	4.29
Nicaragua	124	4.23	124	4.23
Syria	125	4.22	125	4.22
Maldives	126	4.15	126	4.15
Morocco	127	4.09	127	4.09
Timor-Leste	128	4.01	128	4.01
Swaziland	129	3.86	129	3.86
Namibia	130	3.85	130	3.85
Bhutan	131	3.84	131	3.84
Gabon	132	3.81	132	3.81
Kenya	133	3.76	133	3.76
Vanuatu	134	3.65	134	3.65
Cameroon	135	3.60	135	3.60
Lao P.D.R.	136	3.60	136	3.60
Bangladesh	137	3.51	137	3.51
Nepal	138	3.50	138	3.50
Zimbabwe	139	3.38	139	3.38
Lesotho	140	3.37	140	3.37
Solomon Islands	141	3.27	141	3.27
Togo	142	3.16	142	3.16
Nigeria	143	3.13	143	3.13
South Sudan	144	3.12	144	3.12
Myanmar	145	3.06	145	3.06
Zambia	146	3.06	146	3.06
Benin	147	3.06	147	3.06
Congo (Dem. Rep.)	148	3.01	148	3.01
Cambodia	149	3.00	149	3.00
Pakistan	150	2.78	150	2.78
Madagascar	151	2.77	151	2.77
Gambia	152	2.66	152	2.66
Afghanistan	153	2.65	153	2.65
Sudan	154	2.62	154	2.62
Djibouti	155	2.59	155	2.59
Côte d'Ivoire	156	2.57	156	2.57
Liberia	157	2.56	157	2.56
Yemen	158	2.54	158	2.54
Angola	159	2.43	159	2.43
Uganda	160	2.43	160	2.43
Rwanda	161	2.42	161	2.42
Tanzania	162	2.33	162	2.33
Malawi	163	2.30	163	2.30
Equatorial Guinea	164	2.27	164	2.27
Guinea	165	2.19	165	2.19
Senegal	166	2.17	166	2.17
Mali	167	2.15	167	2.15
Mauritania	168	2.02	168	2.02
Burundi	169	2.01	169	2.01
Guinea-Bissau	170	1.87	170	1.87
Mozambique	171	1.74	171	1.74
Ethiopia	172	1.71	172	1.71
Burkina Faso	173	1.48	173	1.48
Chad	174	1.30	174	1.30
Niger	175	1.01	175	1.01

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

- The low quartile contains the 44 least connected countries (LCCs), from Côte d'Ivoire with an IDI value of 2.86 to Niger with an IDI value of 1.07.

Overall distribution of IDI rankings

The country topping the IDI rankings in 2016, as in 2015, is the Republic of Korea, with an IDI 2016 value of 8.84, up from 8.78 in IDI 2015. Two further economies in the Asia-Pacific region – Hong Kong (China) and Japan – also rank in the top ten, along with seven countries from Europe (Iceland, Denmark, Switzerland, the United Kingdom, Sweden, the Netherlands and Norway). The differences in IDI 2016 values among these highest-performing countries are relatively small, with only 0.47 points separating those in first and tenth positions. This reflects the high level of ICT development that has been achieved in many developed and some high-income developing countries, which have experienced high levels of investment in ICT infrastructure and innovation as well as high levels of adoption of new services by consumers. These high-performing countries also rank towards the top of the rankings for GNI p.c. and other economic indicators.

There has been relatively little change in the IDI rankings for most economies between 2015 and 2016. Only one change took place in the countries making up the top ten ranked economies, for example, with Japan narrowly displacing Luxembourg in tenth position; and only one change in the composition of the ten lowest-ranked countries, where Guinea has replaced Madagascar. Only two countries (St. Kitts and Nevis and Portugal) moved up into the highest quartile from the one below. Only eight (St. Kitts and Nevis, Myanmar, Algeria, Dominica, Grenada, Rwanda, Côte d'Ivoire and Bolivia) climbed more than five places in the rankings, and only two (Saint Lucia and Saudi Arabia) fell by more than five places.

In the lowest quartile, only four countries (Côte d'Ivoire, Myanmar, Rwanda and Liberia) improved their position in the rankings by five or more places, while two (Sudan and Kiribati) fell by five places. Of the 44 countries ranked as LCCs, 30 are in the Africa region, including the ten countries with the lowest rankings, while four are in the Arab States region (three of which are on the African continent), one in the Americas and nine in the Asia-Pacific region.

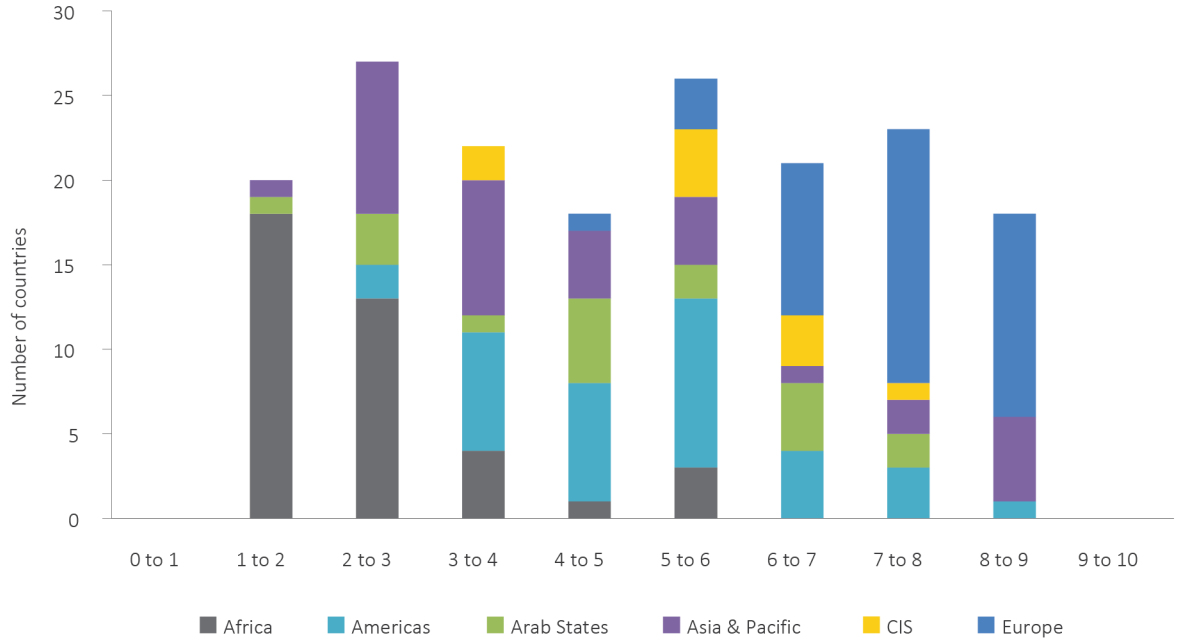
This relative stability of the Index year on year reflects steady progress in almost all countries on the indicators for access and use. Only five countries registered a decline in their IDI 2016 value, all by less than 0.05 points. Three of these are northern European countries near the top of the rankings (Denmark, Sweden and Finland); the two others are developing countries (Antigua and Barbuda and Kiribati).

The average improvement in IDI values across all economies was 0.20 points, for an average IDI score of 4.94. The scale of improvement was highest in the middle of the distribution. The improvement in IDI values for the top ten countries was on average just 0.07, partly reflecting the fact that they are already approaching the maximum attainable figure under the current Index. The average improvement for the high quartile was 0.13, for the upper-middle quartile 0.24 and for the lower-middle quartile 0.27. For LCCs at the bottom of the distribution, the average improvement was lower, at 0.15 points.

The distribution between developed and developing countries, and the particular challenges faced by LDCs, are discussed in section 1.4 below. The analysis suggests that the gap between developed countries and higher-income developing countries is diminishing, partly because of higher gains among developing countries on some indicators where developed countries have already attained high levels of performance. However, developed countries and a few developing countries (such as the Republic of Korea, Hong Kong (China) and Singapore) now have access to much higher broadband speeds and to more sophisticated digital services, which are not reflected in the Index, than they did five years ago. The gap between these higher-income countries and the majority of developing countries may thus be widening in terms of these higher speeds and more sophisticated services.

The discussion in section 1.4 also shows, however, that the gap between the majority of developing countries, on the one hand, and LDCs and LCCs, on the other, is growing. This widening digital divide is a cause of particular concern in the light of the role which ICTs are expected to play in efforts to achieve the SDGs.

Chart 1.4: Distribution of IDI values between regions



Source: ITU.

The distribution of IDI values between regions is illustrated in Chart 1.4. The columns clearly highlight the preponderance of high-performing countries in the Europe region and of low-performing countries in the Africa region. These two regions are relatively economically homogeneous. All but three countries in the Europe region are developed countries, while all of those in the Africa region that are included in the IDI are developing countries, and 25 of them are LDCs. The CIS region, most countries of which are found in the upper half of the distribution, is also relatively homogeneous. Other regions are more heterogeneous, with a wider spread including both high- and low-income countries and one or more LDCs. These regional characteristics are discussed in Chapter 2.

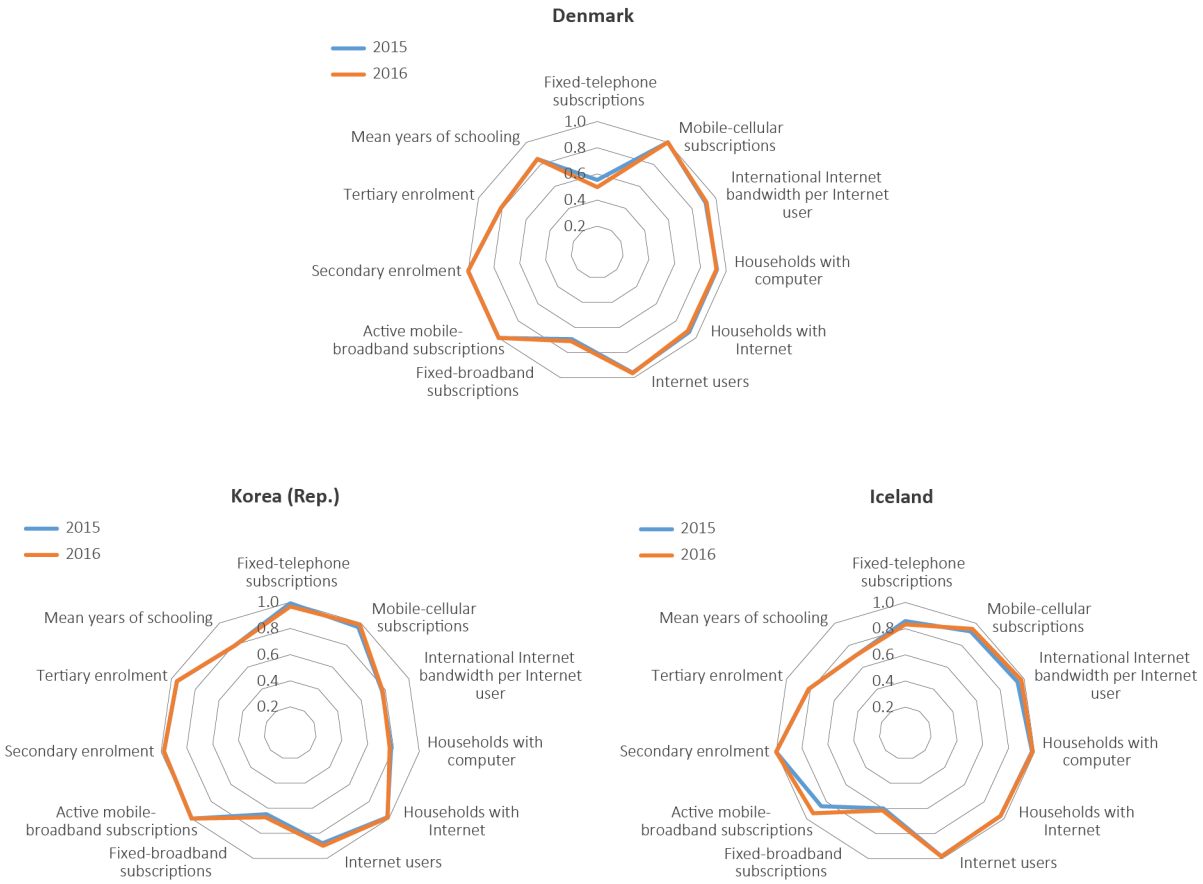
Top performing countries

The top performing country in the 2016 IDI, as in IDI 2015, is the Republic of Korea, followed by two Nordic countries, Iceland and Denmark, which have exchanged places during the year. Spider charts illustrating the performance of these three countries on all the indicators in the IDI are presented in Chart 1.5. As is to be expected of countries with very high IDI 2016 scores, the spider charts show high levels of attainment across all the indicators, although there are some differences that are worthy of note.

Aspects of the Republic of Korea's ICT performance are outlined in Box 1.2. There has been very little change in individual indicators in the country during the past year, the most significant being a marginal decline in fixed-telephone subscriptions matched by marginal increases in mobile-cellular and fixed-broadband subscriptions and in the number of Internet users. The country's overall IDI performance is boosted by very high values for fixed-telephone subscriptions and for tertiary enrolment. However, its IDI values for the percentage of households with a computer and for international Internet bandwidth per Internet user are notably lower than those of Iceland and Denmark, indicating that there is scope for further progress in performance in these areas.

Aspects of the IDI performances of Iceland and Denmark are outlined in Boxes 1.3 and 1.4. Iceland's overtaking Denmark in the IDI 2016 rankings is attributable to movements in two indicators within the Index. Mobile-broadband penetration in Iceland rose significantly during

Chart 1.5: IDI values for top-ranking countries, 2015 and 2016



Source: ITU.

the year, while Denmark had already attained almost 100 per cent penetration by 2015. At the same time, fixed-telephone penetration in Denmark dropped more substantially than it did in Iceland. This fall in fixed-telephone subscriptions in Denmark may be the result of fixed-mobile substitution, as individuals and households in some high-income developed countries no longer choose to obtain or maintain fixed as well as mobile subscriptions.

Iceland and Denmark both display higher IDI values than the Republic of Korea on several indicators, particularly the proportion of households with a computer, but also international Internet bandwidth per Internet user and the proportion of Internet users. Iceland's performance in the access sub-index significantly exceeds that of the Republic of Korea (9.42 against 8.99), and lags only slightly behind it in the use sub-index (8.44 against 8.57). Denmark's performance in relation to the two other leading countries is primarily determined by its low level of fixed-telephone penetration. Both Nordic countries, however, fall well below the Republic of Korea in one of the proxy indicators that make up the skills sub-index – tertiary enrolment – while Iceland also has a significantly lower value for mean years of schooling. As a result, they register much lower overall values in the skills sub-index (8.87 for Denmark and 8.40 for Iceland against 9.08 for the Republic of Korea).

Box 1.2: ICT and IDI developments in the Republic of Korea

The Republic of Korea has consistently ranked as one of the most connected countries in the IDI. New initiatives and developments in 2015 have further improved its ICT environment, reinforcing its position among the top performers in the Index.

The government aims to improve competition for mobile subscribers further by licensing an additional operator and through legislation which seeks to increase the market share of low-price service plans from 10 per cent to 12 per cent.[7] New legislation should allow operators to launch new tariffs without approval, enabling them to respond more quickly to consumer demand. The country also remains ahead in new developments and technologies. In 2015, the Republic of Korea's operator SK Telecom (SKT) launched what it claims to be the world's first commercial tri-band LTE-Advanced (LTE-A) service, offering downlink speeds of up to 300 Mbit/s by aggregating three component carriers in three different frequency bands.[8]

The government is actively promoting use of the Internet across the entire population in order to extend the benefits of its high ICT development to currently unconnected groups. Government initiatives, such as the "Development and Supply of IT Assistance Devices", "Supply of Green PCs of Love" and "Telecommunication Relay Service", designed for hearing- and speech-impaired people, are examples of responses to ensure that disadvantaged groups have equal opportunity to access information (KISA, 2015).

While use of the Internet is increasing among women and girls, household data collected by the Ministry of Science, ICT and Future Planning (MSIP) and the Korea Internet and Security Agency (KISA) still show that there is a gender gap in Internet use in the Republic of Korea. This contrasts with many European countries, where the gender differences are minor, resulting in a higher overall Internet uptake. Household data further reveal that Internet use by the elderly (those aged 75 and over) is well below that of other countries with high Internet uptake. While every second elderly person in Japan uses the Internet, and one in four in Switzerland, only one out of eight elderly persons in the Republic of Korea state that they use the Internet. This might reflect the fast pace of ICT development, as well as the fact that economic developments in the country are more recent in comparison with other high-income economies. This is discussed in detail in Chapter 6.

Box 1.3: ICT and IDI developments in Iceland

Iceland has overtaken Denmark to rank second in IDI 2016. The main reason for this is a significant increase (11 per cent) in the number of mobile-broadband subscriptions in the country, lifting Iceland to fifth place in the use sub-index in 2016, up from seventh in 2015.

As in IDI 2015, Iceland ranks second in the access sub-index, mainly because of high levels of access to computers and the Internet. As many as 98 per cent of Icelandic households are estimated to have access to a computer, the highest ratio in the world. Iceland also has the highest share of population using the Internet worldwide, at 98.2 per cent, boosted by an increase in female Internet participation from 92 per cent in 2010 to 98 per cent in 2014.

Iceland ranks 20th in the skills sub-index, however, mainly because of a relatively low score on mean years of schooling (10.59) compared with other Nordic countries.

Box 1.3: ICT and IDI developments in Iceland (continued)

In May 2016, the Icelandic operator Siminn (Iceland Telecom) announced that its LTE network covered 91 per cent of the country's population, only two years after deployment in January 2014 (and three years since the operator Nova launched the country's first LTE network).[9] This follows an upgrade of Siminn's LTE transmitters to allow for an increase in maximum download speeds over the 4G network from 100 Mbit/s at launch to 150 Mbit/s in 2015. In 2015, the Icelandic parliament, the Althingi, approved expenditure of USD 4 million for the development of high-speed networks in 2016, with the aim of bridging the final digital divide in Iceland and allowing almost all households in the country to have access with at least a 100 Mbit/s connection by the year 2020 (Post and Telecom Administration in Iceland, 2015).

The Post and Telecom Administration (Póst- og Fjarskiptastofnun) (PTA) has announced plans to increase competition by holding an auction for frequencies in the 700 MHz band by the end of 2016.

Box 1.4: ICT and IDI developments in Denmark

Denmark has dropped one place in the 2016 IDI ranking to third, just behind the Republic of Korea and Iceland, with an IDI score of 8.74. The main reason for its lower ranking is a 10 per cent decrease in fixed-telephone subscriptions, resulting in a decline in the access sub-index and thereby in the IDI as a whole. The number of fixed-telephone subscriptions has fallen by nearly 60 per cent since its peak in 2001, from 72.2 to 29.9 subscriptions per 100 inhabitants in 2015.

However, Denmark tops the use sub-index, mainly because of its high fixed-broadband penetration (42.5 subscriptions per 100 inhabitants) and high Internet use (96.3 per cent). Denmark is also one of the few countries with a higher share of female Internet users than male (96.4 per cent compared with 96.2 per cent). The country ranks sixth in the skills sub-index, and first among the Nordic countries, largely because of its high score on mean years of schooling (12.7).

Like other countries near the top of the IDI, Denmark is a leader in the adoption of new technologies. By the end of 2015, almost the entire population of Denmark was covered by an LTE network - just five years after the launch of TeliaSonera's first commercial LTE service in December 2010. In 2015, the three largest operators (Telia[10], TDC[11] and Telenor[12]) all commenced deployment of 4G+ or LTE-A networks using carrier aggregation (CA) technology over several frequency bands. This new technology enables theoretical download speeds of up to 300 Mbit/s. These developments are in line with Denmark's national broadband strategy, which aims to enable all households and businesses to have access to at least 100 Mbit/s download and 30 Mbit/s upload speeds by 2020.[13]

Most dynamic countries

Countries' movement within the IDI can be measured in terms of changes in their IDI ranking and/or their IDI value. Table 1.6 sets out the most dynamic gains which have been made by individual countries in the IDI as a whole during the year 2015-2016 in terms of ranking and value.

There is broad correspondence between countries registering the strongest improvements in ranking and in value. Only two of the top performers in terms of improved IDI ranking – Rwanda and

Table 1.6: Most dynamic countries in IDI rankings and values, 2015-2016

Change in IDI ranking			Change in IDI value (absolute)		
IDI rank 2016	Country	IDI rank change	IDI rank 2016	Country	IDI value change
34	St. Kitts and Nevis	20	34	St. Kitts and Nevis	0.98
140	Myanmar	13	103	Algeria	0.66
103	Algeria	9	117	Bhutan	0.62
69	Dominica	8	140	Myanmar	0.59
74	Grenada	8	61	Malaysia	0.58
150	Rwanda	8	69	Dominica	0.57
132	Côte d'Ivoire	7	111	Bolivia	0.53
111	Bolivia	6	74	Grenada	0.46
117	Bhutan	5	132	Côte d'Ivoire	0.44
61	Malaysia	5	120	Namibia	0.43

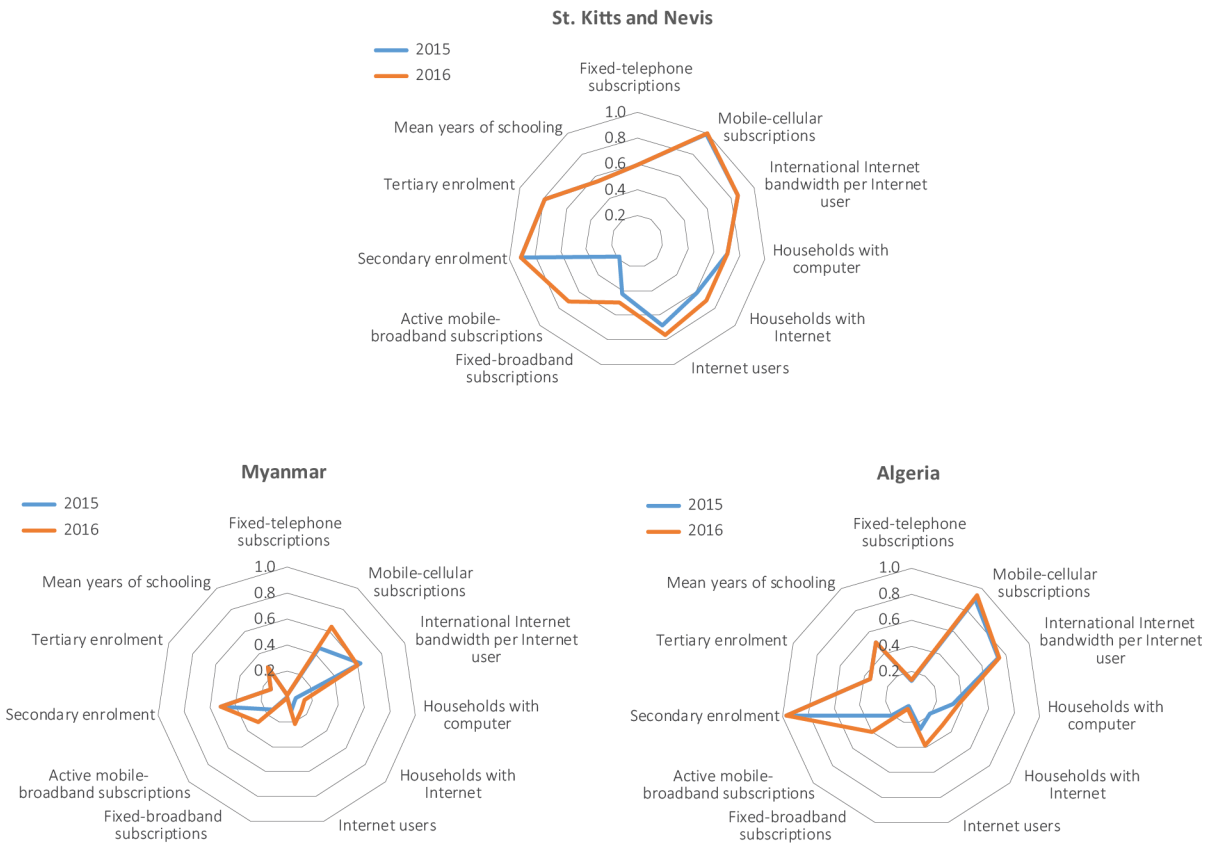
Source: ITU

Liberia – are not also in the top ten countries in terms of improvements in IDI value.

Spider charts illustrating the IDI values of the three countries which have improved their position most dynamically in the IDI 2016 rankings – St. Kitts and Nevis, Myanmar and Algeria – are presented in Chart 1.6. Aspects of the IDI performance of St. Kitts and Nevis and Myanmar are outlined in Boxes 1.5 and 1.6. Analysis of the performance of other dynamic countries at a regional level is included in Chapter 2.

The spider charts show a marked difference between the experience of the most dynamic country, St Kitts and Nevis, which ranks in 34th

Chart 1.6: IDI values for most dynamic countries, 2015 and 2016



Source: ITU.

Box 1.5: ICT and IDI developments in St. Kitts and Nevis and other Eastern Caribbean countries

The most dynamic country in IDI 2016 is St. Kitts and Nevis, which moved up 20 places to 34th in the rankings in this year's Index. Very substantial gains were also made by two of its neighbours in the Eastern Caribbean, Dominica and Grenada. These countries have seen improvements in most of the indicators making up the IDI, although with different emphases.

St. Kitts and Nevis experienced a very significant and rapid increase in active mobile-broadband subscriptions, building on a strong performance in mobile-cellular subscriptions. The mobile-broadband penetration rate increased from just 18.6 per 100 inhabitants in 2014 to 71.0 in 2015. A similar trend can be observed in Grenada, where mobile-broadband penetration rose from only 2.6 per 100 inhabitants in 2014 to 28.8 in 2015. Dominica saw an increase in active mobile-broadband subscriptions from 29.3 to 42.2 per 100 inhabitants in the course of the past year, as well as substantial improvements in fixed-broadband penetration, the proportion of Internet users, and households with access to the Internet.

A number of factors appear to have contributed to this trend. In St. Kitts and Nevis, the cost of prepaid mobile broadband decreased from USD 51.9 in 2014 to USD 13.7 in 2015. A number of promotions and zero-rating options also became available, which may have had an impact. Digicel offered occasional promotions of free credit in 2014. At the end of 2014 and throughout 2015, Digicel offered free Wikipedia, free social media (Facebook, Twitter, Instagram, and later on WhatsApp), and triple credit promotions several times a month.

The two main operators in the region, Digicel and Cable & Wireless Communications (C&W), have undertaken large infrastructure investments that support this improvement in local IDI values. C&W launched Project Marlin in 2014 to invest USD 250 million to improve and upgrade its network across the region.[14] According to C&W, this has enabled significant improvements in network resilience and speed, and its network is carrying 104 per cent more traffic on mobile and 42 per cent more traffic on fixed networks in 2016 in comparison with previous years. Digicel has also invested heavily in the region in the three years ending on 31 March 2015 (Digicel, 2015).

position, in the high quartile of the IDI, and Algeria and Myanmar, which rank in 103rd and 140th positions, in the lower-middle and low (LCC) quartiles, respectively.

St. Kitts and Nevis is a small island developing country in the Caribbean with a very high level of mobile-cellular penetration, lower but substantial fixed-telephone penetration and a high level of international bandwidth per Internet user. It also displays relatively high levels of performance in the skills sub-index, including a degree of tertiary enrolment on a par with many developed countries. It has improved its performance in the use sub-index, which has propelled the country up the IDI 2016 rankings as a whole. Its use sub-index value climbed from 4.31 to 6.53, a far bigger rise than any other country, and its ranking on that sub-index rose correspondingly, from 64th to 32nd. St. Kitts and Nevis' improved performance on the use sub-index has been driven by a spectacular rise in the proportion of active mobile-broadband subscriptions.

The shapes of the spider charts for the two other highly dynamic countries illustrated above – Algeria and Myanmar – differ markedly from that for St. Kitts and Nevis but resemble one another. Like many countries in the lower half of the overall distribution, these countries have relatively high values for mobile-cellular subscriptions but very low values for fixed-telephone subscriptions; relatively high values for international Internet bandwidth per Internet user but low values for fixed-broadband subscriptions; and relatively high levels of secondary enrolment but low values for tertiary enrolment.

Algeria's relative prosperity compared with Myanmar – it had a GNI p.c. of USD 4 870 in 2015, according to the World Bank, as against just USD 1 280 for Myanmar the year before[15] – is

Box 1.6: ICT and IDI developments in Myanmar

The Government of Myanmar passed a new Telecommunications Law in 2013 (MCIT, 2013) which opened up the country's telecommunication market. Since then, Myanmar has seen rapid improvement in ICT access and use, moving up 13 places in the global IDI rankings between 2015 and 2016. Myanmar has consistently been placed among the top five fastest growing telecom markets in the world recently, and in early 2016 was ranked second after India.[16]

The most significant improvements in Myanmar are seen in mobile-cellular subscriptions and Internet access. The entry of two new operators in the market, Qatari Ooredoo and Norwegian Telenor, in 2014, proved a significant driver for mobile-cellular uptake. Competition led to a significant decrease in prices, the cost of a SIM card falling from USD 150 in 2013 to just USD 1.5 in 2015 (A4AI, 2015). ITU's ICT Price Basket for mobile-cellular subscriptions shows that the cost of a subscription went down from USD 4.8 in 2014 to USD 1.9 in 2015, while the cost of a mobile-broadband subscription fell from USD 10.16 in 2014 to USD 2.41 in 2015. Operators have also been making zero-rating and/or cheaper data plans available, while handset costs have decreased significantly with Ooredoo launching a subsidized 3G phone for less than USD 15 (Ooredoo, 2015).

Infrastructure roll-out in Myanmar has been very rapid of late. Telenor alone invested more than USD 7.6 billion between 2014 and 2015. Ooredoo also invested heavily in network expansion with loan support from the Asian Development Bank and International Finance Corporation,[17] prioritizing data with an initial 3G-only network roll-out. As of April 2016, its network covered 85 per cent of the population.

These improvements in affordability and network availability help to explain the country's fast Internet uptake, supported by two other trends that distinguish Myanmar from neighbouring markets. Firstly, smartphone penetration is very high, reaching 66 per cent of phone owners in early 2015 according to a survey by the independent research institute LIRNEasia.[18] According to Ooredoo, as many as 80 per cent of mobile-phone users opt for smartphones (Oxford Business Group, 2015). Secondly, growth in data usage has overtaken growth in voice traffic. Data from Telenor indicate that data usage grew by 196 per cent between January and June 2015, compared with 93 per cent for voice traffic (Oxford Business Group, 2015). As many as 52 per cent of Telenor's mobile-phone subscribers are active data users.

reflected in its higher values across all indicators. The principal difference between the two countries' spider charts, other than this, lies in the growth of mobile-cellular subscriptions over the year. This was marginal in Algeria, which had already attained close to 100 per cent penetration of mobile subscriptions by 2015; but rose sharply in Myanmar, where mobile telephony only became widely available in 2014 (see Box 1.6).

The growth in IDI performance in both Algeria and Myanmar was otherwise propelled by improvements on the indicators for the proportion of Internet users, households with Internet, and the penetration of mobile-broadband subscriptions. It was these developments that enabled these countries to move ahead of others with comparable IDI values and rankings in 2015.

Improvements in IDI values

As well as assessing economies' performance in terms of the IDI value itself, it is also important to assess the progress they are making in relation to their own previous performance. Table 1.7 lists economies in order of the improvement achieved in their overall IDI value between IDI 2015 and IDI 2016. Tables 1.9 and 1.11 do the same for the access and use sub-indices.

Table 1.7: IDI value change, 2015-2016

Economy	IDI value change	IDI 2015	IDI 2016	Rank IDI 2016
St. Kitts and Nevis	0.98	6.23	7.21	34
Algeria	0.66	3.74	4.40	103
Bhutan	0.62	3.12	3.74	117
Myanmar	0.59	1.95	2.54	140
Malaysia	0.58	5.64	6.22	61
Dominica	0.57	5.14	5.71	69
Bolivia	0.53	3.49	4.02	111
Grenada	0.46	4.97	5.43	74
Côte d'Ivoire	0.44	2.43	2.86	132
Namibia	0.43	3.20	3.64	120
Mexico	0.42	4.45	4.87	92
Mongolia	0.41	4.54	4.95	90
China	0.39	4.80	5.19	81
Jordan	0.38	4.67	5.06	85
Botswana	0.38	3.79	4.17	108
Cape Verde	0.37	4.23	4.60	97
Maldives	0.35	4.68	5.04	86
Uruguay	0.35	6.44	6.79	47
Morocco	0.35	4.26	4.60	96
Vanuatu	0.35	2.73	3.08	127
Romania	0.34	5.92	6.26	60
Rwanda	0.34	1.79	2.13	150
Tunisia	0.34	4.49	4.83	95
Cambodia	0.34	2.78	3.12	125
South Africa	0.34	4.70	5.03	88
Belize	0.33	3.32	3.66	119
Iran (I.R.)	0.33	4.66	4.99	89
Gabon	0.32	2.81	3.12	124
Barbados	0.31	6.87	7.18	35
Argentina	0.31	6.21	6.52	55
Jamaica	0.31	4.20	4.52	99
Portugal	0.30	6.64	6.94	44
Philippines	0.30	3.97	4.28	107
Tonga	0.30	3.63	3.93	114
Albania	0.29	4.62	4.92	91
Montenegro	0.29	5.76	6.05	62
Lesotho	0.29	2.47	2.76	134
Uzbekistan	0.29	3.76	4.05	110
Trinidad & Tobago	0.28	5.48	5.76	67
Dominican Rep.	0.28	4.02	4.30	104
Mauritius	0.28	5.27	5.55	73
Costa Rica	0.27	6.03	6.30	57
Viet Nam	0.27	4.02	4.29	105
Brazil	0.27	5.72	5.99	63
Seychelles	0.27	4.77	5.03	87
Greece	0.27	6.86	7.13	36
Slovakia	0.26	6.69	6.96	42
Armenia	0.26	5.34	5.60	71
Burundi	0.26	1.16	1.42	171
Bulgaria	0.26	6.43	6.69	49
Georgia	0.26	5.33	5.59	72
Fiji	0.25	4.16	4.41	102
Cyprus	0.25	6.28	6.53	54
Ghana	0.25	3.75	3.99	112
New Zealand	0.24	8.05	8.29	13
Liberia	0.24	1.73	1.97	156
St. Vincent and the Grenadines	0.24	5.07	5.32	78
Nigeria	0.24	2.48	2.72	137
Turkey	0.24	5.45	5.69	70
Oman	0.24	6.04	6.27	59
Belarus	0.24	7.02	7.26	31
Panama	0.24	4.63	4.87	93
Chile	0.24	6.11	6.35	56
Swaziland	0.23	2.49	2.73	136
Lao P.D.R.	0.23	2.21	2.45	144
Indonesia	0.23	3.63	3.86	115
Italy	0.23	6.89	7.11	37
Mauritania	0.22	1.90	2.12	151
Andorra	0.22	7.39	7.61	27
Ethiopia	0.22	1.29	1.51	169
Bosnia and Herzegovina	0.22	5.03	5.25	80
Kenya	0.21	2.78	2.99	129
Croatia	0.21	6.83	7.04	41
Latvia	0.20	6.88	7.08	40
Sri Lanka	0.20	3.56	3.77	116
Burkina Faso	0.20	1.60	1.80	162
Suriname	0.20	4.89	5.09	84
Malta	0.20	7.49	7.69	24
Pakistan	0.19	2.15	2.35	146
Paraguay	0.19	3.88	4.08	109
Ireland	0.19	7.73	7.92	21
Peru	0.19	4.23	4.42	101
India	0.19	2.50	2.69	138
Switzerland	0.18	8.50	8.68	4
Nepal	0.18	2.32	2.50	142
Colombia	0.18	4.98	5.16	83
Egypt	0.18	4.26	4.44	100
Bahamas	0.18	5.80	5.98	64

Economy	IDI value change	IDI 2015	IDI 2016	Rank IDI 2016
Germany	0.17	8.13	8.31	12
Samoa	0.17	2.78	2.95	130
Saint Lucia	0.17	4.68	4.85	94
Zambia	0.16	2.05	2.22	147
Spain	0.16	7.46	7.62	26
Iceland	0.16	8.66	8.83	2
France	0.16	7.95	8.11	16
Palestine	0.16	4.12	4.28	106
Mozambique	0.16	1.60	1.75	163
Serbia	0.16	6.43	6.58	51
Austria	0.16	7.53	7.69	23
Russian Federation	0.16	6.79	6.95	43
Moldova	0.15	5.60	5.75	68
TFYR Macedonia	0.15	5.82	5.97	65
Israel	0.15	7.25	7.40	30
United Arab Emirates	0.15	6.96	7.11	38
Guinea	0.15	1.57	1.72	165
Kazakhstan	0.14	6.42	6.57	52
Mali	0.14	2.00	2.14	149
Nicaragua	0.14	2.74	2.88	131
Belgium	0.14	7.69	7.83	22
Kyrgyzstan	0.14	3.85	3.99	113
Slovenia	0.13	7.10	7.23	33
Thailand	0.13	5.05	5.18	82
Timor-Leste	0.13	2.92	3.05	128
Malawi	0.13	1.49	1.62	168
Ukraine	0.13	5.21	5.33	76
Qatar	0.12	6.78	6.90	46
Hungary	0.12	6.60	6.72	48
Senegal	0.12	2.41	2.53	141
Estonia	0.12	7.95	8.07	18
Madagascar	0.12	1.57	1.69	166
Macao, China	0.12	7.47	7.58	28
Guatemala	0.11	3.09	3.20	123
United States	0.11	8.06	8.17	15
Syria	0.10	3.21	3.32	122
Afghanistan	0.10	1.62	1.73	164
Tanzania	0.10	1.54	1.65	167
Chad	0.10	1.00	1.09	174
Cuba	0.10	2.64	2.73	135
Lithuania	0.10	7.00	7.10	39
Cameroon	0.10	2.07	2.16	148
Japan	0.09	8.28	8.37	10
Monaco	0.09	7.86	7.96	19
Djibouti	0.09	1.73	1.82	161
El Salvador	0.09	3.64	3.73	118
Guyana	0.09	3.44	3.52	121
Benin	0.09	1.83	1.92	158
Honduras	0.09	3.00	3.09	126
Togo	0.09	1.78	1.86	159
Poland	0.08	6.56	6.65	50
Kuwait	0.08	6.45	6.54	53
Uganda	0.08	1.86	1.94	157
Brunei Darussalam	0.08	5.25	5.33	77
Bangladesh	0.08	2.27	2.35	145
Angola	0.08	1.95	2.03	154
Norway	0.07	8.35	8.42	9
Canada	0.07	7.55	7.62	25
Singapore	0.07	7.88	7.95	20
Netherlands	0.07	8.36	8.43	8
Hong Kong, China	0.06	8.40	8.46	6
Czech Republic	0.06	7.20	7.25	32
Yemen	0.06	1.96	2.02	155
Korea (Rep.)	0.06	8.78	8.84	1
Gambia	0.06	2.40	2.46	143
Venezuela	0.05	5.22	5.27	79
Azerbaijan	0.05	6.23	6.28	58
South Sudan	0.05	1.36	1.42	172
Zimbabwe	0.05	2.73	2.78	133
Guinea-Bissau	0.05	1.34	1.38	173
Solomon Islands	0.05	1.99	2.04	153
Sudan	0.05	2.56	2.60	139
Bahrain	0.04	7.42	7.46	29
Niger	0.04	1.03	1.07	175
Equatorial Guinea	0.03	1.82	1.85	160
Saudi Arabia	0.03	6.88	6.90	45
United Kingdom	0.02	8.54	8.57	5
Luxembourg	0.02	8.34	8.36	11
Ecuador	0.02	4.54	4.56	98
Congo (Dem. Rep.)	0.02	1.48	1.50	170
Lebanon	0.01	5.91	5.93	66
Australia	0.01	8.18	8.19	14
Kiribati	-0.01	2.07	2.06	152
Sweden	-0.01	8.47	8.45	7
Denmark	-0.03	8.77	8.74	3
Finland	-0.03	8.11	8.08	17
Antigua & Barbuda	-0.04	5.41	5.38	75

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

The average improvement in IDI value over the year, as noted earlier, was 0.20 points. Table 1.7 shows that, of the 175 economies in the Index, 73 exceeded this average improvement, 12 of them improving their IDI values by more than twice the global average. No fewer than 52 of these have IDI rankings within the upper-middle and lower-middle quartiles. The highest 34 countries ranked by improvement in their IDI values are developing countries.

At the other end of the scale, 45 economies had IDI values which improved by less than half the average (less than 0.10 points), with five countries experiencing a fall in value. Of these, 16 came from the highest quartile of the Index, including eight of the ten highest-ranking economies in IDI 2016, while 15 came from the lowest quartile. This supports the earlier suggestion that, at least in terms of indicators that are included in the Index, middle-ranking countries are closing the gap on the most-connected economies towards the top of the Index while drawing away from LCCs.

The access, use and skills sub-indices

As in previous years, significant differences can be identified between scores on the overall IDI 2016 and on the three sub-indices of which it is composed. As described in section 1.2, the access and use sub-indices each make up 40 per cent of IDI 2016, with the remaining 20 per cent derived from the skills sub-index. While the access and use sub-indices are composed of ICT-specific indicators, the skills sub-index uses proxy indicators which are essentially concerned with educational attainment. The skills sub-index is therefore less directly related to ICTs than the other sub-indices.

Not surprisingly, given the composition of the Index, there is a strong level of correspondence between rankings in IDI 2016 and in the access and use sub-indices, but greater disparity between the overall IDI and the skills sub-index.

Economies that rank higher in the access sub-index than in IDI 2016 tend to rank lower in the use sub-index, and vice versa. In some cases, among economies towards the top of the IDI, it is possible that somewhat lower rankings in the access sub-index relative to the use sub-index are the result of fixed-mobile substitution.

All but one of the top ten economies in IDI 2016 also rank in the top 15 in the access sub-index, although the highest performer in the access sub-index, Luxembourg, only comes 11th in the overall IDI 2016. Other countries towards the top of the access sub-index displaying significantly higher performance in that sub-index than in the IDI as a whole are Germany, Malta, Singapore and France. All of the top ten economies in IDI 2016 also rank in the top 15 in the use sub-index, in which Denmark is the highest performing country.

There is similarly broad consistency between the access and use sub-indices at the bottom of the distribution: 11 of the 15 countries at the bottom of the use sub-index are also in the bottom 15 countries in the access sub-index. However, greater variations between rankings in these two sub-indices occur in the case of individual countries towards the middle of the distribution.

Twenty-one countries in IDI 2016 have rankings for access which are 20 or more places higher than their rankings for usage, the greatest differences being observed for Brunei Darussalam (52 places), Ukraine (43 places), Seychelles (34 places), the Islamic Republic of Iran (31 places) and Mauritius (30 places). These imbalances suggest that there is scope for greater deployment and policy interventions to stimulate demand in these countries.

Conversely, 15 countries have rankings in the use sub-index which are 20 or more places higher than their rankings for access, the highest differences being observed for Finland (32 places), Nigeria and Bhutan (each 31 places). In Finland, this is due to the country's low level of fixed-telephone subscriptions. In Nigeria, Bhutan and other developing countries, the imbalance suggests that strong demand for services is not currently matched by adequate high-quality infrastructure, and that policy interventions to stimulate the supply side of the market may be required.

As already noted, there is much more variation between the overall IDI and the skills sub-index, which is derived from non-ICT-specific indicators. Only three of the top ten ranking countries in IDI 2016 (the Republic of Korea, Denmark and Norway) come within the top ten countries in the skills sub-index; and five of the top ten performers in IDI 2016 are ranked down between 29th and 35th in the skills sub-index.

The access sub-index

Rankings and values in the access sub-index for IDI 2015 and IDI 2016 are set out in Table 1.3 above. Table 1.9 below ranks countries according to the change in access sub-index value they have achieved during the course of the year.

There has been less movement in the access sub-index than in the use sub-index in the year between IDI 2015 and IDI 2016. The average value of the access sub-index, at 5.58, is significantly higher than that of the use sub-index (3.91) and the IDI as a whole (4.94). It has improved by 0.13 points over the year, as compared with an improvement of 0.37 in the use sub-index and 0.20 in IDI 2016 overall.

A total of 19 countries, all of them developing countries, improved their access sub-index value by more than twice the average increase (by 0.27 points or higher), while 20 economies saw their value in this sub-index fall over the year. Half of the latter group came from the high quartile of IDI performers, where there is little scope for further improvement in mobile-cellular penetration and fixed-telephone penetration is now in decline.

The highest values achieved in the access sub-index are significantly higher than those in the use sub-index. Luxembourg tops the access sub-index rankings for 2016 with a sub-index value of 9.54, followed by Iceland (9.42), the United Kingdom (9.24) and Hong Kong (China) (9.16). Of the 20 lowest ranking countries in the access sub-index, 19 are LDCs, all but six of them in the African region.

Not surprisingly, the rankings of most economies in the access sub-index resemble their rankings in the overall IDI 2016, though there are significant exceptions. As many as 41 economies have access rankings which differ by ten or more places from their IDI 2016 rankings.

Two countries - Finland and Cuba - have overall IDI rankings which are more than 20 places higher than their access sub-index rankings. In the case of Finland, where the difference is 22 places, this is primarily due to its low penetration of fixed-telephone subscriptions, probably as a result of fixed-mobile substitution. The overall IDI ranking for Cuba, meanwhile, is boosted by the country's high performance on the skills sub-index, where it ranks 57th, as against 150th in the use sub-index and 167th in the access sub-index. Other countries whose access sub-index rankings are significantly below their overall IDI 2016 rankings include Lithuania towards the top of the overall distribution, Costa Rica and Albania in the middle of the distribution, and Kiribati towards the bottom of the distribution. In these cases, the difference indicates that infrastructure limitations are the principal constraint on ICT development.

Equally, a number of countries have access sub-index rankings which are considerably higher than their overall IDI 2016 rankings. These include Malta, the United Arab Emirates, Portugal and Barbados towards the top of the distribution; Mauritius, Seychelles and Brunei Darussalam in the middle of the distribution; and El Salvador, Gambia and Mozambique towards the lower end of the distribution. In these cases, the difference indicates that efforts to increase usage of available infrastructure would have most positive impact on ICT development.

Table 1.8 identifies the countries which have recorded the biggest increases in their access sub-index rankings and values in the year 2015-2016. While some of these countries also appear in Table 1.5, which identifies the most dynamic performers in IDI 2016, this is far from universally the case, illustrating how the use sub-index, whose average value has changed almost three times as much as that of the access sub-index, has more influence on changes in overall IDI rankings. It is notable, in particular, that St. Kitts and Nevis, which tops Table 1.6, does not figure in Table 1.8, while the second most dynamic country in the access sub-index rankings, Barbados, does not appear among the most dynamic countries overall.

Table 1.8 shows the importance of comparing improvements in sub-index value alongside movements in the rankings. Seven of the ten countries which showed the strongest improvements in sub-index values do not appear among the top ten improvers in the rankings, including the country with the third highest improvement in its access sub-index value, Morocco.

All but one of the indicators making up the access sub-index showed some increase for the majority of countries between 2015 and 2016. The most substantial average increases in this sub-index

Table 1.8: Access sub-index, most dynamic countries, 2015-2016

Change in access ranking			Change in access value		
Access rank 2016	Country	Access rank change	Access rank 2016	Country	Access value change
144	Myanmar	15	144	Myanmar	0.63
20	Barbados	8	98	Algeria	0.47
98	Algeria	7	83	Morocco	0.42
58	Mauritius	7	20	Barbados	0.38
17	New Zealand	5	129	Côte d'Ivoire	0.36
26	Andorra	5	96	Mongolia	0.35
116	Dominican Rep.	5	75	Dominica	0.34
149	Burkina Faso	5	112	Uzbekistan	0.31
15	Austria	5	55	Trinidad & Tobago	0.31
46	Oman	5	168	Burundi	0.30

Source: ITU.

in most regions occurred in the proportion of households with access to the Internet. In Africa, however, the biggest average increase was in mobile-cellular subscriptions, while in the CIS region it was in households with access to a computer. There was a fall in the indicator for fixed-telephone subscriptions in a majority of countries, including both LCCs, which have historically been characterized by low levels of fixed lines, and highly connected countries, where the numbers of fixed-telephone subscriptions have historically been high. This development raises questions about the viability of measuring fixed-telephone subscriptions as a long-term indicator of ICT development.

The use sub-index

Rankings and values in the use sub-index for IDI 2015 and IDI 2016 are set out in Table 1.4 above. Table 1.11 below ranks countries according to the change in use sub-index value they have achieved during the course of the year.

As indicated above, the use sub-index has witnessed more substantial improvements in values over the year 2015-2016 than the access sub-index. The average value for the use sub-index in 2016 is 3.91, up 0.37 points (more than 10 per cent) on the figure of 3.54 in 2015. As a result, the use sub-index has had more influence on movements in IDI 2016 as a whole.

There is also much more consistency between the top countries in terms of improvement in rankings and in values for this sub-index than for the access sub-index. Nine of the top ten countries in terms of improved value are among the ten countries with the most improved rankings for this sub-index.

Seven countries saw increases over the year of more than one whole point in this sub-index, with a further ten countries experiencing increases that were also more than twice the average for the sub-index. All of these are developing countries, the largest improvement for a developed country being that of Bulgaria, ranked 24th in the table for improvements in sub-index values. Meanwhile, 27 countries improved their value for the use sub-index by less than 0.10 of a point, of which three registered falls in value.

The highest ranking economies in the use sub-index closely resemble those in the overall IDI. With two exceptions – Finland and Luxembourg in place of Hong Kong (China) and the Netherlands – the ten highest-ranking economies are the same as those in IDI 2016, and there is only one difference in the top twenty, Macao (China) taking the place of Germany. It is a similar story at the bottom of the distribution, where 17 of the 20 lowest-ranking countries in IDI 2016 appear among the 20 lowest in the use sub-index.

Table 1.9: Access sub-index value change, 2015-2016

Economy	IDI access value change 2015-2016	IDI access sub-index 2015	IDI access sub-index 2016	Rank IDI access sub-index 2016
Myanmar	0.63	2.45	3.08	144
Algeria	0.47	4.56	5.03	98
Morocco	0.42	5.64	6.07	83
Barbados	0.38	7.86	8.24	20
Côte d'Ivoire	0.36	3.44	3.79	129
Mongolia	0.35	4.77	5.12	96
Dominica	0.34	6.06	6.40	75
Uzbekistan	0.31	4.22	4.53	112
Trinidad & Tobago	0.31	6.72	7.03	55
Burundi	0.30	1.84	2.14	168
Fiji	0.29	4.68	4.97	100
Iran (I.R.)	0.28	5.97	6.26	79
Cambodia	0.28	3.93	4.21	122
Armenia	0.28	6.29	6.57	70
Panama	0.28	5.72	5.99	84
Tunisia	0.28	5.01	5.29	95
Mauritius	0.27	6.59	6.86	58
Bhutan	0.27	3.75	4.02	125
Thailand	0.27	5.24	5.50	89
Dominican Rep.	0.26	4.12	4.38	116
Ethiopia	0.26	1.85	2.11	170
Vanuatu	0.26	3.40	3.66	131
Greece	0.26	7.60	7.85	34
Nepal	0.26	2.91	3.16	143
Croatia	0.25	7.33	7.58	41
Mexico	0.25	4.82	5.08	97
Romania	0.25	6.65	6.90	57
Albania	0.25	4.48	4.73	106
Oman	0.25	7.12	7.37	46
New Zealand	0.25	8.08	8.32	17
Bolivia	0.25	4.13	4.37	117
Sri Lanka	0.25	4.26	4.51	113
Kenya	0.24	3.30	3.54	133
Philippines	0.24	4.46	4.70	108
Burkina Faso	0.23	2.63	2.87	149
Tanzania	0.23	2.42	2.65	158
Palestine	0.23	5.12	5.35	93
Seychelles	0.23	6.58	6.81	62
St. Kitts and Nevis	0.23	7.50	7.72	37
Ghana	0.23	4.51	4.74	105
Tonga	0.23	4.20	4.43	115
Andorra	0.22	7.84	8.06	26
Malaysia	0.22	6.53	6.75	66
Suriname	0.21	5.67	5.88	85
Chad	0.21	1.74	1.94	173
South Africa	0.21	5.26	5.46	90
United Arab Emirates	0.20	7.94	8.14	24
China	0.19	5.26	5.45	91
Austria	0.19	8.16	8.35	15
Turkey	0.19	6.00	6.20	81
St. Vincent and the Grenadines	0.19	6.28	6.47	72
Jordan	0.19	5.91	6.10	82
Madagascar	0.18	2.21	2.39	165
Latvia	0.18	7.20	7.38	45
Lao P.D.R.	0.18	3.03	3.21	142
Maldives	0.18	6.04	6.22	80
Indonesia	0.18	4.53	4.71	107
Zambia	0.17	2.66	2.84	151
Cuba	0.17	2.00	2.17	167
Viet Nam	0.17	4.42	4.60	110
Jamaica	0.17	4.65	4.83	103
India	0.17	3.15	3.32	139
Swaziland	0.17	3.11	3.28	141
Chile	0.17	6.65	6.81	61
Estonia	0.17	7.85	8.02	27
Guinea	0.17	2.41	2.57	161
Portugal	0.16	7.77	7.93	30
Liberia	0.16	2.59	2.76	155
United States	0.16	8.11	8.27	19
Samoa	0.16	3.27	3.43	134
Bahrain	0.16	7.76	7.91	32
Grenada	0.15	6.14	6.30	77
Bahamas	0.15	6.62	6.77	64
Lesotho	0.15	3.26	3.41	135
Brazil	0.15	6.28	6.42	74
Bangladesh	0.14	2.91	3.06	145
Moldova	0.14	6.50	6.64	68
Peru	0.14	4.66	4.80	104
Slovakia	0.14	7.08	7.22	50
Argentina	0.14	6.63	6.77	65
Solomon Islands	0.14	2.59	2.73	156
Guyana	0.14	4.19	4.33	118
Nigeria	0.14	2.82	2.96	147
Paraguay	0.14	4.45	4.59	111
Hungary	0.13	7.49	7.62	40
Benin	0.13	2.72	2.86	150
Saint Lucia	0.13	5.52	5.65	88
Colombia	0.13	5.70	5.83	86
Zimbabwe	0.13	3.22	3.35	137
Guatemala	0.13	4.34	4.47	114
Cape Verde	0.13	4.89	5.02	99
Costa Rica	0.13	6.31	6.44	73
Afghanistan	0.13	2.39	2.51	163
Spain	0.13	7.80	7.92	31
Honduras	0.12	4.04	4.17	123
Belarus	0.12	7.68	7.80	36
Guinea-Bissau	0.12	2.29	2.41	164
Mauritania	0.11	2.88	2.99	146
Montenegro	0.11	6.74	6.85	60
Uruguay	0.10	7.15	7.25	48
Djibouti	0.10	2.44	2.55	162
Rwanda	0.10	2.54	2.65	159
Kazakhstan	0.10	7.46	7.56	42
Gabon	0.10	3.88	3.98	126
Israel	0.10	8.18	8.28	18
Egypt	0.10	5.20	5.30	94
Azerbaijan	0.09	6.68	6.78	63
Kuwait	0.09	7.31	7.40	44
Kyrgyzstan	0.09	4.16	4.25	121
Monaco	0.09	8.03	8.12	25
Singapore	0.09	8.61	8.70	11
Syria	0.09	4.58	4.66	109
Pakistan	0.09	3.30	3.39	136
Nicaragua	0.08	4.00	4.08	124
Netherlands	0.08	8.94	9.02	7
Mozambique	0.08	2.82	2.90	148
El Salvador	0.08	4.88	4.95	101
Senegal	0.07	3.51	3.59	132
Belize	0.07	3.62	3.69	130
Iceland	0.07	9.35	9.42	2
Lithuania	0.07	7.01	7.08	54
Bosnia and Herzegovina	0.07	5.71	5.78	87
United Kingdom	0.06	9.18	9.24	3
Niger	0.06	1.99	2.04	171
South Sudan	0.06	1.28	1.34	175
Botswana	0.06	4.27	4.33	119
Slovenia	0.06	7.88	7.93	29
Ukraine	0.05	6.43	6.48	71
TFYR Macedonia	0.05	6.63	6.68	67
Cyprus	0.05	6.97	7.02	56
Japan	0.05	8.75	8.80	10
Italy	0.05	7.64	7.69	38
Luxembourg	0.05	9.49	9.54	1
Gambia	0.05	3.85	3.90	128
Brunei Darussalam	0.04	7.16	7.21	52
Georgia	0.04	6.25	6.29	78
Timor-Leste	0.04	3.87	3.91	127
Togo	0.04	2.55	2.59	160
Russian Federation	0.04	7.19	7.23	49
Serbia	0.04	7.18	7.22	51
France	0.03	8.67	8.70	12
Malta	0.03	9.01	9.04	6
Uganda	0.02	2.34	2.37	166
Czech Republic	0.02	7.44	7.46	43
Norway	0.02	8.19	8.21	22
Malawi	0.02	2.01	2.03	172
Bulgaria	0.01	6.85	6.86	59
Qatar	0.01	7.90	7.91	33
Yemen	0.01	2.65	2.66	157
Canada	0.01	7.98	7.99	28
Equatorial Guinea	0.00	2.76	2.77	153
Lebanon	0.00	6.57	6.57	69
Angola	0.00	2.75	2.76	154
Belgium	0.00	8.34	8.34	16
Congo (Dem. Rep.)	0.00	1.83	1.83	174
Australia	-0.01	8.24	8.23	21
Korea (Rep.)	-0.01	9.00	8.99	8
Mali	-0.01	3.31	3.30	140
Poland	-0.02	7.11	7.09	53
Sudan	-0.02	3.35	3.33	138
Venezuela	-0.02	5.44	5.42	92
Macao, China	-0.03	7.85	7.83	35
Kiribati	-0.03	2.14	2.11	169
Hong Kong, China	-0.04	9.20	9.16	4
Cameroon	-0.04	2.82	2.77	152
Finland	-0.04	7.73	7.69	39
Switzerland	-0.05	9.00	8.95	9
Ireland	-0.05	8.24	8.19	23
Germany	-0.08	9.17	9.09	5
Sweden	-0.08	8.77	8.69	13
Namibia	-0.09	4.35	4.25	120
Denmark	-0.13	8.65	8.52	14
Saudi Arabia	-0.22	7.51	7.29	47
Antigua & Barbuda	-0.22	6.56	6.34	76
Ecuador	-0.26	5.16	4.90	102

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

Although there is less divergence between use sub-index rankings and overall IDI rankings than there is between access sub-index rankings and overall rankings, there are nevertheless a number of countries which perform significantly better or worse in the use sub-index than in IDI 2016 as a whole.

Countries that perform disproportionately well in the use sub-index include Finland, the United Arab Emirates, Qatar, Kuwait and Malaysia towards the top of the distribution; Lebanon, China, Mexico and Bhutan in the middle of the distribution; and Côte d'Ivoire, Nigeria, Sudan, Rwanda, Uganda and Malawi towards the bottom of the distribution. In these economies, limitations in the availability of infrastructure and devices are likely to be the major constraint on ICT development, thus calling for stronger policy focus on these areas.

Other countries perform less well in the use sub-index than in the access sub-index or in IDI 2016. These include Slovenia, Greece, Armenia, Mauritius, Ukraine and Brunei Darussalam in the upper half of IDI 2016; the Islamic Republic of Iran (the most affected country) and Nicaragua in the lower-middle quartile of IDI 2016; and Cuba and Kiribati among the LCCs. In these economies, demand-side policies to stimulate usage of available infrastructure are most likely to raise the level of ICT development.

Table 1.10 identifies the countries which have achieved the most significant rise in their use sub-index rankings and values in the year 2015-2016. This table more closely resembles the representation of dynamic countries in IDI 2016 in Table 6 than does the corresponding Table 1.8 for the access sub-index, because the higher value changes which are observed for this sub-index mean that it has more influence on changes in the overall IDI. The very substantial improvement in the use sub-index achieved by St. Kitts and Nevis – almost one whole point above that of the next most dynamic country in this sub-index – is what has propelled it to the top of Table 1.6. This is primarily attributable to growth in mobile-broadband penetration. Myanmar, on the other hand, has seen significant improvements in both the access and use sub-indices. Other strong performers in the use sub-index, with improvements in value exceeding one point, include Bhutan, Malaysia, Namibia, Algeria, Dominica and Bolivia.

There have been significant average gains in two of the three indicators in this sub-index – Internet users and mobile-broadband subscriptions – in all regions during the year between IDI 2015 and IDI 2016. The biggest increase in all regions has been in mobile-broadband subscriptions. All regions also experienced growth in fixed-broadband subscriptions, but at a lower rate, which raises some concerns for the long-term development of high-capacity networks and services in less developed regions.

Table 1.10: Use sub-index, most dynamic countries, 2015-2016

Change in use ranking			Change in use value		
Use rank 2016	Country	Use rank change	Use rank 2016	Country	Use value change
32	St. Kitts and Nevis	32	32	St. Kitts and Nevis	2.22
129	Myanmar	17	94	Bhutan	1.27
94	Bhutan	16	46	Malaysia	1.23
46	Malaysia	15	109	Namibia	1.18
136	Rwanda	15	108	Algeria	1.17
111	Bolivia	12	65	Dominica	1.10
87	Grenada	12	111	Bolivia	1.08
109	Namibia	12	87	Grenada	0.99
108	Algeria	11	98	Botswana	0.89
65	Dominica	11	129	Myanmar	0.84

Note: Cape Verde also has 11-rank change.
Source: ITU.

Table 1.11: Use sub-index value change, 2015-2016

Economy	IDI use value change 2015-2016	IDI use sub-index 2015	IDI use sub-index 2016	Rank IDI use sub-index 2016
St. Kitts and Nevis	2.22	4.31	6.53	32
Bhutan	1.27	2.13	3.40	94
Malaysia	1.23	4.63	5.86	46
Namibia	1.18	1.73	2.91	109
Algeria	1.17	1.75	2.92	108
Dominica	1.10	3.72	4.82	65
Bolivia	1.08	1.65	2.72	111
Grenada	0.99	2.79	3.78	87
Botswana	0.89	2.37	3.26	98
Myanmar	0.84	0.89	1.73	129
Mexico	0.81	3.43	4.24	74
Cape Verde	0.79	3.24	4.03	77
China	0.79	3.79	4.58	67
Uruguay	0.77	5.43	6.20	39
Belize	0.76	1.79	2.55	115
Jordan	0.76	2.44	3.20	101
Rwanda	0.75	0.73	1.47	136
Côte d'Ivoire	0.74	1.34	2.08	122
Maldives	0.71	3.59	4.30	72
Gabon	0.69	1.23	1.92	124
Mongolia	0.68	2.97	3.64	90
Argentina	0.64	4.81	5.45	57
South Africa	0.64	3.37	4.00	79
Bulgaria	0.63	5.21	5.84	47
Montenegro	0.62	3.99	4.61	66
Vanuatu	0.61	1.60	2.21	119
Jamaica	0.60	2.94	3.55	91
Romania	0.60	4.48	5.08	63
Georgia	0.60	3.40	4.00	80
Portugal	0.59	5.07	5.67	51
Lesotho	0.58	1.22	1.80	128
Tunisia	0.57	3.37	3.95	82
Cyprus	0.57	4.89	5.46	55
Cambodia	0.56	1.53	2.09	121
Costa Rica	0.55	5.24	5.80	48
Iran (I.R.)	0.55	2.19	2.74	110
Brazil	0.53	5.07	5.60	52
Ireland	0.53	6.85	7.38	23
Italy	0.52	5.73	6.25	38
Slovakia	0.52	5.86	6.38	34
Tonga	0.52	2.07	2.59	112
Philippines	0.52	2.42	2.93	107
Switzerland	0.51	8.17	8.67	2
Germany	0.51	6.98	7.49	21
Viet Nam	0.50	3.01	3.51	92
Albania	0.49	3.40	3.88	84
Belarus	0.47	5.40	5.88	44
Bosnia and Herzegovina	0.47	3.74	4.21	75
Nigeria	0.47	1.81	2.28	116
Malta	0.46	6.28	6.75	28
Morocco	0.45	2.95	3.40	95
Liberia	0.45	0.44	0.89	155
Mauritania	0.44	0.85	1.29	140
Dominican Rep.	0.44	2.97	3.41	93
Seychelles	0.44	2.94	3.37	96
Chile	0.42	4.48	4.91	64
Mauritius	0.42	3.36	3.78	88
Swaziland	0.42	1.19	1.61	134
St. Vincent and the Grenadines	0.41	3.47	3.89	83
Uzbekistan	0.41	2.17	2.58	113
Greece	0.41	5.05	5.46	56
Barbados	0.41	5.47	5.88	43
Lao P.D.R.	0.41	0.70	1.11	146
Turkey	0.40	3.77	4.18	76
Indonesia	0.40	1.79	2.19	120
Pakistan	0.40	0.69	1.09	148
Trinidad & Tobago	0.40	4.13	4.53	68
Ghana	0.39	2.64	3.03	103
Armenia	0.38	3.47	3.85	85
France	0.37	7.23	7.61	17
New Zealand	0.36	7.66	8.03	11
Mali	0.36	0.61	0.97	152
Serbia	0.35	5.15	5.50	54
Egypt	0.35	2.78	3.14	102
Burundi	0.35	0.06	0.42	169
Fiji	0.35	2.88	3.23	100
Russian Federation	0.35	5.52	5.87	45
Paraguay	0.35	2.61	2.96	105
Oman	0.35	5.05	5.39	58
Belgium	0.34	6.76	7.10	24
Peru	0.34	2.61	2.94	106
Andorra	0.33	6.41	6.74	29
Iceland	0.33	8.11	8.44	5
Latvia	0.32	5.94	6.27	37
Colombia	0.32	3.52	3.85	86
TFYR Macedonia	0.32	4.85	5.17	61
Panama	0.32	2.92	3.24	99
Macao, China	0.32	7.22	7.53	20
Mozambique	0.32	0.30	0.62	164
Malawi	0.30	0.56	0.86	156
Ecuador	0.30	3.01	3.31	97
India	0.30	0.95	1.25	142
Bahamas	0.29	4.17	4.46	70
Kenya	0.29	1.76	2.05	123
Saudi Arabia	0.29	6.03	6.32	36
Qatar	0.29	6.03	6.32	35
Saint Lucia	0.29	3.43	3.72	89
Ethiopia	0.29	0.54	0.82	158
Suriname	0.28	4.20	4.48	69
Cameroon	0.28	0.55	0.84	157
Timor-Leste	0.28	1.42	1.70	130
Spain	0.28	6.65	6.93	25
Croatia	0.28	5.85	6.13	41
Slovenia	0.28	5.43	5.71	49
Israel	0.27	5.75	6.02	42
Nicaragua	0.27	0.73	1.00	151
Samoa	0.26	0.97	1.23	143
Burkina Faso	0.26	0.63	0.90	154
Ukraine	0.26	2.31	2.57	114
Sri Lanka	0.26	1.44	1.70	131
Kazakhstan	0.25	4.90	5.15	62
Kyrgyzstan	0.25	2.00	2.25	118
Moldova	0.24	4.02	4.26	73
Zambia	0.23	0.93	1.17	144
Poland	0.23	5.13	5.35	59
Senegal	0.22	1.42	1.64	133
Nepal	0.20	1.15	1.35	139
Guinea	0.20	0.42	0.62	163
Hong Kong, China	0.20	7.74	7.94	12
Austria	0.19	6.48	6.67	30
Angola	0.19	0.91	1.10	147
Japan	0.18	7.96	8.14	8
Syria	0.17	1.35	1.52	135
Uganda	0.17	1.10	1.27	141
Togo	0.17	0.32	0.49	165
Canada	0.17	6.68	6.85	26
Lithuania	0.17	6.23	6.40	33
Palestine	0.17	2.08	2.25	117
United Arab Emirates	0.16	6.66	6.82	27
Hungary	0.16	5.12	5.28	60
Norway	0.16	8.33	8.48	4
Venezuela	0.15	3.80	3.95	81
Brunei Darussalam	0.15	2.81	2.97	104
Guatemala	0.15	1.25	1.40	137
El Salvador	0.15	1.72	1.87	127
Korea (Rep.)	0.15	8.42	8.57	3
Monaco	0.14	7.78	7.92	13
Sudan	0.14	1.73	1.87	126
Afghanistan	0.13	0.34	0.47	166
Antigua & Barbuda	0.13	3.89	4.02	78
Yemen	0.13	0.99	1.12	145
Estonia	0.13	7.75	7.87	14
Czech Republic	0.12	6.43	6.55	31
Djibouti	0.12	0.59	0.71	161
United States	0.12	7.45	7.57	18
Kuwait	0.11	6.03	6.15	40
Madagascar	0.11	0.33	0.44	168
Honduras	0.10	1.29	1.38	138
Netherlands	0.09	7.68	7.77	15
Gambia	0.09	0.83	0.91	153
Singapore	0.09	7.45	7.54	19
Benin	0.09	0.32	0.40	171
Guyana	0.09	1.57	1.65	132
Equatorial Guinea	0.08	0.66	0.74	159
South Sudan	0.07	0.57	0.65	162
Cuba	0.07	0.97	1.04	150
Denmark	0.07	8.84	8.91	1
Thailand	0.06	4.27	4.33	71
Sweden	0.05	8.31	8.36	6
Congo (Dem. Rep.)	0.04	0.36	0.41	170
Bangladesh	0.04	1.02	1.06	149
Niger	0.04	0.10	0.14	174
Azerbaijan	0.04	5.66	5.70	50
Chad	0.04	0.10	0.14	173
Australia	0.03	7.67	7.70	16
Lebanon	0.03	5.48	5.51	53
Tanzania	0.02	0.27	0.30	172
Kiribati	0.01	0.44	0.45	167
Guinea-Bissau	0.01	0.12	0.12	175
United Kingdom	0.00	8.09	8.09	9
Zimbabwe	0.00	1.91	1.91	125
Luxembourg	0.00	8.05	8.05	10
Solomon Islands	-0.02	0.75	0.73	160
Finland	-0.02	8.21	8.18	7
Bahrain	-0.06	7.54	7.48	22

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

The skills sub-index

The IDI skills sub-index was amended during 2015, following consideration by EGTI (see Box 1.1), in order to provide a better gauge of ICT-relevant skills. Two of the proxy indicators which had previously been included in the sub-index – secondary and tertiary enrolment – were retained. A new indicator – mean years of schooling – was introduced in place of the previous indicator (adult literacy rate). Data in the current skills sub-index are not, therefore, directly comparable with those for the sub-index published in earlier annual editions of the *Measuring the Information Society Report*.

Data for the skills sub-index are provided by the UNESCO Institute for Statistics (UIS). Revisions have also been made to the IDI 2015 data, as they are published in this report, to ensure that they reflect the three current indicators, rather than the set that was included in last year's report. This accounts for differences in the data for this sub-index between this report and the 2015 edition.

Data used for the calculation of IDI 2016 are the latest available for the three indicators now included in the skills sub-index. Because of data collection schedules, data available for this sub-index are identical for 2015 and 2016. It is not therefore possible to analyse changes in the skills sub-index between 2015 and 2016, and the sub-index has not contributed to changes in the overall IDI for this year.

Although it carries less weighting than the access and use sub-indices, the skills sub-index does nevertheless have an impact on overall IDI performance insofar as some countries perform particularly well or particularly badly where these proxy indicators are concerned. The highest performing country in the skills sub-index, for example, is the United States which, despite ranking only 19th for access and 18th for use, lies in 15th place in the overall IDI. Australia, which comes second in the skills sub-index, likewise ranks only 21st for access and 16th for use but 14th in the overall IDI.

The biggest positive differences between the skills sub-index and the overall IDI rankings, which effectively boost IDI 2016 performance, are observed for Ukraine (which ranks 11th in the skills sub-index and 76th in IDI 2016) and Cuba (which ranks 57th in the skills sub-index and 135th in IDI 2016). The biggest negative differences which impair overall IDI performance are observed for Luxembourg (which ranks 70th in the skills sub-index but 11th in IDI 2016, and first in the access sub-index) and the United Arab Emirates (which ranks 105th in the skills sub-index but 38th in IDI 2016). It is possible that some of these differences may be ascribed to different definitions used for national data gathering.

1.4 The IDI and the digital divide

The term "digital divide" is used to describe differences in ICT development within and between countries, regions and socio-economic groupings. ITU and other UN agencies are committed to bridging such digital divides, in order to ensure that everyone is able to take advantage of the benefits of the emerging information society and that these benefits thereby contribute to sustainable development. The UN General Assembly reaffirmed this commitment in its ten-year review of outcomes of the World Summit on the Information Society (WSIS) in 2015.[19]

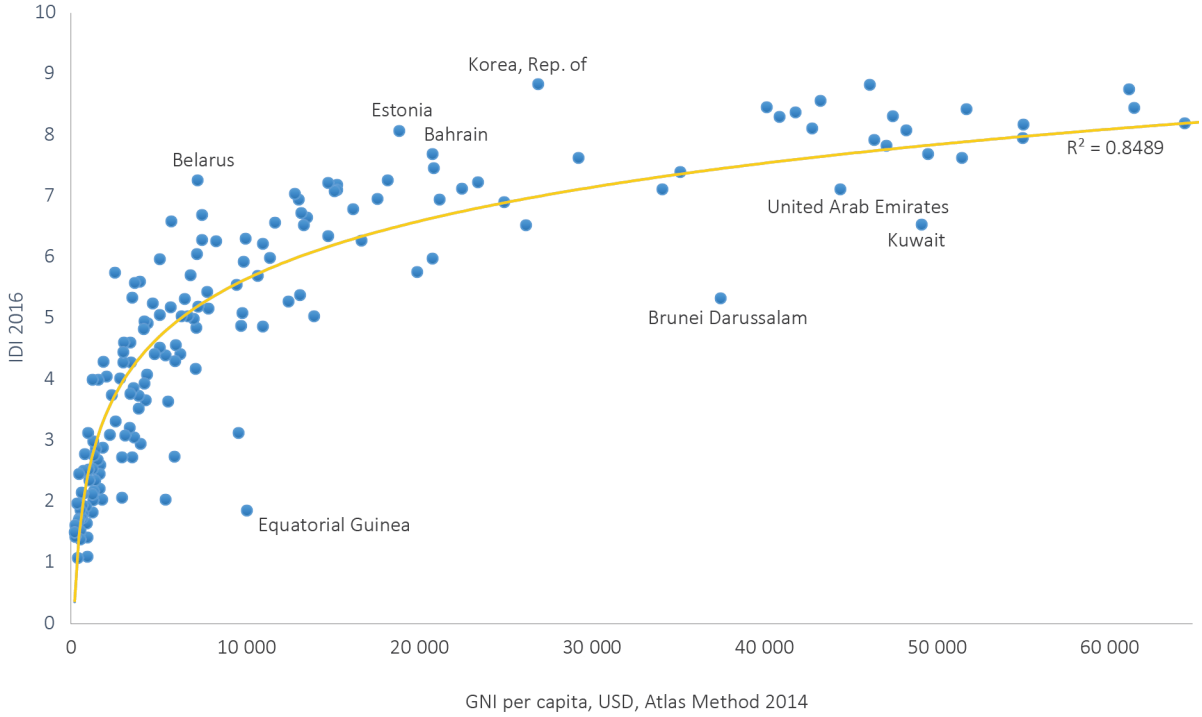
There has been growing concern that, while the digital divide in basic services between developed and developing countries has narrowed since WSIS, as a result of the spread of mobile-cellular uptake in almost all economies, digital divides in the availability of broadband networks and services, on the other hand, have been widening; and that LDCs in particular may be falling further behind other countries. As a composite index, the IDI provides a useful tool for comparing differences between economies, and between regions which include countries with higher and lower levels of economic and ICT development.

The relationship between IDI and GNI p.c.

One important starting point for such comparative analysis is the relationship between Gross National Income per capita (GNI p.c.) and IDI performance.

Chart 1.7, which plots IDI 2016 values against GNI p.c. data for 2014 (the latest year for which data are available), shows that there is a strong and significant correlation between the two, suggesting that the level of GNI p.c. (an indicator of a country's economic performance) has a bearing

Chart 1.7: IDI and GNI p.c., 2016



Source: ITU.

on ICT development. In most cases, it is likely that GNI p.c. levels influence both consumer demand for use of ICTs and infrastructure investment in access networks to meet that demand.

Outliers – countries that display significantly better or worse IDI performance than might be anticipated from their GNI p.c. rankings – are worth considering further, as their experience may point to policy and investment choices which are more or less effective in leveraging ICT access and use. The Republic of Korea, which has the highest IDI ranking, notably outperforms its expected position on the trend line in Chart 1.7, as do Belarus, Estonia and Bahrain. Countries which noticeably underperform in comparison with their peers with similar GNI p.c. levels include Brunei Darussalam, Kuwait and the United Arab Emirates.

The relationship between IDI and development status

Another way to assess differences between economic groupings is to view IDI rankings and values in relation to development status, in particular by differentiating between developed and developing countries and considering the special circumstances of LDCs.

It is important to be clear about the composition of development categories when interpreting data that distinguish between them. The developing-economies group, as defined in UN data sets, includes a number of economies with high GNI p.c., including several economies in East Asia as well as oil-exporting members of the Gulf Cooperation Council (GCC). Some of these economies (notably the Republic of Korea, Hong Kong (China) and Singapore) have become ICT champions with very high rankings in the IDI. Five countries defined by the UN as developing countries – Chile, Israel, the Republic of Korea, Mexico and Turkey – are also member countries of the Organisation for Economic Cooperation and Development (OECD). The developed-country grouping, by contrast, includes relatively few countries with GNI p.c. levels that are significantly lower than average, and only one country (Albania) that is in the lower half of the IDI rankings. As a result, the upward effect on the developing-country average IDI value exerted by outliers in the developing-country grouping tends to be greater than the downward effect on the developed-

Table 1.12: IDI by development status, 2016 and 2015

	IDI 2016						IDI 2015						Change in average value 2016-2015
	Average value*	Min.	Max.	Range	StDev	CV	Average value*	Min.	Max.	Range	StDev	CV	
World	4.94	1.07	8.84	7.76	2.22	44.95	4.74	1.00	8.78	7.78	2.23	47.01	0.20
Developed	7.40	4.92	8.83	3.91	0.98	13.29	7.25	4.62	8.77	4.15	1.03	14.26	0.15
Developing	4.07	1.07	8.84	7.76	1.85	45.56	3.85	1.00	8.78	7.78	1.83	47.41	0.22

Note: *Simple averages. StDev= Standard deviation, CV= Coefficient of variation
Source: ITU.

country average IDI value of outliers in the developed-country category.

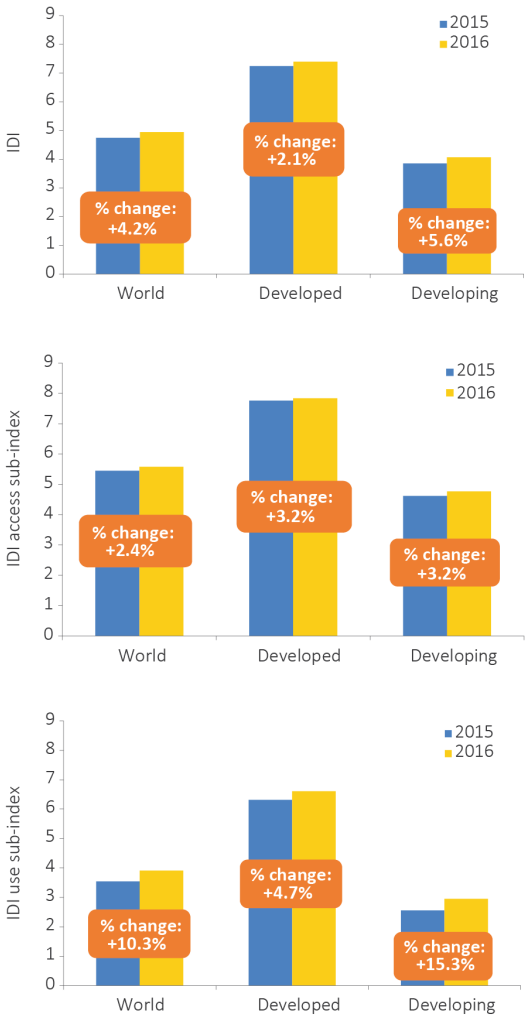
Data for the period 2010-2015, reported in the *Measuring the Information Society Report 2015*, showed that the average IDI values of both developed and developing countries increased substantially during that period, and more or less in step with one another, leaving the digital divide between developed and developing countries largely unchanged. However, they also indicated that there was a growing gap between the majority of developing countries and LDCs.

IDI values by level of development for 2015 and 2016 are summarized in Table 1.12 and depicted in Chart 1.8. The gap between the developed- and developing-country groupings remains considerable, with developed countries having an average IDI value of 7.40 against an average of 4.07 for developing countries, a difference of 3.33 points. However, developing countries have improved their position slightly relative to developed countries during the year, raising their average IDI value by 0.22 points (an increase of 5.6 per cent) as against 0.15 points (an increase of 2.1 per cent) for developed countries. Developing countries as a group registered higher rates of improvement in both the access and use sub-indices (0.15 points as against 0.08 points, and 0.39 points as against 0.30 points, respectively).

Least developed countries[20]

When it comes to the digital divide, the situation of LDCs is of particular concern, given the potential role of ICTs in facilitating sustainable development. The bottom 27 countries in the IDI rankings are all LDCs, as are 36 of the bottom (LCC) quartile, while a further eight do not appear in the Index. The highest ranking LDC is Bhutan, in 117th place out of 175 economies.

Chart 1.8: IDI values by development status, 2015 and 2016



Source: ITU.

Table 1.13 and Chart 1.9 compare the IDI performance of LDCs in the period 2015-2016 with that of all developing countries and with the global average. The overall IDI performance of LDCs had been poorer than that of higher- and middle-income developing countries over the five years from 2010 to 2015, and this trend continued in 2015-2016, with LDCs recording an average

Table 1.13: IDI values for LDCs compared with global values and with all developing countries

Development status	IDI 2015				IDI 2016			
	Access	Use	Skills	IDI	Access	Use	Skills	IDI
World	5.45	3.54	5.74	4.74	5.58	3.91	5.74	4.94
Developed	7.76	6.31	8.08	7.25	7.84	6.61	8.08	7.40
Developing	4.62	2.56	4.91	3.85	4.77	2.95	4.91	4.07
LDCs	2.67	0.75	2.69	1.91	2.80	1.01	2.69	2.07

Source: ITU.

improvement in their IDI value of 0.16 points, as against 0.22 points for all developing countries (including LDCs) and 0.24 points for developing countries other than LDCs. However, the average rate of improvement in LDC values was slightly more positive, at 8.4 per cent as opposed to 5.6 per cent for all developing countries.

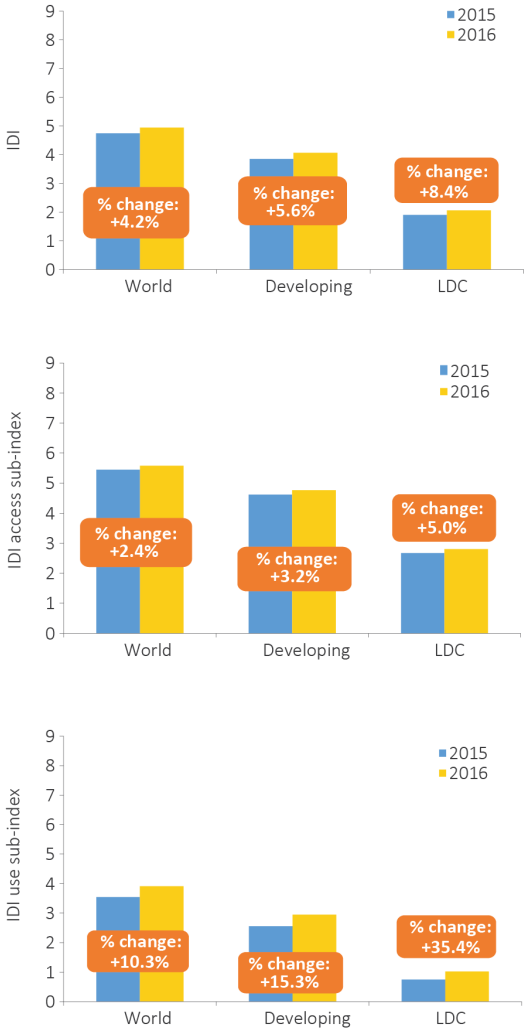
In the access sub-index, the average improvement in values for LDCs was marginally smaller than the average improvement for all developing countries (0.13 points as against 0.15 points), while in the use sub-index the margin was more substantial (0.27 points as against 0.39 points). As Chart 1.9 indicates, LDCs fare particularly poorly on indicators in the use sub-index, where their average value is just 1.01 compared with 2.95 for all developing countries and 6.61 for developed countries. These findings suggest that LDCs as a group are not making significant headway in catching up with other developing countries; indeed, they may in fact be falling further behind them in ICT development.

IDI performance quartiles and least connected countries (LCCs)

Another way of looking at the relationship between countries in the IDI is to divide the Index into four quartiles, representing high, upper-middle, lower-middle and low IDI values. The group forming the lowest of these quartiles is also referred to in this report as LCCs. Table 1.14 shows the range of values for each quartile in IDI 2015 and 2016, while Figure 1.3 plots the quartiles on a world map.

There is a close coincidence between LDCs and LCCs. As noted above, 36 of the LCCs in the lowest quartile are also LDCs. This is the large majority of the 40 LDCs reflected in the IDI, while a further eight LDCs which have not reported data for

Chart 1.9: IDI values for LDCs compared with global values and with all developing countries



Source: ITU.

inclusion may well also have fallen into the LCC quartile had they done so.

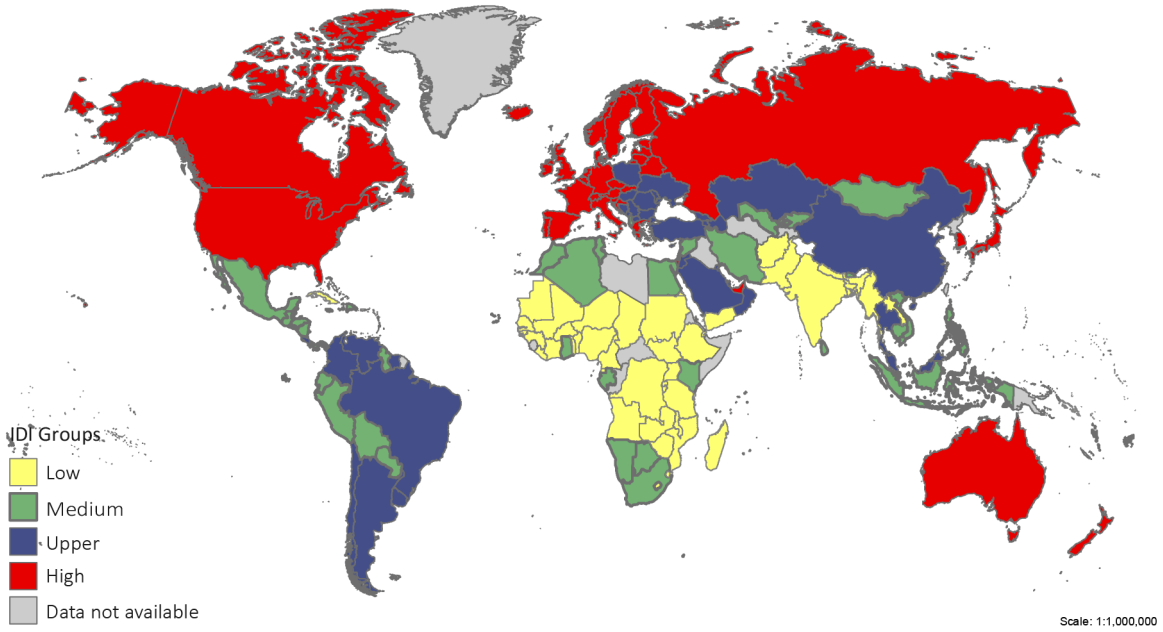
The map in Figure 1.3 shows how strongly IDI performance is related to geography as well as to development status. As noted earlier in this chapter, most of the highest-performing

Table 1.14: IDI values by IDI quartile, 2015 and 2016

	IDI 2015							IDI 2016						
Group	Number of countries	Average	Min.	Max.	Range	StDev	CV	Number of countries	Average	Min.	Max.	Range	StDev	CV
High	44	7.67	6.69	8.78	2.09	0.64	8.38	44	7.80	6.94	8.84	1.89	0.59	7.57
Upper-middle	43	5.66	4.68	6.64	1.96	0.60	10.60	42	5.92	5.04	6.90	1.87	0.59	9.90
Lower-middle	43	3.78	2.74	4.68	1.94	0.61	16.24	45	4.05	2.88	5.03	2.15	0.66	16.35
Low	45	1.93	1.00	2.73	1.73	0.46	23.64	44	2.06	1.07	2.86	1.79	0.48	23.07
Total	175	4.74	1.00	8.78	7.78	2.23	47.01	175	4.94	1.07	8.84	7.76	2.22	44.95

Source: ITU.
Note: *Simple averages. StDev= Standard deviation, CV= Coefficient of variation

Figure 1.3: Geographical distribution of IDI quartiles, 2016



UNCS Disclaimer: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

The base map for this infographic is based on the UNmap database of the United Nations Cartographic Section.

Source: ITU.

economies in the IDI are member countries of OECD, particularly in Western Europe, North America, East Asia and Oceania. Most, but not all, of these are categorized as developed economies. Countries in the upper-middle and lower-middle quartiles in IDI 2016 are more likely to be found in Eastern Europe, Latin America and the Caribbean, Central Asia and the Arabian Peninsula, with a scattering in other regions including Oceania and a few in Africa. The majority of LCCs are located in the Africa region and in South Asia, with a few, such as Yemen and Kiribati, in other regions.

1.5 Summary and conclusion

Measuring progress towards the information society is a complex task which entails striking a balance between different dimensions of ICT experience in different countries. The IDI pulls together 11 indicators concerned with ICT access, ICT use and ICT skills into a composite index which reflects the diversity and complexity of that experience. Reported annually in the ITU's *Measuring the Information Society Report*, the

IDI has become an important input to building understanding of the spread of ICTs and their impact on economies and societies.

Analysis of IDI 2016, and of progress during the year since IDI 2015, shows that almost all of the 175 economies included in the Index have continued to improve their level of ICT development. The average improvement over the year was 0.20 points. Improvements have been most significant among countries in the middle of the IDI rankings, many of which are middle-income developing countries. Some developed and higher-income developing economies towards the top of the rankings experienced little further improvement in their IDI values. Many LDCs towards the bottom of the distribution likewise saw little improvement in their performance. The region with the lowest average IDI values, as in previous years, was Africa.

More progress occurred during the year, on average, in the indicators which reflect ICT use than on those related to ICT access, although the indicators concerning ICT use started from a lower baseline in IDI 2015.

The most substantial improvements within the access sub-index, in most regions, related to the proportion of households with access to the Internet. In Africa, however, the largest increase in this sub-index was in the penetration of mobile-cellular subscriptions – an indicator which had already reached near-saturation levels in some other regions. There was a fall in the indicator for fixed-telephone subscriptions in the majority of countries, including highly-connected developed countries which are experiencing fixed-mobile substitution.

The most significant increases within the use sub-index were in the indicator relating to mobile-broadband subscriptions, with particularly marked gains in a number of countries in the Caribbean and other developing regions (see Chapter 2). Factors contributing to this include investment in new infrastructure, growing uptake of smartphones, and reductions in prices following increased competition or regulatory intervention. The increase in mobile-broadband subscriptions also contributed to growth in household access to the Internet and in the percentage of the population using the Internet. Fixed-broadband subscriptions generally grew more slowly than mobile-broadband subscriptions, raising some concerns about the long-term development of high-capacity networks in some regions.

The findings reported in this chapter show the continued importance of efforts to address digital divides. The IDI 2016 highlights very considerable differences between countries and regions around the world, with IDI values ranging from 8.84 out of 10 in the Republic of Korea to just 1.07 in Niger. It is notable that, as in previous years, while most countries have improved their IDI values, overall IDI rankings have remained relatively stable. Few countries moved up by more than five places in the IDI rankings.

While this general improvement in ICT development is to be welcomed, the relatively poor performance of LDCs remains a matter of concern. There is a strong correlation between LDCs and LCCs in the bottom quartile of the IDI distribution. Of the 44 LCCs, 36 are also LDCs, while a number of other LDCs do not appear in the IDI data set. As recognized in last year's report, this suggests that many countries in this grouping are locked into persistent low performance in the Index. Given that ICT development is increasingly cited as an important enabling factor for progress towards sustainable development, poor IDI performance points to the need for policy interventions by governments and other stakeholders in order to improve levels of achievement on the indicators making up the IDI.

As well as analysing IDI findings at global and regional levels, this chapter includes examples of the experience of countries at the top of the distribution and of countries which have witnessed the most dynamic improvement in their IDI values and rankings over the past year. While each country is different, these examples – and those of other dynamic countries reported in Chapter 2 – suggest approaches which may be valuable in other contexts and are worthy of consideration by governments, communications businesses and development agencies.

Endnotes

1 A fuller account of the information in this section can be found in ITU (2016), at https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf, and on the ITU website, at http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

2 Previous reports can be accessed online at http://www.itu.int/en/ITU-D/Statistics/Pages/publications/anapub.aspx.

3 Data on the indicators included in the skills sub-index are sourced from the UNESCO Institute for Statistics (UIS). See Annex 1 for more details on the definition of the indicators.

4 ITU (2015), p.43 and Annex 2.

5 http://www.itu.int/net4/ITU-D/ExpertGroup/default.asp.

6 http://www.itu.int/net4/ITU-D/forum/expertgrouponhouseholds/forum/.

7 Telegeography, 'South Korea to accept applications for fourth MNO licence in August 2015'. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/06/26/south-korea-to-accept-applications-for-fourth-mno-licence-in-august-2015/.

8 Telegeography, 'SK Telecom introduces tri-band LTE-A commercially', 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/01/02/sk-telecom-introduces-tri-band-lte-a-commercially/.

9 Telecompaper, 'Siminn says 4G population coverage reaches 91%', 2015. Available at: http://www.telecompaper.com/news/siminn-says-4g-population-coverage-reaches-91--1141852.

10 Telegeography, 'Telia embarks on LTE-A deployment', 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/08/10/telia-embarks-on-lte-a-deployment/.

11 Telegeography, 'TDC starts '4G+' network deployment', 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/07/06/tdc-starts-4g-network-deployment/.

12 Telegeography, 'Telenor launches '4G+' network in five cities', 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/12/08/telenor-launches-4g-network-in-five-cities/.

13 https://ec.europa.eu/digital-single-market/en/country-information-denmark.

14 Mance, H., 'CWC plans to fire up telecoms networks with $250m investment', 2014, in Financial Times. Available at: http://www.ft.com/cms/s/0/61fe7820-e0e6-11e3-a934-00144feabdc0.html#axzz4DhgytUZm.

15 http://databank.worldbank.org/data/download/GNIPC.pdf.

16 Ericsson (2015a, 2015b and 2015c).

17 Ooredoo, 'Ooredoo Myanmar secures USD 300 million combined funding from the Asian Development Bank and International Finance Corporation for network rollout', 7 February 2016. Available at: http://ooredoo.com/en/media/news_view/ooredoo-myanmar-secures-usd-300-million-combined-funding-from-the-asian-development-bank-and-international-finance-corporation-for-network-rollout/ .

18 Galpaya (2015), p.9.

19 http://workspace.unpan.org/sites/Internet/Documents/UNPAN96078.pdf.

20 The current list of LDCs can be found at: http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_list.pdf.

Chapter 2. The ICT Development Index (IDI) – regional and country analysis

Key findings

There is a strong association between national and regional levels of ICT development, as captured by the ICT Development Index (IDI), and the level of social and economic development. While the overall regional IDI values did not shift dramatically compared to 2015, some countries made significant progress as a result of infrastructure investment and changes in policy and regulation.

Europe continues to lead the way in ICT development. It had the highest average IDI value among world regions (7.35 points). Albania is the only country in Europe falling – slightly – below the global average. This reflects the region's high levels of economic development and ICT investment. Countries in Europe generally have liberalized communication markets with high levels of ICT access, use and skills.

A number of countries in the Americas significantly improved their performance in the IDI. Three island countries in the Caribbean – St. Kitts and Nevis, Dominica and Grenada – featured among the most dynamic countries, with strong improvements in their IDI value and rank. Several countries in Latin America, notably Bolivia and Mexico, also made noticeable progress in their IDI performance. Similar to other regions, the growth of mobile-broadband subscriptions played a particularly strong part in these outcomes.

The Commonwealth of Independent States (CIS) is the most homogeneous region in terms of ICT development. Nearly all countries in the CIS have IDI values above the global average, and all countries in the region improved their IDI values as a result of increases in mobile-cellular and mobile-broadband penetration.

The Asia and the Pacific region is, by contrast, the most heterogeneous. The region's top seven economies have IDI values above 7.50 points and rank within the highest quartile of IDI 2016. The region also includes a number of countries that significantly increased their IDI value and rank over the year, including Bhutan, Myanmar and Malaysia. However, nine out of 34 countries in the region, including several with large populations, are least connected countries (LCCs).

There is great diversity in ICT development across the Arab States. The five highest performing countries in the Arab States region are oil-rich high-income economies, but the region also includes a number of low-income countries, three of which are LCCs. This illustrates that the digital divide between the LCCs and the more prosperous countries in the region may be growing.

Africa is the region with the lowest IDI performance. The average IDI 2016 value for the Africa region was 2.48 points, just over half the global average of 4.94. The majority of the 39 African countries in IDI 2016 are LCCs. This reflects the lower level of economic development in the region, which inhibits ICT development. The highest growth achieved was in the number of mobile-cellular subscriptions, in contrast to other regions, in which the number of mobile-broadband subscriptions experienced the highest growth.

Investment, policy and regulation influence the performance of individual countries. A number of countries rank higher than expected on the IDI relative to their level of economic development. In most regions, a number of countries also significantly increased their IDI rankings in only one year. The experiences of these dynamic countries, several of which are illustrated in this chapter, are a source of insights for other governments and businesses within their regions.

Chapter 2. The ICT Development Index (IDI) – regional and country analysis

2.1 Introduction

Chapter 1 described the ICT Development Index (IDI) and compared global findings for IDI 2015 and IDI 2016. This chapter extends the analysis by investigating IDI findings at the regional level. It also explores findings in relation to a number of individual countries which stand out as having improved their position in the overall IDI rankings dynamically in comparison with others in their regions.

2.2 Regional IDI analysis

ITU Member States are divided into six regions – Africa, the Americas, Arab States, Asia and the Pacific, Commonwealth of Independent States (CIS) and Europe. The distribution of countries between regions differs in a number of respects from the regional distributions used in other UN data series, most notably where the Europe and Africa regions are concerned, and this should be borne in mind when undertaking comparative analysis with other data sets.[1]

The IDI 2016 data published in this volume are derived from 175 economies, of which 39 are in the Africa region, 34 in the Americas, 18 in the Arab States region, 34 in Asia and the Pacific, 10 in the CIS region and 40 in the Europe region. Of the 21 ITU Member States for which data are not available, five are in the Africa region, one in the Americas, four in the Arab States region, six in Asia and the Pacific (including five from the UN Oceania region), two in the CIS region, and three, all small states, in Europe.

Table 2.1 sets out the results of IDI 2016 for each of the six ITU regions, and compares them with the results for IDI 2015. Chart 2.1 shows the distribution of average, minimum and maximum IDI values in these regions, compared with the global average.

As in previous years, the Europe region records the highest regional average IDI value, at 7.35, and includes only one country, Albania, just below the global average of 4.94. The regional average value for the CIS region, at 5.74, is significantly higher than the global average (although it should be noted that two lower-income countries in this region are not included in the Index). The average for the Americas slightly exceeds the global average, at 5.13, while the average IDI values for the Arab States and Asia-Pacific regions, at 4.81 and 4.58, respectively, fall somewhat below. As in previous years, the Africa region records by far the lowest average IDI value, at 2.48, little more than half that of the next lowest region.

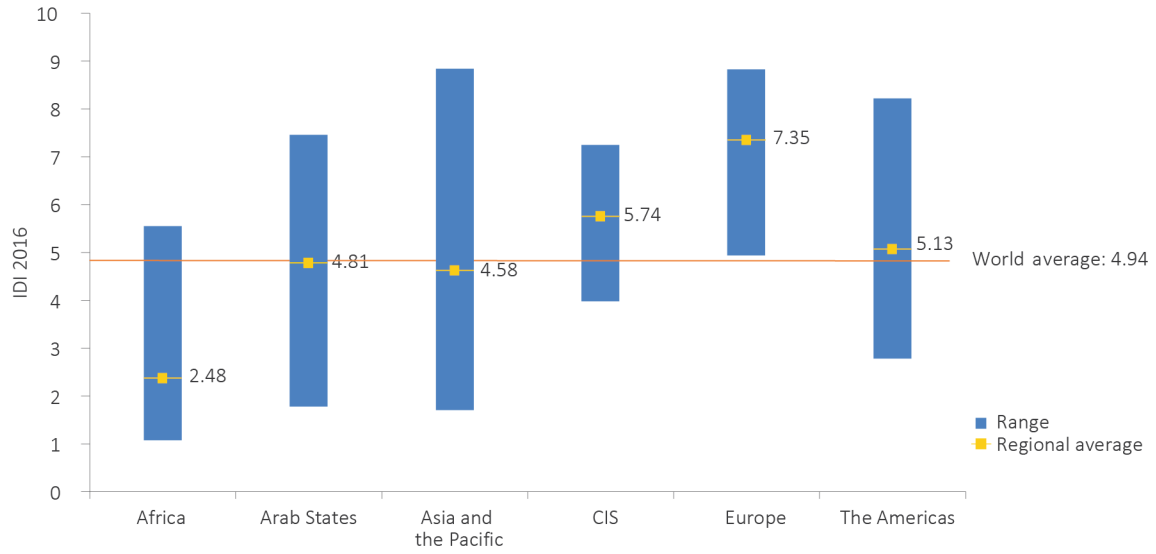
There is much greater variation in some regions than in others. The CIS region has the smallest range between its highest and lowest IDI values, 3.27 points, reflecting its relative economic homogeneity. Europe also has a relatively narrow IDI range, of 3.91 points, a figure which drops to 3.14 if the region's two lowest-ranking countries (Albania and Bosnia and Herzegovina) are excluded.

Table 2.1: IDI by region, 2016 and 2015

Region	Number of economies	IDI 2016						IDI 2015						Difference 2015-2016		
		Max.	Min.	Range	Average*	StDev	CV	Max.	Min.	Range	Average*	StDev	CV	Range	Average*	CV
Europe	40	8.83	4.92	3.91	7.35	0.97	13.23	8.77	4.62	4.15	7.19	1.03	14.36	-0.24	0.16	-1.14
CIS	10	7.26	3.99	3.27	5.74	1.10	19.15	7.02	3.76	3.26	5.56	1.12	20.10	0.01	0.18	-0.94
The Americas	34	8.17	2.73	5.44	5.13	1.39	27.09	8.06	2.64	5.42	4.89	1.35	27.55	0.01	0.25	-0.46
Arab States	18	7.46	1.82	5.64	4.81	1.87	38.79	7.42	1.73	5.69	4.63	1.89	40.74	-0.05	0.18	-1.95
Asia & Pacific	34	8.84	1.73	7.11	4.58	2.19	47.87	8.78	1.62	7.16	4.35	2.23	51.14	-0.05	0.23	-3.27
Africa	39	5.55	1.07	4.47	2.48	1.14	46.06	5.27	1.00	4.27	2.30	1.07	46.57	0.20	0.18	-0.51

Note: *Simple averages. StDev = Standard deviation, CV = Coefficient of variation.
Source: ITU.

Chart 2.1: IDI by region compared with global average, 2016



Source: ITU.

The IDI distribution in the Africa region is more variable, but at much lower levels which are consistent with the region's economic development. Here again, the distribution is affected by outliers, in this case three relatively high-performing countries (Mauritius, Seychelles and South Africa); without these, Africa's average IDI would drop from 2.48 to 2.26 and the IDI range would shrink from 4.47 points to 3.53.

The range of IDI values is greater in the Americas, the Arab States and, particularly, Asia and the Pacific, reflecting the economic heterogeneity of these regions. The Americas region includes high-income countries in North America as well as developing countries to the south. The Arab States region includes oil-rich countries belonging to the Gulf Cooperation Council but also several least developed countries (LDCs). The Asia-Pacific region includes a number of top performers in the Index, such as the Republic of Korea, Singapore and Hong Kong (China), alongside least connected countries (LCCs) in South Asia.

There were broadly consistent improvements in the average level of the IDI across all regions in the year between IDI 2015 and IDI 2016, the greatest improvements taking place in the Americas and Asia-Pacific regions. The range between the highest and lowest IDI values changed only marginally in most regions in the year between IDI 2015 and IDI 2016, the largest variations being observed in the Europe and Africa regions. In Europe, the 0.24-point reduction in the range resulted from a higher rate of improvement by the lowest-ranking country, Albania, in comparison with countries at the top end of the distribution which are approaching the Index's maximum value. In Africa, the 0.20-point increase in the range resulted from faster improvements by the country with the highest ranking, Mauritius, in comparison with those at the bottom of the distribution.

Table 2.2 illustrates the five highest- and-lowest ranking countries in each region in IDI 2016, in order to provide further insight into differences in levels of ICT development.

The similarities and differences between regions can be explored in more detail by comparing spider charts of the average scores achieved in the different regions on each of the 11 indicators making up the Index. These are presented in Chart 2.2, along with a world chart to enable comparison between regional and global average values. In considering these charts, it should be remembered that they do not reflect the range of values within regions, which, as noted above, is much wider in some regions than in others.

Table 2.2: Highest- and lowest-ranking countries by region, IDI 2016

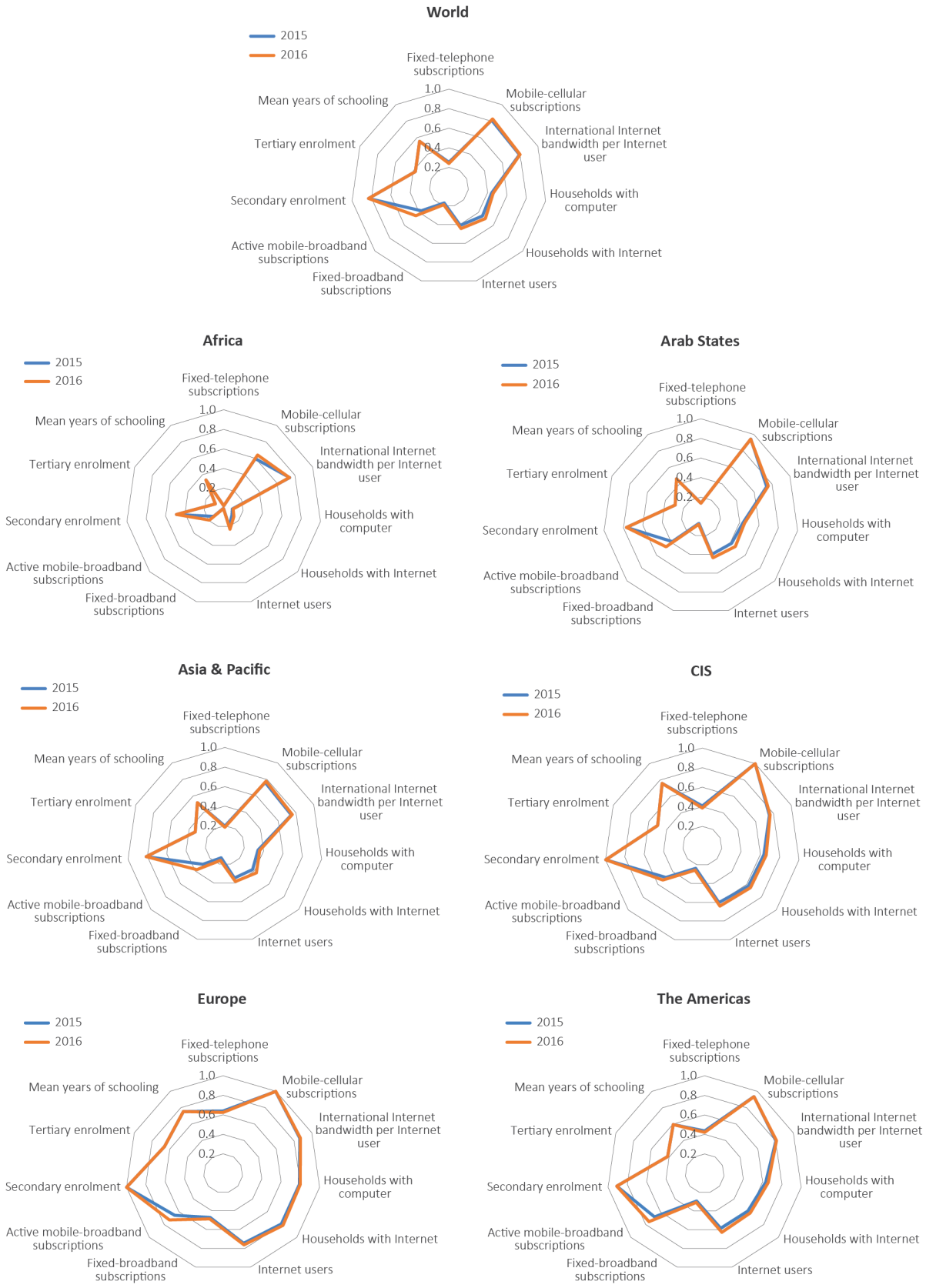
Regional IDI rank	Country	IDI	Global IDI rank
Europe			
1	Iceland	8.83	2
2	Denmark	8.74	3
3	Switzerland	8.68	4
4	United Kingdom	8.57	5
5	Sweden	8.45	7
36	Montenegro	6.05	62
37	TFYR Macedonia	5.97	65
38	Turkey	5.69	70
39	Bosnia and Herzegovina	5.25	80
40	Albania	4.92	91
Asia & Pacific			
1	Korea (Rep.)	8.84	1
2	Hong Kong, China	8.46	6
3	Japan	8.37	10
4	New Zealand	8.29	13
5	Australia	8.19	14
30	Bangladesh	2.35	145
31	Pakistan	2.35	146
32	Kiribati	2.06	152
33	Solomon Islands	2.04	153
34	Afghanistan	1.73	164
The Americas			
1	United States	8.17	15
2	Canada	7.62	25
3	St. Kitts and Nevis	7.21	34
4	Barbados	7.18	35
5	Uruguay	6.79	47
30	Guyana	3.52	121
31	Guatemala	3.20	123
32	Honduras	3.09	126
33	Nicaragua	2.88	131
34	Cuba	2.73	135

Regional IDI rank	Country	IDI	Global IDI rank
Arab States			
1	Bahrain	7.46	29
2	United Arab Emirates	7.11	38
3	Saudi Arabia	6.90	45
4	Qatar	6.90	46
5	Kuwait	6.54	53
14	Syria	3.32	122
15	Sudan	2.60	139
16	Mauritania	2.12	151
17	Yemen	2.02	155
18	Djibouti	1.82	161
CIS			
1	Belarus	7.26	31
2	Russian Federation	6.95	43
3	Kazakhstan	6.57	52
4	Azerbaijan	6.28	58
5	Moldova	5.75	68
6	Armenia	5.60	71
7	Georgia	5.59	72
8	Ukraine	5.33	76
9	Uzbekistan	4.05	110
10	Kyrgyzstan	3.99	113
Africa			
1	Mauritius	5.55	73
2	Seychelles	5.03	87
3	South Africa	5.03	88
4	Cape Verde	4.60	97
5	Botswana	4.17	108
35	Burundi	1.42	171
36	South Sudan	1.42	172
37	Guinea-Bissau	1.38	173
38	Chad	1.09	174
39	Niger	1.07	175

Source: ITU.

As these spider charts indicate, there has been little difference in average IDI performance across regions over the year between IDI 2015 and IDI 2016 on the majority of indicators in the Index. The biggest change in most regions has been in the proportion of active mobile-broadband subscriptions, followed by the proportion of Internet users and of households with Internet access. Increases in households with a computer were more significant in regions displaying a higher average overall performance (Europe, CIS and the Americas) than in those with a lower average overall performance (Africa, Asia and the Pacific and the Arab States region), reflecting the

Chart 2.2: Average IDI values for each indicator, world and regions, IDI 2015-2016



Source: ITU.

relative importance of growth in mobile-cellular subscriptions in the latter regions' lower-income countries. Most regions showed fairly modest increases in fixed-broadband subscriptions and a decline in fixed-telephone subscriptions. There has been no change in the three skills indicators over the year since, for reasons discussed in Chapter 1, the same data set has been used for both years.

The smoothest distribution of results across the range of indicators – with relatively high performance across the board – is observed in the Europe region. The distribution of indicator results becomes less smooth as overall IDI performance declines, the most significant contributors to this phenomenon being differences between regions in the proportions of fixed-telephone and fixed-broadband subscriptions. The spider charts for the CIS and Americas regions reveal stronger performance overall than those for the Arab States and Asia-Pacific regions, but are broadly similar in their overall shape, reflecting this distribution of indicator values.

The spider chart for the Africa region is much less smooth than those for other regions. This reflects particularly low indicator values in Africa for fixed-telephone and fixed-broadband subscriptions and for household Internet and computer access, as well as for enrolment in tertiary education. The strongest results in the Africa region relate to mobile-cellular subscriptions and international Internet bandwidth. These variations between indicators have been influenced by the prevalence of mobile over fixed terrestrial infrastructure in Africa, the relatively high cost of fixed-broadband connections on the continent, and the increasing number of submarine cables offering international connectivity.

The following paragraphs describe the findings for each region in more detail, and explore the results achieved by a number of individual countries which have performed better than others within their regions.

Africa

The IDI values and rankings for the Africa region are set out in Table 2.3 and Chart 2.3. As noted above, the Africa region registers by far the lowest regional average IDI performance. Only three countries in the region – the Indian Ocean island states of Mauritius and Seychelles, together with South Africa – fall into the two upper quartiles of the IDI distribution or exceed the global average value in IDI 2016, while only these and two other countries – Cape Verde and Botswana – exceed the average value of 4.07 for developing countries.

By contrast, 29 out of 39 African countries in the Index rank as LCCs in the lowest quartile of the distribution, and the region includes all ten countries at the bottom of the global rankings. A number of African LDCs are not included in the Index, and it is likely that at least some of these would also have IDI values within the lowest quartile if data were available. These findings illustrate the extent to which Africa lags behind other regions in ICT development, and the importance of addressing the region's ongoing digital divide.

All countries in the region showed some improvement in IDI value between 2015 and 2016, although in 11 countries this improvement was marginal (less than 0.10 points). The average improvement recorded was 0.18 points, less than the average improvement of 0.22 points for developing countries. The ten countries at the top of the African rankings achieved an average improvement in their IDI values of 0.33 points, well above the global average of 0.20, while the remaining countries in the region, all of which are in the LCC quartile, managed an average improvement of just 0.14 points. Only four countries in the lower half of the regional distribution - Rwanda, Liberia, Ethiopia and Burundi – raised their IDI value by more than 0.20 points. This supports the suggestion that LDCs may be falling further behind other developing countries in ICT development.

Across the Africa region as a whole, the indicators making up the IDI which showed the greatest improvement were mobile-cellular penetration and mobile-broadband penetration. A particularly strong improvement in mobile-cellular penetration was recorded in Burundi, Côte d'Ivoire, Ethiopia, the Gambia, Ghana, Guinea, South Africa and Tanzania, although this indicator also fell in nine countries in the region, including by a substantial margin in Namibia and Mali. Various factors may account for these reductions: in Mali, for example, the reduction followed a change in the law requiring identification of mobile subscribers.[2] Particularly strong improvements

Table 2.3: IDI rankings for the Africa region, 2016 and 2015

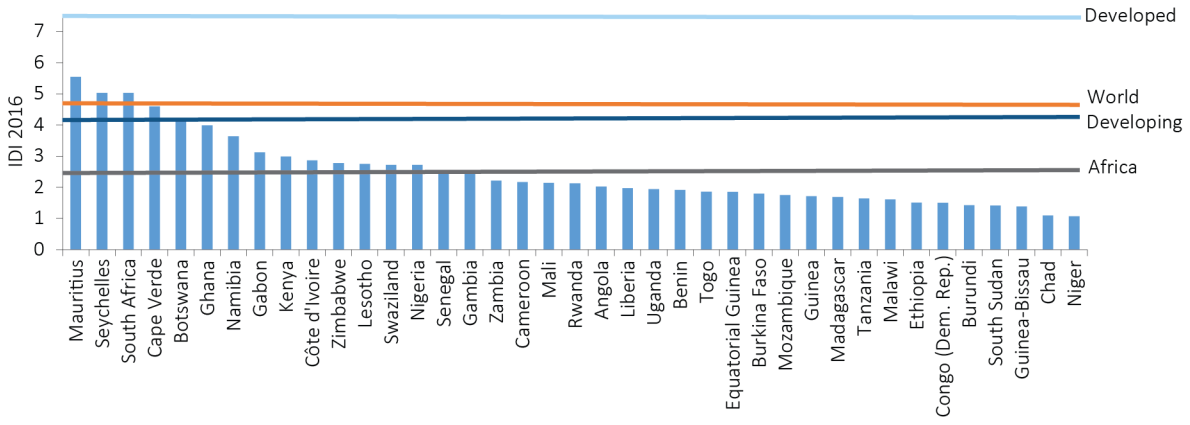
Economy	Regional rank 2016	Global rank 2016	IDI 2016	Global rank 2015	IDI 2015	Global rank change 2016-2015
Mauritius	1	73	5.55	73	5.27	0
Seychelles	2	87	5.03	85	4.77	-2
South Africa	3	88	5.03	86	4.70	-2
Cape Verde	4	97	4.60	99	4.23	2
Botswana	5	108	4.17	109	3.79	1
Ghana	6	112	3.99	111	3.75	-1
Namibia	7	120	3.64	121	3.20	1
Gabon	8	124	3.12	126	2.81	2
Kenya	9	129	2.99	129	2.78	0
Côte d'Ivoire	10	132	2.86	139	2.43	7
Zimbabwe	11	133	2.78	132	2.73	-1
Lesotho	12	134	2.76	138	2.47	4
Swaziland	13	136	2.73	136	2.49	0
Nigeria	14	137	2.72	137	2.48	0
Senegal	15	141	2.53	140	2.41	-1
Gambia	16	143	2.46	141	2.40	-2
Zambia	17	147	2.22	148	2.05	1
Cameroon	18	148	2.16	146	2.07	-2
Mali	19	149	2.14	149	2.00	0
Rwanda	20	150	2.13	158	1.79	8
Angola	21	154	2.03	152	1.95	-2
Liberia	22	156	1.97	161	1.73	5
Uganda	23	157	1.94	155	1.86	-2
Benin	24	158	1.92	156	1.83	-2
Togo	25	159	1.86	159	1.78	0
Equatorial Guinea	26	160	1.85	157	1.82	-3
Burkina Faso	27	162	1.80	163	1.60	1
Mozambique	28	163	1.75	164	1.60	1
Guinea	29	165	1.72	166	1.57	1
Madagascar	30	166	1.69	165	1.57	-1
Tanzania	31	167	1.65	167	1.54	0
Malawi	32	168	1.62	168	1.49	0
Ethiopia	33	169	1.51	172	1.29	3
Congo (Dem. Rep.)	34	170	1.50	169	1.48	-1
Burundi	35	171	1.42	173	1.16	2
South Sudan	36	172	1.42	170	1.36	-2
Guinea-Bissau	37	173	1.38	171	1.34	-2
Chad	38	174	1.09	175	1.00	1
Niger	39	175	1.07	174	1.03	-1
Average			**2.48**		**2.30**	

Source: ITU.

in mobile-broadband penetration were recorded in Botswana, Cape Verde, Côte d'Ivoire, Gabon, Namibia and Rwanda. The most significant increases in fixed telephony and fixed broadband occurred in South Africa.

Table 2.4 shows the most dynamic countries in the Africa region in terms of IDI ranking and value. It shows that there is a marked difference in which countries are identified as most dynamic in the region according to whether this is measured by

Chart 2.3: IDI values, Africa region, 2016



Source: ITU.

Table 2.4: Most dynamic countries by IDI ranking and IDI value, Africa, 2015-2016

Change in IDI ranking				Change in IDI value (absolute)			
IDI rank 2016	Region rank	Country	IDI rank change	IDI rank 2016	Region rank	Country	IDI value change
150	20	Rwanda	8	132	10	Côte d'Ivoire	0.44
132	10	Côte d'Ivoire	7	120	7	Namibia	0.43
156	22	Liberia	5	108	5	Botswana	0.38
134	12	Lesotho	4	97	4	Cape Verde	0.37
169	33	Ethiopia	3	150	20	Rwanda	0.34
				88	3	South Africa	0.34

Source: ITU.

improvements in IDI values or by progress up the global rankings.

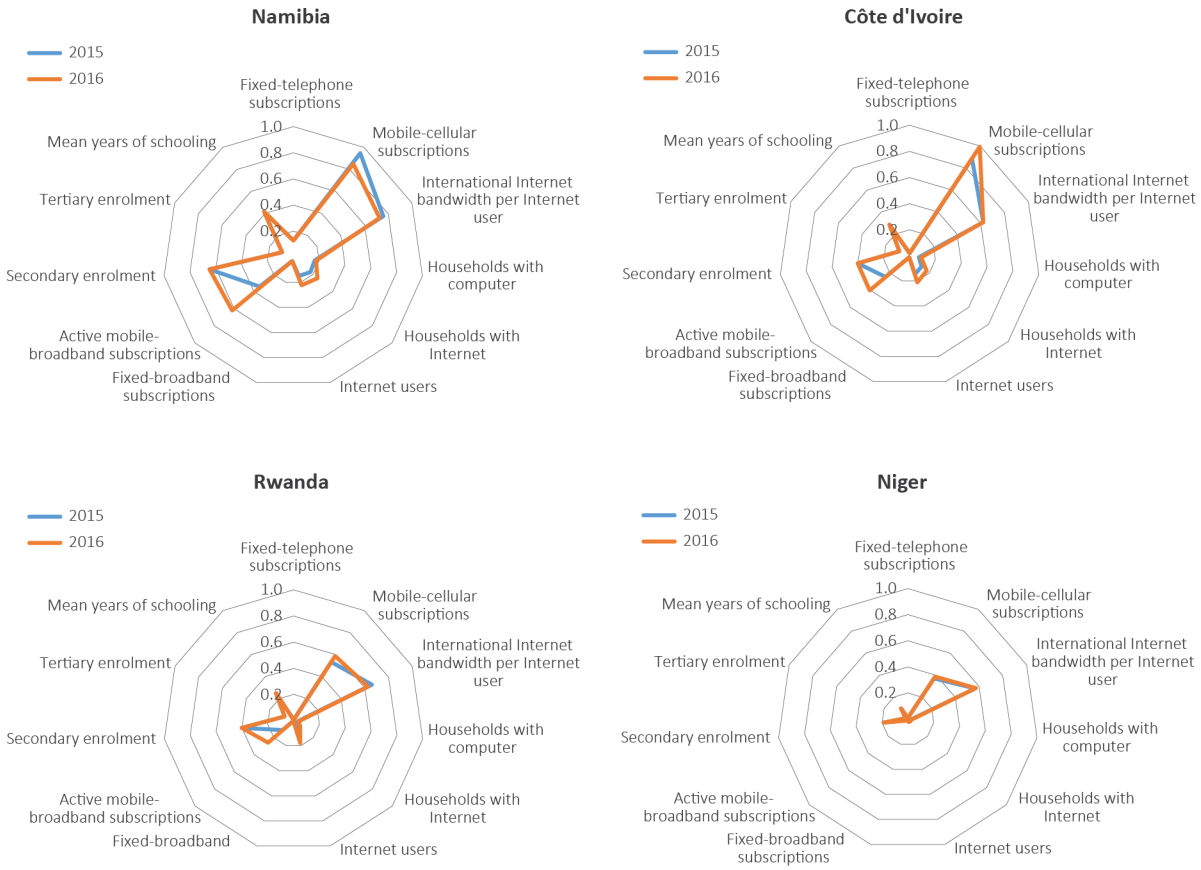
The biggest improvements in IDI values in the region were made by Côte d'Ivoire (up 0.44 points, lifting it out of the LCC quartile), Namibia (0.43 points), Botswana (0.38 points), Cape Verde (0.37 points) and Rwanda and South Africa (each 0.34 points).

The countries which were in the top group of African performers secured only marginal improvements in their global rankings in spite of strong performances in terms of IDI values. Namibia and Botswana moved up only one place in the global rankings, and Cape Verde two places, while South Africa actually dropped down two places in the global rankings in spite of improvement in its IDI value that was well above average. This is because they were ranked alongside other middle-income developing countries which also achieved a relatively high improvement in their average IDI. Countries lower down the African distribution, such as Côte d'Ivoire and Rwanda, made much bigger leaps up the global rankings because they were ranked alongside lower-income LCCs whose average IDI improvement was much smaller. This discrepancy in dynamism within the Index between IDI rankings and values again illustrates the growing gap between middle-ranking countries and LCCs already discussed in Chapter 1.

Chart 2.4 presents spider charts showing the performance on all the IDI indicators of three of the region's strong performers – Namibia, Côte d'Ivoire and Rwanda – together, for purposes of comparison, with the lowest-performing country in the IDI, Niger.

These four charts bear strong similarities with one another and with those of other developing countries in the lower half of the IDI distribution. All four countries show relatively strong performance on two of the access indicators (mobile-cellular subscriptions and international

Chart 2.4: IDI values, selected countries, Africa, IDI 2015-2016



Source: ITU.

Internet bandwidth per Internet user) coupled with very weak performance on fixed-telephone subscriptions and on the proportion of households with a computer or with Internet. The three improving countries illustrated show significant improvements in Internet users and mobile-broadband subscriptions. All four countries are also characterized by very low performance on the proxy indicators in the skills sub-index.

The principal difference between the four countries illustrated is in their overall level of performance on indicators across the Index. This reflects their overall standing in terms of GNI p.c. Namibia, which ranks 120th globally in terms of GNI p.c., outperforms the other three countries on ten out of the 11 indicators in the Index. Côte d'Ivoire, which ranks 175th in terms of GNI p.c., outperforms Rwanda, which ranks 198th, on nine of them. Niger, one of the world's poorest countries,[3] has some of the lowest values of any country across all of the indicators in the Index.[4]

As is the case for many developing countries in the IDI, in both Namibia and Côte d'Ivoire it is the indicator for mobile-broadband subscriptions that has registered the biggest increase between IDI 2015 and IDI 2016, followed by the indicators for Internet users and households with Internet. Côte d'Ivoire has also taken mobile-cellular subscriptions close to the highest possible value, though this indicator fell substantially in Namibia. Boxes 2.1 and 2.2 provide further information about developments in these countries.

Box 2.1: ICT and IDI developments in Namibia

Namibia improved its IDI score from 3.20 in 2015 to 3.64 in 2016, making it the second most dynamic country in Africa in terms of IDI value after Côte d'Ivoire. The main reason for this improvement was substantial growth in the number of mobile-broadband subscriptions, pushing up Namibia's use sub-index value from 1.73 to 2.91, the largest increase in the use sub-index of all African countries, and resulting in a 12-place jump in the global ranking for this sub-index. The growth was stimulated primarily by reductions in tariffs and packages aimed at low-income users. In 2015, Namibia's mobile-broadband penetration stood at 62 subscriptions per 100 inhabitants, the fourth highest in Africa after Cape Verde, Botswana and Ghana.

Namibia's overall IDI score would have improved further had it not been for a drop in its access sub-index value caused by a 9 per cent reduction in the number of mobile subscriptions, the result of a decrease in the use of multiple SIM cards following a merger between two operators. Namibia's score on the access sub-index fell from 4.35 to 4.25.

Namibia is one of the frontrunners in Africa in ICT development, as the government has encouraged modernization of the country's telecom network. In 2014, Telecom Namibia started to construct a fibre-based network to connect the central government to the administrative capitals of all 14 regions in the country. The project aims to support government efforts towards decentralization and make effective e-government available to the wider public.[5]

Mobile Telecommunications (MTC), the largest operator in Namibia, was also one of the first operators in Africa to launch both commercial 3G and 4G networks (in 2006[6] and 2012[7], respectively). In April 2016, MTC, in cooperation with Huawei, also announced the first commercial use of an LTE-Advanced (LTE-A) network in Africa, making Namibia the first country in Africa to reach speeds of 1 Gbit/s.[8]

Box 2.2: ICT and IDI developments in Côte d'Ivoire

Côte d'Ivoire achieved an improvement in its IDI value of 0.44 points between 2015 and 2016. It also moved up six places in the global IDI rankings.

Both Internet uptake and mobile-cellular subscriptions improved during the year. The percentage of households with Internet access grew from 12 per cent in 2014 to 17 per cent in 2015. The percentage of individuals using the Internet also rose from 15 per cent to 21 per cent. This latter increase may be attributed to the significant increase in active mobile-broadband subscriptions, which climbed from 25 per 100 inhabitants in 2014 to 40 per 100 inhabitants in 2015.

Continuous 2G and 3G network expansion help to explain the steady growth in mobile-cellular subscriptions as well as the recent growth in mobile-broadband subscriptions. In 2014, the operator MTN expanded its network with 252 2G and 105 co-located 3G sites, and in 2015 the company invested ZAR 833 million to roll out a further 132 2G and 339 co-located 3G sites (MTN, 2014 and 2015). 3G coverage in Côte d'Ivoire rose from 43.6 per cent of the population in 2014 to 71.0 per cent in 2015.

Mobile money may have contributed to the increase in the number of mobile-cellular subscribers in the country. The subscriber base for MTN's Mobile Money service grew from 1.4 million in 2013 to 2.5 million in 2014 and then to 2.9 million in 2015.

Box 2.2: ICT and IDI developments in Côte d'Ivoire (continued)

Moov (Maroc Telecom) has also launched an international mobile money transfer service called Flooz (Maroc Telecom, 2015). Prices for calls and SMS were reduced following a decision by the regulator ARTCI in January 2015, which is also likely to have improved the affordability and uptake of mobile-cellular subscriptions (ARTCI, 2015).

Arab States

IDI values and rankings for the Arab States region are set out in Table 2.5 and in Chart 2.5, where they are compared with the global average and with averages for developed and developing countries.

There are marked variations in IDI rankings and values within the region. The five highest-performing countries in the region (Bahrain, United Arab Emirates, Saudi Arabia, Qatar and Kuwait) are oil-rich high-income economies which are members of the Gulf Cooperation Council (GCC). While only two of these (Bahrain and United Arab Emirates) are in the top quartile of the IDI rankings, these countries all have IDI values above 6.50. A further three countries in the region (Oman, Lebanon and Jordan) have IDI values above the global average of 4.94.

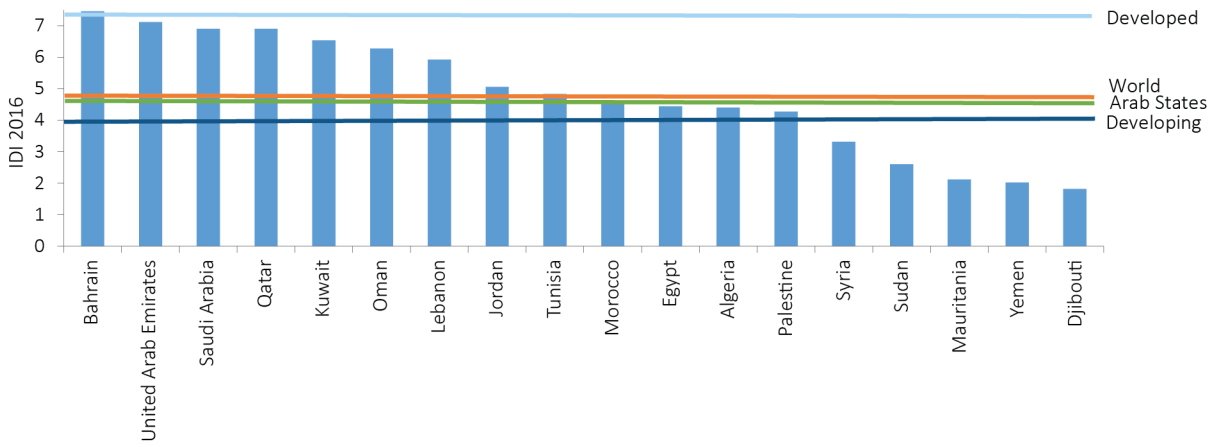
The region also includes a number of low-income countries with lower IDI values. Four countries in the region – Yemen, which has experienced civil conflict, and three countries located on the African continent (Sudan, Mauritania and Djibouti) – are in the bottom (LCC) quartile. With the exception of Mauritania, these countries have fallen further behind middle-ranking economies in the region during the course of the year, adding to concerns about a growing digital divide between more and less prosperous nations.

Table 2.5: IDI ranking and values, Arab States region, 2016 and 2015

Economy	Regional rank 2016	Global rank 2016	IDI 2016	Global rank 2015	IDI 2015	Global rank change 2016-2015
Bahrain	1	29	7.46	28	7.42	-1
United Arab Emirates	2	38	7.11	35	6.96	-3
Saudi Arabia	3	45	6.90	38	6.88	-7
Qatar	4	46	6.90	43	6.78	-3
Kuwait	5	53	6.54	48	6.45	-5
Oman	6	59	6.27	58	6.04	-1
Lebanon	7	66	5.93	61	5.91	-5
Jordan	8	85	5.06	89	4.67	4
Tunisia	9	95	4.83	95	4.49	0
Morocco	10	96	4.60	98	4.26	2
Egypt	11	100	4.44	97	4.26	-3
Algeria	12	103	4.40	112	3.74	9
Palestine	13	106	4.28	103	4.12	-3
Syria	14	122	3.32	120	3.21	-2
Sudan	15	139	2.60	134	2.56	-5
Mauritania	16	151	2.12	154	1.90	3
Yemen	17	155	2.02	151	1.96	-4
Djibouti	18	161	1.82	160	1.73	-1
Average			**4.81**		**4.63**	

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

Chart 2.5: IDI values, Arab States region, 2016



Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the Plenipotentiary Conference.
Source: ITU.

The most substantial average improvement in the region on any individual indicator was in mobile-broadband penetration, where there were particularly strong performances in Algeria, Jordan, Morocco, Saudi Arabia and Tunisia. Growth in mobile-cellular penetration was much stronger in Jordan than in any other country in the region, followed by Bahrain and Kuwait. All countries in the region also improved their performance on the proportion of households with Internet access (where there were particularly strong performances in Morocco, Algeria and Mauritania) and on the proportion of Internet users (where Algeria was, by some distance, the strongest performer). Saudi Arabia registered a substantial reduction in households with a computer.

Five of the higher-performing countries in this region (Bahrain, United Arab Emirates, Saudi Arabia, Oman and Lebanon) were among the most dynamic economies worldwide in terms of IDI values and rankings in the period between 2010 and 2015 (ITU, 2015). Between 2015 and 2016, however, while all countries in the region saw some improvement, all but six saw their IDI values rise by less than the world average and only four out of the 18 regional economies included in the IDI improved their position in the global rankings. Four countries (Saudi Arabia, Kuwait, Lebanon and Sudan) dropped by five or more places overall.

The most dynamic improvements in values in the region between IDI 2015 and IDI 2016 were observed in middle-income countries – Algeria (which improved its overall IDI value by 0.66 points and rose nine places in the global rankings), Jordan (up 0.38 points), Morocco (up 0.35 points) and Tunisia (up 0.34 points). Among lower-performing countries, Mauritania was the biggest gainer, improving its overall IDI value by 0.22 points, just above the world average gain of 0.20 points.

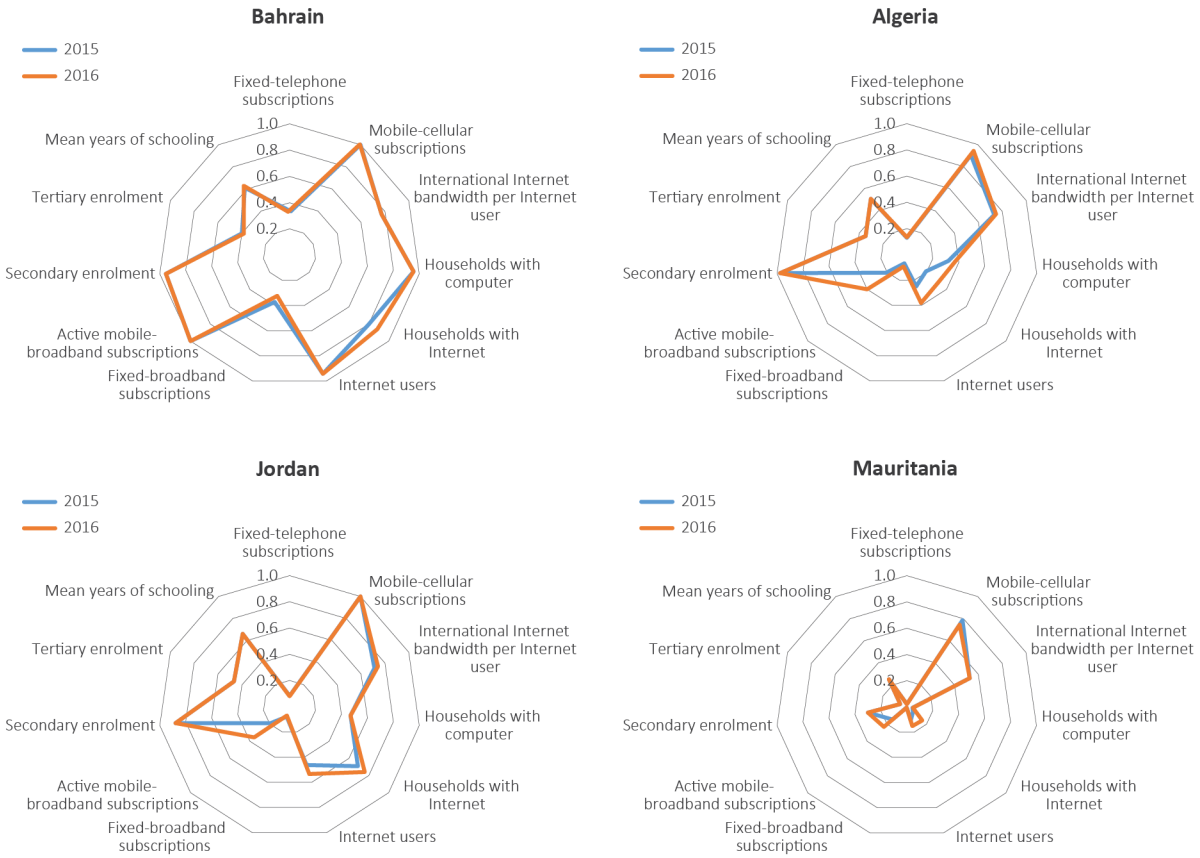
Table 2.6 sets out the most dynamic countries in the region in terms of both IDI values and rankings. Chart 2.6 presents spider charts for four countries in the region – Bahrain (the region's top performer), Algeria and Jordan (its most dynamic performers in terms of both rankings and values)

Table 2.6: Most dynamic countries by IDI ranking and IDI value, Arab States, 2015-2016

Change in IDI ranking				Change in IDI value (absolute)			
IDI rank 2016	Region rank	Country	IDI rank change	IDI rank 2016	Region rank	Country	IDI value change
103	12	Algeria	9	103	12	Algeria	0.66
85	8	Jordan	4	85	8	Jordan	0.38
151	16	Mauritania	3	96	10	Morocco	0.35
96	10	Morocco	2	95	9	Tunisia	0.34
				59	6	Oman	0.24

Source: ITU.

Chart 2.6: IDI values, selected countries, Arab States region, 2015-2016



Source: ITU.

and Mauritania (the only LCC in the region to improve its global ranking). Box 2.3 includes further information concerning Jordan.

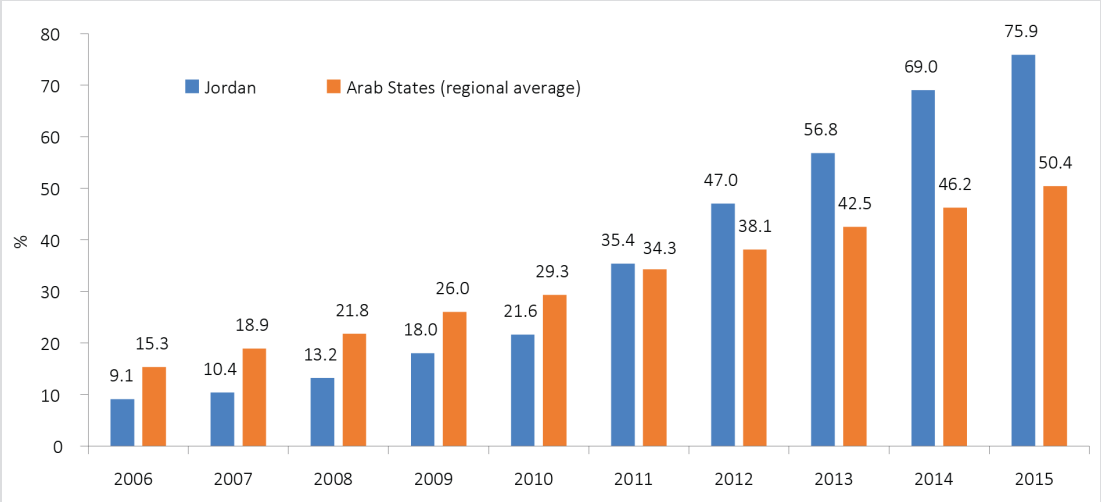
These charts illustrate the different patterns of ICT development within the region. The wealthiest country among the four depicted, Bahrain, has the highest IDI ranking and value. Its performance exceeds that of the other three countries most markedly in the use sub-index, where it achieved a score of 7.48 in 2016 compared with 3.20 for Jordan, 2.92 for Algeria and 1.29 for Mauritania. Bahrain performs particularly strongly on household access to a computer and to the Internet and on the proportion of Internet users. Bahrain had also recorded the second highest fixed-telephone penetration among the Arab States (after United Arab Emirates) and a much higher level of mobile-broadband subscriptions by the time of IDI 2015 than the other three countries.

The differences are equally marked between the middle-income countries Algeria and Jordan, on the one hand, and low-income Mauritania, on the other. Algeria and Jordan have a significantly higher penetration of mobile-cellular subscriptions than Mauritania, while the latter has very low scores across the use sub-index, on households with a computer, and on all three proxy indicators in the skills sub-index. The indicators that contributed most strongly to the rise in IDI values in both Algeria and Jordan were those concerned with households with Internet, Internet users and mobile-broadband subscriptions. The increase achieved by Mauritania was mostly due to increases – from a much lower base – in Internet users and mobile-broadband subscriptions, along with some increase in mobile-cellular subscriptions.

Box 2.3: ICT and IDI developments in Jordan

Jordan improved its IDI value from 4.67 in IDI 2015 to 5.06 in IDI 2016. This included a strong performance in the use sub-index. Its percentage of households with Internet had been growing more rapidly than in other countries in the Arab States region since 2006 (see Chart Box 2.3) and increased further, from 69 per cent to 76 per cent, between 2014 and 2015. The percentage of Internet users also rose strongly, from 46 per cent to 53 per cent, between 2014 and 2015.

Chart Box 2.3: Households with Internet, 2006-2015



Source: ITU.

This increased access to the Internet was associated with strong growth in mobile-broadband penetration, which rose from just 0.1 per cent in 2010 to 19.1 per cent in 2014 and then to 35.6 per cent by end 2015. The growth in mobile-broadband penetration can be attributed partly to lower prices and new promotions, and to the launch of LTE services in 2015. Prices for mobile broadband appear to have been stable between 2012 and 2014, but then dropped by 42 per cent for the ITU-defined prepaid handset-based sub-basket in 2015 and by 35 per cent for the postpaid USB/dongle-based sub-basket.

Following the investment of USD 270 million (with more than USD 100 million meant for network roll-out) by Zain,[9] and USD 351.52 million by Orange,[10] these two operators launched commercial LTE services in 2015. The country's third operator, Umniah, followed suit in the first quarter of 2016. Both Orange and Umniah have also invested in upgrading their existing 2G and 3G networks (Batelco, 2016). Zain has reported an increase in daily data volume from 76 TB in 2014 to 275 TB in 2015 (Zain, 2015 and 2016).

Asia and the Pacific

Asia and the Pacific is the most diverse region in terms of ICT development, reflecting the marked differences in levels of economic development between OECD member countries and other high-income economies in East Asia and Oceania, on the one hand, and a number of low-income countries in the region, including LDCs, on the other. IDI values and rankings for this region are set out in Table 2.7 and Chart 2.7.

The top ten positions in the regional rankings for 2016 are almost identical to those for 2015, with China just displacing Thailand in tenth position.

The top seven economies in the region – the Republic of Korea, which is the global top performer, Hong Kong (China), Japan, New

Table 2.7: IDI rankings and values, Asia and Pacific region, 2016 and 2015

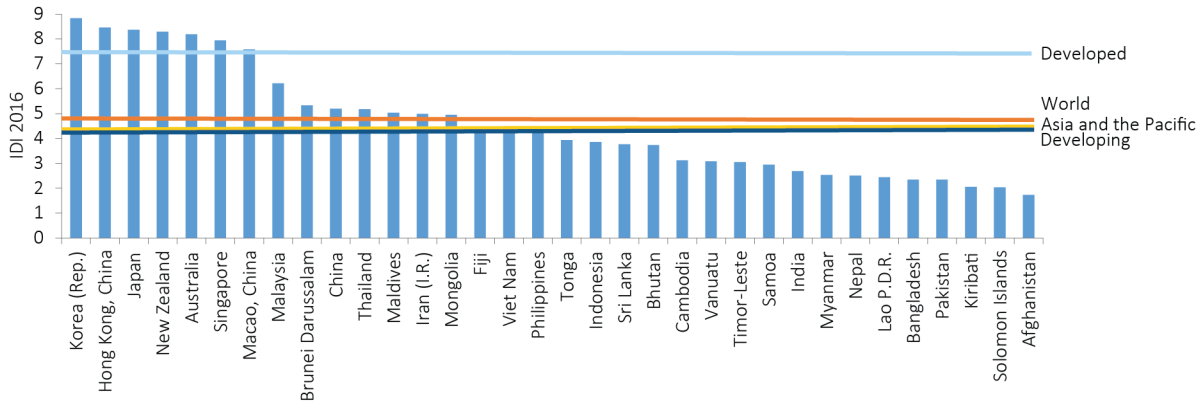
Economy	Regional rank 2016	Global rank 2016	IDI 2016	Global rank 2015	IDI 2015	Global rank change 2016-2015
Korea (Rep.)	1	1	8.84	1	8.78	0
Hong Kong, China	2	6	8.46	7	8.40	1
Japan	3	10	8.37	11	8.28	1
New Zealand	4	13	8.29	16	8.05	3
Australia	5	14	8.19	12	8.18	-2
Singapore	6	20	7.95	19	7.88	-1
Macao, China	7	28	7.58	26	7.47	-2
Malaysia	8	61	6.22	66	5.64	5
Brunei Darussalam	9	77	5.33	74	5.25	-3
China	10	81	5.19	84	4.80	3
Thailand	11	82	5.18	79	5.05	-3
Maldives	12	86	5.04	88	4.68	2
Iran (I.R.)	13	89	4.99	90	4.66	1
Mongolia	14	90	4.95	93	4.54	3
Fiji	15	102	4.41	102	4.16	0
Viet Nam	16	105	4.29	104	4.02	-1
Philippines	17	107	4.28	106	3.97	-1
Tonga	18	114	3.93	114	3.63	0
Indonesia	19	115	3.86	115	3.63	0
Sri Lanka	20	116	3.77	116	3.56	0
Bhutan	21	117	3.74	122	3.12	5
Cambodia	22	125	3.12	127	2.78	2
Vanuatu	23	127	3.08	131	2.73	4
Timor-Leste	24	128	3.05	125	2.92	-3
Samoa	25	130	2.95	128	2.78	-2
India	26	138	2.69	135	2.50	-3
Myanmar	27	140	2.54	153	1.95	13
Nepal	28	142	2.50	142	2.32	0
Lao P.D.R.	29	144	2.45	144	2.21	0
Bangladesh	30	145	2.35	143	2.27	-2
Pakistan	31	146	2.35	145	2.15	-1
Kiribati	32	152	2.06	147	2.07	-5
Solomon Islands	33	153	2.04	150	1.99	-3
Afghanistan	34	164	1.73	162	1.62	-2
Average			**4.58**		**4.35**	

Source: ITU.

Zealand, Australia, Singapore and Macao (China) – all have IDI values above 7.5 and sit in the high quartile of the IDI rankings. They are all high-income economies which have maintained high IDI performance throughout the period since the Index was first published. The average improvement in IDI value for these economies during the year was just below 0.1 point, reflecting their position near the top of the Index, where there is limited scope for further improvement as the IDI is currently constituted. Of these economies, only one – New Zealand – improved its IDI value by more than the world average.

There is a significant gap in IDI values and rankings between these seven economies and others in the region. A further five countries – Malaysia, Brunei Darussalam, China, Thailand and Maldives – rank in the top half of the IDI, while two more – the Islamic Republic of Iran and Mongolia – occupy places just below half-way. Significantly greater improvements in IDI values, however,

Chart 2.7: IDI values, Asia and Pacific region, 2016



Source: ITU.

were achieved by a number of middle- and lower-ranking countries than by those at the top of the regional rankings. The most substantial improvement was made by Bhutan (up 0.62 points), followed by Myanmar (up 0.59), Malaysia (up 0.58), Mongolia (up 0.41) and China (up 0.39).

One of these countries, Myanmar, is among the nine countries in the region which fall within the lowest (LCC) quartile in the rankings. These regional LCCs also include three of the most populous countries in the region – India, Bangladesh and Pakistan. With the exception of Myanmar, countries from the region within the LCC quartile averaged an improvement of only 0.13 points in overall IDI value, with one country, Kiribati, recording a marginal fall.

As in other regions, the highest average improvement on any individual indicator in this region was for mobile-broadband penetration. The most substantial improvements on this indicator were recorded by Malaysia, Bhutan, New Zealand, Mongolia and Vanuatu, while only one country, Thailand, recorded a fall. Thailand registered a significant fall on the indicator for mobile-cellular penetration, perhaps because of the exclusion of inactive SIMs, while also recording much the greatest improvement in the region on households with Internet access. Substantial falls in the mobile-cellular indicator were also registered by Viet Nam and the People's Democratic Republic of Laos. Myanmar recorded the strongest improvements on the indicators for mobile-cellular penetration and for the proportion of Internet users. There was, overall, a small decline in the indicator for fixed-telephone penetration across the region.

These findings for the Asia-Pacific region reveal greater improvement in IDI values among middle-ranking countries than among countries in the top and bottom quartiles, suggesting that the region may be witnessing a reduction in the digital divide between developed countries and most developing countries alongside a worsening divide between the majority of developing countries and the least connected.

Table 2.8 identifies the most dynamic countries in the Asia-Pacific region in terms of IDI rankings and values. In both cases, these were Bhutan, Malaysia and Myanmar. Chart 2.8 contains spider charts showing the performance of these three countries, together with that of the region's top performer (and the global top performer), the Republic of Korea.

These spider charts illustrate differences between countries that have performed strongly in each of the four quartiles of the IDI distribution: the Republic of Korea in the high quartile, Malaysia in the upper-middle quartile, Bhutan in the lower-middle quartile, and Myanmar in the low (LCC) quartile.

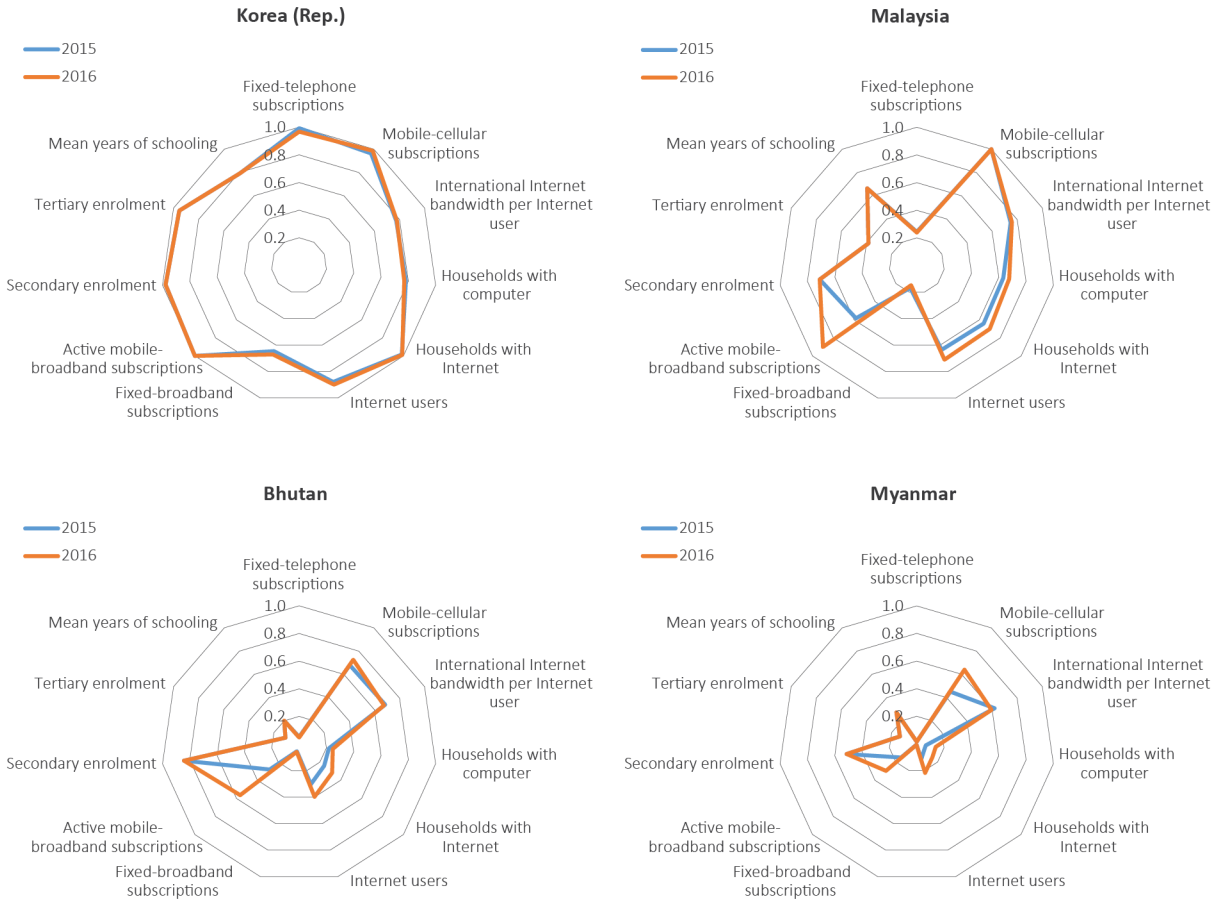
The Republic of Korea has long achieved high IDI values across the board, though there is still room for improvement in international Internet bandwidth per Internet user, the proportion of households with a computer and the penetration of fixed-broadband subscriptions. Like many developed countries, the Republic of Korea has very high penetrations of fixed-telephone and mobile-cellular subscriptions.

Table 2.8: Most dynamic countries by IDI ranking and IDI value, Asia and Pacific, 2015-2016

Change in IDI ranking				Change in IDI value (absolute)			
IDI rank 2016	Region rank	Country	IDI rank change	IDI rank 2016	Region rank	Country	IDI value change
140	27	Myanmar	13	117	21	Bhutan	0.62
61	8	Malaysia	5	140	27	Myanmar	0.59
117	21	Bhutan	5	61	8	Malaysia	0.58
127	23	Vanuatu	4	90	14	Mongolia	0.41
81	10	China	3	81	10	China	0.39
90	14	Mongolia	3				
13	4	New Zealand	3				

Source: ITU.

Chart 2.8: IDI values, selected countries, Asia and Pacific region, 2015-2016



Source: ITU.

The shape of the chart for Malaysia is typical of those for middle-income developing countries. Malaysia records a high value for mobile-cellular subscriptions but a much lower value for fixed-telephone subscriptions than found in developed countries and high-income developing countries such as the Republic of Korea. It achieves substantially higher values in the use sub-index, and for households with a computer and with Internet, than do lower-income developing countries such as Bhutan and Myanmar, although its value for fixed-broadband subscriptions is low compared with developed countries. Its values in the skills sub-index fall between those for developed and developing countries. As in many other countries, the biggest improvement

Box 2.4: ICT and IDI developments in Malaysia

Malaysia is one of the most dynamic countries in the Asia-Pacific region in IDI 2016, climbing five places in the global rankings on the strength of an improvement of 0.58 points in its IDI value during 2015.

Malaysia has seen a significant improvement in Internet uptake. The proportion of the population using the Internet increased from 63.7 per cent in 2014 to 71.1 per cent at end 2015. The proportion of households with Internet access also increased from 64.1 per cent to 70.1 per cent over the same period.

Malaysia achieved considerable growth in mobile-broadband penetration, from 58.3 per cent in 2014 to 89.9 per cent at end 2015, although it also registered a slight decrease in the penetration of fixed broadband, perhaps indeed associated with this improvement in mobile broadband. Data volumes have been increasing steadily. Maxis says that total data volume on its network increased from about 20 000 TB in the first quarter of 2014 to 50 000 TB by end 2015. Subscribers have also been using more data on a monthly basis. According to Maxis, average data usage per prepaid subscriber on its network increased from 476 MB/month in the first quarter of 2014 to 1 478 MB/month by end 2015.[11]

Such a substantial growth in mobile-broadband subscriptions can be attributed to three main developments in the local market – new data plans and promotions; upgrades and expansion in network coverage; and a high level of smartphone ownership in the country. Greater competition in the Malaysian telecom market has encouraged operators to introduce new data plans and promotions. Digi, for example, launched unlimited Facebook access and/or unlimited music streaming in 2014 (Digi, 2016). Celcom has offered a new SIM card, Xpax Magic SIM, which provides free basic Internet,[12] free calls and SMS and many other benefits (Axiata, 2016). Maxis has offered unlimited streaming on Spotify Premium, and cheaper data plans, as well as a programme 'zerolution' which enabled people to buy smartphones by instalments (Maxis, 2016). U Mobile has partnered with Berjaya Credit to offer a similar smartphone financing programme called U MicroCredit, and has also promoted a cheaper data plan including 1 GB of high-speed Internet free every month.[13]

Strong competition has encouraged operators to invest in network deployment and improvement. Population coverage by LTE networks increased from 33 per cent in 2014 to 71 per cent in 2015 and continues to expand in 2016. In order to prioritize LTE roll-out into areas of high demand, Digi encouraged citizens to nominate priority areas for LTE deployment (Digi, 2016).

The high level of smartphone ownership in Malaysia can be linked to specialized postpaid data plans which allow instalment payments for smartphones. According to Ericsson (Ericsson, 2015c), Malaysia ranks highly in smartphone subscription penetration within the region, behind Singapore and Australia but ahead of Thailand, the Philippines and Indonesia. Celcom reported growth in smartphone users of almost 20 per cent in 2015 (Axiata, 2016),[14]while Digi[14] reported an increase in smartphone users from 26 per cent in 2012 to 59.2 per cent in 2015 (Digi, 2016). Maxis experienced an increase in smartphone penetration among prepaid subscribers from 38 per cent at the beginning of 2014 to 67 per cent by end 2015.

in Malaysia's IDI performance in 2015-2016 has been in the penetration of mobile-broadband subscriptions, supported by improvements in the proportions of Internet users and of households with access to a computer and to Internet.

The shapes of the charts for Bhutan and Myanmar are characteristic of those for low-income developing countries. Both show lower values of mobile-cellular subscriptions and very low values for fixed-telephone and fixed-broadband

subscriptions. The two countries also display much lower levels of household access to computers and the Internet than do developed and middle-income developing countries, as well as lower levels of performance in the skills sub-index.

Improvements in the proportions of mobile-broadband subscriptions (especially), Internet users and households with Internet and with a computer have contributed to the overall performance improvement of both countries. In the case of Myanmar, however, the most significant contributing factor has been rapid growth in mobile-cellular subscriptions, following the relatively recent introduction of mobile-cellular networks to the country. This has also facilitated the growth of mobile-broadband subscriptions in the country.

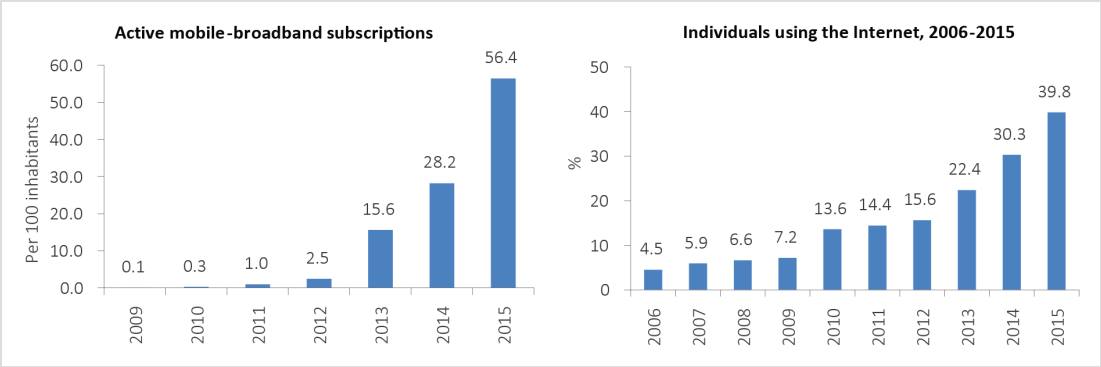
Boxes 1.2 and 1.6 in Chapter 1 include further information concerning ICT and IDI developments in the Republic of Korea and in Myanmar. Boxes 2.4 and 2.5 below provide further information concerning Malaysia and Bhutan.

Box 2.5: ICT and IDI developments in Bhutan

Bhutan was the most dynamic country in terms of IDI value in the Asia-Pacific region during the year between IDI 2015 and IDI 2016.

The most significant change in Bhutan occurred in the active mobile-broadband subscriptions per 100 inhabitants, which increased from 28.2 to 56.4 over the year, continuing a trend of rapid growth since 2012 (Box Chart 2.5). There was also an increase in the proportion of individuals using the Internet, from 4.5 per cent in 2006 to 39.8 per cent in 2015 (Box Chart 2.5), while the proportion of households with Internet rose from 24.0 per cent in 2014 to 31.7 per cent in 2015.

Chart Box 2.5: Bhutan – Active mobile-broadband subscriptions and Internet users (%)



Source: ITU.

The growth in Internet usage, especially through mobile broadband, can be explained by the expansion of 3G coverage in the country during 2015, alongside network upgrades to LTE. TashiCell's 3G network covered all 20 administrative districts as of July 2015, as compared with 14 in March 2015 and eight in 2014.[15] Overall, population coverage by 3G networks climbed to 80 per cent by end 2015, with 40 per cent coverage by LTE. The roll-out of LTE network and expansion of 3G network enabled data users to move from EDGE to 3G and LTE in 2015 (BICMA, 2016).

Steadily falling prices for mobile broadband over the last four years are also likely to have boosted growth in mobile-broadband subscriptions. The price of a postpaid mobile broadband subscription (USB/dongle) for one month stood at USD 4.81 in 2015, as against USD 5.6 in 2012. The prepaid handset-based mobile-broadband subscription had fallen to USD1.66 in 2015, compared with USD 3 in 2012.

Commonwealth of Independent States (CIS)

The CIS region is economically relatively heterogeneous. Ten countries within the region supply data for the IDI, the exceptions being Tajikistan and Turkmenistan. Four countries in the region (Belarus, Moldova, the Russian Federation and Ukraine) are categorized as developed countries, while the remainder are categorized as developing countries.

IDI values and rankings for the CIS region are set out in Table 2.9 and Chart 2.9. Two countries in the region (Belarus and the Russian Federation) rank in the high quartile of IDI 2016, while the remainder of those reporting data appear in the two middle quartiles of the rankings. All but two of these have IDI levels above the world average. However, only one, Belarus, improved its position in the global rankings in the year under review. All others either retained their global ranking or saw it decline. This section does not therefore include an analysis of individual dynamic countries in the CIS region.

All countries in the region nevertheless experienced improvements in their IDI value during the year 2015-2016, all but one of them (Azerbaijan) in the range between 0.1 and 0.3 points, and with a regional average of 0.18 points, which is just below the global average. The sharpest fall in global ranking was experienced by Kyrgyzstan, in spite of its improving its IDI value by 0.14 points, because better performance improvements were made by other middle-income countries with similar IDI values.

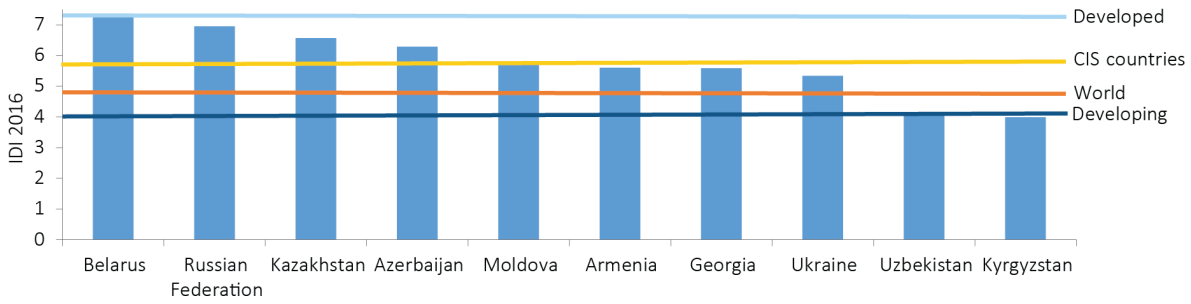
The strongest average improvements on individual indicators in this region were for mobile-cellular penetration and mobile-broadband penetration, and for the proportions of Internet users and households with access to the Internet. The regional averages for mobile-cellular penetration and for mobile-broadband penetration were

Table 2.9: IDI ranking and values, CIS region, 2016 and 2015

Economy	Regional rank 2016	Global rank 2016	IDI 2016	Global rank 2015	IDI 2015	Global rank change 2016-2015
Belarus	1	31	7.26	33	7.02	2
Russian Federation	2	43	6.95	42	6.79	-1
Kazakhstan	3	52	6.57	52	6.42	0
Azerbaijan	4	58	6.28	55	6.23	-3
Moldova	5	68	5.75	67	5.60	-1
Armenia	6	71	5.60	71	5.34	0
Georgia	7	72	5.59	72	5.33	0
Ukraine	8	76	5.33	76	5.21	0
Uzbekistan	9	110	4.05	110	3.76	0
Kyrgyzstan	10	113	3.99	108	3.85	-5
Average			**5.74**		**5.56**	

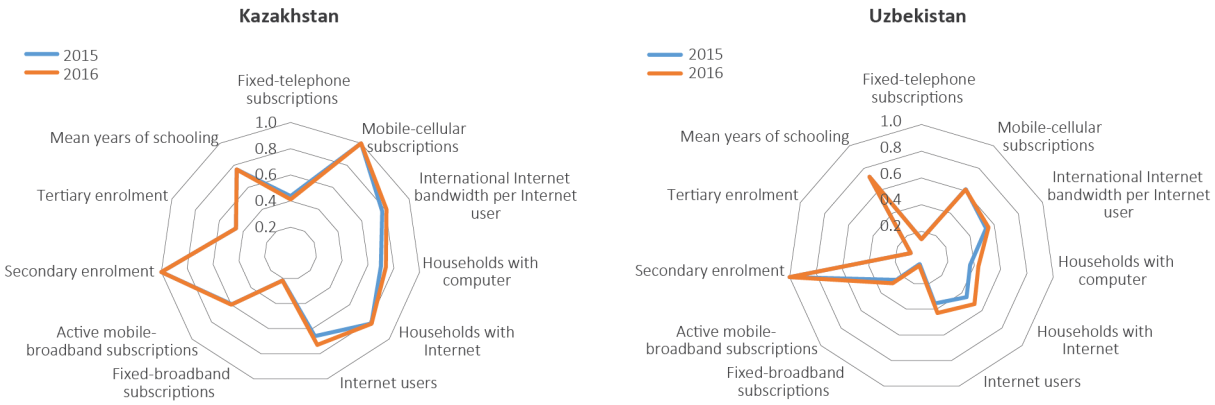
Note: Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries.
Source: ITU.

Chart 2.9: IDI values, CIS region, 2016



Note: Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries.
Source: ITU.

Chart 2.10: IDI values, selected countries, CIS region, 2015-2016



Source: ITU.

boosted by much higher improvements reported for one individual country than for others, namely Kazakhstan in the case of mobile-cellular penetration, and Georgia[16] in the case of mobile-broadband penetration. The greatest improvements on the indicators for households with access to Internet and for Internet users were made in Uzbekistan. All but one country in the region (Belarus) saw a reduction in the indicator for fixed telephony.

Chart 2.10 presents spider charts for two countries from the CIS region – Kazakhstan towards the top of the regional distribution, and Uzbekistan towards the bottom. The relative position of these two countries in the IDI rankings – 52nd and 110th, respectively – reflects their position in terms of GDI p.c. (82nd and 162nd).[17]

These charts illustrate the similarities and differences between middle- and lower-income developing countries in this region. Kazakhstan displays much higher performance levels than Uzbekistan across the range of indicators, with the exception of secondary enrolment which, throughout the region, is at or close to 100 per cent, and mean years of schooling. It has a much higher penetration of mobile-cellular, fixed-telephone, fixed-broadband and mobile-broadband subscriptions, as well as Internet users and households with a computer or with Internet, even though Uzbekistan has considerably improved its values on the latter three indicators over the year. If Uzbekistan's very low level of tertiary enrolment were excluded, the shape of the two spider charts would be very similar, the variation between them largely a reflection of differences in GNI p.c. The most significant improvements in Uzbekistan during the last year were in households with a computer and with Internet, and in the percentage of Internet users in the population.

Europe

Europe is the region which boasts the highest average IDI value, at 7.35, just below the developed-country average of 7.40.[18] No fewer than 29 of the region's 40 countries are among the 44 countries in the high quartile of the IDI rankings, while only one country, Albania, is outside the top half of the distribution. Albania is also the only country in the Europe region with an IDI value below the global average (4.92, as against a global average of 4.94).

IDI values and rankings for the Europe region are set out in Table 2.10 and Chart 2.11. They show that, while all countries in the region are high- or relatively high-performing, there are also some geographical differences in the distribution. Positions at the top of the regional rankings are mostly occupied by countries in Northern and Western Europe, while those towards the bottom are mostly held by countries in Southern and Eastern Europe. As in previous years, the five Nordic countries – Denmark, Finland, Iceland, Norway and Sweden – rank particularly highly, all within the top 20 worldwide. The lowest 16 places in the regional rankings are occupied by countries on the Mediterranean and in Eastern Europe. The lowest five places are occupied by countries which are not members of the European Union.

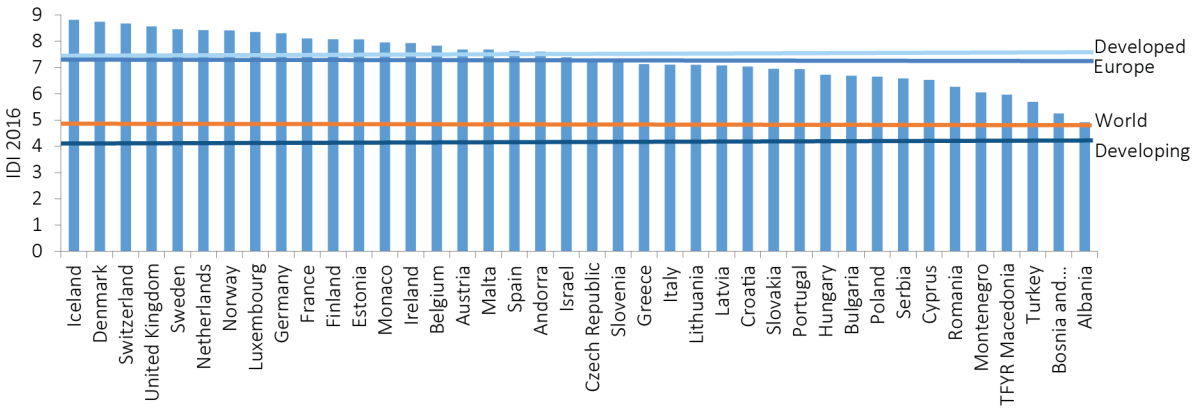
Table 2.10: IDI ranking and values, Europe region, 2016 and 2015

Economy	Regional rank 2016	Global rank 2016	IDI 2016	Global rank 2015	IDI 2015	Global rank change 2016-2015
Iceland	1	2	8.83	3	8.66	1
Denmark	2	3	8.74	2	8.77	-1
Switzerland	3	4	8.68	5	8.50	1
United Kingdom	4	5	8.57	4	8.54	-1
Sweden	5	7	8.45	6	8.47	-1
Netherlands	6	8	8.43	8	8.36	0
Norway	7	9	8.42	9	8.35	0
Luxembourg	8	11	8.36	10	8.34	-1
Germany	9	12	8.31	13	8.13	1
France	10	16	8.11	17	7.95	1
Finland	11	17	8.08	14	8.11	-3
Estonia	12	18	8.07	18	7.95	0
Monaco	13	19	7.96	20	7.86	1
Ireland	14	21	7.92	21	7.73	0
Belgium	15	22	7.83	22	7.69	0
Austria	16	23	7.69	24	7.53	1
Malta	17	24	7.69	25	7.49	1
Spain	18	26	7.62	27	7.46	1
Andorra	19	27	7.61	29	7.39	2
Israel	20	30	7.40	30	7.25	0
Czech Republic	21	32	7.25	31	7.20	-1
Slovenia	22	33	7.23	32	7.10	-1
Greece	23	36	7.13	40	6.86	4
Italy	24	37	7.11	36	6.89	-1
Lithuania	25	39	7.10	34	7.00	-5
Latvia	26	40	7.08	37	6.88	-3
Croatia	27	41	7.04	41	6.83	0
Slovakia	28	42	6.96	44	6.69	2
Portugal	29	44	6.94	45	6.64	1
Hungary	30	48	6.72	46	6.60	-2
Bulgaria	31	49	6.69	50	6.43	1
Poland	32	50	6.65	47	6.56	-3
Serbia	33	51	6.58	51	6.43	0
Cyprus	34	54	6.53	53	6.28	-1
Romania	35	60	6.26	60	5.92	0
Montenegro	36	62	6.05	64	5.76	2
TFYR Macedonia	37	65	5.97	62	5.82	-3
Turkey	38	70	5.69	69	5.45	-1
Bosnia and Herzegovina	39	80	5.25	80	5.03	0
Albania	40	91	4.92	92	4.62	1
Average			**7.35**		**7.19**	

Source: ITU.

The average increase in IDI values in the region in the year between 2015 and 2016 was 0.16 points, below the world average. However, the average increase in the lower half of the European distribution was much higher (0.21 points) than that in the upper half (0.11 points). This reflects the fact that countries towards the top of the distribution are pushing against the ceiling of the

Chart 2.11: IDI values, Europe region, 2016



Source: ITU.

Index, which does not necessarily capture some of the developments in ICT access and usage which have been taking place in highly developed economies, such as the introduction of very high fixed-broadband speeds, the predominance of smartphones, and the widespread use of cloud computing driving higher data volumes.

The strongest improvement in performance over the year in this as in other regions was registered on the indicator for mobile-broadband penetration. Only three countries – Luxembourg, Estonia and the United Kingdom – reported a fall in this indicator, while the most substantial improvements were recorded by Bulgaria, Romania and Ireland. Estonia also reported a substantial decline in mobile-cellular penetration, but this was due to a change in definition. All but six countries in the region saw a reduction in the indicator for fixed telephony.

Table 2.11 sets out the most dynamic countries in the region in terms of IDI rankings and values. The greatest gains in value for individual countries were made in the lower half of the regional distribution, by Romania (0.34 points), Portugal (0.30 points), and Montenegro and Albania (each 0.29 points). In the upper half of the distribution, the most substantial gains were made by Switzerland (near the top of the distribution, 0.18 points) and Ireland (0.19 points). Unusually for this Index, IDI values for three countries, all in Scandinavia, fell marginally during the year (see above).

Chart 2.12 presents spider charts for three of the countries which achieved higher than average gains – Switzerland, Romania and Albania – in order to illustrate similarities and differences within the region. It also includes one of the countries, Finland, whose overall IDI value fell during the year. Analysis of the spider charts for the region's two highest-performing countries (and the second and third global performers), Iceland and Denmark, can be found in Boxes 1.3 and 1.4 in Chapter 1. Further information about Romania and Albania can be found in Boxes 2.6 and 2.7 below.

These charts differ from those in other regions in a number of respects, on account of the higher overall IDI ranking of European countries.

Table 2.11: Most dynamic countries by IDI ranking and IDI value, Europe region, 2015-2016

Change in IDI ranking				Change in IDI value (absolute)			
IDI rank 2016	Region rank	Country	IDI rank change	IDI rank 2016	Region rank	Country	IDI value change
36	23	Greece	4	60	35	Romania	0.34
27	19	Andorra	2	44	29	Portugal	0.30
42	28	Slovakia	2	91	40	Albania	0.29
62	36	Montenegro	2	62	36	Montenegro	0.29
				36	23	Greece	0.27

Source: ITU.

Box 2.6: ICT and IDI developments in Romania

Romania improved its IDI value by 0.34 points, from 5.92 in IDI 2015 to 6.26 in IDI 2016. The strongest improvements in the country's performance were observed in Internet access and use. The percentage of households with a computer has grown steadily from 26.0 per cent in 2006 to 68.7 per cent by end 2015. The percentage of households with Internet access increased from 14.3 per cent to 67.7 per cent over the same period. A similar steady growth has taken place in the percentage of individuals using the Internet, which stood at 55.8 per cent at end 2015.

Fixed-telephone subscriptions per 100 inhabitants decreased from 21.1 in 2014 to 19.8 at end 2015, in line with a widespread general trend. There was a slight increase in fixed-broadband subscriptions per 100 inhabitants, from 18.6 to 19.7 by end 2015. The most significant improvement in penetration rates was seen in mobile-broadband, which increased from 49.3 in 2014 to 63.5 per 100 inhabitants at end 2015.

The growth in active mobile-broadband subscriptions can be explained by a combination of network upgrades, network sharing, the launch of LTE and VoLTE, promotions and lower prices. At the beginning of 2015, DiGiMobil (RCS & RDS) invested in its 3G network in order to increase download speed (to up to 21.6 Mbit/s).[19] Later in 2015, it launched LTE, the last operator in the country to do so.[20] In September 2015, Orange launched VoLTE services in the country.[21]

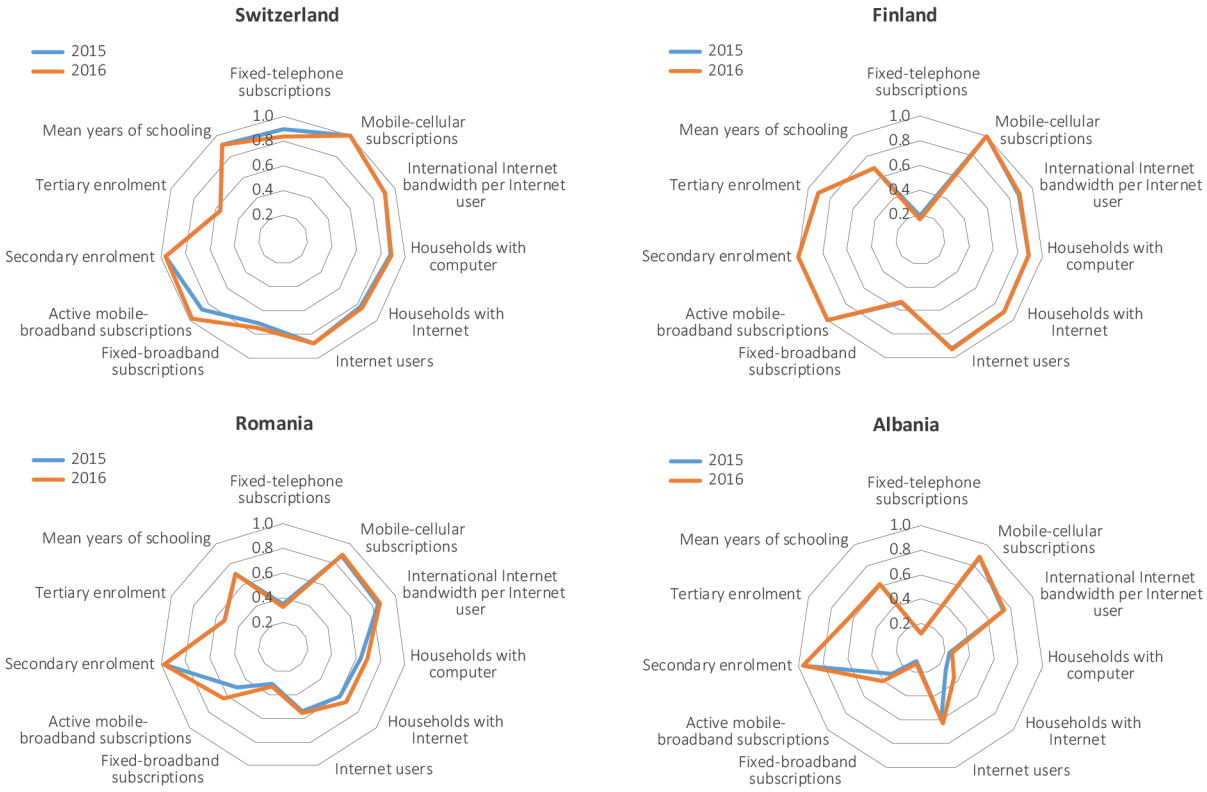
During 2013, Orange and Vodafone signed a network sharing agreement in order to improve 2G and 3G coverage, in respect of which 70 per cent of the resulting programme of work was completed by end 2015 (Orange, 2015 and 2016). Telekom Romania has also been investing in infrastructure to improve network coverage (OTE, 2015 and 2016). In 2015, overall network population coverage stood at 99.9 per cent for 3G and 72 per cent for LTE.

Owing to the high levels of competition, operators have been offering a variety of promotions which may have boosted the proportion of active mobile-broadband subscribers. Since 2014, for example, Orange has included Internet access and international calls in all its contracts (Orange, 2016). Telecom Romania has opted for bundles of mobile, fixed and TV subscriptions (OTE, 2015). The prices for mobile broadband (handset-based, prepaid) have also decreased from USD 13 in 2012 to just USD 5.55 in 2015. The price of the ITU's mobile-cellular sub-basket dropped from USD 24.52 in 2008 to USD 6.65 in 2015. The falling price for the mobile-cellular sub-basket can be attributed to a decision taken by the regulator ANCOM in 2014 (Decision No. 366/2014) which lowered the termination call rates for mobile from 3.07 eurocents/min to 0.96 eurocents/min.

High-income developed countries in Europe – with some exceptions (see below) – tend to have very high penetration levels for both fixed-telephone and mobile-cellular subscriptions, and both fixed- and mobile-broadband subscriptions. They also tend to display high values for other indicators in the access and use sub-indices. Many middle-income countries in Eastern Europe, such as Romania, have a broadly similar shape to their spider charts, but lower values across the board, including lower values for fixed-broadband subscriptions. Albania has the lowest figure for mobile-broadband subscriptions in the region, reflecting its significantly lower GNI p.c. and the late launch of 3G in the country.[22]

However, the charts for Romania and Albania show that the most significant improvements in values for both countries between 2015 and 2016 were in mobile-broadband subscriptions and in the proportion of households with Internet, with a smaller but significant increase in Romania in the proportion of households with a computer.

Chart 2.12: IDI values, selected countries, Europe, 2015-2016



Source: ITU.

The Americas

The Americas region, like the Asia-Pacific region, is highly diverse, including two high-income developed countries in North America, large middle-income developing countries in South America, and smaller developing countries and small island states in Central America and the Caribbean.

IDI values and rankings for the region are set out in Table 2.12 and Chart 2.13. At the top of the rankings are the region's two large developed countries, the United States and Canada, which rank within the top 25 countries worldwide. Like developed countries in Europe and the Asia-Pacific region, the improvement in their IDI level over the year was below the global average. Two of the region's small island countries – St. Kitts and Nevis and Barbados – are also in the high quartile of the rankings, while only one country in the region, Cuba, ranks in the lowest (LCC) quartile. The region's only LDC, Haiti, does not provide data for the IDI.

Higher rates of improvement were achieved by a number of South American developing countries and Caribbean countries. In South America, significant gains were made by both relatively high performers – Uruguay (up 0.35 points), Argentina (up 0.31 points), and Costa Rica and Brazil (up 0.27 points) – and relatively low performers – Mexico (up 0.42 points) and Bolivia (up 0.53 points). However, some other countries made only marginal gains on the previous year.

The greatest gain in the region was made by the Caribbean island state of St. Kitts and Nevis, which rose 20 places in the global rankings on the strength of an increase of 0.98 points in its IDI value. This improvement on the IDI appears to have resulted from infrastructure improvements and marketing initiatives by communications operators (see Box 1.5 in Chapter 1). Substantial improvements in IDI value were also recorded by five other Caribbean countries – Dominica (up 0.57 points), Grenada (up 0.46 points), Belize (up 0.33 points), Barbados (up 0.31 points) and the Dominican Republic (up 0.28 points).

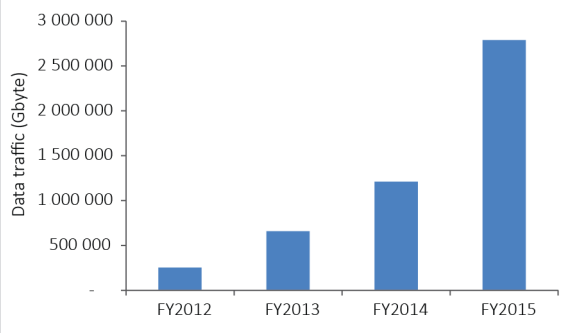
Box 2.7: ICT and IDI developments in Albania

Albania ranks 91st in IDI 2016, and has improved its IDI value from 4.62 in IDI 2015 to 4.92 in IDI 2016. The most significant progress in the country has been made in Internet uptake and in the growth of households with a computer, the latter having risen from just 4.9 per cent in 2006 to 25.7 per cent in 2015. The fixed-broadband penetration rate for Albania increased slightly from 6.5 per cent in 2014 to 7.6 per cent in 2015.

The price of the ITU-defined fixed-broadband sub-basket fell from USD 29.79 per month in 2008 to USD 9.52 in 2015. The mobile-cellular sub-basket decreased in price from USD 32.13 in 2008 to just USD 6.35 in 2015. Mobile-broadband prices also declined between 2012 and 2015.

The increase in mobile-broadband penetration, from 30.9 per cent in 2014 to 40.6 per cent in 2015, was influenced by the commercial launch of LTE and LTE-A. In 2015, the regulator AKEP amended Law No. 9918 to allow spectrum refarming for LTE services.[23] Telekom Albania (OTE) was the first operator in Albania to launch LTE in July 2015 and LTE-A in September 2015,[24] followed by ALBtelecom and Vodafone which both launched LTE in September 2015.[25] As a result of fast network roll-out and upgrade, data traffic has been approximately doubling year on year in Albania, as reported by Telekom Albania (Chart Box 2.7).

Chart Box 2.7: Growth in data traffic in Albania



Source: OTE (2016).

The Americas region shared the general trend in the IDI whereby the greatest improvements occurred in the indicator for mobile-broadband penetration. Gains on this indicator were driven by large increases in a number of Caribbean countries (St. Kitts and Nevis, Grenada, Belize and Jamaica) and four countries on the South American mainland (Bolivia, Uruguay, Argentina and Brazil). As in other regions, there were also significant improvements in average performance on the proportion of Internet users and the proportion of households with Internet. Ecuador registered a sizeable reduction in the indicator for mobile-cellular penetration, apparently because of a new telecommunication law passed in 2015 which imposed a charge on each active line above a given threshold and so prompted mobile operators to purge their subscriber base of inactive SIM cards[26] .

Table 2.13 sets out the most dynamic countries in the Americas region in terms of IDI rankings and values. In both cases, the most dynamic countries are three island states in the Eastern Caribbean – St. Kitts and Nevis, Dominica and Grenada – which share a common communications regulatory authority. The most dynamic country on the American mainland, also in both cases, is Bolivia. Chart 2.14 contains spider charts showing the performance of these countries. Developments in St. Kitts and Nevis are discussed in Box 1.5 in Chapter 1. Box 2.8 below describes the ICT and IDI environment in Bolivia.

Table 2.12: IDI ranking and values, Americas region, 2016 and 2015

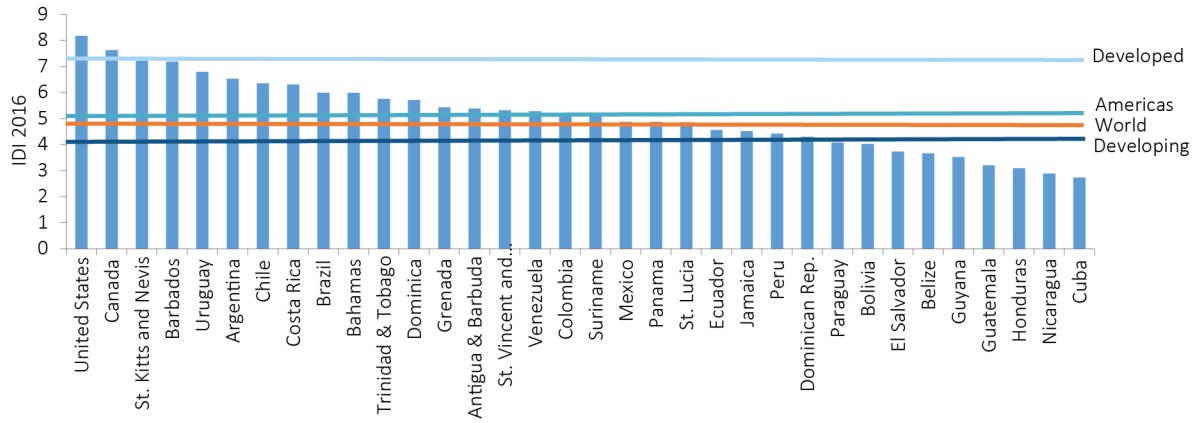
Economy	Regional rank 2016	Global rank 2016	IDI 2016	Global rank 2015	IDI 2015	Global rank change 2016-2015
United States	1	15	8.17	15	8.06	0
Canada	2	25	7.62	23	7.55	-2
St. Kitts and Nevis	3	34	7.21	54	6.23	20
Barbados	4	35	7.18	39	6.87	4
Uruguay	5	47	6.79	49	6.44	2
Argentina	6	55	6.52	56	6.21	1
Chile	7	56	6.35	57	6.11	1
Costa Rica	8	57	6.30	59	6.03	2
Brazil	9	63	5.99	65	5.72	2
Bahamas	10	64	5.98	63	5.80	-1
Trinidad & Tobago	11	67	5.76	68	5.48	1
Dominica	12	69	5.71	77	5.14	8
Grenada	13	74	5.43	82	4.97	8
Antigua & Barbuda	14	75	5.38	70	5.41	-5
St. Vincent and the Grenadines	15	78	5.32	78	5.07	0
Venezuela	16	79	5.27	75	5.22	-4
Colombia	17	83	5.16	81	4.98	-2
Suriname	18	84	5.09	83	4.89	-1
Mexico	19	92	4.87	96	4.45	4
Panama	20	93	4.87	91	4.63	-2
St. Lucia	21	94	4.85	87	4.68	-7
Ecuador	22	98	4.56	94	4.54	-4
Jamaica	23	99	4.52	101	4.20	2
Peru	24	101	4.42	100	4.23	-1
Dominican Rep.	25	104	4.30	105	4.02	1
Paraguay	26	109	4.08	107	3.88	-2
Bolivia	27	111	4.02	117	3.49	6
El Salvador	28	118	3.73	113	3.64	-5
Belize	29	119	3.66	119	3.32	0
Guyana	30	121	3.52	118	3.44	-3
Guatemala	31	123	3.20	123	3.09	0
Honduras	32	126	3.09	124	3.00	-2
Nicaragua	33	131	2.88	130	2.74	-1
Cuba	34	135	2.73	133	2.64	-2
Average			**5.13**		**4.89**	

Source: ITU.

The spider charts highlight a number of similarities and differences between dynamic countries within the region. The chart for St. Kitts and Nevis has the more rounded shape associated with higher-income higher-ranked countries in the IDI, with a relatively high value for fixed-telephone subscriptions, and stronger performance in the use sub-index than lower-income lower-ranked countries. The charts for Dominica and Bolivia are more representative of those associated with middle-ranking developing countries, with low (in the case of Bolivia, very low) levels of fixed telephony and fixed broadband, relatively strong values for international Internet bandwidth per Internet user, and moderate values for other access indicators.

The principal gains made by all of these more dynamic countries in the Americas between IDI 2015 and IDI 2016 were in mobile-broadband

Chart 2.13: IDI values, Americas region, 2016



Source: ITU.

Table 2.13: Most dynamic countries by IDI ranking and IDI value, Americas region, 2015-2016

Change in IDI ranking				Change in IDI value (absolute)			
IDI rank 2016	Region rank	Country	IDI rank change	IDI rank 2016	Region rank	Country	IDI value change
34	3	St. Kitts and Nevis	20	34	3	St. Kitts and Nevis	0.98
69	12	Dominica	8	69	12	Dominica	0.57
74	13	Grenada	8	111	27	Bolivia	0.53
111	27	Bolivia	6	74	13	Grenada	0.46
35	4	Barbados	4	92	19	Mexico	0.42
92	19	Mexico	4				

Source: ITU.

subscriptions, Internet users and households with Internet. This is consistent with findings in other dynamic developing countries. However, the two island states in the Eastern Caribbean, whose geography is more conducive to fixed-network deployment than that of a large country with difficult terrain such as Bolivia, also registered significant gains in fixed-broadband subscriptions.

By far the largest gain for any indicator in any country in this region within IDI 2016, however, was observed on mobile-broadband penetration in St. Kitts and Nevis, which rose from 18.63 per cent to 71.02 per cent over the year. Strong performance on this indicator was also a feature of the improvement in IDI values and rankings achieved by Dominica and Grenada. Some of the factors which contributed to this are described in Box 1.5 in Chapter 1.

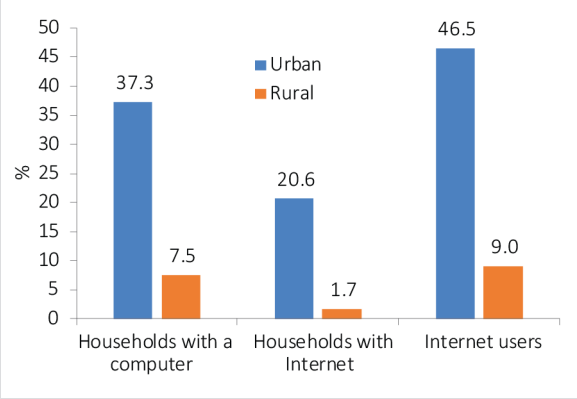
Box 2.8: ICT and IDI developments in Bolivia

Bolivia moved up six places in the IDI ranking, thanks to an increase of 0.53 points in its IDI value, more than twice the world average IDI improvement. This Andean country significantly improved its performance in terms of the percentage of households with a computer and households with Internet, which rose to an estimated 33.1 per cent and 23.8 per cent, respectively, by end 2015.

The increase in household ICT access was spurred by growth in mobile-broadband subscriptions, which almost tripled from 12.2 subscriptions per 100 inhabitants in 2014 to 33.8 at end 2015. This large increase in active mobile-broadband subscriptions resulted from the migration of 2G mobile data customers to 3G networks. The growth of household Internet access and mobile-broadband uptake also contributed to an increase in the proportion of Internet users from 34.6 per cent in 2014 to an estimated 45.1 per cent by end 2015. Higher Internet uptake was reflected in an increase in data consumed: mobile Internet data traffic doubled between 2014 and 2015 (ATT, 2015), and the traffic exchanged in the national Internet exchange point also grew significantly.[27]

Although more people are coming online in Bolivia, there remains a large urban-rural divide. Most Internet users and households with Internet access are located in urban areas, while less than 10 per cent of the population in rural areas use the Internet (Box 2.8). In addition, 3G coverage remains limited to 27 per cent of the population, suggesting that most rural areas do not have access to mobile-broadband networks.

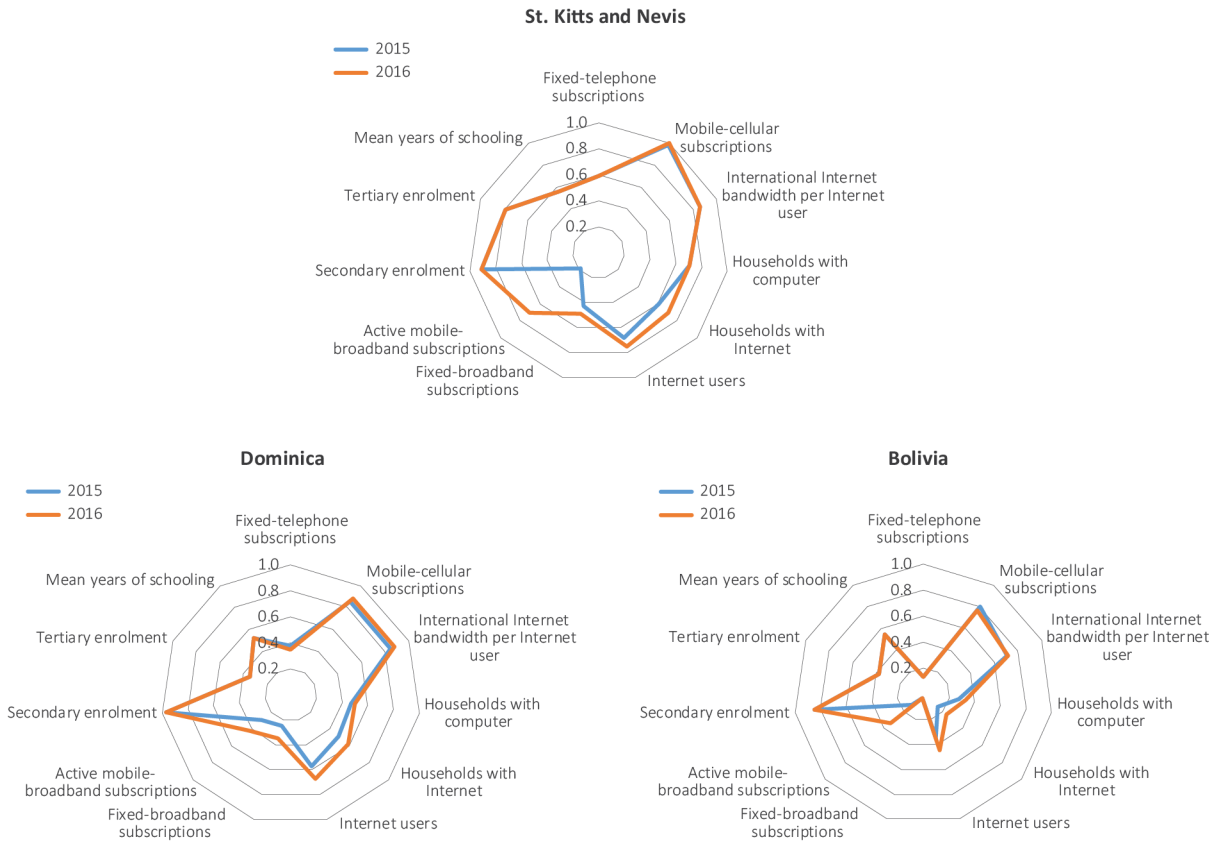
Chart Box 2.8: Households with Internet, households with a computer and Internet users, Bolivia, 2014



Source: ITU.

The extension of broadband networks to rural areas and the promotion of Internet uptake among rural communities is therefore one of the most important challenges that ICT policy-makers face in Bolivia. This has been a focus of policy attention, and several initiatives of the *Programa Nacional de Telecomunicaciones de Inclusión Social* have tried to bridge the gap, for example by providing Internet access to rural schools or deploying mobile-broadband-capable base stations in rural areas.[28]

Chart 2.14: IDI values, selected countries, Americas region, 2015-2016



Source: ITU.

2.3 Summary and conclusion

The IDI continues to demonstrate the diversity of ICT environments within the world community, from economies with high levels of ICT performance to least connected countries.

As indicated in Chapter 1, there is a broad association between levels of economic performance (as represented by GNI p.c.) and levels of performance in the IDI. This is reflected in variations between and within different geographic regions. Regions which are relatively prosperous, such as Europe, have higher average IDI values than those which are less prosperous, such as Africa. Regions which are economically more diverse, such as Asia-Pacific and the Americas, show the greatest variations in IDI performance. Within each region, some countries have improved their IDI values more than others, as a result of changes in policy, infrastructure deployment and other factors.

Each economy within the IDI faces different challenges, related to its geography, infrastructure requirements and social and economic structure, as well as the resources available to it. Policy interventions aimed at improving the ICT environment need to be tailored to those particular characteristics. Nevertheless, governments and ICT businesses can draw on the experience of more dynamic countries in the IDI when developing their plans for improving national ICT environments. The policies, infrastructure and service deployment approaches implemented in a number of these dynamic countries are illustrated in this chapter. Understanding how and why they have achieved higher rates of ICT development can help policy-makers and businesses elsewhere as they pursue better ICT performance which can, in turn, contribute towards sustainable economic and social development within their countries.

Endnotes

1 The countries included in each regional grouping of the ITU's Telecommunication Development Bureau are listed at http://www.itu.int/en/ITU-D/Statistics/Pages/definitions/regions.aspx. Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.

2 See http://www.amrtp-mali.org/index.php?option=com_content&view=article&id=136:lancement-de-la-campagne-de-communication-sur-l-identification-des-abonnes-aux-services-de-la-telephonie-et-de-l-internet&catid=87:actualite; and http://www.africtech.net/2016/01/le-mali-identifie-les-abonnes-du-telephone-mobile.

3 213th of 217 countries in the GNI p.c. rankings

4 GNI p.c. figures from http://databank.worldbank.org/data/download/GNIPC.pdf.

5 Telegeography, 'Telecom Namibia nears completion of second-phase government fibre project' in Telegeography CommsUpdate, 2 February 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/02/02/telecom-namibia-nears-completion-of-second-phase-government-fibre-project/index.html.

6 Telegeography, 'MTC Namibia launches USD 5.8 million 3.5G network', 18 December 2006. Available at: https://www.telegeography.com/products/commsupdate/articles/2006/12/18/mtc-namibia-launches-usd5-8-million-3-5g-network/.

7 Telegeography, 'LTE arrives in Namibia: MTC launches 4G in capital', 18 May 2012. Available at: https://www.telegeography.com/products/commsupdate/articles/2012/05/18/lte-arrives-in-namibia-mtc-launches-4g-in-capital/.

8 Telegeography, 'MTC Namibia, Huawei treble LTE speeds' in Telegeography CommsUpdate, 15 March 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2016/04/15/mtc-namibia-huawei-treble-lte-speeds/.

9 Telegeography, 'Zain launches Jordan's first LTE network' in Telegeography CommsUpdate, 17 February 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/02/17/zain-launches-jordans-first-lte-network/.

10 Telegeography, 'Orange inks deal with Huawei for June 3G launch' in Telegeography CommsUpdate, 26 March 2016. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/03/26/orange-inks-deal-with-huawei-for-june-4g-launch/.

11 Maxis, 'Results 1Q 2015' (Quarterly Presentation), 27 April 2015. Available at: http://maxis.listedcompany.com/misc/Presentation/1Q15_v3_presentation_slide.pdf; Maxis, 'Financial Results: 4Q 2015 & FY2015' (Quarterly Presentation), 4 February 2016. Available at: http://maxis.listedcompany.com/misc/Presentation/4Q15_presentation_slide.pdf; Maxis, 'Financial Results: First Quarter 2016' (Quarterly Presentation), 21 April 2016. Available at: http://maxis.listedcompany.com/misc/Presentation/1Q16_presentation_slide.pdf.

12 According to Celcom: 'All New Magic SIMTM from Xpax comes with free basic internet that are subject to a monthly Fair Usage Policy of 500 MB with speed of up to 64kbps ("Free Basic Internet").' See: https://www.xpax.com.my/magicsim_tnc.

13 U Mobile, 'U Mobile wows Malaysian consumers with market-best plans for the amazing iPhone 6 and iPhone 6 Plus, RM98 to take home iPhone 6 with U MicroCredit' (Public Release), 19 March 2015. Available at: http://www.u.com.my/press-release/6205; U Mobile, 'Free 1GB high speed Internet for life with U Mobile's brand new power prepaid pack' (Public Release), 23 July 2015. Available at: http://www.u.com.my/press-release/6585.

14 Digi, '4th Quarter: 2014 Results' (Quarterly Presentation), 9 February 2015. Available at: http://digi.listedcompany.com/misc/presentation/presentation4Q14.pdf.

15 TashiCell, '3G coverage' (Operator's Official Facebook post), 31 March 2015. Available at: https://www.facebook.com/TashiCell/; TashiCell, '3G coverage' (Operator's Official Facebook post), 3 July 2015. Available at: https://www.facebook.com/TashiCell/; Ministry of Information and Communications, Royal Government of Bhutan (MOIC, 2014), Annual InfoComm and Transport Statistical Bulletin (5th Edition), March 2014. Available at: http://www.moic.gov.bt/wp-content/uploads/2016/05/2014.pdf.

16 Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries.

17 Atlas methodology: http://databank.worldbank.org/data/download/GNIPC.pdf.

18 The Europe region includes three countries classified as developing countries – Cyprus, Israel and Turkey.

19 Telegeography. 'RCS & RDS promises faster 3G speeds in 25 cities' in Telegeography CommsUpdate, 10 March 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/03/10/rcsrds-promises-faster-3g-speeds-in-25-cities/.

20 Telegeography, 'Digi entering 4G data segment via 2K Telekom licence takeover' in Telegeography CommsUpdate, 21 August 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/08/21/digi-entering-4g-data-segment-via-2k-telecom-licence-takeover/.

21 Telegeography, 'Orange Romania launches VoLTE; Wi-Fi calling to follow' in Telegeography CommsUpdate, 14 September 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/09/14/orange-romania-launches-volte-wi-fi-calling-to-follow/.

[22] Albania was the last country in Europe to launch 3G services: the first 3G licence was awarded to Vodafone in December 2010, and the operator started offering 3G services in January 2011. For more information, see Cullen International (2012) and Vodafone's press release: http://www.vodafone.al/vodafone/Vodafone_i_pari_qe_sjell_teknologjine_3G_duke_filluar_me_Tiranen_799_1.php.

[23] Telegeography, 'AKEP opens door for 4G launches via spectrum refarming' in Telegeography CommsUpdate, 5 June 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/06/05/akep-opens-door-for-4g-launches-via-spectrum-refarming/.

[24] Telegeography, 'Telekom Albania switches on LTE-A network; offers download speeds of 225 Mbps' in Telegeography CommsUpdate, 2 September 2015. Available at: https://www.telegeography.com/products/commsupdate/articles/2015/09/02/telekom-albania-switches-on-lte-a-network-offers-download-speeds-of-225mbps/.

[25] Vodafone Albania, 'Vodafone Albania sjell internet super të shpejtë me 4G+' (Public Release), 2015. Available at: http://www.vodafone.al/vodafone/Vodafone_Albania_sjell_internet_super_te_shpejte_me_4G_4286_1.php.

[26] See Article 34 of the *Ley Orgánica de Telecomunicaciones* approved in February 2015, available at: http://www.telecomunicaciones.gob.ec/wp-content/uploads/downloads/2016/05/Ley-Org%C3%A1nica-de-Telecomunicaciones.pdf.

[27] Punto de Intercambio de Tráfico Bolivia, http://www.pit.bo/index.php/en/trafico.

[28] For more information on the initiatives undertaken under Bolivia's *Programa Nacional de Telecomunicaciones de Inclusión Social*, see: https://www.oopp.gob.bo/vmtel/index.php/informacion_institucional/content,1160.html.

Chapter 3. The role of ICTs in monitoring the SDGs

Key findings

In 2015, the United Nations identified 17 Sustainable Development Goals (SDGs) and associated targets, which will guide international development between 2015 and 2030. To measure progress towards achievement of the SDGs, the United Nations Statistical Commission adopted a global framework of indicators. Several SDGs refer to ICTs and technology, and several **ICT indicators were identified to help track SDGs 4, 5, 9 and 17.**

Monitoring access to computers and the Internet in schools. SDG 4 is concerned with inclusive and equitable educational opportunities for all. One of its targets is to ensure provision of appropriate and inclusive educational facilities. Available data on schools with access to computers and the Internet suggest that, **while a number of developing countries have achieved 100 per cent access to computers in both primary and secondary schools, many other countries lag behind.**

Monitoring ICT skills among youth and adults. Another SDG 4 target is to enhance the skills needed for employment, decent jobs and entrepreneurship. This will be measured by the proportion of young people and adults with a range of ICT skills. Data show that **the share of the population with specific ICT skills is considerably higher in developed countries than it is in developing countries.**

Monitoring the role of ICTs in women's empowerment. SDG 5 is concerned with women's empowerment. One of its targets is to enhance the use of ICTs to promote empowerment. Data on the percentage of women and men who own a mobile phone show that **the gender gap in mobile phone ownership and use is higher in lower-income and less connected countries**.

Monitoring the growth of access to ICTs and the Internet. SDG 9 calls for increased access to ICTs, working towards "universal and affordable access to the Internet in least developed countries by 2020". One of its targets focuses on the need to increase access to ICTs and the Internet, as measured by the percentage of the population covered by different mobile technologies. **The proportion of the population covered by a mobile-broadband network will reach 84 per cent in 2016 globally, but only 67 per cent in rural areas**. Just over half of the global population is covered by LTE or higher networks and few of those living in rural areas.

Monitoring the contribution of ICTs to science, technology and innovation. SDG 17 is concerned with revitalizing the global partnership for sustainable development. One of its targets is to improve cooperation in science, technology and innovation. This will be measured, in part, by monitoring the number and speed of fixed-broadband subscriptions. Data show that **there are substantial differences between developed and developing countries, and within regions, in terms of both the proportion of the population with fixed-broadband subscriptions and the speeds delivered by these subscriptions.** While some countries, such as the Republic of Korea, Denmark and France, have fixed-broadband penetration rates of around 40 per cent and almost exclusively high-speed connections of above 10 Mbps, many low-income economies have less than 2 per cent fixed-broadband penetration rates and exclusively lower-speed connections of below 2 Mbps.

Monitoring the use of ICTs as an enabling technology. Another target under SDG 17 is to enhance society's use of technology, including ICTs. This is measured by the proportion of individuals using the Internet. **In 2016, Internet usage rates are about twice as high in developed countries as in developing countries, and more than twice as high in developing countries, as a whole, than as in least developed countries.**

Chapter 3. The role of ICTs in monitoring the SDGs

3.1 Introduction

In September 2015, the *2030 Agenda for Sustainable Development* was agreed upon at the United Nations Sustainable Development Summit.[1] The Agenda sets out a comprehensive framework for international cooperation between 2015 and 2030 in support of sustainable development, covering its economic, social and environmental dimensions through 17 Sustainable Development Goals (SDGs) and 169 targets. The SDGs, which succeed the Millennium Development Goals that guided international development policy between 2000 and 2015, are summarized in Table 3.1. They are applicable to all countries and regions, and are intended to ensure that 'no one is left behind' in the course of progress towards sustainable development.

In March 2016, the United Nations Statistical Commission (UNSC) agreed on a global indicator framework, including 230 indicators, to help monitor progress, identify challenges and guide policy-makers in their efforts to implement the Goals and Targets (ECOSOC, 2016). Six of the indicators (including two sub-indicators) are explicitly concerned with ICTs. This chapter outlines each of these indicators, considers the availability of relevant data, and takes stock of current levels of achievement.

3.2 ICTs and SDGs

The role of ICTs in development has been under discussion since at least 1984, when the report of the ITU-led Maitland Commission advocated international cooperation to reduce inequalities in access to communications. It formed a centrepiece of the World Summit on the Information Society (WSIS), held in 2003 and 2005, which called for 'a people-centred, inclusive and development-oriented Information Society, … enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life.'

There is now extensive experience in ICTs for development (ICT4D), which exploits the potential of ICTs to achieve particular development goals

Table 3.1: The Sustainable Development Goals

1	End poverty in all its forms everywhere
2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	Ensure healthy lives and promote well-being for all at all ages
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Achieve gender equality and empower all women and girls
6	Ensure availability and sustainable management of water and sanitation for all
7	Ensure access to affordable, reliable, sustainable and modern energy for all
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10	Reduce inequality within and among countries
11	Make cities and human settlements inclusive, safe, resilient and sustainable
12	Ensure sustainable consumption and production patterns
13	Take urgent action to combat climate change and its impacts
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development

Source: UN.

while facilitating access to ICTs and their use by individuals and communities. The decade since WSIS has also seen remarkable developments in the capabilities and reach of ICTs within developing countries, including the spread of broadband networks and the emergence of mobile Internet, smartphones and tablets, social media and cloud computing, all of which are widely recognized as enablers of sustainable development.[2]

At the same time, there has been increasing concern about digital divides between developed and developing countries, particularly LDCs, and between different sections of communities within individual countries; about the extent to which these enablers have facilitated development in practice; and about the impact of the digital divide on other development divides. Data concerning the overall extent of digital divides can be found in the opening section of Chapter 1 and in other ITU publications.[3] In its 2016 *World Development Report* on *Digital Dividends*, the World Bank (2016) noted that 'the effect of technology on global productivity, expansion of opportunity for the poor and the middle class, and the spread of accountable governance has so far been less than expected,' and that, to date, 'the better educated, well connected, and more capable have received most of the benefits.' It emphasized the need for policy-makers to focus on analogue complements to digital development, in particular 'a favorable business climate, strong human capital, and good governance.'

The importance of ICTs in sustainable development was recognized by the UN General Assembly following its overall review of the implementation of WSIS outcomes which concluded in December 2015. The outcome document from that review called for 'close alignment' between the WSIS process and the *2030 Agenda*, highlighting the 'crosscutting contribution of information and communications technology' to the SDGs and poverty eradication,' and called on governments and international organizations to integrate ICTs in their implementation of sustainable development. The review expressed concern about continued digital divides which could slow progress towards sustainable development, with particular reference to the gender digital divide.[4]

The *2030 Agenda for Sustainable Development* also recognized that 'The spread of information and communication technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies.'[5] The Summit did not, however, adopt an SDG concerned specifically with ICTs, and only one of the 169 targets in the *2030 Agenda* is explicitly concerned with their availability. Three other targets refer to the potential of ICTs for achieving other Goals, and indicators adopted by UNSC for these four targets are discussed in this chapter. Several other Goals and targets refer more generally to the importance of technology and to the role of information in enabling the achievement of sustainable development.

Concern has been expressed by a number of stakeholders about the need to develop a more comprehensive framework for assessing the role of ICTs within the SDGs, including stronger measurement of the adoption and use of ICTs themselves. An expert group meeting organized by the UN Department of Economic and Social Affairs in 2015, for example, highlighted three ways in which ICTs are likely to have a major impact on sustainable development as they become more pervasive and more sophisticated over the period of SDG implementation: by changing the underlying characteristics of economic and social development, supporting the delivery of specific Goals and targets, and facilitating more effective measurement of all Goals and targets.[6] WSIS Action Line facilitators have developed a matrix juxtaposing WSIS Action Lines and SDGs, which will inform SDG implementation.[7] Big-data analysis is expected to play a substantial role in the measurement of some of the Goals in the *Agenda*.[8]

3.3 The SDG indicator framework

In March 2016, UNSC adopted a global indicator framework for the SDGs and Targets which are set out in the *2030 Agenda for Sustainable Development*.[9] This framework, which includes 230 individual indicators, was developed by the UN Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) in the course of a year-long process of consultation with international agencies and Member States. It will provide the basis for annual monitoring, follow-up and subsequent review of implementation of the *2030 Agenda* at the national, regional and global levels. The IAEG-SDGs is continuing its work to establish baselines for

indicators, develop and review methodologies and address data gaps.

Substantial data challenges are raised by the indicator framework. Global monitoring will, to the extent possible, be based on comparable official statistics produced by national statistical systems (NSS). Where feasible, and in line with the *Agenda*'s pledge that 'no-one will be left behind,' data will be disaggregated according to income, gender, age, disability and other characteristics in order to improve the granularity of monitoring. It is recognized, however, that this will be difficult to achieve. The resources available to NSS in many developing countries are limited. In many cases, national data sets are not collected regularly, are not comparable or are not disaggregated. UNSC has therefore called for steps to be taken to standardize indicators internationally, strengthen national capacity to collect data, and improve reporting mechanisms. Nevertheless, it is recognized that it will be difficult to obtain high-quality data for some indicators in a number of countries for some time.[10]

Indicators in the framework have been grouped into three tiers reflecting variations in data standards and availability:

- Tier I – indicators for which an established methodology exists and data are already widely available.
- Tier II – indicators for which a methodology has been established but for which data are not easily available.
- Tier III – indicators for which an internationally agreed methodology has not yet been developed.

Six of the 230 indicators in the framework (one of which is divided into two sub-indicators) are concerned explicitly with ICTs. These indicators, the targets with which they are concerned and the agency responsible for data-gathering at global level are shown in Table 3.2.

The following sections of this chapter discuss the relationship between these targets and indicators, data sources and availability, as well as current levels of achievement where these indicators are concerned.

Indicators for Target 4.a: Proportion of schools with access to computers, and Proportion of schools with access to the Internet for pedagogical purposes

SDG Goal 4 aims to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.' It includes ten targets, two of which will be measured by ICT indicators. Target 4.a seeks to ensure provision of educational facilities which are 'child, disability and gender sensitive' and to provide 'safe, non-violent, inclusive and effective learning environments for all.' As well as two ICT sub-indicators – the availability of computers and the Internet – it will be measured by sub-indicators concerned with the availability of electricity, adapted infrastructure and materials for students with disabilities, basic drinking water, single-sex basic sanitation facilities, and basic handwashing facilities.[11]

The sub-indicators concerned with computers and the Internet are Tier I/II[12] indicators. The definition of a computer for the purpose of indicator 4.a is 'a programmable electronic device that can store, receive and process data, as well as share information in a highly-structured manner,' including desktop, laptop and tablet devices.[13] Internet access, as defined for the indicator, includes fixed-narrowband access at download speeds of less than 256 Kbit/s, as well as fixed-broadband access at speeds higher than 256 Kbit/s and mobile-broadband access of at least 3G standard.

Data concerned with the provision of computers and the Internet in schools are collected by the UNESCO Institute for Statistics (UIS) from different national sources , including ministries of education, national statistical offices and other specialized agencies. Data concerning schools with computer access were available in 2015 for 66 countries and territories, along with data for 40 countries and territories concerning schools with Internet access. No data were available for countries in Europe, where computer and Internet access in schools is generally high. Some UIS data currently available are relatively old:

- Two countries supplied data concerned with computers in schools from 2014, with a further seven supplying data from 2013.

Table 3.2: ICT indicators and related SDG targets

Target		Indicator	Agency**	Tier
4.a	Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all	Proportion of schools with access to computers for pedagogical purposes	UIS	I/II*
		Proportion of schools with access to the Internet for pedagogical purposes	UIS	I/II*
4.4	By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	Proportion of youth/adults with ICT skills, by type of skills	ITU	II
5.b	Enhance the use of enabling technology, in particular information and communication technology, to promote the empowerment of women	Proportion of individuals who own a mobile phone, by sex	ITU	II
9.c	Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	Percentage of the population covered by a mobile network, by technology	ITU	I
17.6	Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovations, and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	Fixed Internet broadband subscriptions, by speed	ITU	I
17.8	Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	Proportion of individuals using the Internet	ITU	I

Note: *Since Target 4.4 includes several sub-indicators (some collected by UIS, and others by other agencies), this tier reference refers to the different sub-indicators. Both UIS indicators were classified as Tier I/II since data for both indicators are collected by UIS, based on an established methodology. While data exist for a large number of countries, UIS does not yet have a regular, global data collection, and for most countries data exist for only one year.
** UIS = UNESCO Institute for Statistics; ITU = International Telecommunication Union.
Source: ITU, adapted from ECOSOC (2016).

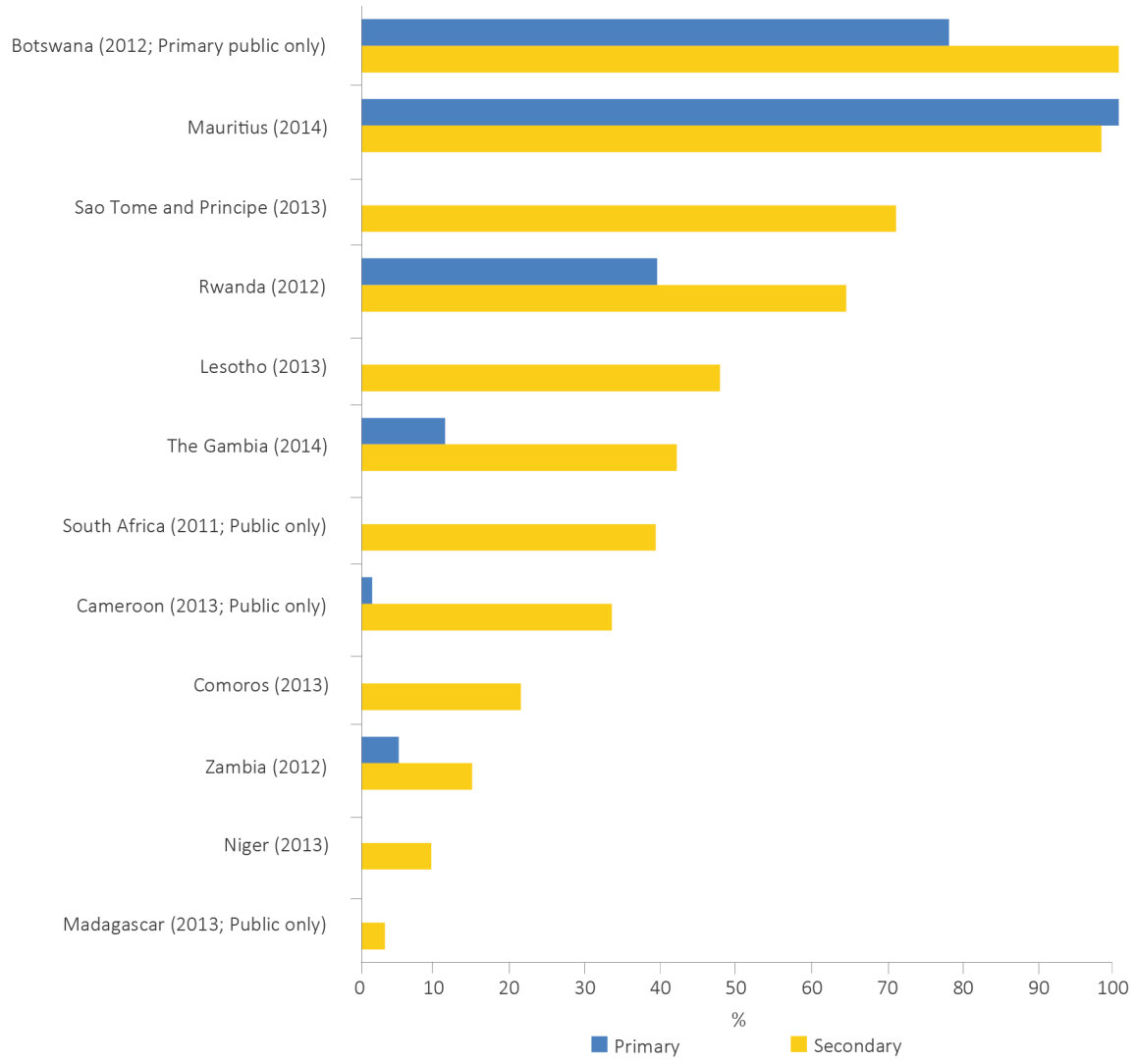
- Data for the remaining 57 countries and territories were derived from 2012 or earlier, with those from 29 of them being derived from 2009 or 2010.

- In the case of data on Internet in schools, three countries supplied data from 2013 and 2014, with the remaining 37 countries supplying data from 2012 or earlier, 18 of them from 2009 and 2010.

Most of the available data, therefore, do not allow for effective assessment of performance against this target in 2015. In addition, while most countries and territories that have provided data have disaggregated secondary and primary schools, some have combined these while others have provided data for only one or the other category.

Substantial variations between countries are evident from those data which are available. Some countries from across different regions – including Armenia, Barbados, Malaysia, Mongolia, Oman and Uruguay – reported achieving 100 per cent access to computers in both secondary and primary schools as early as 2012. Others reported significantly lower figures at such earlier dates. Where figures for secondary and primary schools are reported separately, a higher proportion of the former is usually reported to have computer

Chart 3.1: Percentage of schools with computers, selected African countries, various years



Source: UIS.

access. The most recent data for this indicator are derived from Africa, and are illustrated in Chart 3.1.

No data comparable to these are available for Internet access in Africa. However, data from before 2013 show a similar pattern in other regions to that for computer access – with some countries achieving 100 per cent access at least for secondary schools by 2012, and generally higher levels of access in secondary than in primary schools.

The principal challenge concerning these two indicators is the need to gather comprehensive recent data, rather than relying on information which significantly pre-dates adoption of the target. UIS issued a questionnaire to all countries seeking data on these indicators during 2016, results from which are expected in 2017.

Indicator for Target 4.4: Proportion of youth/adults with ICT skills, by type of skills

Target 4.4 within SDG Goal 4 seeks, with a target date in 2030, to 'substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.'

ICT skills enhance the level of use that can be made of ICTs by individuals, businesses and organizations, while the lack of ICT skills is generally considered one of the principal

barriers preventing people from deriving full benefit from ICT availability. In particular, the UN General Assembly's WSIS+10 review asserted that 'differences in individuals' capabilities to both use and create information and communications technologies represent a knowledge divide that perpetuates inequality' (UNGA, 2015).

The indicator assigned for this target is the proportion of youth and adults with such skills, disaggregated by type of skill. Information derived from this Tier 2 indicator should enable governments and other stakeholders to improve the link between ICT usage and impact, targeting improvements in ICT literacy and proficiency while paying particular attention to the gender digital divide, differences between people in different age groups, and the needs of vulnerable groups such as the unemployed and people with disabilities.

This relatively new indicator was added to the list of core indicators of the Partnership on Measuring ICT for Development[14] and endorsed by UNSC in 2014, since when a corresponding question has been included in ITU's annual questionnaire to National Statistical Offices (NSOs). Nine skills are included in the questionnaire and indicator, including copying/moving files and documents, using e-mail, connecting devices, using spreadsheets and presentation programmes, configuring software and programming. At national level, data are collected through national household surveys, based on self-reported answers which are not independently verified.

A total of 51 economies have provided data for this indicator, almost all of them supplying data from 2014 or 2015. Of these economies, 36 are in Europe, five in the Asia-Pacific region, five in the Arab States region, two in the CIS region, two in the Americas and only one in Africa. They include 34 developed and 17 developing economies. All but six of those providing data fall within the top half of rankings for ITU's ICT Development Index (IDI) (see Chapter 1), while only one (Zimbabwe) falls into the lowest quartile of the IDI (least connected countries), and none is an LDC. There are some differences in the age ranges applied in these surveys which may have an impact on interpretation.[15]

The limited geographical range of countries reporting data means that it is not yet possible to produce regional aggregates for this indicator, except for Europe. However, the data currently available do give a broad indication of current outcomes and set a benchmark for the future.

Chart 3.2 shows the average level of attainment reported among countries for the nine different skills included in the indicator across the whole dataset, as a percentage of the population. It also distinguishes between developed and developing countries. However, it is not weighted according to the populations of the different countries involved.

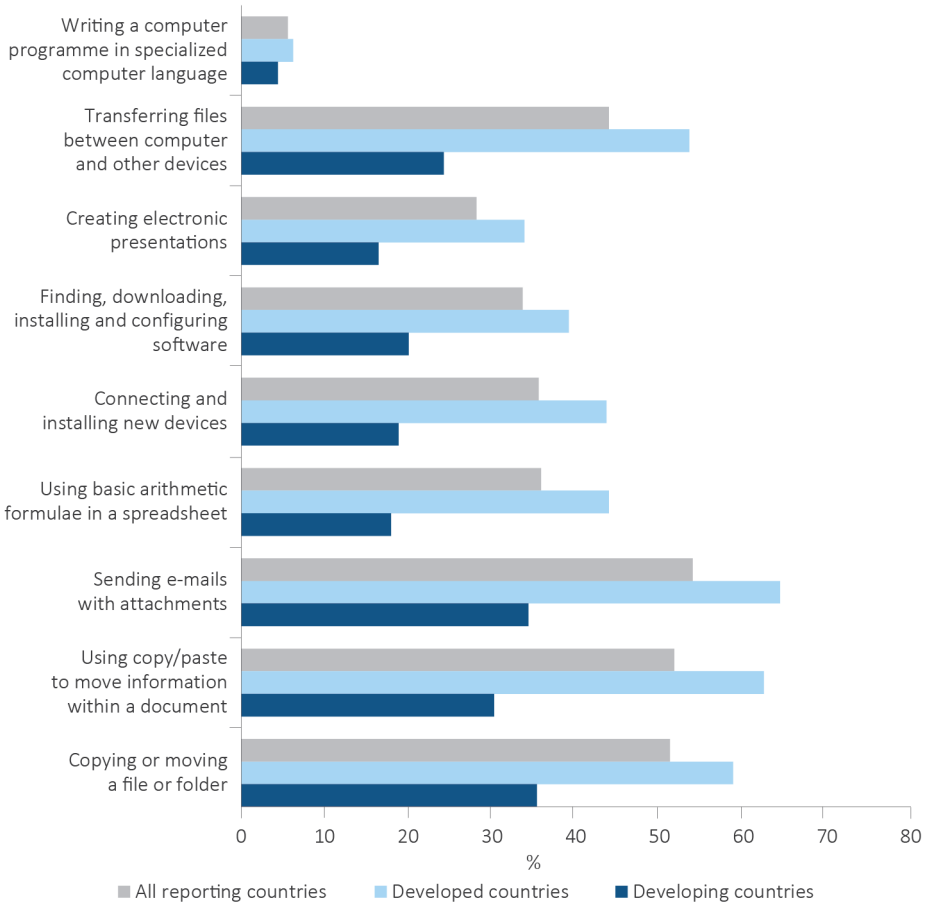
Chart 3.2 shows that, with the exception of programming, the share of the population with specific ICT skills is considerably higher in developed countries than it is in developing countries. The difference between highly-connected countries (in the top quartile of the IDI distribution) and less-connected countries is even more marked. Only eight countries reported figures of over ten per cent of adults with programming skills – Iceland (the highest, at 18.2 per cent), Croatia, Denmark, Luxembourg, Sweden and Norway in Europe, together with Bahrain and Morocco in the Arab States region – while two countries reported figures below 1 per cent for this indicator (Azerbaijan and Zimbabwe).

Chart 3.3 presents illustrative spider chart for three individual countries which illustrate the diversity of reported ICT skill levels between countries at different levels of development – Sweden, a highly developed and highly connected member of the OECD; Morocco, a middle-income developing country in North Africa; and Zimbabwe, a landlocked developing country, which is at the top of the least connected group of countries in the IDI.

Out of the total of 51 countries reporting data, 41 provided gender-disaggregated data for this indicator, of which 33 are developed countries and eight are developing countries. (One developed country provided gender-disaggregated data for only one skill.) No gender-disaggregated data were provided by countries in the lowest quartile of the IDI distribution.

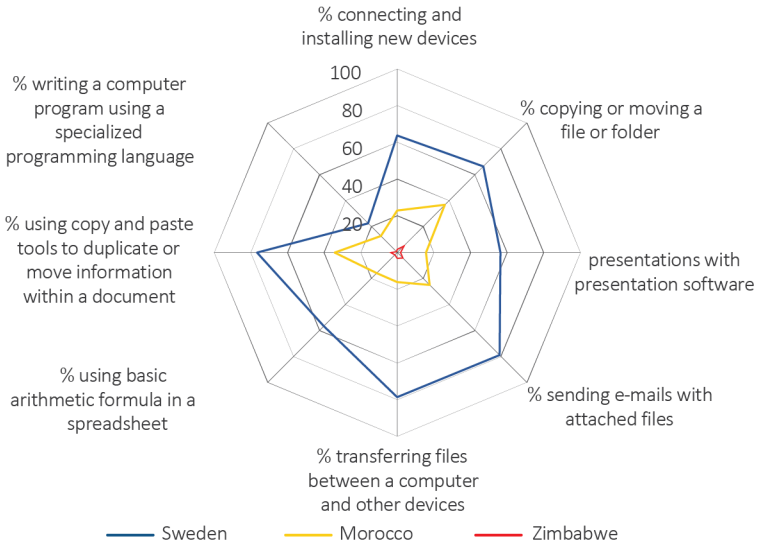
Chart 3.4 shows the average level of attainment reported for each of the nine skills included in the indicator in these 41 countries, by proportion of their male and female populations, in those developed and developing countries that reported findings for this indicator.

Chart 3.2: Proportion of individuals with ICT skills, by type of skill, latest available year, 2012-2015



Note: Based on simple averages of 51 countries that reported data (34 developed and 17 developing countries).
Source: ITU.

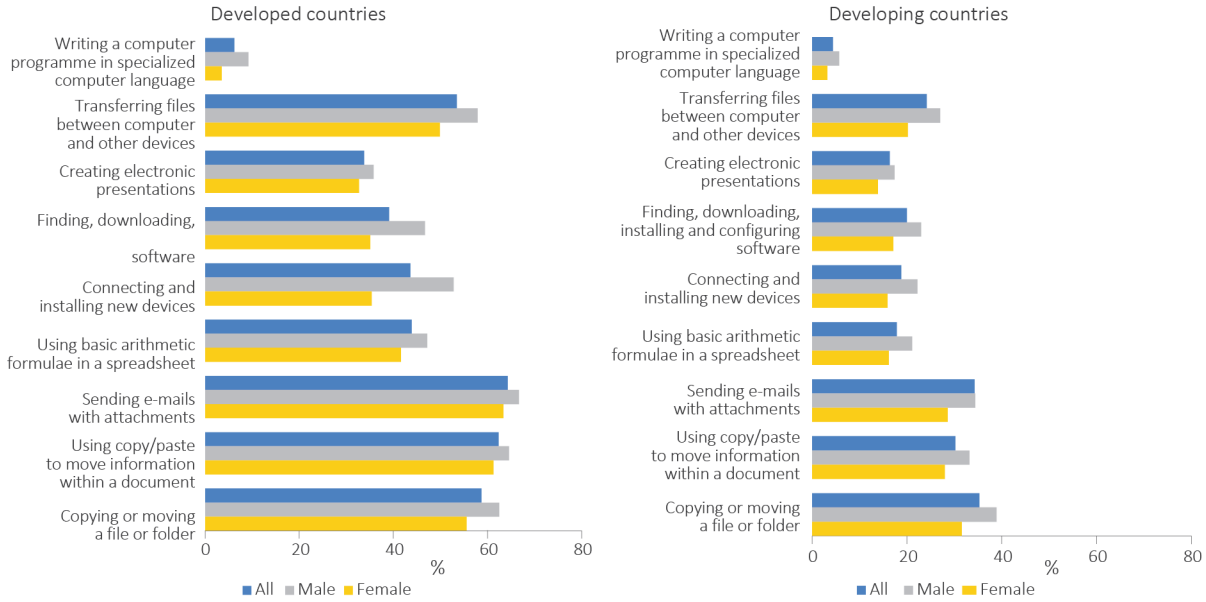
Chart 3.3: Proportion of individuals with reported ICT skills, Sweden, Morocco and Zimbabwe, 2014/2015



Source: ITU.

In 25 of the 41 countries reporting data for this indicator, a higher proportion of men than women had acquired ICT skills in all of the skill categories concerned. The discrepancy between

Chart 3.4: Proportion of individuals with ICT skills, by type of skill, by sex, developed (left) and developing (right) countries, latest available year (2012-2015)



Note: Based on simple averages of 41 countries that reported data (33 developed and eight developing).
Source: ITU.

men and women was more marked in hardware and software skills (installing and configuring devices and software) than in usage skills (such as e-mail, spreadsheets and presentations). At the most basic level, only one country (Slovenia) recorded a higher proportion of women than men able to move files and folders. At the more advanced level, only one country (Qatar) recorded a higher proportion of women than men with skills in connecting and installing new devices, installing and configuring software, or computer programming. No country recorded a higher proportion of women with skills in transferring files and folders between devices of different types.

The difference in the male/female skills gap between developed countries in Europe and the small number of developing countries reporting data for this indicator is not particularly high. However, the small number of developing countries reporting data and absence of any LDCs or least connected countries mean that this apparent finding is not generalizable.

The data currently available, and reported here, provide a useful starting point for assessing this indicator. However, the majority of available data are currently derived from developed countries in Europe, which have high levels of connectivity, educational attainment and ICT skills. A much wider evidence base is required for this indicator to support implementation of SDG target 4.4, particularly gender-disaggregated data from LDCs and less-connected countries. Achieving this will require support to NSOs to improve the frequency and reliability of household surveys.

Indicator for Target 5.b: Proportion of individuals who own a mobile phone, by sex

SDG 5 aims to 'achieve gender equality and empower all women and girls.' It includes nine targets, addressing different aspects of gender equality. Target 5.b seeks to 'enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women.' The outcome document from the UN General Assembly's review of the World Summit on the Information Society similarly called for 'immediate measures to achieve gender equality in Internet users by 2020,' a goal which is also included in ITU's Connect 2020 Agenda.[16] An assessment of efforts to measure ICT and gender was published by the Partnership on Measuring ICT for Development in 2014 (UNCTAD, 2014).

Mobile phones have spread rapidly to become, for many people, the principal means of business

and interpersonal communications and Internet use. Although the number of mobile phone subscriptions now exceeds the global population, there are many duplicate subscriptions, with the GSM Association estimating there to have been 4.7 billion unique mobile subscribers in 2015 (see Chapter 5) (GSMA, 2016). Furthermore, some of those subscribers own one or more SIM cards but do not own a phone device.

Mobile phone ownership is valuable in tracking gender equality since mobile phones are personal devices that can provide women and girls with greater independence and autonomy in their social and economic lives. A number of studies have identified a significant gender gap in mobile phone ownership and use that is broadly but not exclusively associated with other differences between men and women's life experience, particularly where income and educational attainment are concerned.[17] ITU has reported that there is a gender gap of 12 per cent in Internet use worldwide in 2016, and that the gap is considerably higher (30.9 per cent) in LDCs (ITU, 2016). Building a stronger evidence base around mobile phone ownership should help to determine whether there is a comparable gender gap in mobile ownership.

The indicator assigned for this target is the proportion of individuals who own a mobile phone, by sex. This is a Tier II indicator, with established international measurement standards. It was developed by the Task Group on Gender of the Partnership on Measuring ICT for Development, approved by the World Telecommunication/ ICT Indicators Symposium in 2014, and has been added to the Partnership's Core List of Indicators.[18] It seeks to measure the number of individuals with a mobile phone device and at least one active SIM card[19] for personal use, either prepaid or postpaid, but does not include those who own a SIM card without a mobile device.[20]

Measurement of this indicator should help governments and other stakeholders to design policies that can address the gender digital divide and support initiatives aimed at other aspects of gender inequality. Data for the indicator will be collected by ITU through an annual questionnaire to NSOs, which was issued for the first time in 2015.

At present, however, data on the proportion of individuals who own a mobile phone are available for only a small number of countries, and are often not gender-disaggregated. Only 21 countries and territories supplied data on mobile phone ownership through the 2015 questionnaire, with 15 of them having provided data relating to 2015 itself. Only 12 of these countries and territories supplied sex-disaggregated data. Results for these 12 countries are set out in Chart 3.5. While all are developing countries, only one (Burundi) is an LDC or LCC. Three other countries (Egypt, Indonesia and Morocco) also fall within the lower half of the IDI rankings (see Chapter 1). It should be noted that there are some variations in the age groups covered by these data in different countries.

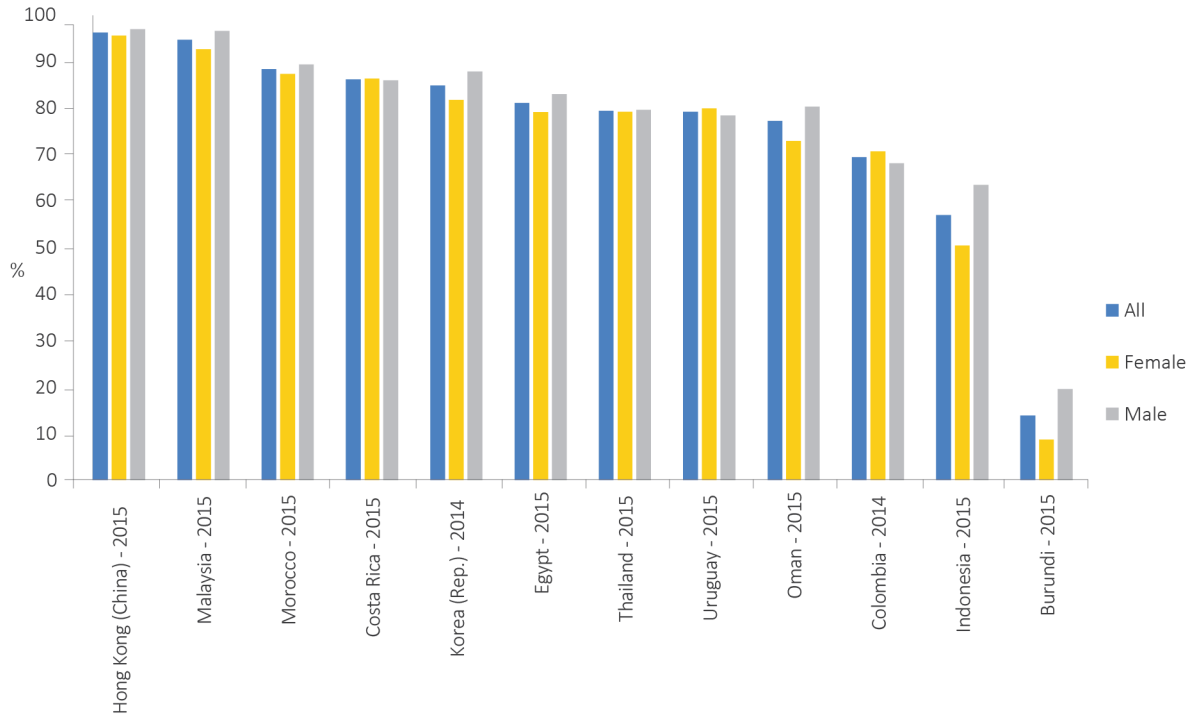
These data are consistent with findings in other research which suggest that there is a gender gap in mobile phone ownership and use, and that this varies between different countries. Although there is insufficient evidence in the current dataset to confirm this, other evidence suggests that this gender gap may be higher in lower-income, less-connected countries.[21]

The most appropriate means of data collection for this indicator is through national household surveys. While some countries include questions on mobile phone ownership in household surveys, many do not yet do so. This partly explains why only a small number of countries provided data for this indicator following its inclusion in the ITU annual questionnaire for the first time in 2015. ITU is encouraging all countries to add this indicator to such surveys, where these are undertaken, in the hope that this will increase the availability of data in the near future. Other surveys of mobile phone ownership undertaken by commercial businesses and non-governmental organizations provide valuable information to supplement this indicator, and should also be taken into account.[22]

Indicator for Target 9.c: Percentage of the population covered by a mobile network, by technology

SDG 9 aims to 'build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation,' and includes eight targets. Target 9.c seeks to 'significantly increase access to information and communications technology and strive to provide universal and affordable access to

Chart 3.5: Proportion of individuals owning a mobile phone, by sex, 2014/2015



Source: ITU.

the Internet in least developed countries by 2020.' This is the only target within the *2030 Agenda* which is specifically concerned with ICT networks and services.

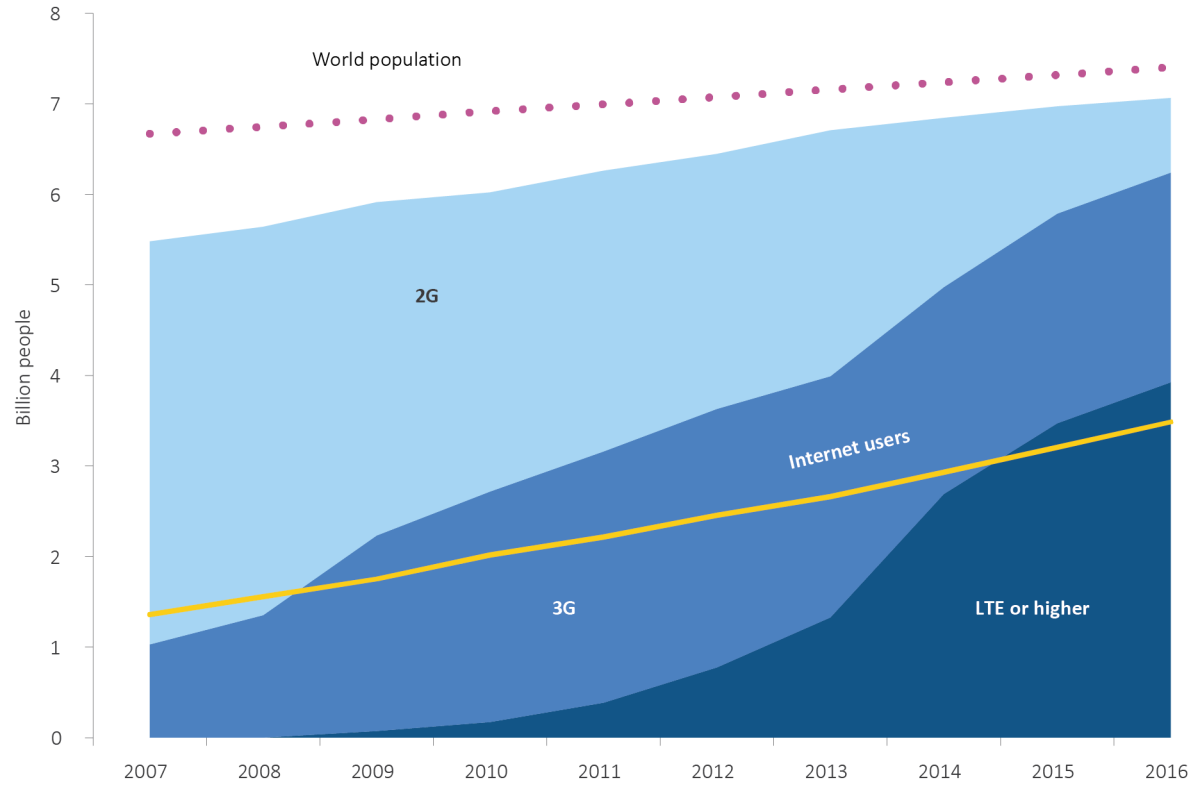
The proportion of the population covered by a high-speed mobile-cellular network can be considered a useful indicator for ICT access. Over the last decade, mobile-cellular networks have expanded rapidly, overcoming many of the access limitations of fixed terrestrial networks and thus extending inclusion in basic telecommunications. While 2G (narrowband) networks offer basic access, particularly to voice-based services, which is valuable, effective Internet access requires access to 3G or higher (broadband) networks. Access to broadband networks is therefore crucial to Internet inclusiveness, as well as to the more sophisticated services that foster innovation and enable online business.

The indicator assigned to this target is the percentage of the population covered by a high-speed mobile network (i.e. those whose home is within range of a mobile signal), irrespective of whether they are mobile phone users or subscribers, disaggregated between those with access to 2G, 3G and LTE or higher-speed networks. This is a Tier 1 indicator that is based on an internationally agreed definition and methodology and included in the Partnership on Measuring ICT for Development's Core List of Indicators. Information from this indicator should help governments and businesses to design regulatory frameworks and business models for broadband deployment that will maximize benefits to communities that are currently underserved.

ITU collects data for this indicator through an annual questionnaire sent out to national communications regulators and ICT ministries, which in turn obtain data from licensed mobile-cellular operators. Data on 2G networks were available for 144 countries in 2015, while data for 3G networks were available for 135 countries. In some countries, the available data refer only to the operator with the most extensive network, which may underestimate total coverage.

Chart 3.6 shows the evolution of mobile-network coverage worldwide since 2007. The proportion of the world's population living in areas without mobile coverage is now small, but still significant. The proportion covered by a mobile-broadband network will reach 84 per cent in 2016, but only 67 per cent in the case of the rural population. Just over half (53 per cent) of the global population is now covered by LTE or higher networks.

Chart 3.6: Mobile network coverage and evolving technologies, 2007-2016



Note: * Estimate.
Source: ITU.

Indicator for Target 17.6: Fixed Internet broadband subscriptions, by speed

SDG 17 aims to 'strengthen the means of implementation and revitalize the global partnership for sustainable development.' This broad goal includes 19 targets addressing different aspects of global development, two of which have assigned ICT indicators.

Target 17.6 seeks to 'enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovations, and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism.' It has two assigned indicators, one concerned with science and technology agreements (which lies outside the scope of this chapter), the other with fixed Internet broadband subscriptions.

The Internet has become an increasingly important resource providing access to information, enhancing knowledge-sharing and facilitating international cooperation in science, technology and innovation. Reliable broadband access is essential in order to use more sophisticated ICT applications, including those required for scientific collaboration. While mobile-broadband networks are increasingly widely available in both developed and developing countries, many developing countries have only limited fixed-broadband availability, which is considered preferable for high-volume, time-critical applications. Those networks which are available also vary considerably in terms of the speed of access they can provide, presenting barriers to international cooperation.

The Tier I ICT indicator for this target, which concerns fixed-Internet broadband subscriptions, differentiated by speed of access, is based on an internationally-agreed definition and methodology. Fixed broadband subscriptions per 100 inhabitants, a related but distinct indicator, is included in the Partnership on Measuring ICTs for Development's Core List of Indicators and forms part of the IDI,

the latest results from which are reported in Chapters 1 and 2. Information concerning this indicator will help governments and Internet businesses to target public and commercial resources in areas that will enhance scientific and technical collaboration, with anticipated onward benefits for productivity and economic growth.

ITU collects data for this indicator through an annual questionnaire sent out to national communications regulators and ICT ministries, which obtain data from Internet service providers (ISPs). Data and/or ITU estimates[23] for the overall number of fixed-broadband subscriptions per hundred inhabitants are available for 205 economies for 2015 (including 19 territories not included in ITU regions), while data differentiated by speed are available for 115 economies (including two such territories).[24]

Since most ISPs offer broadband plans linked to download speed, the indicator is relatively straightforward to collect, but data collected at national level do not all follow the same tiers of broadband capacity. ITU has therefore sought to collate information in three bands: between 256 kbit/s (the lowest data-transfer rate to be considered broadband) and 2 Mbit/s; between 2Mbit/s and 10 Mbit/s; and above 10 Mbit/s.

There are very substantial differences between developed and developing countries, and within regions, in terms both of the proportion of inhabitants with fixed-broadband subscriptions and the speeds that these subscriptions prove (Chart 3.8). While some countries, such as the Republic of Korea, Denmark and France have fixed-broadband penetration rates of around 40 per cent and almost exclusively high-speed connections of above 10 Mbps, many low-income economies have less than 2 per cent fixed-broadband penetration rates, and exclusively lower-speed connections of below 2 Mbps. Table 3.3 illustrates the weighted average for fixed-broadband subscriptions within each region, together with figures for the highest and lowest performing countries in each region. It also includes ITU's estimate for the number of fixed-broadband subscriptions for each region in 2016, including estimates for other countries which have not provided data.

Table 3.3 shows that the number of fixed-broadband subscriptions per 100 inhabitants in Europe is 29 per cent, while that in other regions is much lower. Within the African region it is just 0.5 subscriptions per 100 inhabitants (including the region's two highest performers, the small island States Mauritius and Seychelles, which had subscription levels of 15.7 and 14.3 respectively), while only two other countries in the region – South Africa and Cape Verde – had rates above 2.0. With the exception of Europe, each region includes one or more countries with very low levels of fixed-broadband penetration.

Table 3.3: Fixed broadband subscriptions per 100 inhabitants, per region, 2015

	Weighted average	Highest performing country	Lowest performing country
Africa	0.5	15.8	0.0
Arab States	4.2	22.8	0.1
Asia & Pacific	8.9	40.2	0.0
CIS	14.8	31.4	0.1
Europe	29.2	47.5	7.6
The Americas	18.4	36.4	0.0

Source: ITU.

Most fixed-broadband subscriptions in developed countries now offer higher advertised speeds. All broadband subscriptions in the Republic of Korea are now reported to offer speeds of 10 Mbit/s and above. The number of broadband subscriptions at speeds at or above 10 Mbit/s in Europe[25] is 21.8 per hundred inhabitants, more than three-quarters of the total with fixed-broadband subscriptions in that region. Thirty-two countries in Europe and sixteen economies outside that region reported that more than half of their subscriptions have speeds at or above 10 Mbit/s, while only one country in Africa (Mauritius) reported more than 1 per cent of its subscriptions at that level.

Datasets for this indicator are relatively well established, with historic data for a substantial number of countries, and estimates for others, available back to 2008. While data on fixed-broadband subscriptions are available for the large majority of economies, more data on different broadband speeds are needed, especially for developing countries and LDCs. Greater standardization in reporting might also facilitate monitoring and analysis. In addition, as the capacities of broadband networks continue to increase during the SDG implementation period,

it will from time to time be necessary to include higher-speed categories within this indicator.

Indicator for Target 17.8: Proportion of individuals using the Internet

The second target within SDG 17 to which an ICT indicator is assigned is Target 17.8 which seeks to 'fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology.' No indicator has as yet been assigned for the first part of this target. The indicator which has been selected for the second part of the target, concerned with enhancing the use of enabling technology, in particular ICT, is the proportion of individuals using the Internet.

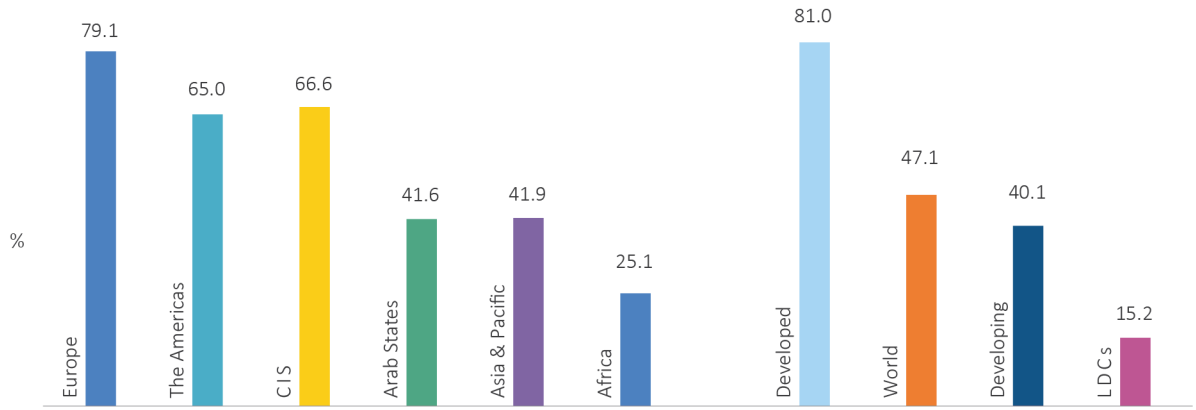
This target recognizes the Internet's substantial and growing importance in all aspects of sustainable development (economic, social and environmental), and in particular its importance as an enabler of development for individuals, communities and countries. The Internet provides extensive and growing access to information, services and applications which add value to people's lives, enhance their productivity and enable them to access new opportunities. Lack of Internet access and use can exacerbate existing disadvantage. Understanding gaps in access to and usage of ICTs between and within countries, and between women and men, different age categories and different social groups, should help governments and other stakeholders to target resources in order to encourage affordable and effective use of the Internet.

The proportion of individuals using the Internet is defined as the proportion who have used it from any location in the last three months. The Tier I indicator for this target is one of the Partnership on Measuring ICT for Development's Core List of Indicators, is based on an internationally-agreed methodology, and is included in the IDI, the latest results for which are discussed in Chapters 1 and 2. It was also used to support the measurement of Millennium Development Target 8.F, which was concerned with making available the benefits of new technologies, especially ICTs.

Data for this indicator are collected by ITU through an annual questionnaire sent out to NSOs. In most developed countries and a growing number of developing countries, NSOs obtain data for this indicator through national household surveys. Such data are available for 100 countries from at least one survey in the period 2011-2015. Where NSOs have not collected data, ITU uses a variety of techniques to estimate the percentage of individuals using the Internet, including hot-deck imputation, regression models and time series forecasting. Hot-deck imputation uses data from countries with "similar" characteristics, such as GNI per capita and geographic location.

Chart 3.7 illustrates the differences between regions and between developed countries, developing countries and LDCs for this indicator.

Chart 3.7: Proportion of individuals using the Internet, by region and by development status, 2016*



Note: *Estimate.
Source: ITU.

Chart 3.7 shows clearly that Internet usage rates, using the definition for the indicator, are about twice as high in developed countries as in developing countries, and more than twice as high in developing countries as a whole than they are in LDCs. Europe, the CIS and the Americas have much higher Internet usage rates overall than the African, Arab States and Asia/Pacific regions. In the case of developed countries, moreover, it is worth noting that higher bandwidth available to users, lower broadband access costs in relation to GNI p.c. (see Chapter 4) and generally higher levels of educational attainment make it likely that people in developed countries are more intensive users of the Internet than those in developing countries.

3.4 Summary and conclusion

The United Nations has adopted 17 SDGs, supported by 169 targets and 230 indicators, to guide international development policy and practice between 2015 and 2030. Six of the indicators directly concern ICTs, and their measurement will provide important evidence concerning progress towards implementation of the UN's *2030 Agenda for Sustainable Development*. While a substantial evidence base exists for several of those indicators, concerned with ICT infrastructure and adoption, the evidence base for others – particularly those concerned with ICTs in education, ICT skills and gender equity – is less substantial. ITU is working with the international statistical community and national statistical systems to improve the coverage and quality of the required data.

Chart 3.8: Fixed-broadband subscriptions per 100 inhabitants, by speed, 2015

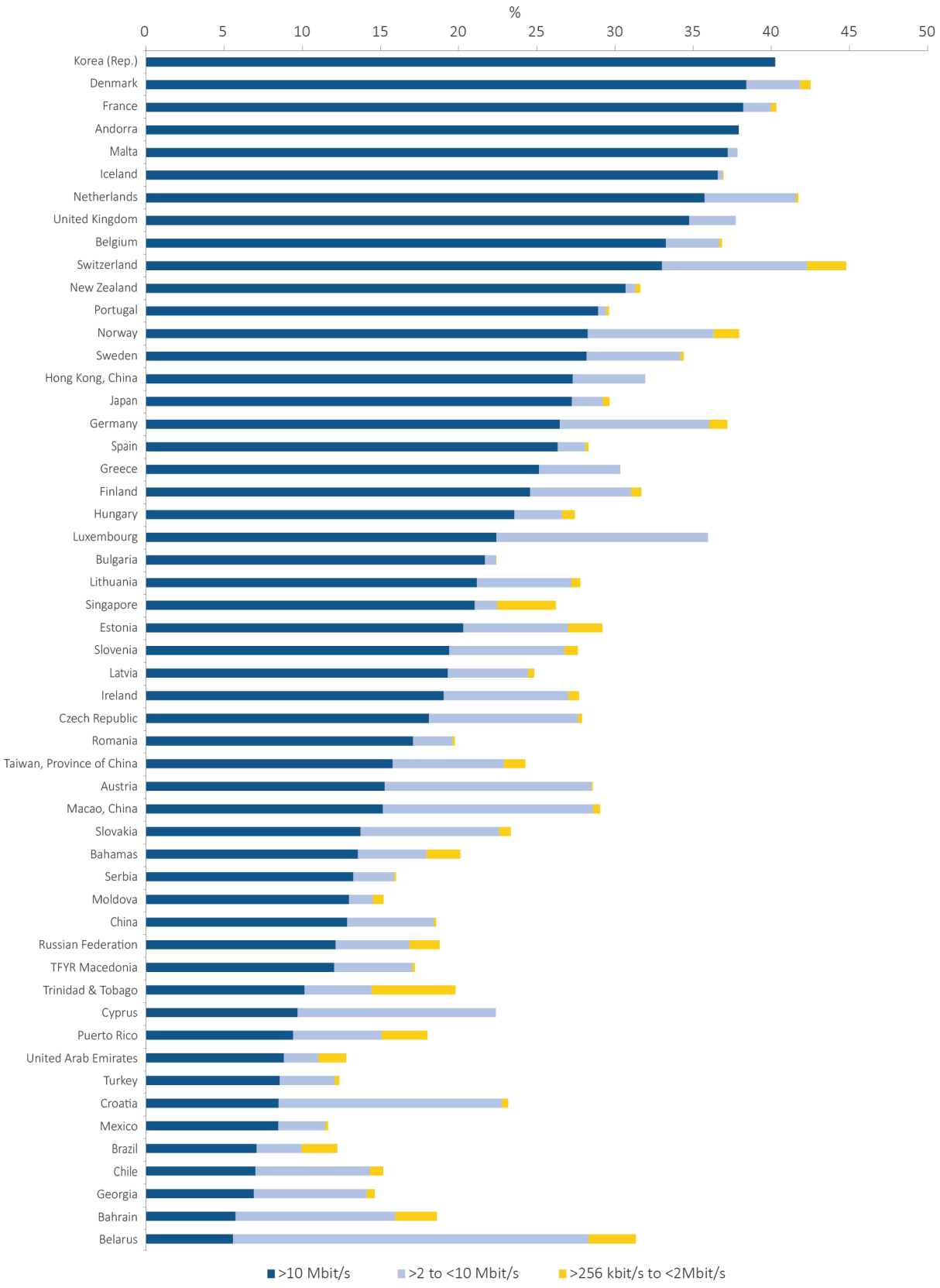
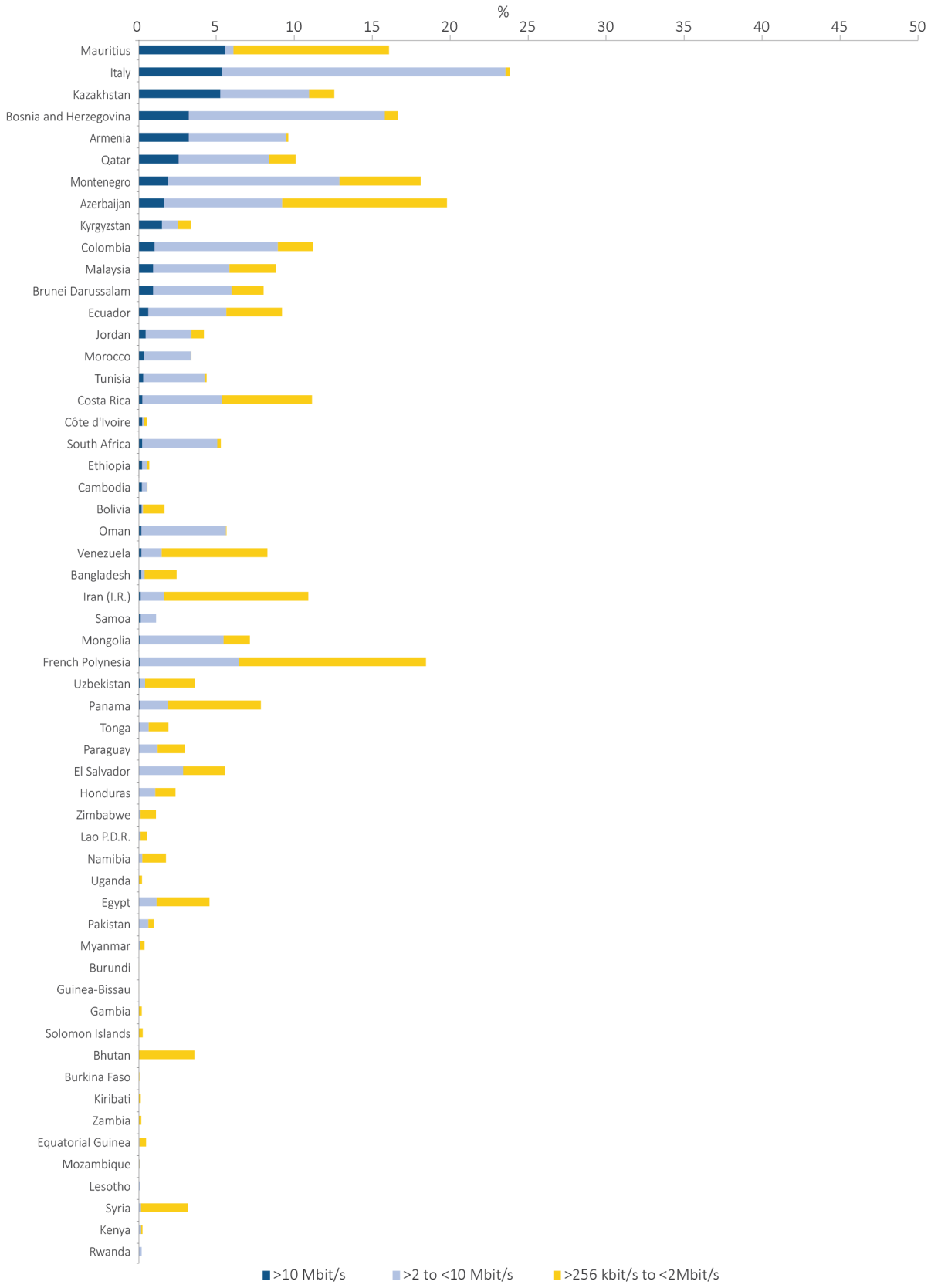


Chart 3.8: Fixed-broadband subscriptions per 100 inhabitants, by speed, 2015 (continued)



Source: ITU.

Endnotes

1 The *2030 Agenda* can be found at http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.

2 Experience to date is analysed in: UN Commission on Science and Technology for Development (2015), World Bank (2016); and Broadband Commission for Sustainable Development (2015).

3 See ITU (2016) and http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

4 Resolution A/RES/70/125, at http://workspace.unpan.org/sites/Internet/Documents/UNPAN96078.pdf.

5 The *2030 Agenda*, http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E, para. 15.

6 http://workspace.unpan.org/sites/Internet/Documents/UNPAN94615.pdf.

7 https://www.itu.int/net4/wsis/sdg/Content/wsis-sdg_matrix_document.pdf.

8 See, for example, UN Secretary-General's Expert Advisory Group on Data Revolution (2014).

9 Report of the Inter-Agency and Expert Group, *loc. cit.*

10 *ibid.*, paras 26-31.

11 http://unstats.un.org/sdgs/metadata/files/Metadata-04-0A-01.pdf.

12 Since the Target 4.4 includes several sub-indicators (some collected by UIS, and others by other agencies), this tier reference refers to the different sub-indicators. Both UIS indicators were classified as Tier I/II since data for both indicators are collected by UIS, based on an established methodology. While data exist for a large number of countries, UIS does not yet have a regular, global data collection and data exist for only one year for most countries.

13 *ibid.*

14 A collaboration between United Nations and other international agencies, established following WSIS: see http://www.itu.int/en/ITU-D/Statistics/Pages/Intlcoop/partnership/default.aspx.

15 In Europe, these relate to the adult population aged 16-74. Data for developing countries vary, in some cases referring to the whole population, in others to the adult population only or to a wider age range than European data. The fact that younger children are less likely to have acquired ICT skills than older children may exacerbate the difference between developed and developing countries. However, this may be offset by the higher proportion of the European population which falls into older age groups, which were educated before the prevalence of computers and the Internet.

16 http://workspace.unpan.org/sites/Internet/Documents/UNPAN96078.pdf, para. 27; http://www.itu.int/en/connect2020/Pages/default.aspx.

17 For example, Gillwald, A., Milek, A. & Stork, C. (2010) and GSMA (2015).

18 http://www.itu.int/en/ITU-D/Statistics/Documents/coreindicators/Core-List-of-Indicators_March2016.pdf. EGH has agreed that this indicator should also be included in the ITU data collection.

19 An active SIM card is one that has been used within the last three months.

20 http://unstats.un.org/sdgs/files/metadata-compilation/Metadata-Goal-5.pdf, p. 43.

21 For further discussion of the gender gap in mobile phone and Internet access and use, see GSM Association, *op. cit.*; A4AI (2015). See also https://www.weforum.org/agenda/2016/05/smartphones-are-closing-the-digital-divide-and-these-countries-have-made-the-most-progress?utm_content=bufferc5a03&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer.

22 See, for example, GSMA (2015); Gillwald, A., Milek, A. & Stork, C. (2010), Zainudeen, A. and Galpaya, H. (2015).

23 2015 data on the number of fixed-broadband subscriptions for 43 economies were estimated.

24 ITU does not estimate data for fixed-broadband subscriptions broken down by speed.

25 Disaggregated data are available for only 38 of the 42 European countries in the sample.

Chapter 4. ICT prices

Key findings

Many people continue to be excluded from the global information society, and the relatively high cost of ICT services remains one of the main barriers to ICT uptake. Monitoring prices is critical for developing policies that aim to make ICT services affordable for all citizens.

Mobile-cellular prices continued to fall in 2015, and more steeply than in previous years. For the first time, the average cost of the mobile-cellular basket (which includes 100 SMS and 30 mobile calls per month) in developing countries accounted for less than 5 per cent of GNI per capita. Least developed countries (LDCs) saw a 20 per cent drop in mobile-cellular prices, the strongest decrease in five years. The price drop is linked to the growing availability of prepaid packages that bundle SMS and local calls. Innovative pricing schemes, such as dynamic discounting, are also helping to make the service more affordable for low-income groups.

The Asia and the Pacific region has the lowest average PPP$ price for mobile-cellular services of all regions. It is home to the countries with the lowest mobile-cellular price baskets worldwide: Sri Lanka and Bangladesh, where prices stand out at PPP$ 2.45 and PPP$ 4.14 per month.

Fixed-broadband prices continued to drop significantly in 2015 but remained highest – and clearly unaffordable - in a number of LDCs. Globally, the price of a basic fixed-broadband connection fell from around USD 80 per month in 2008 to USD 25 in 2015, corresponding to a drop in the ratio of price to average GNI per capita from over 90 per cent to 14 per cent. In LDCs, a fixed-broadband plan with a minimum of 1GB of data per month still corresponds to over 60 per cent of GNI per capita. The service is sold at over USD 300 a month in Uganda, Chad and the Central African Republic, and remains very expensive and clearly unaffordable in some of the small island developing States.

People in most low-income countries get lower speeds and quality for their money. In developed countries, the minimum speeds of entry-level fixed-broadband packages have increased considerably in recent years. Developing countries, on the other hand, are only gradually upgrading broadband infrastructure to offer higher speeds. In 2015, not a single developed country offered an entry-level broadband connection with speeds below 1 Mbit/s, but a large majority of LDCs did. These differences in available speeds have an impact on the types of services and applications that users can access and benefit from.

Mobile-broadband is cheaper and more widely available than fixed-broadband, but is still not deployed in the majority of LDCs. Globally, handset-based mobile-broadband prices fell from an average of PPP$ 29 per month in 2013 to PPP$ 18 in 2015. Mobile-broadband services are offered in only 38 per cent of the LDCs; however, in those countries where the service is offered, handset-based prices more than halved in PPP terms between 2012 and 2015 and currently account for 11 per cent of GNI per capita. Still, mobile-broadband cannot always replace fixed-broadband Internet access, especially in the business sector, and a growing number of applications require higher speeds and better connection quality.

The decrease in mobile-broadband prices goes hand in hand with an increase in the intensity of use. Figures on mobile Internet traffic show that the amount of data consumed by each subscription is increasing in most countries for which data are available. This suggests that the reduction in mobile-broadband prices contributes not only to connecting more people but also to fostering more intense Internet usage among those who are already online.

Chapter 4: ICT prices

4.1 Introduction

Many people continue to be excluded from the global information society, and the relatively high cost of ICT services remains one of the key barriers to ICT uptake. Survey-based data that ITU collects from national statistical offices confirm that, next to the availability of access and the relevance of services, affordability is one of the key factors that continue to determine whether or not people will use ICTs. A number of recent studies on ICT developments also confirmed these findings.[1] Monitoring prices is therefore a critical step towards better policies to make ICT services more affordable.

The need to provide affordable access to ICTs has been clearly recognized by policy-makers at the national and international level. The World Bank's 2015 World Development Report states that collecting Internet price data and benchmarking is the first step towards better regulation for lower prices.[2]

Furthermore, making ICT services more affordable and increasing the number of ICT users will play a key role in the context of the 2030 Agenda for Sustainable Development. This new global development agenda, which was adopted by the United Nations in September 2015, recognizes the immense potential of ICTs to "*accelerate human progress*" and specifically refers to the need to "*significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet...*" (UNGA, 2015c).

The main objective of this chapter is to investigate the price and affordability of all key ICT services, benchmark countries and regions and highlight key trends over time.

Free, or low-cost, access – at what price?

A current debate – and controversy – among policy-makers has been driven by a number of initiatives that provide lower-priced or free access to service-specific data plans. These data service models, including zero-rating, refer to agreements between operators and content providers, including Facebook, Google and Wikipedia, which offer clients access to restricted content, at no or reduced cost.

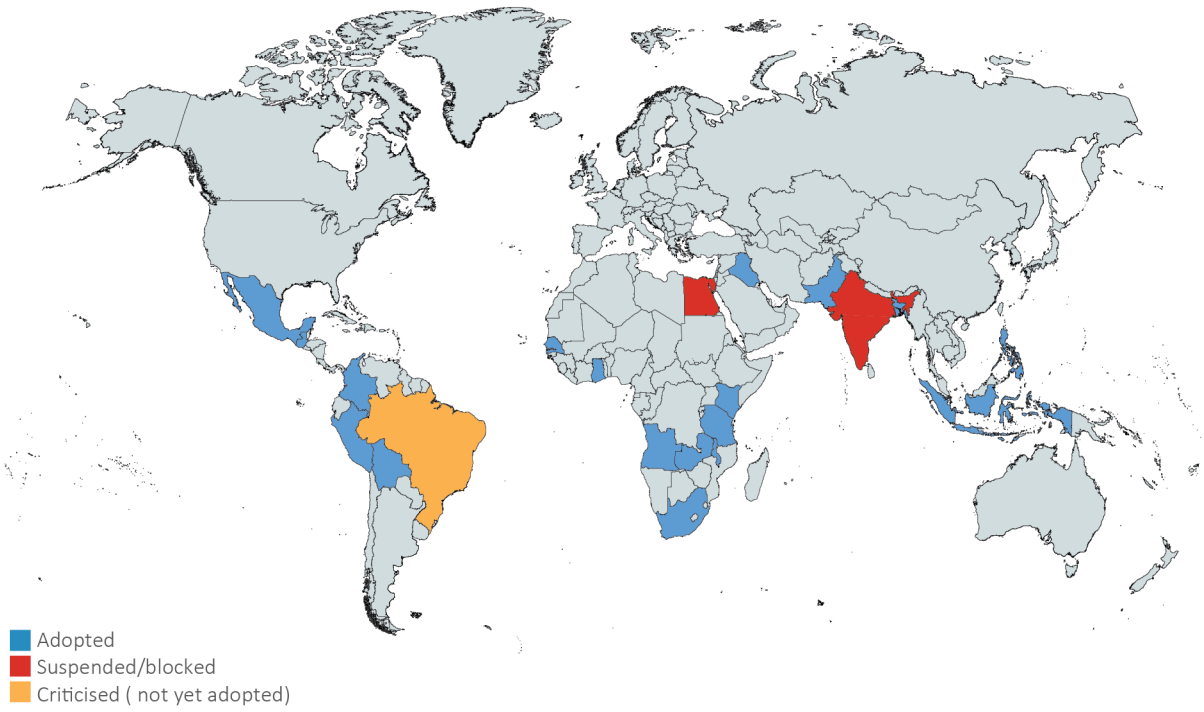
'Zero-rating' or 'price-differentiation' schemes have become a widely discussed topic, and supporters and opponents highlight both their benefits and their risks. What is the cost of allowing ICT users to have access not to the wider Internet but *only* to selected Internet content, which is determined by the provider? Opponents point to the threat to net-neutrality and consumer choice and evoke anti-competitive behaviour, while supporters emphasize the benefits of making services more affordable, or even free, and bringing more people in developing countries online. Advocates suggest that access to *some* information is better than none, and that greater demand for general Internet access can encourage investments in infrastructure,[3] whereas detractors lament the lack of empirical evidence on the risks but also on the effectiveness of zero-rated or otherwise free but restricted services, suggesting that it is still difficult at this stage to make informed policy decisions. In the meantime, zero-rating type services have been banned in several European countries, as well as in Chile, Japan and, more recently, India and Egypt, while free access to certain content or applications continues to be offered by service providers in many developing and developed countries.[4] As of June 2016, for instance, Facebook's Free Basics was available in some 40 countries worldwide (Figure 4.1).

Although much debate has focused on zero-rating offers, a recent study highlights that data-specific services may actually be the most popular way of providing cheaper, but restricted Internet access (Box 4.1).

Electricity and device costs

The affordability of services is important, but the cost of electricity for charging a device and the one-time purchase price of the device, in particular a mobile phone, are equally important

Figure 4.1: Facebook's Free Basics around the world, as of June 2016



Source: https://info.internet.org/en/story/where-weve-launched/

and can constitute important barriers (Facebook, 2015). With the growth in mobile-broadband services and applications, smartphones provide an excellent opportunity to access voice and data services, including in many rural and remote areas. As smartphones become more affordable, consumer demand increases, and by September 2014 more smartphones than traditional mobile handsets were sold in developing countries.[6] While smartphones are becoming smarter, more widely available and more affordable, they remain expensive for many of the world's poorest population groups (Box 4.2).

About this chapter

This chapter will look first at the evolution of mobile-cellular prices over the period 2008-2015, in absolute and relative terms, in USD, in international dollars (PPP$) and as a percentage of GNI p.c., for both developed and developing countries. It will include the presentation of the 2015 mobile-cellular sub-baskets and country rankings, and show some regional differences in the affordability of mobile-cellular prices. Recent price and pricing trends will be examined, highlighting changes in prepaid offers and bundled services, which have an impact on the affordability of services.

This will be followed by a more in-depth analysis of prices in the fixed-broadband and mobile-broadband markets. Country rankings will be presented for the fixed-broadband and mobile-broadband sub-baskets, with the latter including both prepaid and postpaid packages and computer-based and handset-based plans. The analysis of fixed-broadband prices will include 2008-2015 price trends and a discussion on changes in broadband speeds (offered for minimum broadband plans) as well as developments in terms of the data volume included in broadband offers. A regional analysis will be provided for both fixed- and mobile-broadband services.

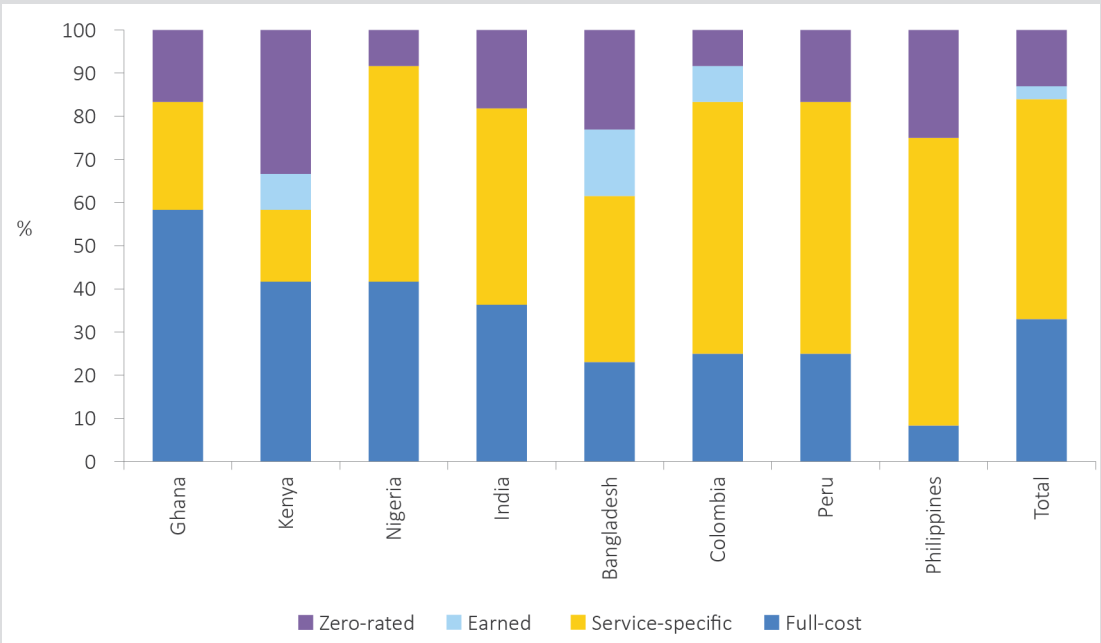
This chapter will also look at the growing trend of offering bundled telecommunication services and highlight some efforts to monitor the price of bundles, in particular in OECD countries.

Box 4.1: Zero-rating and price-differentiation schemes

There are different ways of providing free or discounted access to restricted and selected services and applications, both over fixed as well as mobile networks. So called 'zero-rating' refers to services that make certain content or applications available at no, or no additional, cost to the customer, and data volumes used to access the specified site or application do not contribute towards the customer's data usage. A user of a service provider offering Wikipedia Zero, for example, has unlimited, no-cost access to everything in the online encyclopaedia. Facebook's Free Basics provides clients of certain mobile-network providers free access to a limited number of websites and applications.

A November 2015 comparison of available data plans in eight developing countries (Kenya, Nigeria, Ghana, Bangladesh, Philippines, India,[5] Colombia and Peru) showed that zero-rated plans were offered in all of them, but not by all carriers. While the three largest carriers in Kenya offered at least one zero-rated service, zero-rating was only proposed by one operator in Nigeria. The most common plan generally offered was the service-specific data plan. Service-specific plans offer data bundles at discounted rates that give users access only to specific applications and sites, over a given web browser, and/or for a specified period of time. They are often part of operators' marketing strategies to increase their customer base by providing discounted access to popular sites and applications. In Bangladesh, Kenya and Colombia, customers can also 'earn' extra data, for example by watching a certain video, or by buying a specific device. Overall, however, these earned data plans are not very frequent. Finally, full-cost plans are offered in all the countries studied, although they are not always the most common offering. While in Ghana seven out of 12 plans were offered at full cost, only one out of a total of 12 plans in the Philippines was a regular, full-cost plan (Chart Box 4.1).

Chart Box 4.1: Percentage of data plans, by type of plan, by country

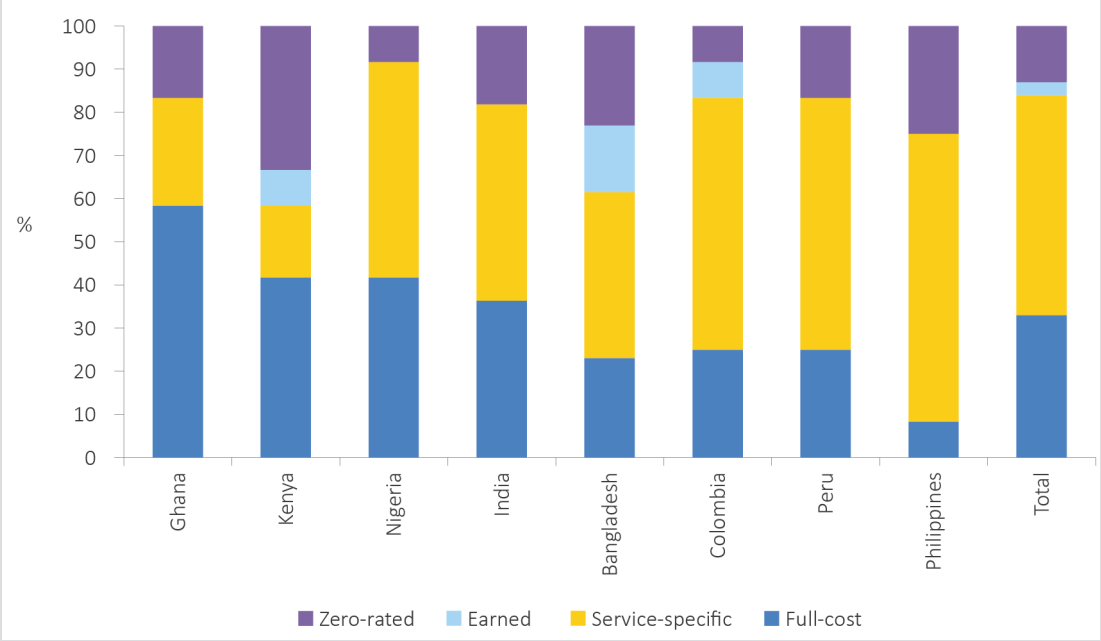


Note: Based on a simple count of all plans offered by the top carriers in each of the selected countries. A total of 12 plans were included in the comparison for all the countries except Bangladesh, where 13 plans were included.
Source: ITU, adapted from A4AI (2015b).

Box 4.2: Smarter and cheaper: Global smartphone prices continue to drop but remain high for low-income population groups

While smartphones are becoming 'smarter', with increasing functionalities and processing power, prices are going down. As highlighted by IDC, the average smartphone price (ASP) continues to drop, falling to below USD 300 by end 2015. Relatively higher prices in developed regions reflect the use of more sophisticated and expensive phones (Chart Box 4.2). Lower prices in developing regions are also the result of handset manufacturers' efforts to offer increasingly affordable entry-level smartphones for low-income users. Many budget (but smart) phones are on sale for less than USD 200, and producers in India and China are promising even lower prices. Even at these prices, however, many people in the world will not be able to own a smartphone.

Chart Box 4.2: Average selling price of smartphones, 2015



Note: The average selling price for smartphone handsets is calculated by region as the total spent on smartphones divided by the total number of units sold.
Source: ISOC (2015) based on data from IDC.

Prices in this chapter are expressed in three complementary units:

- In USD, using the IMF annual rates of exchange.
- In international dollars (PPP$), using purchasing power parity (PPP) conversion factors instead of market exchange rates. The use of PPP exchange factors helps to screen out price and exchange-rate distortions, thus providing a measure of the cost of a given service taking into account the purchasing power equivalences between countries.[7]
- As a percentage of countries' monthly GNI p.c. (Atlas method).[8] Prices are expressed as a percentage of GNI p.c. in order to show them relative to the size of the economy of each country, thus pointing to the affordability of each ICT service at country level.

The prices collected for each service correspond to the cheapest plan offered by the dominant operator that fulfils the usage requirements of each basket. The methodological details of the IPB and the collection of mobile-broadband prices can be found in Annex 2.

4.2 Mobile-cellular prices

Mobile-cellular prices continued to decrease in 2015

Mobile-cellular prices continued to decrease in 2015, and the price drop was stronger than in previous years: 6 per cent in purchasing power parity (PPP) terms, twice as much as in 2014 (Chart 4.1). In USD the decrease was even bigger, in part due to the exchange-rate fluctuations with countries in the Euro area. By end 2015, a mobile-cellular basket cost approximately the same on average in developed, developing and least-developed (LDCs) countries: the equivalent of around PPP$ 21 per month.

The decrease in prices led to an improvement in the affordability of mobile-cellular services and, for the first time, the average cost of the mobile-cellular basket in developing countries corresponded to less than 5 per cent of GNI per capita.[9] Although LDCs are still far from achieving this milestone, prices in terms of GNI p.c. fell by 20 per cent in LDCs in 2015, the strongest decrease in the last five years. The historical trend highlights the progress achieved in LDCs: the average cost of 100 SMS and 30 mobile calls per month has fallen at a steady rate of USD 1 per year (except in 2013), from USD 15.8 in 2008 to USD 9.1 in 2015. In parallel, GNI p.c. has increased by more than 40 per cent in LDCs during the same period. Combined, these developments have made mobile-cellular services much more affordable than before in LDCs, at an average price corresponding to 11 per cent of GNI p.c. in 2015.

The list of the top ten countries with the most affordable mobile-cellular services includes high-income economies such as Macao (China), Austria, Singapore, Hong Kong (China) and the United Arab Emirates, but also countries with much lower income levels, such as Estonia and Lithuania (Table 4.1). All these economies have in common very high mobile-cellular penetrations (more than 135 subscriptions per 100 inhabitants).

Overall, mobile-cellular services are quite affordable in a majority of countries: the cost of the service represents less than 1 per cent of GNI p.c. in 61 countries. Nevertheless, there are 47 countries where the price still corresponds to more than 5 per cent of GNI p.c., most of them LDCs and/or low-income African countries. The examples of Bhutan, Bangladesh and Myanmar – all of them with prices representing less than 2 per cent of GNI p.c. – show that affordable mobile-cellular services are also achievable in low-income LDCs.

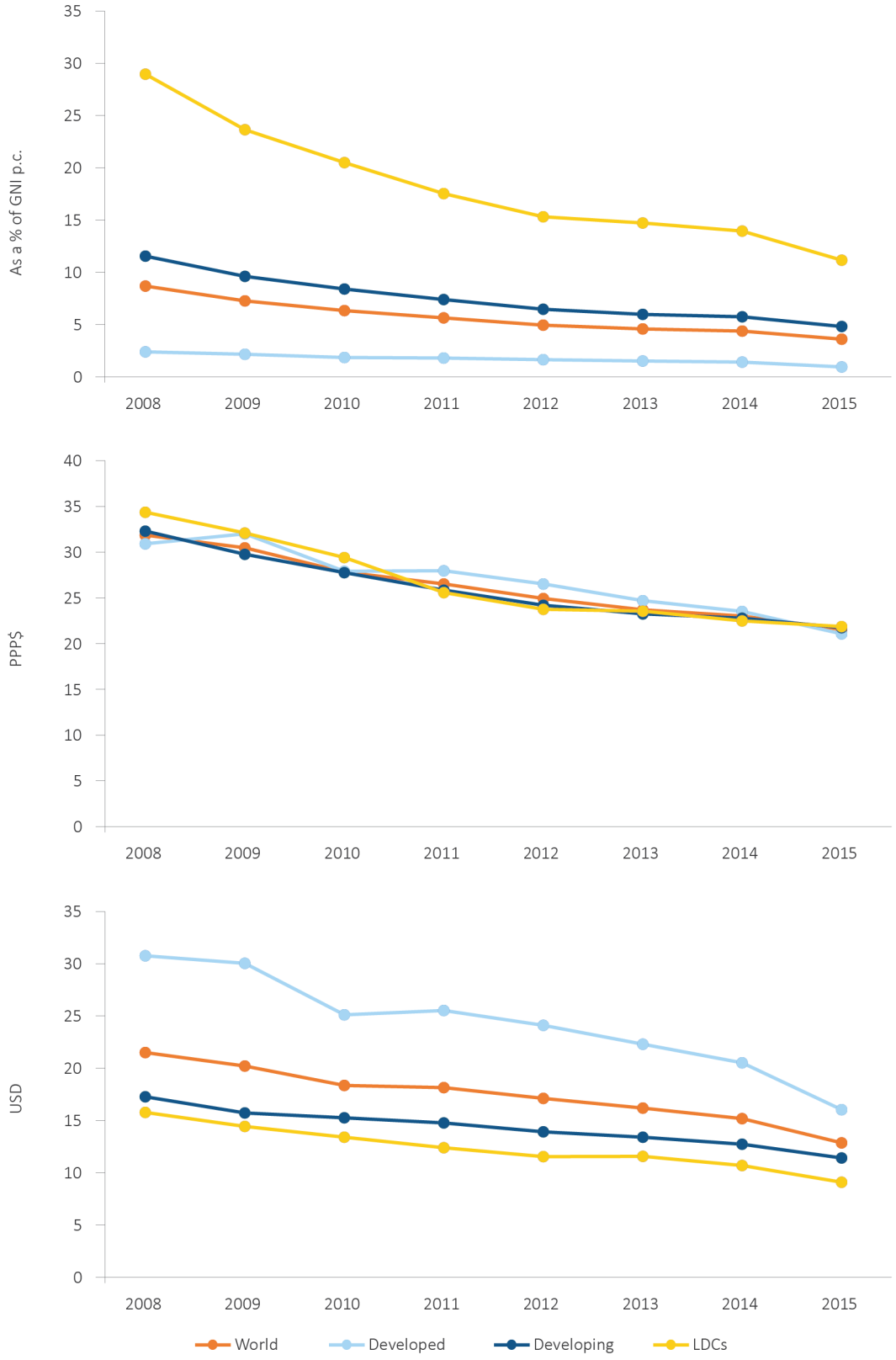
Prepaid packages are driving prices down

Although mobile-cellular subscription growth has slowed in most countries,[10] there is still a significant proportion of the global population that do not use and/or own a mobile phone (see Chapter 5). To reach these people as well as to retain current customers, competition is increasing and thus exerting downward pressure on prices. This is even more true in countries where mobile number portability has been effectively implemented (Chart 4.2). One strategy that mobile operators are employing to retain prepaid customers without cannibalizing their revenue flows is that of offering lower priced value-for-money packages of bundled services.

Indeed, the drop in mobile-cellular prices in 2015 is linked to the increasing availability of prepaid packages that include bundles of SMS and local calls. When purchasing a package, the customer obtains a discount in the price per unit and, in exchange, has to pay upfront the cost of the consumption included in the package.

To monitor mobile-cellular prices, ITU uses the **mobile-cellular sub-basket**, which refers to the price of a standard basket of 30 outgoing calls per month (on-net/off-net to a fixed line and for peak and off-peak times, in predetermined ratios), plus 100 SMS messages. It is calculated as a percentage of a country's average monthly GNI per capita, and also presented in USD and PPP$. The mobile-cellular sub-basket is based on prepaid prices, although postpaid prices are used for countries where prepaid subscriptions make up less than 2 per cent of all mobile-cellular subscriptions.

Chart 4.1: Mobile-cellular sub-basket, as a percentage of GNI p.c. (top), in PPP$ (middle) and in USD (bottom), 2008-2015



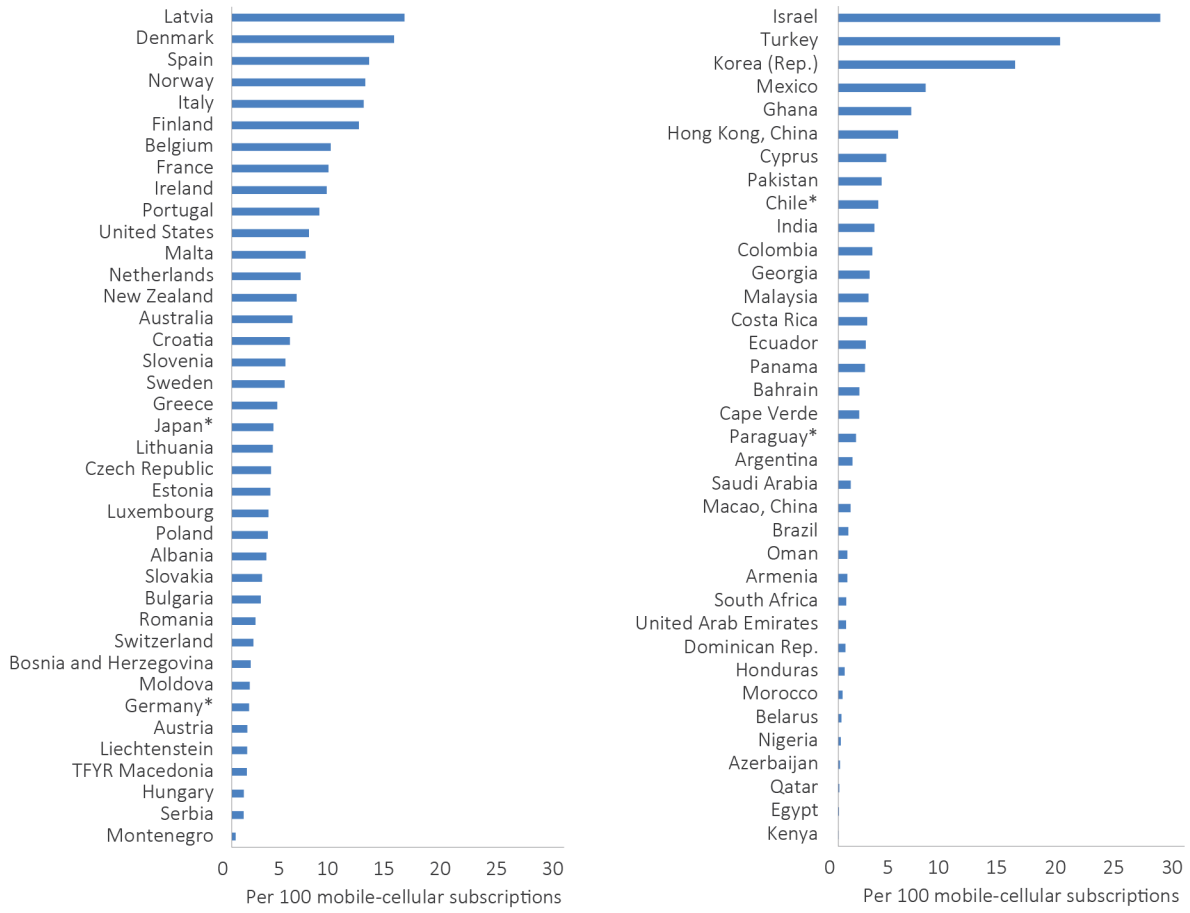
Note: Simple averages. Based on 140 economies for which data on mobile-cellular prices were available for 2008-2015.
Source: ITU.

Table 4.1: Mobile-cellular sub-basket, 2015

Rank	Economy	Mobile-cellular sub-basket			Tax rate included (%)	GNI p.c., USD*
		as% of GNI p.c.	USD	PPP$		
1	Macao, China	0.09	5.68	7.36	0.0	76,270
2	Austria	0.16	6.69	6.97	20.0	49,670
3	Singapore	0.17	7.96	9.10	7.0	55,150
4	Hong Kong, China	0.18	6.02	7.52	0.0	40,320
5	United Arab Emirates	0.18	6.70	9.15	0.0	44,600
6	Norway	0.21	18.11	14.57	25.0	103,630
7	Estonia	0.21	3.33	4.67	20.0	19,030
8	Sweden	0.23	11.74	10.78	25.0	61,610
9	Qatar	0.24	18.68	25.02	0.0	92,200
10	Lithuania	0.25	3.22	5.59	21.0	15,430
11	Finland	0.27	11.05	9.98	24.0	48,420
12	Australia	0.27	14.75	12.65	10.0	64,540
13	Germany	0.28	11.08	12.15	19.0	47,640
14	Brunei Darussalam	0.29	9.04	15.24	0.0	37,663
15	Sri Lanka	0.30	0.86	2.45	27.5	3,460
16	Iran (I.R.)	0.31	1.85	5.43	9.0	7,113
17	Cyprus	0.31	6.88	8.56	19.0	26,370
18	Russian Federation	0.34	3.69	13.46	18.0	13,220
19	Kuwait	0.35	14.19	22.83	0.0	49,300
20	Latvia	0.35	4.43	6.84	21.0	15,280
21	Luxembourg	0.36	22.81	21.15	17.0	75,990
22	New Zealand	0.39	13.25	12.17	15.0	41,070
23	Slovenia	0.39	7.71	10.40	22.0	23,580
24	Greece	0.41	7.76	10.03	37.8	22,657
25	United Kingdom	0.42	15.28	12.60	20.0	43,430
26	Costa Rica	0.46	3.87	5.51	13.0	10,120
27	Switzerland	0.47	34.29	21.77	8.0	88,032
28	Iceland	0.56	21.57	19.43	24.0	46,304
29	Malaysia	0.56	5.21	12.62	6.0	11,120
30	Canada	0.58	25.07	24.57	13.0	51,630
31	Kazakhstan	0.60	5.96	14.02	12.0	11,850
32	Oman	0.62	8.74	16.80	0.0	16,853
33	Mauritius	0.63	5.05	9.18	15.0	9,630
34	Bahrain	0.63	11.12	18.74	0.0	21,039
35	Italy	0.64	18.30	19.99	22.0	34,270
36	Netherlands	0.65	28.02	28.19	21.0	51,890
37	China	0.65	4.01	6.63	0.0	7,400
38	Poland	0.67	7.63	15.19	23.0	13,690
39	Saudi Arabia	0.68	14.13	28.56	0.0	25,115
40	Denmark	0.69	35.22	28.45	25.0	61,310
41	Belarus	0.70	4.28	-	20.0	7,340
42	Belgium	0.72	28.54	29.10	21.0	47,260
43	Turkmenistan	0.73	4.89	-	15.0	8,020
44	United States	0.78	35.73	35.73	8.9	55,200
45	Korea (Rep.)	0.80	17.98	22.20	10.0	27,090
46	Portugal	0.80	14.22	19.51	23.0	21,360
47	Mongolia	0.82	2.92	7.26	10.0	4,280
48	Andorra	0.83	30.99	-	-	45,033
49	Romania	0.84	6.65	13.64	24.0	9,520
50	Japan	0.84	29.44	31.23	8.0	42,000
51	Ireland	0.86	33.27	30.70	23.0	46,550
52	Czech Republic	0.87	13.34	22.93	21.0	18,370
53	Croatia	0.90	9.74	16.23	25.0	12,980
54	Slovakia	0.91	13.42	21.77	20.0	17,750
55	Namibia	0.92	4.33	9.54	15.0	5,630
56	Thailand	0.94	4.51	11.81	7.0	5,780
57	France	0.94	33.66	34.77	20.0	42,960
58	Tunisia	0.95	3.35	8.52	23.0	4,230
59	Libya	0.98	6.36	-	0.0	7,820
60	Mexico	0.98	8.10	13.90	19.0	9,870
61	Trinidad & Tobago	0.98	16.47	19.69	15.0	20,070
62	Ukraine	1.00	2.96	18.27	20.0	3,560
63	Bahamas	1.00	17.48	15.39	-	20,980
64	Israel	1.11	32.53	29.25	17.0	35,320
65	Malta	1.12	19.65	26.52	18.0	20,979
66	Seychelles	1.13	13.24	20.77	15.0	14,100
67	Maldives	1.14	6.08	7.86	6.0	6,410
68	Jordan	1.15	4.96	10.21	40.0	5,160
69	Venezuela	1.21	12.67	10.41	12.0	12,615
70	Brazil	1.24	11.94	21.19	40.2	11,530
71	South Africa	1.25	7.07	15.81	14.0	6,800
72	Uruguay	1.25	17.04	23.36	22.0	16,350
73	Azerbaijan	1.27	8.03	-	18.0	7,590
74	Spain	1.29	31.60	37.95	21.0	29,440
75	Bhutan	1.30	2.57	7.96	5.0	2,370
76	Paraguay	1.34	4.93	10.45	10.0	4,400
77	Panama	1.36	12.64	21.30	7.0	11,130
78	Georgia	1.44	4.47	12.49	27.1	3,720
79	Botswana	1.45	8.77	17.71	12.0	7,240
80	St. Kitts and Nevis	1.52	18.96	23.50	-	14,920
81	Montenegro	1.59	9.70	18.96	19.0	7,320
82	Chile	1.61	20.03	32.15	19.0	14,910
83	Bangladesh	1.70	1.53	4.14	15.0	1,080
84	Albania	1.71	6.35	14.08	20.0	4,450
85	Myanmar	1.76	1.87	7.33	0.0	1,270
86	Pakistan	1.79	2.09	7.04	33.5	1,400
87	Indonesia	1.80	5.45	15.88	10.0	3,630
88	Iraq	1.86	10.05	19.49	0.0	6,500
89	Lebanon	1.88	15.73	-	10.0	10,030
90	Egypt	1.90	4.83	16.78	15.0	3,050
91	Hungary	1.93	21.48	42.06	27.0	13,340
92	Jamaica	1.99	8.54	13.10	16.5	5,150
93	Colombia	2.01	13.33	29.68	20.0	7,970
94	Turkey	2.01	18.15	34.46	43.0	10,830
95	Suriname	2.05	17.00	29.31	8.0	9,950
96	Gabon	2.06	16.66	26.74	-	9,720
97	Peru	2.07	10.97	21.30	18.0	6,360
98	Armenia	2.10	7.05	17.26	20.0	4,020
99	India	2.11	2.76	9.65	14.4	1,570
100	Antigua & Barbuda	2.11	23.40	28.62	15.0	13,300
101	Nigeria	2.12	5.25	10.17	5.0	2,970
102	Ghana	2.16	2.87	10.38	23.5	1,590
103	Barbados	2.18	28.11	22.62	-	15,451
104	Algeria	2.24	10.23	29.48	17.0	5,490
105	Sudan	2.25	3.21	5.96	31.3	1,710
106	Equatorial Guinea	2.43	20.72	-	-	10,210
107	TFYR Macedonia	2.47	10.59	25.29	18.0	5,150
108	Uzbekistan	2.60	4.52	-	20.0	2,090
109	Argentina	2.74	30.81	-	21.0	13,480
110	Dominican Rep.	2.79	14.02	28.62	30.0	6,040
111	Viet Nam	2.81	4.42	10.92	10.0	1,890
112	Serbia	2.94	14.27	30.96	20.0	5,820
113	Kyrgyzstan	3.08	3.21	10.56	17.0	1,250
114	Bosnia and Herzegovina	3.18	12.63	26.71	17.0	4,760
115	Moldova	3.23	6.89	21.51	16.7	2,560
116	Tonga	3.29	11.66	15.10	15.0	4,260
117	Kenya	3.36	3.62	7.96	26.0	1,290
118	Angola	3.37	15.39	20.47	5.0	5,476
119	Ecuador	3.38	17.17	29.53	12.0	6,090
120	Bulgaria	3.42	21.73	50.01	20.0	7,620
121	Philippines	3.42	9.99	22.90	12.0	3,500
122	Congo (Rep.)	3.61	8.19	15.61	16.0	2,720
123	Dominica	3.66	21.13	28.42	15.0	6,930
124	Grenada	3.97	26.17	35.06	15.0	7,910
125	Nepal	3.98	2.42	7.85	24.3	730
126	Morocco	4.00	10.24	24.22	20.0	3,070
127	Guyana	4.01	13.15	-	16.0	3,936
128	Swaziland	4.08	12.06	32.89	14.0	3,550
129	Fiji	4.18	16.97	28.56	15.0	4,870
130	El Salvador	4.22	13.80	26.39	13.0	3,920
131	Cuba	4.31	21.53	-	-	5,999
132	Bolivia	4.48	10.73	22.95	13.0	2,870
133	St. Lucia	4.54	27.46	33.33	15.0	7,260
134	St. Vincent and the Grenadines	4.68	25.77	34.66	15.0	6,610
135	Tajikistan	4.75	4.27	-	-	1,080
136	Samoa	4.89	16.55	22.95	15.0	4,060
137	Lao P.D.R.	4.94	6.84	17.41	10.0	1,660
138	Palestine	5.69	14.51	22.12	16.0	3,060
139	Zambia	5.70	7.97	23.52	16.0	1,680
140	Marshall Islands	6.07	22.22	-	0.0	4,390
141	Ethiopia	6.74	3.09	8.70	15.0	550
142	Honduras	7.43	14.05	27.40	15.0	2,270
143	Yemen	7.76	8.39	-	5.0	1,299
144	Lesotho	7.85	8.70	25.79	5.0	1,330
145	Tuvalu	8.00	38.11	-	7.0	5,720
146	Cambodia	8.02	6.82	17.37	10.0	1,020
147	Cape Verde	8.30	23.87	50.57	15.5	3,450
148	Vanuatu	8.32	21.91	20.81	12.5	3,160
149	S. Tomé & Principe	8.37	11.65	20.76	5.0	1,670
150	Kiribati	8.47	20.83	-	-	2,950
151	Belize	8.62	31.23	54.02	12.5	4,346
152	South Sudan	8.66	7.00	-	13.0	970
153	Tanzania	8.68	6.65	17.93	32.5	920
154	Cameroon	9.18	10.32	26.07	19.3	1,350
155	Afghanistan	9.58	5.43	16.04	0.0	680
156	Guatemala	9.58	27.37	50.84	12.0	3,430
157	Micronesia	9.68	25.82	-	0.0	3,200
158	Rwanda	10.04	5.85	15.48	18.0	700
159	Solomon Islands	10.26	15.64	15.56	10.0	1,830
160	Uganda	10.93	6.10	17.53	30.0	670
161	Benin	11.40	8.46	21.95	18.0	890
162	Côte d'Ivoire	11.71	14.15	35.81	18.0	1,450
163	Papua New Guinea	12.04	22.47	26.53	10.0	2,240
164	Gambia	12.25	5.10	20.17	22.3	500
165	Comoros	13.56	8.93	-	0.0	790
166	Haiti	13.61	9.30	20.37	10.0	820
167	Guinea	13.87	5.43	11.76	18.0	470
168	Mauritania	14.21	15.04	39.43	18.0	1,270
169	Senegal	15.82	13.84	34.65	23.0	1,050
170	Mozambique	16.20	8.10	19.99	17.0	600
171	Burkina Faso	16.71	9.75	26.23	18.0	700
172	Nicaragua	17.31	26.98	69.38	15.0	1,870
173	Zimbabwe	18.39	12.87	-	20.0	840
174	Chad	19.29	15.75	33.61	18.0	980
175	Sierra Leone	20.59	12.01	31.05	15.0	700
176	Mali	22.85	12.38	32.85	18.0	650
177	Guinea-Bissau	26.91	12.33	30.38	15.0	550
178	Niger	27.75	9.48	25.31	-	410
179	Togo	28.07	13.33	34.16	18.0	570
180	Burundi	35.56	8.00	20.38	18.0	270
181	Madagascar	41.49	15.21	55.80	20.0	440
182	Central African Rep.	43.13	11.50	-	19.0	320
183	Liberia	45.66	14.08	20.68	14.0	370
184	Malawi	52.55	10.95	37.46	26.5	250
	Somalia**	-	2.91	-	10.0	-
	Congo (Dem. Rep.)**	-	9.77	-	13.0	-
	Djibouti**	-	11.26	18.99	7.0	-
	Timor-Leste**	-	14.04	-	-	-
	Nauru**	-	19.25	-	-	-
	San Marino**	-	24.07	27.96	0.0	-
	Liechtenstein**	-	30.13	-	8.0	-
	Monaco**	-	40.03	-	20.0	-
	Syria**	-	95.32	-	-	-

Note: * Data correspond to the GNI per capita (Atlas method) in 2014 or latest available year adjusted with international inflation rates.** Country not ranked because data on GNI p.c. are not available.
Source: ITU. GNI p.c. and PPP$ values are based on World Bank data.

Chart 4.2: Mobile numbers ported, developed (left) and developing (right) countries, 2014



Note: * 2013 data.
Source: ITU.

For instance, in Namibia, MTC offers a weekly prepaid package including 50 minutes, 150 SMS and 50 MB for USD 1.1, while the cost of consuming the same amount of voice and SMS on a pay-per-use basis would be USD 6.6.

Operators may also offer free minutes and SMS in exchange for large prepaid refills, which in practice has the same effect on prices as a prepaid package. For example, in Sweden, Telia offers 100 minutes, 500 SMS and 0.5 GB to be used within 30 days with each prepaid top-up of USD 11.7, which is much cheaper than the cost of consuming the same minutes and SMS on a pay-per-use basis (USD 49.1).

A third variant is the hybrid prepaid plans offered by some operators that include a package of minutes and SMS as well as preferential pay-per-use rates for any extra consumption. For instance, the incumbent operator in Venezuela, Movilnet, offers the "Optimo" prepaid plan, which requires a monthly payment of USD 8.5 and includes 300 SMS and 50 on-net minutes; extra calls are charged at USD 0.31 per minute, whereas the basic pay-per-use tariff costs USD 0.51 per minute.

Operators are increasingly offering these new prepaid plan arrangements with the dual objective of fostering customer loyalty and ensuring more stable revenue streams from their prepaid customer base. As a result, prepaid subscriptions are acquiring some of the features of postpaid subscriptions, such as the requirement of a minimum expenditure per month. However, some of the fundamental characteristics of prepaid subscriptions that make them attractive to lower-income groups are retained: prepaid packages do not require a commitment period and the customer can opt out without a penalty.

Prepaid packages with a significantly lower cost than pay-per-use plans are driving down prices in developed countries such as Albania, Bulgaria, Croatia, Greece, Italy, Latvia, New Zealand, Romania, the Russian Federation, Slovenia and

Sweden. In several cases, voice and SMS are packaged with data services (e.g. Mobitel's prepaid packages in Bulgaria and Vodafone's prepaid packages in New Zealand). In a few countries, prepaid packages offer unlimited local SMS (e.g. Rogers Talk & Text packages in Canada) and voice calls (e.g. Tele 2 in Latvia). These examples confirm the trend towards the commoditization of voice and SMS, and suggest that data is becoming the main element in determining mobile prices in developed countries.

In the developing world, the situation is slightly different because prepaid packages tend to have shorter validity periods[11] and they are seldom the cheapest option for a continuous monthly usage. There are, however, some exceptions, such as Brazil, where operator Vivo offers the Smart Vivo Controle plans starting at USD 10.5 per month and including packages of on-net voice and SMS, as well as data. In Morocco, the incumbent operator Maroc Telecom offers the "Jawal Pass" including a large bundle of voice minutes, SMS and data for USD 10.2 per month. These examples suggest that, if operators in most developing countries were to offer prepaid monthly bundles, prices could be further reduced, particularly for those customers with a continuous monthly usage of mobile-cellular services.

Indeed, traffic data show that the average voice usage per subscription is above 60 minutes per month in most countries, including in the developing world (Table 4.2). Moreover, mobile voice traffic is increasing in most economies.[12] Although the number of SMS sent per subscription is decreasing globally,[13] in many countries the average is still above 20 SMS per month (Table 4.2). These figures suggest that prepaid customers in many developed and developing countries could benefit from lower mobile-cellular prices by subscribing to prepaid packages tailored to their monthly consumption. Taking into account that the availability and uptake of mobile bundled packages in developing countries is not as widespread as in developed countries, there is an opportunity for further mobile-cellular price reductions in the developing world.

Regional analysis of mobile-cellular prices

A regional analysis of mobile-cellular prices reveals some differences across and within regions (Chart 4.3):

Africa:

Mobile-cellular prices range from USD 3 to USD 25 per month in African countries, and the average price in the region (USD 10 per month) is similar to that in Asia and the Pacific.

In PPP (and in GNI p. c.) terms, the range is wider and the average (PPP$ 24 per month) is the second highest of all regions, below only that of the Americas, reflecting the lower incomes in the region. Kenya and Ethiopia stand out as the countries with the lowest mobile-cellular prices in PPP terms in the region (Table 4.3). These countries have very different market conditions: Kenya is a vibrant mobile market with three operators (the incumbent and two transnational operators) and 81 per cent mobile-cellular penetration; Ethiopia is an LDC at the early stages of mobile-cellular development (43 per cent penetration) and the incumbent operator, Ethio Telecom, retains the monopoly in the mobile market. The other two African countries with mobile-cellular prices below PPP$ 10 are Namibia and Mauritius.

An analysis of prices relative to GNI p.c. levels shows that in more than two thirds of African countries the cost of the mobile-cellular basket represents more than 5 per cent of GNI p.c., and the service thus remains unaffordable for large segments of the population. This is particularly the case in African LDCs, in all of which the mobile-cellular basket corresponds to more than 5 per cent of GNI p.c., except oil-rich Angola and Equatorial Guinea.

Arab States:

Mobile-cellular services cost between USD 3 and USD 20 per month in all Arab States except Syria, where prices are significantly higher.[14] Excluding Syria, the regional average (USD 10 per month) is comparable to that of other developing regions such as Africa and Asia and the Pacific.

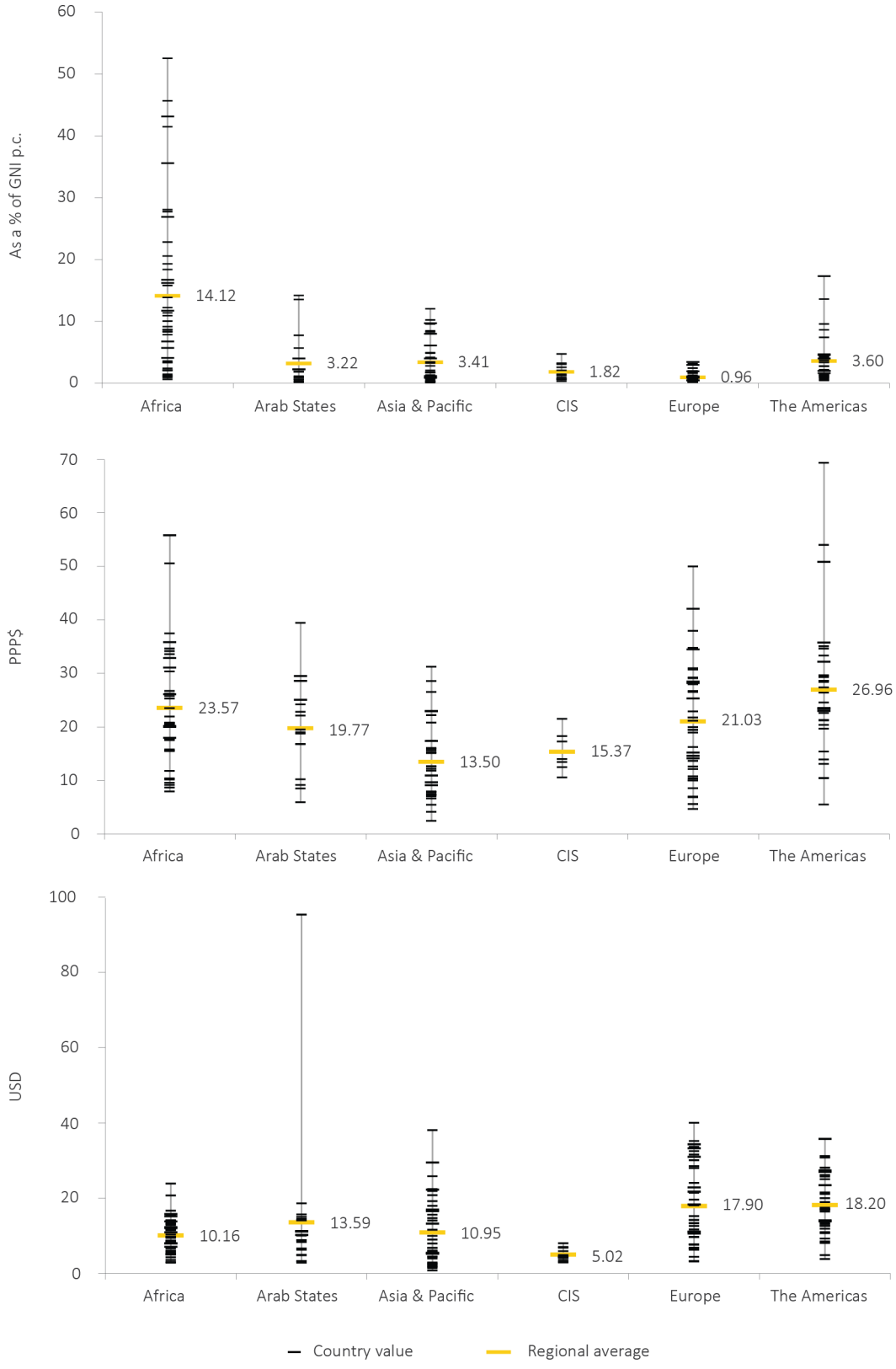
Table 4.2: Domestic mobile minutes (left) and SMS (right), selected economies, 2014 and 2013

Economy	Average domestic mobile minutes per subscription per month		
	2014	2013	Difference 2013-2014
Canada	409	397	12
Colombia	365	325	40
United States	317	386	-70
Jordan	257	268	-11
Romania	243	231	12
Turkey	238	224	14
Bahrain	229	237	-8
Pakistan	228	194	34
Latvia	222	186	36
Cyprus	214	227	-13
Armenia	210	188	22
Algeria	194	189	6
China*	190	415	-226
France	188	171	17
Jamaica	188	192	-4
TFYR Macedonia	186	172	15
Korea (Rep.)	182	167	15
Sweden*	180	165	15
Norway	179	175	4
Ireland	178	170	9
Greece	176	163	13
Trinidad & Tobago	175	191	-15
Belarus	174	168	5
Iceland	173	177	-4
India	169	168	1
Albania	166	150	16
Portugal	163	145	17
Honduras	162	200	-38
Bangladesh	161	146	15
Croatia	159	145	13
Azerbaijan	155	193	-37
Lithuania	153	139	14
Tunisia	152	152	0
Russian Federation	151	149	3
United Kingdom	146	142	4
Denmark	144	137	7
Slovenia	142	140	2
Italy	140	126	15
Bulgaria	139	129	10
Georgia	134	132	2
Hungary	133	132	2
Kazakhstan	132	115	16
Austria	131	133	-1
Serbia	131	123	8
Spain	131	118	13
Slovakia	130	128	2
Estonia	126	125	1
Germany	126	88	37
Moldova	123	113	10
Czech Republic	121	108	13
Poland	120	111	9
Mexico	118	112	6
Venezuela	118	112	6
Guatemala	112	87	25
Mauritius	109	127	-18
Tanzania	109	106	3
Malta	107	95	11
Saudi Arabia	106	103	4
Namibia	104	86	18
Costa Rica	103	103	0
Hong Kong, China	99	90	9
Senegal	96	78	18
United Arab Emirates	96	99	-3
Belgium	94	94	0
Paraguay	94	98	-4
Uruguay	93	97	-4
Morocco	90	77	12
Oman	88	99	-11
New Zealand*	87	74	13
Nigeria	86	80	5
Zambia	84	61	23
Luxembourg	83	85	-2
Thailand	81	39	42
Switzerland	81	88	-7
South Africa	80	40	40
Rwanda	80	82	-3
Ecuador	78	80	-2
Kenya	76	78	-2
St. Lucia	75	85	-10
Panama	70	71	-1
Côte d'Ivoire	68	72	-4
Bosnia and Herzegovina	61	63	-2
Seychelles	60	42	18
Cuba	58	53	5
Andorra	52	51	2
Chad	41	39	2
Bolivia	35	32	3
Benin	34	33	0
Congo (Dem. Rep.)	33	32	1
Burkina Faso	32	30	3
Dominican Rep.	31	27	3
Zimbabwe	29	32	-3
Lao P.D.R.	18	9	9
Mali	16	16	0
Madagascar	2	2	0

Economy	Average SMS sent per mobile subscription per month		
	2014	2013	Difference 2013-2014
Iran (I.R.)	333	238	95
Venezuela	314	304	10
Namibia	305	305	0
Jamaica	252	276	-23
France	251	254	-3
New Zealand*	196	235	-39
Pakistan	190	206	-16
Portugal	168	186	-18
Belgium	163	176	-12
Turkey	144	212	-68
Costa Rica	142	227	-85
Lithuania	134	129	5
Ireland	129	163	-34
Paraguay	129	247	-118
United Kingdom	116	137	-20
Argentina	104	174	-70
Denmark	101	112	-11
Georgia	97	93	3
Serbia	92	98	-6
Malaysia	91	149	-58
Cyprus	90	101	-11
Saudi Arabia	89	55	35
Sweden*	88	116	-28
Latvia	87	77	10
Luxembourg	87	97	-10
Norway	86	86	0
Slovenia	86	77	8
Uruguay	83	99	-16
Korea (Rep.)	81	81	-1
Malta	78	88	-10
Poland	77	76	1
Romania	71	61	9
Kenya	68	52	16
Croatia	60	62	-2
Singapore	60	76	-16
China*	58	37	20
Czech Republic	49	56	-6
Trinidad & Tobago	49	50	-1
Mauritius	48	59	-11
Iceland	47	50	-3
Albania	45	38	7
Italy	40	67	-27
Bhutan	37	8	29
Morocco	37	22	15
Bolivia	37	43	-6
Finland	36	50	-14
Bosnia and Herzegovina	35	37	-2
Slovakia	32	28	4
Greece	31	38	-7
Austria	29	37	-9
Ecuador	28	28	1
Switzerland	26	32	-6
Moldova	26	17	9
Seychelles	25	28	-2
Russian Federation	25	32	-6
Azerbaijan	25	25	1
India	23	34	-11
Oman	19	29	-10
Estonia	19	17	2
Germany	19	32	-13
Cuba	18	17	1
Panama	17	32	-15
Madagascar	16	16	1
Tunisia	15	20	-4
Jordan	15	21	-6
South Africa	15	6	9
Andorra	15	14	0
Thailand	14	9	5
Hungary	13	13	0
TFYR Macedonia	12	15	-3
Hong Kong, China	12	15	-3
Colombia	11	26	-14
Chad	11	8	3
Senegal	10	14	-4
United Arab Emirates	10	12	-2
Zimbabwe	10	9	1
Armenia	9	9	1
Bangladesh	9	7	2
Mali	9	2	7
Sudan	9	6	2
Lao P.D.R.	9	4	4
Bulgaria	8	9	0
St. Lucia	8	8	0
Macao, China	8	10	-2
Zambia	7	9	-1
Bahrain	7	13	-6
Algeria	7	6	0
Guatemala	7	8	-1
Kazakhstan	6	7	-1
Burkina Faso	6	7	-1
Egypt	6	5	1
Kyrgyzstan	5	8	-2
Dominican Rep.	4	4	0
Spain	4	6	-2
Congo (Dem. Rep.)	3	12	-9
Nigeria	1	1	0

Note: * 2014 and 2012 data.
Source: ITU.

Chart 4.3: Mobile-cellular prices as a percentage of GNI p.c. (top), in PPP$ (middle) and in USD (bottom) by region, 2015



Note: Each horizontal dash represents the price in one country in the region. The yellow marks signal the regional average.
Source: ITU.

Table 4.3: Top five countries with the cheapest mobile-cellular services in each region, PPP$, 2015

Europe		Asia & Pacific		The Americas	
Country	**PPP$**	**Country**	**PPP$**	**Country**	**PPP$**
Estonia	4.67	Sri Lanka	2.45	Costa Rica	5.51
Lithuania	5.59	Bangladesh	4.14	Venezuela	10.41
Latvia	6.84	Iran (I.R.)	5.43	Paraguay	10.45
Austria	6.97	China	6.63	Jamaica	13.10
Cyprus	8.56	Pakistan	7.04	Mexico	13.90
Arab States		**CIS**		**Africa**	
Country	**PPP$**	**Country**	**PPP$**	**Country**	**PPP$**
Sudan	5.96	Kyrgyzstan	10.56	Kenya	7.96
Tunisia	8.52	Georgia	12.49	Ethiopia	8.70
United Arab Emirates	9.15	Russian Federation	13.46	Mauritius	9.18
Jordan	10.21	Kazakhstan	14.02	Namibia	9.54
Egypt	16.78	Armenia	17.26	Nigeria	10.17

Note: Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries.
Source: ITU.

In PPP terms, both the price range (PPP$ 6 – PPP$ 40) and the average (PPP$ 20) are twice as high as the USD values. Sudan stands out as the country with the lowest mobile-cellular prices in the region (PPP$ 6 per month). Despite being an LDC, Sudan has a very competitive mobile market[15] and this is also reflected in the low handset-based mobile-broadband prices (see Section 4.4). The other Arab States where mobile-cellular services cost less than PPP$ 10 per month are Tunisia and the United Arab Emirates.

Prices relative to GNI p.c. levels are moderately affordable in most countries in the region, and the United Arab Emirates stands out as being among the top five countries with the most affordable mobile-cellular prices worldwide (Table 4.1). The Arab States in which prices correspond to more than 5 per cent of GNI p.c. include Comoros, Mauritania and Yemen, which are LDCs with the lowest GNI p.c. levels in the region. Comoros saw a significant decrease in mobile-cellular prices in 2015 (34 per cent in USD terms) in parallel with a series of measures undertaken to pave the way for some competition in the country's mobile monopoly,[16] whereas in Mauritania and Yemen prices remained the same or even increased. Although Palestine has higher GNI p.c. levels than the region's LDCs, mobile-cellular prices are relatively high compared with most Arab States (USD 14.5 per month) and, as a result, the cost of the service represents 5.7 per cent of GNI p.c.

Asia and the Pacific:

The region has the widest range of mobile-cellular prices, varying from USD 1 per month in Sri Lanka to USD 38 per month in Tuvalu.

In PPP terms, Asia and the Pacific has the lowest average of all regions, highlighting that despite the diversity of prices mobile-cellular services are on average the least expensive of all regions. Indeed, the region is home to the lowest mobile-cellular prices worldwide, Sri Lanka and Bangladesh standing out with prices below PPP$ 5 per month. Other Asian countries that display remarkably low mobile-cellular prices include the Islamic Republic of Iran (PPP$ 5.4), China (PPP$ 6.6) and Pakistan (PPP$ 7).

When the GNI p.c. of each country is taken into consideration, Macao (China) has the most affordable mobile-cellular services worldwide, representing 0.09 per cent of GNI p.c., and Singapore (0.17 per cent GNI p.c.) and Hong Kong (China) (0.18 per cent GNI p.c.) are also among the global top five. The mobile markets in these three economies are characterized by the presence of at least three strong operators, despite their small population size, and very high mobile-cellular penetration rates (more than 140 subscriptions per 100 inhabitants). Considering that mobile number portability is only widely employed in Hong Kong (China), competition is probably spurred by multi-SIM ownership, thus fostering low mobile-cellular prices. Overall, mobile-cellular

prices represent less than 5 per cent of GNI p.c. in most countries in Asia and the Pacific, including several LDCs, such as Bangladesh, Bhutan, Lao PDR, Myanmar, Nepal and Samoa. In other Asian LDCs, such as Afghanistan and Cambodia, although prices in terms of GNI p.c. are above the 5 per cent threshold, the low mobile-cellular prices achieved (USD 6.8 and USD 5.4, respectively) confirm that low mobile-cellular prices are possible even in low-income countries.

Commonwealth of Independent States (CIS):

Mobile-cellular prices range in the CIS from USD 3 to USD 8 per month. Indeed, CIS is the most homogeneous region when it comes to mobile-cellular prices, which is explained by the relatively small number of countries the region comprises[17] and by the prevalence of transnational operators such as MTS and VimpelCom, which offer their services in several CIS countries.

In PPP terms, prices are significantly higher, with an average of PPP$ 15 per month, although the CIS still has on average the second lowest PPP-adjusted prices of all regions, after Asia and the Pacific. No CIS country stands out for having particularly low prices in the global PPP comparison, the lowest mobile-cellular prices being those offered in Kyrgyzstan (PPP$ 10.5) and Georgia (PPP$ 12.5).[18]

A regional comparison of prices relative to GNI p.c. levels shows that the CIS is the second region with the most affordable mobile-cellular services, after Europe. The Russian Federation and Kazakhstan are the CIS countries with the most affordable prices, representing 0.34 and 0.6 per cent of GNI p.c., respectively. All CIS countries have mobile-cellular prices corresponding to less than 5 per cent of GNI p.c., including Tajikistan, the last CIS country to achieve this milestone in 2015.

Europe:

Mobile-cellular prices vary between USD 3 and USD 40 per month in Europe, with an average of USD 18 per month, the highest after the Americas.

An analysis considering purchasing power parity factors reveals that prices in Europe are on average similar to those in the Arab States and Africa, despite significant income differences. Moreover, the Baltic States (Estonia, Lithuania and Latvia) stand out in the global comparison as having some of the lowest mobile-cellular prices in PPP terms worldwide.

When the GNI p.c. of each country is taken into account in order to assess the affordability of mobile-cellular services, the average price in terms of GNI p.c. in Europe is the lowest of all regions. Most European countries have mobile-cellular prices corresponding to less than 1 per cent of GNI p.c., and all of them are below the 5 per cent of GNI p.c. threshold. Albania and Bulgaria were the last European countries to reach this milestone thanks to the price reductions achieved through prepaid bundled packages. As in the past, Austria features among the global top five countries with the most affordable mobile-cellular prices, and the country also stands out for having some of the world's most affordable mobile-broadband prices (see Section 4.4).

Americas:

Mobile-cellular prices range from USD 4 to USD 36 in the Americas region, and the average is the highest of all regions at USD 18.

In PPP terms the range is wider, and the average remains the highest of all regions at PPP$ 27. The high average price in the Americas is explained, on the one hand, by the relatively high pay-per-use prices in countries such as Argentina, Belize, Guatemala and Nicaragua, where prepaid packages of bundled services with long validity periods are not available. On the other hand, in high-income countries such as Canada and the United States, good value-for-money offers are typically all-inclusive family plans (voice, SMS and data), whereas individual prepaid packages have a higher price. In the global comparison, Costa Rica is the only country in the Americas that stands out for the affordability of mobile-cellular prices (PPP$ 5.5). Indeed, the service in Costa Rica costs almost half as much as in Venezuela and Paraguay, the second and third countries with the lowest mobile-cellular prices in PPP terms in the Americas, respectively.

Variations are narrower when considering the GNI p.c. of each country, and most countries in the region have prices that represent less than 5 per cent of GNI p.c. This suggests that, although there is room for further reductions of mobile-

cellular prices in most countries in the Americas, the service is already relatively affordable in most countries of the region. The countries where mobile-cellular prices correspond to more than 5 per cent of GNI p.c. remain unchanged in the Americas since 2014, namely Honduras, Belize, Guatemala, Haiti and Nicaragua. In addition to some specific initiatives to reduce prices in these countries, such as the dynamic discounts offered by the operator Tigo in Guatemala, some additional and sustained private-led initiatives or regulatory and policy interventions would be required to achieve lower mobile-cellular prices in these countries, particularly in Belize and Haiti, the countries with the lowest mobile-cellular penetration in the region, together with Cuba.

Dynamic tariffs in mobile-cellular services

Dynamic tariffing refers to the '*process of offering automated variable pricing of mobile services based on real-time analysis of network utilization*' (Smyk, 2011). An optimization and analytics system (Figure 4.2) analyses network traffic and computes location-specific discounts at any given time which are then broadcast to customers (Piscataway, N.J., 2010). The technical and commercial implications of dynamic discounting are manifold and concern operators, customers and regulators. Dynamic discounting:

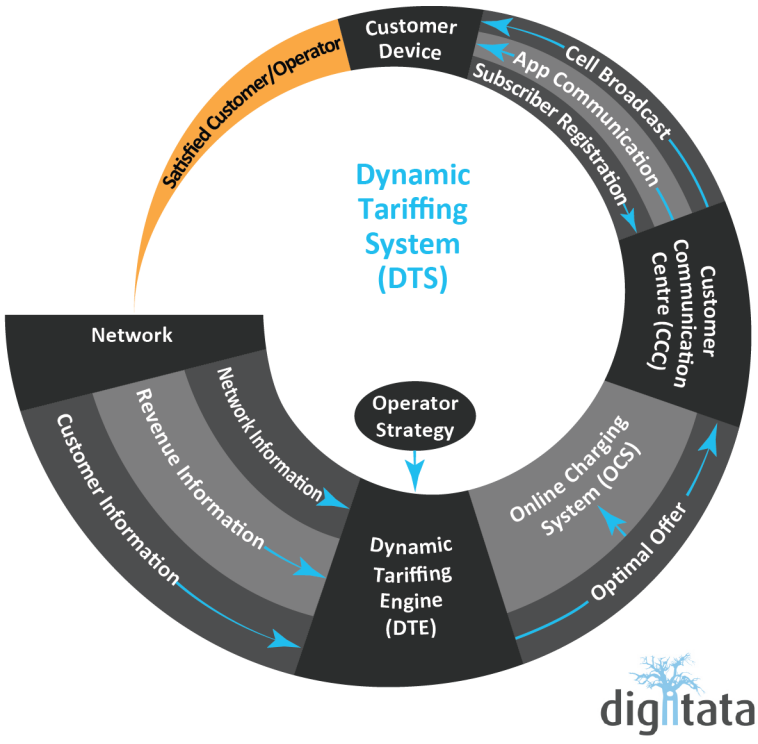
1. Enables operators to distribute traffic more evenly location-wise and time-wise and thus optimize the utilization of existing cell-towers. As a result, quality of service may be improved.

2. Provides an opportunity for operators to increase their market share and/or customer base without the need for upgrading the existing network in the short term.[19] Therefore, it allows operators to increase revenue generation at very low incremental cost.

3. Helps make mobile-cellular services affordable for the lowest-income segments of the population for which standard rates may not be affordable. Hence, it may contribute to increasing mobile-cellular uptake.

4. Allows operators to foster customer loyalty, and existing customers may enjoy lower rates in selected time and geographical zones.

Figure 4.2: Dynamic discounting systems



Source: Digitata (2016).

5. Makes mobile-cellular pricing schemes more complex and, as a result, may complicate operators' accountability vis-à-vis customers and regulators.

6. Does not allow customers who are benefitting from dynamic discounts to know in advance how much they are going to pay for a specific consumption in a given month.

Operators offer dynamic discounts in markets with a majority of prepaid customers who are very price sensitive (Piscataway, 2010). Discounts may be as much as 99 per cent on call and SMS prices, depending on the time and the location of the customer. In 2007, MTN Swaziland was the first operator to launch dynamic discounting. To test this method, MTN first ran a five-week pilot which offered discounts of up to 99 per cent for on-net calls. As a result, peak traffic was reduced by 14 per cent on over-utilized cell towers, while overall network utilization increased by 11 per cent.[20] Network utilization was more evenly spread over time and location, and congestion was significantly reduced (Digitata, 2016). MTN Swaziland then launched the dynamic discounting offer, MTN Zone, in August 2007.[21] Following this initial deployment, other operators in many countries have implemented dynamic discounting, particularly in Africa but also in Asia and the Americas (Figure 4.3).

The benefits of dynamic discounting in terms of expanding mobile-cellular penetration and fostering mobile usage are well illustrated by the case of MTN Uganda. In July 2008, the operator launched MTN Zone in the country, and within three months more than 2 million customers had subscribed to this offer, i.e. about 60 per cent of its customer base (Digitata, 2016). MTN Uganda has also noted a 70 per cent increase in voice traffic since the launch of MTN Zone. The estimated average discount offered was 45-50 per cent during the day and 95 per cent at night.[22]

In conclusion, dynamic discounting may benefit both customers and operators, insofar as it helps to distribute network utilization more evenly, thus providing a better quality of service. In addition, lower prices may make access to mobile-cellular services affordable for the lowest-income segments of the population (Africa Telecoms, 2011), while increasing operator revenues at an almost zero incremental cost. However, caution must be exercised when analysing the overall impact of dynamic discounting on account of the time and geographical constraints it imposes on customers. Moreover, dynamic discounting makes mobile pricing schemes more complex: customers may not always understand the price they are being charged, and they cannot know in advance how much a given consumption will cost each month. These factors may impair customers' control over their mobile-cellular spending.

4.3 Fixed-broadband prices

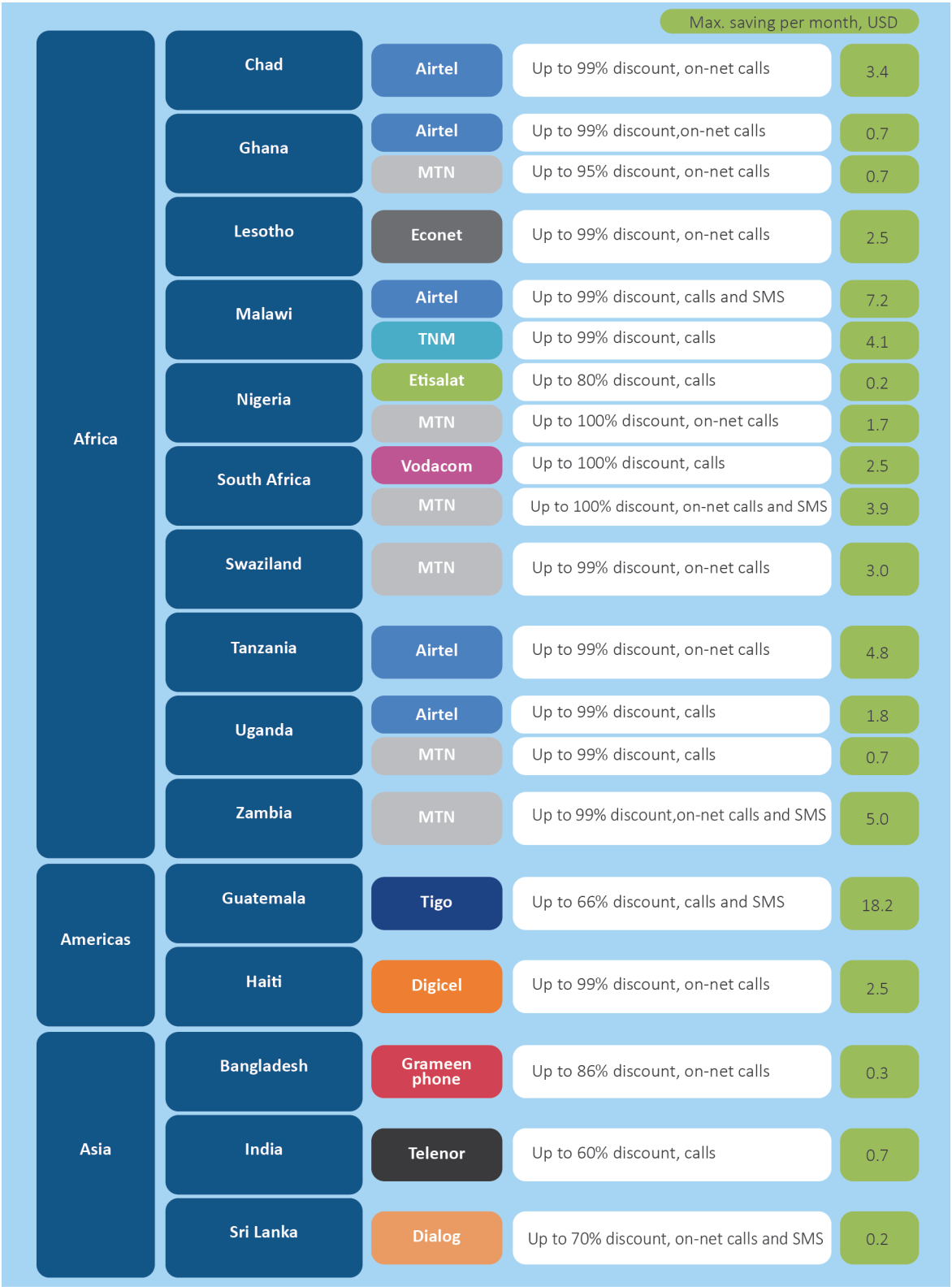
The price of fixed-broadband services has dropped substantially and become much more affordable since 2008, when ITU first started collecting comprehensive price data for this service. Globally, the price of a basic fixed-broadband connection has fallen from around USD 80 in 2008, to USD 25 in 2015, corresponding to a decrease in price relative to average GNI p.c. from over 90 per cent to 14 per cent. The price drop resulted mainly from a substantial decrease in developing countries, where prices fell from around USD 200 to USD 26.

Although the USD price of the service is approaching similar levels across both developed and developing regions, the service nonetheless remains unaffordable for large parts of the population living the world's LDCs. These discrepancies are also highlighted in terms of PPP-adjusted prices of the service, with PPP$ prices almost twice as high in the LDCs as in the developing countries (Chart 4.4).

Recent trends – comparing developed, developing and least developed countries

Contrary to previous years, 2014 fixed-broadband price averages showed that the service had become less affordable. However, this price hike was due mainly to increases in a small number of countries and stagnating or zero price drops in many others.[23] In 2015, fixed-broadband services saw a renewed and significant drop in the price for the service. A price comparison in terms of USD and PPP-adjusted prices and as a percentage of GNI p.c. highlights the following recent trends:

Figure 4.3: Dynamic discounting schemes applied in selected countries



Note: The maximum saving per month is calculated as the difference between the plan selected for the mobile-cellular sub-basket and the maximum discounted rates, considering the call distribution of the mobile-cellular sub-basket. It should be noted that the discounted rates are often time and geographically limited. As a result, the maximum discounted rates may not be available for the call distribution specified in the mobile-cellular sub-basket (i.e. the number of peak, off-peak and weekend minutes) and may be concentrated in a few days, rather than having a 30-day validity as in the plans considered in the ITU price data collection.
Source: ITU.

To monitor fixed-broadband prices, ITU uses the **fixed-broadband sub-basket**, which refers to the price of a monthly subscription to an entry-level fixed-broadband plan. It is calculated as a percentage of a country's average monthly GNI per capita, and also presented in USD and PPP$. For comparability reasons, the fixed-broadband sub-basket is based on a monthly data usage of (a minimum of) 1 Gigabyte (GB). For plans that limit the monthly amount of data transferred by including data volume caps below 1 GB, the cost for the additional bytes is added to the sub-basket. The minimum speed of a broadband connection is 256 kbit/s.

Percentage of GNI p.c.

- At end 2015, fixed-broadband prices were more affordable than at end 2014 in both developed and developing regions (Chart 4.4, top). At 1.2 per cent of GNI p.c., the service remains very affordable in developed countries, but is still relatively expensive in developing countries, where the monthly subscription to an entry-level service corresponded to close to 20 per cent of GNI p.c.

- Globally, the average price of an entry-level fixed-broadband subscription as a percentage of GNI p.c. fell from close to 21 per cent in 2014 to 14 per cent in 2015. In LDCs and other developing countries, prices dropped by one third, while the prices in developed countries decreased at a lower rate. However, by end 2015 an entry-level fixed-broadband subscription still represented close to 61 per cent of GNI p.c. in LDCs, making it unaffordable for a large portion of the population.

Purchasing power parity

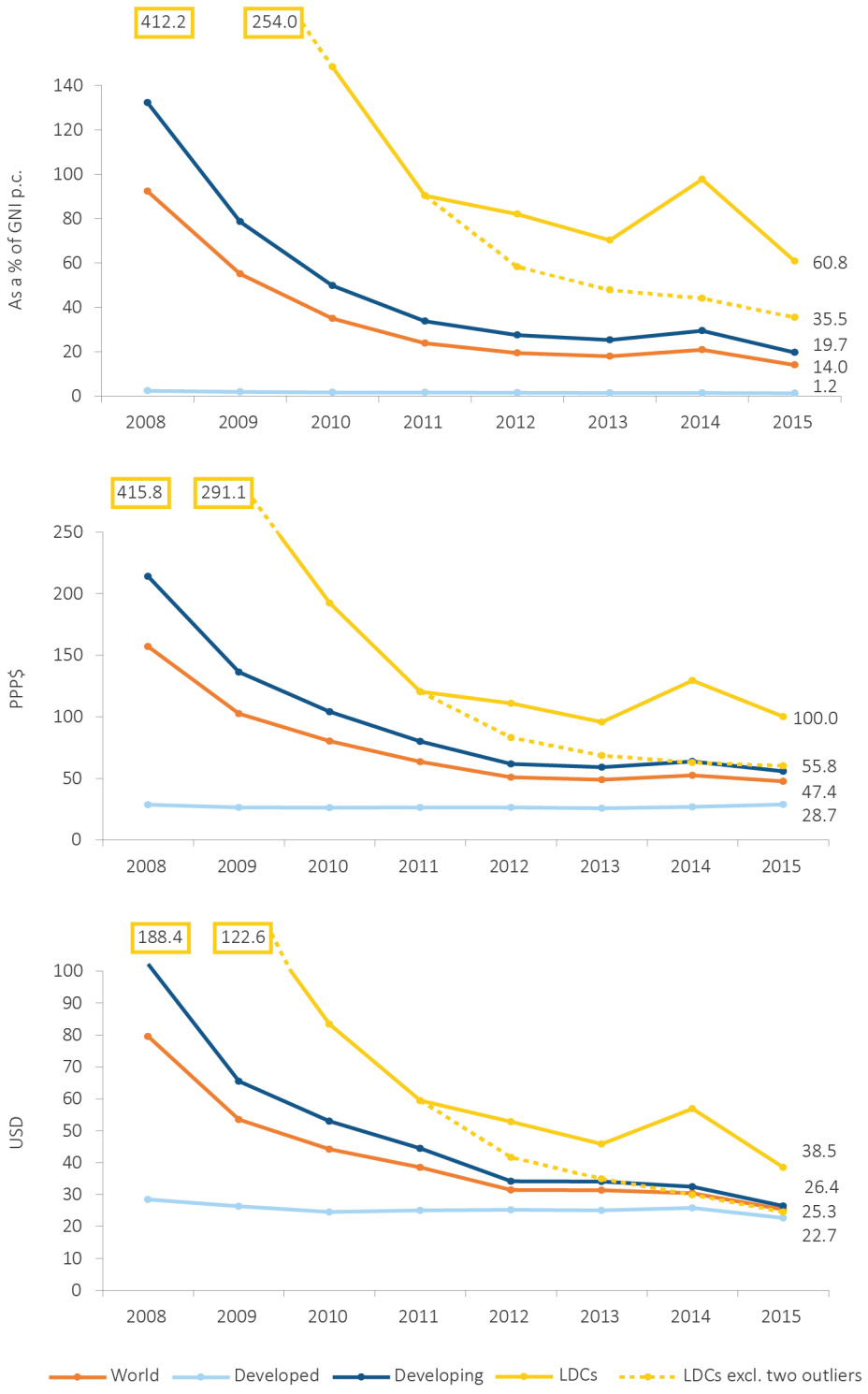
- Purchasing power parity prices confirm that fixed-broadband services remain unaffordable in the world's LDCs. Although PPP-adjusted prices in the LDCs dropped from a high of PPP$ 130 in 2014 to PPP$ 100 in 2015, the service still remained on average more expensive than in 2013. However, the average for LDCs was significantly influenced by the very high prices in two countries, Rwanda and Uganda. Considering only the other LDCs included in the price comparison, the average for 2015 was PPP$ 60, and there was a slight but sustained decrease between 2013 and 2015 (8 and 4 per cent, respectively). At the global level, PPP-adjusted prices fell by about 10 per cent from 2014 to 2015, the same decrease as in developing countries (Chart 4.4, middle).

USD prices

- Between 2014 and 2015, USD prices for fixed-broadband services decreased in developed and developing regions, and most strongly in the LDCs, thus reducing differences in the absolute USD price. By 2015, the price of a fixed-broadband service stood at USD 23 and USD 26 in developed and developing regions, respectively, compared to USD 38 in the LDCs. Differences in terms of USD are relatively small in comparison with PPP$ and GNI p.c. prices, and would be even smaller in the case of LDCs if the two outliers were not included in the average (Chart 4.4, bottom).

Global averages provide an important indication of trends over time, and are useful for understanding broad differences between geographic regions and those at different stages of development. At the same time, averages tend to hide major differences between countries within a given region, in particular for very diverse regions in terms of income levels and development. In some cases, and in regions with a relatively small number of countries, just a few outliers will have a disproportionately large impact on regional averages, especially since price data are not capped and remain exorbitantly high in a few economies. These outliers are often from within the group of low-income economies within a region, where fixed-broadband services are not intended for residential users, and where broadband penetration rates remain particularly low.

Chart 4.4: Fixed-broadband sub-basket, as a percentage of GNI p.c. (top), in PPP$ (middle) and in USD (bottom), 2008-2015



Note: Simple averages. Based on 144 economies for which data on fixed-broadband prices were available for the years 2008-2015. It should be noted that the 2014 price hike in the LDCs is partially the result of very substantial price increases in only two countries (Uganda and Rwanda), which had a sizeable impact on the LDC average (especially because complete price data for the period 2008-2015 are only available for 25 LDCs). The dotted line in the chart shows the evolution of the average in LDCs without these two countries.
Source: ITU.

Benchmarking countries

Country price data rank countries based on the affordability of fixed-broadband services, but also show USD and PPP$ values and indicate price relative to their GNI p.c. There is a strong link between income levels and the affordability of fixed-broadband services, and the service tends to be more affordable in high-income economies and less affordable in low-income economies. This is not surprising, given that that affordability of fixed-broadband is calculated on the basis of countries' GNI p.c. levels. Some countries, however, stand out in that they offer relatively affordable fixed-broadband services despite relatively low incomes. A comparison of USD prices points to these positive outliers (Table 4.4):

In most countries of the world, fixed-broadband services cost between USD 10 and 40. A number of developing countries offer lower prices, though, making the service relatively affordable, in particular given their relatively low income levels. Countries that offer fixed-broadband services at below USD 10 include Mauritius (USD 2.9), the Russian Federation (USD 6.6), the Islamic Republic of Iran (USD 3.8), but also Ukraine (USD 2.7), Brazil (USD 8.9) and Turkey (USD 8.8). These economies rank among the top 40 countries (i.e. in the top quartile) in terms of the most affordable fixed-broadband sub-basket. Mauritius in particular stands out for very low and affordable prices: this African country ranks fourth in the sub-basket and, at USD 2.9, has the third lowest USD prices in the world.

Other countries that stand out for having low absolute fixed-broadband prices are Belarus (USD 7.2), Tunisia (USD 4.2) and Sri Lanka (USD 4.1), but also Viet Nam (USD 2.8) and Bangladesh (USD 4.4).

Economies with relatively high incomes but also expensive high-speed Internet services are Canada (USD 49.4), Ireland (USD 49.9) and New Zealand (USD 45.3), as well as Hong Kong (China), although for USD 51 subscribers in Hong Kong (China) have Internet access through an advertised 100 Mbit/s connection.

The most expensive fixed-broadband connections are on sale in some of the poorest countries in the world, where the service is clearly out of the reach of households and even of most (at least smaller) businesses. Services are sold at over USD 300 in Uganda, Chad and the Central African Republic, and are also very expensive in some of the small island developing states (SIDS), such as the Solomon Islands (USD 275) and Kiribati (USD 188). Cuba (USD 180) also stands out for its very high fixed-broadband prices.

Cheaper and faster – how entry-level broadband speeds are evolving

Since 2008, so as to be able to make comparisons between countries, ITU has collected prices for the so-called *entry-level fixed-broadband service*. This refers to an Internet connection of a minimum of 256 kbit/s, with at least 1 GB of data included, a benchmark that has remained unchanged. However, a comparison of the speeds of entry-level fixed-broadband packages highlights that the minimum speeds on offer have risen considerably over the last eight years. While in 2008 only about 30 per cent of all countries offered entry-level speeds above 1 Mbit/s, by 2015 close to 80 per cent of countries offered entry-level speeds of 1 Mbit/s or above. Indeed, by 2015, not a single developed country offered a connection with speeds below 1 Mbit/s and the majority of plans were based on advertised speeds of above 10 Mbit/s. This indicates that while the price of connections has decreased, speeds have increased, on average, but not equally for all subscribers (Chart 4.5).

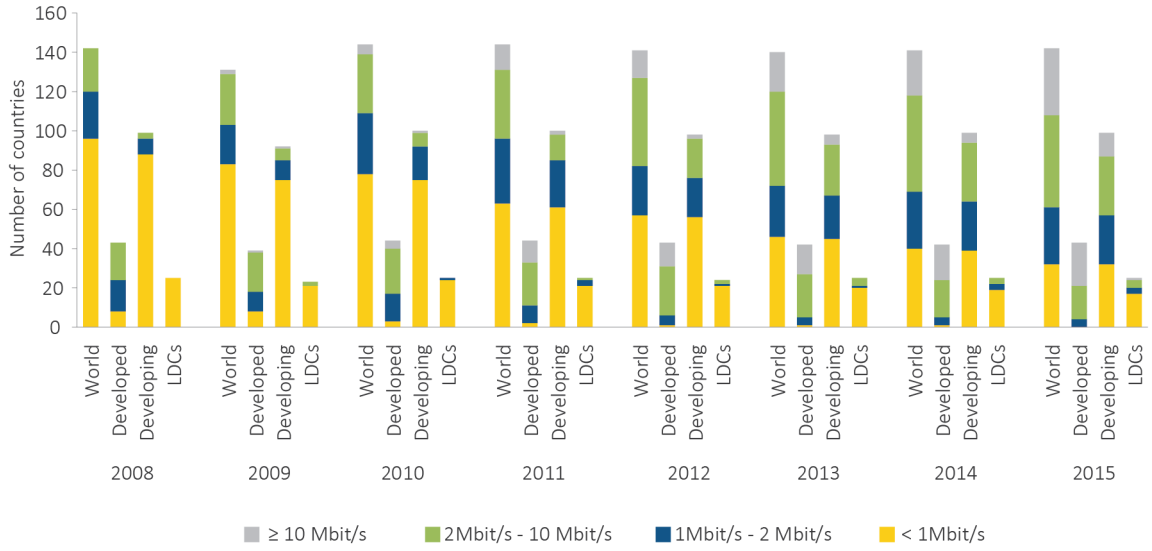
Higher speeds reflect changes in the types of services and applications that Internet users access and providers offer, and which result in an increase in data traffic. At the same time, speeds have not increased equally in all countries and regions of the world, and developing countries are only gradually upgrading broadband infrastructure to deliver higher speeds. By 2012, over 50 per cent of all countries were still offering services at speeds below 1 Mbit/s, and 10 Mbit/s remained the exception for entry-level fixed-broadband packages. The distribution of offers between four speed categories is shown in Chart 4.5, which reveals that in 2015 more than 50 per cent of countries continue to offer speeds of 2 Mbit/s or less, and in LDCs the large majority of entry-level plans are still offering speeds of below 1 Mbit/s.

Table 4.4: Fixed-broadband sub-basket, 2015

Rank	Economy	Fixed-broadband sub-basket			Speed in Mbit/s	Cap per month in GB	Tax rate included (%)	GNI p.c. USD*
		as % of GNI p.c.	USD	PPP$				
1	Kuwait	0.26	10.54	16.95	0.5	Unlimited	0.0	49,300
2	Macao, China	0.27	17.28	22.40	1.5	Unlimited	0.0	76,270
3	United States	0.35	16.32	16.32	2	Unlimited	8.9	55,200
4	Mauritius	0.36	2.85	5.19	0.5	2	15.0	9,630
5	United Kingdom	0.42	15.28	12.60	17	10	20.0	43,430
6	Andorra	0.46	17.39	-	0.5	2	4.5	45,033
7	Norway	0.47	40.80	32.83	6	Unlimited	25.0	103,630
8	Switzerland	0.48	35.33	22.43	5	Unlimited	8.0	88,032
9	Japan	0.51	18.02	19.12	12	900	8.0	42,000
10	Luxembourg	0.52	32.72	30.33	8	2	17.0	75,990
11	Austria	0.57	23.46	24.46	8	Unlimited	20.0	49,670
12	Russian Federation	0.60	6.56	23.93	30	Unlimited	18.0	13,220
13	Singapore	0.63	29.02	33.18	200	Unlimited	7.0	55,150
14	Iran (I.R.)	0.64	3.79	11.13	0.25	3	9.0	7,113
15	France	0.65	23.29	24.06	15	Unlimited	20.0	42,960
16	Australia	0.70	37.53	32.18	8	100	10.0	64,540
17	Iceland	0.74	28.43	25.60	12	5	24.0	46,304
18	Finland	0.74	29.83	26.95	10	Unlimited	24.0	48,420
19	Denmark	0.75	38.50	31.10	25	Unlimited	25.0	61,310
20	Bahrain	0.76	13.30	22.42	2	20	0.0	21,039
21	Belgium	0.77	30.50	31.10	50	100	21.0	47,260
22	Cyprus	0.81	17.79	22.16	3	Unlimited	19.0	26,370
23	Qatar	0.83	64.01	85.76	1	Unlimited	0.0	92,200
24	Netherlands	0.83	36.04	36.26	20	Unlimited	21.0	51,890
25	Sweden	0.85	43.75	40.17	100	Unlimited	25.0	61,610
26	Kazakhstan	0.88	8.70	20.46	1	10	12.0	11,850
27	Brunei Darussalam	0.90	28.37	47.82	1	45	0.0	37,663
28	Poland	0.91	10.35	20.61	10	Unlimited	23.0	13,690
29	Romania	0.91	7.24	14.84	100	Unlimited	24.0	9,520
30	Ukraine	0.92	2.74	16.92	5	Unlimited	20.0	3,560
31	Czech Republic	0.93	14.19	24.39	2	Unlimited	21.0	18,370
32	Brazil	0.93	8.95	15.88	1	Unlimited	40.2	11,530
33	Latvia	0.95	12.09	18.69	5	Unlimited	21.0	15,280
34	Italy	0.97	27.62	30.16	7	Unlimited	22.0	34,270
35	Germany	0.98	38.76	42.51	16	Unlimited	19.0	47,640
36	Turkey	0.98	8.82	16.75	1	1	23.0	10,830
37	Lithuania	1.00	12.82	22.30	100	Unlimited	21.0	15,430
38	Greece	1.03	19.48	25.17	4	Unlimited	23.0	22,657
39	Slovenia	1.07	21.07	28.42	1	Unlimited	22.0	23,580
40	Spain	1.09	26.71	32.08	1	5	21.0	29,440
41	United Arab Emirates	1.09	40.57	55.39	0.25	Unlimited	0.0	44,600
42	Malaysia	1.11	10.31	24.97	1	1	6.0	11,120
43	Estonia	1.12	17.75	24.88	10	Unlimited	20.0	19,030
44	Slovakia	1.12	16.64	26.99	2	300	20.0	17,750
45	Israel	1.13	33.19	29.84	15	Unlimited	17.0	35,320
46	Canada	1.15	49.43	48.44	15	50	13.0	51,630
47	Belarus	1.17	7.16		3	Unlimited	20.0	7,340
48	Tunisia	1.19	4.21	10.68	4	Unlimited	23.0	4,230
49	Seychelles	1.28	15.10	23.68	1	3	15.0	14,100
50	Ireland	1.29	49.91	46.05	100	Unlimited	23.0	46,550
51	Korea (Rep.)	1.29	29.17	36.01	50	Unlimited	10.0	27,090
52	Oman	1.30	18.21	34.99	4	Unlimited	0.0	16,853
53	Trinidad & Tobago	1.30	21.80	26.07	2	Unlimited	15.0	20,070
54	Uruguay	1.32	17.93	24.57	-	30	22.0	16,350
55	New Zealand	1.32	45.33	41.62	-	80	15.0	41,070
56	Croatia	1.37	14.79	24.65	4	1	25.0	12,980
57	Portugal	1.37	24.39	33.46	12	Unlimited	23.0	21,360
58	Sri Lanka	1.43	4.12	11.76	4	3.5	12.2	3,460
59	Malta	1.49	26.06	35.16	30	Unlimited	18.0	20,979
60	Hong Kong, China	1.53	51.34	64.20	100	Unlimited	0.0	40,320
61	Azerbaijan	1.54	9.76		1	Unlimited	18.0	7,590
62	Bulgaria	1.59	10.09	23.22	20	Unlimited	20.0	7,620
63	Bosnia and Herzegovina	1.67	6.63	14.03	2	2	17.0	4,760
64	Bahamas	1.72	29.99	26.40	1	Unlimited	-	20,980
65	Panama	1.73	16.04	27.03	1	Unlimited	7.0	11,130
66	Viet Nam	1.79	2.83	6.98	2.5	1.00	10.0	1,890
67	Mongolia	1.85	6.61	16.42	1	Unlimited	10.0	4,280
68	Saudi Arabia	1.90	39.73	80.33	10	Unlimited	0.0	25,115
69	Hungary	1.91	21.23	41.57	1.28	Unlimited	27.0	13,340
70	Colombia	2.03	13.49	30.04	1	Unlimited	16.0	7,970
71	Peru	2.07	10.99	21.35	0.25	Unlimited	18.0	6,360
72	Chile	2.09	25.97	41.69	8	500	19.0	14,910
73	Lebanon	2.10	17.51	-	2	40	10.0	10,030
74	Costa Rica	2.17	18.33	26.10	1	Unlimited	13.0	10,120
75	Turkmenistan	2.19	14.63	-	1	Unlimited	20.0	8,020
76	Venezuela	2.19	23.07	18.96	1	Unlimited	12.0	12,615
77	South Africa	2.28	12.93	28.92	2	10	14.0	6,800
78	Barbados	2.33	30.00	24.14	2	Unlimited	-	15,451
79	Armenia	2.50	8.37	20.50	4	Unlimited	20.0	4,020
80	Montenegro	2.51	15.31	29.90	1	1	19.0	7,320
81	TFYR Macedonia	2.51	10.79	25.74	4	30	18.0	5,150
82	Egypt	2.56	6.50	22.61	1	10	0.0	3,050
83	Albania	2.57	9.52	21.10	2	4	20.0	4,450
84	Mexico	2.68	22.02	37.80	5	Unlimited	16.0	9,870
85	St. Kitts and Nevis	2.83	35.19	43.62	2	Unlimited	-	14,920
86	Sudan	2.85	4.06	7.54	0.5	2	30.0	1,710
87	Gabon	2.92	23.67	37.99	0.5	Unlimited	-	9,720
88	Serbia	2.94	14.24	30.89	10	Unlimited	20.0	5,820
89	China	3.12	19.27	31.81	2	Unlimited	-	7,400
90	Libya	3.34	21.74	-	0.5	20	0.0	7,820
91	Algeria	3.38	15.45	44.54	0.5	Unlimited	17.0	5,490
92	Belize	3.45	12.50	21.62	0.25	Unlimited	0.0	4,346
93	Cape Verde	3.46	9.96	21.10	12	5	15.5	3,450
94	Argentina	3.66	41.16	-	3	Unlimited	21.0	13,480
95	Uzbekistan	3.78	6.59	-	0.25	1.17	-	2,090
96	Georgia	3.84	11.90	33.23	10.00	Unlimited	18.0	3,720
97	Maldives	3.87	20.69	26.76	4.00	15	6.0	6,410
98	Thailand	3.89	18.71	48.96	10.00	Unlimited	7.0	5,780
99	Morocco	3.96	10.14	23.98	4.00	Unlimited	20.0	3,070
100	Ecuador	3.97	20.16	34.67	3.00	Unlimited	12.0	6,090
101	Dominican Rep.	3.98	20.05	40.95	1.00	Unlimited	30.0	6,040
102	Bhutan	4.14	8.17	25.31	2.00	4	5.0	2,370
103	Fiji	4.14	16.82	28.30	10.00	10.00	15.0	4,870
104	Grenada	4.30	28.33	37.96	2.00	Unlimited	15.0	7,910
105	Moldova	4.41	9.41	29.36	50.00	Unlimited	16.7	2,560
106	Suriname	4.47	37.06	63.90	2.00	Unlimited	8.0	9,950
107	Botswana	4.75	28.65	57.86	0.50	Unlimited	12.0	7,240
108	Bangladesh	4.92	4.43	11.96	0.25	4	15.0	1,080
109	Antigua & Barbuda	4.96	54.94	67.20	1.00	Unlimited	15.0	13,300
110	India	5.11	6.69	23.39	2.00	1.5	14.4	1,570
111	Iraq	5.22	28.27	54.81	0.25	Unlimited	0.0	6,500
112	Jamaica	5.46	23.42	35.93	1.00	Unlimited	16.5	5,150
113	Dominica	5.58	32.20	43.30	2.00	Unlimited	15.0	6,930
114	Pakistan	5.70	6.64	22.33	1.00	10	14.0	1,400
115	Namibia	5.83	27.35	60.30	0.50	Unlimited	0.0	5,630
116	St. Lucia	5.98	36.20	43.95	2.00	Unlimited	15.0	7,260
117	Bolivia	5.99	14.33	30.65	0.25	Unlimited	13.0	2,870
118	El Salvador	6.50	21.23	40.61	2.00	Unlimited	18.0	3,920
119	Palestine	6.73	17.16	26.16	4.00	Unlimited	15.0	3,060
120	Yemen	6.77	7.33	-	0.25	4	5.0	1,299
121	Guatemala	6.81	19.46	36.15	1.00	Unlimited	12.0	3,430
122	Lesotho	7.00	7.76	22.99	1.00	1	5.0	1,330
123	Jordan	7.04	30.28	62.38	1.00	10	8.0	5,160
124	St. Vincent and the Grenadines	7.33	40.37	54.28	9.00	Unlimited	-	6,610
125	Guyana	7.38	24.21	-	1.50	Unlimited	16.0	3,936
126	Philippines	7.53	21.95	50.34	3.00	Unlimited	12.0	3,500
127	Paraguay	7.81	28.63	60.73	1.00	Unlimited	10.0	4,400
128	Tuvalu	8.43	40.19	-	-	Unlimited	7.0	5,720
129	Kyrgyzstan	8.58	8.94	29.36	0.50	Unlimited	14.0	1,250
130	Angola	8.94	40.78	54.22	0.25	Unlimited	-	5,476
131	Tonga	9.08	32.22	41.70	-	5	15.0	4,260
132	South Sudan	9.48	7.66	-	0.50	2	13.0	970
133	Indonesia	9.51	28.75	83.87	10.00	Unlimited	10.0	3,630
134	Mauritania	10.17	10.76	28.20	0.25	Unlimited	14.0	1,270
135	Nepal	10.75	6.54	21.20	0.50	7	13.0	730
136	Samoa	11.43	38.66	53.62	2.00	3	15.0	4,060
137	Papua New Guinea	11.61	21.67	25.59	-	1.17	10.0	2,240
138	Equatorial Guinea	11.92	101.45	-	0.25	Unlimited	-	10,210
139	Micronesia	12.38	33.00	-	0.25	Unlimited	0.0	3,200
140	Tajikistan	12.44	11.20	-	0.25	10	-	1,080
141	Nigeria	13.23	32.74	63.38	1.00	5	5.0	2,970
142	Lao P.D.R.	13.31	18.41	46.90	0.50	Unlimited	10.0	1,660
143	Marshall Islands	13.65	49.95	-	0.25	Unlimited	0.0	4,390
144	Ghana	13.85	18.35	66.44	4.00	20	23.5	1,590
145	Cambodia	14.12	12.00	30.56	4.00	Unlimited	10.0	1,020
146	Nicaragua	15.39	23.99	61.70	0.50	Unlimited	15.0	1,870
147	Honduras	16.39	31.00	60.47	1.00	Unlimited	12.0	2,270
148	Swaziland	16.61	49.14	134.02	0.25	6	14.0	3,550
149	Myanmar	17.20	18.21	71.51	0.50	Unlimited	5.0	1,270
150	S. Tomé & Principe	19.92	27.73	49.41	1.00	12	5.0	1,670
151	Zambia	20.69	28.96	85.44	2.00	10	16.0	1,680
152	Vanuatu	20.86	54.93	52.16	0.50	Unlimited	12.5	3,160
153	Zimbabwe	21.43	15.00	-	1.00	2	15.0	840
154	Ethiopia	26.31	12.06	33.95	0.50	2	15.0	550
155	Côte d'Ivoire	28.82	34.83	88.11	0.25	Unlimited	18.0	1,450
156	Tanzania	29.47	22.60	60.91	0.50	Unlimited	32.5	920
157	Mozambique	32.51	16.26	40.13	0.50	Unlimited	17.0	600
158	Senegal	34.78	30.43	76.19	1.00	Unlimited	23.0	1,050
159	Cuba	36.00	180.00	-	0.25	Unlimited	0.0	5,999
160	Congo (Rep.)	36.07	81.77	155.80	0.25	Unlimited	16.0	2,720
161	Afghanistan	36.72	20.81	61.50	0.25	Unlimited	0.0	680
162	Kenya	40.65	43.70	96.14	21.00	50	26.0	1,290
163	Sierra Leone	41.82	24.40	63.07	1.00	5	15.0	700
164	Cameroon	44.94	50.55	127.67	0.25	Unlimited	19.3	1,350
165	Malawi	49.26	10.26	35.12	10.00	2	26.5	250
166	Gambia	50.56	21.05	83.26	0.25	Unlimited	22.3	500
167	Benin	56.99	42.27	109.72	0.50	Unlimited	18.0	890
168	Mali	62.12	33.65	89.29	0.25	Unlimited	18.0	650
169	Comoros	63.35	41.71	-	0.50	Unlimited	-	790
170	Burkina Faso	63.77	37.20	100.06	0.25	Unlimited	18.0	700
171	Kiribati	76.40	187.82	-	0.25	Unlimited	-	2,950
172	Togo	79.36	37.70	96.56	0.25	Unlimited	18.0	570
173	Guinea-Bissau	106.98	49.03	120.77	0.25	Unlimited	15.0	550
174	Guinea	130.46	51.10	110.64	0.25	Unlimited	18.0	470
175	Madagascar	138.52	50.79	186.31	8.00	Unlimited	20.0	440
176	Niger	147.22	50.30	134.25	0.25	Unlimited	19.0	410
177	Rwanda	166.44	97.09	256.69	10.00	Unlimited	18.0	700
178	Solomon Islands	180.48	275.22	273.87	0.25	6	10.0	1,830
179	Burundi	368.46	82.90	211.13	0.25	Unlimited	18.0	270
180	Uganda	537.31	300.00	861.68	0.25	Unlimited	18.0	670
181	Chad	613.19	500.77	1068.38	0.25	Unlimited	18.0	980
182	Central Afr. Rep.	1832.36	488.63	-	0.25	Unlimited	-	320
	San Marino**	-	18.47	21.45	20.00	Unlimited	0.0	-
	Somalia**	-	30.00	-	0.50	10	10.0	-
	Djibouti**	-	31.61	53.30	0.25	5	7.0	-
	Liechtenstein**	-	35.33	-	5.00	Unlimited	8.0	-
	Timor-Leste**	-	49.00	-	2.00	6	-	-
	Monaco**	-	55.34	-	100.00	Unlimited	20.0	-
	Nauru**	-	60.10	-	0.50	10	0.0	-
	Syria**	-	80.18	-	0.50	3	-	-

Note: * Data correspond to the GNI per capita (Atlas method) in 2014 or latest available year adjusted with international inflation rates.** Country not ranked because data on GNI p.c. are not available.

Chart 4.5: Most common entry-level fixed-broadband speed, globally and by level of development



Note: Based on 144 economies for which 2008-2015 data on fixed-broadband prices were available.
Source: ITU.

Source: ITU. GNI p.c. and PPP$ values are based on World Bank data.

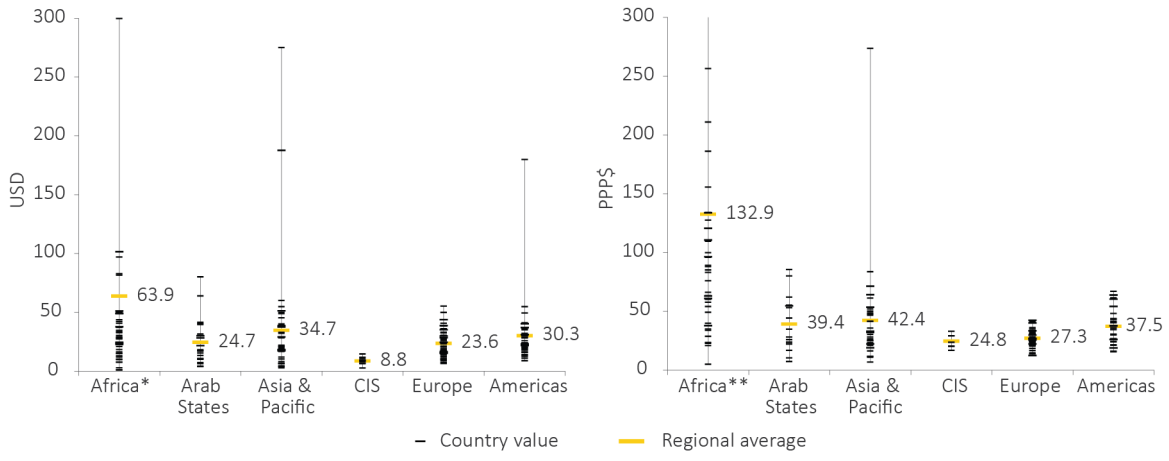
Regional analysis of fixed-broadband prices

A regional comparison of fixed-broadband prices, speeds and data caps highlights important differences between, as well as within, regions. Africa remains the region with the greatest divergence in absolute and relative price for Internet access, while the CIS region has relatively low, and similar, prices. Africa, but also Asia and the Pacific and the Americas, have some outliers, where prices remain prohibitively expensive, which influence these regions' averages (Chart 4.6).

Africa

In 2015, Africa remained the region with the highest absolute and relative fixed-broadband prices (Chart 4.6), and the only region where the average price of the service, at 119 per cent, exceeded GNI p.c. levels. The regional average is

Chart 4.6: Fixed-broadband prices by region, 2015, in USD (left) and in PPP$ (right)



Note: Each horizontal dash represents the price in one country in the region. The yellow marks indicate the regional average. *In Africa, the price of a fixed-broadband subscription was above USD300 (at USD489 and at USD500) in two countries. ** In Africa, the price of a fixed-broadband subscription was above PPP$300 (at PPP$862) in one country.
Source: ITU.

influenced by nine countries where the price of a fixed-broadband connection exceeded average GNI per capita levels, but prices still remain unaffordable in many countries.

In two thirds of all African countries for which price data are available, the fixed-broadband service corresponds to more than 20 per cent of GNI p.c. In only six countries – Mauritius, Seychelles, South Africa, Gabon, Cape Verde and Botswana – is the entry-level offer below 5 per cent of GNI p.c. (Chart 4.7). The unaffordability of fixed broadband in Africa goes hand in hand with the very low fixed-broadband penetration levels observed in the region.

More than half the countries included in the price-data collection continue to offer fixed-broadband services at speeds of 512 kbit/s, or below. In some countries, including Kenya, Malawi and Rwanda, entry-level fixed-broadband services offer high speeds of above 10 Mbit/s, but at high prices, suggesting that these offers are aimed more at businesses than residential users. Very low fixed-broadband penetration rates in these countries support this conclusion. Cape Verde, which only recently graduated from the list of LDCs, stands out for its entry plan that offers theoretical speeds of 12 Mbit/s and includes 5 GB of data, at a relatively affordable price.

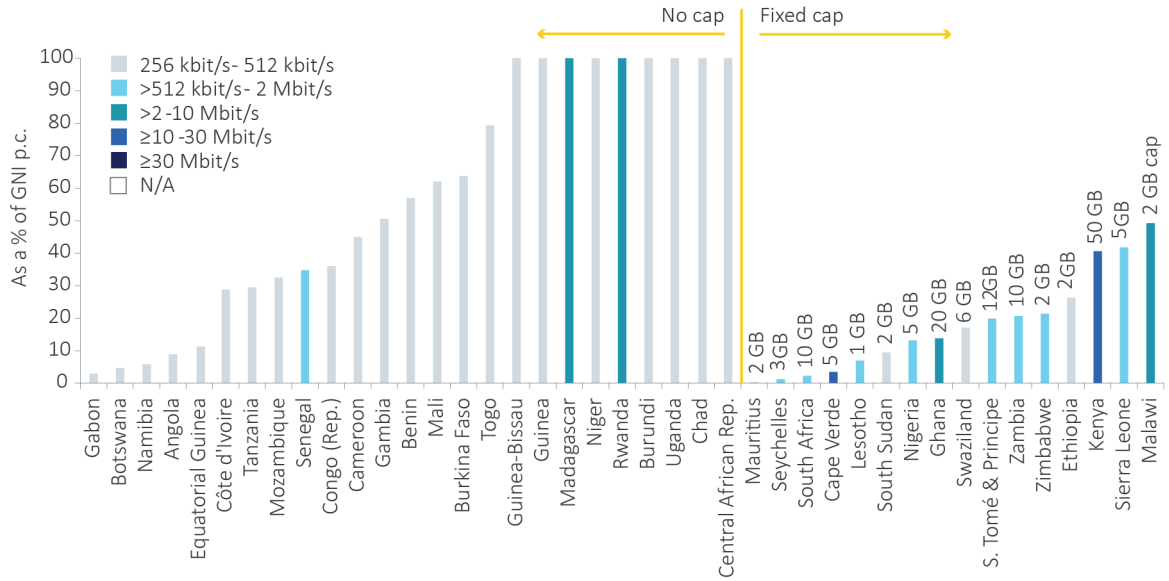
Although a fairly large number of African countries have unlimited fixed-broadband plans, none of the unlimited offers come with high speed and at an affordable price, suggesting that subscribers will not be able to take full advantage of data-intensive services or applications.

Americas

In the Americas, the cost of a fixed-broadband connection has dropped to about USD 30 (PPP$ 37) and at end 2015 the region is close to meeting the 5 per cent of GNI p.c. benchmark in terms of affordability of the service. Fixed broadband is most affordable in the United States and Brazil, where it corresponds to as little as 0.4 and 0.9 per cent of GNI p.c. In about two thirds of the countries in the Americas fixed-broadband services cost less than 5 per cent of GNI p.c., but most other countries, including Jamaica and lower middle-income economies such as Bolivia, El Salvador and Guatemala, have made the service relatively affordable. The exceptions are Nicaragua, Honduras, and Cuba, where the service is still the most expensive and remains relatively unaffordable (Chart 4.8).

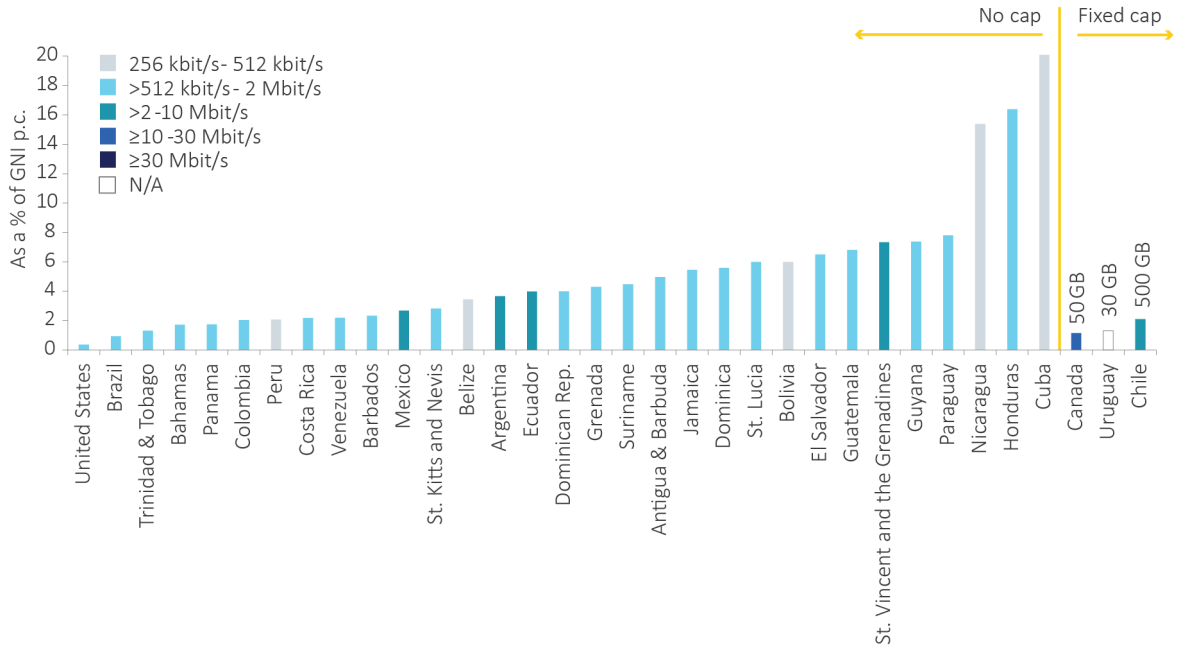
In the majority of countries in the Americas, entry-level fixed-broadband connections are offered at speeds between 512 kbit/s and 2 Mbit/s. Lower speeds are offered only in Bolivia, Belize, Cuba,

Chart 4.7: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Africa, 2015



Note: Broadband speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription.
Source: ITU. GNI p.c. values are based on World Bank data.

Chart 4.8: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Americas, 2015



Note: Broadband speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription.
Source: ITU. GNI p.c. values are based on World Bank data.

Nicaragua and Peru. A handful of countries, including Argentina, Chile, Ecuador and Mexico, offer connections with speeds of between 2 and 10 Mbit/s. Canada's entry-level plan offers 15 Mbit/s.

The Americas is the region with the largest number of unlimited data plans. Only Canada, Chile and Uruguay cap the amount of data that subscribers can download, and even then the caps are very high, at 50, 30 and 500 GB, respectively.

Commonwealth of Independent States (CIS)[24]

Of all the regions, the CIS has on average the cheapest fixed-broadband services, both in terms of USD and PPP$ (Chart 4.6). Apart from Europe, it is also the region with the most affordable fixed-broadband services, which correspond to 3.6 per cent of GNI p.c. In the Russian Federation, Kazakhstan and Ukraine, the price of the service amounts to less than 1 per cent of GNI p.c., and only Kyrgyzstan and Tajikistan, where the service represents 8.6 and 12.4 per cent of GNI p.c., lie above the 5 per cent GNI p.c. benchmark (Chart 4.9).

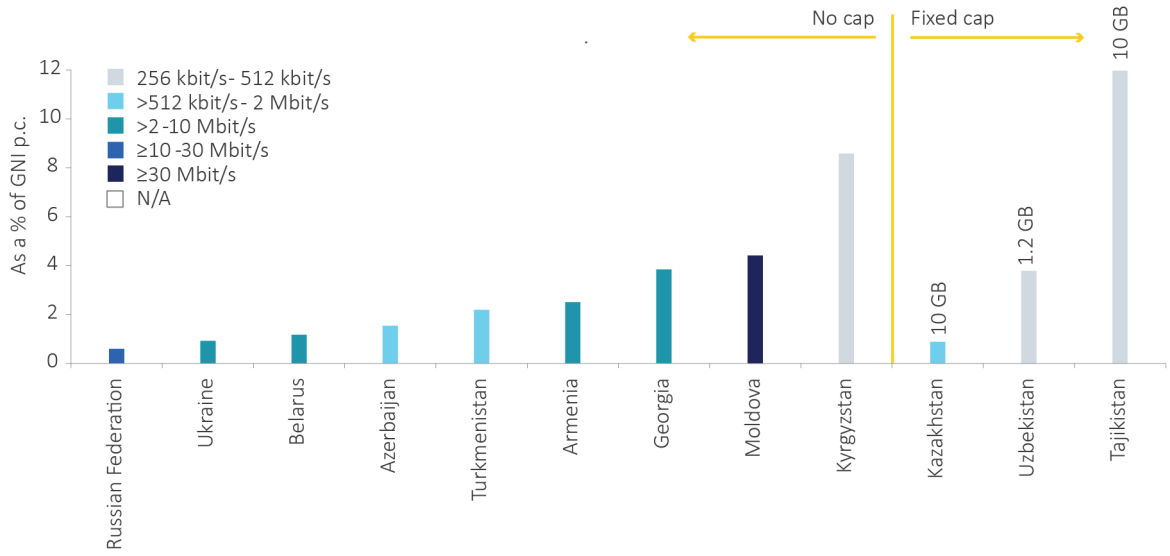
There are large variations in terms of the speeds offered for entry-level fixed-broadband services in the CIS. In Kyrgyzstan, Tajikistan and Uzbekistan, speeds vary between 256 kbit/s and 512 kbit/s, followed by higher speeds of up to 2 Mbit/s in Azerbaijan, Kazakhstan, and Turkmenistan. Armenia, Belarus and Ukraine have entry-level plans with speeds of between 2 and 10 Mbit/s. The highest speeds, and unlimited data plans, are offered in Georgia, Moldova and the Russian Federation. The number of fixed-broadband subscriptions in these countries has increased steadily over the last years, and by end 2015 penetration rates stood at around 15 per cent in Georgia and Moldova, and at 19 per cent in the Russian Federation.

In Kazakhstan and Tajikistan, entry-level fixed-broadband plans included 10 GB of data, and only Uzbekistan had a much lower limit, of 1.2 GB. All other countries in the region offer unlimited fixed-broadband services.

Europe

Europeans benefit from the most affordable entry-level fixed-broadband services globally, usually at relatively high speeds and with unlimited data. Although the service is not among the cheapest in terms of absolute prices – a fixed-broadband connection in Europe costs on average USD 25

Chart 4.9: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, CIS, 2015

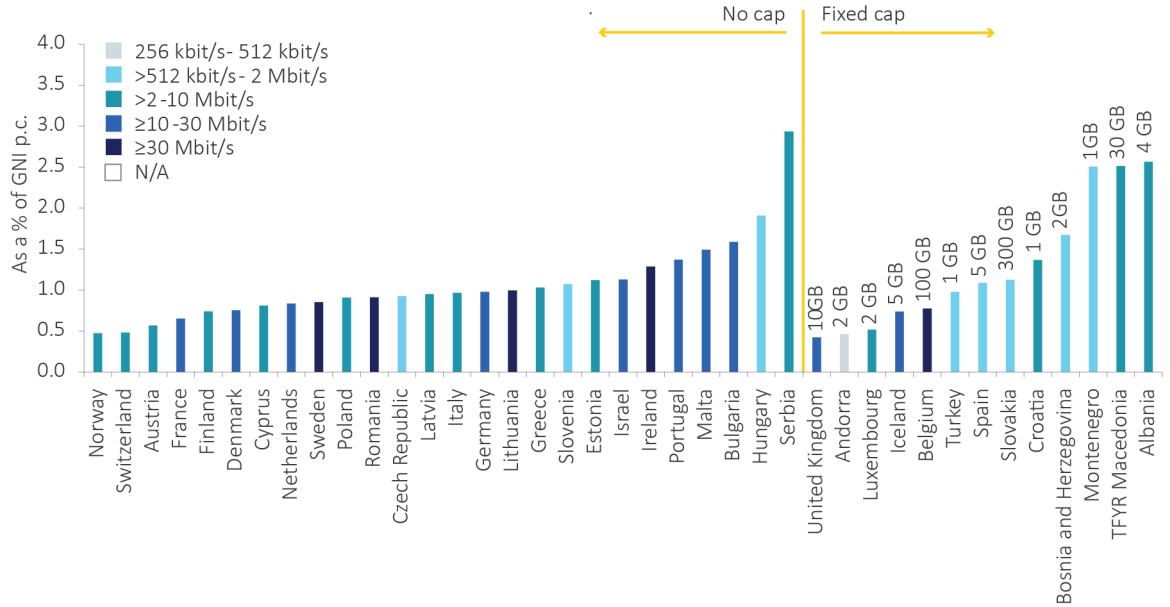


Note: Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries. Broadband speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription.
Source: ITU. GNI p.c. values are based on World Bank data.

(PPP$ 27) – high income levels make the service very affordable (Chart 4.6). By 2015, the average price of fixed broadband as a percentage of GNI p.c. stood at 1.1 per cent (down from 1.3 per cent a year earlier), compared to 3.6 per cent in the CIS, 5.4 per cent in the Americas, 6.6 per cent in the Arab States, 13.6 per cent in Asia and the Pacific and 119.1 per cent in Africa. The service is particularly affordable in the United Kingdom, Andorra, Norway, Switzerland and Luxembourg, but represents less than 5 per cent of GNI p.c. in all countries. In Serbia – the country with the highest relative price for high-speed Internet access – the plan represents 2.9 per cent of GNI p. c. (Chart 4.10)

Fixed broadband in Europe is not only cheap but also relatively fast. Only Andorra continues to

Chart 4.10: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Europe, 2015



Note: Broadband speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription.
Source: ITU. GNI p.c. values are based on World Bank data.

offer an entry-level plan of 512 kbit/s. Speeds of below 2 Mbit/s are offered in another nine countries, including the Czech Republic, Turkey, Slovenia, Spain, Hungary and Albania. The majority of European countries offer plans at speeds of 2 Mbit/s and above, and entry-level plans in Belgium, Sweden, Romania, Lithuania, Ireland and Malta provide speeds of at least 30 Mbit/s.

Fixed broadband in Europe is affordable and fast, and two thirds of all countries offer unlimited data plans. One third of countries continue to impose data caps, ranging from a high of 300, 100 and 30 GB in Slovakia, Belgium and TFYR Macedonia, respectively, to more restrictive caps in Andorra, Luxembourg, Iceland, Bosnia and Herzegovina and Albania. A 1 GB cap is applied only in Turkey, Spain, Croatia, Hungary (1.3 GB) and Montenegro.

Arab States

The average relative and absolute prices of fixed-broadband services in the Arab States conceal sizeable variations between countries, in part owing to wide variations in income levels between the region's oil-exporting members of the Gulf Cooperation Council (GCC) and others. The 2015 price of a fixed-broadband connection represented less than 1 per cent of GNI p.c. in Kuwait, Bahrain and Qatar, and fell below the 5 per cent benchmark in most countries in the region. Prices remain relatively high in Palestine, Yemen, Jordan and Mauritania, and very high in Comoros (Chart 4.11).

Almost half of countries in the Arab States region for which price data are available offer entry-level fixed-broadband plans with speeds of between 256 kbit/s and 512 kbit/s, which is a greater proportion than in other regions, except for Africa. With the exception of Saudi Arabia, where the entry-level speed is 10 Mbit/s, all GCC members offer relatively low-speed plans. Entry-level plans in Tunisia, Oman, Morocco and Palestine, on the other hand, come with speeds of 4 Mbit/s.

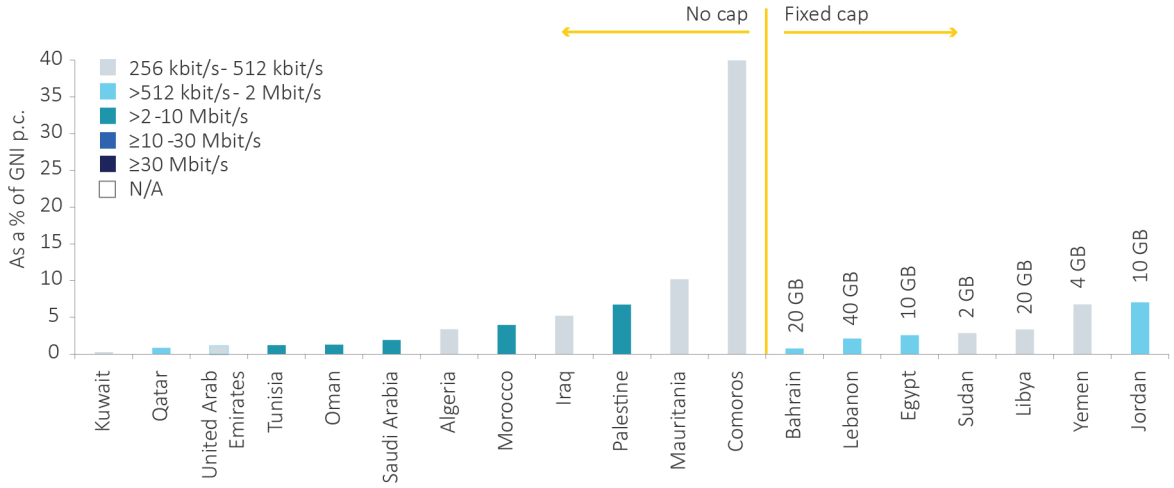
Two thirds of countries in the Arab States region offer unlimited data plans, and caps are relatively high in Lebanon (40 GB), Bahrain (20 GB) and Libya (20 GB). Egypt and Jordan limit the amount of data included in the entry-level broadband plan to 10 GB, and Yemen and Sudan's data limits are 4 GB and 2 GB, respectively.

Asia and the Pacific

Fixed broadband in Asia and the Pacific varies greatly between countries in terms of absolute and relative prices, and in terms of speed and data allowance. These differences reflect wide variations that also characterize the region in terms of income, infrastructure, population size and density, and which make Asia and the Pacific one of the most diverse regions in the world.

Very affordable fixed-broadband services are offered in several of the high-income economies of the region, including Japan, Singapore and Australia, but also in the Islamic Republic of Iran,

Chart 4.11: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Arab States, 2015



Note: Broadband speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription.
Source: ITU. GNI p.c. values are based on World Bank data.

where the 2015 price of the service corresponds to 0.6 per cent of GNI p.c. Malaysia and Sri Lanka, but also Viet Nam and Mongolia, have lower incomes yet relatively affordable fixed-broadband services, corresponding to less than 2 per cent of GNI p.c. (Chart 4.12). Prices in the region's most populous countries, China and India, have become relatively affordable, corresponding to 3.1 and 5.1 per cent of GNI p.c., respectively.

Overall, almost half of all countries in the region offer prices below the 5 per cent GNI p.c. benchmark, including the LDCs Bangladesh and Bhutan. The service remains less affordable in many of the region's other LDCs and SIDS – including in the Solomon Islands, Kiribati and Vanuatu – where infrastructure barriers and limited international Internet bandwidth often keep prices high.

In the Asia and the Pacific region broadband speeds and data caps vary significantly between countries, but most of the LDCs and SIDS with the most unaffordable fixed-broadband services are also those which offer relatively low-speed connections. Exceptions include Cambodia and Samoa, where the ISP offers entry-level speeds of 4 Mbit/s and 2 Mbit/s, respectively. Relatively high-speed connections of between 2 and 10 Mbit/s are also offered in the Philippines, Maldives, Viet Nam and Sri Lanka. Papua New Guinea, Indonesia, Fiji and Thailand offer high-speed Internet access at between 10 and 30 Mbit/s. Entry-level plans with speeds of above 30 Mbit/s are only offered in the high-income, highly connected nations Singapore and the Republic of Korea.

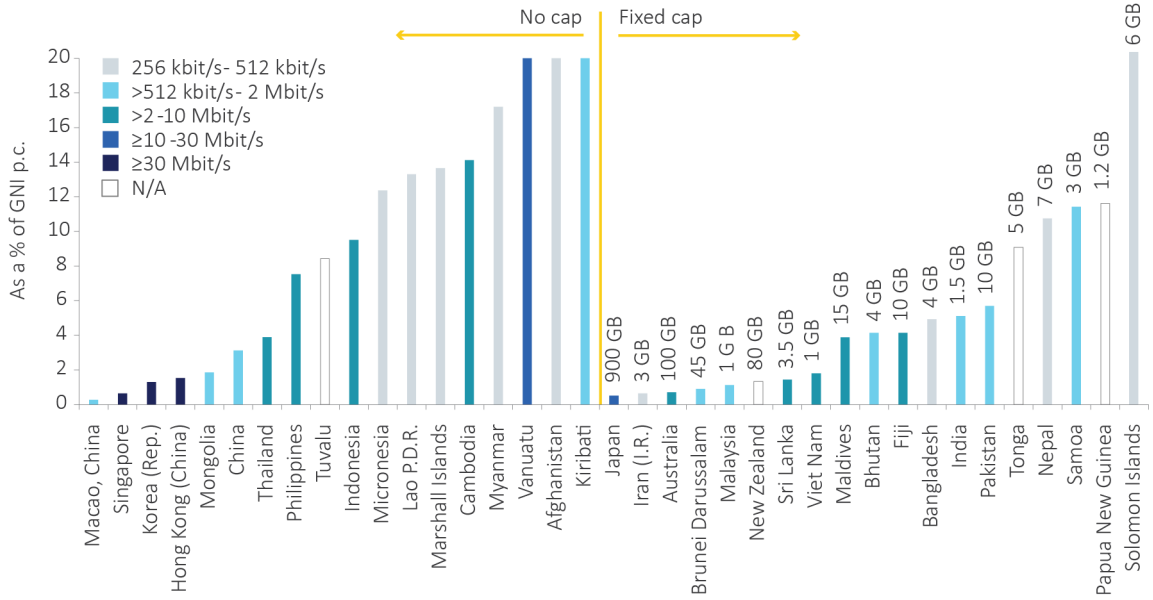
About half of the economies in the region offer entry-level broadband packages that include unlimited data volumes. These include some of the high-income economies with faster speeds, including Singapore, Australia and the Republic of Korea, but also low-income economies with slower broadband connections, such as Kiribati, Afghanistan and Myanmar. In these latter economies, however, the limited speeds are likely to restrict the type and amount of services and applications that subscribers can use in practice.

Why some of the poorest countries continue to have the highest fixed-broadband prices

Unlike mobile-cellular prices, the highest entry-level fixed-broadband prices are found in developing countries, and in particular in some of the world's least developed countries (LDCs).

By the end of 2015, a fixed-broadband plan with a minimum of 1 GB of data per month cost more than USD 80 per month in ten developing countries (Table 4.5). Eight of those countries were

Chart 4.12: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Asia and the Pacific, 2015



Note: Broadband speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription.
Source: ITU. GNI p.c. values are based on World Bank data.

Table 4.5: Countries with the highest fixed-broadband prices in USD, 2015

Economy	Fixed broadband	Mobile broadband (computer-based)	Total household expenditure** USD per capita/month	Development status
	Prices USD/month	Prices USD/month		
Chad	501	17	58	LDC
Central African Rep.	489	N/A	32	LDC
Uganda	300	11	41	LDC
Solomon Islands	275	73	-	LDC
Kiribati	188	56	-	LDC
Cuba	180	N/A	308*	non-LDC
Equatorial Guinea	101	N/A	272	LDC
Rwanda	97	8	39	LDC
Burundi	83	N/A	18	LDC
Congo (Rep.)	82	17	107	non-LDC

Note: N/A means the service is not available. "-" means that the information is not available. * 2014 data. ** Calculated by dividing the indicator "household final consumption expenditure (current USD)" by the population of the country.
Source: ITU. Data on household final consumption expenditure sourced from the World Bank.

LDCs in which the total household consumption expenditure per capita ranged from USD 18 to USD 58 per month.[25] This highlights how unaffordable fixed broadband is in these countries, especially considering the international comparisons: the highest entry-level fixed-broadband prices in the developed world are recorded in Ireland, at USD 50 per month. This is significantly lower than in all the countries listed in Table 4.5, even though income in Ireland is much higher[26] and the entry-level plan has a speed of 100 Mbit/s, whereas in most LDCs the entry-level speed is 256 kbit/s.

Entry-level fixed-broadband plans cost less than USD 15 per month in a number of LDCs, including Bangladesh, Bhutan, Ethiopia, Cambodia, Mauritania, Malawi, Lesotho, South Sudan and Sudan. However, fixed-broadband uptake is also very low in these countries, with the exception of Bangladesh and Bhutan.[27] Therefore, the much higher prices in other LDCs must have specific supply-side causes which, if addressed, could significantly contribute to making fixed broadband more affordable in these countries.

In LDCs with very high fixed-broadband prices, operators often market fixed-broadband services as a premium or business service. For instance, Foris Telecom in Uganda and Airtel in DR Congo advertise fixed Internet offers to business customers, whereas households are only offered mobile-broadband services. Even in some cases where it is not specifically stated, the inclusion of some features typical of business broadband services, such as a minimum guaranteed speed (Orange WiMAX offer in the Central African Republic) or low contention ratios (CBINET ADSL offer in Burundi),[28] is added by default to entry-level fixed-broadband plans. Normally, operators would offer these extra features for a higher price, but also offer basic plans to residential customers. This is not the case in several LDCs, and therefore basic fixed-broadband plans become unaffordable for residential customers.

Another element that may explain the high prices in some countries is the technology used in the fixed-broadband network. The traditional fixed-line network (copper wire) has limited reach in most LDCs and ADSL services rely on this infrastructure. As a result, ADSL plans are often only offered by the incumbent operator (i.e. the only operator having access to the legacy fixed-line infrastructure in most LDCs)[29] and at very high prices. Fixed wireless technologies, such as fixed WiMAX, are often a more affordable alternative for extending the reach of the fixed-broadband network in countries with limited basic fixed-line infrastructure and reduced or sparse demand. Significant investment is needed in LDCs to extend the basic wired-line infrastructure and making the appropriate technological choice in each situation could help streamline the limited investment flows allocated to fixed services.

Uganda is a good example of how the technology may affect the price of entry-level fixed-broadband services. The local ISP Foris Telecom offered WiMAX plans at 512 kbit/s for USD 14 per month in 2013. The service was discontinued in 2014

and, in that year, the cheapest fixed-broadband plan advertised on the incumbent's website was based on ADSL and cost USD 300 per month for a speed of 256 kbit/s. In 2015 the plans offered by the incumbent operator Uganda Telecom were the same as in 2014. However, in June 2016, Uganda Telecom advertised a WiMAX plan at 256 kbit/s for USD 37 per month. This suggests that, if the WiMAX offer is maintained, prices in Uganda may become much lower in 2016 than in 2015.

Other infrastructure elements have an impact on the underlying costs of fixed-broadband provision in LDCs. These include limited and expensive international connectivity and backhaul connections, as well as deficiencies in the power grid. However, these factors are to a large extent common in the broadband infrastructure chain, and therefore also affect mobile-broadband prices. An analysis of mobile-broadband prices in countries with very high fixed-broadband prices reveals that mobile-broadband is much cheaper, thus suggesting that the infrastructure elements common to fixed and mobile broadband are not the main determinant of the very high fixed-broadband prices. Instead, the regulatory challenges faced in the fixed-broadband market and the resulting limited competition in some LDCs (ITU, 2013) may better explain some of the differences in fixed and mobile-broadband prices.

Another distinct element in LDCs that may have an impact on the fixed-broadband prices is the way in which prices are communicated. Price information is not always available on operators' websites but can sometimes be obtained by phone, e-mail or paper advertisements. As a result, bespoke prices and/or one-off offers may be common and information on prices is more difficult to obtain, even for telecommunication regulators. For instance, MTN Rwanda does not advertise fixed-broadband prices on the website, but the small alternative operator Hai advertises fibre-optic packages starting at USD 97 per month for 10 Mbit/s. None of them publishes prices for fixed-wireless broadband plans, although data from the Rwanda Utilities Regulatory Authority show that most fixed-broadband subscriptions in the country relied on fixed-wireless technologies in 2014.

Fixed-broadband Internet access cannot always be replaced by mobile-broadband access, particularly for users requiring high capacity and high speed. Some of the most promising future ICT opportunities are linked to areas requiring high connectivity, such as big data analytics and the Internet of Things (IoT). Moreover, developing countries, and LDCs in particular, could benefit the most from these ICT developments.[30] Therefore, policy-makers and regulators in these countries should not disregard the issue of very high fixed-broadband prices, but rather address the concrete commercial and infrastructure-related problems mentioned above that make fixed broadband a premium service that is unaffordable for residential customers and small/micro undertakings.

4.4 Mobile-broadband prices

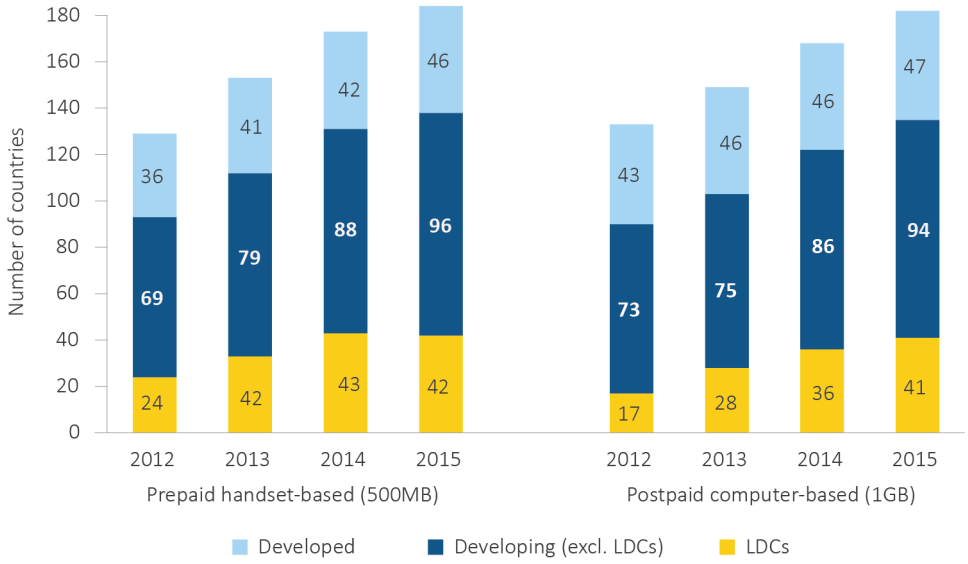
Overview of global trends in mobile-broadband prices

Mobile-broadband services are becoming available in more and more countries, including LDCs, where the availability of prepaid handset-based plans almost doubled in the period 2012-2015, and tripled in the case of postpaid computer-based plans (Chart 4.13). In 2015, eight developing countries started offering mobile-broadband services.

In addition to 3G mobile broadband, mobile-broadband networks based on LTE and other advanced technologies are being deployed and are now available in 70 per cent of countries worldwide. However, the availability of LTE broadband networks varies across development levels: LTE technologies have been deployed only in 38 per cent of LDCs, as against 58 per cent of developing countries and 91 per cent of developed countries.[32] This suggests that the speed and capacity enjoyed by mobile-broadband users may differ significantly across countries.

Apart from the increasing availability of the service, another key factor for the uptake of mobile broadband has been the drop in prices. Globally, handset-based mobile-broadband prices have fallen from an average of USD 23 in 2013 to USD 13 in 2015 (Chart 4.14). In parallel, average prices for computer-based mobile-broadband services have decreased from USD 21 to USD 16. The decrease has been remarkable in LDCs, where handset-based prices have more than halved in both USD and PPP terms in the period 2012-2015,

Chart 4.13: Availability of mobile-broadband services by type of service, by level of development, 2012-2015



Note: A mobile-broadband service is counted as being available if it was advertised on the website of the dominant operator or if prices were provided to ITU through the ICT Price Basket Questionnaire.[31]
Source: ITU.

while there has been a 40 per cent reduction in computer-based prices.

Nevertheless, prices in LDCs still represent on average 11 per cent of GNI p.c. for handset-based services and 17 per cent for computer-based plans. This suggests that the service, and particularly computer-based mobile broadband, is still unaffordable for large segments of the population in LDCs. In developing countries, handset-based mobile broadband is also significantly more affordable than computer-based mobile broadband (5.1 per cent against 7.6 per cent, on average, in 2015). This is in stark contrast with the situation in developed countries, where both handset-based and computer-based services are very affordable and correspond on average to less than 1 per cent of GNI p.c. (i.e. mobile broadband is more affordable than fixed-broadband and mobile-cellular services in developed countries).

The increasing availability of mobile-broadband services and the decrease in prices is changing the way people access the Internet: a growing number of Internet users are connecting through mobile networks (Chart 4.15). Available data show that in a majority of developed countries Internet users are increasingly connecting to the Internet while on the move.[33] The limited data available from developing countries suggest that mobile broadband may be having a stronger impact on how people go online in the developing world. Indeed, the percentage of users accessing the Internet on the move tripled in Egypt between 2013 and 2014, and doubled in Brazil. As Internet usage continues to grow in Brazil and Egypt, a significant proportion of new Internet users may go online exclusively through mobile networks. The situation is most likely to be the same in other developing countries, in view of the growing proportion of households with Internet and the low fixed-broadband subscription figures in most developing countries. This highlights the importance of affordable mobile-broadband services to expand Internet usage in the developing world.

In addition to the increase in Internet users connecting through mobile networks, the decrease in mobile-broadband prices goes hand in hand with an increase in the intensity of use. Indeed, the statistics on mobile Internet traffic show that the amount of data consumed by each subscription is increasing in most countries for which data are available (Chart 4.16). This suggests that the reduction in mobile-broadband prices contributes not only to connecting more people but also to fostering more intense Internet usage among those who are already online.

Chart 4.14: 500 MB handset-based (left) and 1 GB computer-based (right) mobile-broadband prices: as a percentage of GNI p.c. (top graph), in PPP$ (middle graph) and in USD (bottom graph), 2013-2015

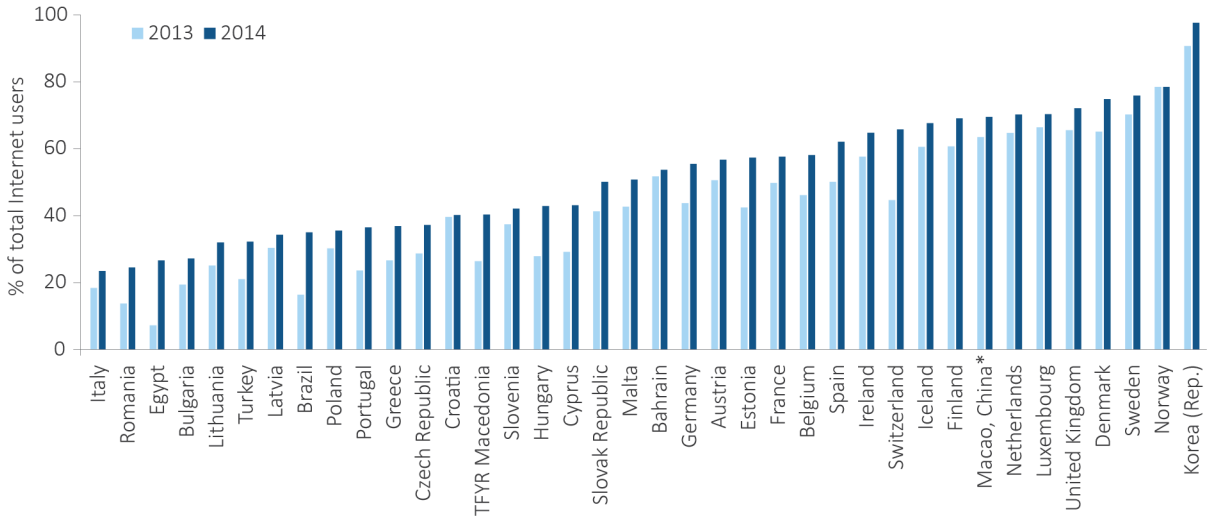
Note: Simple averages. Based on 153 and 147 economies for which 2013-2015 data on handset-based and computer-based mobile-broadband prices are available, respectively.
Source: ITU.

To monitor **mobile-broadband prices**, ITU collects data for (a) prepaid handset-based mobile-broadband plans with a data allowance of 500 MB per month, and (b) postpaid computer-based mobile-broadband plans with a data allowance of 1 GB per month. The plan selected in each country for each service is not necessarily the one with the cap closest to 500 MB or 1 GB, but the one from the dominant operator that is cheapest while including a minimum of 500 MB/1 GB. The validity period considered for the plans is 30 days or four weeks.

Comparison of mobile-broadband, fixed-broadband and mobile-cellular prices

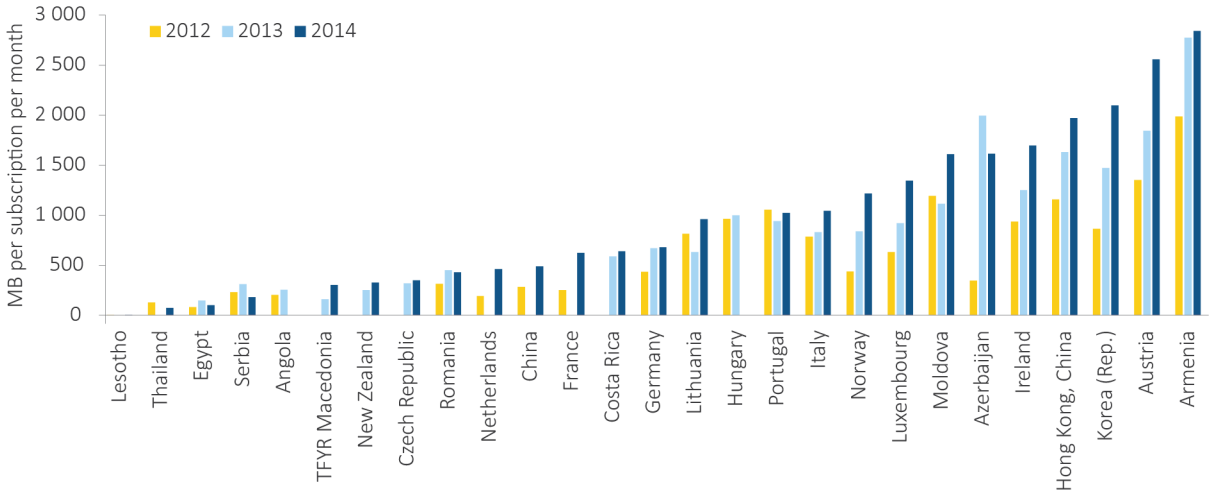
A comparison between postpaid fixed-broadband and postpaid computer-based mobile-broadband prices shows that mobile broadband is significantly less expensive (Chart 4.17). Indeed, in developing countries fixed broadband costs on average twice

Chart 4.15: Percentage of Internet users that used the Internet on the move, selected economies, 2013 and 2014



Note: * 2012 and 2013 data.
Chart 4.15 refers to use of the Internet while mobile via a mobile phone or other mobile access devices, for example, a laptop computer, tablet or other handheld device. For developing countries, it refers to Internet use through the above mentioned devices connected to a mobile phone network and if the location is away from "home", "work", "place of education", "another person's home" and "community and commercial access facilities". For European countries, it refers to Internet use through the above-mentioned devices "away from home and work". For more information on the definitions of Internet use by location, see page 55 in *Manual for Measuring ICT Access and Use by Households and Individuals 2014* available at: http://www.itu.int/en/ITU-D/Statistics/Pages/publications/manual2014.aspx.
Source: ITU and Eurostat for European countries.

Chart 4.16: Mobile data traffic per subscription per month, selected economies, 2012-2014

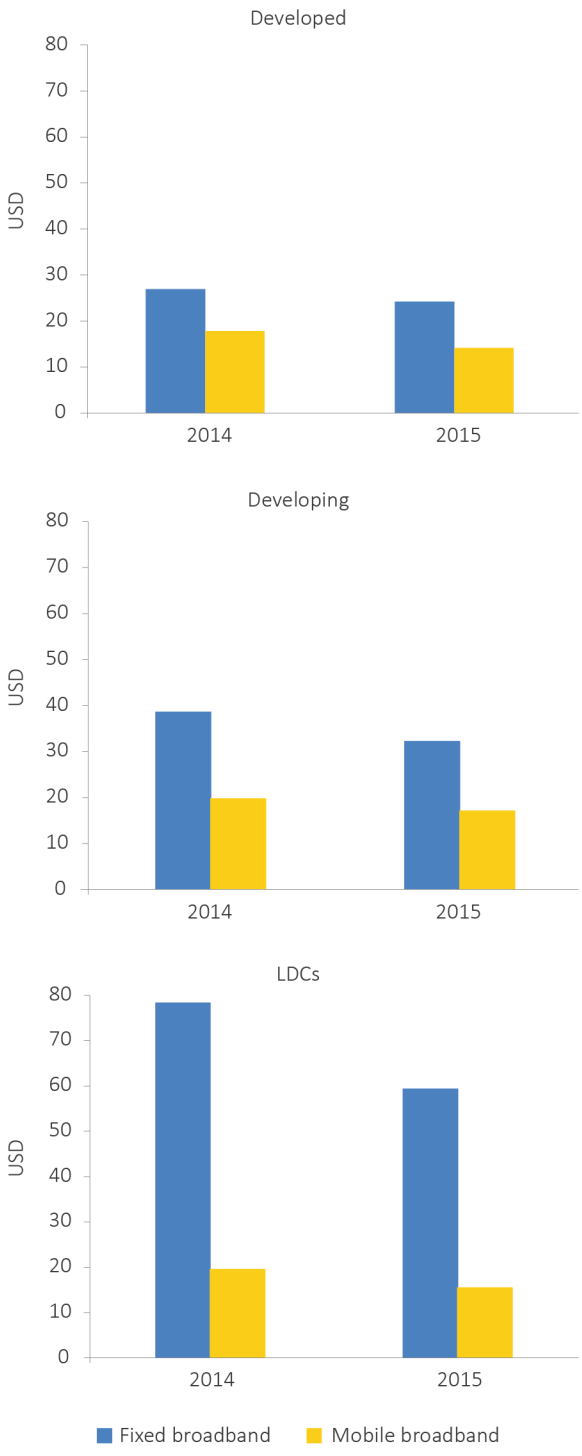


Note: Mobile data traffic does not include traffic offloaded onto fixed networks through WiFi.
Source: ITU.

as much as mobile broadband. In LDCs, a fixed-broadband plan cost four times as much as a mobile-broadband plan in 2014 and this ratio did not improve much in 2015, despite the decrease in fixed-broadband prices. Even in developed countries, where fixed-broadband prices are significantly lower than in the developing world, mobile-broadband services were 40 per cent cheaper than fixed broadband in 2015.

A more detailed analysis at the country level reveals that in 13 developing countries fixed-broadband services are prohibitively expensive (above USD 50 per month), and in three LDCs the service costs more than USD 200.

Chart 4.17: Comparison of postpaid fixed-broadband prices and postpaid computer-based mobile-broadband prices (1 GB/month), in USD, by level of development, 2014 and 2015



Note: Simple averages. Based on 161 economies for which 2014 and 2015 data on computer-based mobile-broadband and fixed-broadband prices are available.
Source: ITU.

In these countries, computer-based mobile-broadband prices range from USD 40 to USD 10 per month, making mobile broadband the only affordable means of connecting to the Internet with a computer. The only two countries in which both fixed broadband and computer-based mobile broadband cost more than USD 50 per month are the Solomon Islands and Syria.

Caution must be exercised when comparing the prices of fixed-broadband plans and computer-based mobile-broadband services, however, because of the different characteristics of the two services. In particular, a majority of the fixed-broadband plans (two thirds of the total in the 2015 ITU data collection) include an unlimited data allowance, whereas most mobile-broadband plans include 1 GB per month. As a result, the intensity of use may be higher in fixed-broadband users, as the available data on Internet data traffic seem to confirm.[34]

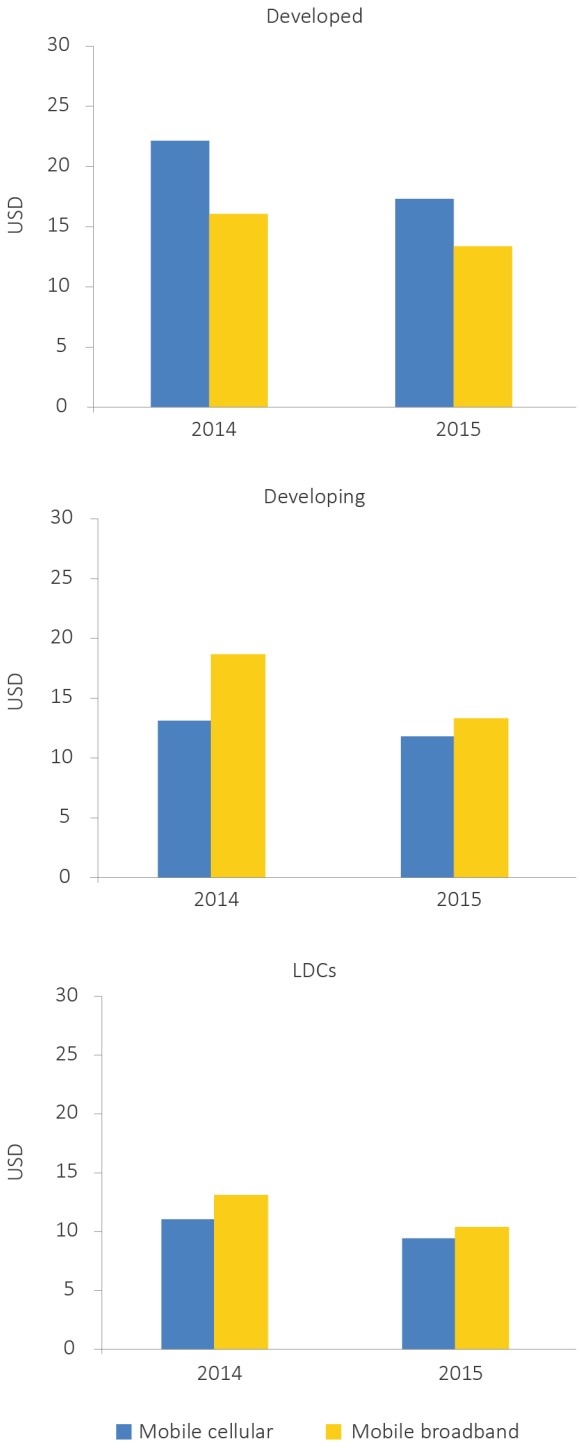
A comparison of handset-based mobile-broadband prices and mobile-cellular prices sheds some light on the cost of mobile broadband relative to other mobile services that are complementary and often contracted together (see Section 4.5).

Available data show that average mobile-cellular prices and handset-based mobile-broadband prices are converging: in 2015, handset-based mobile broadband was only USD 1.5 per month more expensive than mobile-cellular services in developing countries, and USD 1 per month in LDCs, whereas the difference had been twice as much in 2014 (Chart 4.18).

In developed countries the situation was the opposite, with handset-based mobile broadband more than 20 per cent cheaper than mobile-cellular services. This finding highlights the low mobile-broadband prices available in many developed countries, and the fact that in many of them the average consumption per subscription is above 500 MB per month (Chart 4.16).

The fact that handset-based mobile-broadband prices are comparable to mobile-cellular prices in the developing and the developed world, as well as in LDCs, suggests that the growth in mobile-cellular subscriptions witnessed in the last decade could be replicated in the mobile-broadband market.

Chart 4.18: Comparison of prepaid mobile-cellular prices and prepaid handset-based mobile-broadband (500 MB/month) prices, in USD, by level of development, 2014 and 2015



Note: Simple averages. Based on 186 economies for which 2014 and 2015 data on handset-based mobile-broadband and mobile-cellular prices are available.
Source: ITU.

Indeed, affordable prepaid handset-based plans were a major driver for the uptake of mobile voice and SMS services, and they could have a similar effect in promoting handset-based mobile-broadband services. Nevertheless, the cost of the service is not the only price component to be considered in relation to mobile-broadband services, and other factors such as the cost of a smartphone may be a decisive factor for future uptake.[35]

Mobile-broadband prices in 2015

An analysis of prices in local currency shows that in about 70 per cent of countries mobile-broadband prices decreased or remained the same in 2015.[43] Moreover, a drop in prices of more than 10 per cent was recorded in 35 per cent of countries for handset-based plans, and in 30 per cent of countries for computer-based services. Despite the general flat or downward trend, in about 15 per cent of countries mobile-broadband prices went up by more 10 per cent.

These findings provide a more nuanced view of mobile-broadband price trends in 2015. A more detailed analysis requires the examination of country data, and is presented in this section on the basis of the 2015 mobile-broadband prices.

The price of a prepaid handset-based service with a 500 MB monthly data allowance corresponds to less than 0.15 per cent of GNI p.c. in Norway, Sweden, Austria, Estonia and Ireland, the countries with the most affordable services (Table 4.8). European nations dominate the list of the top ten countries with the most affordable handset-based mobile broadband, which also includes two Asian economies: Singapore (0.16 per cent GNI p.c.) and the Republic of Korea (0.22 per cent). All these countries have in common high income levels, advanced mobile networks (all have deployed LTE), strong competition in the mobile-broadband market (three or more operators) and high mobile-broadband penetration rates (above 65 per cent).

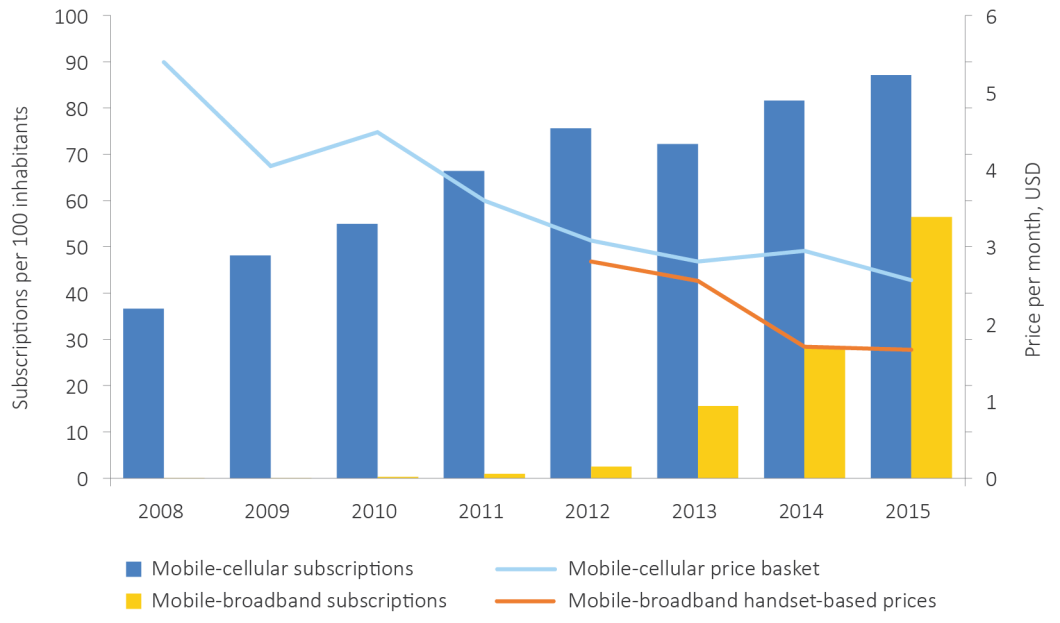
Apart from high-income developed countries, the list of economies with relatively affordable handset-based mobile-broadband services (where the cost of the service corresponds to less than 1 per cent of GNI p.c.) includes 28 developing countries. Some of these are countries with relatively low income per capita levels, such

Box 4.3: Mobile broadband takes off in Bhutan

Bhutan is a country of 776 000 inhabitants with a mountainous and rugged geography. A majority of the population in the country lives in rural areas.[36] These demographic and geographic constraints pose a challenge for the deployment of telecommunication networks, which has been partially overcome by the deployment of wireless networks in the country, especially using low-frequency bands (800 and 700 MHz) that are better suited to Bhutan's topology.

Bhutan Telecom launched 3G services in 2008 in parallel with the launch of GPRS and EDGE data services. GPRS was soon available in most of the country, and EDGE in the major towns, but 3G services were only available in the capital city, Thimphu, until 2011.[37] The second operator, TashiCell, only started offering mobile services in 2008, and 3G services at the end of 2013.[38] Therefore competition in the mobile market was focused on traditional mobile-cellular services (voice, SMS, narrowband data) in the period 2008-2013 and that resulted in high mobile-cellular subscription growth and lower prices (Chart Box 4.3).

Chart Box 4.3: Mobile-cellular and mobile-broadband penetration in Bhutan, 2008-2015



Source: ITU.

Mobile broadband took off in Bhutan in 2013, coinciding with Bhutan Telecom's expansion of the service to 15 out of 20 districts in the country, and the launch of 3G services by TahsiCell. Mobile-broadband subscriptions have more than tripled between 2013 and 2015, in parallel with the extension of 3G coverage in the country (from 54.7 per cent to 80 per cent during the same period) and the drop in prices (35 per cent decrease between 2013 and 2015).

Bhutan Telecom launched LTE services in some areas of the capital city in October 2013,[39] although its LTE coverage has remained very limited.[40] TashiCell launched LTE services in 2016.[41] As the two Bhutanese operators are engaging in campaigns to promote the upgrade of 3G customers to LTE,[42] future LTE developments could play an important role in driving future mobile-broadband growth (in terms of both subscriptions and intensity of use).

Table 4.6: Top three countries with the cheapest mobile-broadband services in each region, PPP$, 2015

Prepaid handset-based 500MB											
Europe		Asia & Pacific		The Americas		Arab States		CIS		Africa	
Country	PPP$	Country	PPP$	Country	PPP$	Country	PPP$	Country	PPP$	Country	PPP$
Estonia	3.11	Cambodia	2.55	Uruguay	5.01	Sudan	6.09	Georgia	3.69	Rwanda	3.67
Lithuania	4.34	Sri Lanka	4.11	Chile	9.79	Jordan	10.15	Moldova	6.71	Liberia	5.87
Iceland	4.71	Bhutan	5.15	Antigua & Barbuda	11.32	Egypt	10.40	Kazakhstan	10.50	Mozambique	6.17
Postpaid computer-based 1GB											
Europe		**Asia & Pacific**		**The Americas**		**Arab States**		**CIS**		**Africa**	
Country	PPP$	Country	PPP$	Country	PPP$	Country	PPP$	Country	PPP$	Country	PPP$
Denmark	5.88	Sri Lanka	4.64	Trinidad & Tobago	10.57	Egypt	11.30	Georgia	6.15	Kenya	12.02
Austria	6.82	Cambodia	5.09	Uruguay	10.93	Tunisia	16.18	Kyrgyzstan	10.20	Tanzania	12.18
Iceland	7.44	Bangladesh	10.96	Barbados	14.48	Sudan	16.95	Kazakhstan	10.50	South Africa	14.90

Note: Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries.
Source: ITU.

Table 4.7: Average mobile-broadband prices and ranges by region, as a percentage of GNI p.c., 2015

Region	Prepaid handset-based 500MB				Postpaid computer-based 1GB			
	Min. 2015	Max. 2015	Average 2015*	% change avg. 2014/15	Min. 2015	Max. 2015	Average 2015*	% change avg. 2014/15
Europe	0.07	2.16	0.59	-26%	0.14	1.67	0.65	17%
CIS	0.30	12.29	2.68	-22%	0.45	12.29	2.82	-56%
The Americas	0.27	12.99	3.05	-11%	0.36	28.86	3.96	-12%
Asia & Pacific	0.16	20.71	3.25	-20%	0.31	47.64	5.77	-20%
Arab States	0.29	29.73	4.15	-16%	0.21	29.73	5.24	-25%
Africa	0.70	27.89	9.47	-27%	1.06	114.29	20.75	-22%

Note: *Simple averages based on 155 countries for which 2014 and 2015 price data for all mobile-broadband services were available.
Source: ITU.

as Belarus (0.41 per cent of GNI p.c.), Georgia (0.43 per cent) and Bhutan (0.84 per cent), the only LDC with handset-based mobile-broadband prices representing less than 1 per cent of GNI p.c. (Box 4.3).

At the end of the table, most of the countries with the least affordable handset-based mobile-broadband prices are LDCs from Africa and Asia and the Pacific. Indeed, in nine LDCs the cost of the service corresponds to more than 20 per cent of GNI p.c., thus making it unaffordable for most of the population in these countries. This is reflected in the low mobile-broadband penetration achieved in these countries (less than 25 subscriptions per 100 inhabitants).

The list of countries with the most affordable postpaid computer-based services with a 1 GB monthly data allowance is also dominated by European countries, with Denmark, Austria, Luxembourg and Norway at the top, having prices that represent less than 0.2 per cent of GNI p.c. (Table 4.9). The top 20 also include some non-European countries such as Qatar (0.2 per cent of GNI p.c.), Singapore (0.3 per cent), Australia (0.3 per cent) and the United States (0.4 per cent). There are two developing countries that stand out as offering relatively affordable computer-based mobile broadband despite their low income levels, namely Sri Lanka (0.56 per cent of GNI p.c.) and the Islamic Republic of Iran (0.63 per cent of GNI p.c.).

Table 4.8: Mobile-broadband prices, prepaid handset-based, 500 MB, 2015

Rank	Economy	Mobile-broadband, prepaid handset-based (500 MB)			Monthly data allowance (MB)	GNI p.c., USD*
		as % of GNI p.c.	USD	PPP$		
1	Norway	0.07	6.08	4.89	500	103,630
2	Sweden	0.11	5.81	5.33	1,000	61,610
3	Austria	0.13	5.55	5.78	1,024	49,670
4	Iceland	0.14	5.23	4.71	500	46,304
5	Estonia	0.14	2.22	3.11	500	19,030
6	Ireland	0.14	5.53	5.11	500	46,550
7	Singapore	0.16	7.27	8.31	1,024	55,150
8	Finland	0.18	7.32	6.61	500	48,420
9	Lithuania	0.19	2.50	4.34	1,024	15,430
10	Korea (Rep.)	0.22	4.86	6.00	30,720	27,090
11	Poland	0.23	2.65	5.28	1,000	13,690
12	United Kingdom	0.25	9.17	7.56	500	43,430
13	Uruguay	0.27	3.66	5.01	512	16,350
14	Switzerland	0.27	19.74	12.54	600	88,032
15	Germany	0.28	10.98	12.04	500	47,640
16	Australia	0.28	15.03	12.88	700	64,540
17	Belgium	0.28	11.07	11.29	500	47,260
18	Qatar	0.29	21.98	29.45	3,000	92,200
19	Hong Kong, China	0.29	9.80	12.26	600	40,320
20	Russian Federation	0.30	3.28	11.96	2,250	13,220
21	Netherlands	0.31	13.31	13.39	500	51,890
22	Spain	0.32	7.76	9.32	525	29,440
23	Macao, China	0.35	22.29	28.89	500	76,270
24	New Zealand	0.39	13.25	12.17	500	41,070
25	Kuwait	0.40	16.62	26.74	5,120	49,300
26	Belarus	0.41	2.51	-	500	7,340
27	Georgia	0.43	1.32	3.69	500	3,720
28	United Arab Emirates	0.44	16.34	22.30	500	44,600
29	Slovenia	0.45	8.87	11.97	500	23,580
30	Kazakhstan	0.45	4.46	10.50	1,024	11,850
31	Bahrain	0.46	7.98	13.45	1,024	21,039
32	Portugal	0.47	8.31	11.40	500	21,360
33	Chile	0.49	6.10	9.79	500	14,910
34	Sri Lanka	0.50	1.44	4.11	1,200	3,460
35	Latvia	0.52	6.64	10.27	600	15,280
36	Canada	0.52	22.48	22.03	500	51,630
37	Slovakia	0.52	7.75	12.58	700	17,750
38	Israel	0.52	15.44	13.88	500	35,320
39	Croatia	0.54	5.83	9.72	500	12,980
40	Turkey	0.57	5.15	9.77	500	10,830
41	Italy	0.58	16.64	18.17	1,024	34,270
42	Brunei Darussalam	0.59	18.62	31.39	500	37,663
43	Azerbaijan	0.62	3.90		600	7,590
44	France	0.62	22.18	22.92	600	42,960
45	Luxembourg	0.63	39.93	37.01	4,608	75,990
46	Iran (I.R.)	0.63	3.76	11.03	1,000	7,113
47	Hungary	0.64	7.12	13.95	500	13,340
48	Andorra	0.66	24.94	-	2,000	45,033
49	Mauritius	0.70	5.59	10.16	800	9,630
50	Romania	0.70	5.55	11.36	1,024	9,520
51	Malta	0.76	13.31	17.96	1,200	20,979
52	Brazil	0.78	7.48	13.27	600	11,530
53	China	0.78	4.82	7.95	500	7,400
54	Czech Republic	0.79	12.16	20.90	500	18,370
55	United States	0.83	38.11	38.11	500	55,200
56	Antigua & Barbuda	0.84	9.26	11.32	700	13,300
57	Bhutan	0.84	1.66	5.15	512	2,370
58	Ukraine	0.85	2.52	15.54	500	3,560
59	Denmark	0.87	44.59	36.02	500	61,310
60	Malaysia	0.88	8.14	19.71	1,500	11,120
61	Greece	0.88	16.64	21.50	600	22,657
62	Argentina	0.89	9.96	-	1,400	13,480
63	Saudi Arabia	0.89	18.67	37.74	500	25,115
64	Oman	0.93	13.00	24.99	1,024	16,853
65	Serbia	0.95	4.60	9.97	800	5,820
66	Costa Rica	0.98	8.22	11.71	500	10,120
67	Moldova	1.01	2.15	6.71	500	2,560
68	Cyprus	1.01	22.18	27.63	600	26,370
69	Bulgaria	1.07	6.78	15.61	600	7,620
70	St. Kitts and Nevis	1.10	13.70	16.99	1,024	14,920
71	Jordan	1.15	4.93	10.15	500	5,160
72	Cambodia	1.18	1.00	2.55	500	1,020
73	Egypt	1.18	2.99	10.40	500	3,050
74	Albania	1.18	4.37	9.68	1,000	4,450
75	Maldives	1.21	6.44	8.33	500	6,410
76	Thailand	1.21	5.81	15.20	1,536	5,780
77	Cape Verde	1.22	3.52	7.46	500	3,450
78	Bahamas	1.23	21.50	18.93	800	20,980
79	TFYR Macedonia	1.25	5.38	12.85	1,024	5,150
80	Turkmenistan	1.28	8.57	-	500	8,020
81	Tunisia	1.30	4.59	11.65	1,024	4,230
82	Algeria	1.30	5.96	17.18	600	5,490
83	Lebanon	1.32	11.00	-	500	10,030
84	Indonesia	1.36	4.11	11.98	1,024	3,630
85	South Africa	1.37	7.76	17.35	500	6,800
86	Bosnia and Herzegovina	1.43	5.67	11.99	600	4,760
87	Seychelles	1.44	16.91	26.52	600	14,100
88	Philippines	1.50	4.37	10.03	750	3,500
89	Barbados	1.55	19.98	16.07	2,000	15,451
90	Mongolia	1.57	5.59	13.89	1,126	4,280
91	Trinidad & Tobago	1.61	26.88	32.14	2,048	20,070
92	Panama	1.62	14.99	25.26	2,048	11,130
93	Pakistan	1.67	1.95	6.54	1,000	1,400
94	Peru	1.78	9.42	18.30	500	6,360
95	Mexico	1.81	14.89	25.56	800	9,870
96	Iraq	1.90	10.28	19.93	500	6,500
97	Gabon	1.98	16.06	25.78	500	9,720
98	Morocco	2.00	5.12	12.11	4,096	3,070
99	Paraguay	2.10	7.69	16.30	1,200	4,400
100	Fiji	2.13	8.65	14.55	1,200	4,870
101	Namibia	2.16	10.11	22.29	800	5,630
102	Montenegro	2.16	13.20	25.78	6,144	7,320
103	Viet Nam	2.20	3.46	8.55	675	1,890
104	Congo (Rep.)	2.20	4.99	9.50	500	2,720
105	Colombia	2.25	14.95	33.29	2,048	7,970
106	Myanmar	2.28	2.41	9.46	550	1,270
107	Sudan	2.30	3.28	6.09	500	1,710
108	Tonga	2.31	8.19	10.60	1,024	4,260
109	Japan	2.37	82.98	88.02	500	42,000
110	Rwanda	2.38	1.39	3.67	500	700
111	Bolivia	2.42	5.79	12.39	500	2,870
112	Botswana	2.44	14.71	29.72	800	7,240
113	St. Lucia	2.45	14.81	17.98	1,000	7,260
114	Armenia	2.50	8.37	20.50	4,500	4,020
115	St. Vincent and the Grenadines	2.69	14.81	19.92	1,000	6,610
116	Vanuatu	2.98	7.85	7.45	510	3,160
117	Suriname	3.07	25.42	43.83	5,120	9,950
118	India	3.09	4.04	14.12	1,024	1,570
119	Bangladesh	3.11	2.80	7.57	1,024	1,080
120	S. Tomé & Principe	3.25	4.53	8.07	600	1,670
121	Angola	3.29	14.99	19.94	500	5,476
122	Grenada	3.37	22.22	29.77	1,024	7,910
123	Jamaica	3.49	14.97	22.97	2,048	5,150
124	Venezuela	3.49	36.70	30.15	800	12,615
125	Ecuador	3.94	20.00	34.39	1,000	6,090
126	Ghana	3.96	5.24	18.98	600	1,590
127	Guyana	4.13	13.56	-	800	3,936
128	Belize	4.14	15.00	25.95	1,024	4,346
129	El Salvador	4.29	14.00	26.78	2,000	3,920
130	Nigeria	4.41	10.91	21.13	600	2,970
131	Lao P.D.R.	4.44	6.14	15.63	5,000	1,660
132	Kyrgyzstan	4.47	4.65	15.29	1,024	1,250
133	Guatemala	4.52	12.93	24.02	1,500	3,430
134	Dominican Rep.	4.96	24.97	50.99	3,072	6,040
135	Mozambique	5.00	2.50	6.17	500	600
136	Kenya	5.08	5.46	12.02	700	1,290
137	Libya	5.56	36.23	-	500	7,820
138	Palestine	5.73	14.62	22.29	1,024	3,060
139	Uzbekistan	5.74	10.00	-	1,000	2,090
140	Samoa	5.77	19.52	27.08	1,650	4,060
141	Dominica	5.90	34.07	45.82	1,000	6,930
142	Swaziland	6.07	17.95	48.95	500	3,550
143	Zambia	6.62	9.27	27.34	500	1,680
144	Nicaragua	7.06	11.01	28.31	1,500	1,870
145	Lesotho	7.07	7.84	23.22	550	1,330
146	Côte d'Ivoire	8.26	9.98	25.24	800	1,450
147	Guinea	8.53	3.34	7.23	500	470
148	Cameroon	9.02	10.14	25.62	2,000	1,350
149	Senegal	9.12	7.98	19.98	800	1,050
150	Kiribati	9.17	22.54	-	500	2,950
151	Honduras	9.64	18.24	35.57	1,024	2,270
152	Tanzania	9.82	7.53	20.30	2,048	920
153	Gambia	9.86	4.10	16.24	500	500
154	Nepal	9.95	6.05	19.63	1,000	730
155	Benin	10.26	7.61	19.75	600	890
156	Afghanistan	10.28	5.83	17.22	1,000	680
157	Chad	10.35	8.45	18.04	500	980
158	Uganda	11.05	6.17	17.73	500	670
159	Micronesia	11.81	31.50	-	2,048	3,200
160	Tajikistan	12.29	11.06	-	1,000	1,080
161	Yemen	12.47	13.50	-	1,024	1,299
162	Papua New Guinea	12.77	23.84	28.15	1,500	2,240
163	Liberia	12.97	4.00	5.87	500	370
164	Haiti	12.99	8.87	19.44	2,500	820
165	Zimbabwe	14.29	10.00	-	500	840
166	Burkina Faso	14.49	8.45	22.74	1,024	700
167	Mali	14.67	7.95	21.09	500	650
168	Comoros	17.12	11.27	-	500	790
169	Togo	17.80	8.45	21.66	1,024	570
170	Solomon Islands	20.71	31.59	31.43	500	1,830
171	Ethiopia	21.05	9.65	27.16	1,000	550
172	Sierra Leone	23.35	13.62	35.22	500	700
173	Niger	23.56	8.05	21.48	1,600	410
174	Malawi	25.13	5.23	17.91	500	250
175	South Sudan	25.16	20.34	-	512	970
176	Madagascar	27.89	10.23	37.51	1,500	440
177	Mauritania	29.73	31.46	82.47	500	1,270
178	Guinea-Bissau	127.27	58.33	143.68	1,024	550
	Timor-Leste**	-	10.00	-	600	-
	Monaco**	-	12.20	-	1,024	-
	Congo (Dem. Rep.)**	-	15.00	-	500	-
	Somalia**	-	15.40	-	560	-
	San Marino**	-	27.73	32.21	1,024	-
	Syria**	-	267.26	-	500	-

Note: * Data correspond to the GNI per capita (Atlas method) in 2014 or latest available year adjusted with international inflation rates. ** Country not ranked because data on GNI p.c. are not available.
Source: ITU. GNI p.c. and PPP$ values are based on World Bank data.

Table 4.9: Mobile-broadband prices, postpaid computer-based, 1 GB, 2015

Rank	Economy	Mobile-broadband, postpaid computer-based (1 GB)			Monthly data allowance (GB)	GNI p.c., USD*
		as % of GNI p.c.	USD	PPP$		
1	Denmark	0.14	7.28	5.88	2	61,310
2	Austria	0.16	6.54	6.82	1	49,670
3	Luxembourg	0.18	11.09	10.28	1	75,990
4	Norway	0.19	16.00	12.87	1	103,630
5	Iceland	0.21	8.26	7.44	1	46,304
6	Qatar	0.21	16.48	22.08	1	92,200
7	Sweden	0.23	11.74	10.78	6	61,610
8	Netherlands	0.29	12.75	12.83	1	51,890
9	France	0.31	11.08	11.45	2	42,960
10	Singapore	0.31	14.47	16.55	2	55,150
11	Lithuania	0.35	4.44	7.72	2	15,430
12	Australia	0.35	18.78	16.11	1	64,540
13	United States	0.36	16.50	16.50	1	55,200
14	Ireland	0.37	14.41	13.29	3	46,550
15	Italy	0.39	11.09	12.11	2	34,270
16	Slovenia	0.39	7.71	10.40	1	23,580
17	Andorra	0.40	15.07	-	1	45,033
18	Germany	0.40	16.03	17.57	1	47,640
19	Finland	0.41	16.53	14.93	1	48,420
20	United Kingdom	0.42	15.28	12.60	1	43,430
21	Korea (Rep.)	0.43	9.72	12.00	1	27,090
22	Kazakhstan	0.45	4.46	10.50	1	11,850
23	Romania	0.47	3.74	7.67	5	9,520
24	Russian Federation	0.52	5.74	20.94	3	13,220
25	Estonia	0.52	8.31	11.65	2	19,030
26	Trinidad & Tobago	0.53	8.84	10.57	1	20,070
27	Belgium	0.53	20.94	21.35	2	47,260
28	Switzerland	0.55	40.52	25.73	10	88,032
29	Saudi Arabia	0.56	11.73	23.72	1	25,115
30	Sri Lanka	0.56	1.63	4.64	1	3,460
31	Uruguay	0.59	7.98	10.93	1	16,350
32	Spain	0.59	14.42	17.32	1	29,440
33	Latvia	0.61	7.82	12.09	2	15,280
34	New Zealand	0.63	21.61	19.84	1	41,070
35	Iran (I.R.)	0.63	3.76	11.03	1	7,113
36	Malta	0.63	11.09	14.96	5	20,979
37	Brunei Darussalam	0.65	20.36	34.33	2	37,663
38	Macao, China	0.69	43.58	56.48	1	76,270
39	Poland	0.70	7.96	15.85	25	13,690
40	Georgia	0.71	2.20	6.15	1	3,720
41	Belarus	0.72	4.39	-	4	7,340
42	United Arab Emirates	0.73	26.96	36.80	1	44,600
43	Slovakia	0.75	11.08	17.97	2	17,750
44	Cyprus	0.76	16.64	20.72	1	26,370
45	Portugal	0.81	14.41	19.77	4	21,360
46	Turkey	0.81	7.32	13.89	1	10,830
47	Hong Kong, China	0.83	27.86	34.84	1	40,320
48	Greece	0.88	16.64	21.50	2	22,657
49	Kuwait	0.89	36.56	58.82	100	49,300
50	Ukraine	0.93	2.75	16.95	1	3,560
51	Oman	0.93	13.00	24.99	1	16,853
52	Czech Republic	0.93	14.19	24.39	2	18,370
53	Canada	0.94	40.46	39.66	3	51,630
54	Bulgaria	0.98	6.23	14.33	2	7,620
55	Hungary	1.05	11.66	22.83	3	13,340
56	Bahrain	1.06	18.62	31.39	10	21,039
57	Mauritius	1.06	8.53	15.51	1	9,630
58	Croatia	1.06	11.52	19.20	2	12,980
59	Azerbaijan	1.08	6.83	-	1	7,590
60	Israel	1.09	32.13	28.89	1	35,320
61	St. Kitts and Nevis	1.16	14.44	17.91	1	14,920
62	South Africa	1.18	6.66	14.90	1	6,800
63	Albania	1.18	4.37	9.68	1	4,450
64	Montenegro	1.18	7.20	14.06	2	7,320
65	Thailand	1.21	5.81	15.20	1	5,780
66	Japan	1.25	43.72	46.38	2	42,000
67	Brazil	1.25	12.01	21.32	1	11,530
68	TFYR Macedonia	1.25	5.38	12.85	1	5,150
69	Egypt	1.28	3.25	11.30	1	3,050
70	China	1.30	8.03	13.25	1	7,400
71	Malaysia	1.32	12.21	29.56	2	11,120
72	Serbia	1.32	6.42	13.94	5	5,820
73	Costa Rica	1.33	11.22	15.98	6	10,120
74	Indonesia	1.36	4.11	11.98	2	3,630
75	Barbados	1.40	18.00	14.48	2	15,451
76	Mongolia	1.42	5.08	12.63	1	4,280
77	Argentina	1.45	16.25	-	1	13,480
78	Chile	1.46	18.19	29.20	1	14,910
79	Bahamas	1.54	26.88	23.66	1	20,980
80	Seychelles	1.59	18.68	29.29	1	14,100
81	Colombia	1.64	10.90	24.28	1	7,970
82	Libya	1.67	10.87	-	1	7,820
83	Bosnia and Herzegovina	1.67	6.63	14.03	3	4,760
84	Tunisia	1.81	6.37	16.18	5	4,230
85	Mexico	1.91	15.71	26.97	1	9,870
86	Moldova	2.02	4.30	13.42	3	2,560
87	Jordan	2.12	9.13	18.80	6	5,160
88	Panama	2.15	19.95	33.62	1	11,130
89	Armenia	2.19	7.32	17.94	2	4,020
90	Turkmenistan	2.35	15.71	-	1	8,020
91	Cambodia	2.35	2.00	5.09	1	1,020
92	Iraq	2.37	12.85	24.91	1	6,500
93	Bhutan	2.44	4.81	14.92	1	2,370
94	Lebanon	2.50	20.90	-	2	10,030
95	Suriname	2.55	21.18	36.52	3	9,950
96	Grenada	2.58	17.04	22.83	1	7,910
97	Peru	2.67	14.13	27.44	1	6,360
98	Antigua & Barbuda	2.77	30.72	37.57	1	13,300
99	St. Lucia	2.82	17.04	20.68	2	7,260
100	Gabon	2.92	23.67	37.99	1	9,720
101	Fiji	2.96	12.01	20.21	3	4,870
102	Kyrgyzstan	2.98	3.10	10.20	1	1,250
103	India	2.98	3.90	13.63	1	1,570
104	Jamaica	2.99	12.83	19.69	2	5,150
105	Bolivia	3.03	7.24	15.48	1	2,870
106	St. Vincent and the Grenadines	3.36	18.52	24.90	2	6,610
107	Dominican Rep.	3.38	17.02	34.76	1	6,040
108	Belize	3.45	12.50	21.61	1	4,346
109	Viet Nam	3.52	5.54	13.68	2	1,890
110	Maldives	3.64	19.46	25.16	3	6,410
111	Namibia	3.66	17.16	37.84	2	5,630
112	Dominica	3.85	22.22	29.89	1	6,930
113	Paraguay	3.93	14.41	30.57	2	4,400
114	Ghana	3.96	5.24	18.98	1	1,590
115	Morocco	3.96	10.14	23.98	15	3,070
116	El Salvador	4.28	13.99	26.76	2	3,920
117	Algeria	4.34	19.86	57.25	2	5,490
118	Ecuador	4.41	22.40	38.52	1	6,090
119	Bangladesh	4.51	4.06	10.96	1	1,080
120	Guyana	4.72	15.50	-	1	3,936
121	Pakistan	4.88	5.69	19.13	3	1,400
122	Lao P.D.R.	4.88	6.75	17.20	5	1,660
123	Palestine	4.94	12.61	19.22	1	3,060
124	Kenya	5.08	5.46	12.02	1	1,290
125	Venezuela	5.55	58.39	47.97	1	12,615
126	Cape Verde	5.56	15.99	33.88	6	3,450
127	Uzbekistan	5.74	10.00	-	1	2,090
128	Tanzania	5.89	4.52	12.18	1	920
129	Samoa	5.97	20.21	28.03	1	4,060
130	Sudan	6.41	9.13	16.95	5	1,710
131	Philippines	6.74	19.67	45.10	5	3,500
132	Guatemala	6.81	19.46	36.15	2	3,430
133	Myanmar	6.87	7.27	28.55	1	1,270
134	Nigeria	7.35	18.19	35.21	2	2,970
135	Congo (Rep.)	7.46	16.91	32.22	1	2,720
136	Nicaragua	7.70	12.00	30.86	1	1,870
137	Senegal	9.66	8.45	21.16	2	1,050
138	Zambia	9.98	13.98	41.23	1	1,680
139	Afghanistan	10.28	5.83	17.22	1	680
140	Swaziland	10.57	31.27	85.28	1	3,550
141	Botswana	11.00	66.36	134.05	1	7,240
142	Honduras	11.63	22.00	42.91	5	2,270
143	Cameroon	12.02	13.53	34.16	3	1,350
144	Mozambique	12.23	6.12	15.10	1	600
145	Tajikistan	12.29	11.06	-	1	1,080
146	Yemen	12.47	13.50	-	1	1,299
147	Nepal	12.65	7.70	24.95	1	730
148	Vanuatu	14.02	36.93	35.07	1	3,160
149	Rwanda	14.03	8.18	21.64	3	700
150	Burkina Faso	14.49	8.45	22.74	1	700
151	Lesotho	15.56	17.24	51.09	2	1,330
152	Togo	17.80	8.45	21.66	1	570
153	Benin	18.83	13.97	36.25	1	890
154	Uganda	19.34	10.80	31.02	1	670
155	S. Tomé & Principe	20.92	29.11	51.88	3	1,670
156	Côte d'Ivoire	20.99	25.36	64.16	4	1,450
157	Ethiopia	21.05	9.65	27.16	1	550
158	Papua New Guinea	21.07	39.34	46.44	2	2,240
159	Chad	21.37	17.45	37.23	1	980
160	Kiribati	22.92	56.34	-	2	2,950
161	Mali	23.41	12.68	33.65	1	650
162	Guinea	23.88	9.35	20.25	3	470
163	Niger	24.74	8.45	22.56	2	410
164	Comoros	25.68	16.91	-	1	790
165	Haiti	28.86	19.72	43.21	7	820
166	Mauritania	29.73	31.46	82.47	1	1,270
167	Angola	32.85	149.92	199.35	20	5,476
168	Malawi	37.93	7.90	27.04	1	250
169	Sierra Leone	39.03	22.77	58.87	1	700
170	Madagascar	41.37	15.17	55.64	1	440
171	Solomon Islands	47.64	72.65	72.29	1	1,830
172	South Sudan	53.05	42.88	-	1	970
173	Liberia	77.84	24.00	35.25	5	370
174	Zimbabwe	114.29	80.00	-	1	840
175	Guinea-Bissau	127.27	58.33	143.68	1	550
176	San Marino**	-	11.09	12.88	1	-
177	Timor-Leste**	-	12.50	-	1	-
178	Congo (Dem. Rep.)**	-	20.00	-	1	-
179	Somalia**	-	25.00	-	1	-
180	Liechtenstein**	-	30.13	-	1	-
181	Monaco**	-	43.25	-	10	-
182	Syria**	-	133.63	-	1	-

Note: * Data correspond to the GNI per capita (Atlas method) in 2014 or latest available year adjusted with international inflation rates. ** Country not ranked because data on GNI p.c. are not available.
Source: ITU. GNI p.c. and PPP$ values are based on World Bank data.

The countries with the least affordable computer-based mobile broadband are mainly LDCs. Indeed, 17 out of the 19 countries in which computer-based mobile-broadband plans correspond to more than 20 per cent of GNI p.c. are LDCs. Most of these countries have in common very low income levels and a limited proportion of households with a computer (a prerequisite for using a computer-based mobile-broadband plan).[44] Even in some countries with higher income levels, such as Angola, Kiribati and Papua and New Guinea, the high cost of computer-based mobile-broadband plans (more than USD 35 per month) makes them unaffordable for a majority of the population.

On the basis of the price comparison taking account of the purchasing power of local currencies, some countries can be highlighted for having the lowest PPP mobile-broadband prices in each region (Table 4.6). The following observations can be made based on the 2015 prices:

- The lowest prepaid handset-based mobile-broadband prices are found in Cambodia, Estonia, Rwanda and Georgia. In all of these countries, mobile-broadband services are offered for less than PPP$ 4 per month, whereas in 2014 prices below PPP$ 5 were only found in Europe. This shows that countries from different regions have succeeded in reducing mobile-broadband prices to very low levels.

- In the Arab States and the Americas, the lowest handset-based mobile-broadband prices are higher than the lowest prices offered in other regions. Nevertheless, prices are relatively low in countries such as Uruguay and Sudan. In Africa, Liberia stands out for having some of the lowest prices globally, despite being a country with very low income levels.[45]

- The lowest postpaid computer-based mobile-broadband prices are significantly higher than the lowest handset-based prices in the Americas, the Arab States and Africa. In Europe and Asia and the Pacific, there are a number of countries with prices below PPP$ 10, which illustrates the lower computer-based mobile-broadband prices found in these two regions.

- Sri Lanka and Cambodia stand out for having the lowest postpaid computer-based mobile-broadband prices worldwide. Moreover, the prices in these two countries decreased from 2014, when they were already among the lowest in the world. The sustained low prices for both handset-based and computer-based mobile-broadband services in Sri Lanka go hand in hand with the very low mobile-cellular prices (see Section 4.2), and confirm the competitive environment in the Sri Lankan mobile market. Cambodia also enjoys intense competition in the mobile-broadband market,[46] but its benefits are still to be translated into lower mobile-cellular prices.

Regional analysis of mobile-broadband prices

The aggregate analysis of prices in terms of GNI p.c. shows that, on average, mobile broadband became more affordable in all regions in 2015 (Table 4.7). All regional averages saw double-digit drops in 2015, and the strongest improvement was recorded in the CIS, where computer-based prices as a percentage of GNI p.c. dropped by more than 50 per cent.

Europe continues to be the region with the most affordable mobile-broadband services, and also the one with the smallest differences across countries in terms of GNI p.c. The **CIS** and the **Americas** have similar ranges for handset-based mobile broadband, but the average for the CIS is lower and decreasing faster. When considering postpaid computer-based services, the Americas has an average price in terms of GNI p.c. that is well above that of the CIS. Moreover, the Americas saw the smallest reduction in the average price of all regions.

Prices across countries in the **Asia-Pacific** region display a wide range, especially for postpaid computer-based plans, thus reflecting the different stages of development of the mobile-broadband markets in the region. Furthermore, the relatively high average for postpaid computer-based prices in terms of GNI p.c. suggests that providing affordable Internet access with large data allowances remains an issue in several countries in the region.

The **Arab States** region has the widest range of handset-based mobile-broadband prices in terms

of GNI p.c. of all regions. This is explained by the contrast between a few Arab LDCs where the service remains largely unaffordable and the high-income GCC countries where prices represent less than 1 per cent of GNI p.c. The range is similar for postpaid computer-based services, although they are more expensive than handset-based mobile-broadband in most Arab States.

Africa is the only region in which the average price of handset-based mobile-broadband plans represents more than 5 per cent of GNI p.c. This underlines that the service remains unaffordable for several segments of the population in many African countries, although there has been a large reduction in prices in terms of GNI p.c. in 2015. Postpaid computer-based services have much higher prices in Africa, with an average price corresponding to more than 20 per cent of GNI p.c. in the region. This average is four times that of any other region and, coupled with the high fixed-broadband prices in Africa (see Section 4.3), highlights that computer-based broadband access remains largely unaffordable in the region.

A closer look at prepaid handset-based mobile-broadband prices as a percentage of GNI p.c. provides additional insights into the differences in affordability within each region.[47] Based on a regional comparison, the following points can be highlighted:

Africa:

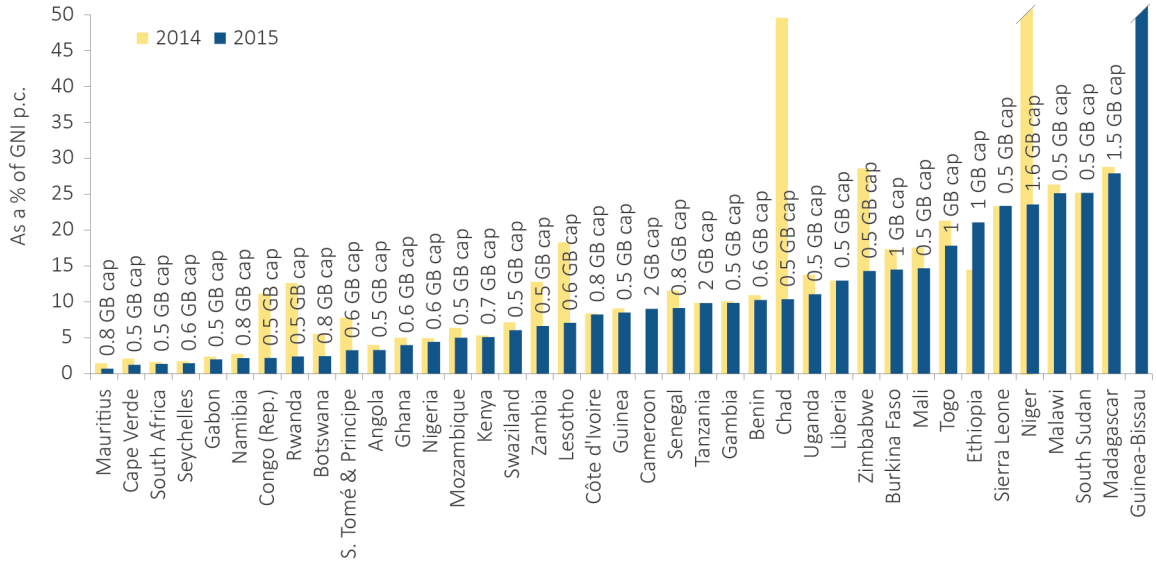
Prepaid handset-based mobile-broadband prices represent less than 5 per cent of GNI p.c. in 13 African countries, including several countries in which prices were above that threshold in 2014, such as Congo (Rep.), Rwanda, Botswana and São Tomé and Principe (Chart 4.19). This confirms that the service is becoming affordable in more and more African countries.

Despite the progress made in reducing handset-based mobile-broadband prices in some low-income African countries, such as Chad, Zimbabwe and Sierra Leone, in two thirds of the countries in the region prices correspond to more than 5 per cent of GNI p.c. Therefore, the service remains rather unaffordable in these countries.

Apart from the African countries with the highest GNI p.c. levels (Mauritius, South Africa, Seychelles, Gabon and Namibia), there are other African countries with much lower income levels where handset-based mobile broadband is fairly affordable, such as Cape Verde, Congo (Rep.) and Rwanda.

All African countries with handset-based mobile-broadband prices that represent more than 10 per cent of GNI p.c. are LDCs, except Zimbabwe. The service is unaffordable for large segments of the population in these countries, and this may be an

Chart 4.19: Prepaid handset-based mobile-broadband prices (500 MB per month) as a percentage of GNI p.c. and data volume (cap) included, in the Africa region, 2015 and 2014



Note: The caps indicated refer to the 2015 prices.
Source: ITU. GNI p.c. values based on World Bank data.

obstacle for the take-off of mobile broadband, considering that mobile-broadband penetration in these LDCs is below 20per cent.

Arab States:

Prepaid handset-based mobile-broadband prices correspond to less than 5 per cent of GNI p.c. in most Arab States, the only countries where prices are clearly above that threshold being Mauritania, Comoros and Yemen (Chart 4.20). These three countries, together with Iraq and Libya – two countries suffering ongoing armed conflict – have the lowest mobile-broadband penetrations in the Arab States (all below 25 subscriptions per 100 inhabitants). This suggests that the affordability of mobile-broadband services remains a major barrier for the uptake of the service in Mauritania, Comoros and Yemen.

High-income Arab States belonging to the GCC, such as Qatar, Kuwait and the United Arab Emirates, have the most affordable mobile-broadband prices in the region. Moreover, in Qatar and Kuwait, entry-level packages offer large data allowances (3 GB and 5 GB, respectively). Bahrain, despite having much lower income levels than the high-income GCC countries, has achieved equally affordable mobile-broadband services thanks to the relatively low prices offered in the country (USD 8 per month for 1 GB).

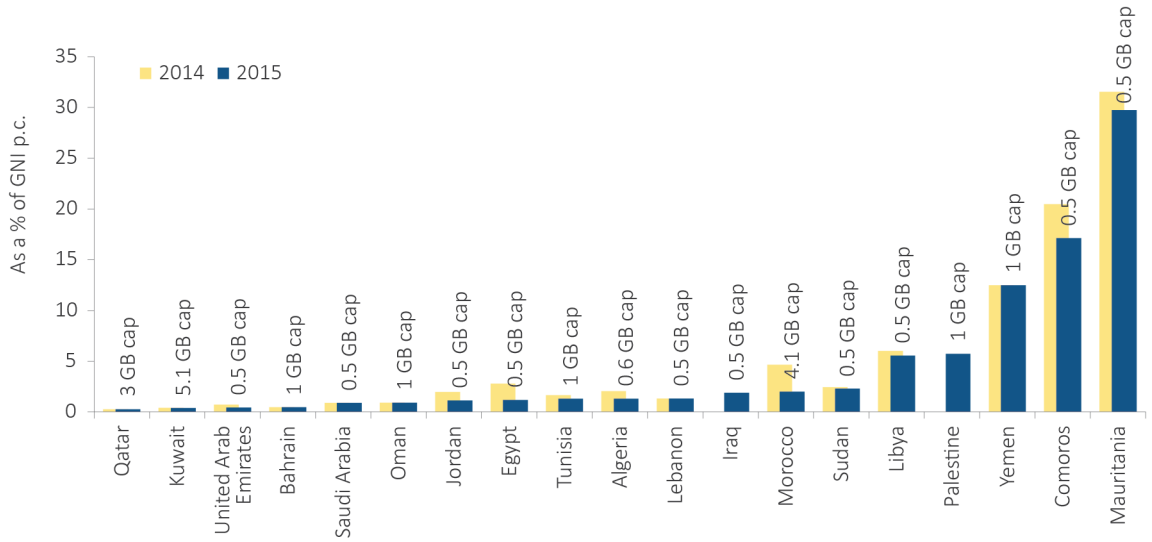
Arab States that saw a significant fall in prices in 2015 include Jordan, Egypt, Algeria and Morocco. The availability of data add-ons that can be attached to popular mobile prepaid bundles (e.g. Maroc Telecom's data add-ons to the Jawal pass) and flexible mobile bundles (e.g. Vodafone's Flex prepaid plans in Egypt) are driving prices down in these countries.

Asia and the Pacific:

Prepaid handset-based mobile-broadband plans that represent less than 5 per cent of GNI p.c. are offered in a majority of economies in the Asia and the Pacific region, including Myanmar and Vanuatu, the two countries that witnessed the largest drop in prices in the region in 2015 (Chart 4.21).

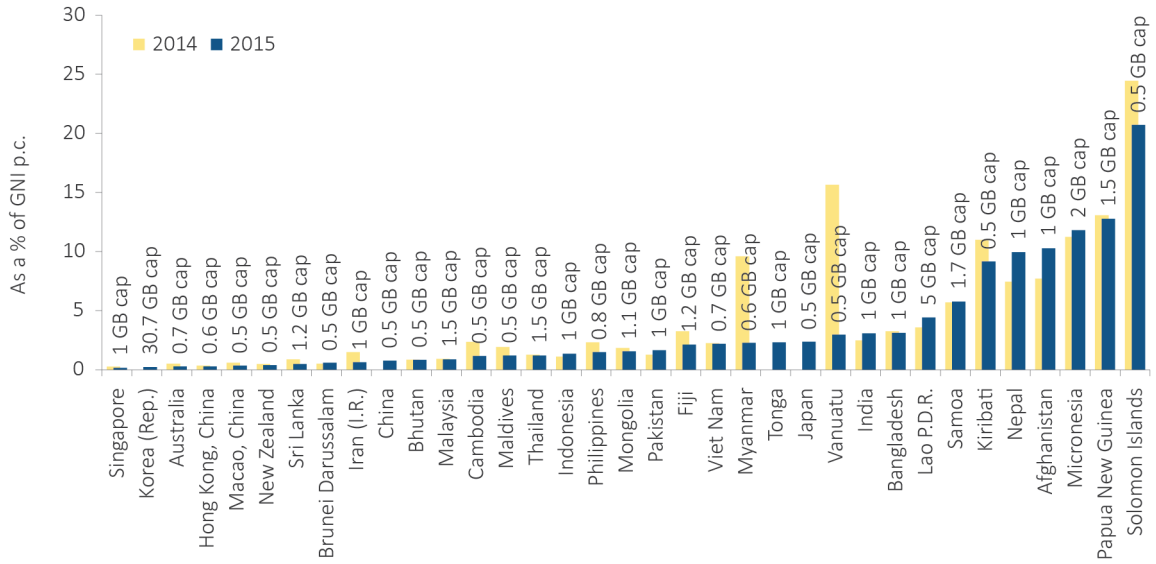
In several SIDS, mobile-broadband remains unaffordable as prices correspond to more than 5 per cent of GNI p.c. Indeed, in countries such as Micronesia, Papua New Guinea and the Solomon Islands, prepaid mobile broadband costs more than USD 20 per month, and thus represents more than 10 per cent of GNI p.c. in these countries. High mobile-broadband prices in terms of GNI p.c. go hand in hand with the limited mobile-broadband uptake in these countries (less than 15 mobile-broadband subscriptions per 100 inhabitants). The example of other SIDS with lower prices and higher mobile-broadband uptake,

Chart 4.20: Prepaid handset-based mobile-broadband prices (500 MB per month) as a percentage of GNI p.c. and data volume (cap) included, in the Arab States region, 2015 and 2014



Note: The caps indicated refer to the 2015 prices.
Source: ITU. GNI p.c. values based on World Bank data.

Chart 4.21: Prepaid handset-based mobile-broadband prices (500 MB per month) as a percentage of GNI p.c. and data volume (cap) included, in the Asia-Pacific region, 2015 and 2014



Note: The caps indicated refer to the 2015 prices.
Source: ITU. GNI p.c. values based on World Bank data.

such as Maldives, Fiji and Vanuatu, highlights the importance of affordable prices for fostering mobile broadband.

Some of the world's most affordable mobile-broadband prices are found in the Asia and the Pacific region, in countries such as Singapore and the Republic of Korea. In the latter, entry-level mobile-broadband plans include very large data allowances (above 30 GB). This shows that high-capacity mobile broadband at very affordable prices (less than USD 5 per month) is possible. Other countries that stand out for having affordable mobile-broadband prices despite their low GNI p.c. levels include Sri Lanka, Bhutan, Cambodia and Pakistan, all of them offering prepaid mobile-broadband plans at prices below USD 2 per month and representing less than 2 per cent of GNI p.c.

Commonwealth of Independent States (CIS):

Prepaid handset-based mobile-broadband prices correspond to less than 5 per cent of GNI p.c. in all CIS countries except Uzbekistan and Tajikistan (Chart 4.22). Thanks to the decrease in prices recorded in Kyrgyzstan (from USD 8 per month in 2014 to USD 4.7 per month in 2015), prices were brought below the 5 per of GNI p.c. threshold there for the first time, while the data allowance was increased from 500 MB to 1 GB per month.

Conversely, the increase of the data allowance from 500 MB to 1 GB in Uzbekistan drove prices up (from USD 6 to USD 10 per month) and thus the cost of the service represented more than 5 per cent of the country's GNI p.c. in 2015.

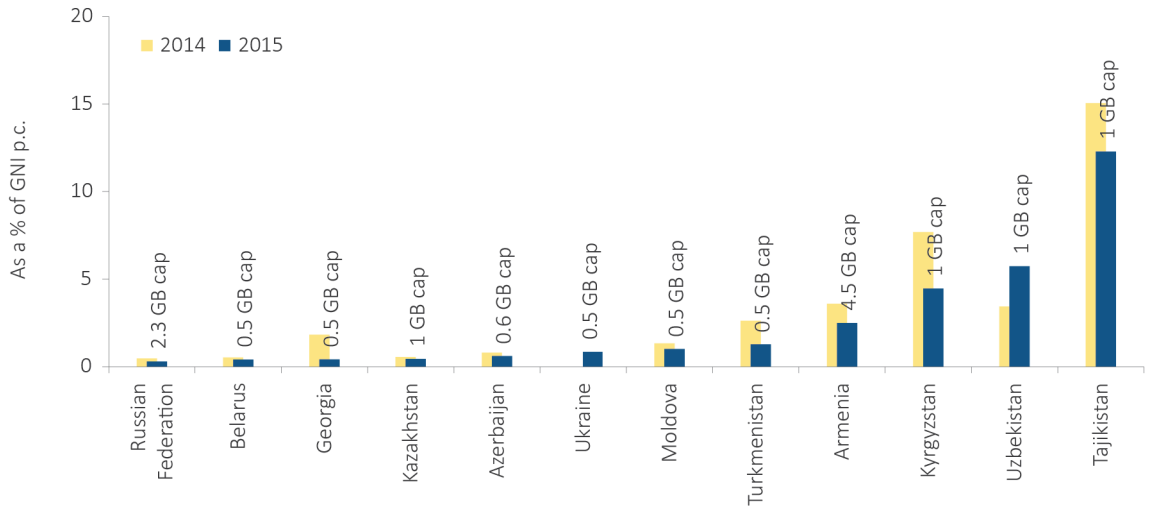
The most affordable mobile-broadband services in the CIS were found in the Russian Federation. There were five additional countries (Belarus, Georgia,[48] Kazakhstan, Azerbaijan and Ukraine) where the cost of the service represented less than 1 per cent of GNI p.c. and was therefore relatively affordable.

In Ukraine, the roll-out of 3G networks in 2015 is making mobile-broadband services available to a larger share of the population, which previously only had narrowband mobile Internet access (through GPRS technology).[49] Coupled with the relatively affordable price of the service, the extension of 3G networks in Ukraine is expected to boost mobile-broadband adoption, which was among the lowest in the region in 2015 at less than 10 subscriptions per 100 inhabitants.

Europe:

Europe has the most affordable prepaid handset-based mobile-broadband prices of all regions. Most countries in the region have prices that correspond to less than 1 per cent of GNI p.c. and

Chart 4.22: Prepaid handset-based mobile-broadband prices (500 MB per month) as a percentage of GNI p.c. and data volume (cap) included, in the CIS region, 2015 and 2014

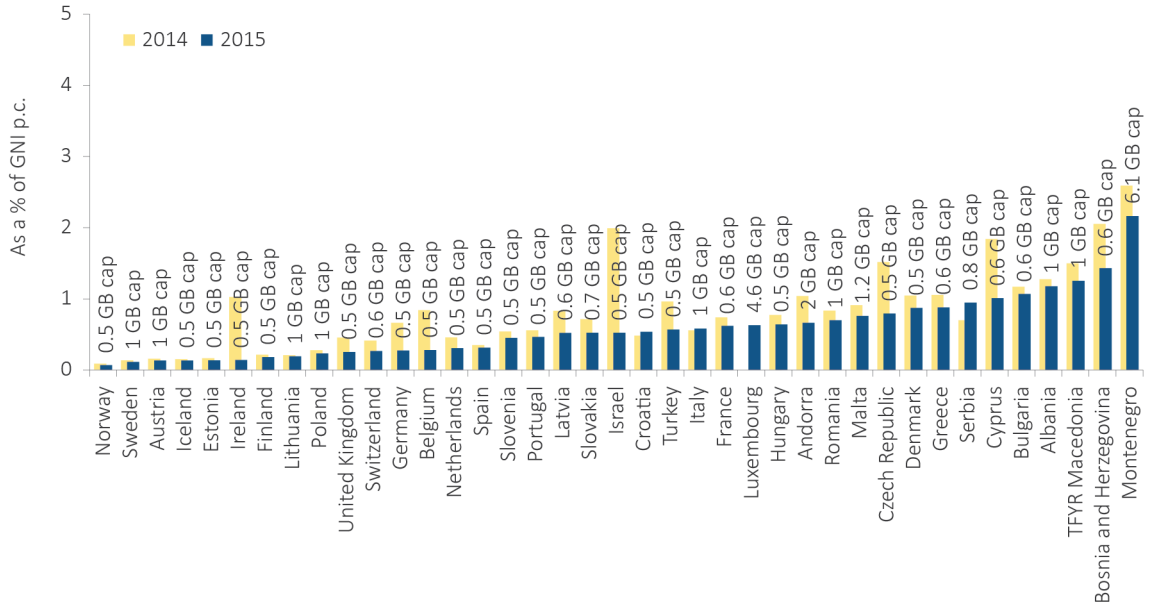


Note: Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries. The caps indicated refer to the 2015 prices.
Source: ITU. GNI p.c. values based on World Bank data.

Norway, Sweden, Austria, Iceland, Estonia and Ireland have the most affordable prices worldwide, representing less than 0.15 per cent of GNI p.c. (Chart 4.23).

Competition in the European mobile markets continues to be strong and data is the main determinant in the pricing of mobile services, which are often contracted as a bundle. The powerful downward pressure on mobile prices exerted by competition is thus also having an impact on the affordability of prepaid handset-based mobile-broadband services. Indeed, more than one third of European countries saw a reduction in prices in 2015. The price reduction was greatest in Ireland, Israel, the Czech Republic, Cyprus and Bosnia and Herzegovina.

Chart 4.23: Prepaid handset-based mobile-broadband prices (500 MB per month) as a percentage of GNI p.c. and data volume (cap) included, in Europe, 2015 and 2014



Note: The caps indicated refer to the 2015 prices.
Source: ITU. GNI p.c. values based on World Bank data.

Mobile-broadband services are affordable in Europe not only because of the high income levels in the region, but also because of the low price of the service. Indeed, in countries such as Estonia, Lithuania, Poland, Serbia and Albania prepaid mobile-broadband plans were offered at prices below USD 4 per month in 2015.

The Americas:

Prepaid handset-based mobile-broadband plans priced at less than 5 per cent of GNI p.c. are offered in a majority of countries in the Americas region. These now include the Dominican Republic, where the price reduction between 2014 and 2015 drove prices down below that threshold (Chart 4.24).

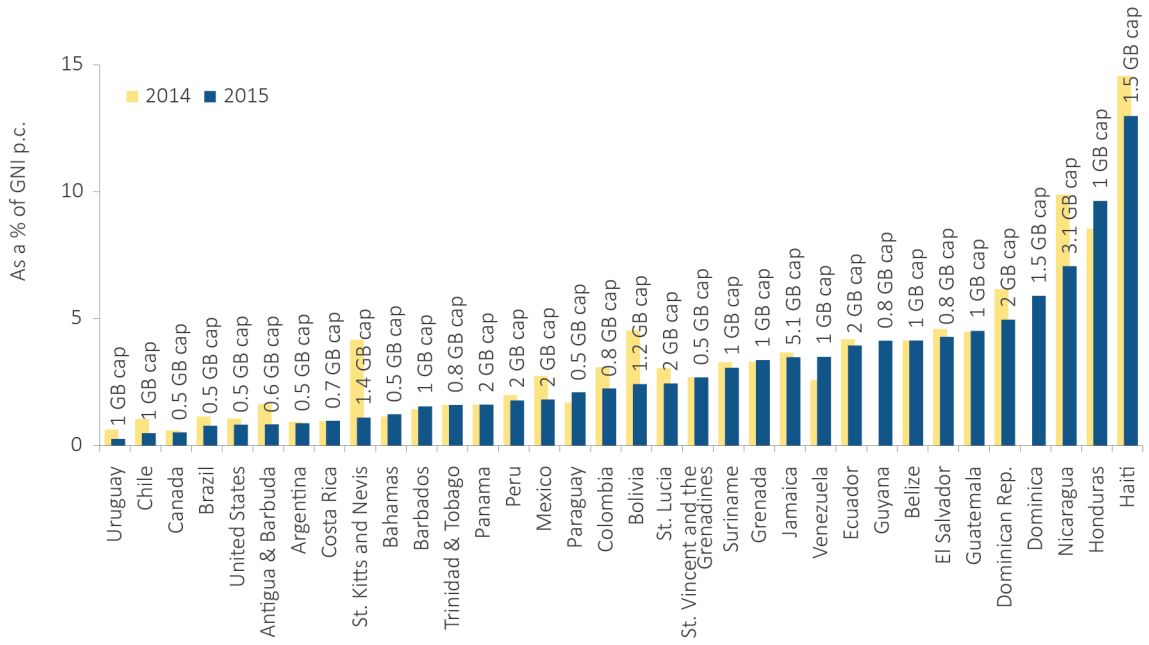
Haiti stands out for having the least affordable mobile-broadband services in the region, as well as very low mobile-broadband penetration (less than one subscription per 100 inhabitants). Honduras and Nicaragua are in a similar situation, with prices representing more than 5 per cent of GNI p.c. and low mobile-broadband uptake (17 and seven subscriptions per 100 inhabitants, respectively). The relatively large data allowances in these three countries suggest that lower prices could be possible if smaller data add-ons were offered.

Uruguay and Chile stand out for having the most affordable mobile-broadband services in the region, with prices below USD 7 per month, corresponding to less than 0.5 per cent of GNI p.c. The high-income countries in North America have relatively affordable mobile-broadband services (representing less than 1 per cent of GNI p.c.) despite much higher absolute prices (USD 22 per month in Canada and USD 38 per month in the United States). Brazil and Costa Rica, the countries in the region with the highest mobile-broadband penetration after the United States, have mobile-broadband prices that also correspond to less than 1 per cent of GNI p.c., thus confirming the link between affordable prices and high mobile-broadband uptake.

4.5 Monitoring the price of bundled services

Not only prices, but also pricing plans and models, change over time, usually to adapt to user needs, address specific income structures and

Chart 4.24: Prepaid handset-based mobile-broadband prices (500 MB per month) as a percentage of GNI p.c. and data volume (cap) included, in the Americas, 2015 and 2014



Note: The caps indicated refer to the 2015 prices.
Source: ITU. GNI p.c. values based on World Bank data.

For the purposes of collecting bundled telecommunication subscriber data, ITU has defined the notion of bundled telecommunication services as a prepaid or postpaid subscription that meets all of the following criteria:

1. A commercial offer that includes two or more of the following services: fixed telephony, mobile voice, fixed broadband, mobile broadband, pay TV.

2. Marketed as a single offer, with a single invoice and single price for the set of services included in the bundle.

3. Subscribed under conditions that cannot be obtained by adding single-play offers together.

affordability issues, and ultimately attract new customers and increase operator revenues.

Over the last decade, the marketing and sale of telecommunication service packages have become increasingly common. The move to higher broadband speeds and convergence over the Internet Protocol (IP) are enabling operators to offer a range of services in one single package. In an attempt to offer customers a better deal, while at the same time increasing customer loyalty by offering a more comprehensive package, service providers are putting together bundles of related – and in some cases unrelated – services and selling them as packages at a price that is lower than the combined prices of the individual services.

Bundling can refer to both fixed and mobile services and can include two, three or more services, including fixed and mobile voice telephony, broadband data and pay television. The packages created are often called bundles or, more specifically, when referring to the number of services involved, double-play, triple-play or quad-play offers. They are also often generically known as "multiplay offers".

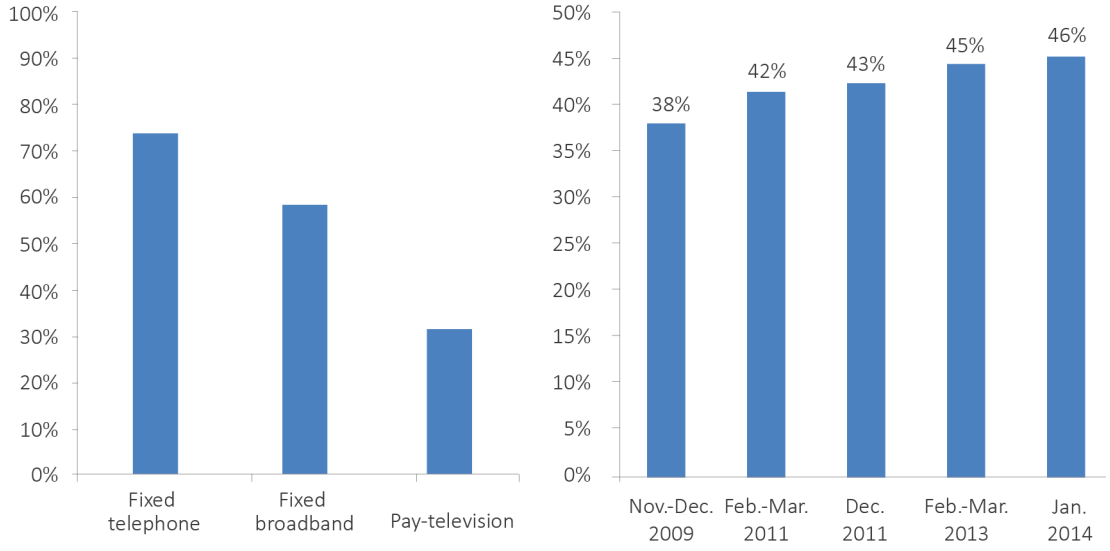
A 2015 OECD report which looked at 12 major OECD economies found that an increasing number of operators no longer offer standalone services. While most operators still offered standalone fixed-telephone services, *"only 23 in 38 provide standalone broadband services and the number drops to only twelve operators if a standalone pay-television offer is requested*" (OECD, 2015c, see 4.25). On the demand side, a 2014 European Union survey showed that almost half of all households in the European Union subscribed to bundled services, up from 38 per cent in 2009 (EC, 2014, see Chart 4.26) . The same survey highlighted the fact that domestic Internet access is more likely to come as a bundled service, and that triple-play bundles have increased by ten percentage points since 2007.

According to the OECD, which started to monitor bundled services in 2010, bundling can "increase competition if it brings more choices, higher quality, or lower prices to consumers from the facilities-based networks providing bundled offers" (OECD, 2015c). At the same time, bundling raises concerns about price transparency, since customers cannot easily compare how much they have to pay for a specific service. It also carries the risk of consumer 'lock in' because bundles make it more complicated to switch from one operator to another for parts of the package. Bundling may also lead to commercial practices considered anticompetitive, for instance by allowing customers to buy a given telecommunication service only if purchased together with another one.[50]

Thus, while monitoring the evolution of bundled offers and prices is relevant from a regulatory and consumer-protection perspective, comparing the prices of bundled services can also be very challenging.

In an increasing number of countries outside the OECD, operators are offering bundles that are similar to those available in OECD countries. For example, Latin America's two largest mobile operators, América Móvil and Telefónica, both offer double- and/or triple-play services combining fixed telephony, fixed broadband and pay TV in several Latin American countries, including Brazil, Chile, Colombia, Ecuador, Honduras, Mexico

Chart 4.25: Availability of standalone offers (% of operators) by service, selected OECD economies (left), Chart 4.26: Proportion of households in the EU that subscribe to bundled (two or more) telecommunication services, 2014 (right)



Note: The left chart relates to the following 12 OECD countries: Australia, Canada, France, Germany, Italy, Japan, Republic of Korea, Mexico, Netherlands, Spain, United Kingdom and United States.
Source: OECD (2015c) (left chart), Eurobarometer (right chart).

and Peru. Other incumbent operators in the region, such as CNT in Ecuador and Oi in Brazil, also offer double- and triple-play packages. In some cases, quadruple-play bundles including mobile services are also on offer.[51] Although in a number of countries with very limited fixed-line infrastructure, including some least developed countries, bundled services based on the fixed network are offered, mobile-based bundles are likely to be more relevant for such countries.[52]

How to measure bundles

Since bundles are created from a set of individual services, these may retain their original price structure, as shown in Figure 4.4.

Benchmarking prices for bundled services is far more challenging than it is for individual services, as the structures and properties of all the bundled services must be considered together. Basically, there are two main ways to ensure a proper like-for-like comparison:

1. Comparing similar structure bundles

    a. By ensuring that the bundles included in the comparison have more or less the same structure (e.g. all are double play)

    b. … and that the same types of service are included in all bundles (e.g. all have fixed broadband and fixed voice)

    c. … and that all the included services have similar properties (e.g. all fixed-broadband services fall within a given speed range).

2. Comparing multiplay services

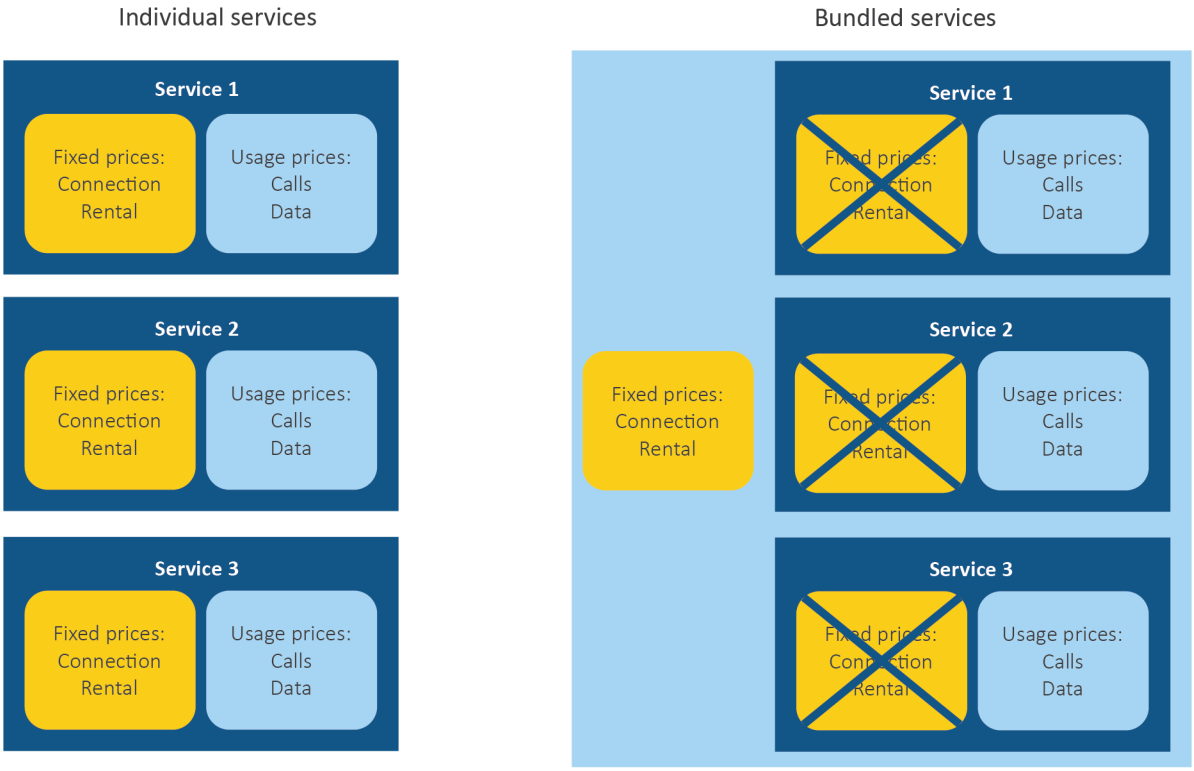
    d. By building a "super-basket" with requirements and definitions for all services covered by the bundles.

    e. For each bundle, by ensuring that all requirements are fulfilled

    f. … and, where a bundle does not offer all the services required, by filling the gaps with the best possible service that can be bought individually.

Methodologies have been developed for the two types of comparison listed above, but they do give different types of result and should be used for different purposes. The "comparison of similar structure bundles" is the simpler approach, and is useful for comparing the prices of bundles only. This method can be used with or without inclusion of the individual service usage element, i.e. it is possible to compare only the fixed prices, or also

Figure 4.4: Individual price structure vs. bundle price structure



Source: Strategy Analytics based on research in OECD countries.

to include usage elements in respect of voice calls, data, TV channel packages, etc. However, this type of comparison allows for analysis of only one specific type of bundle at a time, potentially requiring a multitude of different, parallel analyses that may create different outcomes, depending on which bundle combination is being considered.

Where the objective is to compare the end-user cost for a specific set of services and to compare across different types of offer, the more comprehensive "multiplay comparison" could be used, as this takes more elements into account and will yield more detailed results. This type of approach is more flexible and can be used to compare different types of bundle; however, it does require a much broader and more detailed set of data, and its application to broader international benchmarking exercises will be limited owing to the amount of data that needs to be collected and processed. Data from the majority of providers in a given country are typically included, across all services.

Typical bundle structures

Bundles are most commonly made possible by the utilization of an underlying network, whereby several, if not all, of the bundled services benefit from a common transport network. This can, for example, include fixed-broadband and fixed-telephony services delivered over the copper line of traditional fixed-line operators; or fixed-voice, fixed-broadband and TV services delivered over the coaxial cable of a cable TV network. These examples show that the types of service offered in bundles may vary with the type of network operated by the provider. A cable TV provider will typically approach bundling from a different angle than a provider with a copper-pair based network. The most typical combinations found in OECD countries are shown in Table 4.10.

With the development of LTE mobile networks, the distinction between fixed and mobile services is becoming less important, and there are now five-play offers available that are based either on mobile networks only, with fixed-location services based on mobile networks, or on a combination of fixed and mobile networks.

Table 4.10: Most common bundle combinations found in OECD countries

Network	Category	Fixed voice	Fixed broadband	Mobile voice	Computer-based mobile broadband	TV
Fixed, copper	Double play	✓	✓			
	Triple play	✓	✓			✓
Cable TV	Double play		✓			✓
	Triple play	✓	✓			✓
Mobile	Double play			✓	✓	
	Triple play	✓		✓	✓	

Note: * Fixed voice under mobile bundles will typically mean fixed-location services based on mobile networks.
Source: Strategy Analytics based on research in OECD countries.

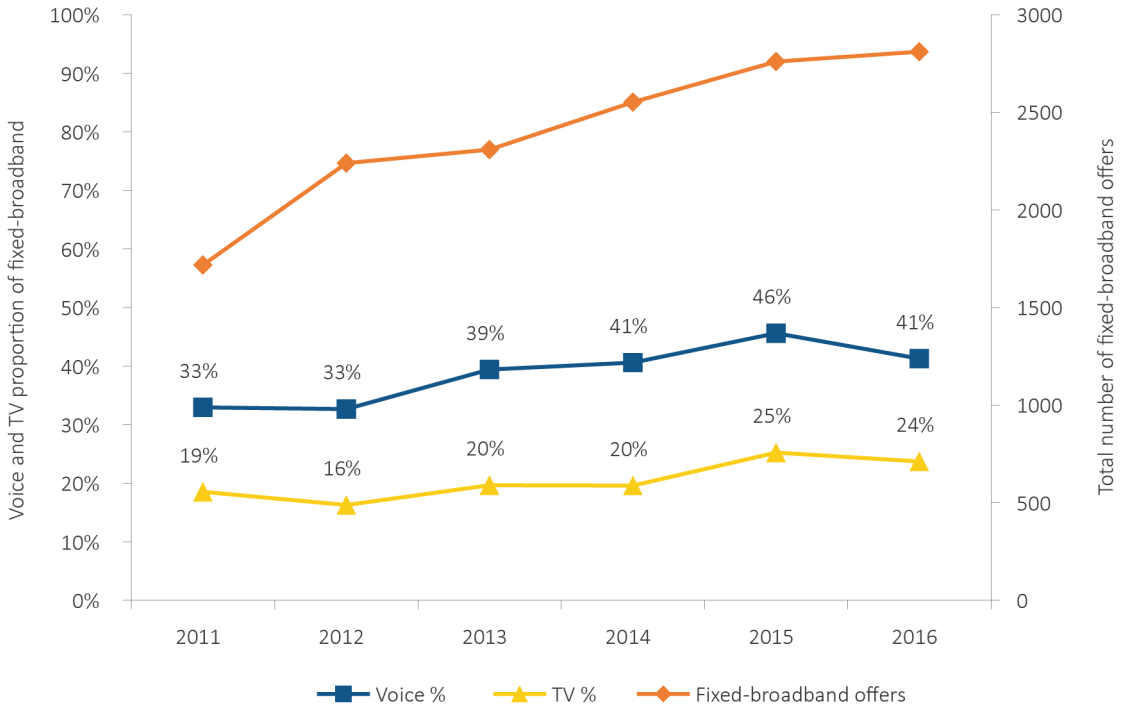
Also, for developing countries, where fixed-network services may be more limited, typical bundles may be based on mobile networks, with double-play combinations of mobile voice and mobile broadband. Mobile-based bundles may also increasingly contain fixed-location services based on mobile networks.

From individual to bundled fixed-broadband price benchmarking

The OECD has for many years been benchmarking fixed-broadband services as offered by fixed-line and cable TV providers. While the methodology adopted in 2010 focused on individual fixed-broadband services, it has become increasingly difficult to subscribe to fixed broadband on its own. However, to facilitate further analysis, the fixed-broadband information collected also contains indicators for bundling with fixed-voice and TV services, which allows a basic analysis of the availability and pricing of double- and triple-play bundles based on fixed networks.

Chart 4.27 shows the proportion of basic fixed-broadband offers that include either voice or TV services in the OECD countries. In 2016, 41

Chart 4.27: Voice and TV services included in fixed-broadband offers, OECD



Note: Total fixed-broadband offers include standalone/'naked' fixed-broadband offers, as well as offers that include fixed-broadband services combined with voice services and fixed-broadband services combined with TV services.
Source: OECD/Strategy Analytics Ltd.

per cent of all fixed-broadband offers (including standalone) across the OECD countries include the fixed-voice service element, as compared to 33 per cent in 2011. Basic TV services are included in 24 per cent of 2016 fixed-broadband offers, as compared to 19 per cent in 2011.

Not all providers in OECD countries offer bundles, but the vast majority of fixed-broadband providers will have some kinds of bundle that include a combination of fixed broadband with either fixed voice or TV services, or both.

Price comparisons for bundled services

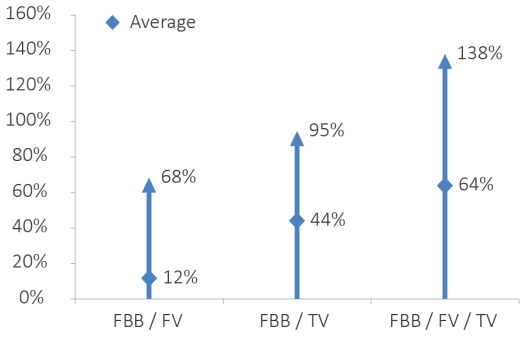
The pricing of bundled services in the OECD varies immensely. In some countries, the inclusion of fixed voice on top of fixed broadband is "free", i.e. only the voice calls are payable in addition to the basic fixed broadband prices. In other countries, it is more common to pay an additional 10 to 30 per cent or more on the fixed price in order to have the fixed-voice service in addition to fixed broadband.

Chart 4.28 shows the additional price, over and above the best fixed-broadband price, for adding a fixed-voice service and/or a TV service. The additional price is shown as a percentage above the price of the cheapest fixed-broadband service in the country, for a broadband speed above 1.5 Mb/s and at least 5 GB data usage. The fixed-broadband service may differ between the three scenarios, as higher speeds are required to support TV services.

Among the OECD and EU countries, the actual price of the cheapest fixed-broadband offer varies by country, and ranges from 9 PPP$ per month (Lithuania, 2 Mbit/s) to 49 PPP$ per month (Spain, 20 Mbit/s). At the same time, the cheapest fixed-broadband offers may also include different services, making comparisons more difficult. The Spanish offer, for example, includes a fixed-voice service, while in Lithuania the addition of fixed voice increases the cost considerably. The range of speeds for the cheapest fixed-broadband services found in each country varies considerably, from 2 Mb/s to 100 Mb/s.

Chart 4.29 shows the added cost of bundling a fixed-voice service on top of the fixed-broadband

Chart 4.28: Price range over and above the price of the cheapest individual fixed-broadband offer, selected OECD countries, January 2016



Note: FBB refers to fixed broadband. FV refers to fixed voice. TV refers to television. Out of a total 40 OECD/EU countries, this chart covers 27 countries included in the FBB / FV data, 30 countries in the FBB / TV data, and 36 countries in the FBB / FV / TV data.
Source: OECD/Strategy Analytics Ltd.

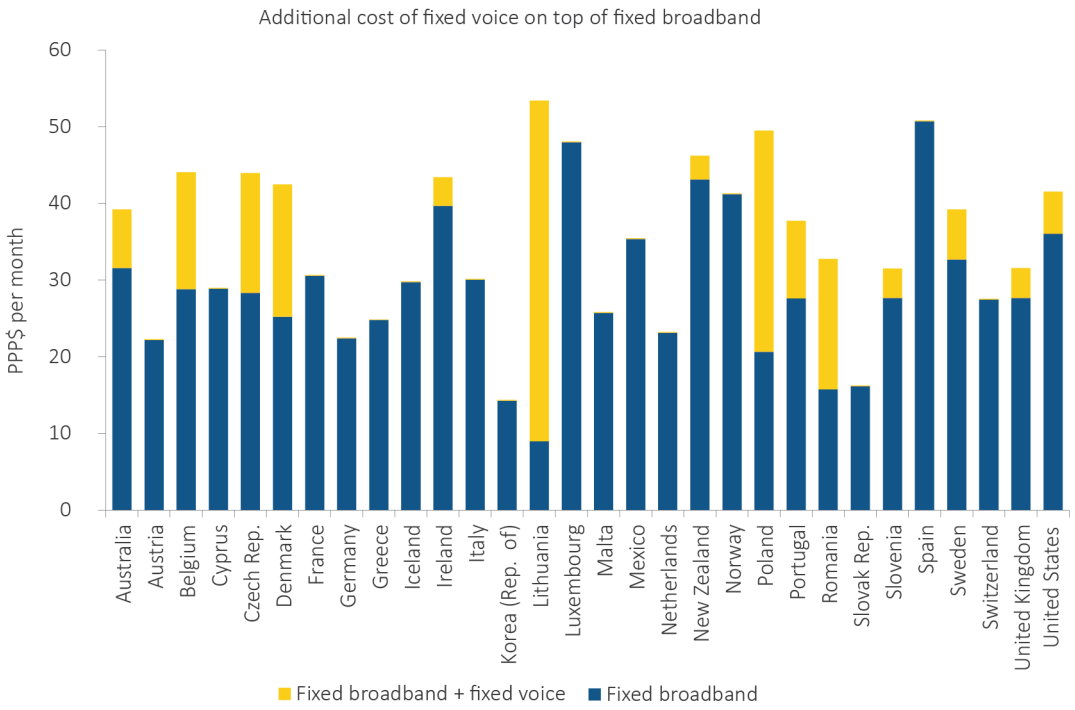
service in selected countries. It should be noted that in many countries the fixed-voice service is already included in the cheapest fixed-broadband offer.

Adapting international ICT price comparisons

The above analysis highlights the fact that, because of technological changes and new commercial practices in an increasing number of countries, telecommunication services are bundled. Although countries with limited fixed networks are likely to offer more mobile-network-based bundles, standalone services will become less common as more countries move towards high-speed networks and services.

This will make price comparisons of individual services less relevant, and the monitoring of ICT price developments more challenging, in all parts of the world. Indeed, as more countries offer bundled-only services, international price comparisons will have to take this trend into account and the corresponding methodologies will need to be reviewed. One first step could be to carry out an analysis of the types of bundle available in all parts of the world, so as to understand and monitor the trend from individual to bundled telecommunication services.

Chart 4.29: Price difference for bundling fixed voice with fixed broadband, selected OECD/EU countries, March 2016



Note: Where there is only a small marker on top of the fixed-broadband bar, the additional cost of having a fixed-voice service on top of the fixed-broadband service is zero, i.e. the cheapest offer already includes fixed voice. The OECD fixed broadband price benchmarking is based on 3 providers per country, with one xDSL provider, one cable TV provider, and the next large provider. However, the type of provider may vary as not all countries have extensive cable TV networks.
Source: OECD/Strategy Analytics Ltd, March 2016.

Endnotes

1 See, for example, Facebook (2015) and ISOC (2015). Both reports highlight access/infrastructure, content and affordability as key barriers to ICT access and use.

2 World Bank (2016), page 218: "*Up-to-date price data will allow for comparisons, both within the country (between operators and over time) and between countries, using appropriate comparators. Armed with data, the next step is to work out in which part of the value chain for the supply of internet the market may be failing*."

3 See, for example, Facebook (2015) as well as Drossos, A. (2015), Eisenach, J.A. (2015) and The Economist (2015).

4 See Telecom Regulatory Authority of India (2016) and Abutaleb, Y. and Menn, J. (2016).

5 Since the study was published, India has banned all discriminatory tariffs for data services.

6 See ISOC (2015), p. 16.

7 For example, if country A and country B have the same price in USD for any given ICT service, but in country A prices of other products are in general cheaper (in USD), then applying PPP exchange rates to the price of the ICT service in country A will make this service more expensive. That is so because, compared to country B, in country A the same amount of USD (exchanged into national currency at market exchange rates) can buy more products or services. Therefore, the ICT service in country A is more expensive in terms of what could be bought with that amount in each country. The International Comparison Program (ICP) is the major global initiative to produce internationally comparable price levels. For more information on the PPP methodology and data, see http://icp.worldbank.org.

8 GNI takes into account all production in the domestic economy (i.e. GDP) plus the net flows of factor income (such as rents, profits and labour income) from abroad. The Atlas method smooths exchange-rate fluctuations by using a three-year moving average, price-adjusted conversion factor. See: http://data.worldbank.org/indicator/NY.GNP.PCAP.CD.

9 In the 2015 targets set by the Broadband Commission for Digital Development, 5 per cent of monthly income was the reference set for *making broadband affordable*. The ITU Connect 2020 Agenda incorporates a similar reference value in Target 2.3.B: "*Broadband services should cost no more than 5% of average monthly income in developing countries by 2020*". Throughout this section, the 5 per cent of GNI p.c. is used as a rule of thumb to determine the affordability of mobile-cellular prices.

10 Mobile-cellular subscriptions increased by 2 per cent globally, the lowest growth rate in the last 10 years.

11 For example, in Senegal, Orange offers a series of prepaid packages called "Illimix". These packages include bundles of services ranging from 60 on-net and 10 off-net minutes to unlimited on-net calls, SMS and 1 GB of data. Most of these packages have a validity of one day, except the top package that is valid for a week.

12 In parallel to the increase in mobile voice minutes, fixed-telephone minutes are decreasing in most countries, thus suggesting that there may be a fixed-mobile substitution effect in voice usage.

13 The number of SMS sent per subscription is decreasing in most developed countries, suggesting that many customers are substituting SMS with instant messages, using applications such as WhatsApp that operate on top of the Internet and require a mobile data connection. In the developing world, the downward trend in the volume of SMS is not so strong: there are only a few more countries in which the number of SMS sent is decreasing than countries in which it is increasing.

14 Mobile-cellular prices in Syria have been above the global and regional averages since ITU started publishing the ICT Price Basket. Indeed, the cost of the mobile-cellular basket in Syria has been above USD 80 per month since 2008, reaching a maximum of USD 95 per month in 2015.

15 Three transnational operators offer mobile-cellular services in Sudan: MTN, Sudatel and Zain. Unlike in other mobile markets in the Arab States where the incumbent retains a very large market share, none of the three operators in Sudan accounts for more than 45 per cent of total subscriptions. As a result, the Sudanese mobile market is very competitive, with a Herfindahl-Hirschman Index of 0.34, on a scale of 0 to 1, where 0 denotes perfect competition and 1 a monopoly. Data source: GSMA Intelligence, Q4 2015 data.

16 In December 2015, a second mobile licence was awarded to the operator Telma as a first step in the process of market liberalization. In addition, a public-private partnership has been created with the fibre-optic assets of Comoros Telecom in order to separate the incumbent's retail and the wholesale operations. Together with the deployment of an additional undersea cable (FLY-LION) in a project coordinated by the World Bank, these initiatives aim to ease the international connectivity bottleneck and prepare the telecommunication market for its effective liberalization. Sources: "How the WDR16 Policy Framework is applied in the Union of Comoros", World Bank ICT4D Blog, 13 January 2016; "Union des Comores : un procesus d'attribution de licence de communications électroniques réussi", Press release from the Autorité Nationale de Régulation des TIC de Comores, 22 January 2016.

17 Data on mobile-cellular prices were available for 12 CIS countries in 2015. This compares with mobile-cellular price data available for 43 countries in Africa, 22 in the Arab States, 39 in Asia and the Pacific, 42 in Europe and 35 in the Americas.

[18] Georgia exited the Commonwealth on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries.

[19] Source: One2Many's Dynamic Tariffing available at: http://www.one2many.eu/en/portfolio/dynamic-tariffing.

[20] Source: Digitata's Case Studies available at: http://www.digitata.com/about-digitata/case-studies.

[21] Ibid.

[22] Ibid.

[23] It should be noted that in 2014 the price of fixed-broadband services fell in only six LDCs, remained the same in more than half of all LDCs, increased slightly in two LDCs, and increased substantially in two others (Uganda and Rwanda). The high prices in these latter two countries had a sizeable impact on the average, especially because complete price data for the period 2008-2015 are only available for 25 LDCs. In the remaining LDCs, fixed-broadband services were not available or not advertised during one or more years in that period. While in 2015 prices remained high in Uganda, they dropped substantially in Rwanda, as well as in a number of other countries, including Zambia and Mali.

[24] Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries.

[25] The only exception being oil-rich Equatorial Guinea, in which the household final consumption expenditure per capita was USD 272 per month in 2015. Household final consumption expenditure is an indicator produced in the context of national accounts and therefore does not reflect income and consumption inequalities. As a result, depending on the distribution of income/consumption within the population, the actual economic wealth of most households may be significantly lower than the average value derived from the national accounts. Data from household income and expenditure surveys provide better indicators to measure household economic wealth, but data availability is limited in developing countries. For more information, see pp. 140-146 in ITU (2014a).

[26] Measured in terms of household final consumption expenditure per capita, income levels are seven times higher in Ireland than in Equatorial Guinea, the LDC with the highest household final consumption expenditure per capita (of all those with data available).

[27] Of 44 LDCs with data available on fixed-broadband prices in 2015, 37 had a fixed-broadband penetration rate below one subscription per 100 inhabitants. In Bangladesh, there were 2.4 fixed-broadband subscriptions per 100 inhabitants, and 3.6 in Bhutan.

[28] In Burundi, CBINET offers contention ratios for ADSL services of 1:4. Contention ratios for common residential fixed-broadband plans are around 1:15 in most countries.

[29] For an example of the issues relating to ISP access to the wired local loop in many LDCs, see ITU (2013).

[30] For more details on the development opportunities that IoT brings, see Chapter 5 in ITU (2015), and ITU and Cisco (2016).

[31] Data on mobile-broadband prices were collected from 2010 to 2014 through the ICT Price Basket Questionnaire, which is sent out annually to all ITU Member States/national statistical contacts. Since 2015, data on mobile-broadband prices have been collected by ITU from operators' websites.

[32] Source: ITU calculation based on GSMA data on LTE deployments.

[33] "On the move" refers to use of the Internet while mobile via a mobile cellular telephone or other mobile access devices, for example, a laptop computer, tablet or other handheld device. For developing countries, it refers to Internet use through the above mentioned devices connected to a mobile phone network and if the location is away from "home", "work", "place of education", "another person's home" and "community and commercial access facilities". For European countries, it refers to Internet use through the above mentioned devices "away from home and work". For more information on the definitions of Internet use by location, see page 55 in *Manual for Measuring ICT Access and Use by Households and Individuals 2014* available at: http://www.itu.int/en/ITU-D/Statistics/Pages/publications/manual2014.aspx.

[34] Of the 25 countries (16 developing and nine developed) that reported mobile and fixed Internet data traffic in the period 2013-2014, 80 per cent reported more fixed-broadband Internet traffic than mobile-broadband Internet traffic, despite the fact that in all of them there were more mobile-broadband subscriptions than fixed-broadband subscriptions.

[35] See, for instance, OECD (2013) for an analysis of how the cost of the smartphone affects the total cost of ownership in OECD countries. Further information on the recent average selling prices of smartphones in Sub-Saharan Africa and their impact on affordability of mobile services in the region are presented in GSMA (2016c).

[36] According to the World Bank, 38 per cent of the population in Bhutan lived in urban areas in 2014.

[37] Source: Bhutan Telecom, http://www.bt.bt/?page_id=183.

[38] Source: TashiCell, http://www.tashicell.com/posts/tashicell-3g-services.

[39] Source: Bhutan Telecom, http://www.bt.bt/?page_id=3683.

[40] By the end of 2015, Bhutan Telecom's LTE coverage was below 1 per cent of the population of the country.

[41] Source: TashiCell: http://www.tashicell.com/posts/tashicell-4g-services.

[42] See for instance TaahiCell's campaign to exchange 3G data cards with 4G USD devices, http://tashicell.com/posts/3g-data-card-exchange-offer.

[43] The change in mobile-broadband prices between 2014 and 2015 is analysed in local currency so that the effects of exchange-rate fluctuations or changes in GNI p.c. are screened out.

[44] ITU's definition of computer includes desktop computers, laptop (portable) computers and tablets (or similar handheld computers). Smartphones are not considered as computers.

[45] Liberia has the second lowest GNI p.c. of all countries for which data are available on mobile-broadband prices, higher only than Malawi's.

[46] For more information on the Cambodian mobile-broadband market, see Box 4.7 in ITU (2015).

[47] Prepaid handset-based mobile broadband is selected for the analysis because it is the mobile-broadband service which holds the greatest potential for development. Indeed, handset-based subscriptions are much more widespread than computer-based subscriptions, and most handset-based subscriptions in the world are prepaid. This suggests that the affordability of prepaid handset-based mobile-broadband services will be a key enabling factor if the "mobile miracle" (i.e. the mass uptake of regular mobile-cellular services) is to be replicated in the broadband arena.

[48] Georgia exited the CIS on 18 August 2009 but is included in the ITU/BDT administrative region for the CIS countries.

[49] For more information on 3G deployments in Ukraine, see Kyvistar's press release of 27 May 2016 at http://www.kyivstar.ua/ru/kr-620/press_center_new/news/?id=58604.

[50] For a discussion on bundling in the European Union, including market trends and regulatory issues regarding the bundling of services, see BEREC (2010) and OECD (2015c).

[51] See, for instance, the quadruple-play offer from Claro in Brazil: http://www.combomulti.com.br.

[52] In Senegal, for example, Orange's Home+ offer includes fixed-telephony, fixed-broadband Internet and TV services. See Orange Senegal Home+ at: http://www.home.sn/.

Chapter 5. Measuring mobile uptake

Key findings

Mobile phone adoption has largely been monitored based on mobile-cellular subscription data since these are widely available and regularly collected and disseminated by regulators and operators. At the end of 2016, there are almost as many mobile-cellular subscriptions as people on earth and 95 per cent of the global population lives in an area that is covered by a mobile-cellular signal. However, since many people have multiple subscriptions or devices, other metrics need to be produced to accurately assess mobile uptake, such as the number of mobile phone users or mobile phone owners.

Many people still do not own or use a mobile phone. Household data from developing countries show that a significant part of the population does not use mobile-cellular services at all. In developing economies where recent household data is available, close to 20 per cent of the population, on average, are still not using a mobile phone. The proportion of mobile-phone ownership is even lower, especially in large developing economies such as Bangladesh, India, Indonesia and Pakistan, where more than 40 per cent of the population do not own a mobile phone.

Most people who do not own or use a mobile phone are among the youngest (5-14 years old) and the oldest (>74 years old) segments of the population. Usage and ownership penetration rates amongst these age groups are much lower than amongst the rest of the population. Among the 15-74 age group, 85 per cent or more of the population owns or uses a mobile phone in the countries where data are available.

Significant gender gaps exist in mobile-phone adoption and the gap is larger for mobile-phone ownership than for mobile-phone use. Many women in developing countries rely on someone else's mobile phone or SIM card to access mobile-cellular services. The gender divides are associated with differences in income and educational attainment, and reflect other types of social divides. Most people not owning or using a mobile phone have lower incomes and are less educated.

People living in rural areas are less likely to own or use a mobile phone than people in urban areas. In several developing countries, sizeable segments of both the urban and the rural population do not yet own or use a mobile phone. Although basic mobile infrastructure is available for most of the global population living in rural areas, rural populations tend to have lower incomes and lower education levels, which are in turn linked to lower mobile-phone ownership and usage.

Affordability is the main barrier to mobile-phone ownership. It is the cost of the handset, rather than the cost of the service itself, which is often reported as the main barrier to owning a mobile phone. Another important barrier is the lack of perceived benefits. In communities where overall mobile uptake is low, mobile phone use is perceived to have fewer benefits since fewer community members are also using this mode of communication. Other barriers include poor network quality and lack of ICT skills necessary for accessing the Internet through a mobile phone.

Universal use of mobile-cellular services has not been achieved yet. Policy-makers and the telecommunication industry in developing countries should focus on targeted policies for promoting mobile adoption. As the 2030 Agenda for Sustainable Development has pledged, ICTs can be a strong empowerment tool, and no one should be deprived of their benefits because of economic, educational, social or technical barriers.

Chapter 5. Measuring mobile uptake

5.1 Introduction

Mobile-cellular services have witnessed unprecedented growth over the last 15 years, and have taken a prominent place among the world's most ubiquitous technologies: in some countries, more people have access to mobile-cellular services than to a bank account, electricity or clean water (World Bank, 2012). In the time-span covered by the Millennium Development Goals (MDGs, 2000-2015), the number of mobile-cellular subscriptions has increased ten-fold, from 738 million to over 7 billion.

This phenomenon has been described as the "mobile miracle", and has driven broad societal and economic transformations. Indeed, mobile-phone usage has changed not only the way people communicate, but also the way they plan their daily lives, organize themselves socially, and access educational, health, business and employment opportunities (Castells et al., 2007; GSMA et al., 2010; PewInternet, 2012; Vodafone, 2013).

Developing countries have embraced mobile technologies following a "mobile first" approach, insofar as other ICTs have very limited reach in the developing world. This has spurred genuine ICT innovation from the developing world in the mobile arena, in forms such as low-cost and multi-SIM mobile phones, low-value prepaid refills and mobile-money services (World Bank, 2012). These innovations have contributed to making mobile-cellular services more pervasive and inclusive, thus transforming mobile technology into a powerful development tool for empowering entrepreneurs, women, young people, vulnerable groups – in fact, virtually anyone (Broadband Commission, 2013; UNDP, 2012).

As the international community moves on from the MDG timeframe to that of the sustainable development goals (SDGs, 2015-2030), the question remains as to whether universal mobile-phone usage has been achieved as a means of fulfilling the pledge of the 2030 Agenda for Sustainable Development that "No one must be left behind". This question is even more relevant given the role that mobile technologies can play as development enablers for those at the bottom of the pyramid.

Data on the population living in an area covered by a mobile signal and data on the number of mobile-cellular subscriptions show that the two are almost equal to the global population (Chart 5.1). Country-specific disaggregated data, however, show that some segments of the population do not yet use or own a mobile phone, for example numerous women in low- and middle-income countries (GSMA, 2015; GSMA and LIRNEasia, 2015) and the lowest-income segments of the population in developing countries (InfoDev 2012a, 2012b; CKS Consulting, 2012; Galpaya, H. et al., 2015).[1]

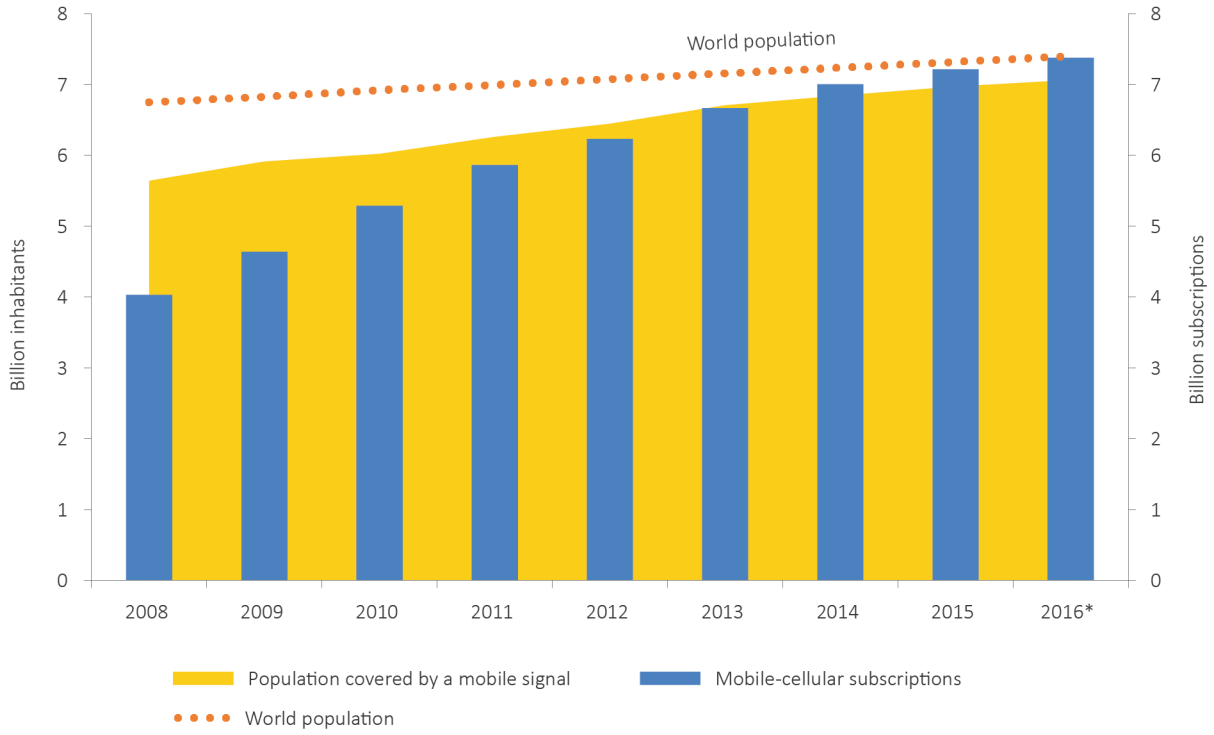
Despite the large numbers of mobile-cellular subscriptions at global level, hundreds of millions of people in the world do not use or own a mobile phone today. This chapter analyses the available data on mobile-phone ownership and usage, provides insights into who does not own or use a mobile phone today, and highlights some of the main barriers preventing such people from connecting to the basic mobile network.

These data will contribute to informing some of the targets identified in the 2030 Agenda for Sustainable Development, for example those under Goal 5, which calls for "the use of enabling technology, in particular information and communications technology, to promote the empowerment of women" (United Nations, 2015). This chapter also aims to raise awareness among ICT policy-makers regarding the current status of mobile-phone uptake and the challenges that must be overcome in order to strengthen digital inclusion through universal mobile-cellular uptake, particularly in developing countries.

5.2 Moving beyond subscriptions: phone owners and users

The most widely available indicator for measuring the uptake of mobile-cellular services is the number of mobile-cellular subscriptions (Box 5.1). This indicator is reported by telecommunication operators and therefore provides information

Chart 5.1: Global mobile-cellular subscriptions and population coverage, 2008-2016*



Note: * Estimates.
Source: ITU.

from the supply side. In contrast to demand-side statistics, which are established based on national household surveys that include questions on mobile-phone ownership and usage, supply-side statistics are less expensive to establish because their collection does not entail the costs associated with conducting surveys. Indeed, supply-side statistics simply require administrative notifications from mobile operators and are often publicly disclosed by listed operators as part of their annual or quarterly reports.

The subscription (i.e. a SIM card in most cases) is the basic revenue-generating unit for mobile operators, and data on mobile-cellular subscriptions have therefore traditionally been used by the mobile industry to gauge size and trends in mobile markets. When the metric was originally introduced over a decade ago, most mobile users had a single subscription and it was therefore statistically valid to assume that subscriptions equaled subscribers. However, as the price of handsets and services fell and prepaid services became popular and coverage ubiquitous, it became common in many markets for users to have multiple SIM cards and mobile devices, from handsets to tablets and other data-centric devices.

The mobile-cellular-subscription indicator is thus becoming obsolete[2] as it refers to registered SIM cards rather than people, and should therefore be interpreted with caution when drawing conclusions on the uptake of mobile-cellular services. Specifically, the following issues should be considered:

- **Double counting:** one person can own and use multiple subscriptions. For instance, a single subscriber may have one subscription at home and one at work, or decide to have several subscriptions with different operators in order to benefit from special offers or lower on-net prices.[3] The latter is more common in mobile markets that are predominantly prepaid and in which mobile termination rates are relatively high.

  According to GSMA Intelligence, unique mobile subscribers tend to use on average 1.45 SIM cards globally, while subscribers in countries such as South Africa, UAE, Saudi Arabia, the Russian Federation or Côte d'Ivoire use more than two SIM cards each on average.[4] These findings are in accordance with available data on dual-SIM handsets. Indeed, more than

Box 5.1: Definitions of selected indicators to measure mobile-cellular uptake included in the Core List of ICT Indicators of the Partnership on Measuring ICT for Development

Supply side:

- Mobile-cellular subscriptions: Number of subscriptions to a public mobile-telephone service that provide access to the public switched telephone network (PSTN) using cellular technology. The indicator includes the number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months). The indicator applies to all mobile-cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging, M2M and telemetry services.

Demand side:

- Proportion of individuals using a mobile-cellular telephone: proportion of individuals who used a mobile telephone in the last three months. A mobile (cellular) telephone refers to a portable telephone subscribing to a public mobile telephone service using cellular technology, which provides access to the PSTN. This includes analogue and digital cellular systems and technologies such as IMT-2000 (3G) and IMT-Advanced. Users of both postpaid subscriptions and prepaid accounts are included.

- Proportion of individuals who own a mobile phone: An individual owns a mobile cellular phone if he/she has a mobile-cellular phone device with at least one active SIM card for personal use. It includes mobile-cellular phones supplied by employers that can be used for personal reasons (to make personal calls, access the Internet, etc.) and those who have a mobile phone for personal use that is not registered under his/her name. It excludes individuals who have only active SIM card(s) and not a mobile phone device.

Source: ITU.

50 per cent of Android users in developing countries such as Nigeria, Bangladesh and Tanzania have a dual-SIM handset, as against fewer than 5 per cent in the United Kingdom and the United States (OpenSignal, 2015).

Disparities in multiple SIM usage and ownership make the relationship between mobile-cellular subscriptions and mobile users different across countries, and may also conceal inequalities within countries.[5]

- **Counting of inactive subscriptions:** it is difficult to track active mobile-cellular subscriptions accurately in markets that are predominantly prepaid.[6] The maintenance of a prepaid subscription does not necessarily imply a payment and there tend to be significantly more registered subscriptions than active subscriptions. For example, in the Central African Republic, there were 1.2 million active mobile-cellular subscriptions in 2014, as against 2.1 million registered subscriptions in the same year. In Benin, there were 8.7 million active mobile-cellular subscriptions in 2014, as against 10.6 million registered subscriptions. GSMA Intelligence estimates that 7 per cent of global subscriptions (excluding M2M) were inactive in 2015.

New regulations concerning the taxation of registered subscriptions have prompted operators in some countries to clean up the subscriber base. For example, a new tax on numbering resources approved in Guatemala in 2014 prompted operators to return several numbers, and caused a 22 per cent reduction in the number of active mobile-cellular subscriptions reported.[7] Likewise, a new law passed in Ecuador in 2015 imposing taxation on the number of active mobile lines produced a 20 per cent drop in the

number of mobile-cellular subscriptions.[8] New regulations concerning SIM card registration also tend to have the side-effect of cleaning up the subscription base. This was the case, for instance, in the Lao People's Democratic Republic, where the enforcement of mandatory SIM card registration in 2015 led to a 19 per cent decrease in the number of mobile-cellular subscriptions .

The difficulties in collecting accurate data on active mobile-cellular subscriptions may lead to overestimation of actual mobile-cellular uptake in some countries.

- **Non-consideration of shared subscriptions:** the sharing of mobile phones and mobile-cellular subscriptions is not uncommon in the lowest income segments of the population, but it is not reflected in mobile-cellular subscription figures.

  Studies conducted in developing countries in Africa and Asia show that numerous people may not have a subscription but still use mobile-cellular services by sharing someone else's subscription and/or phone (Galpaya, H. et al., 2015; James, J., 2010).

  Other studies have shown that mobile-phone sharing decreases as the percentage of phone owners increases (Wesolowski, A. et al., 2012; InfoDev, 2012a), and that people at the bottom of the pyramid share their mobile phones, mainly with family members – usually the male head of the household with the spouse.[9] This suggests that mobile phones may be used as household devices in some contexts.

  The different sharing patterns are not captured in the data on mobile-cellular subscriptions, which may therefore not correctly reflect mobile-phone usage in some segments of the population.

These three different issues may apply simultaneously to the data on mobile-cellular subscriptions in a specific country, and have contradicting effects. For instance, the counting of inactive subscriptions may overestimate the actual number of subscribers, but not counting the sharing of subscriptions may underestimate the number of users.

Moreover, these issues mean that data on mobile-cellular subscriptions are often not comparable across countries, as they may have different impacts in each country depending on national circumstances. The latter include consumer behaviour, such as sharing and multi-SIM ownership patterns, as well as market conditions and regulation, such as the off-net pricing policies of operators, taxation of numbering resources and mobile termination rate regulation.

A comparison between data from household surveys on mobile-phone usage and data from telecommunication operators on mobile-cellular subscriptions for countries in which both metrics are available (Chart 5.2) allows the following conclusions to be drawn:

1. The fact that there are more mobile-cellular subscriptions than inhabitants does not mean that everyone in a country uses a mobile phone.

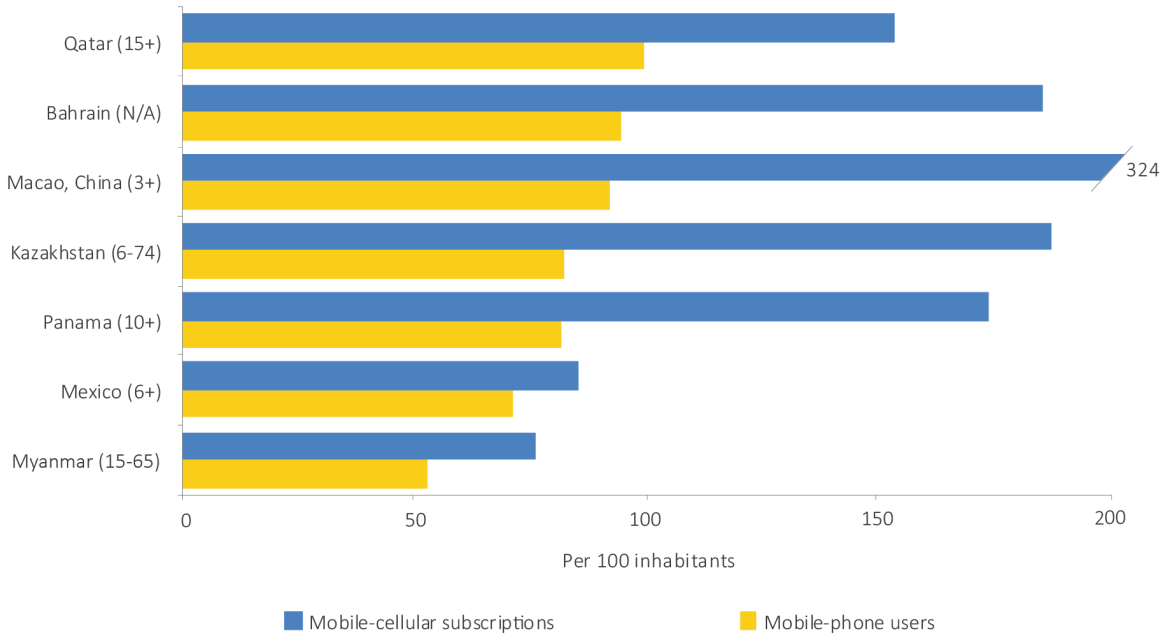
2. The number of mobile-cellular subscriptions per 100 inhabitants provides a significant over-estimation of the actual number of mobile-phone users.

3. The relationship between mobile-cellular subscriptions per 100 inhabitants and mobile-phone users varies enormously between countries.

As more and more economies reach a situation in which there are more mobile-cellular subscriptions than inhabitants in the country (Chart 5.3), data on mobile-cellular subscriptions provide little additional information on progress made in terms of mobile-cellular uptake.[10] Even in countries with fewer subscriptions per 100 inhabitants, subscription data are of limited use in identifying people that do not yet use or own a mobile phone.

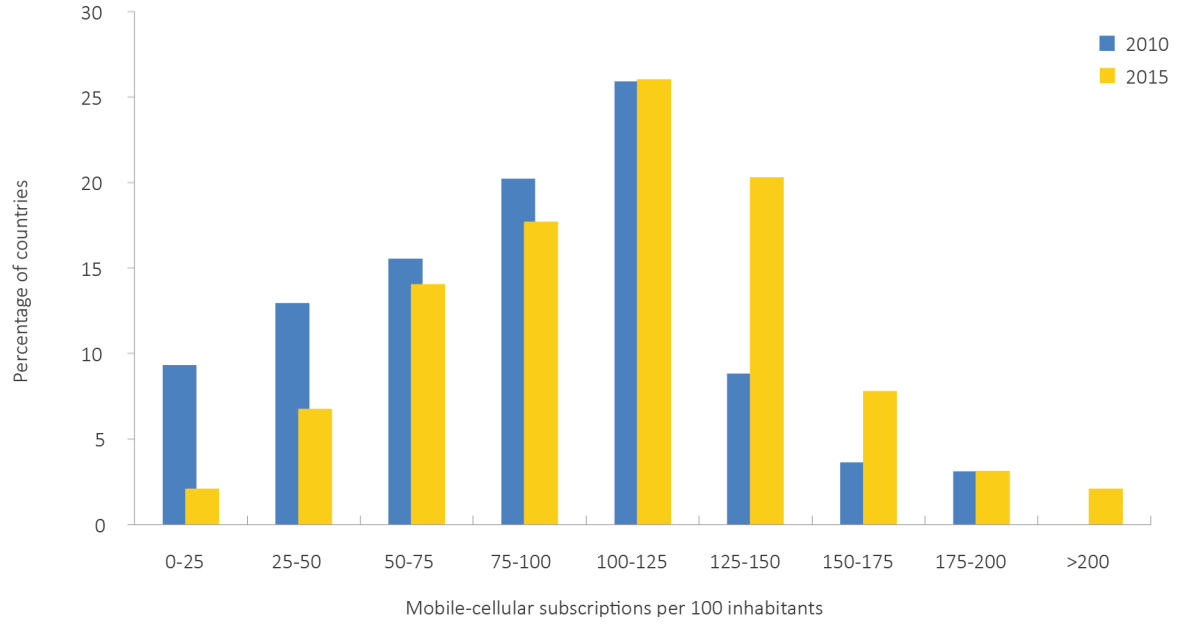
It can thus be concluded that the traditional way of calculating mobile-cellular penetration – dividing total mobile-cellular subscriptions in a country by the number of inhabitants – has become obsolete. It should be complemented or replaced by indicators using data relating to individuals, thus ranging from 0 to 100 per cent of the total population. In addition, the target population should be considered carefully, because there may be population groups that cannot use a mobile

Chart 5.2: Mobile-cellular subscriptions and mobile-phone users, selected economies, 2015



Note: For mobile-phone users, the age scope of each survey is indicated in brackets.
Source: ITU except Myanmar, sourced from LIRNEasia.

Chart 5.3: Evolution of mobile-cellular penetration, 2010, 2015



Source: ITU.

phone or subscribe to mobile services (e.g. the very young).[11]

The following sections look at two of the metrics collected from household surveys: individuals who own a mobile-cellular telephone, and individuals who use a mobile-cellular telephone. These indicators have been defined according to international standards by the Partnership on Measuring ICT for Development and adopted by the United Nations Statistical Commission.

5.3 How many people actually own or use a mobile phone?

Data on mobile-phone usage and ownership are collected through national household surveys. In these surveys, individuals are asked whether they have used a mobile phone and, in a separate question, whether they own a mobile phone. Based on the answers from the respondents, the totals for the country are estimated. Since questions included in household surveys are addressed directly to people, they sidestep the methodological pitfalls relating to inactive subscriptions and the double counting of subscribers. Moreover, they allow the shared use of mobile phones to be taken into consideration.

Since 2005, ITU has been collecting data on mobile-phone usage based on nationally representative household surveys carried out by national statistics offices. The data available for the period 2013-2015 are presented in Chart 5.4 together with data from the Financial Inclusions Insights Program.[12] When comparing the results across countries, it is important to consider the different age scopes of the surveys, because most of the people who do not use or own a mobile phone belong to the youngest or oldest segments of the population (see section 5.4) and are unequally represented in the surveys.

The following conclusions can be derived from these data:

- In most economies with data available, more than 80 per cent of the population use a mobile phone, and almost universal usage has been reached in Qatar, the Republic of Korea, Bahrain and Hong Kong (China).
- Data are available for only three least developed countries (Bangladesh, Myanmar and Uganda) and two low-income countries (Tanzania and Uganda). It is therefore impossible to draw conclusions on mobile-phone usage in the world's poorest nations.
- Less than 70 per cent of the population used a mobile phone in Cuba, the Islamic Republic of Iran, Myanmar and Puerto Rico in 2013. Cuba stood out with only 11 per cent of the population using a mobile phone in 2013. More recent data on mobile-phone ownership show that significant progress has been made in Cuba since 2013, which increased from 13 per cent to 33 per cent in 2015. Nevertheless, mobile uptake on the island remains among the lowest in the world.
- In the countries included in Chart 5.4, there were a total of about 525 million people not using a mobile phone, corresponding to 18 per cent of the total population in these economies. Nevertheless, mobile-network coverage reached 94 per cent of the total population in these countries. This indicates that lack of coverage is not the main barrier to mobile-phone usage, at least in these countries.

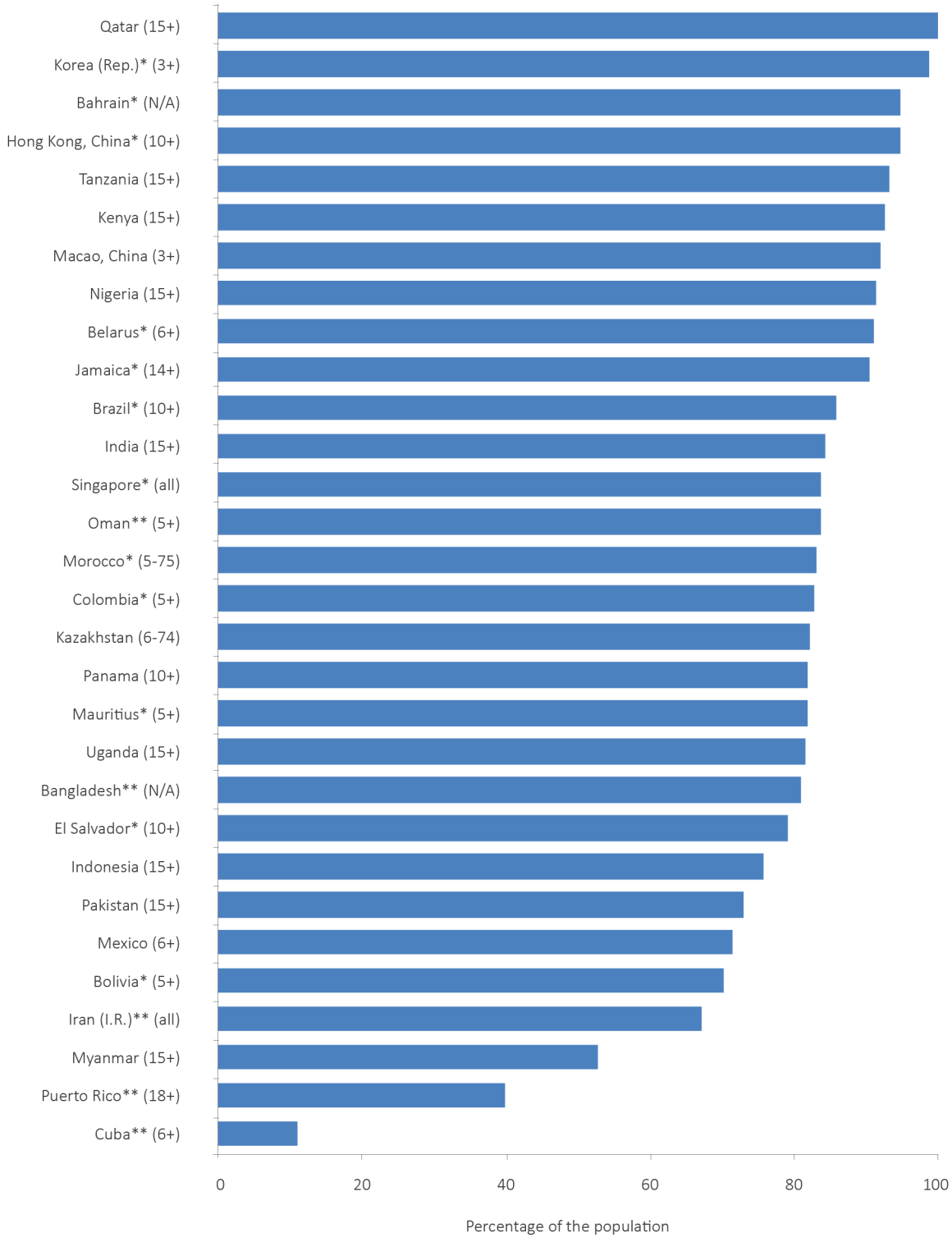
Mobile-phone ownership is related to mobile-phone usage, although there are some differences between the two indicators. Owning a mobile phone is usually linked to greater privacy, convenience and security for the user. Furthermore, mobile phone ownership can also help increase economic and professional opportunities, especially for entrepreneurs or the self-employed. For those at the bottom of the pyramid, owning a mobile phone may be a way of having a personal address providing access to a bank account, microfinance and basic information on health, agriculture or education (GSMA et al., 2010; GSMA, 2015; UNCTAD, 2014).

The importance of mobile-phone ownership as an empowerment tool has been recognized in the SDGs. Indeed, the global indicator framework agreed by the United Nations Statistical Commission in 2016 (ECOSOC, 2016) includes the indicator "Proportion of individuals who own a mobile telephone, by sex" to monitor SDG 5 ("Achieve gender equality and empower all women and girls").

ITU has been collecting data on mobile-phone ownership from national statistics offices since 2015. Based on the limited data available (Chart 5.5), the following conclusions can be drawn:

- In half of the economies with available data, more than 75 per cent of the population owns a mobile phone. In countries such as Bahrain, UAE, the Republic of Korea and Malaysia, almost everyone owns a mobile phone.
- Over 70 per cent of the population are mobile-phone owners in Azerbaijan, Colombia,

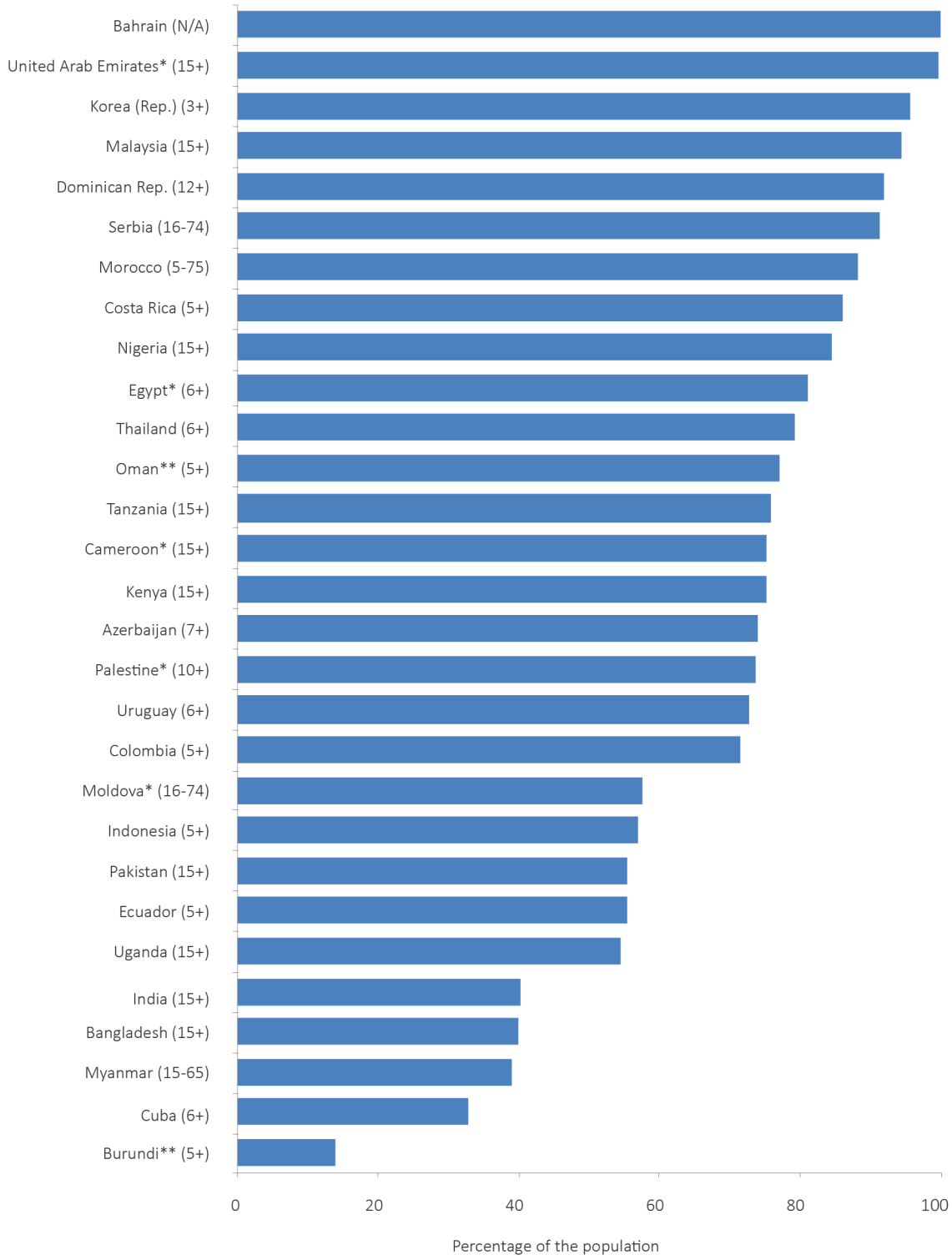
Chart 5.4: Individuals using a mobile-cellular telephone, 2015 or latest available year



Note: The age scope of each survey is indicated in brackets. * 2014 data. ** 2013 data.
Source: ITU for all countries except India, Indonesia, Kenya, Nigeria, Pakistan, Tanzania and Uganda, for which data are sourced from Financial Inclusion Insights, and Myanmar, sourced from LIRNEasia.

Uruguay and Palestine, whereas in the remaining countries less than 60 per cent of the population own a mobile phone. These include Asian countries with large populations, such as Bangladesh, India, Indonesia and Pakistan.

Chart 5.5: Individuals who own a mobile-cellular telephone, 2015 or latest available year



Note: The age scope of each survey is indicated in brackets. * 2014 data. ** 2013 data.
Source: ITU for all countries except Bangladesh, India, Kenya, Nigeria, Pakistan, Tanzania and Uganda, for which data are sourced from Financial Inclusion Insights, and Myanmar, sourced from LIRNEasia.

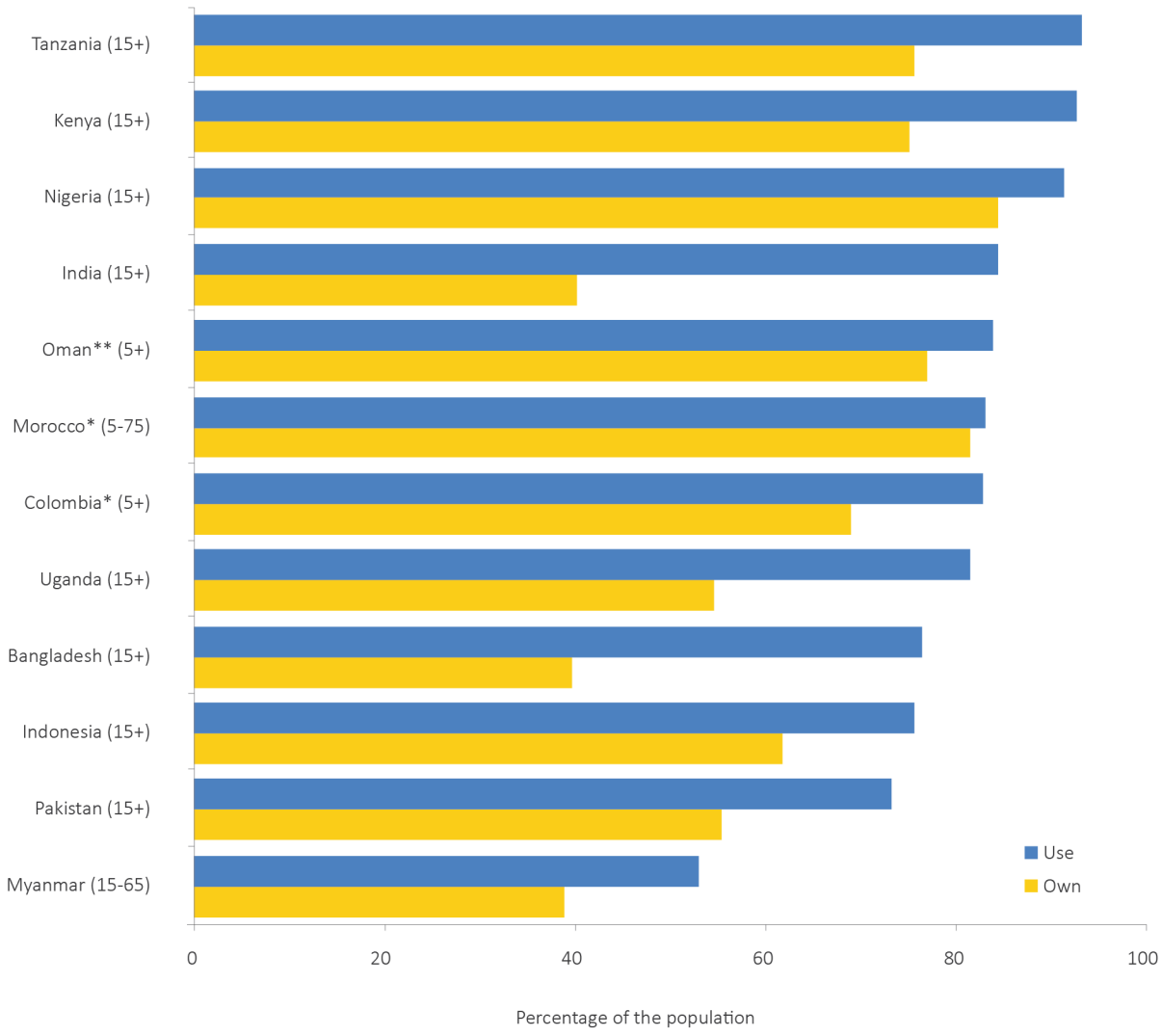
- In the four LDCs with data available, large segments of the population do not own a mobile phone: only 13 per cent of the population owned a mobile phone in Burundi in 2013, 39 per cent in Myanmar in 2015, 40 per cent in Bangladesh in 2015, and 55 per cent in Uganda in 2015. In other countries from sub-Saharan African with data available,

the percentage of the population owning a mobile phone is greater: about 75 per cent of the population in Cameroon, Kenya and Tanzania, and 85 per cent in Nigeria. More data would be needed to understand the overall mobile-phone ownership situation in Africa, as well as in LDCs.[13]

- Chart 5.6 presents the comparison between mobile-phone ownership and mobile-phone usage in the few countries for which both indicators are available for the same year. Differences between ownership and usage are small in Morocco (less than 2 percentage points) and moderate in Oman and Nigeria (about 7 percentage points), suggesting that in these countries only a fraction of mobile users do so using someone else's device or SIM card.

In all other countries with data available, differences between usage and ownership are large (14 percentage points or more), indicating that many people access mobile-cellular services by sharing a device and/or SIM card. Differences between mobile-phone ownership and usage are particularly large in Bangladesh and India, where around half of the mobile-cellular users do so using someone else's SIM card or device.

Chart 5.6: Comparison between individuals who own a mobile-cellular telephone and individuals who use a mobile-cellular telephone, 2015 or latest available year



Note: The age scope of each survey is indicated in brackets. * 2014 data. ** 2013 data.
Source: Financial Inclusion Insights for all countries except Colombia, Morocco and Oman, for which the source is ITU, and Myanmar, sourced from LIRNEasia.

Data from the 11 countries included in Chart 5.6 appear to confirm previous findings on the inverse relationship between mobile-phone ownership and the sharing of devices and/or SIM cards.[14] Indeed, in contexts of low mobile-phone ownership, many people who do not own a mobile phone use the service through sharing; however, as mobile-phone ownership increases, sharing decreases and mobile-phone usage tends to be through owned devices and SIM cards.

These findings suggest that a significant part of the population in developing countries may be using a mobile phone without owning it, and that in some developing countries the mobile market may still have ample space to evolve towards higher mobile-ownership rates. These changes in the way people access and use mobile-cellular services can only be monitored through data from nationally representative household surveys including ICT questions, which are lacking in most countries. In particular, more data would be needed to determine the situation in low and lower-middle income countries, in which the differences between mobile-phone ownership and usage might be larger. Likewise, differences within countries may also be revealed by studying sub-national data (Wesolowski et al., 2012).

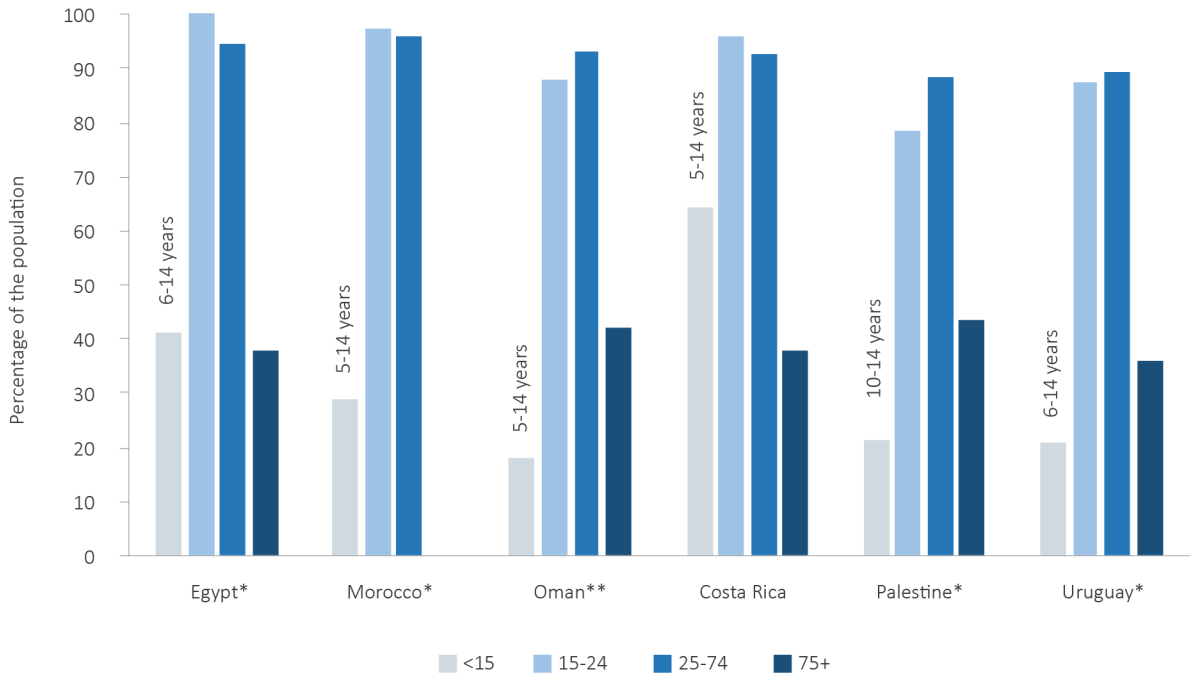
5.4 Who does not own or use a mobile phone?

Age

An analysis of mobile-phone ownership across different age groups indicates that most non-owners belong to the youngest and the oldest segments of the population, as could be expected (Chart 5.7).

Indeed, for the few countries with data available, the percentage of individuals owning a mobile phone exceeds 85 per cent in the 25-74 age group, and it also exceeds that value in the 15-24 age group in all economies with data available except Palestine. On the other hand, fewer than 45 per cent of children up to the age of 14 own a mobile phone in these countries, Costa Rica being the only exception. Nevertheless, even in Costa Rica

Chart 5.7: Individuals who own a mobile-cellular telephone, broken down by age group, 2015 or latest available year



Note: * 2014 data. ** 2013 data. Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

the proportion of 5-14 year-olds owning a mobile phone (64 per cent) is well below that of people owning a mobile phone in the 15-74 age group.

Low mobile-phone ownership among children in these developing countries may indicate that either they do not use mobile-cellular services or they access them using their parents' mobile phone and SIM card, rather than having their own subscription and device.

Another age group with low mobile-phone ownership is that of people over the age of 74: fewer than half of them own a mobile phone in the countries with data available. This suggests that, despite the spread of mobile-cellular services, many older people still do not benefit from mobile communications in their everyday lives.[15] Ten years ago, when mobile-cellular services took off in these countries, these individuals were 65 years old and may have lacked the ICT literacy skills to use mobile phones, or simply may not have perceived the benefits of doing so. Section 5.5 analyses in more detail the different barriers to mobile-phone ownership and use.

ITU data are available for only a few developing countries from the Americas and the Arab States region, and therefore may not be representative of other regions. However, a survey carried out by GSMA Intelligence, covering 24 developing countries and 30 developed countries, also finds that mobile-phone ownership is low among children (Table 5.1).

Table 5.1: Individuals who own a mobile-cellular telephone, broken down by children and adults, 2015

Mobile-phone ownership	Developed	Developing
Children (5-17)	39%	17%
Adults (18+)	95%	90%

Source: GSMA Intelligence.

An analysis of data on mobile-phone usage reveals differences in uptake across age groups similar to those observed for mobile-phone ownership (Chart 5.8), although from a higher baseline because usage is overall higher than ownership.

In half of the countries with data available, 50 per cent or more of children below the age of 15 do not use a mobile phone. In the remaining countries, the percentage of non-users is also significant: in Belarus, Brazil and Hong Kong (China), about 20 per cent of children below the age of 15 do not use a mobile phone, and in the other countries over 35 per cent do not. This suggests that a significant proportion of children in developing countries do not use mobile-cellular services.

Mobile-phone usage is also limited among individuals over the age of 74: in most countries with data available, fewer than 60 per cent of senior adults use mobile-cellular services. The only economy that stands out with a higher level of mobile-phone usage among the eldest is Macao (China), where almost 80 per cent of individuals aged 75 or over use a mobile phone.

Data from GSMA Intelligence suggest that children below the age of 18 are two times less likely to use a mobile phone than adults in developed countries, and four times less likely in developing countries. Data from Financial Inclusion Insights confirm that older age groups are less likely to use mobile-cellular services (see, for instance, FII data on India in Chart 5.9).

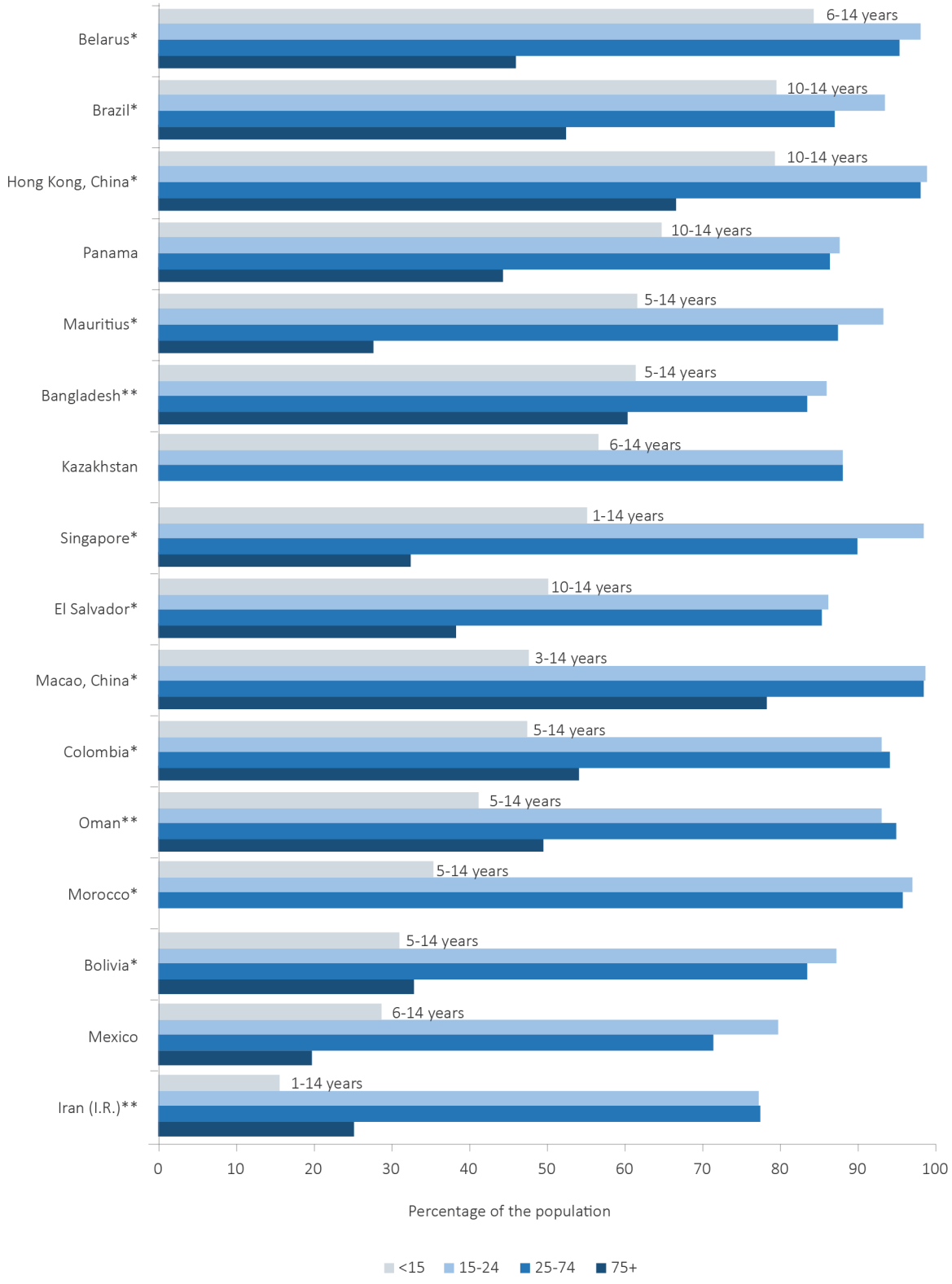
Gender

The disaggregation of data on mobile-phone usage by gender shows that the percentage of male users is higher than that of female users in most countries (Chart 5.10), although differences are small in most economies (less than 4 percentage points).

Countries where the gender gap is slightly greater include Mauritius, Nigeria, Morocco, Oman and Uganda. Four countries stand out as having large gender gaps: Pakistan (64 per cent of female mobile users as against 81 per cent of male mobile users in 2015), the Islamic Republic of Iran (56 as against 78 per cent, 2013), Bangladesh (71 as against 82 per cent, 2015) and India (79 as against 90 per cent, 2015).

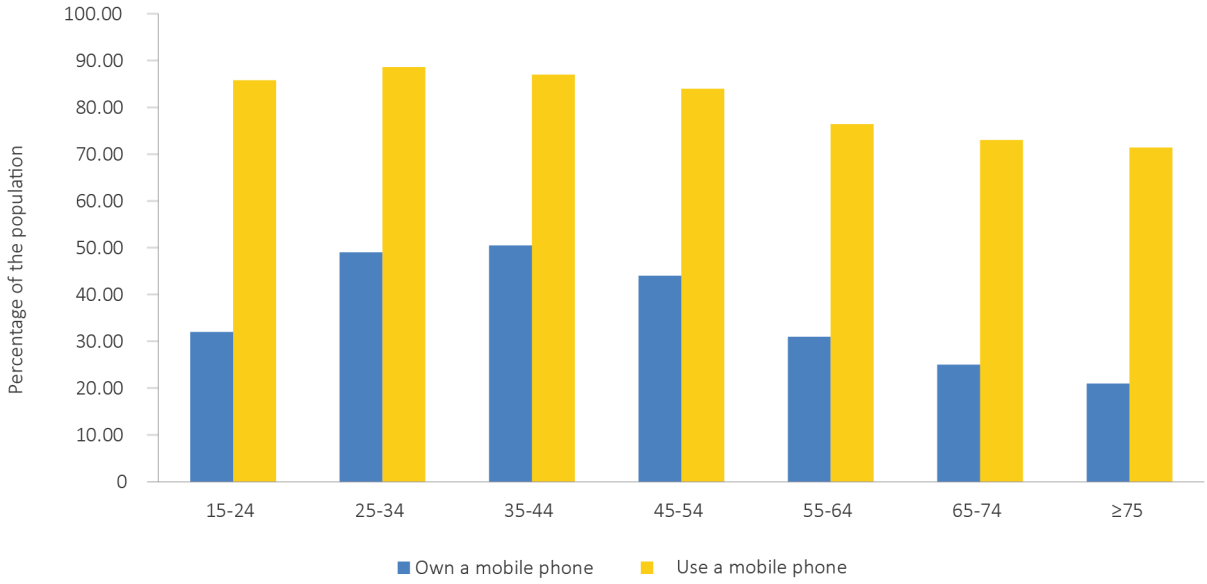
On the other hand, the percentage of female mobile users is slightly higher than that of male mobile users in some countries of the Americas region, such as Colombia, Brazil, Panama and Jamaica.

Chart 5.8: Individuals using a mobile-cellular telephone, broken down by age group, 2015 or latest available year



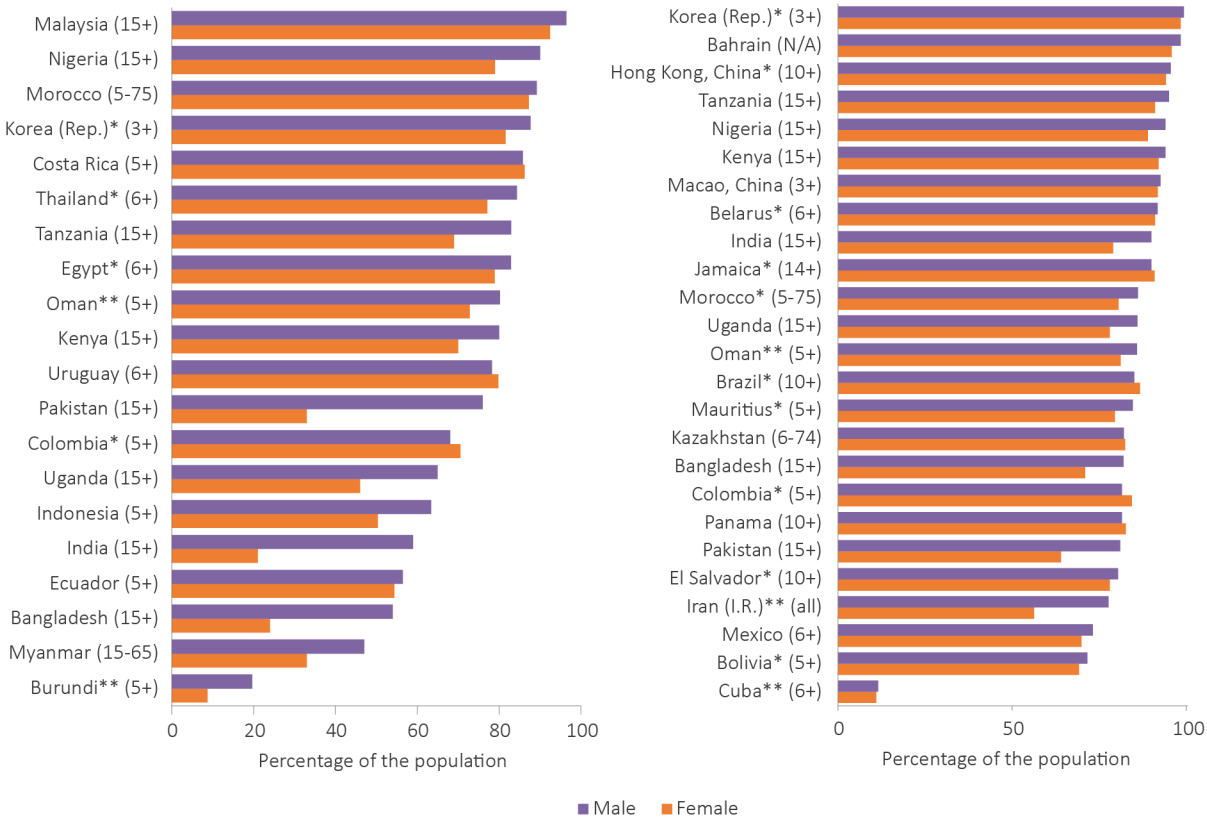
Note: * 2014 data. ** 2013 data.
Source: ITU.

Chart 5.9: Individuals owning a mobile-cellular telephone and using a mobile-cellular telephone, broken down by age group, India, 2015



Source: ITU based on Financial Inclusion Insights.

Chart 5.10: Individuals who own a mobile-cellular telephone (left) and using a mobile-cellular telephone (right), broken down by gender, 2015 or latest available year



Note: The age scope of each survey is indicated in brackets. * 2014 data. ** 2013 data. The percentages of female/male mobile-phone users/owners are calculated as a proportion of total female/male population in each age group.
Source: ITU for all countries except Bangladesh, India, Kenya, Nigeria, Pakistan, Tanzania and Uganda, for which data are sourced from Financial Inclusion Insights, and Myanmar, sourced from LIRNEasia.

Data show larger gender gaps in mobile-phone ownership than in mobile-phone usage. Indeed, in all countries with large gender gaps in mobile-phone usage the gap is even larger in mobile-phone ownership (e.g. men are twice as likely as women to own a mobile phone in Bangladesh, India and Pakistan). Other countries with large gender gaps in mobile-phone ownership include Burundi, Indonesia and Myanmar (more than 10 percentage points), and sizeable gender gaps exist in the Republic of Korea, Oman and Thailand (more than 5 percentage points). The fact that countries with very different income levels display significant differences in mobile-phone ownership between men and women suggests that low mobile-phone ownership among women may not only be an issue in poorer countries.

Because of the limited data available, only cautious conclusions can be drawn on the current gender gap in mobile uptake in the low-income countries and LDCs. However, data for the four LDCs with data available (Bangladesh, Burundi, Myanmar and Uganda) show that women are far less likely to own a mobile phone than men.

All these findings coincide with the results of recent research in low- and middle-income countries pointing to the fact that in these countries over one billion women do not own a mobile phone (GSMA, 2015).

Level of education

Recent research carried out in Myanmar found that the gender gap in mobile-phone ownership varies according to the income level of the household, being higher among lower-income households (GSMA and LIRNEasia, 2015). ITU data on mobile-phone ownership disaggregated by level of education show that the large majority of non-owners (men or women) belong to those segments of the population with the lowest educational attainment (Chart 5.11). These findings highlight the fact that gender gaps are associated with differences in income and educational attainment, and therefore reflect other types of social divides.[16]

Urban/rural

Another factor linked to ICT uptake is the individual's geographical location, in particular whether people live in urban or rural areas (see Chapter 6 for an analysis of how this affects Internet uptake). Individuals living in rural areas are less likely to use mobile phones than those in urban areas (Table 5.2). Unlike with other ICT services for which infrastructure may not be in place, basic mobile infrastructure is available for most of the global population living in rural areas.[17] However, rural populations tend to have lower incomes and lower levels of education, which in turn are linked to lower mobile-phone usage. In addition, certain minority groups, such as indigenous people, may be more represented in rural areas (UNDESA, 2009) and require targeted policies in order to embrace mobile technologies.

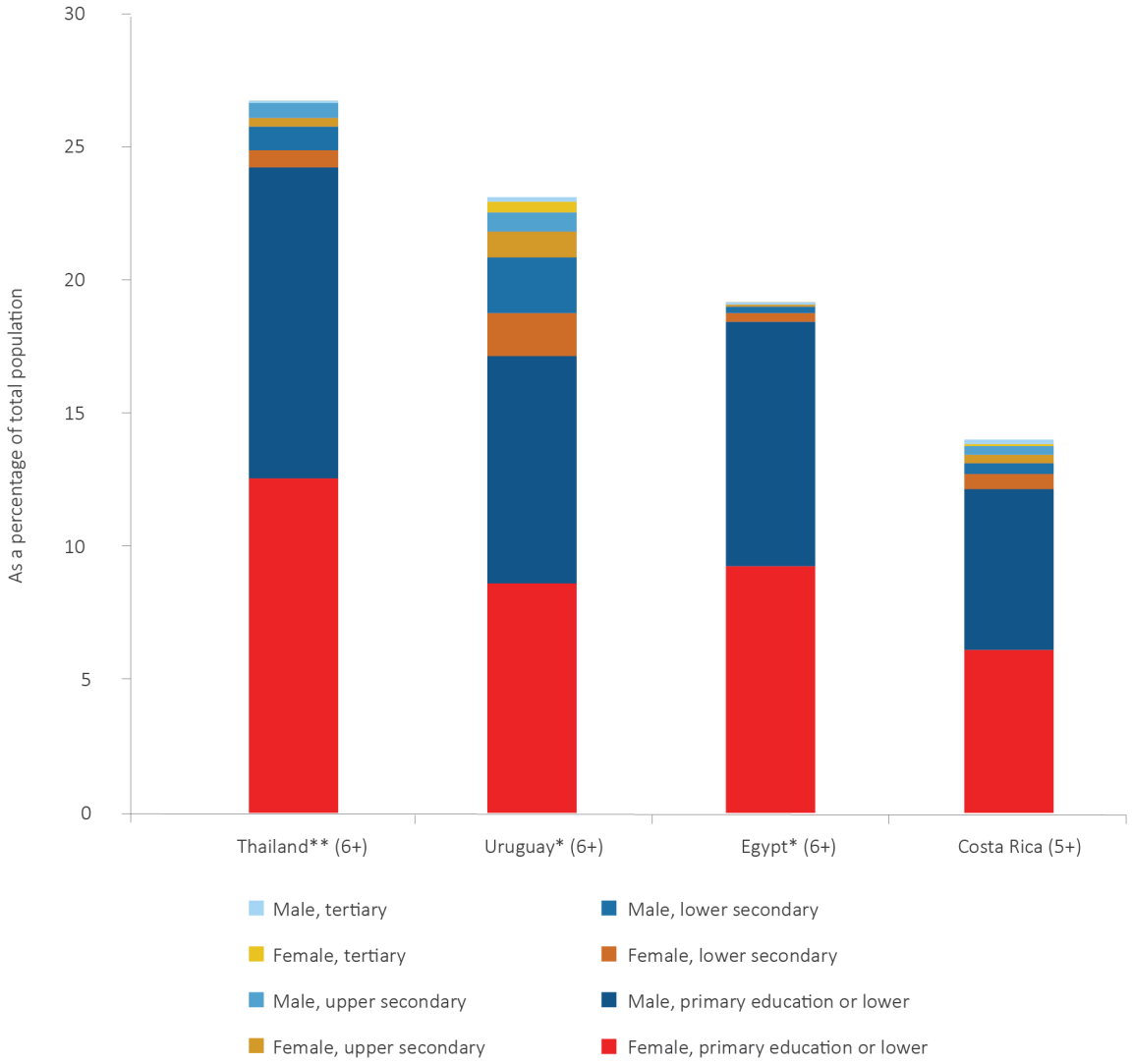
Table 5.2: Individuals who use a mobile-cellular telephone, by urban/rural, 2015 or latest available year, %

	Urban	Rural
Oman** (5+)	84	82
Bangladesh** (N/A)	87	79
Iran (I.R.)** (all)	72	54
Cuba** (6+)	13	4
Belarus* (6+)	94	85
Bolivia* (5+)	78	53
Brazil* (10+)	88	74
Colombia* (5+)	85	77
El Salvador* (10+)	82	74
Jamaica* (14+)	92	89
Panama (10+)	89	66

Note: The age scope of each survey is indicated in brackets. * 2014 data. ** 2013 data. The percentage of urban/rural mobile-phone users is calculated as a proportion of the total urban/rural population in each age group.
Source: ITU.

Despite lower mobile-phone usage in rural areas, some countries have larger urban than rural populations and consequently most individuals not yet using a mobile phone in these countries live in urban areas (Chart 5.12). This suggests that initiatives to promote digital inclusion through mobile uptake should target both urban and rural population segments and focus on the underlying causes of non-ownership or non-use of mobile-cellular phones. A summary of these causes is presented in the following section, based on the

Chart 5.11: Individuals who do not own a mobile-cellular telephone, by gender and level of education, 2015 or latest available year



Note: The age group scope of each survey is indicated in brackets. * 2014 data. ** 2013 data.
Source: ITU.

results of recent quantitative and qualitative research on the main barriers to mobile uptake.

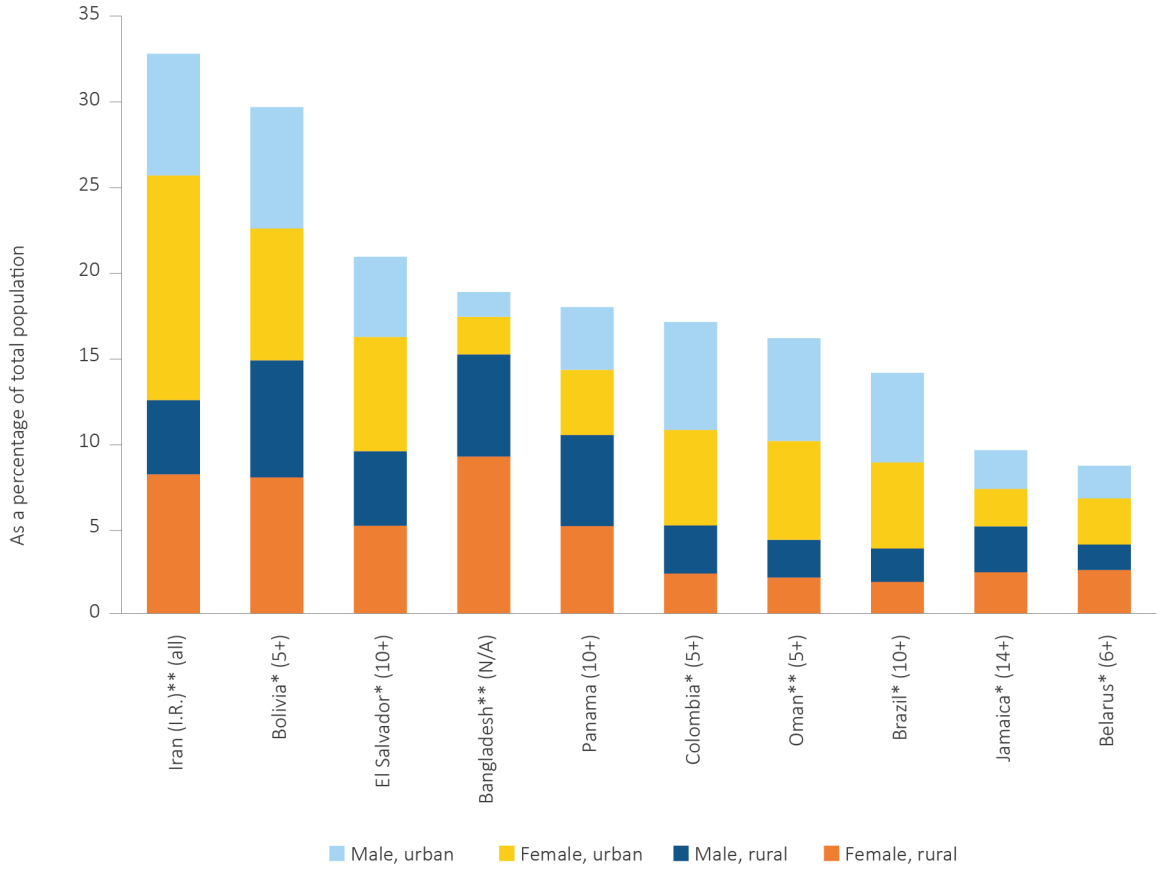
5.5 Why do people not own or use mobile phones?

As reflected in the structure of this chapter, the statistical efforts to inform policy-makers in the field of mobile-cellular uptake can be divided into three interlinked stages:

1. Gathering quantitative evidence showing to what extent mobile-phone ownership and usage are not yet universal.
2. Determining the characteristics (e.g. age, gender, location) of those not yet owning or using a mobile phone.
3. Identifying the specific barriers to mobile-cellular uptake faced by those not yet owning or using a mobile phone.

Reliable information on the barriers to mobile-cellular uptake is essential to ensuring the success of policies in this area, because it constitutes the basis for determining what kind of initiatives can be most effective in making the benefits of mobile-cellular services available to a larger proportion of the population.

Chart 5.12: Individuals who do not use a mobile-cellular telephone, by gender and rural/urban, 2015 or latest available year



Note: The age scope of each survey is indicated in brackets. * 2014 data. ** 2013 data.
Source: ITU.

Figure 5.1 presents a summary of the findings of three studies on barriers to mobile-cellular uptake. These studies combine quantitative research, such as nationally representative surveys including questions on barriers to mobile uptake, and qualitative research, such as face-to-face in-depth interviews with selected respondents and focus-group discussions. The following conclusions can be drawn based on the findings of these studies:

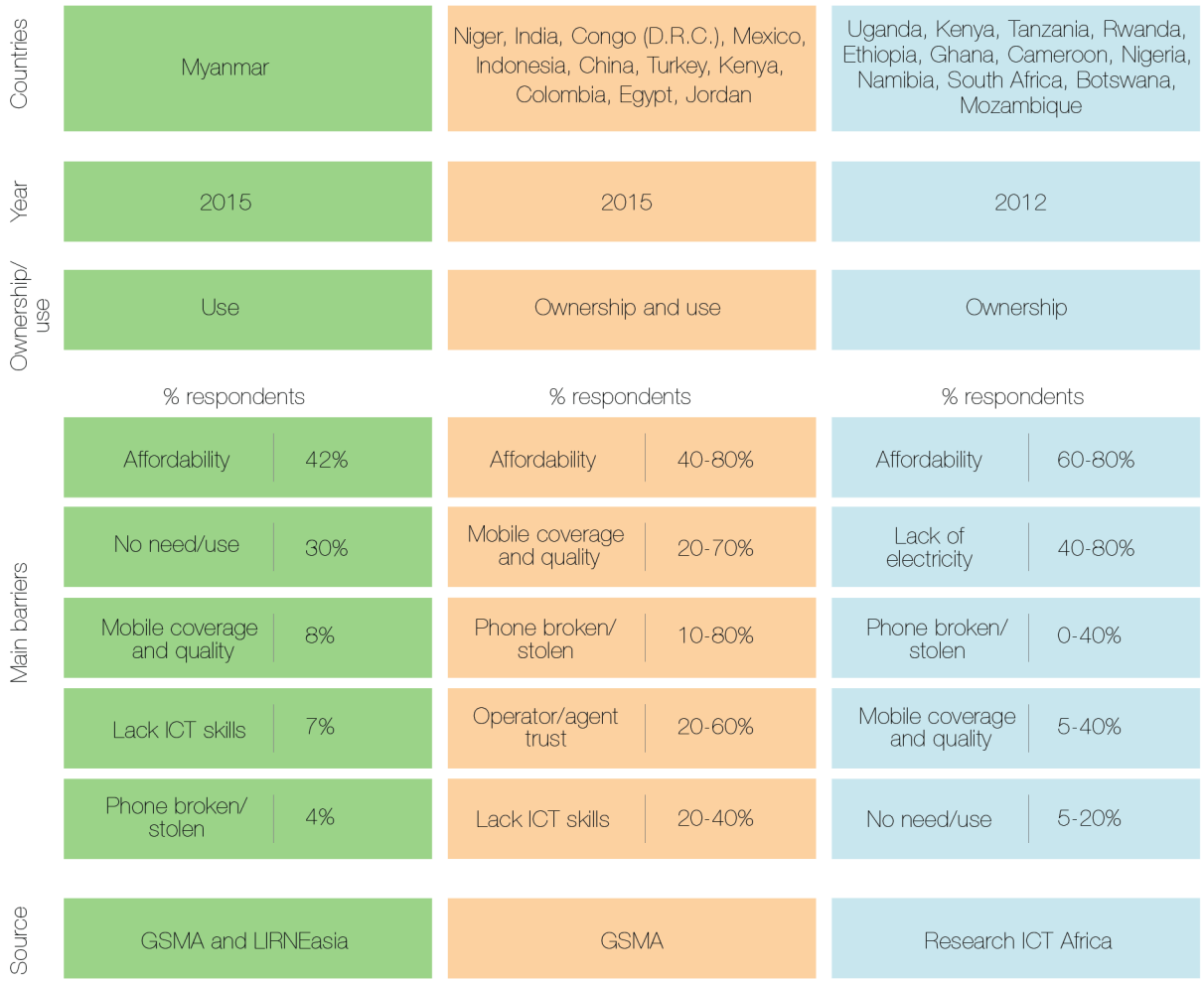
- **Affordability** is the main barrier to mobile uptake (this finding is consistent across all surveys). In those surveys that provide information on the different cost elements, the mobile device is mentioned as the main cost barrier along with, to a lesser extent, credit recharge. The SIM card is considered the most affordable of all cost elements. This indicates, contrary to the predictions of some supply-side estimations (Facebook, 2015), that the main cost barrier for new mobile-phone owners is the cost of the device.

As could be expected, affordability is a greater obstacle for low-income individuals not owning a mobile phone than for the rest of the population not owning a mobile phone (InfoDev, 2012a, 2012b). From a gender perspective, cost in particular is a barrier for women, because they often have less financial independence (GSMA, 2015).

Other surveys focusing on mobile Internet uptake have confirmed that affordability is also a relevant barrier. For mobile Internet uptake, however, affordability is as important as ICT skills and less of an obstacle than relevant local content (GSMA, 2016a, 2016b).

Relevant local content is not mentioned as a major obstacle to mobile-phone ownership and usage because, most probably, those not yet using and owning a mobile phone would start by using voice and SMS services which are less dependent on local content. Lack

Figure 5.1: Main barriers to mobile-phone ownership and usage



Note: "% respondents" refers to the proportion of respondents that identified a given issue as a barrier to mobile-phone ownership or to both mobile-phone ownership and usage, depending on the survey.
Source: ITU based on GSMA and LIRNEasia (2015), Galpaya et al. (2015), GSMA (2015) and data from Research ICT Africa.

of ICT skills is mentioned as an obstacle to mobile-phone ownership and usage, but is not identified as prominently as for mobile Internet uptake, probably because new mobile phone owners and users will most likely use basic mobile services which require fewer ICT skills than accessing the Internet using a mobile phone.

- The **lack of perceived benefits** of mobile-phone ownership among some segments of the population is one of the reasons most cited for not owning a mobile phone. In some cases, the head of the household may own a mobile phone and the other members may not feel the need for it, as the device may be considered a family or common property (GSMA and LIRNEasia, 2015). Through information campaigns (e.g. on the benefits of mobile money and other development-enabling applications) or simply as mobile phones become more available in a given community, the perceived economic value of a phone for work, business and even the coordination of household affairs may increase and convince more people to become mobile-phone owners (CKS Consulting, 2012; GSMA and LIRNEasia, 2015).

- Despite the high mobile-network coverage reported in most countries, including in the developing world, respondents across different countries identify **poor network quality** as a barrier to mobile uptake. Indeed, dropped calls and long waiting times for establishing a call are cited as a common problem not only in several African countries but also in some Latin American and Asian economies. Although

poor network quality is more often a problem for rural respondents, it is also mentioned by urban dwellers.

These findings point to a rather surprising paradox: while most of the regulatory and press attention today is focused on the roll-out of long-term evolution (LTE) networks and discussions on 5G, the quality of the basic mobile network may still be an issue in several developing countries.

- **Lack of ICT skills** is a barrier for some individuals who do not own a mobile phone, and slightly more of an issue for women than men owing to the former's lower education levels and lower confidence with technology. **Phone theft** or broken devices are consistently cited as a barrier to use of the service, although less frequently than other issues such as affordability or the lack of perceived benefits. Lastly, **trust in the operator or agent** is also sometimes cited as an issue, particularly among rural, less-educated segments of the population who are not yet mobile-phone owners.

This section has focused on the main barriers that face those who do not yet own or use a mobile phone at all. Beyond these entry barriers, however, other, significant obstacles may affect the intensity and type of use. For instance, lack of ICT skills is less of a barrier to making use of the basic features of a mobile phone (e.g. making and receiving calls), but a major obstacle when it comes to more sophisticated uses, such as Internet access using a smartphone.

As more and more people own and use a mobile phone, focus is shifting to the barriers preventing some mobile-phone owners from making full use of the device. For example, it has been observed that in low-income countries female mobile-phone owners use their device less frequently and for less sophisticated services than men (GSMA, 2015). Similar usage gaps have also been found in other segments of the population, such as low-income individuals (InfoDev, 2012b). These usage gaps will require particular consideration from both industry players and policy-makers in order to ensure that everyone is able to fully benefit from mobile-cellular and mobile-broadband services.

5.6 Conclusions

Data presented in this chapter show that, although there are almost as many mobile-cellular subscriptions as people globally and almost everyone lives in an area that is covered by a mobile-cellular signal, hundreds of millions of people do not yet own a mobile phone. This apparent paradox is explained by the fact that many people have multiple SIM cards, whereas others own neither a single SIM card nor a mobile device.

Some of those who do not own a mobile phone use mobile-cellular services by borrowing someone else's phone or SIM card (with the constraints this implies in regard to usage). However, even taking account of users who do not own a mobile phone, a significant portion of the population still does not use mobile-cellular services at all.

Policy-makers and operators should therefore be aware that universal use of mobile-cellular services has not yet been achieved, and that specific initiatives should be undertaken to ensure that no one is left behind.

The first step in designing efficient policies in this area is to clearly understand who should be targeted, i.e. the characteristics of those who do not yet own or use a mobile phone. Although these may vary from one country to another, a number of common characteristics emerge from the global analysis.

Most of those who neither own nor use a mobile phone belong to the youngest (age 5-14) and oldest (age >74) segments of the population. In parallel, there are large gender gaps in mobile-cellular uptake in some countries. These gender divides are associated with differences in income and educational attainment, and therefore reflect other types of social divide. Indeed, most people who neither own nor use a mobile phone belong to the less-educated and lower-income segments of the population. Lastly, although people living in rural areas are less likely to own or use a mobile phone than people in urban areas, sizeable segments of both the urban and rural populations of several developing countries do not yet own or use a mobile phone.

A key element in designing efficient policies to foster mobile-cellular uptake is to have reliable information on the specific barriers to mobile-phone ownership and use. Even though the specific relevance of each barrier varies from one country to another, some of them are consistently identified in surveys from different countries.

Affordability is the greatest barrier to mobile-phone ownership and usage. Rather than the cost of the service itself, the cost of the handset is more often considered the main obstacle to ownership. Another major barrier is the lack of perceived benefits. This obstacle can be greater in communities where lower overall mobile uptake makes the service less valuable because of network effects. In other cases, it may simply be linked to lack of information on mobile services. One barrier that may be relevant in some countries is poor network quality, which may deter mobile-phone usage. In addition, lack of ICT skills may be an obstacle in specific population segments, especially for accessing the Internet using a mobile phone.

Policy-makers and the telecommunication industry in developing countries could build on the evidence presented in this chapter, complemented with national data, with a view to adopting targeted policies for promoting mobile uptake. As the 2030 Agenda for Sustainable Development has pledged, mobile services can be a strong empowerment tool, and no one should be deprived of their benefits on account of economic, educational, social or technical barriers.

Endnotes

1 References to income groups are based on the World Bank classification by income group, available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

2 GSMA Intelligence: Measuring mobile penetration https://www.gsmaintelligence.com/research/2014/05/measuring-mobile-penetration/430/.

3 An analysis of the Ukrainian regulator regarding the high number of mobile-cellular subscriptions in Ukraine concluded that: "the number of mobile subscriptions is higher than the population in the country. This situation refers to the fact that one person has several SIM-cards of different operators. However, there are still the residents having no mobile phone in Ukraine, mainly they are children and seniors. One of the main reasons of buying several SIM-cards is the substantial difference between the tariffs for on-net calls and off-net calls. This led to the fact that nearly 94% of mobile outgoing traffic falls on on-net calls" (NCCIR, 2013). In Kenya, a survey from Research ICT Africa found that the main reason for people at the bottom of the pyramid (i.e. with the lowest incomes) having more than one SIM card was to reduce inter-network calling costs (InfoDev, 2012a).

4 Source: GSMA Intelligence Database 2016.

5 For instance, Chinese mobile users in rural areas use 1.18 mobile-cellular subscriptions on average, whereas those in urban areas use on average 2.03 subscriptions (GSMA, 2014).

6 75 per cent of all mobile-cellular subscriptions were prepaid at the end of 2015.

7 See Decree 22-2014 of the Congress of the Republic. It includes the *Ley de Ajuste Fiscal*, which in Chapter 2, Section 1, imposes a tax of GTQ 5.00 per telephone line (fixed and mobile) on operators.

8 See Article 34 of the *Ley Orgánica de Telecomunicaciones* approved in February 2015, available at http://www.telecomunicaciones.gob.ec/wp-content/uploads/downloads/2016/05/Ley-Org%C3%A1nica-de-Telecomunicaciones.pdf.

9 An ICT household survey carried out in Kenya in 2012 found that 25 per cent of the people at the bottom of the pyramid owning a mobile phone shared it with a family member, usually the spouse (InfoDev 2012a). A similar study carried out in South Africa revealed that 10 per cent of mobile phone owners at the bottom of the pyramid shared their mobile phones on a weekly basis (InfoDev, 2012b).

10 In the ICT Development Index, for instance, a reference value of 120 subscriptions per 100 inhabitants is set for the mobile-cellular-subscription indicator. Beyond that value, all countries are given the same score, because differences beyond that threshold are not considered to be indicative of the actual mobile-cellular uptake, but rather of the market structure.

11 GSMA Intelligence: Measuring mobile penetration https://www.gsmaintelligence.com/research/2014/05/measuring-mobile-penetration/430/.

12 The Financial Inclusion Insights (FII) Program is a partnership between InterMedia and the Bill and Melinda Gates Foundation. Under the FII Program, nationally representative household surveys are conducted annually for Bangladesh, India, Indonesia, Kenya, Nigeria, Pakistan, Tanzania and Uganda. The FII questionnaires include specific questions on mobile-phone usage and ownership in these countries. More information on the FII Program is available at: http://finclusion.org. Data presented in this chapter from FII have been calculated combining the survey questions on mobile-phone usage and ownership with those on SIM card use and ownership. Mobile-phone ownership is defined as having "a mobile-cellular phone device with at least one active SIM card for personal use". Likewise, mobile-phone usage is defined as using both a mobile phone and an active SIM card.

13 In its 2011 ICT household and individual survey, Research ICT Africa (RIA) included questions on mobile-phone ownership which made it possible to produce an overview of the situation in sub-Saharan Africa (see Research ICT Africa, 2012). However, given the growth recorded in most African mobile-cellular markets over the last five years, the present situation may well be very different from that reflected in the 2011 RIA surveys. This is confirmed by the data from Cameroon, Nigeria and Tanzania, where less than 50 per cent of the population owned a mobile phone in 2011 according to RIA's surveys, but where mobile-phone ownership today exceeds 75 per cent according to recent ITU and FII data.

14 For the 11 countries in Chart 5.6, the Pearson correlation between mobile-phone ownership and individuals using a mobile-phone without owning it renders a result of-0.76. The Pearson correlation ranges from-1 to 1, being-1 a total negative correlation, 0 no correlation and 1 a total positive correlation.

15 For an example of how ICTs can assist in creating better conditions of life for older adults, see the Active and Assisted Living Programme in Europe, http://www.aal-europe.eu.

16 For a discussion of gender divide in ICT access and usage within the perspective of other digital divides, see for instance https://www.apc.org/en/blog/inside-information-society-how-digital-divide-has.

17 ITU estimates that over 95 per cent of the world's total (i.e. both urban and rural) population is covered by a mobile signal.

Chapter 6. Internet user and activity trends

Key findings

In 2016, people no longer *go* online, they *are* online. An increasingly ubiquitous, open, fast and content-rich Internet has changed the way many people live, communicate and do business, delivering great benefits for individuals, governments, organizations and the private sector. Yet many people are still not using the Internet, and many users do not fully benefit from its potential. A better understanding is needed of who is online and who is not, and how people are using the Internet, in order to create a more inclusive information society.

The benefits of the Internet are still unavailable to over half the world's population. The offline population – 3.9 billion people globally – is disproportionately female, elderly, less educated, lower income and rural. To bring more people online, it is important to focus on reducing overall socio-economic inequalities. Education and income levels are strong determinants of whether or not people use the Internet.

Most people have access to Internet services but many do not actually use them. The spread of 3G and 4G networks across the world had brought the Internet to more and more people. In 2016, mobile-broadband networks covered 84 per cent of the world's population, yet with 47.1 per cent Internet user penetration, the number of Internet users remains well below the number of people with network access. While infrastructure deployment is crucial, high prices, poor quality of service and other barriers are serious obstacles to getting more people to enter the digital world.

The full potential of the Internet remains untapped, especially for low-income and less educated users. Internet users with higher levels of education make greater use of more advanced services, such as e-commerce and online financial and government services, than Internet users with lower levels of education and income, who use the Internet predominantly for communication and entertainment purposes. This suggests that many people do not benefit fully from the opportunities of the Internet. **Indeed, the Internet is liable to reinforce existing inequalities, instead of addressing them.**

Access to the Internet is not enough; policy-makers must address broader socio-economic inequalities and help people acquire the skills they need to take full advantage of the Internet. This is in line with a more integrated development approach, like that adopted in the 2030 Agenda for Sustainable Development, which highlights that development challenges are linked and cannot be met in isolation.

A data revolution is needed to better understand who uses the Internet, where and how. Reliable and valid data on Internet use are currently not available for many developing countries, and almost non-existent for least developed countries. This lack of data is a serious challenge for ICT policy-makers, investors and content producers. The United Nations has called for the use of new data sources, including big data, to supplement official statistics. ITU is responding to this call and has recently launched a new project, "Big Data for Measuring the Information Society", which explores how big data from the ICT industry can help enhance data collections, benchmarks and methodologies for measuring the information society.

Chapter 6. Internet user and activity trends

An increasingly ubiquitous, open, fast and content-rich Internet has changed the way many people live, communicate and do business. Internet uptake has been found to bring great benefits for people, governments, organizations and the private sector. It has opened up new communication channels, provided access to information and services, increased productivity and fostered innovation. It has also created a new Internet economy or digital economy, and new Internet players like Google and Facebook have become some of the world's leading businesses in just over a decade.[1]

By the end of 2016, close to half of the world's population will be using the Internet. This compares to less than two per cent two decades ago, when people connected to the Internet using a modem that would take time to dial-in via a telephone line. Access to the Internet was then limited mainly to e-mail and chat services and very limited amounts of content.[2]

Nevertheless, not everyone has benefited equally from the rapid expansion of the digital economy and its opportunities. Globally, 3.9 billion people, more than half the world's total population, are still offline. In addition, being online does not necessarily mean that people are able to take full advantage of the potential benefits of the Internet. An important step in bringing more people into the digital economy is to understand the profile of current users and the ways in which they use the Internet. It is also important to identify barriers to connecting the other half of the world's population – those who currently do not use the Internet and remain excluded from the information society.

At the same time, increased access to and use of the Internet come with a growing number of challenges, with debates increasingly focused on the negative effects of ICTs, and on how to make the Internet safer and protect users' privacy. Spending large amounts of time online has been linked to depression, decreased social skills, and other neurological complications (Cash, H. et al., 2012).[3]

The aim of this chapter is to develop a better understanding of how people use the Internet, and to identify barriers faced by non-users. It will analyse Internet use and socio-economic variables, such as age, gender, income and level of education, and examine the types of activity that different users engage in online.

The results of the analysis demonstrate a link between lower levels of educational attainment and lower Internet penetration rates among specific groups, including women and the elderly. The offline population remains disproportionately illiterate, poor, rural, elderly, and female. This chapter also finds that three decades into the World Wide Web and almost half a century after the first e-mail was sent, communication, in particular the use of social media, is the key activity of many of those online.[4] Many Internet users, in particular those with lower levels of education and income, make only very limited use of the Internet and are not able to exploit its full potential.

These findings suggest that the Internet is liable to reinforce existing inequalities and leave the most vulnerable population groups even further behind. While the mobile phone has (rightly) been hailed as a development enabler that provides crucial communication channels, access to information and new services to large population groups, including the poor and less privileged, the full potential of the Internet remains largely untapped.

To turn the Internet into a truly universal tool for development, policy-makers must tackle not only the supply-side challenges of the Internet, including infrastructure deficiencies and high prices, but also the demand-side barriers that exist outside the ICT ecosystem. This means addressing broader socio-economic inequalities. Above all, people need to acquire not only the necessary digital skills but also analogue skills, such as basic literacy and numeracy, in order to exploit the potential of the Internet. ICT policy-makers must act as part of a larger Internet ecosystem in order to empower people and make Internet content easily accessible to disadvantaged groups. ICT policies must also be linked to investments in education in order to develop the necessary human skills and raise levels of education, and thus bring more people online.

This chapter uses ITU data and information from complementary sources to analyse Internet usage across gender, age, level of education and other variables. It points to persistent data gaps, especially in developing countries, and highlights the need to produce more and granular data, and to exploit and understand the potential of new sources of data, in particular big data.

6.1 How the Internet has changed – and changed the world

Over a relatively short period of time, the Internet ecosystem has changed and grown considerably in terms of technologies, players (including Internet users, content providers, ISPs and network operators) and content. Technological developments, the open nature of its governance and the technical architecture of the Internet have profoundly changed the Internet, both in terms of its spread and pervasiveness.

In 2016, many people no longer *go* online, they *are* online. Internet access in many parts of the (mostly developed) world is fast, ubiquitous and mobile. Internet users read, shop, bank and date online, thanks to a growing number of websites, services and applications that did not exist a decade ago.

At the same time, the Internet has had an important economic impact, including in terms of the new businesses and business models it has brought about. In 2016 the FT 500 ranking, which ranks companies based on their revenues, included several of the new Internet companies, such as Amazon.com (ranked 18th), Alphabet (which includes Google, ranked 36th), Facebook (ranked 157th) and eBay (ranked 300th).[5] The FT 500 included over 50 companies from the technology and telecommunication sector, including Microsoft (25th), Cisco Systems (54th), and IMB (31st). Apple, whose key products, including its Iphone, build on the success of the Internet, ranked third in terms of revenues, but was touted the world's most valuable company in terms of market value.[6]

Rankings based on market capitalization (or stock market value) show that while in 2006 Microsoft was the only IT/Internet company ranked in the top 10, by 2016 no fewer than six of the top 10 – Apple, Alphabet, Microsoft, Amazon, Facebook and China Mobile – were IT/Internet companies.[7]

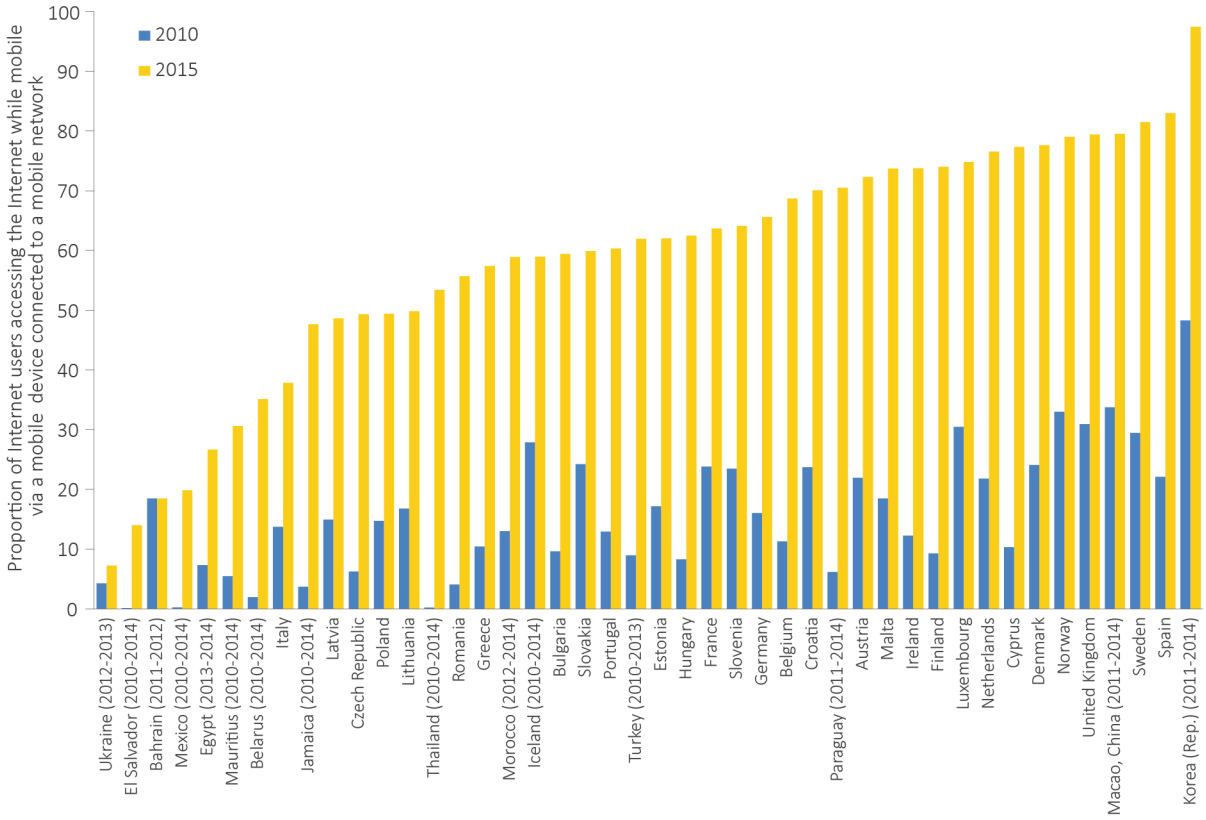
Internet access device and location

The outstanding success of the Internet economy and Internet user growth have been triggered by increased competition in the telecom market, the resulting decrease in the price of Internet access services and devices, and the expansion of and technological advances in mobile broadband networks[8]. The increasing computing power of smartphones has enabled the growth of new applications and functionalities – including the sharing of photos and videos and accessing of information on health, education and location services – while the rapid spread of 3G and 4G networks around the world has helped transform the use of the Internet from fixed locations, such as home, work and schools, to anywhere with network coverage[9]. ITU data show that an increasing number of people are accessing the Internet while mobile using a mobile device connected to a mobile phone network (Chart 6.1). In many developing countries, and in particular the least developed countries (LDCs), Internet access is almost exclusively via mobile networks.

This trend has not only led to new business models, such as the on-demand economy which uses a person's location to offer convenient access to goods and services – such as the transportation service company Uber, and restaurant delivery services that find and deliver food from restaurants located within a person's proximity; mobile connectivity has also impacted how people use the Internet with new devices, services and applications especially tailored to a mobile lifestyle – for example, smart watches for exercising, and reality games such as Pokémon Go.

Although "home" remains the place where people most frequently use the Internet, in particular in developed countries (Chart 6.2), "in mobility" is the second most important access location, followed by access at work. Developing countries show greater diversity in where people access the Internet, and available data suggest that in countries with lower income levels, schools and universities remain important Internet access locations. In Egypt, while most people access the Internet from home, more than half of all Internet users also go online at school or at universities. In several countries in Latin America, such as Mexico, Peru and Venezuela, commercial facilities are among the most frequent access locations.

Chart 6.1: Proportion of Internet users accessing the Internet while mobile via a mobile-cellular telephone connected to a mobile phone network (2010 and 2015 unless otherwise specified)[10]



Note: For developing countries, this chart refers to Internet use via a mobile-cellular telephone connected to a mobile phone network when the person's location is away from "home", "work", "place of education", "another person's home" and "community and commercial access facilities". For European countries, it refers to Internet use via a mobile-cellular telephone "away from home and work". As such, for European countries, it could include Internet use via WiFi at other locations.
Source: Eurostat and ITU.

It should be noted that data are available only for a limited number of developing countries. Data are lacking for those with very low income levels, including the LDCs.

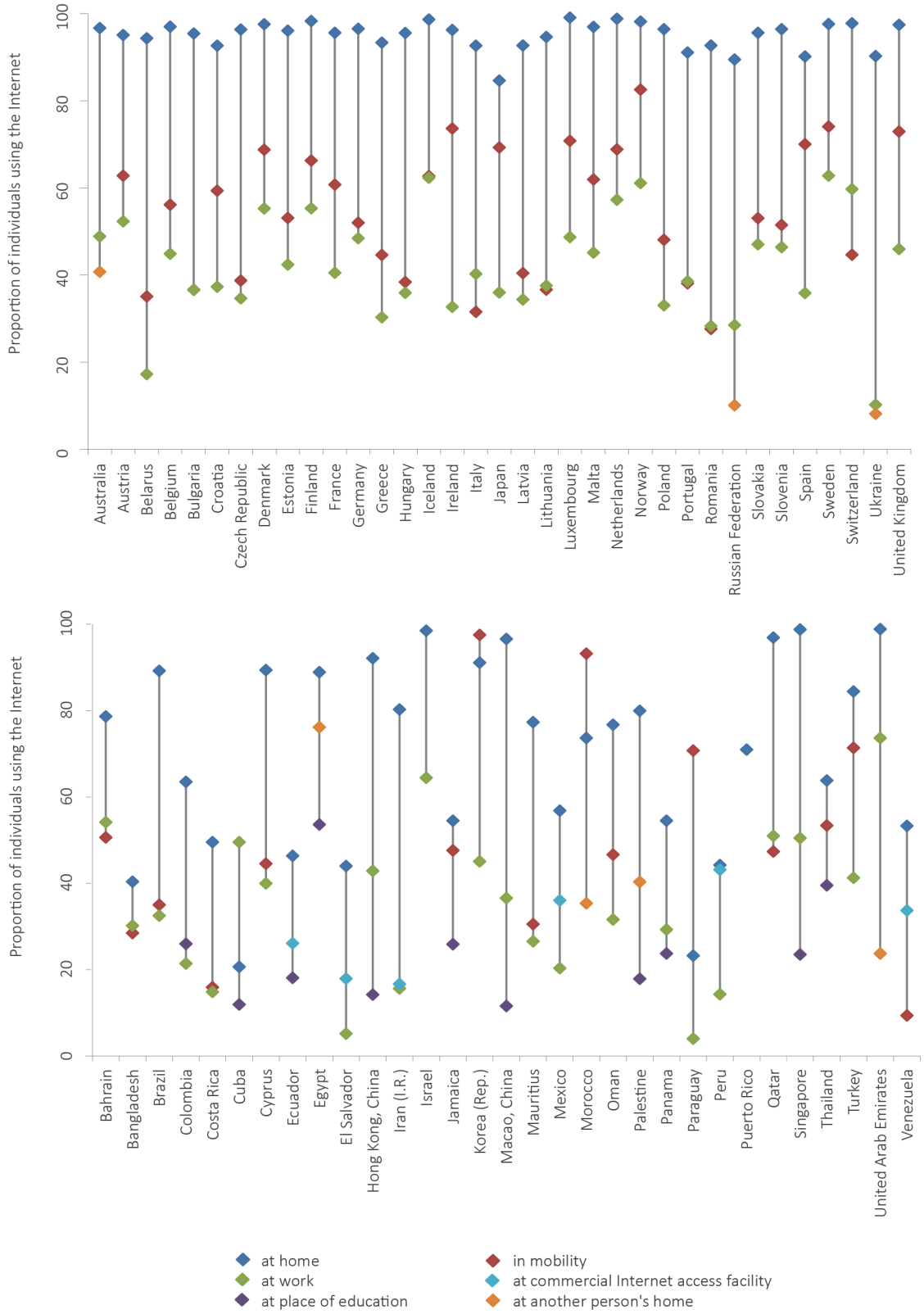
Location and the type of device used to access the Internet are important to policy-makers, content service providers and related businesses, as evidence shows that Internet use varies according to the platform used. Data from Comscore on Internet users in the United States, for example, show that smartphone users spend most of the time on photos, using maps, gaming and social networks (Comscore, 2015). Those accessing the Internet on a computer spend most of the time getting information through online portals, and consulting business and finance as well as entertainment and news websites (Chart 6.3). It should be noted that some content providers have been quicker to adapt their user interfaces to mobile platforms; behaviour could thus change when more web properties adapt their interfaces to the mobile platform.

Internet traffic and content

The change in the Internet ecosystem and its rise in popularity are accompanied by a large growth in Internet traffic. Cisco, which tracks global IP traffic and related measures, predicts that by the end of 2016 annual global IP traffic will pass the zettabyte (ZB), and reach 2.3 ZB per year by 2020.

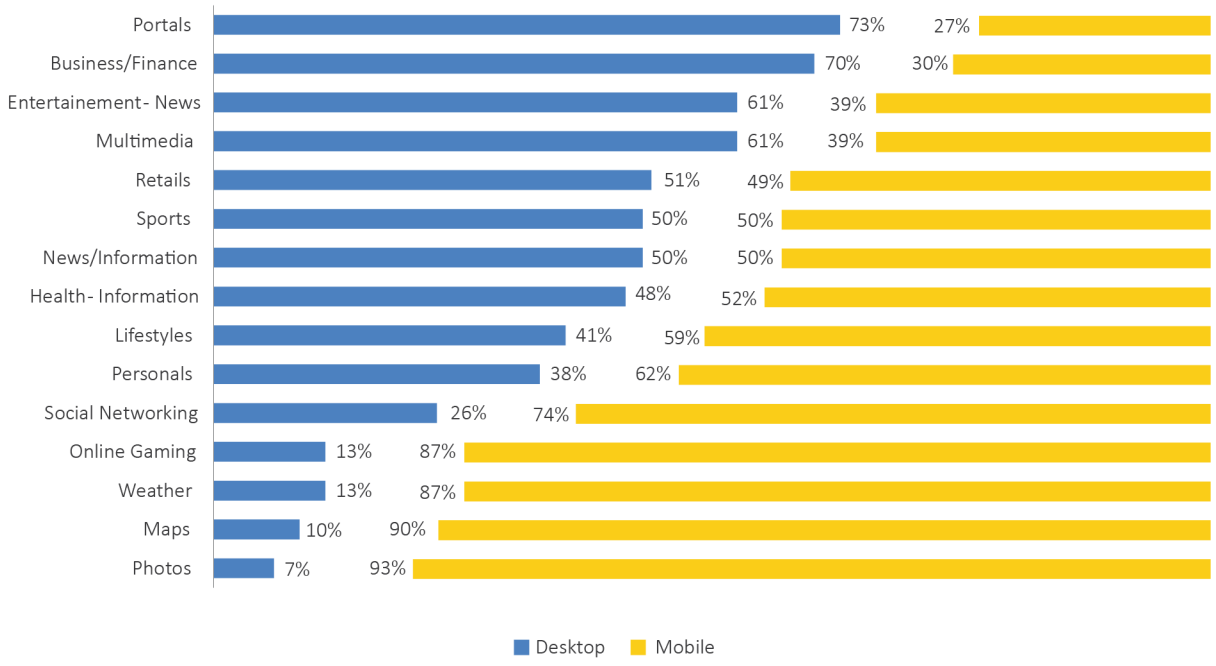
With faster speeds, cheaper mobile subscription plans and devices and more data allowance, video streaming on mobile phones is expected to rise in the coming years.[11] This trend is also facilitated by new apps and developments made by the major video-streaming companies. Smartphone traffic is expected to exceed computer traffic by 2020, while traffic from wireless and mobile devices will then account for two-thirds of all IP traffic.

Chart 6.2: Top three most frequent locations for Internet use in developed (top) and developing (bottom) countries, as a percentage of individuals using the Internet by location; latest data 2012-2015



Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: Eurostat and ITU.

Chart 6.3: Time spent on mobile vs. desktop per content category in the United States



Note: Tablets included in mobile. From comScore's 2015 US "Digital Future in Focus" whitepaper.
Source: comScore Media metrix Multi-Platform, US, Dec 2014.

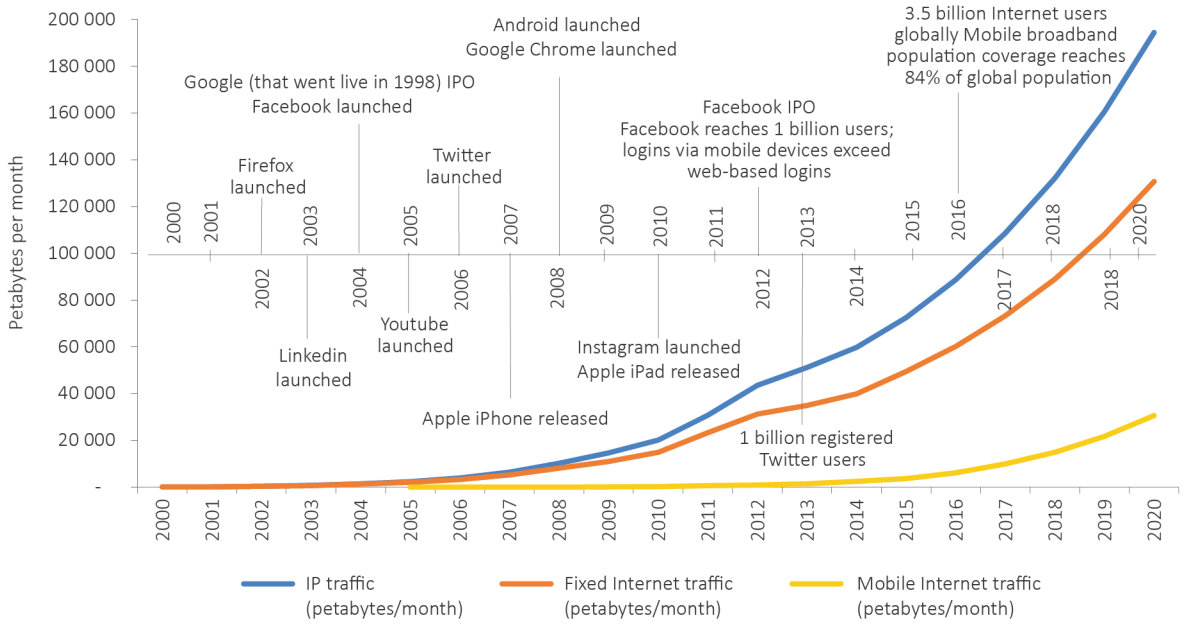
Cisco predicts that by 2020, IP video traffic will account for 82 per cent of all IP traffic, up from 70 per cent in 2015. Growth is being driven by Internet video surveillance traffic, virtual reality traffic, consumer video-on-demand (VoD), Internet video to TV and Internet gaming traffic. To illustrate the impressive growth in video traffic, Cisco highlights that: "It would take more than 5 million years to watch the amount of video that will cross global IP networks each month in 2020. Every second, a million minutes of video content will cross the network by 2020" (Cisco, 2016).

The rapid growth in video traffic is also reflected in the number of video-streaming services, such as YouTube, which has become the leading video-streaming platform globally with over one billion users.[12]
The growth in subscription-based video-streaming services, such as Netflix, accounts for a large share of the total IP traffic. Starting in the United States in 1997 as a postal DVD rental service, Netflix moved towards video streaming on the Internet in 2007. Over the last decade, it has vastly expanded its membership base across the globe and by 2016 was available in over 190 countries, catering to over 83 million subscribers.[13]

Although an increasing amount of content is accessed via mobile and wireless devices, fixed networks continue to dominate in terms of global traffic. Most traffic using mobile devices is offloaded onto the fixed network via WiFi (Chart 6.4).

Other measures of content that include the number of webpages and domain name registrations (ITU, 2014b) show that content on the Internet is growing and becoming more diverse. At the end of the first quarter of 2016, there were an estimated 326.4 million top-level domain (TLD) registrations worldwide, representing an increase of 11 per cent from 294 million registrations the previous year, and nearly doubling the figure for 2008.[14] The total number of country-code top level domain (ccTLD) registrations, which has been used as a proxy indicator for the availability of local content (ITU, 2014b), was estimated at 148.2 million at the end of the first quarter of 2016, an increase of 18 per cent (or 23.2 million registrations) from 2013. This trend is also observed with Wikipedia, the largest user-generated online encyclopedia. The number of Wikipedia articles, which are available in 293 languages, has increased ten-fold over the last decade, from 3.9 million in 2006 to almost 40 million in 2016.

Chart 6.4: Internet and IP traffic



Note: Fixed Internet traffic refers to traffic through fixed network providers on different platforms. Mobile Internet traffic refers to traffic through mobile-cellular networks. IP traffic refers to the sum of fixed and mobile Internet traffic (denoting all IP traffic crossing an Internet backbone) as well as non-Internet IP traffic (e.g. IP WAN, IP transport of TV and video-on-demand).
Source: ITU based on Cisco and company reports.

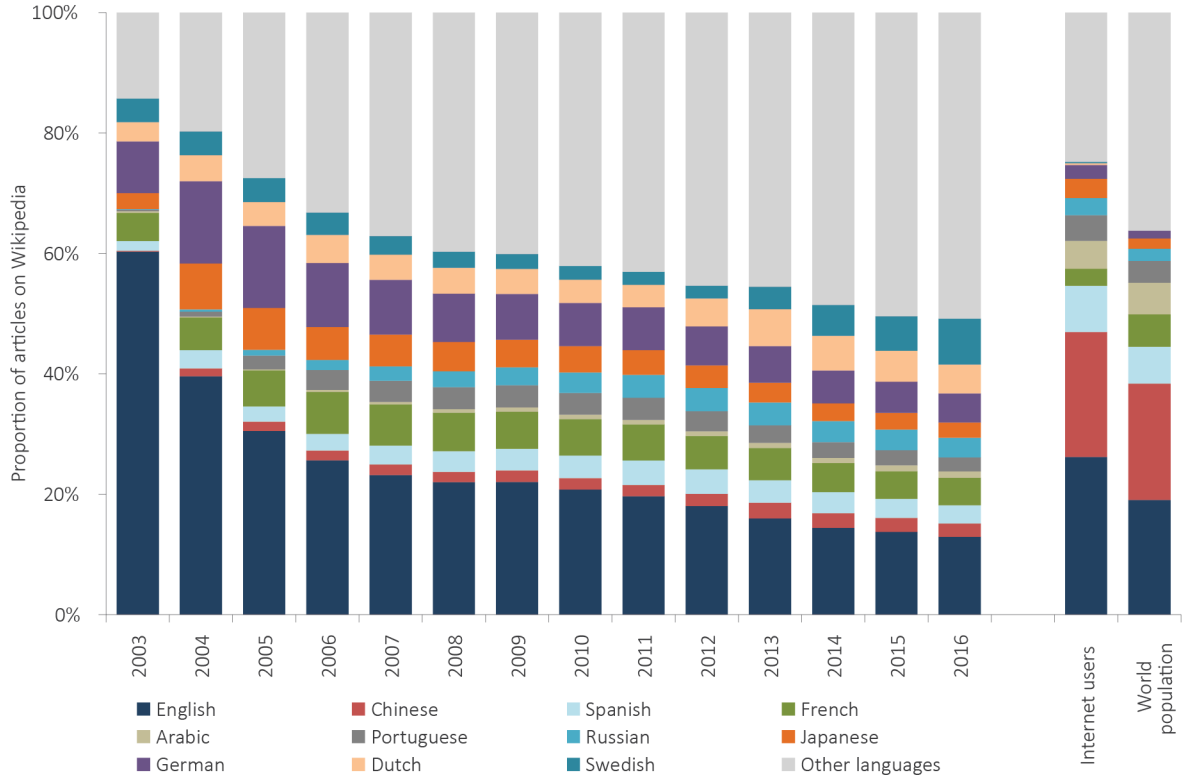
The Internet is also becoming more multilingual. The increase in Internet users outside the primarily English- or Chinese-speaking world is further diversifying the languages used on the Internet, reflected by what appears to be a relative decline in the use of English and Chinese on the Internet. Estimates published by Internet World Statistics suggest that 47 per cent of the world's Internet users are now English or Chinese speakers, down from 51 per cent in 2011.[15] Wikipedia can also be used as an indication of the availability of content in different languages (Chart 6.5). In 2003, two years after Wikipedia was founded, 60 per cent of all articles were in English. By 2016, this proportion had decreased to 13 per cent. The number of articles on Wikipedia has grown by 50 per cent from 2013 to 2016, with five out of every six new articles written in languages other than the six official UN languages (Arabic, Chinese, English, French, Russian and Spanish). In 2016, 73 per cent of all articles on Wikipedia were written in languages other than the official UN languages.

Many other indicators can be used to highlight the spread and growth of the Internet, and the Internet economy. These include the growing number of social media outlets and users, such as Facebook accounts, number of tweets, online searches, and the increase in the number and types of applications, or apps.[16] The commercial value of this information has created new business models with private companies gathering, analysing and selling data for revenue optimization, for example using Internet users' content history to target advertisements to a certain type of online user. However, because of the business value of such data, not all information on how people use the Internet is necessarily freely available to the public, even though such information is important to understanding how more people can be brought online to benefit from the Internet's opportunities. Using big data from the ICT industry could provide such insights in the future, and ITU recently launched an ITU project on "Big Data for Measuring the Information Society", which is exploring ways to use big data to help understand who uses the Internet, and where and how, as well as the benefits it delivers.

6.2 Socio-economic factors that determine Internet use

Although the number of Internet users is increasing continuously in all regions and countries of the world, major differences remain. In the world's developed countries about 80 per cent of the population is online, as against only about 40

Chart 6.5: Distribution of Wikipedia articles by language 2003-2016

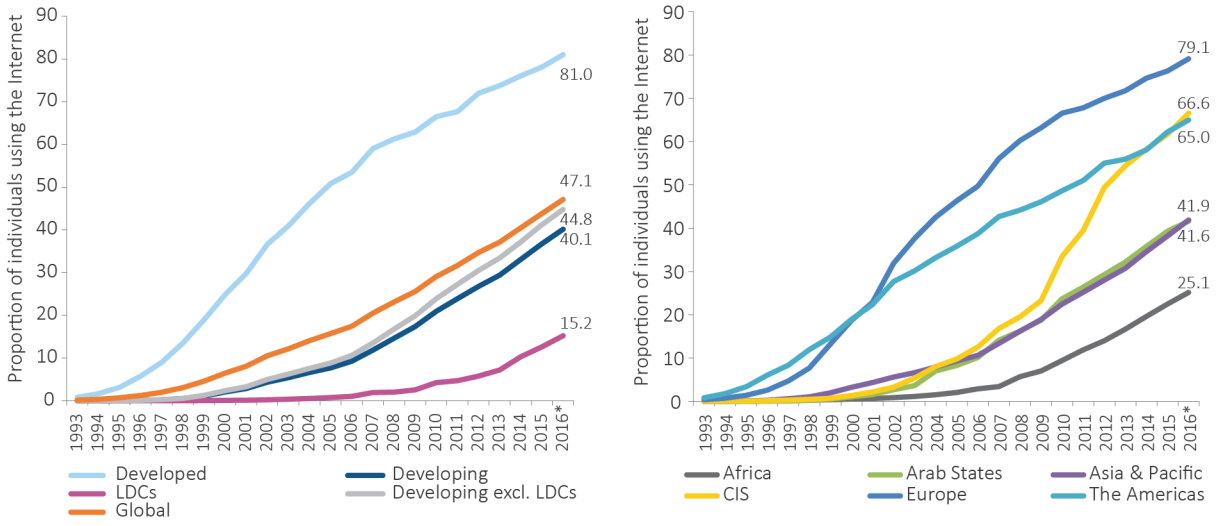


Note: The Internet users by language data are from Internet World Statistics, which assigns a single language to each individual in order to add up to the total world population; however, it is unclear how it assigns people's first language in countries where large proportions of the population are bilingual or multilingual.
Source: Wikipedia statistics at http://stats.wikimedia.org/EN/TablesArticlesTotal.htm, accessed 26 May 2016, and Internet World Statistics.

per cent in the developing countries and less than 15 per cent in LDCs (Chart 6.6). Globally, 47 per cent of the world's population is using the Internet.

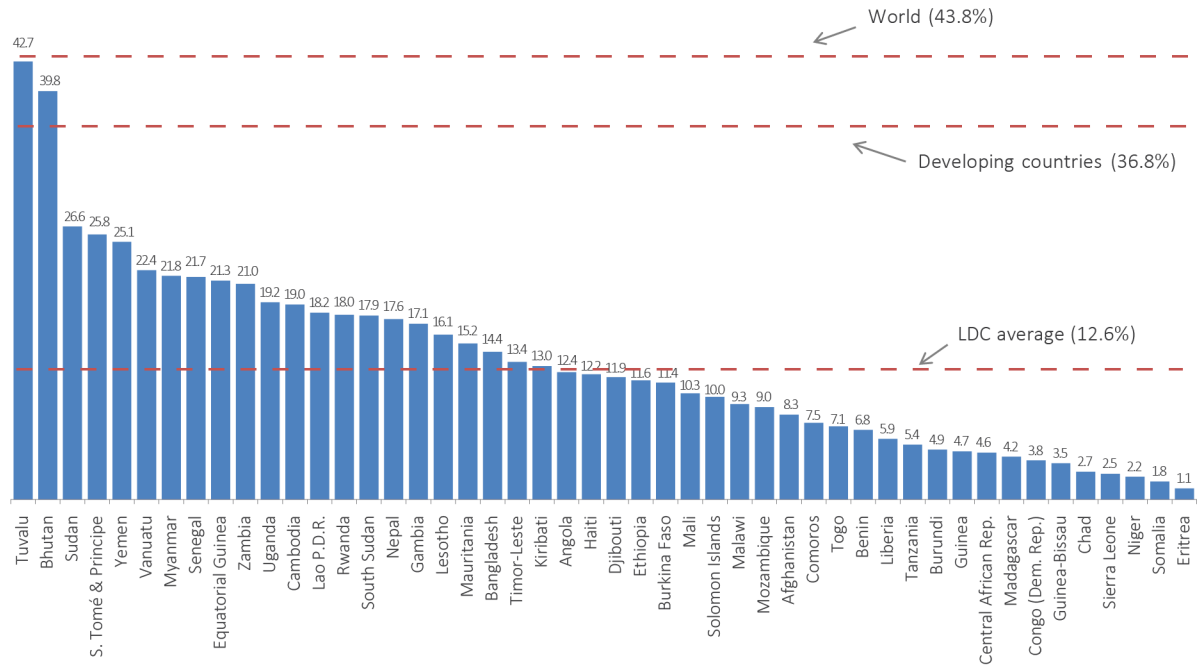
Available data show that although Internet usage in LDCs has tripled in the past five years, Internet penetration levels in LDCs today have reached the level enjoyed by developed countries in 1998,

Chart 6.6: Proportion of individuals using the Internet by level of development (left) and by region (right)



Note: * Estimate.
Source: ITU.

Chart 6.7: Proportion of individuals in LDCs using the Internet, 2015



Source: ITU.

suggesting that the LDCs are lagging nearly 20 years behind the developed countries. At the same time, the LDC average itself hides large differences, with some LDCs doing much better than others (Chart 6.7).

Internet uptake in LDCs has increased significantly in the past years, driven by strong growth in a few LDCs in Asia, such as Bangladesh, Bhutan, Cambodia and Myanmar, but also in a few LDCs in Africa, such as Ethiopia, Lesotho, Mauritania, Rwanda and Senegal. However, no LDC currently reaches the global average of Internet penetration. In addition, in several of Africa's most fragile and poorest countries, still only one person in 10 uses the Internet.

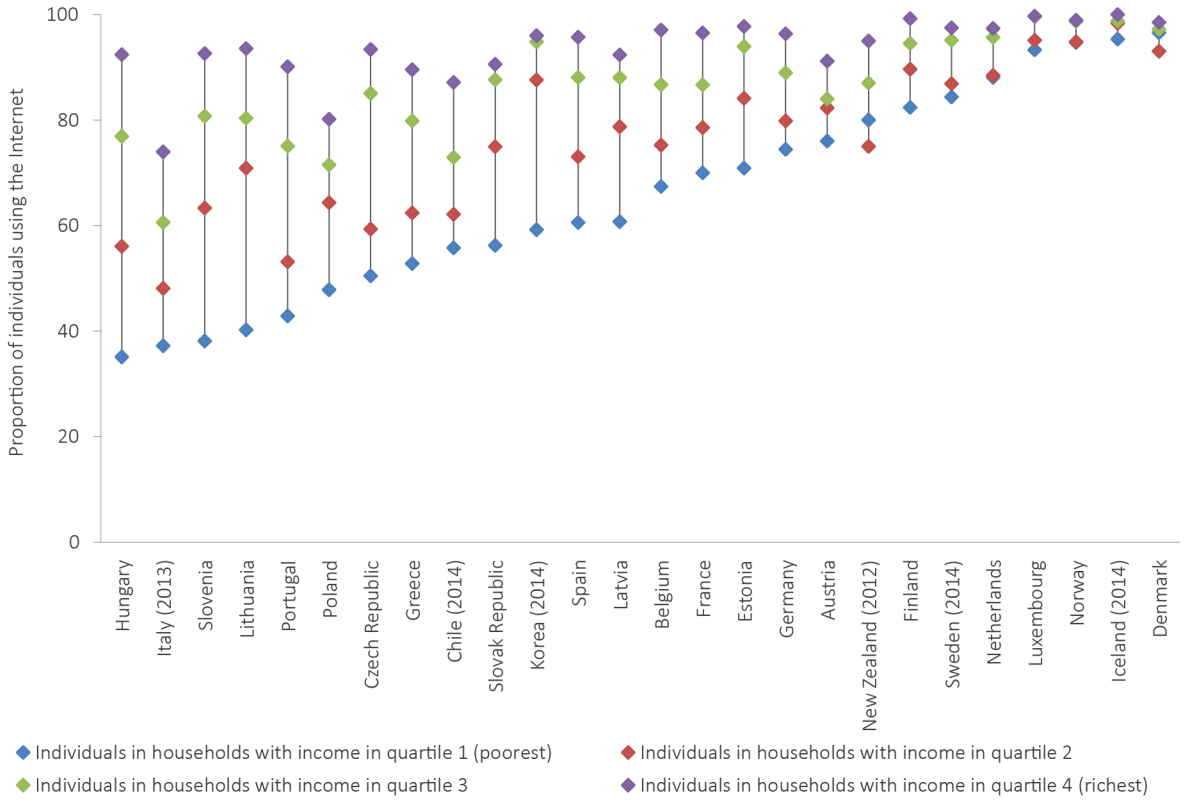
Those LDCs with the lowest Internet penetration levels are those that already face other development challenges, such as low incomes and levels of education and limited health services. Since Internet access and use can deliver better communication channels, more services and applications and higher levels of productivity and innovation, the lack of access in LDCs will reinforce existing inequalities.

Internet uptake is strongly linked to income and education

Internet access and usage vary significantly within countries and available data suggest a strong link between household income and level of Internet use, even in developed countries. The difference in Internet use between a country's poorest and richest segments is considerable (Chart 6.8). Data from Eurostat and OECD show that, while over 90 per cent of individuals living in high-income households use the Internet, Internet use among people in the poorest quartile is far from universal. In some European countries, fewer than half of the people in the poorest quartile use the Internet.

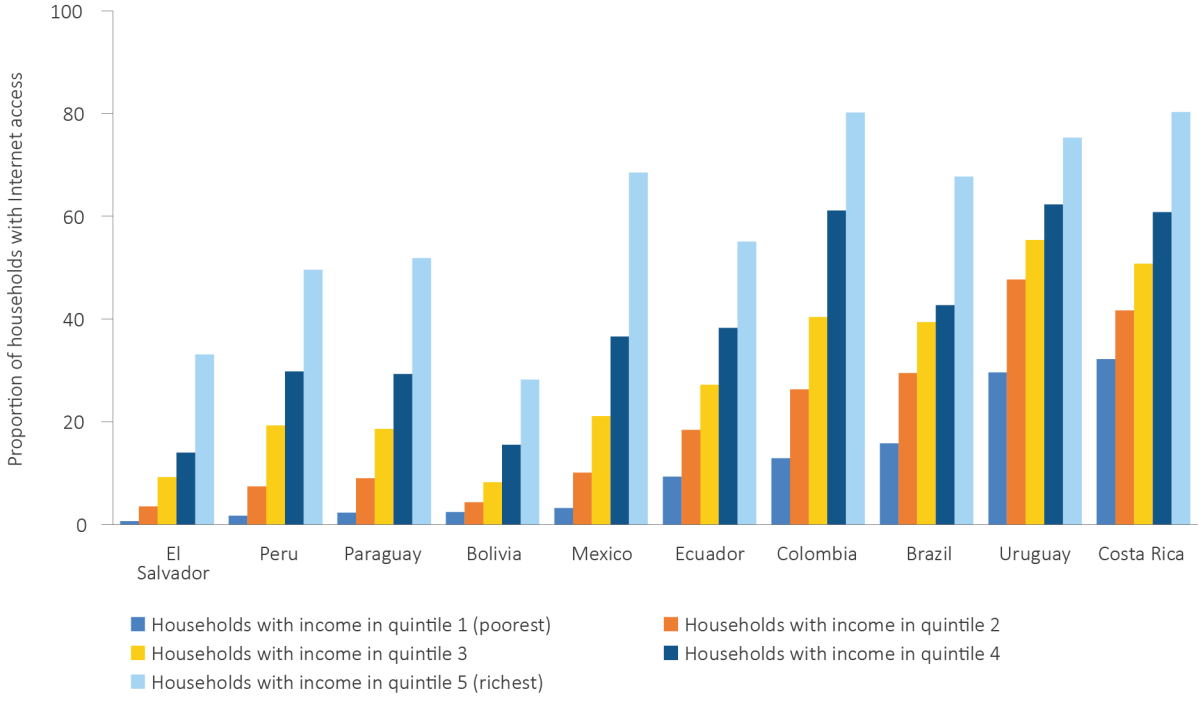
Internet access in Latin America is even more closely linked to household income than in OECD countries. Inequalities in Internet access in Latin America mirror pronounced inequalities in income distribution across the region. The two countries with the highest income inequalities measured by the Gini coefficient, Colombia and Mexico, also present the largest differences in Internet access between the poorest and richest quintiles. In Mexico, nearly 70 per cent of the richest quintile of society has Internet access at home, while only 3 per cent of households in the poorest quintile are connected to the Internet (Chart 6.9).

Chart 6.8: Internet usage by income distribution in OECD countries (2015 unless otherwise specified)



Source: Eurostat and OECD.

Chart 6.9: Households with Internet access by household income distribution in Latin America (latest data 2013-2015)



Source: ECLAC (2015), Regional Broadband Observatory ORBA.

While there is a long way to go to achieve universal access to the Internet in Latin America, data from the Economic Commission for Latin America and the Caribbean (ECLAC) show that the Internet is slowly beginning to reach the poorest segments of society. However, the progress is unequal across countries. Costa Rica made significant progress towards equality in Internet access from 2010 to 2014, but progress has been slower in several other countries of Latin America. In a few countries, such as Bolivia and Peru, household access to the Internet remains an amenity only for the richest quintiles. Chart 6.10 presents the distribution of households with Internet access based on their income level. The straighter the line, the more equal is household access to the Internet across income levels.

Household income is often linked to level of educational attainment. ITU data show that level of education is one of the most important indicators of whether or not people are Internet users (Chart 6.11). While level of education is a key factor explaining Internet usage in developing countries, the same relationship is also observed in nearly all developed countries. Whereas Internet usage in most developed countries is almost universal among people with tertiary education, a large proportion of citizens with lower educational attainment remain unconnected, despite similar access to infrastructure and services.

The strong link between educational attainment and income level may help explain the fact that in developing countries the imbalances in Internet usage across groups of people with different levels of educational attainment are even more pronounced. In the Islamic Republic of Iran, over 90 per cent of people with tertiary education use the Internet as against 40 per cent of people with upper secondary education, and fewer than 20 per cent of people with a lower level of educational attainment. Similar trends are seen in Bangladesh, Egypt and Thailand.

The gender divide

Data on Internet usage broken down by gender points to a very clear gender divide. In the vast majority of countries, the proportion of men using the Internet is higher than the proportion of women. These findings are reflected at global level, where ITU reports a 2016 Internet user gender gap of 12 per cent. Only in certain select countries, in Europe and the Americas in particular, are more women than men online, proportionally. Data also point to significant differences between developed and developing countries (Chart 6.12).

Differences in levels of education and school enrolment are important factors that could explain why more men than women use the Internet. Some of the countries in which more women than men are Internet users, including the Bahamas, Jamaica, New Zealand and Sweden, are also countries that do well on the gender parity index (GPI), which measures parity between girls and boys in terms of school enrolment ratios. The gender equality in these countries is also reflected by a high proportion of women in the labour force.

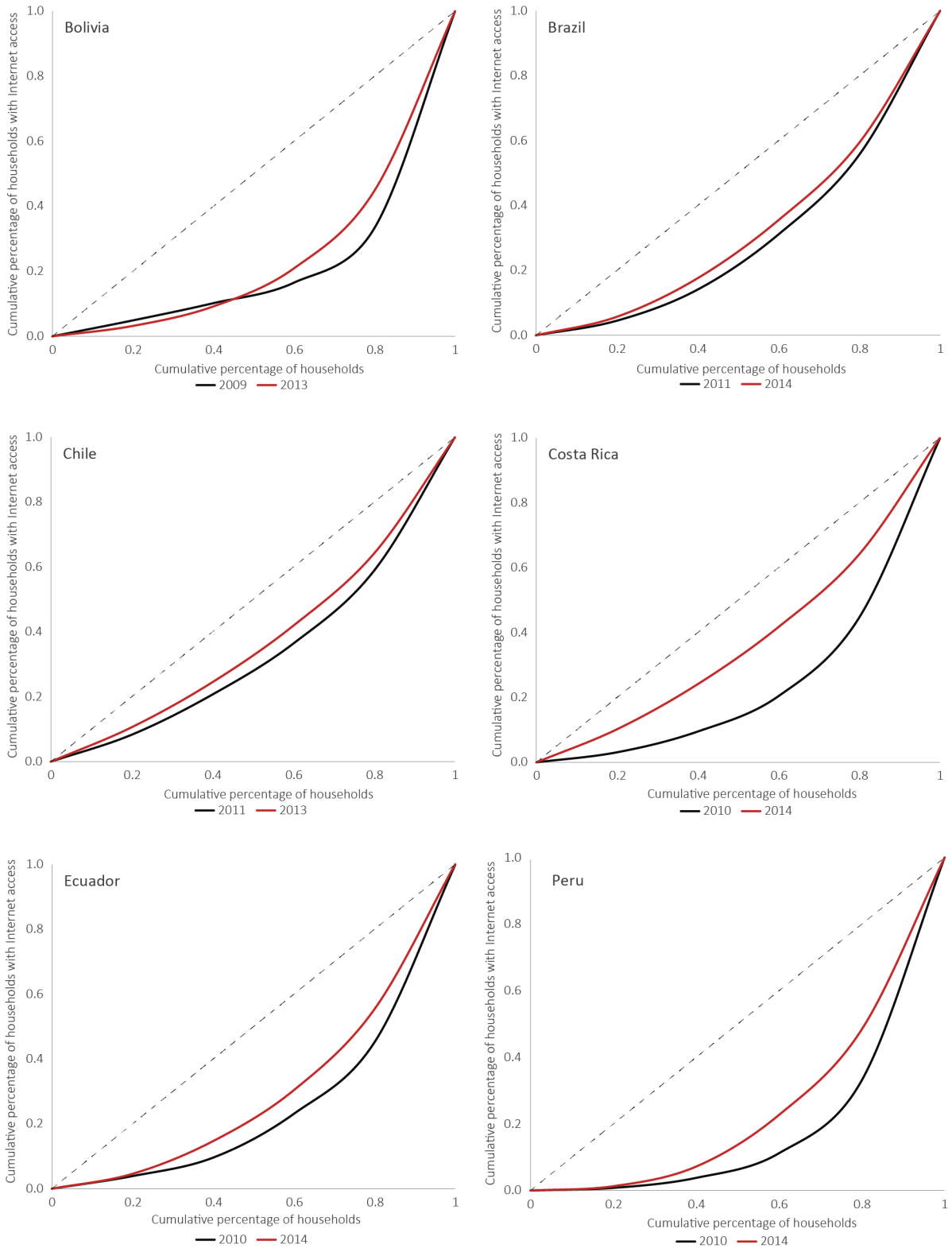
Gender parity in tertiary education can also explain some of the differences in regional gender gaps (Figure 6.1). The smallest Internet user gender gap is observed in the Americas, where countries also score highly on GPI in tertiary education.[18] While Internet penetration among men and women is roughly the same in several countries of North and South America, such as Brazil, Canada, Paraguay, Uruguay and the United States, the link between gender parity in Internet usage and gender parity in tertiary education is especially strong in Caribbean countries. In the Caribbean, there are an average of two females for every male attending tertiary education, and in several Caribbean countries, such as Cuba and Jamaica, Internet usage is higher among women than among men.

This is in contrast with other regions with large gender gaps in Internet usage, especially in Africa and Asia and the Pacific, where many countries suffer from lower gender parity at higher levels of education. Among developing countries, the largest Internet gender gaps are found in countries with low levels of gender parity in tertiary education, such as Bangladesh, Burundi and Ghana.

Seniors online

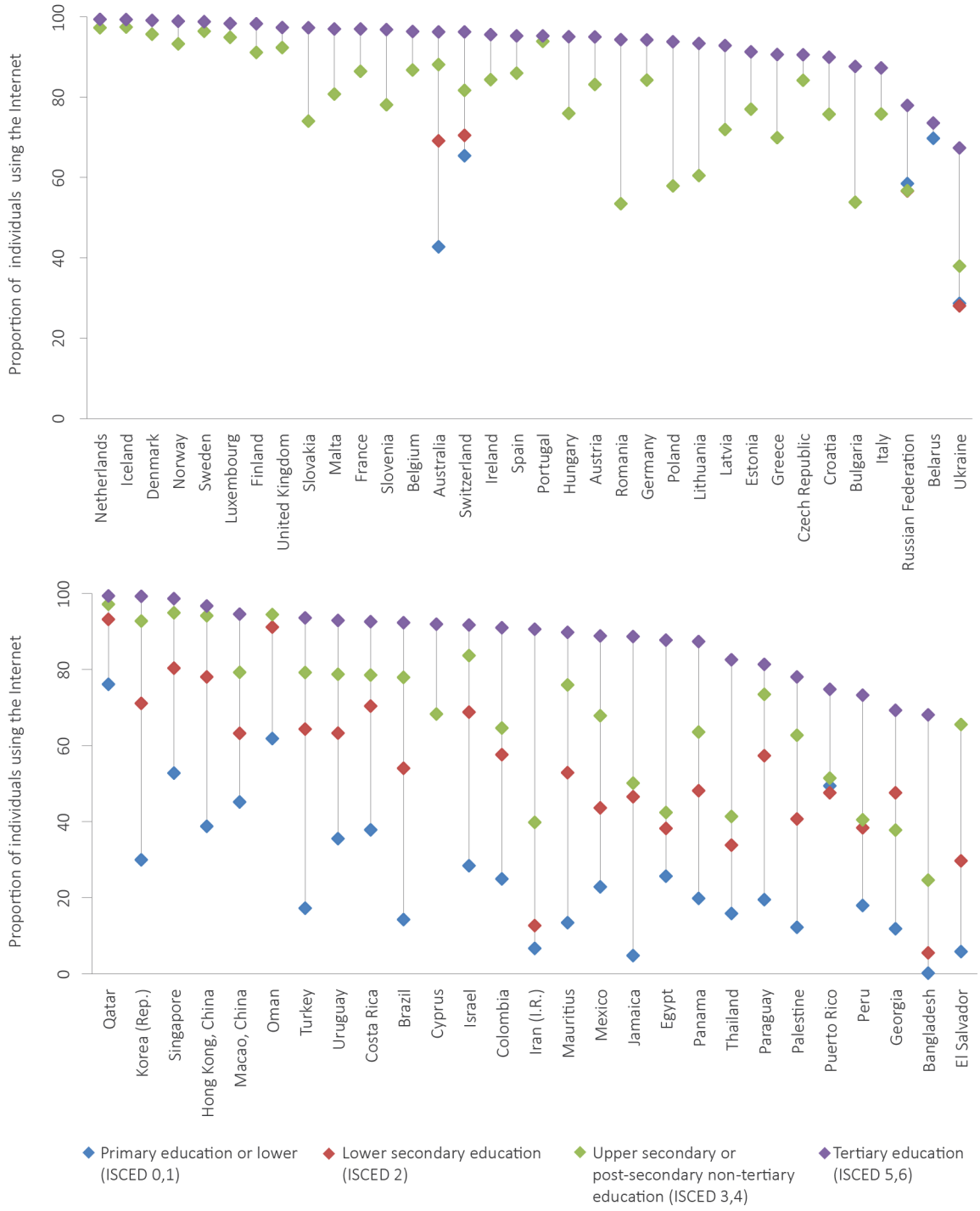
One age group with a proportionally lower Internet user penetration rate is the elderly. ITU data confirm that older population groups have much lower Internet penetration levels than the overall population (Chart 6.13). In most countries,

Chart 6.10: Internet access by household income distribution in Latin America (selected countries)



Note: The Lorentz curve presents the distribution of households with Internet access based on households' income level. The red and black lines show the cumulative percentage of households with Internet access (y-axis) and the cumulative percentage of household income (x-axis) in 2009-2011 and 2013-2014. The straighter the line, the more equal is household access to the Internet across income levels. The grey diagonal line represents full equality in Internet access.
Source: ECLAC (2015), Regional Broadband Observatory ORBA.

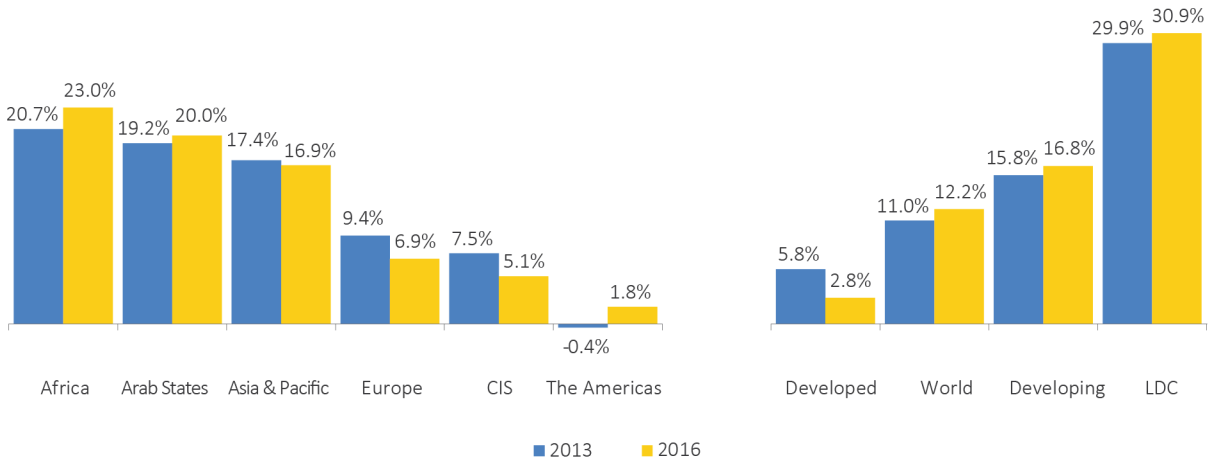
Chart 6.11: Internet use by level of education in developed (top) and developing (bottom) countries (latest data 2013-2015)



Note: Data for most European countries are available only for upper secondary and tertiary education. Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: Eurostat and ITU.

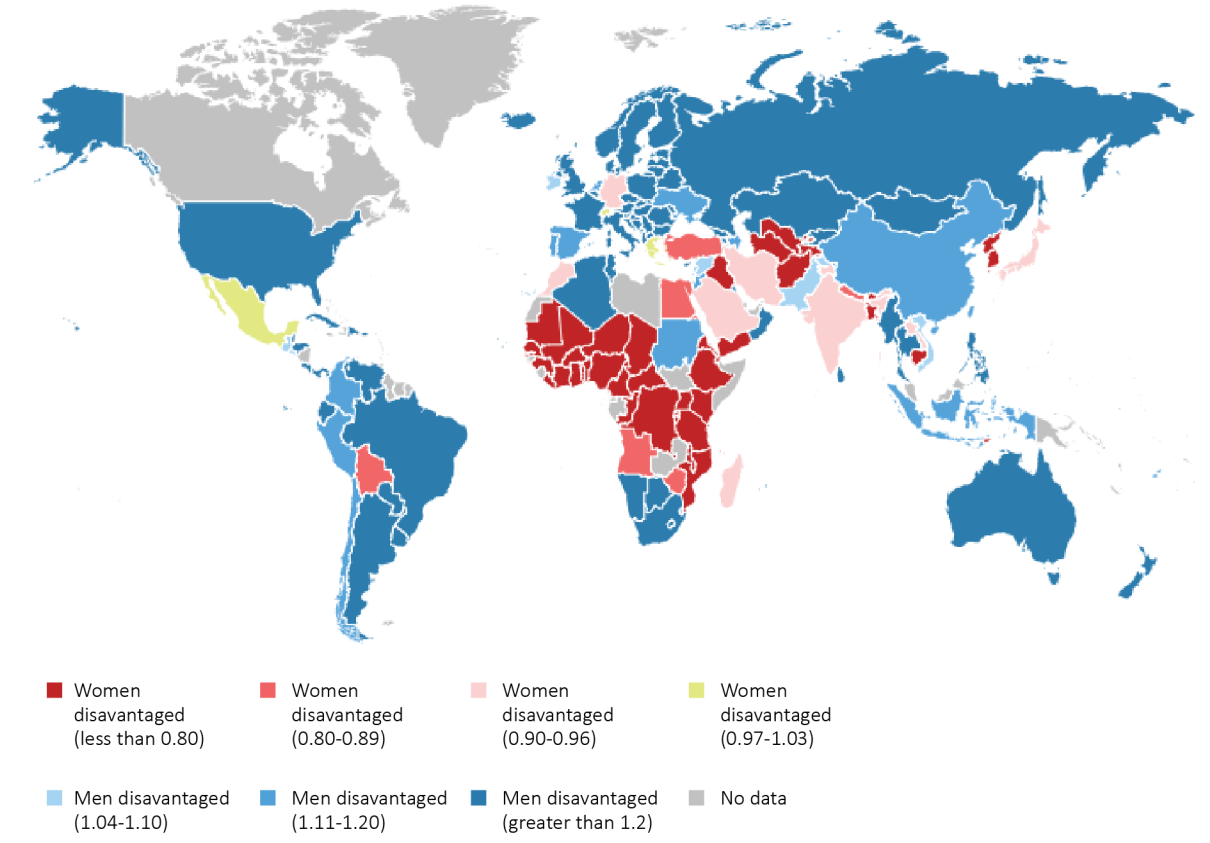
Internet user penetration for people over the age of 75 remains well below 10 per cent. The differences across age groups are especially large in countries which have experienced rapid economic development, such as Hong Kong (China), the Republic of Korea and Singapore. In these countries, Internet usage among adolescents

Chart 6.12: Internet user gender gap (2013 and 2016)



Note: 2016 are estimates. The gender gap is the difference between the Internet user penetration rate for males and females in relation to the Internet user penetration rate for males, expressed as a percentage.
Source: ITU.

Figure 6.1: Gender parity in tertiary education (2015 or latest available)

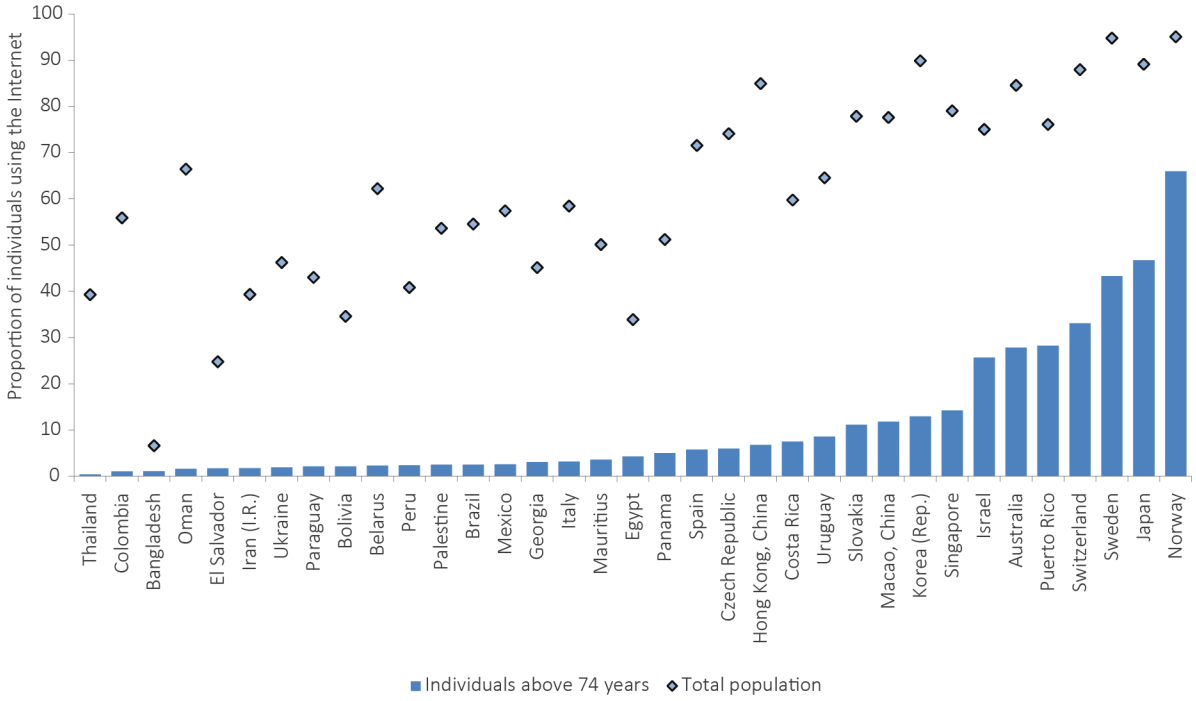


Note: The darker the colours, the larger are the gender differences in enrolment in tertiary education. Dark blue indicates more than 1.2 women per man enrolled in tertiary education while dark red indicates less than 0.8 women per man.
Source: eAtlas of Gender Inequality in Education; UNESCO Institute for Statistics (UIS).

and adults is almost universal; the elderly, however, lag behind.

The elderly, however, are not a homogeneous group, and although their overall Internet usage is significantly lower than that of the general

Chart 6.13: Internet usage among individuals over the age of 74 compared with the general population (latest data 2013-2015)



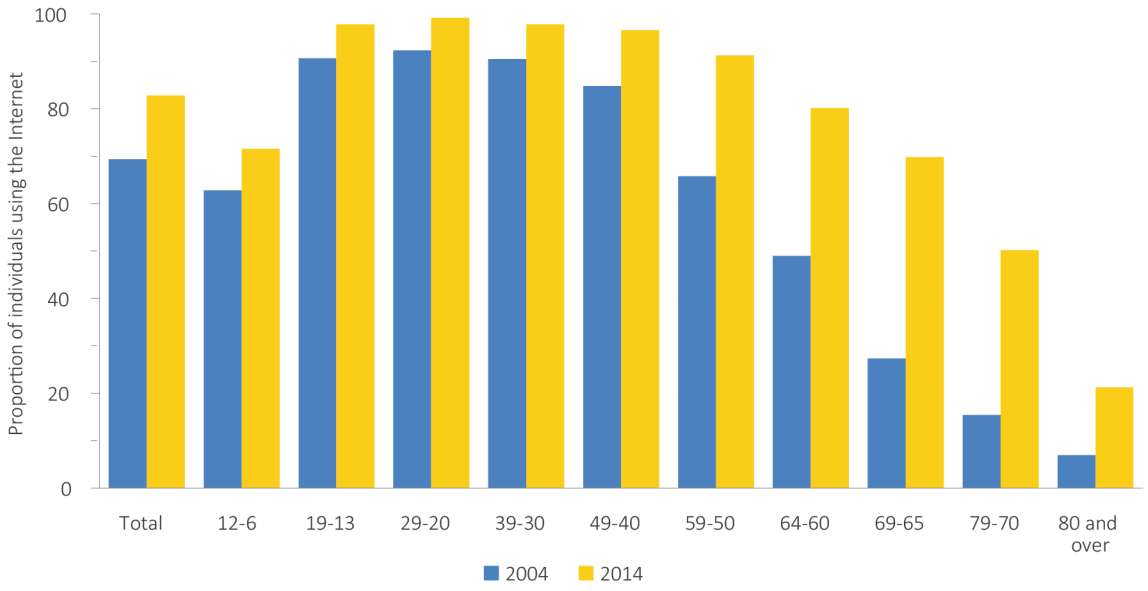
Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: Eurostat and ITU.

population, their reasons for not using the Internet are numerous. Possible explanations include not only socio-economic factors, such as lower incomes, educational attainment and literacy levels, but also social and psychological barriers, such as computer and Internet anxiety, "feeling too old", and social isolation (Van Deursen and Helsper, 2015). A United Kingdom study on the use of the Internet by the elderly highlights that "adults without an Internet connection at home are more likely to be older (particularly those over retirement age), have no formal educational qualifications or have lower annual household incomes." (Milligan, C. and Passey, D., 2011). While young people are fast to embrace technology, the challenge is to get seniors to go online for the first time. Research from the United States shows that the elderly that begin to use the Internet stay online (Pew Internet, 2014).

The possibility of accessing the Internet from almost anywhere and from a multitude of different devices – compared with only accessing the Internet from desktops and laptops two decades ago – has also contributed to the spread of Internet usage across all age groups. The user-friendliness of tablets and mobile devices has especially contributed to a spread of Internet usage among young children, but also offers the possibility of increasing Internet usage among the elderly. Chart 6.14 compares Internet usage rates by age group in Japan between 2004 and 2014; the largest increases can be observed in both the lower *and* the higher age groups.

Although many factors explain why the elderly tend to be late adopters of new technology, including physical or health-related circumstances that may limit their ability to learn or use new technologies without assistance, educational attainment does much to explain which seniors actually use the Internet. A United States survey confirms that education and income levels (similarly related) make an important difference, highlighting that "…affluent and well-educated seniors adopt the Internet and broadband at substantially higher rates than those with lower levels of income and educational attainment. Fully 87 per cent of seniors with a college degree go online, and 76 per cent are broadband adopters.

Chart 6.14: Trends in Internet usage rates by age group (Japan)



Note: Age 6 and over.
Source: The Statistical Handbook of Japan 2016 (Statistics Bureau, Ministry of Internal Affairs and Communications). Available at: http://www.stat.go.jp/english/data/handbook/c0117.htm

Among seniors who have not attended college, 40 per cent go online and just 27 per cent have broadband at home." (Pew Internet, 2014).

Identifying specific barriers to Internet use amongst older generations will be particularly important in countries with large groups of older people, since Internet access can provide them with valuable news and information, government services, health resources and opportunities for social support. Many economies with a large proportion of older population groups, and where the elderly remain the main population group excluded from the information society, have a particular interest in bringing senior citizens online.[19] Several studies have been carried out to identify barriers and ways of increasing Internet penetration in these countries (Box 6.1).[20]

Box 6.1: How to bring seniors online

Studies carried out in economies with high Internet penetration rates but relatively larger proportions of older population groups that remain offline suggest that ICT skills, but also awareness raising, relevant content and an accompanied introduction to the Internet, are crucial in bringing seniors online.

In Germany, where in 2016 one out of two senior citizens is online, there are various efforts and projects by the public and private sectors to encourage the older generation to join the information society.[21] There are also a number of studies and surveys aimed to provide an understanding of the barriers that keep seniors from going online. A recent German study shows that two-thirds of non-users over the age of 65 indicate that they do not need the Internet. Just over half say they do not have the necessary technical skills and 40 per cent do not know what the Internet is about, or do not want to make the effort to use the Internet (BITKOM, 2014). Specific training courses, and accompanied introductions to the Internet, are seen as the main way of encouraging more seniors to join the information society, and are organized through various groups and associations, including telecommunication operators.[22]

Box 6.1: How to bring seniors online (continued)

Another country that has taken action to get senior citizens online is Norway, the country with the highest Internet penetration rate among the elderly. In 2015, one of its main operators, Telenor Norway, started to offer free tablet and smartphone courses to its senior citizens in a bid to significantly raise Internet use among the elderly. Part of its "Internet for all" programme was implemented in co-operation with the Red Cross and also involves a mentor programme, as well as online learning.[23]

A recent study of Internet use by elderly people in Hong Kong, province of China, concluded that to overcome the digital age divide it is imperative to provide more elderly-friendly websites for reading the news and a mobile messaging application for communication, the two main Internet activities undertaken by the elderly, and to create more elderly-friendly digital training courses for seniors.[24]

Internet access and use amongst rural population groups

There is a strong link between Internet use and geographical place of residence. Based on data from 35 countries, Internet use in rural areas is significantly lower than in urban areas (Chart 6.15). A number of factors make rural areas particularly vulnerable: their remoteness, limited access to services (including electricity), and often difficult, i.e. mountainous or rugged, terrain. For network operators, this means that the cost of providing connectivity is proportionally higher, and the expected return on investment lower. Even the most developed economies in the world struggle with connecting their rural and remote areas, and specific policies are usually adopted to encourage and provide incentives to operators to roll out infrastructure to less profitable areas, where economies of scale are absent.

Nevertheless, the urban-rural gap cannot solely be explained by lack of infrastructure. With 3G and 4G networks being rolled out in more and more countries, network coverage is increasing. In 2016, the number of people covered by a mobile broadband network is much higher than the number of Internet users (Chart 6.16).

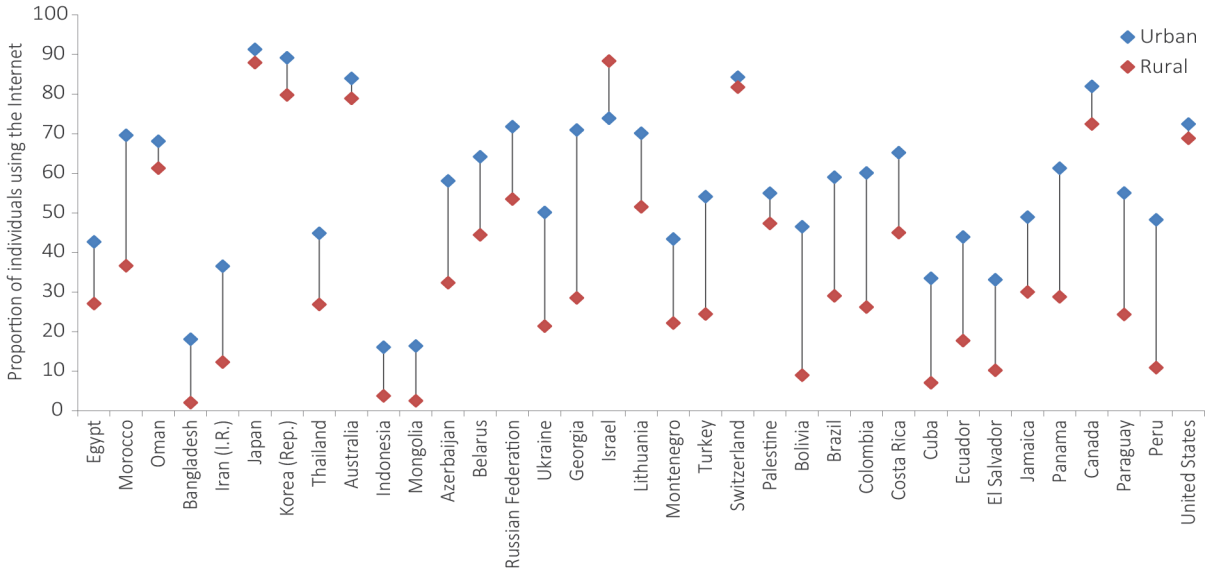
The affordability of services has often been highlighted as a key barrier, since households in rural areas tend to have lower income levels. At the same time, levels of education in rural areas lag behind those in urban areas, suggesting that, as for other population groups, levels of schooling, training and skills are important factors in Internet use and uptake.[25] Since access to the Internet can provide rural population groups with previously unavailable services, open up new markets for agricultural products and increase productivity and income levels, it is particularly important for policy-makers to better understand the barriers in order ultimately to address and overcome them.

Understanding key barriers to Internet use

Identifying barriers that keep more people from joining the information society helps policy-makers – but also businesses, including network operators and content developers – to identify concrete steps that they need to take bring more people online. Especially in developing countries, where Internet user penetration remains low, it is very important for policy-makers to understand the barriers to Internet use in order to address them, and thus allow more people to join the information society.

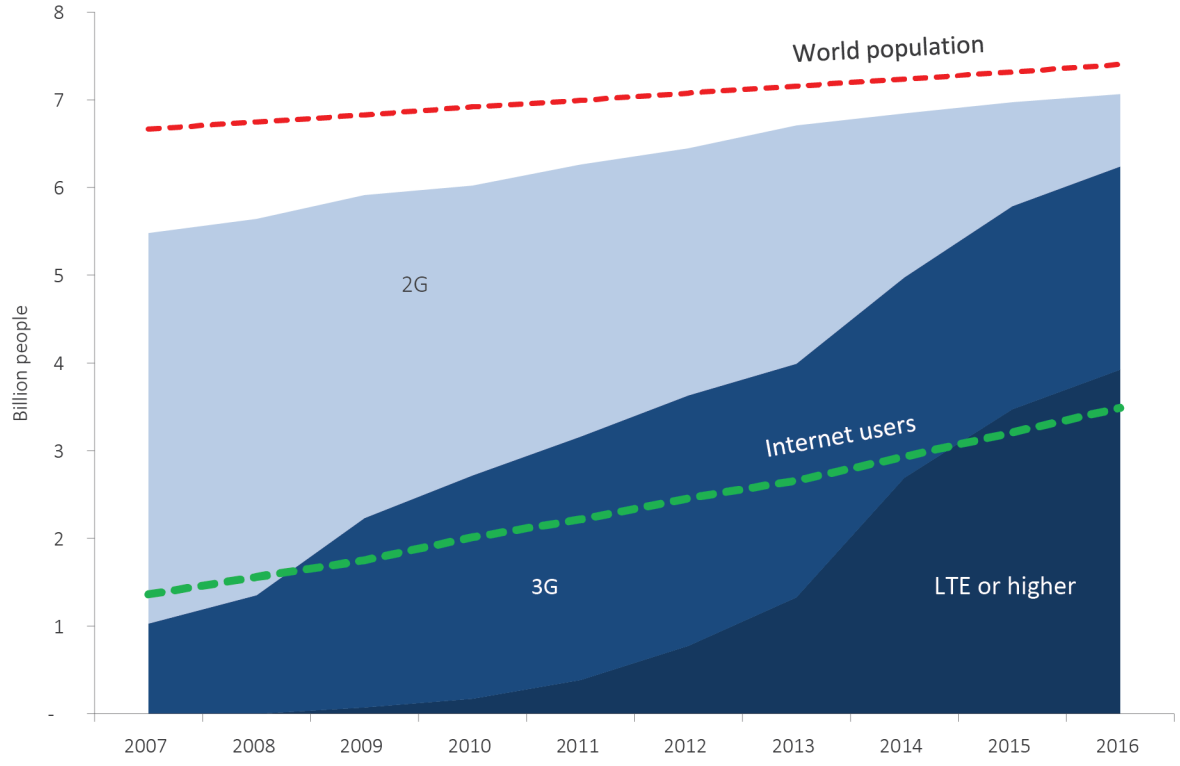
ITU collects data on barriers that households face in adopting the Internet, but the availability of these data, which are based on surveys carried out by national statistical offices, is limited.[26] Data from 45 countries, including 25 developed and 20 developing countries, suggest that most households are not yet online because the cost of services and equipment is too high. The main reasons differ, however, across developed and developing countries. While the cost of services and equipment appears to be the key barrier in developed countries, people in developing countries face other challenges. The most often-

Chart 6.15: Proportion of individuals in urban and rural areas using the Internet (latest data 2010-2015)



Note: The higher figure for Internet use in rural areas than in urban areas in Israel stands out and could be explained by the fact that the income and education levels of the rural population in Israel tend to be very similar to those of the urban population, because most of the small rural localities (fewer than 2 000 inhabitants) are cooperative or collective settlements, with a relatively high socio-economic level. It should also be noted that Israel's rural population is very small.
Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

Chart 6.16: Coverage of mobile-cellular networks in relation to world population and the number of Internet users (2007-2016)



Source: ITU.

cited response is that people "do not need the Internet", which suggests that non-users are either not aware of the information, services and applications available over the Internet, or that there is not sufficiently available relevant content for specific user groups. Lack of confidence, knowledge and skills is another important and often-cited barrier, pointing to the importance of raising levels of education to allow people to benefit from the opportunities of being online (Chart 6.17).

Policy-makers and development experts are not the only ones to see great potential in bringing more people online. Internet content providers and other companies operating in the digital market, and especially those Internet companies whose clients are found *only* amongst those who are online, have a clear interest in connecting the world, and in understanding barriers that keep their potential clients from using the Internet.

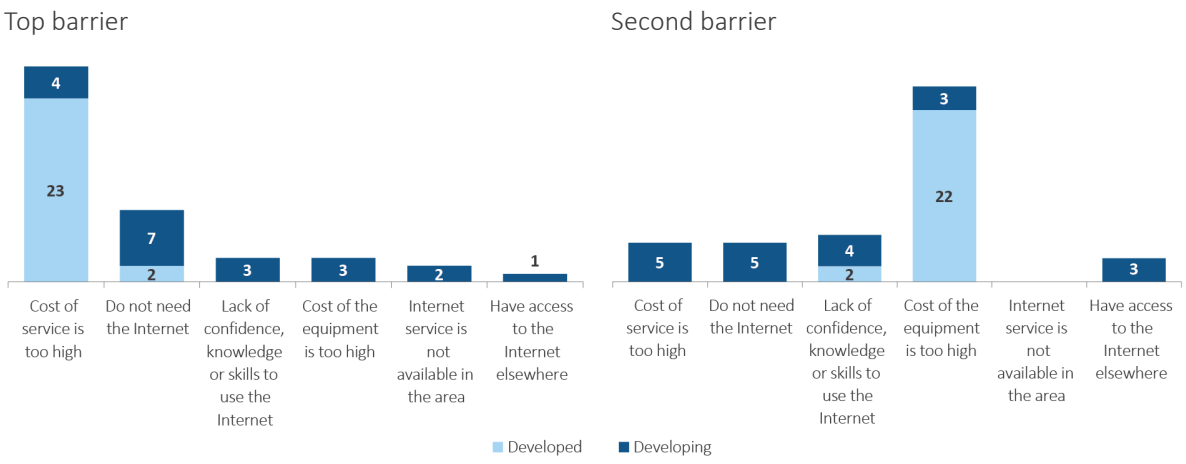
Facebook's *2015 State of Connectivity Report,* for example, focused on the key reasons why people are not using the Internet. The report highlighted availability, affordability, but also relevance – which includes lack of content – and readiness as key barriers. The readiness barrier regroups a number of barriers, including lack of skills, lack of awareness and cultural barriers. The report highlighted that Internet users needed not only digital skills but also basic literacy (reading and writing) skills, which according to the report at least one billion people, mainly in developing countries, did not have (Facebook, 2015).

Similar findings derive from a McKinsey report, which warns about the "costs of the digital divide" and the risk of "leaving substantial portions of the global population at a disadvantage that they might never overcome". The report looks at the factors that deter individuals from going online (compiled into an *Internet Barriers Index*) and concludes that the main factors are incentives, low incomes and affordability, user capability, and infrastructure. The user capability barrier includes both digital literacy and language literacy. The report highlights that large proportions of the offline population are illiterate, and the need for countries to invest in their education systems (McKinsey, 2014).

ICTs also provide humanitarian organizations, such as the UN High Commissioner for Refugees (UNHCR), with novel tools for development. Better information on who is online and who is not allows organizations on the ground to innovate effectively, provide better services, and adapt the way humanitarian services are delivered to those that are connected. In this context, UNHCR has highlighted the opportunities offered by ICTs for the world's 65 million refugees to obtain vital and often life-saving information, have access to basic services, keep in touch with family and friends, and create new links in their new environments and local communities (UNHCR, 2016).

To develop a new strategy, a UNHCR survey was carried out to provide information on refugees' level of ICT connectivity and Internet use. The survey suggests that refugees often spend up

Chart 6.17: Top barriers to household Internet access at home in developed and developing countries (latest data 2013-2015)



Source: Eurostat and ITU.

to one-third of their disposable income on ICTs, in order to remain connected. It also looked at barriers to Internet usage and found that, next to costs, low levels of literacy constituted the second-biggest barrier. Many also lacked content in local languages and had difficulties understanding and using ICTs, or were simply not aware of the benefits of Internet access. The availability of a network and electricity was also a challenge.

6.3 The Internet is not living up to its potential

Internet activities reflecting the transformation towards a digital economy by increasing productivity, improving access to finance, expanding citizens' skills and facilitating more effective interaction with the public sector are becoming increasingly available and used in developed countries. In developing countries, however, the Internet is still mainly used for communication and entertainment purposes, falling short of its potential benefits. Furthermore, education level and gender also seem to influence the type of activity in which users engage, with implications for their potential gains.

The types of activity that Internet users engage in on the Internet have evolved over the last decade (Chart 6.16), and vary greatly across different groups and depending on socio-economic factors, in particular education and income levels. These often also explain other differences, for example in terms of gender and rural/urban Internet access and usage.

While most Europeans already used e-mail in 2006, other activities, such as online shopping or Internet banking, were less common. For example, while three-quarters of the Internet users in Norway and Finland already used e-banking in 2006, only one out of four Internet users in southern and central Europe did their banking online. A decade later, the use of Internet banking services had doubled in most countries of southern Europe, and had nearly tripled in most central European countries. Similar trends are seen across many types of online activities.

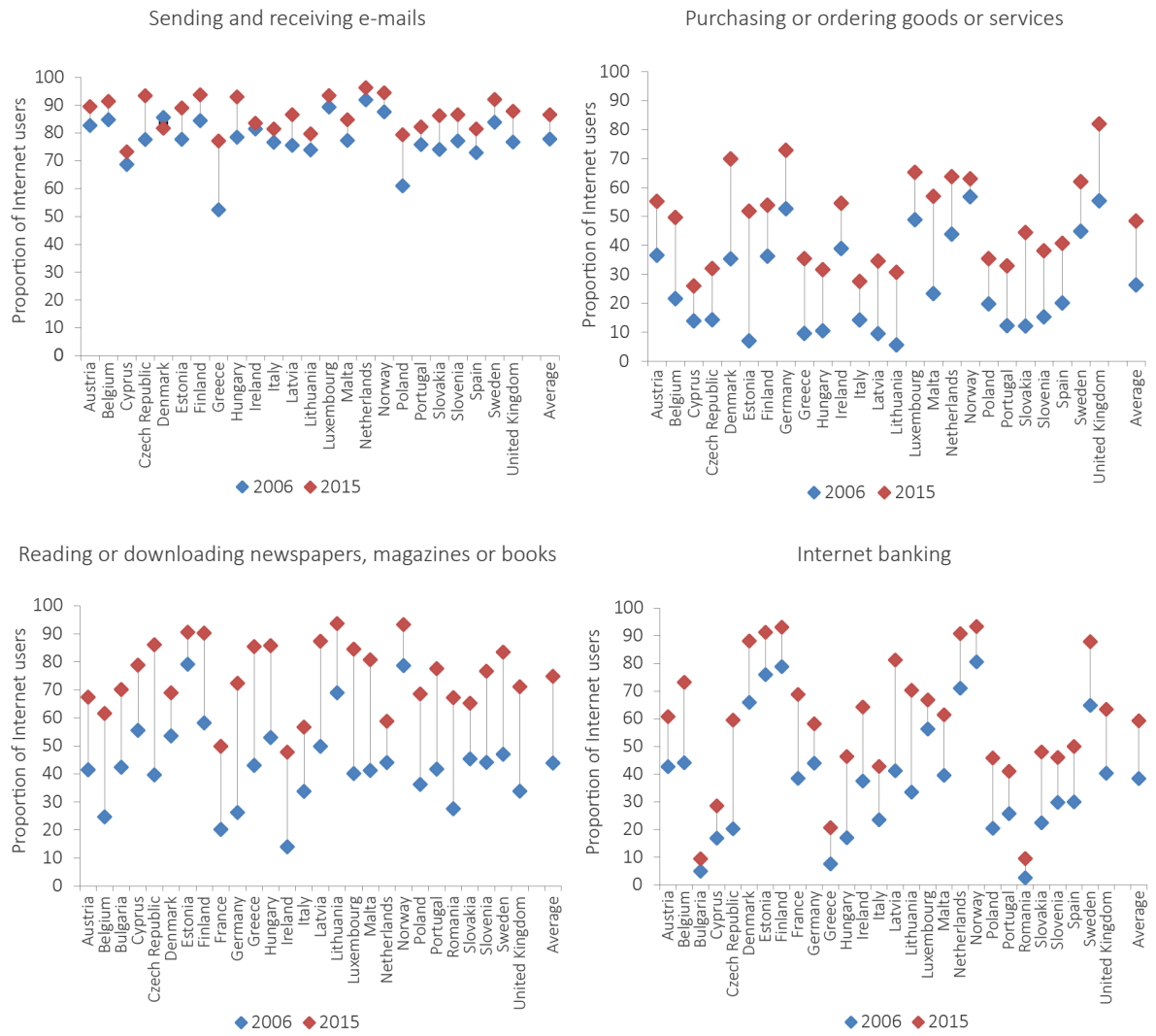
Many Internet users still only use the Internet for entertainment or communication. Chart 6.18 shows the change in the proportion of Internet users engaging in particular activities between 2006 and 2015 in European countries. While engagement in all activities has increased, wide discrepancies persist across countries, especially regarding online services which are highly contingent on countries' financial infrastructure, such as Internet banking and e-commerce.

Based on data and analysis by the web analytics firm Alexa, nearly all of the most visited websites globally in 2016 are either search engines or social networks.[27] Search engines dominate the top-20 list; however, as search engines are the path to find information available elsewhere, and as limited aggregated or internationally comparable information is available on what kind of information users search for, search engines cannot be compared with other websites designed for a specific service, such as communication, entertainment or e-commerce. Besides Facebook, several other social media websites are among the most visited websites, for example LinkedIn, Twitter and Weibo. There are only two online retailers among the most visited websites: the United States company Amazon.com and Taobao, the Chinese giant Alibaba's consumer-to-consumer portal.

While use of the Internet and online services is constantly expanding to new horizons, it is still mostly limited to communication with family and friends. Sending and receiving e-mails represents the most frequent activity in nearly all of the 67 countries with household data on Internet use. While e-mailing is still increasing in many parts of the world, however, it is being complemented, and even replaced, by other forms of online communication through social media and instant messaging. In Turkey, for example, the proportion of Internet users stating that they frequently sent and received e-mails fell from 69 per cent in 2010 to 58 per cent in 2013. In 2013, 84 per cent of Turkish Internet users stated that they regularly participated in social media. In the Republic of Korea, more people indicate that they participate in social media or frequently access chat sites, blogs, newsgroups or online discussions than people indicating that they send and receive e-mails. In Europe, nine out of ten Internet users regularly send and receive e-mails, whereas two out of three participate in social media.

Table 6.1 shows the number of countries in which a particular activity is the top Internet activity or among the top three or top five activities.

Chart 6.18: Trends regarding activities on the Internet (2006-2015; selected activities)



Source: ITU, based on data from Eurostat.

Table 6.1: Top Internet activities (latest data 2010-2015)

(number of countries)	sending or reviewing e-mail	Social media, blogs and online discussions	Getting informaiton about goods or services	Reading newspapers, magazines or books	Entertainment (movies/music/ games)	Interacting with the government	Telephoning over the Internet/VoIP	Buying or selling goods or Services
Top activity	31	13	8	5	4	2	1	1
Among top 3 activities	51	31	36	25	17	5	5	2
Among top 5 activities	62	43	54	44	30	22	10	6
(number of countries)	**Education or other learning activities**	**E-banking**	**Listening to web radio**	**Downloading software/ managing website**	**Watching web TV**	**Information related to health**	**Professional networks or job search**	**Cloud storage or computing**
Top activity	1							
Among top 3 activities	15	10	2	1	1			
Among top 5 activities	26	20	3	4	2	12		

Note: Based on data from 67 countries.
Source: Eurostat and ITU.

The rise of social media

Similar patterns can be identified across developed and developing countries, but significant divergences too. In developed countries, proportionally more citizens use the Internet to a greater degree to read newspapers, magazines and books, interact with government and perform banking services online. The availability and promotion of e-government services in countries in northern Europe have resulted in placing interaction with government among citizens' top online activities.

In developing countries, activities relating to social media are particularly popular, and social media rank as the top Internet activity in far more developing than developed countries. While e-mailing is the top activity in two-thirds of developed countries, it is the top activity in only one out of four developing countries. E-mailing features high amongst the top 3 and 5 activities for both developed and developing countries. Besides the importance of Internet access as a communication tool, data also reveal a significantly higher proportion of developing countries in which entertainment activities, such as streaming media and playing games, rank among the top 3 and top 5 Internet activities. Users in developing countries read newspapers, magazines and books online less than in developed countries (Table 6.2). However, education or other learning activities are more popular in developing countries. This could be linked to the fact that the place of education (school, university) remains an important access location, particularly in low-income economies (as discussed above and shown in Chart 6.2).

The use of social media has spread at an impressive pace across the world and the impact of social media stretches far beyond communication. It has created new business models and influenced politics across the world as citizens are finding new ways to organize themselves beyond traditional parties and

Table 6.2: Proportion of developed and developing countries in which a particular activity is the top Internet activity or among the top 3 or top 5 activities (latest data 2010-2015)

		Developed countries			Developing countries		
		Top activity	top 3	top 5	Top activity	Top 3	Top 5
Communication	sending or reviewing e-mail	65%	84%	95%	23%	67%	90%
	Social media, blogs and online discussions	5%	30%	54%	37%	67%	77%
	Telephoning over the Internet/VoIP	3%	11%	14%	-	3%	17%
Entertainment	Listening to web radio	-	-	-	-	7%	10%
	Watching web TV	-	-	-	-	3%	7%
	Entertainment (movies/music/games)	3%	14%	19%	10%	40%	77%
Learning and finding Infomation	Education or other learning activities	-	16%	22%	3%	30%	50%
	Reading newspapers, magazines or books	11%	49%	78%	7%	23%	50%
	Information related to health	-	-	22%	-	-	13%
	Getting informaiton about goods or services	5%	57%	95%	20%	50%	63%
E-commerce and e-service	Buying or selling goods or Services	3%	5%	14%	-	-	3%
	E-banking	-	24%	43%	-	3%	13%
	Interacting with the government	5%	11%	46%	-	3%	17%
Ohter activities	Downloading software/managing website	-	-	-	-	3%	13%
	Professional networks or job search	-	-	-	-	-	-
	Cloud storage or computing	-	-	-	-	-	-

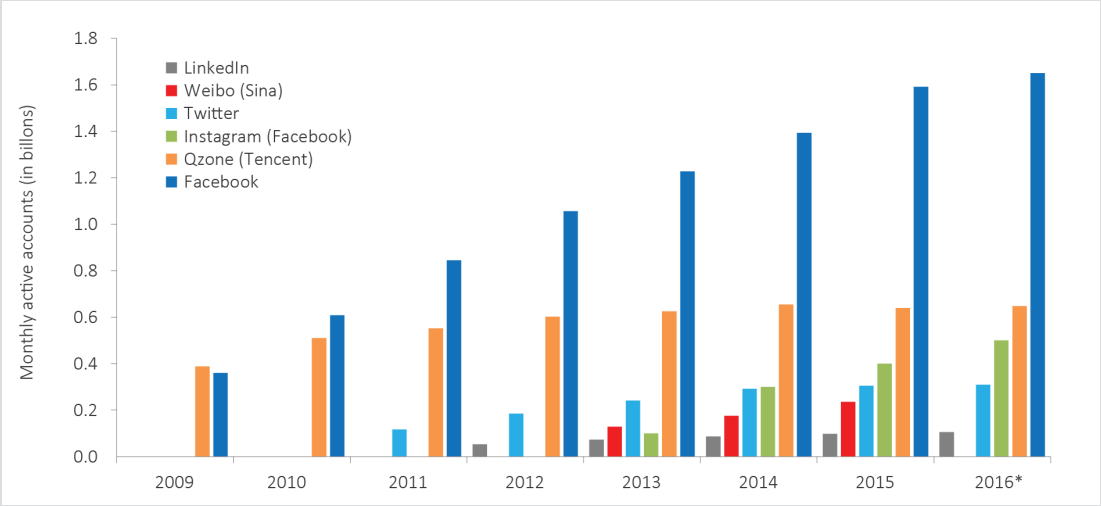
<= 20% | 21 <= 40% | 41 <= 60% | 61 <= 80% | 81 <= 100%

Source: Eurostat and ITU.

Box 6.2: Rise of social media

The social media revolution is best symbolized by the rapid success of companies such as Facebook, LinkedIn, Twitter and Qzone, which did not exist 15 years ago. Facebook, for example, managed to attract a fifth of the world's population in only ten years and its presence and influence have made the company a powerhouse in the global economy. Box Chart 6.2.1 shows the strong rise in the number of monthly active users across different social media platforms, including the popular Chinese platforms Weibo and Qzone.

Box Chart 6.2.1: Monthly active accounts in social media (2009-2016*; in billions)



Note: *2016 refers to quarter 1 only. Monthly active accounts are also often referred to as monthly active users (MAUs), with one active account being treated as one active user. However, some people and organizations may have set up more than one account and some accounts used by organizations are used by many people within the organization.
Source: ITU based on annual and quarterly reports and official public announcements from Facebook, LinkedIn, Sina, Twitter and Tencent.

In recent years there has also been an increase in instant messaging applications, with Facebook's purchase of WhatsApp in 2014 for USD 21.8 billion one of the largest acquisitions of its kind (and more than 20 times the amount Facebook paid for Instagram in 2012).[29] The rapid increase in monthly active users of WhatsApp from 300 million in August 2013 to 1 billion in February 2016 highlights the potential of instant messaging applications, which are quickly replacing mobile network-based short message services (SMSs).

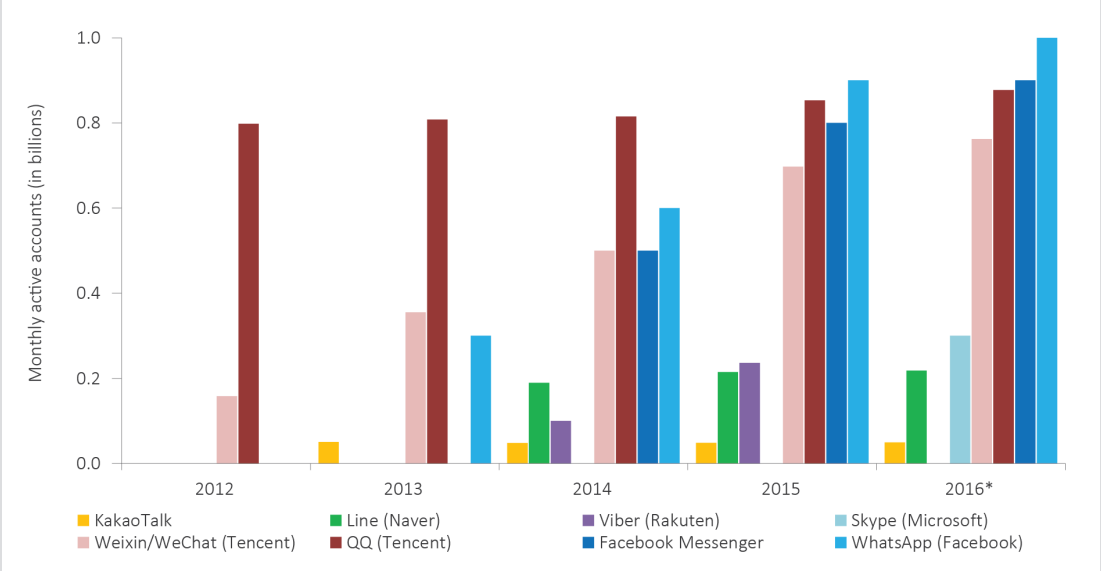
According to data from App Annie, a business intelligence firm specialized in app statistics, WhatsApp was the most downloaded app in 2015 worldwide followed by Facebook messenger (Box Chart 6.2.2).[30] Other large instant-messaging services include Weixin/WeChat and QQ developed by the Chinese Internet company Tencent. With nearly as many users as Facebook and WhatsApp, QQ is immensely popular in China. However, despite its efforts to expand to other countries with QQ International – a version available in six languages and designed for the global audience – it has not experienced the same user growth internationally as WhatsApp.

governments target new avenues to connect with their citizens. According to a recent OECD study, "as of November 2014, the office representing the top executive institution (head of state, head of government, or government as a whole) in 28 out of 34 OECD countries had a Twitter account and 21 had a Facebook account." (OECD, 2015a).[28]

As with overall Internet penetration rates across countries, there is a clear link between countries' gross national income (GNI) per capita level and

Box 6.2: Rise of social media (continued)

Box Chart 6.2.2: Monthly active accounts for instant-messaging services (2012-2016*, in billions)



Note: *2016 refers to quarter 1 only. WhatsApp figures for 2013 and 2014 refer to Q3. Monthly active accounts are also often referred to as monthly active users (MAUs).
Source: ITU based on annual and quarterly reports and official public announcements from Kakao, Naver, Rakuten, Microsoft, Tencent and Facebook.

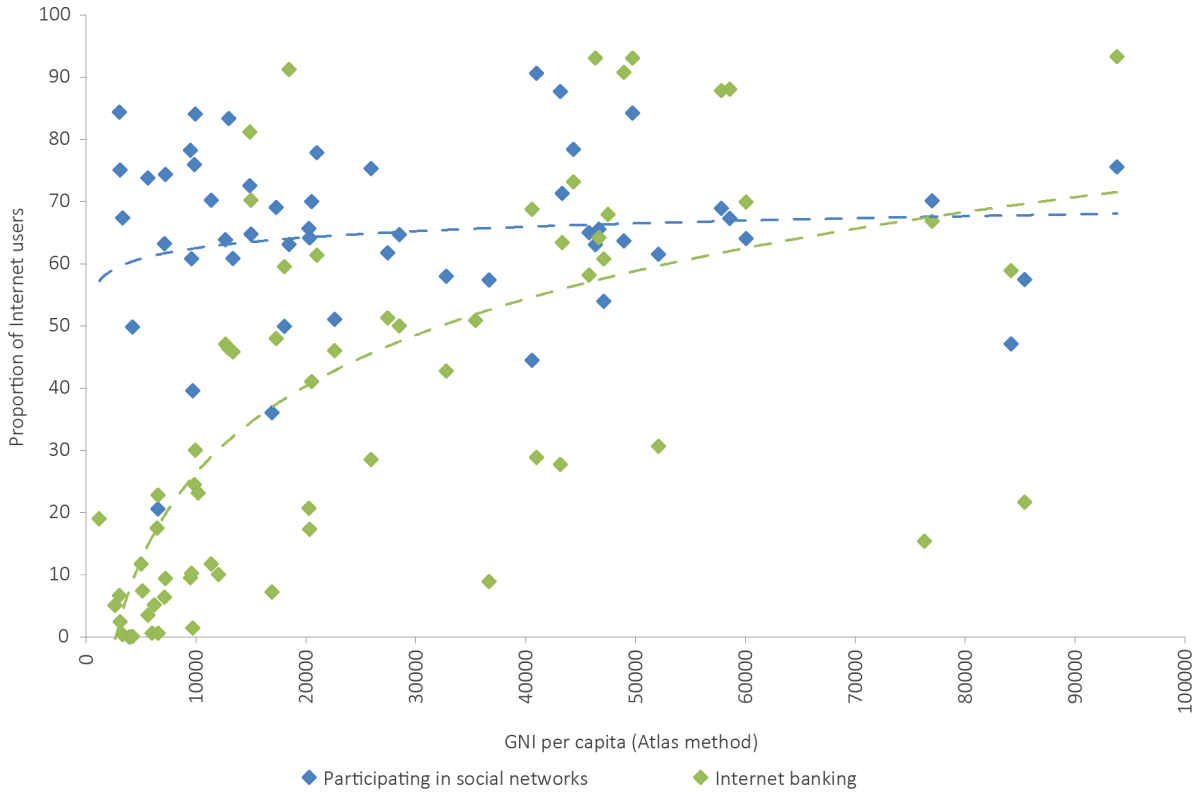
their citizens' activities online. While citizens of low- and middle-income countries participate actively in social networks to a similar degree as citizens of high-income countries, they use financial digital services such as Internet banking far less. This could also be linked to the lack of availability of these kinds of online service in such countries, or to factors such as quality of service. For example, while citizens of developed countries have been able to use sophisticated online banking for more than a decade, Internet banking is less deployed in many developing countries.[31] Chart 6.19 shows participation in social networks and use of e-banking across countries as a proportion of the total online population.

Although the gender gap in Internet penetration is minor in many developed countries, there are some differences in what men and women do online. Despite differences across countries, some clear trends are visible. In nearly all countries, both developed and developing, men tend to download software or applications to a larger extent than women. Women, on the other hand, tend to be more active in seeking health information (Chart 6.20). The data also suggest that gender differences observed in these types of activity are more pronounced in developed than in developing countries.

Most other online activities show minor gender differences, with female participation in social media and educational activities somewhat higher than male participation. In contrast, the data suggest that men use e-banking services and read newspapers online more than women. There are, however, wide discrepancies across countries. Consequently, there is a clear need for all countries to collect more gender-disaggregated data to unveil differences in Internet use among women and men and support policy-makers in finding the most appropriate responses.

Overall, women tend to use the Internet for social media more than men (Chart 6.21). In nearly all developed countries, women are more active on social media, with the largest gender differences in the countries of northern Europe such as Estonia, Iceland, Norway and Sweden. On average in developed countries, participation in social networks among female Internet users is seven per cent higher than among male Internet users.[32]

Chart 6.19: Internet use by countries' income levels (selected activities)



Source: Eurostat and ITU.

In many developing countries the opposite trend is observed. This is especially the case in a few economies in northern Africa and the Middle East, such as Palestine, Egypt and Qatar.

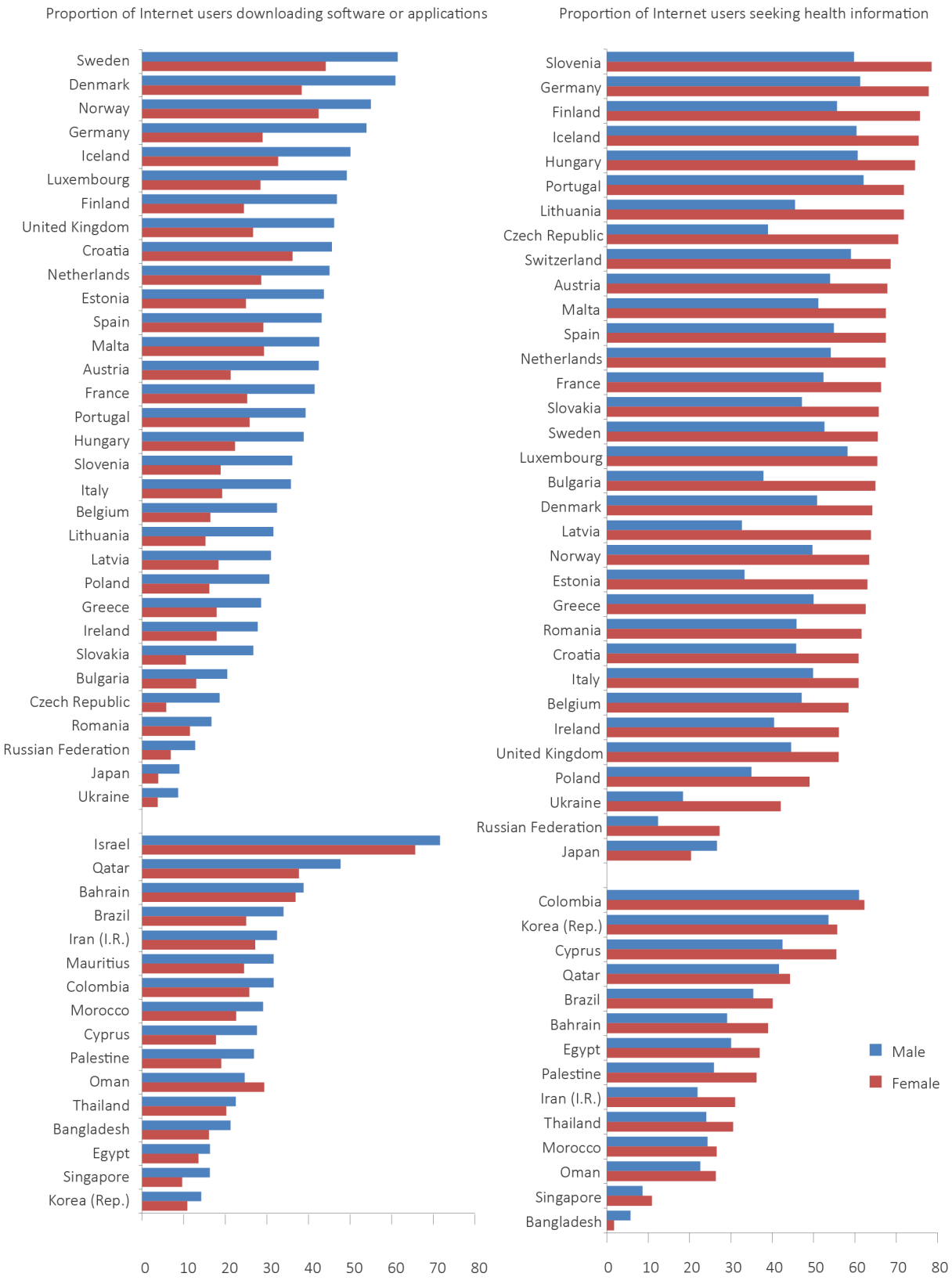
Education determines how people use the Internet

The previous section has illustrated that aside from communication most Internet users do not take advantage of the enormous offer of commercial and public services available online. For this to happen, policy environment, infrastructure and skills matter. It is crucial to address socio-economic challenges within societies that stretch beyond the digital world. In particular, available data show a close link between certain socio-economic characteristics and the way citizens use the Internet. While people with lower levels of education mainly tend to use the Internet for communication and entertainment purposes, people with higher levels of education use the Internet more diversely (Chart 6.22). This is especially the case for more sophisticated activities which require trust in the system, such as Internet banking, e-government, and purchasing and selling goods and services.

A recent OECD study showed that "the breadth of Internet activities carried out by users with tertiary education is, on average, 58 per cent larger than for those with lower secondary education and below" (OECD, 2015a).[33] While there is a clear relationship between level of education and use of e-banking services, the proportion of Internet users participating in social media depends on country contexts. In the Republic of Korea and Brazil, social media participation increases with education; however, the opposite is observed in the Russian Federation and Paraguay.

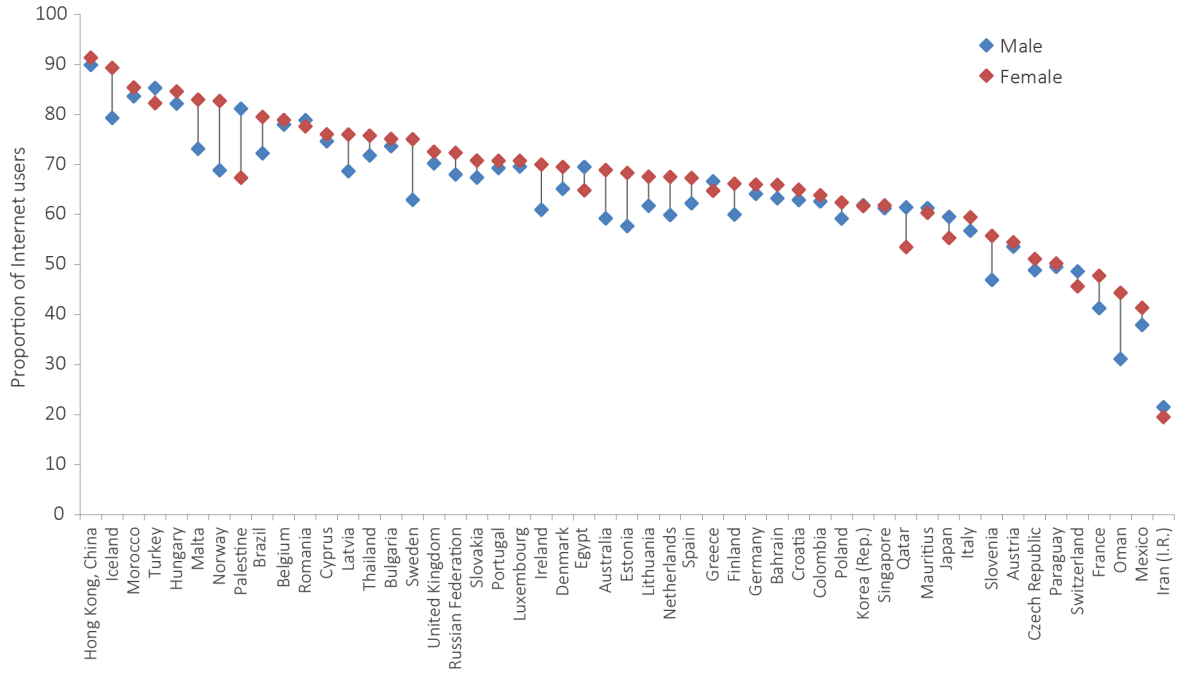
The same pattern is observed for the purchasing or ordering of goods or services and the broad entertainment category "streaming or downloading images, movies, videos or music, playing or downloading games". While people with higher levels of education shop online more frequently than people with lower levels of education, the inverse is seen in several countries for the entertainment category.

Chart 6.20: Proportion of Internet users downloading software (left) and seeking health information (right) (latest data 2013-2015).



Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference. Source: Eurostat and ITU.

Chart 6.21: Proportion of Internet users participating in social media (latest data 2013-2015)



Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: Eurostat and ITU.

The importance of raising education and income levels and skills to allow more people to benefit from ICTs highlights the need for an integrated development approach, which is also recognized in the larger development debate. The recently adopted 2030 Agenda for Sustainable Development recognizes deep interconnections and interlinkages and the integrated nature of the 17 sustainable development goals (SDGs). Just as eradicating poverty and ensuring quality education cannot be seen or achieved in isolation but must be part of the larger development agenda, ICT progress is tied to progress in other key development domains. Likewise, other development domains, such as education, health and climate change, need ICTs in order to achieve progress.

The importance of education levels and skills in order to effectively use and benefit from ICTs also underpins the use of the skills indicators and skills sub-index to calculate the ITU ICT Development Index (IDI, see chapter 1). The three skills indicators (mean years of schooling, gross secondary enrolment and gross tertiary enrolment) have been described as *proxy* indicators since they track education levels, rather than ICT skills more specifically. However, the analysis in this chapter suggests that they are particularly relevant in tracking citizens' potential to take full advantage of ICTs, and in particular the Internet.

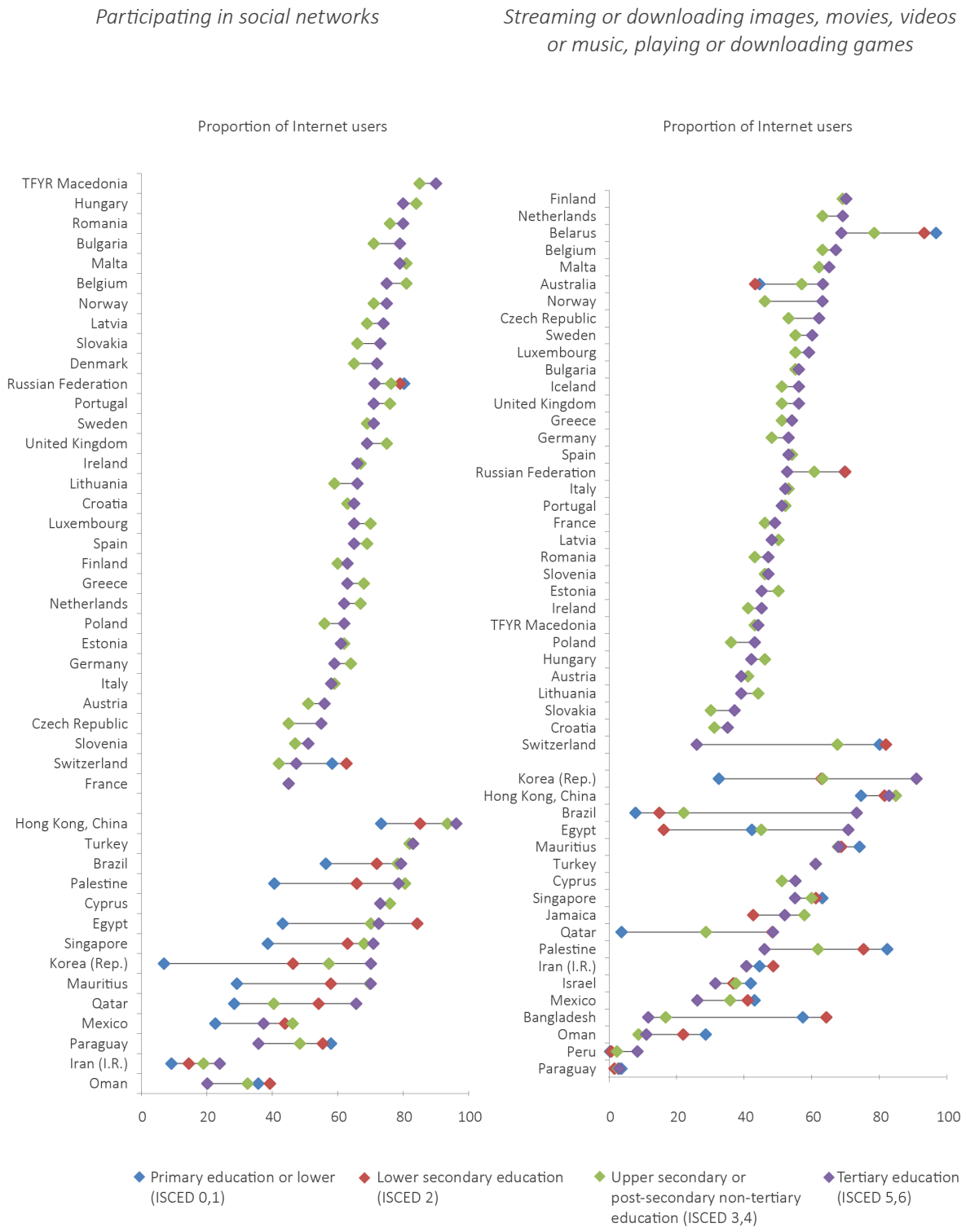
Besides raising education levels, it is also important to note that online services, such as e-commerce and e-banking, cannot function without trust in public administration and stable infrastructure and delivery chains. Educating citizens regarding the broader benefits of the Internet is another key element in enabling more people to participate in the digital economy.

Improving skills begins at school

Overall, young people, and particularly teenagers, tend to be more ICT-savvy, learn more quickly and can be brought online more easily than other age groups. In addition, there is growing evidence on the benefits that Internet access provides younger people. In particular, young people with access to the Internet are often seen as having a competitive advantage over their non-Internet-using classmates.[34]

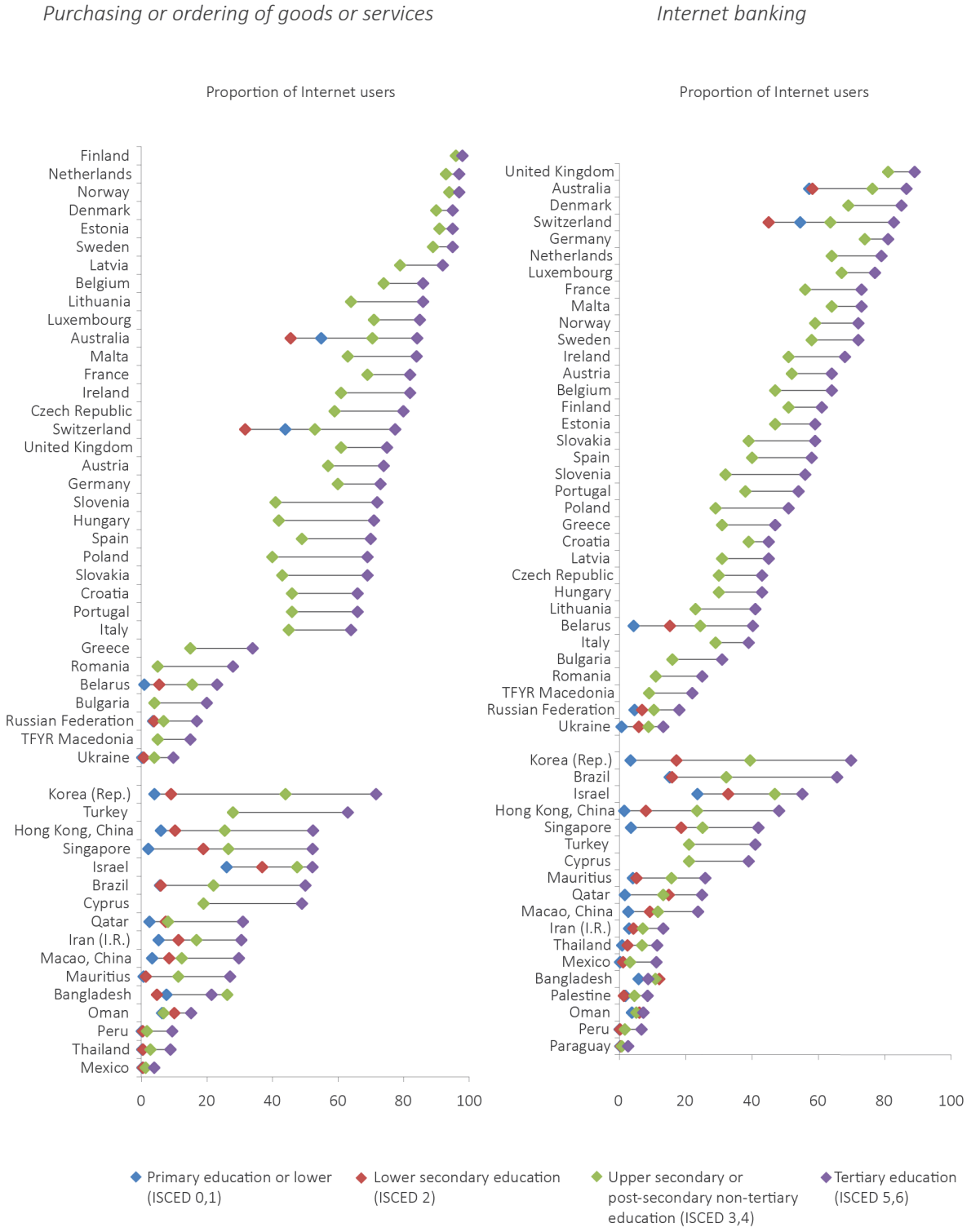
Most countries do not collect household data on children and young teenagers' use of the Internet, and even if they do, the age range differs widely across countries. ITU household data show

Chart 6.22: Internet use by activity and education level (selected activities; latest data 2013-2015)



Note: Data for most European countries are only available for upper secondary and tertiary education. For Eurostat countries, the activity *streaming or downloading images, movies, videos or music, playing or downloading games* relates to *playing/downloading games, images, films or music*.
Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: Eurostat and ITU.

Chart 6.22: Internet use by activity and education level (selected activities; latest data 2013-2015) (continued)



Note: Data for most European countries are only available for upper secondary and tertiary education. For Eurostat countries, the activity *streaming or downloading images, movies, videos or music, playing or downloading games* relates to *playing/downloading games, images, films or music*.
Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: Eurostat and ITU.

that from the age at which children begin lower secondary school, the proportion of adolescents using the Internet exceeds the Internet usage rate for the general population in nearly all countries across the globe (see Chart 6.23).

Adolescents' use of the Internet is already nearly universal in developed countries and the younger population in many developing countries is twice as connected as the general population. In many developing countries, schools and universities remain the entry-way for children and young adults into using computers and the Internet. Further connecting schools is essential in order to increase Internet usage and ensure that today's youth will have the relevant skills for future employment.

However, basic education is crucial to opening up the possibilities of the Internet for those not yet online. As described previously in this chapter, poor literacy remains one of the key barriers to ICT connectivity and Internet usage. UNESCO's Global Education Monitoring Report 2016 estimates that nearly 61 million children of primary school age and 202 million adolescents of secondary school age did not go to school in 2014, many of them living in conflict-affected areas. In addition, 758 million adults, 63 per cent of them women, have not acquired even minimal literacy skills (UNESCO, 2016).[35] The same report highlights an annual shortfall of at least USD 21 billion in low-income countries in regard to achievement of the education targets in the 2030 Agenda for Sustainable Development. Strengthening global efforts to improve basic education for all people is a crucial component of the SDGs, a prerequisite for connecting the last billion and allowing more people to take advantage of the opportunities opened up by Internet access.

A relationship between what people do on the Internet and socio-economic status is also observed among children and adolescents. An OECD study shows that wealthier students are more likely to use the Internet for educationally advantageous activities such as gathering information and reading the news, while poorer students are more likely to use it for communication and playing games (OECD, 2016). The same study suggests that inequalities exist even in countries with almost universal Internet access. Lack of knowledge and familiarity in use of the Internet to find information can hamper young people in their studies and job-finding prospects.

The study shows that traditional education is crucial to increasing the ability of students to use ICT tools for learning purposes. Reading content on the Internet requires the same skills as reading a book or newspaper. While it is important to integrate Internet into education, results from the OECD Programme for International Student Assessment (PISA) show that students in the highest-performing countries in digital reading were "not more exposed to the Internet at school than are students in other OECD countries" (OECD, 2015b).[36]

As much as access to and use of the Internet have been linked to positive outcomes, and as much as a growing number of children and adolescents spend much of their time online, it is also important to acknowledge and understand the negative side-effects of "too much Internet". The number of available studies looking into the possible side-effects of extensive use of the Internet is relatively limited, and given the novelty of the Internet it is also too early to study long-term impacts. Existing evidence, however, suggests that children and teenagers who spend large amounts of time online are more at risk of experiencing different forms of mental distress (Box 6.3).

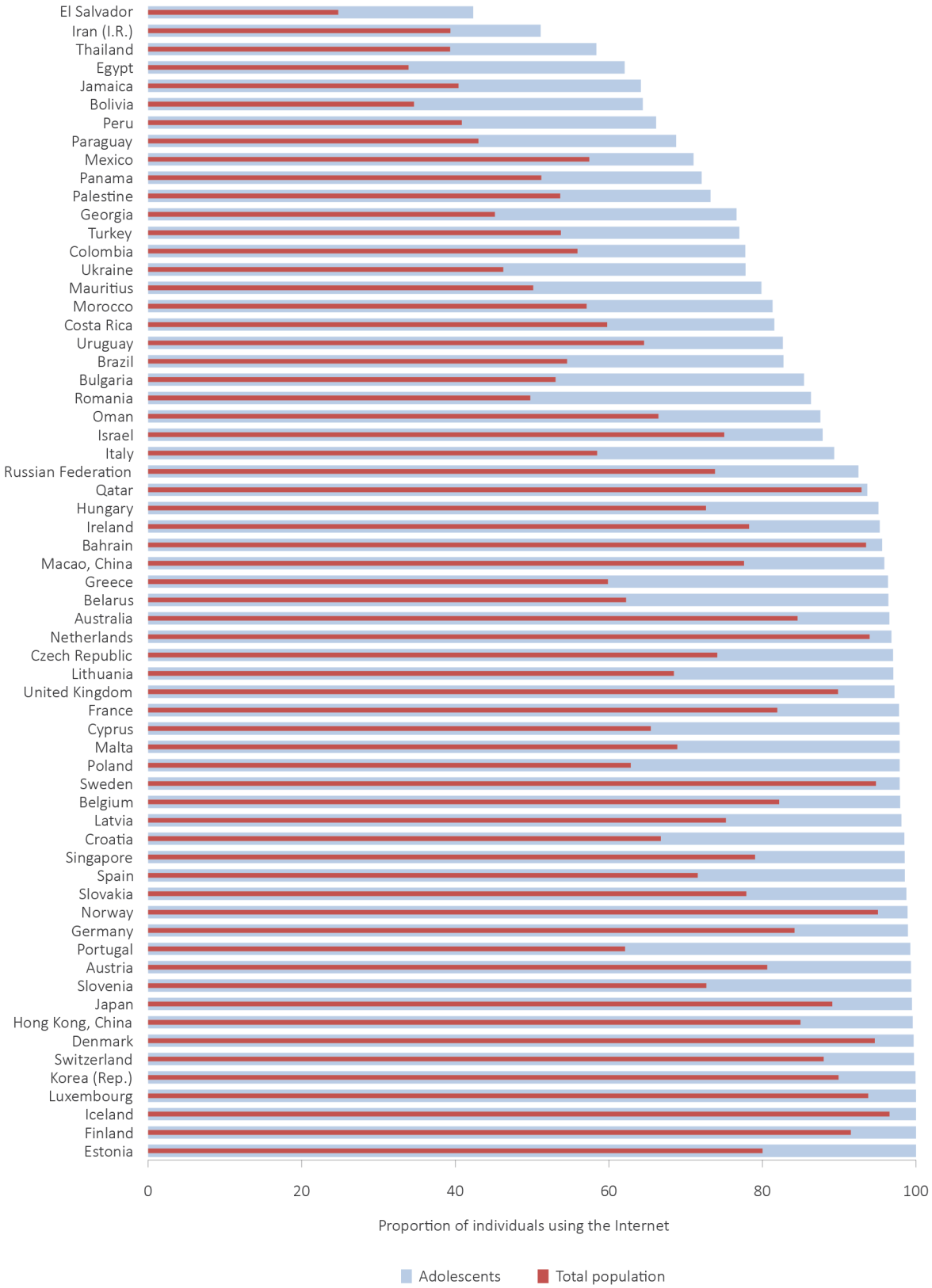
6.4 Conclusions

Over the past decade, the Internet has spread rapidly and, by the end of 2016, 3.5 billion people – or close to 50 per cent of the world's population – are using the Internet, driven by the expansion of mobile networks and falling prices. An increasingly ubiquitous, open, fast and content-rich Internet has changed the way many people live, communicate, and do business, delivering great benefits for people, governments, organizations and the private sector.

Many people no longer *go* online, they *are* online. The Internet has opened up new communication channels, provided access to information and services, increased productivity and fostered innovation. It has also created an Internet economy, and a number of new leading businesses whose clients are exclusively online.

Nevertheless, the Internet and its benefits have spread unequally and many people have not been able to benefit from the potential of the

Chart 6.23: Adolescents' (age 15-24) use of the Internet compared with that of the general population



Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU.

Box 6.3: Research shows side-effects of too much Internet for children

Internet usage does not always have positive effects. The rapid evolution in children's use of the Internet will most likely have an impact on their overall health and development; however, research on the actual effects is scarce. Rapidly increasing attention is being paid to the importance of measuring and understanding children's access to and use of the Internet. This coincides with increasing concern for the health of children spending a lot of time in front of tablets, computers and other screens. A recent government report from the United Kingdom suggests that children and adolescents who spend more time in front of screens tend to experience higher levels of emotional distress, anxiety and depression (Public Health England, 2013). Other studies show negative effects relating to sleep patterns, physical activity and social well-being.

An OECD study from 2015 found that "students who spend more than six hours on line per weekday outside of school are particularly at risk of reporting that they feel lonely at school, and that they arrived late for school or skipped days of school in the two weeks prior to the PISA test" (OECD, 2015b).

In addition, media reports on cyberbullying through social media and other platforms have also augmented the need for more research and information on how children use the Internet. While online access and use has the potential to augment young people's knowledge and learning abilities, more research is required to better understand the full impact of children and adolescents' increasing presence in the online world.

Internet. The offline population – 3.9 billion people globally – is disproportionally female and elderly, less educated, has lower incomes and lives in rural areas. While Internet infrastructure, access and quality of service remain important barriers to uptake, more people have access to Internet services than actually use them. Broader socio-economic factors that are not ICT-related need to be addressed to bring more people online. Education levels in particular, and accompanying income levels, are strong determinants of whether or not people use the Internet.

Socio-economic factors also play an important role in how the Internet is used and to what extent its potential is maximized. Existing data suggest that communication and social media are key activities for Internet users. Unlike Internet users with higher levels of education, many Internet users with lower education and income levels tend to use the Internet predominantly for communication and entertainment purposes. This suggests that they do not benefit fully from the opportunities of the Internet and that the Internet is liable to become a driver of greater inequalities, instead of addressing them.

To overcome these challenges, policy-makers must address broader socio-economic inequalities and in particular help people acquire the necessary skills, including analogue skills, to take full advantage of the Internet. This is in line with a more integrated development approach, like that adopted in the 2030 Agenda for Sustainable Development, which highlights that development challenges are linked and cannot be achieved in isolation.

Finally, this chapter has highlighted the need for more and better data. The lack of data remains an important challenge to ICT policy-makers, investors and content producers. Data that provide in-depth information on how exactly people use the Internet and what people do online are scarce, and often outdated. Most of the information on what people do online today stems from ICT household surveys, which provide reliable data disaggregated by socio-economic characteristics, but are also costly and time-consuming to produce. Moreover, ICT household data are currently not available for many developing countries, and nearly non-existent for the world's LDCs. These constraints lead to information gaps and possible misinformation for policy-makers. In some cases, public and private institutions carry

out ad-hoc surveys to fill these data gaps, but generally these are not representative and are therefore of limited use or, worse, produce wrong information.

Within this context, the United Nations has called for the use of new data sources, including big data, to complement official statistics.[37] A number of efforts are being made to use big data to address and eventually overcome this data gap, including a recently launched ITU project on "Big Data for Measuring the Information Society", which is exploring ways of using big data from the ICT industry to help understand who uses the Internet, and where and how, and to better understand the benefits it delivers. Based on a number of pilot studies, it will show how big data from the ICT industry (including mobile operators and the over-the-top (OTT) market) can be used as a source for new and existing ICT indicators in order to enhance data collections, benchmarks and methodologies for measuring the information society.

Endnotes

1 Google went live only in 1998, LinkedIn launched in 2003, Facebook in 2004, and YouTube in 2005. Twitter started in 2006, just ten years ago.

2 For an account of what the Internet looked like in 1996, see http://www.slate.com/articles/technology/technology/2009/02/jurassic_web.html .

3 According to (Kuss, D.J. and Lopez-Fernandez, O., 2016), a growing amount of research on the topic is emerging.

4 Tim Berners-Lee, a British scientist at CERN, invented the World Wide Web (WWW) in 1989. The web was originally conceived and developed to meet the demand for automatic information-sharing between scientists in universities and institutes around the world, see: http://home.cern/topics/birth-web . See also: http://www.itu.int/net/itunews/issues/2009/10/34.aspx.

5 Alphabet, which was created in October 2015, is the parent company of Google. It is, according to its website and co-founder Larry Page "…mostly a collection of companies. The largest of which, of course, is Google. This newer Google is a bit slimmed down, with the companies that are pretty far afield of our main internet products contained in Alphabet instead", see: https://abc.xyz/

6 See http://beta.fortune.com/fortune500/list/

7 These were: Apple (1), Alphabet (2), Microsoft (3), Amazon (4), Facebook (5) and China Mobile (10), see: http://www.economist.com/news/special-report/21707048-small-group-giant-companiessome-old-some-neware-once-again-dominating-global

8 For data on the rapid expansion of mobile networks, see page 2 of the ITU Facts and Figures 2016, available at: http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf

9 For a discussion of the growing spread of the smartphone and its improved processing power, see: http://www.economist.com/news/leaders/21645180-smartphone-ubiquitous-addictive-and-transformative-planet-phones

10 Chart 6.1 refers to use of the Internet while mobile via a mobile-cellular telephone connected to a mobile phone network. For developing countries, it refers to Internet use via a mobile-cellular telephone connected to a mobile phone network if the location is away from "home", "work", "place of education", "another person's home" and "community and commercial access facilities". It does also not include WiFi connectivity. For European countries, it refers to Internet use via a mobile-cellular telephone "away from home and work". As such, for European countries, it could include Internet use via WiFi at other locations. For more information on the definitions of Internet use by location, see page 55 of the Manual for Measuring ICT Access and Use by Households and Individuals 2014 available at: http://www.itu.int/en/ITU-D/Statistics/Pages/publications/manual2014.aspx.

11 Cisco expects the number of connected devices in 2020 to be more than triple the 2020 global population.

12 See: https://www.youtube.com/yt/press/statistics.html

13 See: https://media.netflix.com/en/press-releases/netflix-is-now-available-around-the-world and https://ir.netflix.com/results.cfm

14 Quarterly reports from VeriSign, the registry operator for .com and .net, which include data from the consultancy ZookNIC and Centralized Zone Data Service. See https://blog.verisign.com/domain-names/internet-grows-to-326-4-million-domain-names-in-the-first-quarter-of-2016/.

15 Internet World Statistics assigns a single language to each individual in order to add up to the total world population; however, it is unclear how it assigns people's first language in countries where large proportions of the population are bilingual or multilingual. See http://www.internetworldstats.com/stats7.htm.

16 By June 2016, Facebook had 1.71 billion monthly active users, spread across almost every country of the world, see: http://newsroom.fb.com/company-info/

17 By September 2016, Twitter, which launched its services just 10 years ago (in 2006), had 313 million monthly active users and 1 billion unique monthly visits to sites with embedded tweets, see: https://about.twitter.com/company

18 There are on average 1.28 women for each man in tertiary education in Latin America and the Caribbean and 1.37 women for each man in North America.

19 See http://www.bloomberg.com/news/articles/2016-02-02/mapping-the-oldest-countries-in-the-world

20 See, for example, Barbosa Neves, B. and Amaro, F. (2012)

21 See for example, the "Golden Internet prize" project, which is sponsored by the Ministry of Justice and Consumer Protection and several private sector associations. This project presents a prize to people aged 60 and over who use the Internet and who help to bring other senior citizens online. See: https://www.goldener-internetpreis.de/. For other projects designed to encourage seniors to use and benefit from the Internet, see: https://www.sicher-im-netz.de/downloads/digital-kompass-handreichung-1 and http://www.wegeausdereinsamkeit.de/.

[22] See, for example, the "Project Table PC for Seniors" which is funded by Telefónica: http://eplus-gruppe.de/tablet-pcs-fuer-senioren/ .

[23] http://www.telenor.com/media/articles/2015/helping-the-elderly-to-master-tablet-and-smartphone/

[24] http://ajgg.org/AJGG/V10N1/2014-175-OA.pdf

[25] For example, see World Bank Education Statistics, available at http://databank.worldbank.org/data/reports.aspx?source=education-statistics-~-all-indicators. Research from the OECD's PISA study also suggests that: "In most countries and economies, students who attend schools in urban areas tend to perform at higher levels than other students", see https://www.oecd.org/pisa/pisaproducts/pisainfocus/pisa%20in%20focus%20n28%20(eng)--FINAL.pdf

[26] The question put to households is: *Why does this household not have Internet access?* (multiple responses possible). For more information, see the *Manual for Measuring ICT Access and Use by Households and Individuals 2014* available at: http://www.itu.int/en/ITU-D/Statistics/Pages/publications/manual2014.aspx.

[27] See http://www.alexa.com/topsites.

[28] OECD (2015a), page 52.

[29] The acquisition initially valued at USD 19 billion increased to USD 21.8 billion because of a rise in Facebook stock value.

[30] http://go.appannie.com/report-app-annie-2015-retrospective

[31] It should be noted that most of the world's unbanked people are in developing countries, which is a reason why m-banking is increasingly successful in such countries.

[32] This is based on the simple averages of the proportion of women and men participating in social media in 33 developed countries. It is calculated by dividing the average proportion of female Internet users participating in social media (68.3%) by the average proportion of male Internet users participating in social media (63.8%), minus one.

[33] OECD (2015a), page 51.

[34] Research from Michigan University suggests that the use of the Internet can improve the mental well-being of retired older adults, reducing the probability of depression by one third, see: http://psychsocgerontology.oxfordjournals.org/content/early/2014/03/25/geronb.gbu018.full

[35] UNESCO (2016), page 73.

[36] In the 2009 and 2012 Programme for International Student Assessment (PISA) assessments, OECD assessed reading on digital media separately from reading printed text. For more information, see the PISA 2012 Assessment and Analytical Framework, available at: http://www.oecd-ilibrary.org/education/pisa-2012-assessment-and-analytical-framework/reading-framework_9789264190511-4-en

[37] The United Nations has recognized the opportunities that new data sources, including big data, offer in filling data gaps to track the 2030 Agenda for Sustainable Development. See: United Nations, A World that Counts. Mobilizing the Data Revolution for Sustainable Development. Report prepared at the request of the United Nations Secretary-General, by the Independent Expert Advisory Group on a Data Revolution for Sustainable Development, November 2014, see: http://www.undatarevolution.org/report/. In recognition of the opportunities offered by big data to support the monitoring of the post-2015 development goals, the UN Statistical Commission also set up the UN Global Working Group on Big Data for Official Statistics, see http://unstats.un.org/unsd/bigdata/.

List of references

Abutaleb, Y. and Menn, J. (2016), Exclusive: *Egypt blocked Facebook Internet service over surveillance - sources*. Reuters. 1 April 2016. http://www.reuters.com/article/us-facebook-egypt-idUSKCN0WY3JZ?feedType=RSS&feedName=technologyNews.

Africa Telecoms (2011), *The History and Future of Dynamic Tariffing*. Africa Telecoms, 12: 68-69. https://issuu.com/magazine1/docs/issue_12_/71?zoomed=&zoomPercent=&zoomX=&zoomY=&noteText=&noteX=&noteY=&viewMode=magazine.

Alliance for Affordable Internet (A4AI) (2015a), *Case Study: Delivering Affordable Internet in Myanmar*, March 2015. http://a4ai.org/wp-content/uploads/2015/03/Myanmar-Case-Study.pdf.

Alliance for Affordable Internet (A4AI) (2015b), *The impacts of emerging mobile data services in developing countries*. November 2015. https://a4ai.org/wp-content/uploads/2015/11/MeasuringImpactsofMobileDataServices_ResearchBrief1.pdf.

Alliance for Affordable Internet (A4AI) (2015c), *The 2015-2016 Affordability Report*. http://a4ai.org/affordability-report/report/2015/.

ARTCI (2015), *Décision No. 2015-0031 du Conseil de Régulation de l'Autorité de Régulation des Télécommunications/TIC de Côte d'Ivoire en date du 08 janvier 2015 portant fixation des plafonds des tarifs de terminaison d'appel fixe et mobile pour l'année 2015*. http://www.artci.ci/images/stories/pdf/decisions_conseil_reg/decision_2015_0031_conseil_regulation.pdf.

ATT (2015), *End-2015 report on Internet in Bolivia*. https://www.att.gob.bo/content/situación-del-internet-en-bolivia.

Axiata (2016), *Shaping the Future Towards a Digital Company: Annual Report 2015*. http://axiata.listedcompany.com/misc/ar2015.pdf.

Barbosa Neves, B. and Amaro, F. (2012), *Too old for technology? How the elderly of Lisbon use and perceive ICT*. Centre for Public Administration and Policies (CAPP). Institute of Social and Political Sciences of Technical University of Lisbon (ISCSP-UTL). http://ci-journal.net/index.php/ciej/article/view/800/904.

Batelco (2016), *Annual Report 2015: Cultivating Convergence*. http://www.batelcogroup.com/media/60887/batelco_ar_2015_english.pdf.

Bhutan InfoComm and Media Authority (BICMA) (2016), *Telecommunication Market Profile: Internet Subscribers*. http://www.bicma.gov.bt/bicmanew/?page_id=555.

BITCOM (2014), *Senioren in der Digitalen Welt.* Berlin. December 2014. https://www.bitkom.org/Presse/Anhaenge-an-PIs/2014/Dezember/141212-BITKOM-Praesentation-Senioren-in-der-Digitalen-Welt-12-12-2014.pdf

Body of European regulators for Electronic communications (Berec) (2010), *BEREC report on impact of bundled offers in retail and wholesale market definition*. BoR(10)64. http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/209-berec-report-on-impact-of-bundled-offers-in-retail-and-wholesale-market-definition.

Broadband Commission for Digital Development (2013), *Doubling Digital Opportunities: Enhancing the Inclusion of Women & Girls in the Information Society*. http://www.broadbandcommission.org/Documents/working-groups/bb-doubling-digital-2013.pdf.

Broadband Commission for Sustainable Development (2015), *The State of Broadband 2015 Broadband as a Foundation for Sustainable Development.* http://www.broadbandcommission.org/publications/Pages/SOB-2015.aspx.

Cash, H., Rae, C., Steel, A. and Winkler, A. (2012), *Internet Addiction: A Brief Summary of Research and Practice.* National Center for Biotechnology Information, Current Psychiatry Rev. 2012 Nov; 8(4): 292–298. Published online 2012 Nov. doi: 10.2174/157340012803520513.

Castells, M., Fernandez-Ardevol, M., Linchuan Qiu, J. and Sey, A. (2007), *Mobile Communication and Society: A Global Perspective*, MIT Press.

Cisco (2016), *The Zettabyte Era—Trends and Analysis*. White Papers. June 2016. http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/vni-hyperconnectivity-wp.html.

CKS Consulting (2012), *Teleuse@BOP4: A Qualitative Study.* Colombo: LIRNEasia. http://cks.in/wp-content/uploads/2012/06/Teleuse-at-BoP-4.compressed.pdf.

ComScore (2015), *The 2015 U.S.* Mobile App Report. https://www.comscore.com/Insights/Presentations-and-Whitepapers/2015/The-2015-US-Mobile-App-Report.

Digi (2016), *Annual Report 2015*. http://digi.listedcompany.com/misc/ar/ar2015.pdf.

Digicel (2015), *Amendment No.4 to Form F-1 Registration Statement under the Securities Act of 1933 (Securities and Exchange Commission Filing)*, 2 October 2015. https://www.sec.gov/Archives/edgar/data/1645826/000119312515335867/d946689df1a.htm.

Digitata (2016), *Digitata: Dynamic Tariffing* (e-Brochure). http://www.digitata.com/wp-content/uploads/2016/02/Digitata-Dynamic-Tariffing-e-Brochure-2016.pdf.

Drossos, A. (2015), *The real threat to the open Internet is zero-rated content*. The Digital Fuel Monitor (Rewheel). http://dfmonitor.eu/downloads/Webfoundation_guestblog_The_real_threat_open_internet_zerorating.pdf.

ECLAC (2015), *State of the Broadband in Latin America and the Caribbean 2015 (*original title: *Estado de la banda ancha en América Latina y el Caribe 2015)*. http://www.cepal.org/es/publicaciones/38605-estado-de-la-banda-ancha-en-america-latina-y-el-caribe-2015.

Eisenach, J.A. (2015), *The Economics of Zero Rating*. NERA Economic Consulting. http://www.nera.com/content/dam/nera/publications/2015/EconomicsofZeroRating.pdf.

Ericsson (2015a), *Ericsson Mobility Report on the Pulse of the Networked Society: August 2015* (Interim Update). https://www.ericsson.com/res/docs/2015/ericsson-mobility-report-august-2015-interim.pdf.

Ericsson (2015b), *Ericsson Mobility Report on the Pulse of the Networked Society: November 2015*. https://www.ericsson.com/res/docs/2015/mobility-report/ericsson-mobility-report-nov-2015.pdf.

Ericsson (2015c), *Ericsson Mobility Report: South East Asia and Oceania*, November 2015. https://www.ericsson.com/res/docs/2015/mobility-report/emr-nov-2015-regional-report-south-east-asia-and-oceania.pdf.

Ericsson (2016), *Ericsson Mobility Report on the Pulse of the Networked Society: June 2016*. https://www.ericsson.com/res/docs/2016/ericsson-mobility-report-2016.pdf.

European Commission (EC) (2014), *Special Eurobarometer 414: E-communications and telecom single market household survey*. March 2014. http://ec.europa.eu/public_opinion/archives/ebs/ebs_414_en.pdf.

Facebook (2015), *State of Connectivity 2015: A Report on Global Internet Access*. http://newsroom.fb.com/news/2016/02/state-of-connectivity-2015-a-report-on-global-Internet-access/.

Galpaya, H., Zainudeen, A. and Suthaharan, P. (2015), *A baseline survey of ICT and knowledge access in Myanmar*. August 2015, p.9. http://lirneasia.net/wp-content/uploads/2015/07/LIRNEasia_MyanmarBaselineSurvey_DescriptiveStats_V1.pdf.

Gillwald, A., Milek, A. & Stork, C. (2010), *Gender Assessment of ICT Access and Usage in Africa*, Research ICT Africa. http://www.ictworks.org/sites/default/files/uploaded_pics/2009/Gender_Paper_Sept_2010.pdf.

GSMA (2014), *Measuring mobile penetration*. Untangling 'subscribers', 'mobile phone owners' and 'users'. https://www.gsmaintelligence.com/research/?file=aafdf6d1736603f2494b61c33cf1de2f&download.

GSMA (2015), *Bridging the Gender Gap: Mobile Access and Usage in Low- and Middle-income Countries.* http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/02/GSM0001_03232015_GSMAReport_NEWGRAYS-Web.pdf.

GSMA (2016a), *Connected Society. Digital inclusion in Latin America and the Caribbean*. https://www.gsmaintelligence.com/research/?file=895f6c0a1efa7a25f5d6b4ff874e92f1&download.

GSMA (2016b), *Connected Society. Consumer barriers to mobile Internet adoption in Asia.* https://www.gsmaintelligence.com/research/?file=c52d213ec6288da6b31248df71e370a3&download.

GSMA (2016c), *The Mobile Economy 2016*. https://www.gsmaintelligence.com/research/?file=97928efe09cdba2864cdcf1ad1a2f58c&download.

GSMA and LIRNEasia (2015), *Mobile phones, internet, and gender in Myanmar*. http://lirneasia.net/wp-content/uploads/2016/04/GSMA_Myanmar_Gender_R2_Spreads.pdf.

GSMA, Cherie Blair Foundation and Vital Wave Consulting (2010), *Women and Mobile: A Global Opportunity*. http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/01/GSMA_Women_and_Mobile-A_Global_Opportunity.pdf.

InfoDev (2012a), *Mobile Usage at the Base of the Pyramid in Kenya*. https://www.infodev.org/infodev-files/final_kenya_bop_study_web_jan_02_2013_0.pdf.

InfoDev (2012b), *Mobile Usage at the Base of the Pyramid in South Africa*. https://www.infodev.org/infodev-files/final_south_africa_bop_study_web.pdf.

Internet Society (ISOC) (2015), *Global Internet Report 2015: Mobile Evolution and Development of the Internet 2015*. http://www.internetsociety.org/globalinternetreport/.

ITU (2009), *Measuring the Information Society Report 2009*. http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2009.aspx.

ITU (2013), *Study on International Internet Connectivity in Sub-Saharan Africa*. https://www.itu.int/en/ITU-D/Regulatory-Market/Documents/IIC_Africa_Final-en.pdf.

ITU (2014a), *Measuring the Information Society Report 2014*. http://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf.

ITU (2014b), *Final WSIS Targets Review: Achievements, Challenges and the Way Forward*. http://www.itu.int/en/ITU-D/Statistics/Pages/publications/wsistargets2014.aspx.

ITU (2015), *Measuring the Information Society Report 2015*. http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf.

ITU (2016), *ICT Facts and Figures 2016.* https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf.

ITU and Cisco (2016), *Harnessing the Internet of Things for Global Development*. https://www.itu.int/en/action/broadband/Documents/Harnessing-IoT-Global-Development.pdf.

James, J. (2010), *Sharing mobile phones in developing countries: Implications for the digital divide, Technological Forecasting and Social Change*, Volume 78, Issue 4, May 2011, Pages 729-735, ISSN 0040-1625. http://dx.doi.org/10.1016/j.techfore.2010.11.008.

KISA (2015), *Korea Internet White Paper.* http://isis.kisa.or.kr/eng/ebook/EngWhitePaper2015.pdf.

Kuss, D.J. and Lopez-Fernandez, O. (2016), *Internet addiction and problematic Internet use: A systematic review of clinical research.* National Center for Biotechnology Information. See comment in PubMed Commons below World J Psychiatry. 2016 Mar 22;6 (1):143-76. doi: 10.5498/wjp.v6.i1.143.

Maroc Telecom (2015), *Key Facts & Figures: Edition of June 30, 2015*. http://www.iam.ma/Lists/Publication/Attachments/50/Maroc%20Telecom%20en%20%20Bref%20S1%202015%20Version%20anglaise_EN.pdf.

Maxis (2016), *Annual Report 2015*. http://maxis.my/ar2015/images/download/pdf/maxis_ar2015.pdf.

Mc Kinsey (2014), *Offline and falling behind: Barriers to Internet adoption*, October, 2014. http://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/high%20tech/pdfs/offline_and_falling_behind_full_report.ashx.

MCIT (2013), *The Telecommunications Law*, The Pyidaungsu Hluttaw Law No.31, 2013. http://www.mcit.gov.mm/sites/default/files/Telecom%20Law%20English%20Version_0.pdf.

Milligan, C. and Passey, D. (2011). Nominet Trust. *Ageing and the use of the Internet. Current engagement and future needs*. https://www.nominettrust.org.uk/sites/default/files/NT per cent20SoA per cent20-per cent20Ageing per cent20and per cent20the per cent20use per cent20of per cent20the per cent20Internet_0.pdf.

Ministry of Information and Communications, Royal Government of Bhutan (MOIC) (2014), *Annual InfoComm and Transport Statistical Bulletin* (5th Edition), March 2014. http://www.moic.gov.bt/wp-content/uploads/2016/05/2014.pdf.

MTN (2014), *Annual Report 2014*. https://www.mtn.com/Sustainability/Documents/MTN_Group_Integrated_Report_2014.pdf.

MTN (2015), *Annual Report 2015*. https://www.mtn.com/Investors/FinancialReporting/Documents/ANNUALREPORTS/2015/Booklet/Annual_results_booklet_2015.pdf.

National Commission for the State Regulation of Communications and Informatization (NCCIR) (2013*), Annual report of the National Commission for the State Regulation of Communications and Informatization*. http://en.nkrzi.gov.ua/img/zstored/File/2013_03/nkrzi-en.pdf.

OECD (2013), *Mobile Handset Acquisition Models.* **OECD Digital Economy Papers**, No. 224, OECD Publishing, Paris. DOI. http://dx.doi.org/10.1787/5k43n203mlbr-en.

OECD (2015a), *OECD Digital Economy Outlook 2015.* http://www.oecd.org/economy/oecd-digital-economy-outlook-2015-9789264232440-en.htm.

OECD (2015b), *Students, Computers and Learning: Making the Connection*. http://www.oecd-ilibrary.org/education/students-computers-and-learning_9789264239555-en.

OECD (2015c), Triple and Quadruple Play Bundles of Communication Services. *OECD Science, Technology and Industry Policy Papers*, 23. OECD Publishing: Paris. http://dx.doi.org/10.1787/5js04dp2q1jc-en.

OECD (2016), *Are there differences in how advantaged and disadvantaged students use the Internet?* http://www.oecd-ilibrary.org/education/are-there-differences-in-how-advantaged-and-disadvantaged-students-use-the-internet_5jlv8zq6hw43-en.

Ooredoo (2015), *Annual Report 2015*. http://ooredoo.com/en/investors/.

OpenSignal (2015), *The Global Prevalence of Dual-SIM Android Devices,* January 2015. http://opensignal.com/reports/2015/01/android-devices-dual-sim.

Orange (2015), *Registration document: Annual financial report 2014*. http://www.orange.com/en/content/download/29884/834878/version/3/file/2014+Registration+document.pdf.

Orange (2016), *Registration document: Annual financial report 2015*. http://www.orange.com/en/content/download/36161/1131283/version/2/file/Orange%20-%20DDR%202015_VA.pdf.

OTE (2015), *2014 Annual Report*. https://www.cosmote.gr/fixed/documents/10280/70481091/EN_Annual_Report_2014.pdf/573e1f16-18cf-4bbc-9d27-a692197dbbbb.

OTE (2016), *2015 Annual Report*. https://www.cosmote.gr/fixed/documents/10280/138879181/OTE_Annual_Report_2015_eng.pdf/dbb4a5ed-e053-4fb9-9c94-f9d2913955de.

Oxford Business Group (2016), *Myanmar witnesses increased demand for mobile communications*. https://www.oxfordbusinessgroup.com/overview/powering-ahead-myanmar-witnessing-massive-increase-demand-mobile-communications.

Pew Internet (2012), *The Best (and Worst) of Mobile Connectivity*. http://www.pewinternet.org/files/old-media//Files/Reports/2012/PIP_Best_Worst_Mobile_113012.pdf.

Pew Internet (2014), *Older Adults and Technology Use,* April 2014. http://www.pewinternet.org/2014/04/03/older-adults-and-technology-use/.

Piscataway, N.J. (2010), *Telecordia Dynamic Pricing Solution Helps Mobile Operators Increase Revenue Through Network Optimization*. 18 May 2010. http://www.prnewswire.com/news-releases/telcordia-dynamic-pricing-solution-helps-mobile-operators-increase-revenue-through-network-optimization-94043729.html.

Post and Telecom Administration in Iceland (2015), *Annual Report 2015*. https://www.pfs.is/library/Skrar/English/About-PTA/PTA_Annual_Report_2015.pdf

Public Health England (2013), *How Healthy Behaviour Supports Children's Wellbeing*. August 2013. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/232978/Smart_Restart_280813_web.pdf.

Research ICT Africa (2012), *Internet Going Mobile – Internet access and usage in 11 African countries*, Research ICT Africa Policy Briefs, no. 2, 2012. http://www.researchictafrica.net/publications/Country_Specific_Policy_Briefs/Internet_going_mobile_-_Internet_access_and_usage_in_11_African_countries.pdf.

Smyk, D. (2011), *Optimization of Dynamic Pricing in Mobile Network: Deriving greater value out of existing network assets* (White Paper). http://www.ericsson.com/res/ourportfolio/pdf/telcordia_white_papers/MC-COR-WP-036v2.pdf.

Telecom Regulatory Authority of India (2016), *Prohibition of Discriminatory Tariffs for Data Services Regulations, 2016*. 8 February 2016. http://www.trai.gov.in/WriteReadData/WhatsNew/Documents/Regulation_Data_Service.pdf.

The Economist (2015), *To be continued: The rules of the road on the internet will always be a work in progress*. 31 January 2015. The Economist. http://www.economist.com/news/business/21641257-rules-road-internet-will-always-be-work-progress-be-continued.

UNESCO (2016), *Global Education Monitoring Report 2016. Education for People and Planet: Creating Sustainable Futures for All*. http://unesdoc.unesco.org/images/0024/002457/245752e.pdf.

United Nations (2015), *Transforming our World: the 2030 Agenda for Sustainable Development*. https://sustainabledevelopment.un.org/content/documents/21252030 Agenda for Sustainable Development web.pdf.

United Nations Commission on Science and Technology for Development (2015*), Implementing WSIS Outcomes*. http://unctad.org/en/PublicationsLibrary/dtlstict2015d3_en.pdf.

United Nations Conference on Trade and Development (UNCTAD) (2014), *Measuring ICT and Gender: An Assessment*. http://unctad.org/en/PublicationsLibrary/webdtlstict2014d1_en.pdf.

United Nations Department of Economic and Social Affairs (UNDESA) (2009), *The State of the World's Indigenous Peoples.* https://www.un.org/development/desa/indigenouspeoples/publications/2009/09/state-of-the-worlds-indigenous-peoples-first-volume.

United Nations Development Programme (UNDP) (2012), *Mobile Technologies and Empowerment: Enhancing human development through participation and innovation.* http://www.undp.org/content/dam/undp/library/Democratic Governance/Access to Information and E-governance/Mobile Technologies and Empowerment_EN.pdf.

United Nations Economic and Social Council (ECOSOC) (2016), *Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators*, E/CN.3/2016/2/Rev.1*, 19 February 2016. http://unstats.un.org/unsd/statcom/47th-session/documents/2016-2-IAEG-SDGs-Rev1-E.pdf.

United Nations General Assembly (UNGA) (2015a), *Transforming our world: the 2030 Agenda for Sustainable Development* (Resolution adopted by the General Assembly on 25 September 2015). A/RES/70/1. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.

United Nations General Assembly (UNGA) (2015b), *Outcome document of the high-level meeting of the General Assembly on the overall review of the implementation of the outcomes of the World Summit on*

the Information Society, 16 December 2015. http://workspace.unpan.org/sites/Internet/Documents/UNPAN96078.pdf.

United Nations High Commissioner for Refugees (UNHCR) (2016), *Connectivity for Refugees. How Internet and Mobile Connectivity can Improve Refugee Well-Being and Transform Humanitarian Action*. Geneva, 2016. http://www.unhcr.org/publications/operations/5770d43c4/connecting-refugees.html.

United Nations Secretary-General's Expert Advisory Group on Data Revolution (2014), *A World That Counts.* http://www.undatarevolution.org/report/.

Van Deursen and Helsper (2015), *A nuanced understanding of Internet use and non-use amongst older adults*. http://eprints.lse.ac.uk/59995/1/Helsper_a_nuanced_understanding_of_Internet_use.pdf.

Vodafone (2013), *Connected Worker. How mobile technology can improve working life in emerging economies*. https://www.vodafone.com/content/dam/sustainability/pdfs/vodafone_connected_worker.pdf.

Wesolowski, A., Eagle, N., Am, N., Rw, S., and Co, B. (2012), *Heterogeneous Mobile Phone Ownership and Usage Patterns in Kenya*. PLoS ONE 7(4):e35319. doi:10.1371/journal.pone.0035319.

World Bank (2012), *Information and Communication for Development 2012: Maximizing Mobile.* http://go.worldbank.org/0J2CTQTYP0.

World Bank (2016), *World Development Report 2016 - Digital Dividends.* http://documents.worldbank.org/curated/en/896971468194972881/pdf/102725-PUB-Replacement-PUBLIC.pdf.

Zain (2015), *Annual Report 2014: Towards a Wonderful Digital World*. http://www.zain.com/media/images/resumes/ZAIN_Annual_Report_2014_EN.pdf.

Zain (2016), *Annual Report 2015: The Future is Now*. http://www.zain.com/media/images/resumes/Zain_Annual_Report_2015_English_2.pdf.

Zainudeen, A. and Galpaya, H. (2015), *Mobile phones, internet, and gender in Myanmar*, LIRNEasia and GSMA. http://lirneasia.net/wp-content/uploads/2016/04/GSMA_Myanmar_Gender_R2_Spreads.pdf

Annex 1. ICT Development Index (IDI) methodology

This annex outlines the methodology used to compute the IDI, and provides additional details on various elements and steps involved, such as the indicators included in the index and their definition, the imputation of missing data, the normalization procedure, the weights applied to the indicators and sub-indices, and the results of the sensitivity analysis.

1. Indicators included in the IDI

The selection of indicators was based on certain criteria, including relevance for the index objectives, data availability and the results of various statistical analyses such as the principal component analysis (PCA).[1] The following 11 indicators are included in the IDI (grouped by the three sub-indices: access, use and skills).

a) ICT infrastructure and access indicators

Indicators included in this group provide an indication of the available ICT infrastructure and individuals' access to basic ICTs. Data for all these indicators are collected by ITU.[2]

1. Fixed-telephone subscriptions per 100 inhabitants

Fixed-telephone subscriptions refers to the sum of active analogue fixed-telephone lines, voice-over-IP (VoIP) subscriptions, fixed wireless local loop (WLL) subscriptions, ISDN voice-channel equivalents and fixed public payphones. It includes all accesses over fixed infrastructure supporting voice telephony using copper wire, voice services using Internet Protocol (IP) delivered over fixed (wired)-broadband infrastructure (e.g. DSL, fibre optic), and voice services provided over coaxial-cable television networks (cable modem). It also includes fixed WLL connections, defined as services provided by licensed fixed-line telephone operators that provide last-mile access to the subscriber using radio technology, where the call is then routed over a fixed-line telephone network (not a mobile-cellular network). In the case of VoIP, it refers to subscriptions that offer the ability to place and receive calls at any time and do not require a computer. VoIP is also known as voice-over-broadband (VoB), and includes subscriptions through fixed-wireless, DSL, cable, fibre-optic and other fixed-broadband platforms that provide fixed telephony using IP.

2. Mobile-cellular telephone subscriptions per 100 inhabitants

Mobile-cellular telephone subscriptions refers to the number of subscriptions to a public mobile-telephone service providing access to the public switched telephone network (PSTN) using cellular technology. It includes both the number of postpaid subscriptions and the number of active prepaid accounts (i.e. that have been active during the past three months). It includes all mobile-cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging and telemetry services.

3. International Internet bandwidth (bit/s) per Internet user

International Internet bandwidth refers to the total used capacity of international Internet bandwidth, in megabits per second (Mbit/s). Used international Internet bandwidth refers to the average traffic load of international fibre-optic cables and radio links for carrying Internet traffic. The average is calculated over the 12-month period of the reference year, and takes into consideration the traffic of all international Internet links. If the traffic is asymmetric, i.e. if there is more incoming (downlink) than outgoing (uplink) traffic, the average incoming (downlink) traffic load is used. The combined average traffic load of different international Internet links can be reported as the sum of the average traffic loads of the individual links. *International Internet bandwidth (bit/s) per Internet user* is calculated by converting to bits per second and dividing by the total number of Internet users.

4. Percentage of households with a computer

Computer refers to a desktop computer, laptop (portable) computer, tablet or similar handheld computer. It does not include equipment with some embedded computing abilities, such as smart TV sets, or devices with telephony as a main function, such as mobile phones or smartphones.

Household with a computer means that the computer is available for use by all members of the household at any time. The computer may or may not be owned by the household, but should be considered a household asset.[3]

Data are obtained by countries through national household surveys and are either provided directly to ITU by national statistical offices (NSOs) or obtained by ITU through its own research, for example from NSO websites. There are certain data-related limits to this indicator, insofar as estimates have to be calculated for many developing countries which do not yet collect ICT household statistics. Over time, as more data become available, the quality of the indicator will improve.

5. Percentage of households with Internet access

The *Internet* is a worldwide public computer network. It provides access to a number of communication services, including the World Wide Web, and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only a computer; it may also be a mobile telephone, tablet, PDA, games machine, digital TV, and so on). Access can be via a fixed or mobile network. *Household with Internet access* means that the Internet is available for use by all members of the household at any time.[4]

Data are obtained by countries through national household surveys and are either provided directly to ITU by NSOs or obtained by ITU through its own research, for example from NSO websites. There are certain data-related limits to this indicator, insofar as estimates have to be calculated for many developing countries which do not yet collect ICT household statistics. Over time, as more data become available, the quality of the indicator will improve.

b) ICT use indicators

The indicators included in this group capture ICT intensity and usage. Data for all these indicators are collected by ITU.[5]

1. Percentage of individuals using the Internet

Individuals using the Internet refers to people who used the Internet from any location and for any purpose, irrespective of the device and network used, in the last three months. Usage can be via a computer (i.e. desktop computer, laptop computer, tablet or similar handheld computer), mobile phone, games machine, digital TV, etc.). Access can be via a fixed or mobile network.

Data are obtained by countries through national household surveys and are either provided directly to ITU by NSOs or obtained by ITU through its own research, for example from NSO websites. There are certain data-related limits to this indicator, insofar as estimates have to be calculated for many developing countries which do not yet collect ICT household statistics. Over time, as more data become available, the quality of the indicator will improve.

2. Fixed-broadband subscriptions per 100 inhabitants

Fixed-broadband subscriptions refers to fixed subscriptions for high-speed access to the public Internet (a TCP/IP connection) at downstream speeds equal to or greater than 256 kbit/s. This includes cable modem, DSL, fibre-to-the-home/building, other fixed-broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband. The total is measured irrespective of the method of payment. It excludes subscriptions that have access to data communications (including the Internet) via mobile-cellular networks. It includes fixed WiMAX and any other fixed wireless technologies, and both residential subscriptions and subscriptions for organizations.

3. Active mobile-broadband subscriptions per 100 inhabitants

Active mobile-broadband subscriptions refers to the sum of standard mobile-broadband subscriptions and dedicated mobile-broadband subscriptions. The subscriptions can be used

through handset-based or computer-based (USB/dongle) devices. It covers actual subscribers, not potential subscribers, even though the latter may have broadband-enabled handsets.

- *Standard mobile-broadband subscriptions* refers to active mobile-cellular subscriptions with advertised data speeds of 256 kbit/s or higher that allow access to the greater Internet via HTTP and which have been used to set up an Internet data connection using IP in the past three months. Standard SMS and MMS messaging do not count as active Internet data connection, even if messages are delivered via IP.

- *Dedicated mobile-broadband data subscriptions* refers to subscriptions to dedicated data services (over a mobile network) that allow access to the greater Internet and are purchased separately from voice services, either as a stand-alone service (e.g. using a data card such as a USB modem/dongle) or as an add-on data package to voice services which requires an additional subscription. All dedicated mobile-broadband subscriptions with recurring subscription fees are included regardless of actual use. Prepaid mobile-broadband plans require use of the monthly data allowance where there is no monthly subscription. This indicator could also include mobile WiMAX subscriptions.

c) ICT skills indicators

Data on mean years of schooling and gross secondary and tertiary enrolment ratios are collected by the UNESCO Institute for Statistics (UIS).

1. Mean years of schooling

Mean years of schooling is the average number of completed years of education of a country's population, excluding years spent repeating individual grades. It is estimated by UIS using the distribution of the population by age group and the highest level of education attained in a given year, and time series data on the official duration of each level of education.[6]

2. Gross enrolment ratio (secondary and tertiary level)

According to UIS, the *gross enrolment ratio* is "the total enrolment in a specific level of education, regardless of age, expressed as a percentage of the eligible official school-age population corresponding to the same level of education in a given school-year."

2. Imputation of missing data

A critical step in the construction of the index is to create a complete data set, without missing values. A number of imputation techniques can be applied to estimate missing data.[7] Each of the imputation techniques, like any other method employed in the process, has its own strengths and weaknesses. The most important consideration is to ensure that the imputed data will reflect a country's actual level of ICT access, usage and skills.

Given that ICT access and usage are both correlated with national income, hot-deck imputation was chosen as the method for imputing the missing data where previous year data are not available to calculate growth rates. Hot-deck imputation uses data from countries with "similar" characteristics, such as gross national income (GNI) per capita and geographical location. For example, missing data for a given country A were estimated for a certain indicator by first identifying countries in the same region with similar levels of GNI per capita and similar levels for an indicator that has a known relationship to the indicator to be estimated. For instance, Internet use data for country A was estimated by using Internet use data for country B from the same region with a similar GNI per capita and similar level of fixed Internet and wireless-broadband subscriptions. The same approach was applied to estimate missing data for all indicators included in the index.

3. Normalization of data

Normalization of data is necessary before any aggregation can take place, in order to ensure that the data set uses the same unit of measurement. Regarding the indicators selected to construct the IDI, the values must be converted into the same unit of measurement, since some values are expressed as a percentage of the population/total

households, where the maximum value is 100, while other indicators can have values exceeding 100, such as mobile-cellular and active mobile-broadband penetration or international Internet bandwidth (expressed as bit/s per user).

Certain particularities need to be taken into consideration in selecting the normalization method for the IDI. For example, in order to identify the digital divide, it is important to measure the *relative* performance of countries (i.e. the divide among countries). Secondly, the normalization procedure should produce index results that allow countries to track progress in their evolution towards an information society over time.

A further important criterion in selecting the normalization method is replicability by countries, as some countries have shown a strong interest in applying the index methodology at the national or regional level. Certain methods therefore cannot be applied, for example those that rely on the values of other countries, which might not be available to users.

For the IDI, the *distance to a reference measure* was used as the normalization method. The reference measure is the *ideal value* that could be reached for each variable (similar to a "goalpost"). For all the indicators chosen, this will be 100, except in regard to the following five indicators:

- International Internet bandwidth per Internet user, which in 2015 ranged from 28 (bit/s/user) to almost 7 186 378. Values for this indicator vary significantly between countries. To diminish the effect of the enormous dispersion of values, the data were first converted to a logarithmic (log) scale. Outliers were then identified using a cut-off value calculated by adding two standard deviations to the mean of the rescaled values, resulting in a log value of 5.99.

- Mobile-cellular subscriptions, which in 2015 ranged from 23.9 to 324.4 per 100 inhabitants. The reference value for mobile-cellular subscriptions was reviewed in the previous edition of the index and was lowered to 120, a value derived by examining the distribution of countries based on their value for mobile-cellular subscriptions per 100 inhabitants in 2013. For countries where postpaid is the predominant mode of subscription, 120 is the maximum value attained, while in countries where prepaid is dominant (57 per cent of all countries included in the IDI have more than 80 per cent prepaid subscriptions), 120 is also the maximum value attained in a majority of countries. It was therefore concluded that 120 is the ideal value that a country could attain, irrespective of the predominant type of mobile subscription. Although the distribution of 2015 values may differ slightly from that of 2013 values, the ideal value of 120 was used to calculate this year's IDI, in the interests of consistency with the value used in previous years.

- Fixed-telephone subscriptions per 100 inhabitants, which ranged from zero to 128.1 in 2015. The reference value was calculated by adding two standard deviations to the mean, resulting in a rounded value of 60 per 100 inhabitants.

- Fixed-broadband subscriptions per 100 inhabitants. Values ranged from zero to 47.5 per 100 inhabitants in 2015. In line with fixed-telephone subscriptions, the ideal value was defined as 60 per 100 inhabitants.

- Mean years of schooling. Values ranged from 1.4 to 13.8 in 2015. The ideal value of 15 is used for this indicator, which refers to the projected maximum number of years of schooling by 2025.[8]

After normalizing the data, the individual series were all rescaled to identical ranges, from 1 to 10. This was necessary in order to compare the values of the indicators and the sub-indices.

4. Weighting and aggregation

The indicators and sub-indices included in the IDI were weighted on the basis of the PCA results obtained when the index was first computed.[9]

Annex Box 1.1: Weights used for indicators and sub-indices included in the IDI

	Weights (indicators)	Weights (sub-indices)
ICT access		0.40
Fixed-telephone subscriptions per 100 inhabitants	0.20	
Mobile-cellular telephone subscriptions per 100 inhabitants	0.20	
International Internet bandwidth per Internet user	0.20	
Percentage of households with a computer	0.20	
Percentage of households with Internet access	0.20	
ICT use		0.40
Percentage of individuals using the Internet	0.33	
Fixed-broadband Internet subscriptions per 100 inhabitants	0.33	
Active mobile-broadband subscriptions per 100 inhabitants	0.33	
ICT skills		0.20
Mean years of schooling	0.33	
Secondary gross enrolment ratio	0.33	
Tertiary gross enrolment ratio	0.33	

Source: ITU.

5. Calculating the IDI

Sub-indices were computed by summation of the weighted values of the indicators included in the respective subgroup.

- *ICT access* is measured by fixed-telephone subscriptions per 100 inhabitants, mobile-cellular subscriptions per 100 inhabitants, international Internet bandwidth per Internet user, the percentage of households with a computer and the percentage of households with Internet access.
- *ICT use* is measured by the percentage of individuals using the Internet, fixed-broadband Internet subscriptions per 100 inhabitants and active mobile-broadband subscriptions per 100 inhabitants.
- *ICT skills* are approximated by mean years of schooling, secondary gross enrolment ratio and tertiary gross enrolment ratio.

The values of the sub-indices were calculated first by normalizing the indicators included in each sub-index in order to obtain the same unit of measurement. The *reference values* applied in the normalization process were discussed above. The sub-index value was calculated by taking the simple average (using equal weighting) of the normalized indicator values.

For computation of the final index, the ICT access and ICT use sub-indices were each given a 40 per cent weighting, and the skills sub-index (because it is based on proxy indicators) a 20 per cent weighting. The final index value was then computed by summation of the weighted sub-indices. Annex Box 1.2 illustrates the process of computing the IDI for the Republic of Korea (which tops the IDI 2016).

Annex Box 1.2: Example of how to calculate the IDI value

	Korea (Rep.)			
	Indicators			
	ICT access	**Ideal value***		
a	Fixed-telephone subscriptions per 100 inhabitants	60		58.1
b	Mobile-cellular telephone subscriptions per 100 inhabitants	120		118.5
c	International Internet bandwidth per Internet user**	976,696		46,764
d	Percentage of households with a computer	100		77.1
e	Percentage of households with Internet access	100		98.8
	ICT use			
f	Percentage of individuals using the Internet	100		89.9
g	Fixed-broadband Internet subscriptions per 100 inhabitants	60		40.2
h	Active mobile-broadband subscriptions per 100 inhabitants	100		109.7
	ICT skills			
i	Mean years of schooling	15		11.9
j	Secondary gross enrolment ratio	100		97.7
k	Tertiary gross enrolment ratio	100		95.3
	Normalized values	**Formula**	**Weight**	
	ICT access			
z1	Fixed-telephone subscriptions per 100 inhabitants	a/60	0.20	0.97
z2	Mobile-cellular telephone subscriptions per 100 inhabitants	b/120	0.20	0.99
z3	International Internet bandwidth per Internet user	log(c)/5.99	0.20	0.79
z4	Percentage of households with a computer	d/100	0.20	0.77
z5	Percentage of households with Internet access	e/100	0.20	0.99
	ICT use			
z6	Percentage of individuals using the Internet	f/100	0.33	0.90
z7	Fixed-broadband Internet subscriptions per 100 inhabitants	g/60	0.33	0.67
z8	Active mobile-broadband subscriptions per 100 inhabitants	h/100	0.33	1.00
	ICT skills			
z9	Mean years of schooling	i/15	0.33	0.79
z10	Secondary gross enrolment ratio	j/100	0.33	0.98
z11	Tertiary gross enrolment ratio	k/100	0.33	0.95
	Sub-indices	**Formula**	**Weight**	
	ICT access sub-index (L)	**y1+y2+y3+y4+y5**	**0.40**	**0.90**
y1	Fixed-telephone subsriptions per 100 inhabitants	z1*.20		0.19
y2	Mobile-cellular telephone subscriptions per 100 inhabitants	z2*.20		0.20
y3	International Internet bandwidth per Internet user	z3*.20		0.16
y4	Percentage of households with a computer	z4*.20		0.15
y5	Percentage of households with Internet access	z5*.20		0.20
	ICT use sub-index (M)	**y6+y7+y8**	**0.40**	**0.86**
y6	Percentage of individuals using the Internet	z6*.33		0.30
y7	Fixed-broadband Internet subscriptions per 100 inhabitants	z7*.33		0.22
y8	Active mobile-broadband subscriptions per 100 inhabitants	z8*.33		0.33
	ICT skills sub-index (N)	**y9+y10+y11**	**0.20**	**0.91**
y9	Mean years of schooling	z9*.33		0.26
y10	Secondary gross enrolment ratio	z10*.33		0.33
y11	Tertiary gross enrolment ratio	z11*.33		0.32
IDI	**ICT Development Index 2016**	**((L*.40)+(M*.40)+(N*.20))*10**		**8.84**

Note: *The ideal value for indicators a, b, c and g was computed by adding two standard deviations to the mean value of the indicator.
**To diminish the effect of the large number of outliers at the high end of the value scale, the data were first transformed to a logarithmic (log) scale. The ideal value of 976'696 bit/s per Internet user is equivalent to 5.99 if transformed to a log scale.
Source: ITU.

6. Sensitivity analysis

Sensitivity analysis was carried out to investigate the robustness of the index results in terms of the relative position in the overall ranking, using different combinations of methods and techniques to compute the index.

Potential sources of variation or uncertainty can be attributed to different processes employed in the computation of the index, including the selection of individual indicators, the imputation of missing values and the normalization, weighting and aggregation of the data.

Each of the processes or combination of processes affects the IDI value. A number of tests were carried out to examine the robustness of the IDI results (rather than the actual values). The tests computed the possible index values and country rankings for different combinations of the processes mentioned above. Results show that, while the computed index values change, the message remains the same. The IDI was found to be extremely robust with regard to different methodologies, with the exception of certain countries including in particular those in the "high" group.

The relative position of countries included in the "high" group (see Chapter 1) can change depending on the methodology used. Caution should therefore be exercised in drawing conclusions based on these countries' rankings. However, the relative position of countries included in the "low" group is in no way affected by the methods or techniques used, and the countries in this group ranked low in all index computations using different methodologies. This confirms the results conveyed by the IDI.

Endnotes

1 PCA was used to examine the underlying nature of the data. A more detailed description of the analysis is available in Annex 1 to the 2009 report "Measuring the Information Society. The ICT Development Index" (ITU, 2009).

2 More information about the indicators is available in the ITU "Handbook for the collection of administrative data on telecommunications/ICT" 2011, (ITU 2011) and the ITU "Manual for Measuring ICT Access and Use by Households and Individuals" (ITU 2014).

3 This definition reflects the revisions agreed by the ITU Expert Group on ICT Household Indicators (EGH) at its meeting in Sao Paulo, Brazil, 4-6 June 2013. See http://www.itu.int/en/ITU-D/Statistics/Documents/events/brazil2013/Final_report_EGH.pdf).

4 See footnote 3.

5 See footnote 2.

6 See http://www.uis.unesco.org/Education/Documents/Mean-years-schooling-indicator-methodology-en.pdf.

7 See OECD and European Commission (2008).

8 See Human Development Index (HDI), Technical Notes, available at http://hdr.undp.org/sites/default/files/hdr2015_technical_notes.pdf.

9 For more details, see Annex 1 to ITU (2009).

Annex 2. ICT price data methodology

Price data collection and sources

The price data presented in this report were collected in the fourth quarter of 2015. With the exception of the data on mobile-broadband prices, which were collected by ITU directly from operators' websites[1], all data were collected through the ITU ICT Price Basket Questionnaire, which was sent to the administrations and statistics contacts of all 193 ITU Member States in October 2015.[2] Through the questionnaire, contacts were requested to provide 2015 data for fixed-telephone, mobile-cellular and fixed-broadband prices; the 2013 and 2014 prices were included for reference, where available. For those countries that did not reply to the ITU ICT Price Basket Questionnaire and for mobile-broadband services, price data were collected directly from operators' websites and/or through direct correspondence. Price data were collected from the operator with the largest market share, as measured by the number of subscriptions. Insofar as, for many countries, it is not clear which Internet service provider (ISP) has the dominant market share, preference was given to prices offered by the (former) incumbent telecommunication operator. In some cases, especially where prices were not clearly advertised or were indicated only in the local language, and where operators did not respond to queries, alternative operators were chosen. All prices were converted into United States dollars using IMF's average annual rate of exchange for 2015, and into PPP$ using World Bank conversion factors for 2014 (as published in February 2016). Prices are also presented as a percentage of countries' monthly gross national income per capita (GNI p.c.) using GNI p.c. values from the World Bank (Atlas method) for 2014 (as published in February 2016) or the latest available year adjusted in accordance with international inflation rates. Price data for 2008, 2009, 2010, 2011, 2012, 2013 and 2014, which are also shown and used in this chapter, were collected in previous years (always during the second half of the respective year), in national currencies, and converted using the average annual rates of exchange.

The mobile-cellular sub-basket

The mobile-cellular sub-basket refers to the price of a standard basket of mobile monthly usage for 30 outgoing calls per month (on-net/off-net to a fixed line and for peak and off-peak times) in predetermined ratios, plus 100 SMS messages[3]. It is calculated as a percentage of a country's average monthly GNI p.c. and is also presented in USD and PPP$. The mobile-cellular sub-basket is based on prepaid prices, although postpaid prices are used for countries where prepaid subscriptions make up less than two per cent of all mobile-cellular subscriptions.

The mobile-cellular sub-basket is largely based on, but does not entirely follow, the 2009 methodology of the OECD low-user basket, which is the entry-level basket with the smallest number of calls included (OECD, 2010). Unlike the 2009 OECD methodology, which is based on the prices of the two largest mobile operators, the ITU mobile sub-basket uses only the largest mobile operator's prices. Nor does the ITU mobile-cellular sub-basket take account of calls to voicemail (which in the OECD basket represent four per cent of all calls) or non-recurring charges, such as the one-time charge for a SIM card. The basket gives the price of a standard basket of mobile monthly usage in USD determined by OECD for 30 outgoing calls per month in predetermined ratios, plus 100 SMS messages.[4] The cost of national SMS is the charge to the consumer for sending a single SMS text message. Both on-net and off-net SMS prices are taken into account. The basket considers on-net and off-net calls as well as calls to a fixed telephone[5] and, since the price of a call often depends on the time of day or week it is made, peak, off-peak and weekend periods are also taken into consideration. The call distribution is outlined in Annex Table 2.1.

Prepaid prices were chosen because they are often the only payment method available to low-income users, who might not have a regular income and will thus not qualify for a postpaid subscription. Rather than reflecting the cheapest option available, the mobile-cellular sub-basket therefore corresponds to a basic, representative (low-usage)

Annex Table 2.1: OECD mobile-cellular low-user call distribution (2009 methodology)

	To fixed	On-net	Off-net	TOTAL	Call distribution by time of day (%)
Call distribution (%)	17.0	56.0	26.0	100.0	100.0
Calls	**5.2**	**16.9**	**7.9**	**30.0**	
Peak	2.4	7.8	3.6	13.8	46.0
Off-peak	1.5	4.9	2.3	8.7	29.0
Weekend	1.3	4.2	2.0	7.5	25.0
Duration (minutes per call)	**2.0**	**1.6**	**1.7**		
Duration (total minutes of calls)	10.4	27.0	13.4	50.9	N/A
Peak	4.8	12.4	6.2	23.4	46.0
Off-peak	3.0	7.8	3.9	14.8	29.0
Weekend	2.6	6.8	3.4	12.7	25.0
Calls	**30 calls per month**				
SMS	100 SMSs per month (50 on-net, 50 off-net)				

Source: ITU, based on OECD (2010).

package available to all customers. In countries where no prepaid offers are available, the monthly fixed cost (minus the free minutes of calls included, if applicable) of a postpaid subscription is added to the basket. To make prices comparable, a number of rules are applied (see Annex Box 2.1).

Annex Box 2.1: Rules applied in collecting mobile-cellular prices

1. The prices of the operator with the largest market share (measured by the number of subscriptions) are used. If prices vary between different regions of the country, prices refer to those applied in the largest city (in terms of population) or in the capital city.

2. Price data should be collected in the currency in which the prices are advertised, including taxes. If prices are not advertised in local currency, a note should be added specifying the currency.

3. Prices refer to prepaid plans. Where the operator offers different packages with a certain number of calls and/or SMS messages included, the cheapest one on the basis of 30 calls and 100 SMSs should be selected. If, instead of a pay-per-use plan, a package is selected for the whole basket (e.g. a bundle including 100 SMSs, 60 minutes and 100MB) or for some of its elements (e.g. a package including 100 SMSs), this should be indicated in the notes. In countries where prepaid subscriptions account for less than 2 per cent of the total subscription base, postpaid prices may be used. In this case, the monthly subscription fee, plus any free minutes, will be taken into consideration for the calculation of the mobile-cellular sub-basket.

4. If per-minute prices are only advertised in internal units rather than in national currency, the price of the top-up/refill charge is used to convert internal units into national currency. If there are different refill prices, then the "cheapest/smallest" refill card is used. If different refill charges exist depending on the validity period, the 30-day validity period (or that closest to 30 days) is used.

5. Prices refer to a regular (non-promotional) plan and exclude special or promotional offers, limited discounts or options such as special prices to certain numbers or restricted to new customers, or plans where calls can only be made during a limited number of (or on specific) days during the month.

6. If subscribers can chose "favourite" numbers (for family, friends, etc.) with a special price, this special price will not be taken into consideration, irrespective of the quantity of numbers involved.

7. Prices refer to outgoing local calls. If different rates apply for local and national calls, then the local rate is used. If different charges apply depending on the mobile operator called, the price of calls to the operator with the second largest market share (measured by the number of subscriptions) should be used, indicating in the notes the rates for calling to other mobile operators. If charges apply to incoming calls, these are not taken into consideration.

8. If prices vary between minutes (1st minute = price A, 2nd minute = price B, 3rd minute = price C), the sum of the different prices is divided by the number of different prices (e.g. price per minute = (A+B+C)/3).

9. If prices vary beyond three minutes, the average price per minute is calculated based on the first three minutes.

10. If there is a connection cost per call, then this is taken into consideration in the formula for the mobile-cellular sub-basket, based on 30 calls.

11. If there are different off-peak prices, then the one that is the cheapest before midnight is used. If the only off-peak period is after midnight, then this is not used. Instead, the peak price is used.

12. If there are different peak prices, the most expensive one during the daytime is used.

13. If there are different weekend prices, the price that applies to Sundays during the daytime is used (or the equivalent day in countries where weekends are not on Sundays).

14. If there is no weekend price, the average peak and off-peak price that is valid during the week is used.

15. If peak and off-peak SMS prices exist, the average of both is used for on-net and off-net SMSs.

16. If calls are charged by call or by hour (and not by the minute), the mobile-cellular sub-basket formula will be calculated on the basis of 30 calls or 50.9 minutes. Similarly, if calls are charged by call or by number of minutes for a specific network/time of the day, this will be taken into account for that particular network/time of the day.

17. If monthly, recurring charges exist, they are added to the sub-basket.

Source: ITU.

The fixed-broadband sub-basket

The fixed-broadband sub-basket refers to the price of a monthly subscription to an entry-level fixed-broadband plan. It is calculated as a percentage of a country's average monthly GNI p.c., and is also presented in USD and PPP$. For comparability reasons, the fixed-broadband sub-basket is based on a monthly data usage of (a minimum of) 1 GB. For plans that limit the monthly amount of data transferred by including data volume caps below 1 GB, the cost for the additional bytes is added to the sub-basket. The minimum speed of a broadband connection is 256 kbit/s.

Where several offers are available, preference is given to the cheapest available connection that offers a speed of at least 256 kbit/s and 1 GB of data volume. Where providers set a limit of less than 1 GB on the amount of data that can be transferred within a month, then the price per additional byte is added to the monthly price in order to calculate the cost of 1 GB of data per month. Preference is given to the most widely used fixed (wired)-broadband technology (DSL, fibre, cable, etc.). The sub-basket does not include the installation charges, modem prices or telephone-line rentals that are often required for a DSL service. The price represents the broadband entry plan in terms of the minimum speed of 256 kbit/s, but does not take into account special offers that are limited in time or to specific geographical areas. The plan does not necessarily represent the fastest or most cost-effective connection since the price for a higher-speed plan is often cheaper in relative terms (i.e. in terms of the price per Mbit/s) (see Annex Box 2.2).

Annex Box 2.2: Rules applied in collecting fixed-broadband Internet price data

1. The prices of the operator with the largest market share (measured by the number of fixed-broadband subscriptions) should be used.

2. Price data should be collected in the currency in which the prices are advertised, including taxes. If prices are not advertised in local currency, a note should be added specifying the currency.

3. Only residential, single-user price data should be collected. If prices vary between different regions of the country, prices applying to the largest city (in terms of population) should be provided. If that information is not available, prices applying to the capital city should be reported. The selected city should be mentioned in a note in the monthly subscription indicator.

4. From all fixed-broadband plans meeting the above-mentioned criteria, the cheapest plan on the basis of a 1 GB monthly usage and an advertised download speed of at least 256 kbit/s should be selected. If there is a price distinction between residential and business tariffs, the residential tariff should be used.

5. If the plan selected places no limit on the monthly data usage, the cap should be set at 0 and a note added to that indicator specifying "unlimited".

6. If operators propose different commitment periods, the 12-month plan (or the one closest to this commitment period) should be used. If the plan selected requires a longer commitment (i.e. over 12 months), it should be indicated in the note regarding the monthly subscription. Furthermore, if different prices apply (e.g. a discount price for the first year, and a higher price as of the 13th month), then the price after the discount period should be selected (e.g. the price as of the 13th month). The discount price charged during the initial period should be indicated in a note regarding the monthly subscription charge. This is because the initial price paid is considered a limited/discount price, whereas the price subsequently charged is the regular price.

7. Price data should be collected for the fixed (wired)-broadband technology with the greatest number of subscriptions in the country (DSL, cable, etc.).

8. The same price plan should be used for collecting all the data specified. For example, if Plan A is selected for the fixed-broadband service, according to the criteria mentioned above, the elements in Plan A shall be taken into account in regard to the monthly subscription, the excess-charge price, the volume of data that can be downloaded, etc.

9. Price data should be collected for regular (non-promotional) plans and should not include promotional offers or limited or restricted discounts (e.g. for students only, for existing customers, etc.).

10. With convergence, operators are increasingly providing multiple (bundled) services such as voice telephony, Internet access and television reception over their networks. They often bundle these offers into a single subscription. This can present a challenge for price data collection, since it may not be possible to isolate the prices for one service. It is preferable to use prices for a specific service (i.e. unbundled); if this is not possible, then the additional services that are included in the price plan should be specified in a note.

The cost of a fixed-telephone line should be excluded if it can be used for other services as well. If a monthly rental for the physical line is not required (e.g. naked DSL), this should be mentioned in a note. If a monthly rental of a fixed-telephone line is required, this should also be explained in a note.

Source: ITU.

Mobile-broadband prices

ITU has been collecting mobile-broadband price data through its annual ICT Price Basket Questionnaire since 2012. The collection of mobile-broadband price data from ITU Member States was agreed upon by the Expert Group on Telecommunication/ICT Indicators (EGTI)[6] in 2012, and revised by EGTI in 2013 in the light of the lessons learned from the first data collection exercise. The revised methodology was endorsed by the eleventh World Telecommunication/ICT Indicators Symposium held in December 2013 in Mexico City, and was applied in the 2014 data collection.

To capture the prices of different data packages, covering both prepaid and postpaid services and support by different devices (handset and computer), mobile-broadband price data were collected for two different data thresholds, based on a set of rules (see Annex Box 2.3).

For plans that were limited in terms of validity (less than 30 days), the price of the additional days was calculated and added to the base package in order to obtain the final price. Two possibilities exist, depending on the operator, for extending a plan that is limited in terms of data allowance (or validity). The customer either (i) continues to use the service and pays an excess usage charge for additional data,[7] or (ii) purchases an additional (add-on) package. Thus, for some countries, prices presented in this chapter reflect the price of the base package plus an excess-usage charge (e.g. a base package including 400 MB plus the price for 100 MB of excess usage for a monthly usage of 500 MB), or a multiplication of the base package price (e.g. twice the price of a 250 MB plan for a monthly usage of 500 MB).

The plans selected represent the least expensive offers that include the minimum amount of data for each respective mobile-broadband plan. The guiding principle is to base each plan on what customers could and would purchase given the data allowance and validity of each plan.

Annex Box 2.3: Rules applied in collecting mobile-broadband prices[8]

1. Price data should be collected based on one of the following technologies: UMTS, HSDPA+/ HSDPA, CDMA2000 and IEEE 802.16e. Prices applying to WiFi or hotspots should be excluded.

2. Price data should be collected in the currency in which they are advertised, including taxes. If prices are not advertised in local currency, a note should be added specifying the currency.

3. Only residential, single-user prices should be collected. If prices vary between different regions of the country, prices applying to the largest city (in terms of population) or to the capital city should be provided.

4. Price data should be collected for both: a) handset-based mobile-broadband subscriptions and b) computer-based mobile-broadband subscriptions.

5. Mobile-broadband price data should be collected from the operator with the largest market share measured by the number of mobile-broadband subscriptions. If this information is not available, mobile-broadband price data should be collected from the mobile-cellular operator with the largest market share (measured by the number of mobile-cellular subscriptions) in the country.

6. Different operators can be chosen for different mobile-broadband services if: a) there are different market leaders for specific segments (postpaid, prepaid, computer-based, handset-based); b) there is no offer available for a specific sub-basket.

7. Price data should be collected for prepaid and postpaid services, for both handset and computer-based plans. If there are several plans, the plan satisfying the indicated data volume requirement should be used.

8. Where operators propose different commitment periods for postpaid mobile-broadband plans, the 12-month plan (or the plan closest to this commitment period) should be selected. A note should be added if only longer commitment periods are offered.

9. Price data should be collected for the cheapest plan, with a data volume allowance of a minimum of:

    i. 1GB for USB/dongle (computer-based) subscription

    ii. 500MB for the handset-based subscription

    The selected plan should not necessarily be the one with the cap closest to 500 MB or 1 GB, but include a minimum of 500 MB/1 GB. This means, for example, that if an operator offers a 300 MB and an 800 MB plan, the 800 MB plan or twice the 300 MB plan (if the package can be purchased twice for a monthly capacity of 600 MB) should be selected for the 500 MB sub-sub-basket. The cheapest option should be selected.

    Data volumes should refer to both upload and download data volumes. If prices are linked to "hours of use" and not to data volumes, this information should be added in a separate note (ITU will not be able to include these cases in a comparison).

10. The validity period considered for the basket is 30 days or four weeks. If a plan with a validity of 15 days is selected, it will be taken into consideration twice to cover the whole period. Likewise, if a plan with a validity of a day or a week is selected, it will be taken into consideration as many times as necessary to cover a period of four weeks. The cheapest plan on the basis of a validity period of 30 days or four weeks should be selected.

11. Preference should be given to packages (including a certain data volume). Pay-as-you-go offers should be used when they are the cheapest option for a given basket or the only option available. If operators charge different pay-as-you-go rates depending on the time of the day (peak/off-peak), then the average of both should be recorded. Night-time data allowances will not be considered.

12. Even if the plan is advertised as "unlimited", the fine print should be read carefully since the data volumes are usually limited, either by throttling (limiting the speed) or by cutting off the service.

13. Data on non-recurrent fees, such as installation/set-up fees, are not collected.

14. Preference should be given to the cheapest available package even if this is bundled with other services (e.g. with voice services). If the plan chosen includes other services besides mobile-broadband access, these should be specified in a note.

15. Prices refer to a regular (non-promotional) plan and exclude promotional offers and limited discounts or special user groups (e.g. existing clients). Special prices applying to a certain type of phone (iPhone/Blackberry, iPad) should be excluded. Night-time allowances are not included.

Source: ITU.

Endnotes

1 Price data for mobile-broadband services were collected by ITU, in collaboration with Teligen/Strategy Analytics.

2 Data for fixed-telephone, mobile-cellular and fixed-broadband have been collected since 2008 through the ITU ICT Price Basket Questionnaire, which is sent out annually to all ITU Member States/national statistics contacts.

3 On-net refers to a call made to the same mobile network, while off-net and fixed-line refer to calls made to other (competing) mobile networks and to a fixed-telephone line, respectively.

4 See OECD (2010).

5 See footnote 3.

6 EGTI was created in May 2009 with the mandate to revise the list of ITU supply-side indicators (i.e. data collected from operators), as well as to discuss outstanding methodological issues and new indicators. EGTI is open to all ITU members and experts in the field of ICT statistics and data collection. It works through an online discussion forum (http://www.itu.int/ITU-D/ict/ExpertGroup/default.asp) and face-to-face meetings. EGTI reports to the World Telecommunication/ICT Indicators Symposium (WTIS).

7 Some operators throttle speeds after the data allowance included in the base package has been reached. Customers can then pay an excess-usage charge in order to continue to have full-speed connections. In some cases, even throttled speeds are still considered to be broadband (i.e. equal to or greater than 256 kbit/s, according to ITU's definition).

Annex 3. Statistical tables of indicators used to compute the IDI

Access indicators

	Economy	Fixed-telephone subscriptions per 100 inhabitants		Mobile-cellular subscriptions per 100 inhabitants		International Internet bandwidth Bit/s per Internet user		Percentage of households with computer		Percentage of households with Internet	
		2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
1	Afghanistan	0.3	0.3	58.8	61.6 [1]	6'850	10'213	*2.7*	*2.9*	*3.0*	*3.9*
2	Albania	7.4	7.1	105.5	106.4	*26'117*	*30'660*	*23.5*	*25.7*	*26.6*	*35.5*
3	Algeria	7.8 [1]	8.0 [1]	108.4	113.0	24'669	30'119	32.0	37.0	19.3	31.9
4	Andorra	47.7	48.0	82.6	88.1	58'543	82'857	*82.6*	*82.7*	*81.6*	*84.8*
5	Angola	1.3	1.2	63.5	60.8	6'236	6'518	10.4	*11.1*	8.8	*10.2*
6	Antigua & Barbuda	21.9	*13.1*	132.1	*137.2*	73'997	*71'825*	*56.1*	*57.6*	*54.0*	*56.3*
7	Argentina	23.5	24.0 [2]	146.5	143.9 [2]	*48'065*	*46'145*	*62.1*	*65.1*	*52.0*	*55.5*
8	Armenia	19.2	18.4	115.9	115.1	37'749	67'871	57.0	*64.7*	52.4	*56.2*
9	Australia	38.9 [2]	38.0 [3]	131.2 [1]	132.8 [3]	*75'569*	*81'564*	*81.2*	80.4	*84.3*	85.9
10	Austria	38.2 [3]	42.2 [4]	151.9	157.4	*79'636*	*90'501*	*81.5*	82.1	81.0	82.4
11	Azerbaijan	18.9 [4]	18.7	110.9	111.3	26'205	35'127	60.3	62.4	76.2	76.7
12	Bahamas	32.8 [5]	31.2	82.3 [2]	80.3	78'227	225'877	*67.7*	*69.2*	*58.3*	*61.1*
13	Bahrain	21.2	20.5	173.3	185.3	41'103	47'205	94.6	94.8	81.0	88.7
14	Bangladesh	0.6	0.5 [5]	80.0	83.4 [4]	4'583	6'181 [1]	*6.9*	*8.2*	*9.9*	*11.0*
15	Barbados	52.9	54.6	106.8	116.5	*126'089*	247'474	*69.0*	*70.8*	*61.5*	*62.9*
16	Belarus	48.5	49.0	122.5	123.6	142'536	139'374	59.9	63.1	57.1	59.1
17	Belgium	40.7	40.1	114.3	115.7	*221'688*	*241'805*	*82.0*	82.1	82.8	81.8
18	Belize	*6.7*	*6.0*	*50.7*	*48.9*	*32'703*	*35'970*	*31.0*	*32.0*	*21.0*	*25.6*
19	Benin	1.8	1.8	81.7 [3]	85.6	2'508	3'002	*4.8*	*5.1*	*3.5*	*5.4*
20	Bhutan	3.1 [6]	2.8 [6]	81.6 [4]	87.1 [5]	*12'933*	11'220 [2]	*21.9*	*24.6*	*24.0*	*31.7*
21	Bolivia	8.1	8.0	96.3	92.2	17'483	19'673	27.5	*33.1*	14.3	*23.8*
22	Bosnia and Herzegovina	22.2	20.2	91.3	90.2	*43'003*	*56'331*	*45.0*	*47.1*	*50.0*	*53.6*
23	Botswana	8.3 [7]	7.8	167.3	169.0	16'437	11'379	*14.8*	*16.0*	*14.5*	*19.6*
24	Brazil	21.8	21.4	139.0	126.6	*43'553*	*43'634*	50.5	*53.5*	49.6	*54.5*
25	Brunei Darussalam	11.4	9.0	106.8 [5]	108.1	52'914	63'090	*92.0*	*93.4*	*79.2*	*81.7*
26	Bulgaria	25.3	23.3 [7]	132.4 [6]	129.3 [6]	135'113 [1]	*145'170*	*57.9*	59.0	56.7	59.1
27	Burkina Faso	0.7	0.4	71.7	80.6	2'860	2'862	*4.6*	*5.2*	*8.3*	*12.5*
28	Burundi	0.2	0.2	30.5	46.2	*6'913*	*5'702*	*1.0*	*1.2*	*1.0*	*4.0*
29	Cambodia	2.3	1.6 [8]	132.7	133.0	10'484	17'792	*10.6*	16.0 [1]	*15.0*	*21.0*
30	Cameroon	4.6	4.5 [9]	75.7	71.8 [7]	*1'219*	*992*	11.8	*12.7*	6.7	*8.6*
31	Canada	46.2 [8]	*44.3*	81.0	*81.9*	*129'244*	*135'496*	84.3	*85.1*	84.9	*86.6*
32	Cape Verde	11.6	11.5	121.8	127.2	*12'330*	17'149	*32.2*	*34.2*	*24.8*	*27.0*
33	Chad	0.2	0.1	39.8	40.2	733	2'575	*2.9*	*3.5*	*2.7*	*3.1*
34	Chile	19.3	19.2	133.2	129.5	86'548	129'825	*60.3*	*63.6*	*57.4*	*59.7*
35	China	17.9	16.5	92.3	93.2	5'141	6'530	*46.7*	*49.6*	*47.4*	*54.2*
36	Colombia	14.7 [9]	14.4 [10]	113.1	115.7	104'991	105'050	44.5	45.5	38.0	41.8
37	Congo (Dem. Rep.)	0.0	0.0	53.5	53.0	*384*	*369*	*1.9*	*2.3*	*2.0*	*2.4*
38	Costa Rica	17.8	17.2 [11]	142.2 [7]	150.7 [8]	50'359	61'746	52.3	53.2 [2]	55.1	60.2
39	Côte d'Ivoire	1.2	1.3	106.2	119.3	5'163	5'194	*7.2*	*8.8*	*12.2*	*17.2*
40	Croatia	36.7 [10]	34.7	104.4	103.8	*58'034*	*72'381*	*70.1*	76.8	68.4	76.7
41	Cuba	11.2	11.5	22.5	29.7	*519*	*572*	12.9	13.0	4.1	5.6
42	Cyprus	28.4	27.8	96.3	95.4	*75'055*	*89'791*	*70.9*	71.5	68.6	71.2
43	Czech Republic	18.6	18.1 [12]	129.5	129.2 [9]	*110'965*	*119'841*	*78.5*	78.9	78.0	79.0
44	Denmark	33.2	29.9	127.0	128.3	*293'498*	*328'018*	*92.7*	92.3	93.1	91.7
45	Djibouti	2.5	*2.6*	32.4	*34.7*	*8'955*	*10'255*	*18.0*	*19.1*	*7.1*	*8.1*

	Economy	Fixed-telephone subscriptions per 100 inhabitants		Mobile-cellular subscriptions per 100 inhabitants		International Internet bandwidth Bit/s per Internet user		Percentage of households with computer		Percentage of households with Internet	
		2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
46	Dominica	22.7	20.8	102.1	106.3	*120'204*	*193'358*	*46.8*	*50.0*	48.5	*58.4*
47	Dominican Rep.	11.6 [11]	12.3 [13]	78.9 [8]	82.6	*24'903*	*36'155*	*26.2*	30.1	*21.1*	23.6
48	Ecuador	15.3 [12]	15.5 [14]	103.9	79.4 [10]	34'796	56'561	37.5	40.8	32.4	32.8
49	Egypt	7.6	7.4	114.3	111.0	8'700	11'318	47.3	*50.8*	39.2	*41.8*
50	El Salvador	14.9	14.7	144.0	145.3	60'342	61'959	*25.2*	*28.1*	13.9	*15.0*
51	Equatorial Guinea	1.9	1.4	66.4	66.7	*1'499*	1'320	*18.0*	*19.3*	*8.5*	*8.9*
52	Estonia	31.7	30.3	160.7 [9]	148.7 [11]	*28'665*	*30'924*	*82.5*	87.9	82.9	87.7
53	Ethiopia	0.8	0.9	31.6	42.8 [12]	*1'884*	1'959	*3.0*	*3.5*	*6.9*	*9.8*
54	Fiji	8.5	8.1	98.8 [10]	108.2	19'769	27'399	*36.7*	*39.2*	*29.0*	*31.3*
55	Finland	11.7	9.8	139.7 [11]	135.5 [13]	*189'910*	*208'526*	*89.0*	89.3	89.8	89.9
56	France	60.0	59.9	101.2	102.6	*119'203*	*129'973*	*81.6*	81.5	83.0	82.6
57	Gabon	1.1	1.1	171.4	168.9	*9'642*	*8'505*	*12.5*	*13.7*	*13.3*	*18.0*
58	Gambia	2.9	2.3	119.6	131.3	10'305	13'342	*8.3*	*8.9*	*12.6*	*13.3*
59	Georgia	25.4	22.1	124.9	129.0	98'432	101'468	45.8	49.5	41.0	44.8
60	Germany	56.9 [13]	54.9 [15]	120.4 [12]	116.7 [14]	*103'877*	*117'540*	*90.6*	91.0	89.5	90.3
61	Ghana	1.0	1.0	114.8	129.7	*3'602*	*2'841*	*39.9*	*43.5*	*29.0*	*34.1*
62	Greece	46.9	46.5 [16]	110.3	114.0 [15]	*78'189*	*100'861*	*62.7*	68.6	65.6	68.1
63	Grenada	25.7 [14]	25.3	110.2 [13]	112.3	*182'308*	*191'597*	45.0	*48.1*	39.8	*42.8*
64	Guatemala	10.8 [15]	10.6	106.6 [14]	111.5	27'471	24'676	*20.9*	*22.2*	*15.0*	*17.4*
65	Guinea	*0.0*	0.0	*72.1*	87.2	*2'365*	*930*	*2.3*	*2.6*	*1.5*	*3.7*
66	Guinea-Bissau	*0.0*	0.0	63.5	69.3 [16]	2'674	*2'923*	*2.5*	*2.7*	*1.9*	*2.1*
67	Guyana	19.9	19.1	70.5	67.2	9'994	25'607	*26.9*	*29.1*	*24.2*	*26.1*
68	Honduras	6.4	5.9	93.5	95.5	21'765	23'617	*21.6*	*23.0*	*19.6*	*22.8*
69	Hong Kong, China	60.9	59.2	233.6	228.8	3'487'142	4'155'651	81.3	80.4	78.7	79.0
70	Hungary	30.3	31.2	118.1	118.9	*37'027*	*55'410*	*74.0*	75.0	75.1	75.6
71	Iceland	51.5	49.9	111.1	114.0	*458'708*	*725'806*	*98.1*	*98.5*	96.5	*96.5*
72	India	2.1 [16]	2.0 [17]	74.5 [15]	78.8 [17]	*4'982*	5'725	*13.0*	*14.1*	*17.0*	*20.0*
73	Indonesia	10.4	*8.8*	128.8 [16]	*132.3*	6'225	*6'584*	17.3	18.7	28.7	38.4
74	Iran (I.R.)	39.1	38.3	87.8	93.4	6'056	8'502	52.5 [1]	*53.4*	44.7 [1]	*52.2*
75	Ireland	43.2 [17]	40.9 [18]	105.1	103.7	*155'337*	*155'521*	*83.6*	83.5	82.2	84.9
76	Israel	43.8	43.1 [19]	121.5 [17]	133.5 [18]	*90'321*	*89'638*	81.3	*83.5*	72.1	*76.0*
77	Italy	33.7	33.1 [20]	154.3	151.3 [19]	*76'640*	*77'322*	*71.8*	72.5	72.6	75.4
78	Jamaica	9.1	9.0	107.4	111.5	14'244	13'261	32.3	*34.3*	26.4	*30.3*
79	Japan	50.1 [18]	50.2 [21]	120.2 [18]	125.1 [20]	49'150	62'618	79.3	*80.0*	96.4	*96.5*
80	Jordan	5.0	4.8	147.8	179.4	18'285	27'524	47.0	*47.0*	69.0 [2]	*75.9*
81	Kazakhstan	26.2	24.7	172.2	187.2	42'821	69'615	*70.0*	73.8	*82.0*	82.2
82	Kenya	0.4	0.2 [22]	73.8	80.7	25'200	40'067	*12.3*	*13.1*	*16.9*	*19.6*
83	Kiribati	*1.9*	1.4	*28.9*	38.8	*11'781*	2'916	*6.1*	*6.7*	*5.6*	*6.3*
84	Korea (Rep.)	59.5	58.1	115.7	118.5	43'358	46'764	78.3	77.1	98.5	98.8
85	Kuwait	14.2	*13.4*	218.4	*231.8*	50'096	*48'619*	*87.8*	*89.0*	*75.4*	*80.5*
86	Kyrgyzstan	7.9	7.1	134.5	132.8	*6'219*	*7'357*	*17.6*	*19.5*	*13.8*	*16.5*
87	Lao P.D.R.	13.4 [19]	13.7 [23]	67.0 [19]	53.1	2'848	16'795 [3]	*10.5*	*11.4*	*5.2*	*11.4*
88	Latvia	19.6	19.5 [24]	116.8	127.0 [21]	*93'683*	*111'881*	*73.5*	76.1	73.4	76.0
89	Lebanon	19.4	*19.2*	88.3	*87.1*	24'551	*27'275*	*80.7*	*81.0*	*68.4*	*69.0*
90	Lesotho	2.4	2.1	102.0	105.5	4'321	3'862	*6.9*	*7.5*	*6.5*	*11.5*
91	Liberia	0.2	*0.2*	73.4	*81.1*	*6'306*	*7'522*	*2.2*	*2.4*	*2.5*	*2.7*
92	Lithuania	19.5	18.7	141.9	139.5	125'454	158'030	*66.8*	67.6	66.0	68.3
93	Luxembourg	50.5 [20]	51.0 [25]	149.5	148.5	6'887'708	7'186'378	*94.8*	95.3	95.6	96.8

	Economy	Fixed-telephone subscriptions per 100 inhabitants		Mobile-cellular subscriptions per 100 inhabitants		International Internet bandwidth Bit/s per Internet user		Percentage of households with computer		Percentage of households with Internet	
		2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
94	Macao, China	26.7 [21]	25.0 [26]	322.6	324.4	88'921	111'931	81.1	79.0	84.3	86.3
95	Madagascar	1.1	*1.0*	41.2	*46.0*	*8'026*	12'420	*4.5*	*5.3*	*4.7*	*5.8*
96	Malawi	0.4 [22]	0.3	33.5	35.3	*4'237*	2'429	*5.2*	*5.8*	*6.2*	*9.1*
97	Malaysia	14.6	14.3	148.8	143.9	29'932	34'119	63.3	67.6	64.1	70.1
98	Maldives	6.4	6.1	189.4	206.7	69'077	88'008 [4]	*65.9*	*68.5*	*44.5*	*49.6*
99	Mali	1.0	1.0	149.1	139.6 [22]	*1'879*	*1'279*	2.7	3.3	6.7	8.2
100	Malta	53.6	53.4	127.0	129.3	1'178'759	1'220'570	*80.7*	81.1	80.7	81.9
101	Mauritania	1.3	1.3	94.2 [20]	89.3 [23]	*1'454*	*1'451*	*4.4*	*4.7*	*6.2*	*15.6*
102	Mauritius	29.8	30.3	132.2	140.6 [24]	30'513	33'896	53.1	57.0	51.9	60.0
103	Mexico	15.5	15.9	84.7	85.3 [25]	*20'926*	*20'855*	38.3	44.9	34.4	39.2
104	Moldova	35.2	35.0	108.0	108.0	152'362	194'898	42.2	*46.4*	*47.5*	*49.0*
105	Monaco	133.0	128.1	88.5	88.8	*56'862* [2]	64'287	*73.5*	*74.9*	*74.7*	*76.6*
106	Mongolia	7.9	8.7	105.1	105.0	*121'819*	*159'595*	32.1	42.6	20.8	24.5
107	Montenegro	26.5	24.8	163.0	162.2	77'016	102'166	*54.7*	*56.4*	*56.6*	*61.1*
108	Morocco	7.4	6.5	131.7 [21]	126.9	10'768	18'316	52.3	54.8	50.2	66.5
109	Mozambique	0.3	0.3	69.8	74.2	9'157	*6'145*	5.6	*6.1*	10.6	*13.2*
110	Myanmar	1.0	1.0	54.0	76.7	5'226	3'676	*6.6*	*14.0*	*7.0*	*15.0*
111	Namibia	7.8	7.6	113.8	102.1	34'531	22'546	*16.5*	*17.7*	*17.3*	*24.5*
112	Nepal	3.0 [23]	3.0 [27]	81.9 [22]	96.7 [26]	3'109	*2'700*	*8.2*	*8.9*	5.6	*6.3*
113	Netherlands	41.3 [24]	41.3	116.4 [23]	123.5	*229'961*	*242'326*	*95.7*	96.2	95.8	96.0
114	New Zealand	40.6	40.2	112.1 [24]	121.8	*95'081*	*108'506*	*79.8*	*82.3*	*79.8*	*82.8*
115	Nicaragua	5.5 [25]	5.7 [28]	114.6 [25]	116.1 [27]	*23'025*	*21'090*	*11.1*	*11.8*	*11.6*	*14.0*
116	Niger	*0.6*	*0.6*	*44.4*	*46.5*	*2'490*	*2'688*	*2.4*	*2.7*	*2.2*	*2.6*
117	Nigeria	0.1 [26]	0.1	77.8	82.2	*3'150*	*2'986*	*9.1*	*9.8*	*8.5*	*11.4*
118	Norway	21.2	20.0 [29]	116.1	113.6 [28]	*203'935*	*220'937*	*95.4*	96.5	93.1	96.6
119	Oman	9.6	10.5	157.8	159.9	33'724	59'784	*84.0*	*87.5*	*80.7*	*84.0*
120	Pakistan	2.6 [27]	1.6 [30]	73.3 [26]	66.9 [29]	5'684	11'907 [5]	*15.9*	19.0 [3]	*21.0*	24.0 [1]
121	Palestine*	9.1	8.9	72.1	77.6	*14'700*	*13'399*	63.1	*66.7*	48.3	*52.4*
122	Panama	15.0 [28]	15.6 [31]	158.1 [27]	174.2 [30]	*72'678*	*75'906*	38.2 [2]	39.6	41.6 [3]	52.7
123	Paraguay	5.4	5.5	105.6	105.4	13'935	17'922	31.9 [3]	*34.1*	24.6 [4]	*27.4*
124	Peru	9.9	9.3	103.6 [28]	109.9	*36'381*	*43'154*	30.6	32.4	23.5	23.2
125	Philippines	3.1	*3.0*	111.2	*118.1*	*27'688*	*37'409*	24.3	*27.0*	*26.9*	*28.3*
126	Poland	12.6 [29]	*11.1*	148.9 [29]	*148.7*	*80'535*	*86'573*	*77.7*	77.9	74.8	75.8
127	Portugal	43.2	44.1	112.1 [30]	110.4 [31]	*202'825*	*232'080*	*69.4*	71.1	64.9	70.2
128	Qatar	18.4 [30]	18.2	145.8 [31]	153.6	67'473	71'566	*88.0*	88.3	*95.8*	95.8
129	Romania	21.1	19.8	105.9 [32]	107.1 [32]	117'320 [3]	146'012 [6]	*63.8*	68.7	60.5	67.7
130	Russian Federation	26.8	25.7	155.1	160.0	*26'377*	26'845	71.0	72.5	69.9	72.1
131	Rwanda	0.4	0.1 [32]	64.0	70.5	8'946	5'661	*3.4*	*4.0*	*3.8*	*6.7*
132	Samoa	6.1	5.6 [33]	55.5	58.5 [33]	6'676	7'842 [7]	*21.1*	*22.6*	*21.9*	*25.5*
133	Saudi Arabia	12.3	12.5	179.6	176.6	69'556	88'669	80.0 [4]	67.0	94.0 [5]	94.0
134	Senegal	2.1	2.0	98.8	99.9	*8'349*	*6'931*	*11.6*	*12.9*	*12.6*	*15.7*
135	Serbia	37.3	36.5	122.1	120.5	*17'475* [4]	20'478	63.3	64.4	62.8	63.8
136	Seychelles	22.7	22.8	162.2	158.1	28'945	38'395 [8]	*61.8*	*66.8*	*55.0*	*59.4*
137	Singapore	36.2	36.0	146.9 [33]	146.1 [34]	677'114	*737'006*	85.7	*87.5*	87.2	*89.5*
138	Slovakia	16.8	15.9	116.9	122.3	*14'901*	*17'240*	*80.5*	*85.2*	78.4	*78.8*
139	Slovenia	37.1	36.2	112.1	113.2	*121'137*	*154'627*	*77.1*	77.8	76.8	77.6
140	Solomon Islands	1.3	1.3	65.8	72.7	4'277	*4'277*	*6.1*	*6.7*	*5.6*	*6.3*
141	South Africa	6.9	7.7	149.2	159.3	149'542	*147'630*	20.8	*23.4*	44.2	*50.6*
142	South Sudan	0.0 [31]	*0.0*	24.5 [34]	*23.9*	27	*28*	*10.0*	*11.7*	*9.6*	*11.2*

	Economy	Fixed-telephone subscriptions per 100 inhabitants		Mobile-cellular subscriptions per 100 inhabitants		International Internet bandwidth Bit/s per Internet user		Percentage of households with computer		Percentage of households with Internet	
		2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
143	Spain	41.2	40.6 [34]	107.9	107.9	*92'025*	*105'006*	*74.0*	75.9	74.4	78.7
144	Sri Lanka	12.6	12.0	103.2	112.8	*12'651*	*13'886*	22.4	*24.2*	*15.3*	*18.1*
145	St. Kitts and Nevis	35.4 [32]	35.7	118.6 [35]	131.8	*134'205*	*131'203*	70.3	*70.8*	61.0	*70.5*
146	St. Lucia	17.9 [33]	18.9	102.6 [36]	101.5	*130'720*	*134'277*	38.4	*41.1*	36.6	*39.7*
147	St. Vincent and the Grenadines	21.9	22.7	105.2	103.7	176'691	*194'268*	58.2	*61.8*	*44.3*	*49.4*
148	Sudan	1.1	0.3 [35]	72.2	70.5	2'499	2'189	*16.6*	*17.9*	*32.2*	*33.5*
149	Suriname	*15.6*	*15.5*	*170.6*	*180.7*	*50'458*	*51'164*	42.8 [5]	*45.2*	36.1 [6]	*44.2*
150	Swaziland	*3.5*	*3.3*	*72.3*	*73.2*	*1'717*	*2'053*	*17.0*	*19.8*	*18.4*	*22.3*
151	Sweden	39.2	36.7	127.8	130.4	*392'780*	*421'237*	*90.1*	88.3	89.6	91.0
152	Switzerland	53.6 [34]	50.3 [36]	136.7 [37]	142.0 [35]	*266'480*	*275'957*	*87.6*	*88.4*	82.6	*84.7*
153	Syria	16.5	18.3	63.9	62.4	*3'724*	*3'146*	*47.6*	*49.9*	*40.9*	*42.3*
154	Tanzania	0.3	0.3	62.8	75.9	*4'054*	*4'107*	*3.8*	*4.0*	*4.1*	*4.5*
155	TFYR Macedonia	18.2	17.7	105.5	105.4	*41'812*	*53'890*	*67.6*	68.4	68.3	69.4
156	Thailand	8.5	7.9	144.4	125.8	54'788	64'907	33.9 [6]	29.5 [4]	34.7	52.2
157	Timor-Leste	0.3	0.2	119.4	117.4	*3'072*	*2'546*	17.1	18.9	18.2	21.7
158	Togo	0.8	0.7	64.6	64.9	8'790	7'310	*3.2*	*3.4*	*3.3*	*6.2*
159	Tonga	11.3 [35]	12.4 [37]	64.3 [38]	65.6 [36]	11'817	14'623 [9]	*34.0*	*37.1*	*35.7*	*39.5*
160	Trinidad & Tobago	21.5	20.1	147.3	157.7	48'903	122'703	*64.0*	*67.9*	58.0	65.0
161	Tunisia	8.5	8.4	128.5	129.9	25'972	33'812	33.2	*38.7*	29.5	*36.1*
162	Turkey	16.5	15.0	94.8	96.0	42'911	59'034	56.0	55.6	60.2	69.5
163	Uganda	0.8 [36]	0.8 [38]	52.4 [39]	50.4 [37]	4'002	4'633 [10]	*5.8*	*6.7*	*6.2*	*7.2*
164	Ukraine	24.6	21.6	144.1	144.0	*38'208*	*45'743*	56.1 [7]	*59.2*	47.7 [7]	*51.1*
165	United Arab Emirates	22.3 [37]	23.1	178.1	187.3	79'641 [5]	107'904 [11]	87.9	*89.3*	90.1 [8]	*95.4*
166	United Kingdom	52.4	52.6	123.6	125.8	*361'057*	*374'554*	*89.0*	89.9	89.9	91.3
167	United States	39.8 [38]	37.5 [39]	110.2 [40]	117.6 [38]	*84'931*	*99'017*	85.1 [8]	*87.3*	79.9 [9]	*82.2*
168	Uruguay	31.7	32.3	160.8 [41]	160.2 [39]	60'676 [6]	73'151 [12]	67.4	68.0	57.4	59.7
169	Uzbekistan	8.6	8.4	73.8	73.3	1'581	2'075	36.9	43.2	*44.7*	*52.6*
170	Vanuatu	2.2	1.8	60.4	66.2	*8'237*	*8'477*	*22.0*	*24.8*	*28.8*	*34.5*
171	Venezuela	25.3	24.9 [40]	99.0	93.0 [40]	14'398	16'310	*43.7*	*46.9*	*34.2*	*34.7*
172	Viet Nam	*6.0*	6.3 [41]	147.1	130.6 [41]	20'749	*24'374*	*20.5*	*22.0*	*18.6*	*24.1*
173	Yemen	*4.7*	*4.7*	*68.5*	*68.0*	*2'487*	*2'496*	*6.1*	*6.5*	*5.1*	*5.5*
174	Zambia	0.8	0.7	67.3	74.5	*3'434*	3'187	*6.6*	*7.4*	*10.1*	*12.7*
175	Zimbabwe	2.3	2.2	80.8	84.8	4'806	6'380	10.7	*11.8*	*18.0*	*18.1*

Note: Data in italics are ITU estimates. *Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU World Telecommunication/ICT Indicators database.

Use indicators

	Economy	Percentage of individuals using the Internet		Fixed-broadband subscriptions per 100 inhabitants		Active mobile broadband subscriptions per 100 inhabitants	
		2014	2015	2014	2015	2014	2015
1	Afghanistan	*7.0*	*8.3*	*0.0*	*0.0*	3.2	6.0
2	Albania	*60.1*	*63.3*	6.5	7.6	30.9	40.6
3	Algeria	*25.0*	*38.2*	4.0	5.6	20.8	40.1 [1]
4	Andorra	*95.9*	*96.9*	35.9	37.9	36.6	42.1
5	Angola	10.2 [1]	*12.4*	0.4	0.7	16.4	19.3
6	Antigua & Barbuda	*64.0*	*65.2*	11.8	*13.1*	*33.0*	*33.8*
7	Argentina	*64.7*	*69.4*	15.6 [1]	*16.1*	*53.6*	67.3 [2]
8	Armenia	54.6 [2]	*58.2*	9.1	9.6	34.2	41.3
9	Australia	*84.0*	84.6 [1]	27.7 [2]	27.9 [1]	112.2 [1]	112.9 [3]
10	Austria	81.0 [3]	83.9 [2]	27.7	28.6	67.2	68.6
11	Azerbaijan	75.0 [4]	77.0 [3]	19.9	19.8	61.5	60.9
12	Bahamas	*76.9*	*78.0*	20.2 [3]	20.9	*14.6*	*21.1*
13	Bahrain	90.5 [5]	93.5 [4]	21.4	18.6	126.2	131.8
14	Bangladesh	*13.9*	*14.4*	2.0	2.4 [2]	13.4	13.5 [4]
15	Barbados	*75.2*	*76.1*	27.2	27.2	*43.7*	54.9
16	Belarus	59.0 [6]	62.2 [5]	28.8	31.3	55.0	61.8
17	Belgium	85.0 [7]	85.1 [6]	36.0	36.8	57.8	66.6
18	Belize	*38.7*	*41.6*	*2.9*	*2.9*	*10.2*	*30.2*
19	Benin	*6.0*	*6.8*	0.4	0.7	2.8	4.2
20	Bhutan	*30.3*	*39.8*	3.3	3.6 [3]	28.2	56.4 [5]
21	Bolivia	34.6 [8]	*45.1*	1.6	1.6	12.2 [2]	33.8 [6]
22	Bosnia and Herzegovina	*60.8*	*65.1*	14.2	16.6	27.8	33.5
23	Botswana	*18.5*	*27.5*	1.6	1.8	49.7	67.3
24	Brazil	54.6 [9]	*59.1*	11.7 [4]	12.2 [4]	78.2 [3]	88.6
25	Brunei Darussalam	*68.8*	*71.2*	7.1	8.0	3.8 [4]	4.5
26	Bulgaria	55.5 [10]	56.7 [7]	20.7 [5]	22.4 [5]	66.4	81.3 [7]
27	Burkina Faso	*9.4*	*11.4*	0.0	0.0	9.6	15.4
28	Burundi	*1.4*	*4.9*	*0.0*	0.0	*0.5*	7.6
29	Cambodia	*14.0*	*19.0*	0.4	0.5	31.1	42.8
30	Cameroon	16.2 [11]	*20.7*	0.1	*0.1*	*0.3*	*4.3*
31	Canada	*87.1*	*88.5*	35.4	*36.4*	54.3	*56.3*
32	Cape Verde	*40.3*	*43.0*	3.4	3.0	51.3	72.9
33	Chad	*2.5*	*2.7*	0.1 [6]	0.1 [6]	0.5 [5]	*1.4*
34	Chile	*61.1*	*64.3*	14.0	15.2	50.1 [6]	57.6
35	China	*47.9* [12]	*50.3* [8]	14.4 [7]	18.6	41.8	56.0
36	Colombia	52.6 [13]	55.9 [9]	10.3	11.2	36.0 [7]	41.0
37	Congo (Dem. Rep.)	*3.0*	*3.8*	*0.0*	*0.0*	7.9	8.5
38	Costa Rica	*53.0*	59.8 [10]	10.4	11.2	86.9	95.5
39	Côte d'Ivoire	*14.6*	*21.0*	0.6	0.5	24.6	40.4
40	Croatia	68.6 [14]	69.8 [11]	23.0	23.2	68.5	75.4
41	Cuba	29.1 [15]	*31.1*	0.1	0.1	0.0	0.0
42	Cyprus	69.3 [16]	71.7 [12]	21.1	22.4	42.1	54.8
43	Czech Republic	79.7 [17]	81.3 [13]	27.9 [8]	27.9 [7]	66.7	68.8 [8]
44	Denmark	96.0 [18]	96.3 [14]	41.5 [9]	42.5 [8]	109.7	116.8
45	Djibouti	*10.7*	*11.9*	2.3	*2.3*	*3.2*	*5.6*
46	Dominica	57.5	*67.6*	14.9	20.9	29.3	42.2
47	Dominican Rep.	*49.6*	51.9 [15]	5.7	6.4	30.1	39.6
48	Ecuador	45.6 [19]	48.9 [16]	8.3 [10]	9.2	30.9	35.1
49	Egypt	33.9 [20]	35.9	3.7	4.5	43.5	50.7

	Economy	Percentage of individuals using the Internet		Fixed-broadband subscriptions per 100 inhabitants		Active mobile broadband subscriptions per 100 inhabitants	
		2014	2015	2014	2015	2014	2015
50	El Salvador	24.8 [21]	*26.9*	5.0	5.5	18.4	19.9
51	Equatorial Guinea	*18.9*	*21.3*	0.5	0.5	*0.0*	0.0 [9]
52	Estonia	84.2 [22]	88.4 [17]	28.9	28.7	117.0	114.3
53	Ethiopia	*7.7*	*11.6*	0.5	0.7 [9]	7.5	11.9 [10]
54	Fiji	*41.8*	*46.3*	1.4	1.4	42.3	*48.2*
55	Finland	92.4 [23]	92.7 [18]	32.3	31.7	138.5	144.1
56	France	83.8 [24]	84.7 [19]	40.2	41.3	66.3	74.7
57	Gabon	*20.0*	*23.5*	*0.6*	0.6	15.8	*33.1*
58	Gambia	*16.5*	*17.1*	0.1	0.2	8.0	10.0
59	Georgia	*44.0* [25]	45.2 [20]	13.9	14.6	35.0	50.4 [11]
60	Germany	86.2 [26]	87.6 [21]	35.8	37.2	63.6	*75.1*
61	Ghana	*18.9*	*23.5*	0.3	0.3	59.8	66.8
62	Greece	63.2 [27]	66.8 [22]	28.4	*30.7*	41.0	45.6
63	Grenada	51.6	*53.8*	17.7	18.5	2.6 [8]	28.8
64	Guatemala	*23.4*	*27.1*	2.7	2.8	9.4 [9]	10.1 [12]
65	Guinea	*1.7*	*4.7*	*0.0*	*0.0*	10.8	13.9
66	Guinea-Bissau	*3.3*	*3.5*	0.1 [11]	0.1 [10]	*0.0*	*0.0*
67	Guyana	*37.4*	*38.2*	5.6	6.6	*0.2*	0.2
68	Honduras	*19.1*	*20.4*	*1.9*	*2.3*	16.3 [10]	17.2
69	Hong Kong, China	79.9 [28]	84.9 [23]	31.4	31.9	104.5	107.0
70	Hungary	76.1 [29]	72.8 [24]	26.0	27.4	34.0	39.8
71	Iceland	98.2 [30]	*98.2*	35.9	37.0	85.3	93.4
72	India	*21.0*	*26.0*	1.2 [12]	1.3 [11]	5.5 [11]	9.4 [13]
73	Indonesia	17.1 [31]	22.0 [25]	1.2	*1.1*	*34.7*	*42.0*
74	Iran (I.R.)	39.4 [32]	*44.1*	9.5	10.9	10.7 [12]	20.0
75	Ireland	79.7 [33]	80.1 [26]	26.9	27.7	81.0 [13]	95.0 [14]
76	Israel	75.0 [34]	*78.9*	27.2 [13]	27.4 [12]	52.2 [14]	*56.1*
77	Italy	62.0 [35]	65.6 [27]	23.5	23.8	70.6	82.1
78	Jamaica	40.4 [36]	*43.2*	5.4	5.8	38.8	53.5
79	Japan	89.1 [37]	*93.3*	29.8	30.5 [13]	121.4 [15]	126.4 [15]
80	Jordan	46.2 [38]	*53.4*	4.7	4.2	19.1	35.6
81	Kazakhstan	*66.0*	72.9 [28]	12.9	13.0	59.4	60.0
82	Kenya	*43.4*	*45.6*	0.2	0.3	9.1	15.5
83	Kiribati	*12.3*	*13.0*	*0.5*	0.1	*0.1*	0.3
84	Korea (Rep.)	87.9 [39]	89.9 [29]	38.8	40.2	108.6	109.7
85	Kuwait	*78.7*	*82.1*	1.4	*1.4*	139.8	*139.3*
86	Kyrgyzstan	*28.3*	*30.2*	3.0	3.7	26.7 [16]	31.0
87	Lao P.D.R.	*14.3*	*18.2*	0.2 [14]	0.5	6.5 [17]	14.2 [16]
88	Latvia	75.8 [40]	79.2 [30]	24.7	25.1	61.2	67.0
89	Lebanon	*73.0*	*74.0*	22.8 [15]	*22.8*	53.5	*53.4*
90	Lesotho	*11.0*	*16.1*	0.1	0.1	25.5	37.7
91	Liberia	*5.4*	*5.9*	*0.1*	*0.2*	7.6	*20.5*
92	Lithuania	72.1 [41]	71.4 [31]	26.7 [16]	27.8	70.2	74.2
93	Luxembourg	94.7 [42]	97.3 [32]	34.8 [17]	36.5 [14]	88.9	83.3
94	Macao, China	69.8 [43]	77.6 [33]	28.1	29.1	322.2 [18]	324.4 [17]
95	Madagascar	*3.7*	*4.2*	0.1	*0.1*	6.1	*9.0*
96	Malawi	*5.8*	*9.3*	0.1	0.0	10.9	16.6
97	Malaysia	63.7 [44]	71.1 [34]	10.1	9.0 [15]	58.3	89.9 [18]
98	Maldives	*49.3*	*54.5*	5.6	6.5	48.9 [19]	63.6 [19]
99	Mali	*7.0*	*10.3*	0.0	0.0	11.3 [20]	18.8 [20]

	Economy	Percentage of individuals using the Internet		Fixed-broadband subscriptions per 100 inhabitants		Active mobile broadband subscriptions per 100 inhabitants	
		2014	2015	2014	2015	2014	2015
100	Malta	73.2 [45]	76.2 [35]	35.2	37.8	56.6	63.2 [21]
101	Mauritania	*10.7*	*15.2*	*0.2*	0.2	14.4	23.1
102	Mauritius	44.8 [46]	50.1 [36]	14.6	15.7 [16]	31.7	37.0 [22]
103	Mexico	44.4 [47]	57.4 [37]	10.2	11.6 [17]	41.5	50.4 [23]
104	Moldova	*46.6*	*49.8*	14.7	15.5	49.4	51.9
105	Monaco	*92.4*	*93.4*	*46.8*	47.5	63.2 [21]	65.2 [24]
106	Mongolia	19.9 [48]	21.4 [38]	6.8	7.1	57.6	76.0
107	Montenegro	*61.0*	*64.6*	16.7	18.1	31.0	43.7
108	Morocco	56.8 [49]	57.1 [39]	3.0	3.4	26.8	39.3
109	Mozambique	*5.9*	*9.0*	0.1	0.1	3.0	9.4
110	Myanmar	*11.5*	*21.8*	0.3	0.3	14.9	*29.5*
111	Namibia	*14.8*	*22.3*	1.8	1.7	34.2	62.1
112	Nepal	*15.4*	*17.6*	0.9 [18]	1.1	*17.4* [22]	*21.1*
113	Netherlands	93.2 [50]	93.1 [40]	40.8 [19]	41.7	69.2 [23]	70.5
114	New Zealand	*85.5*	*88.2*	31.0	31.5	92.7	114.2
115	Nicaragua	*17.6*	*19.7*	1.8 [20]	1.9 [18]	1.4 [24]	7.2
116	Niger	*2.0*	*2.2*	*0.0*	*0.1*	*0.9*	*1.8*
117	Nigeria	*42.7*	*47.4*	0.0	0.0	11.7	21.0
118	Norway	96.3 [51]	96.8 [41]	38.8	38.9 [19]	88.8 [25]	92.8 [25]
119	Oman	*70.2*	*74.2*	4.5	5.6	73.7	78.3
120	Pakistan	*13.8*	18.0 [42]	1.1 [21]	1.0 [20]	5.1 [26]	13.0 [26]
121	Palestine*	53.7 [52]	*57.4*	5.3	6.0	*0.0*	*0.0*
122	Panama	44.9 [53]	51.2 [43]	7.9 [22]	7.9 [21]	29.5 [27]	32.7 [27]
123	Paraguay	43.0 [54]	*44.4*	2.7	3.1 [22]	31.0 [28]	39.2 [28]
124	Peru	40.2 [55]	40.9 [44]	5.7	6.4	28.5 [29]	36.7
125	Philippines	*39.7*	*40.7*	*2.9*	*3.4*	28.0	*41.6*
126	Poland	66.6 [56]	68.0 [45]	18.9	*19.5*	55.7	*60.2*
127	Portugal	64.6 [57]	68.6 [46]	25.7	29.6	44.8	52.0
128	Qatar	*91.5*	92.9 [47]	9.9	10.1	73.0	80.0
129	Romania	54.1 [58]	55.8 [48]	18.6 [23]	19.8 [23]	49.3 [30]	63.5 [29]
130	Russian Federation	70.5 [59]	73.4 [49]	17.5	18.8	65.8	71.3
131	Rwanda	*10.6*	*18.0*	0.0	0.2	11.1	25.9
132	Samoa	*21.2*	*25.4*	1.1	1.1 [24]	6.0	9.6 [30]
133	Saudi Arabia	64.7 [60]	69.6 [50]	10.3	12.0	99.0	111.7
134	Senegal	*17.7* [61]	*21.7*	0.7	0.7	23.7	26.4
135	Serbia	62.1 [62]	65.3 [51]	15.6	16.8	66.4	71.8
136	Seychelles	*54.3*	*58.1*	12.7	14.3	12.7	19.1
137	Singapore	79.0 [63]	*82.1*	26.7	26.5 [25]	141.7 [31]	142.2 [31]
138	Slovakia	80.0 [64]	*85.0*	21.8	23.3	59.5	67.5
139	Slovenia	71.6 [65]	73.1 [52]	26.8	27.6	46.7	52.0
140	Solomon Islands	*9.0*	*10.0*	0.2	0.2	13.0	11.4 [32]
141	South Africa	*49.0*	*51.9*	3.2	5.3	46.7	59.5
142	South Sudan	*15.9*	*17.9*	0.0	*0.0*	1.3	*1.4*
143	Spain	76.2 [66]	78.7 [53]	27.6	28.3 [26]	77.3	82.1
144	Sri Lanka	25.8	*30.0*	2.6	3.1	13.0	15.8
145	St. Kitts and Nevis	68.0	*75.7*	25.6	29.6	18.6	71.0
146	St. Lucia	*50.0*	*52.4*	15.3	15.4	27.4	33.6
147	St. Vincent and the Grenadines	47.4	*51.8*	13.5	15.5	34.4	39.0
148	Sudan	*24.6*	*26.6*	0.1	0.1	27.2	29.4
149	Suriname	*40.1*	*42.8*	*8.5*	*9.5*	*71.6*	*75.8*

	Economy	Percentage of individuals using the Internet		Fixed-broadband subscriptions per 100 inhabitants		Active mobile broadband subscriptions per 100 inhabitants	
		2014	2015	2014	2015	2014	2015
150	Swaziland	*27.1*	*30.4*	*0.4*	*0.5*	*8.0*	*17.0*
151	Sweden	92.5 [67]	90.6 [54]	34.1	36.1	116.3	122.1
152	Switzerland	87.4 [68]	88.0 [55]	42.5 [24]	44.8 [27]	86.8 [32]	97.6 [33]
153	Syria	*28.1*	*30.0*	2.3	3.1	8.5	10.4
154	Tanzania	*4.9*	*5.4*	*0.2*	*0.2*	*3.0*	*3.2*
155	TFYR Macedonia	68.1 [69]	70.4 [56]	16.8	17.2	49.5	56.2
156	Thailand	34.9 [70]	39.3 [57]	8.1	9.2	79.9	75.3
157	Timor-Leste	*11.3*	*13.4*	0.1	0.1	*31.2*	*37.5*
158	Togo	*5.7*	*7.1*	0.2	0.9	3.5	6.0
159	Tonga	*40.0*	*45.0*	*1.7*	1.9 [28]	19.3 [33]	29.5 [34]
160	Trinidad & Tobago	*65.1*	*69.2*	18.4	20.7	28.3	32.2
161	Tunisia	*46.2*	*48.5*	4.5	4.3	47.6	62.6
162	Turkey	51.0 [71]	53.7 [58]	11.7	12.4	42.7	50.9
163	Uganda	*17.7*	*19.2*	0.3 [25]	0.3 [29]	14.7 [34]	18.3 [35]
164	Ukraine	46.2 [72]	*49.3*	9.3	11.8	*7.5*	*8.1*
165	United Arab Emirates	90.4 [73]	*91.2*	11.6 [26]	12.8 [30]	*90.0*	92.0
166	United Kingdom	91.6 [74]	92.0 [59]	37.4	37.7	*88.8* [35]	87.8 [36]
167	United States	*73.0*	74.6 [60]	30.3 [27]	31.5 [31]	102.7 [36]	109.2 [37]
168	Uruguay	61.5 [75]	64.6 [61]	24.6 [28]	26.3 [32]	60.6 [37]	77.7 [38]
169	Uzbekistan	*35.5*	*42.8*	2.8	3.6	25.0	28.7
170	Vanuatu	*18.8*	*22.4*	1.8 [29]	1.6 [33]	26.2 [38]	*41.3*
171	Venezuela	*57.0*	*61.9*	7.8	8.2 [34]	44.0	43.0 [39]
172	Viet Nam	*48.3*	*52.7*	6.5	8.1 [35]	31.0	39.0 [40]
173	Yemen	*22.6*	*25.1*	*1.4*	*1.5*	*4.8*	*5.9*
174	Zambia	*19.0*	*21.0*	0.1 [30]	0.1 [36]	8.8 [39]	13.8
175	Zimbabwe	16.3 [76]	*16.4*	1.0	1.1	39.2	39.0

Note: Data in italics are ITU estimates. *Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: ITU World Telecommunication/ICT Indicators database.

Skills indicators

	Economy	Gross enrolment ratio				Mean years of schooling	
		Secondary		Tertiary			
		2014	2015	2014	2015	2014	2015
1	Afghanistan	54.3	54.3	3.7	3.7	3.2	3.2
2	Albania	96.4	96.4	62.7	62.7	9.3	9.3
3	Algeria	97.6	97.6	34.6	34.6	7.6	7.6
4	Andorra	130.8	130.8	84.6	84.6	10.3	10.3
5	Angola	31.5	31.5	9.9	9.9	4.7	4.7
6	Antigua & Barbuda	102.3	102.3	23.5	23.5	9.2	9.2
7	Argentina	106.3	106.3	80.0	80.0	9.8	9.8
8	Armenia	95.9	95.9	46.6	46.6	10.9	10.9
9	Australia	137.6	137.6	86.6	86.6	13.0	13.0
10	Austria	99.3	99.3	80.0	80.0	10.8	10.8
11	Azerbaijan	102.8	102.8	23.2	23.2	10.6	10.6
12	Bahamas	92.9	92.9	57.1	57.1	10.9	10.9
13	Bahrain	95.5	95.5	36.8	36.8	9.4	9.4
14	Bangladesh	58.3	58.3	13.2	13.2	5.1	5.1
15	Barbados	109.2	109.2	60.8	60.8	10.5	10.5
16	Belarus	107.0	107.0	88.9	88.9	12.0	12.0
17	Belgium	163.1	163.1	72.3	72.3	11.4	11.4
18	Belize	80.2	80.2	24.2	24.2	10.5	10.5
19	Benin	54.4	54.4	15.4	15.4	3.3	3.3
20	Bhutan	84.2	84.2	10.9	10.9	3.0	3.0
21	Bolivia	84.7	84.7	37.7	37.7	8.2	8.2
22	Bosnia and Herzegovina	89.3	89.3	37.7	37.7	9.2	9.2
23	Botswana	83.9	83.9	27.5	27.5	8.9	8.9
24	Brazil	105.8	105.8	25.6	25.6	7.7	7.7
25	Brunei Darussalam	99.1	99.1	31.7	31.7	8.8	8.8
26	Bulgaria	100.9	100.9	70.8	70.8	10.6	10.6
27	Burkina Faso	30.3	30.3	4.8	4.8	1.4	1.4
28	Burundi	37.9	37.9	4.4	4.4	2.7	2.7
29	Cambodia	45.0	45.0	15.8	15.8	4.4	4.4
30	Cameroon	56.4	56.4	11.9	11.9	6.0	6.0
31	Canada	103.4	103.4	66.6	66.6	13.0	13.0
32	Cape Verde	92.6	92.6	23.0	23.0	4.7	4.7
33	Chad	22.8	22.8	3.4	3.4	1.9	1.9
34	Chile	100.5	100.5	83.8	83.8	9.8	9.8
35	China	96.2	96.2	30.2	30.2	7.5	7.5
36	Colombia	93.0	93.0	51.3	51.3	7.3	7.3
37	Congo (Dem. Rep.)	43.5	43.5	6.6	6.6	6.0	6.0
38	Costa Rica	120.3	120.3	53.0	53.0	8.7	8.7
39	Côte d'Ivoire	40.1	40.1	8.7	8.7	4.3	4.3
40	Croatia	98.4	98.4	61.6	61.6	11.0	11.0
41	Cuba	99.7	99.7	41.0	41.0	11.5	11.5
42	Cyprus	99.4	99.4	53.1	53.1	11.7	11.7
43	Czech Republic	104.4	104.4	65.4	65.4	12.3	12.3
44	Denmark	129.8	129.8	81.2	81.2	12.7	12.7
45	Djibouti	47.1	47.1	4.9	4.9	3.8	3.8
46	Dominica	96.7	96.7	34.2	34.2	7.9	7.9
47	Dominican Rep.	78.4	78.4	47.5	47.5	7.7	7.7
48	Ecuador	104.2	104.2	40.5	40.5	7.6	7.6
49	Egypt	86.0	86.0	30.3	30.3	6.6	6.6
50	El Salvador	78.1	78.1	29.2	29.2	6.5	6.5
51	Equatorial Guinea	28.2	28.2	3.3	3.3	5.5	5.5
52	Estonia	108.6	108.6	72.9	72.9	12.5	12.5

	Economy	Gross enrolment ratio				Mean years of schooling	
		Secondary		Tertiary			
		2014	2015	2014	2015	2014	2015
53	Ethiopia	28.9	28.9	6.3	6.3	2.4	2.4
54	Fiji	88.3	88.3	16.1	16.1	9.9	9.9
55	Finland	143.2	143.2	91.1	91.1	10.3	10.3
56	France	110.9	110.9	62.1	62.1	11.4	11.4
57	Gabon	53.9	53.9	8.5	8.5	7.8	7.8
58	Gambia	57.5	57.5	3.4	3.4	2.8	2.8
59	Georgia	99.4	99.4	39.2	39.2	12.3	12.3
60	Germany	102.5	102.5	61.1	61.1	13.5	13.5
61	Ghana	71.0	71.0	15.6	15.6	7.0	7.0
62	Greece	108.2	108.2	110.2	110.2	10.5	10.5
63	Grenada	101.1	101.1	52.8	52.8	8.6	8.6
64	Guatemala	63.5	63.5	18.3	18.3	7.0	7.0
65	Guinea	38.8	38.8	10.8	10.8	2.4	2.4
66	Guinea-Bissau	34.5	34.5	2.6	2.6	2.8	2.8
67	Guyana	101.0	101.0	12.9	12.9	8.5	8.5
68	Honduras	68.4	68.4	21.2	21.2	6.2	6.2
69	Hong Kong, China	100.6	100.6	68.8	68.8	11.2	11.2
70	Hungary	108.2	108.2	57.0	57.0	11.6	11.6
71	Iceland	112.0	112.0	81.4	81.4	10.6	10.6
72	India	68.9	68.9	23.9	23.9	5.4	5.4
73	Indonesia	82.5	82.5	31.3	31.3	7.6	7.6
74	Iran (I.R.)	88.4	88.4	66.0	66.0	8.2	8.2
75	Ireland	126.5	126.5	73.2	73.2	12.2	12.2
76	Israel	101.5	101.5	66.3	66.3	12.8	12.8
77	Italy	102.4	102.4	63.5	63.5	10.1	10.1
78	Jamaica	83.0	83.0	27.4	27.4	9.7	9.7
79	Japan	101.9	101.9	62.4	62.4	11.5	11.5
80	Jordan	87.8	87.8	46.6	46.6	9.9	9.9
81	Kazakhstan	109.1	109.1	46.0	46.0	11.4	11.4
82	Kenya	67.0	67.0	4.0	4.0	6.3	6.3
83	Kiribati	86.4	86.4	17.0	17.0	7.8	7.8
84	Korea (Rep.)	97.7	97.7	95.3	95.3	11.9	11.9
85	Kuwait	92.5	92.5	27.0	27.0	7.2	7.2
86	Kyrgyzstan	90.8	90.8	47.3	47.3	10.6	10.6
87	Lao P.D.R.	57.2	57.2	17.3	17.3	5.0	5.0
88	Latvia	110.5	110.5	67.0	67.0	11.5	11.5
89	Lebanon	68.2	68.2	42.8	42.8	7.9	7.9
90	Lesotho	52.2	52.2	9.8	9.8	5.9	5.9
91	Liberia	37.9	37.9	11.6	11.6	4.1	4.1
92	Lithuania	105.4	105.4	72.0	72.0	12.7	12.7
93	Luxembourg	102.4	102.4	19.7	19.7	11.7	11.7
94	Macao, China	96.1	96.1	69.4	69.4	7.5	7.5
95	Madagascar	38.4	38.4	4.2	4.2	6.0	6.0
96	Malawi	39.5	39.5	0.8	0.8	4.3	4.3
97	Malaysia	71.1	71.1	38.5	38.5	10.0	10.0
98	Maldives	72.3	72.3	13.2	13.2	5.8	5.8
99	Mali	43.5	43.5	7.5	7.5	2.0	2.0
100	Malta	85.5	85.5	45.1	45.1	11.3	11.3
101	Mauritania	29.9	29.9	5.5	5.5	3.8	3.8
102	Mauritius	97.9	97.9	38.7	38.7	8.5	8.5
103	Mexico	87.0	87.0	29.2	29.2	8.4	8.4
104	Moldova	88.3	88.3	41.3	41.3	11.9	11.9
105	Monaco	109.7	109.7	54.9	54.9	11.4	11.4
106	Mongolia	90.7	90.7	64.3	64.3	9.3	9.3

	Economy	Gross enrolment ratio				Mean years of schooling	
		Secondary		Tertiary			
		2014	2015	2014	2015	2014	2015
107	Montenegro	90.3	90.3	55.5	55.5	11.2	11.2
108	Morocco	68.9	68.9	24.6	24.6	4.4	4.4
109	Mozambique	24.5	24.5	6.0	6.0	3.2	3.2
110	Myanmar	51.3	51.3	13.4	13.4	4.1	4.1
111	Namibia	64.8	64.8	9.3	9.3	6.2	6.2
112	Nepal	67.2	67.2	15.8	15.8	3.3	3.3
113	Netherlands	130.7	130.7	77.3	77.3	11.9	11.9
114	New Zealand	117.2	117.2	79.7	79.7	12.5	12.5
115	Nicaragua	68.9	68.9	17.9	17.9	6.0	6.0
116	Niger	18.8	18.8	1.8	1.8	1.5	1.5
117	Nigeria	43.8	43.8	10.4	10.4	5.9	5.9
118	Norway	113.0	113.0	76.1	76.1	12.8	12.8
119	Oman	93.5	93.5	28.1	28.1	8.0	8.0
120	Pakistan	41.6	41.6	10.4	10.4	4.7	4.7
121	Palestine*	82.2	82.2	44.0	44.0	8.9	8.9
122	Panama	75.5	75.5	38.7	38.7	9.3	9.3
123	Paraguay	69.6	69.6	34.5	34.5	8.1	8.1
124	Peru	95.6	95.6	42.6	42.6	9.0	9.0
125	Philippines	88.4	88.4	35.8	35.8	8.9	8.9
126	Poland	108.7	108.7	71.2	71.2	11.9	11.9
127	Portugal	119.7	119.7	66.2	66.2	8.9	8.9
128	Qatar	111.6	111.6	15.8	15.8	9.8	9.8
129	Romania	97.9	97.9	52.2	52.2	10.6	10.6
130	Russian Federation	98.8	98.8	78.0	78.0	12.0	12.0
131	Rwanda	40.2	40.2	7.5	7.5	3.7	3.7
132	Samoa	86.9	86.9	7.5	7.5	10.3	10.3
133	Saudi Arabia	108.3	108.3	61.1	61.1	8.7	8.7
134	Senegal	41.0	41.0	7.6	7.6	2.5	2.5
135	Serbia	94.3	94.3	58.1	58.1	10.8	10.8
136	Seychelles	74.6	74.6	6.5	6.5	9.4	9.4
137	Singapore	97.2	97.2	43.8	43.8	11.6	11.6
138	Slovakia	91.8	91.8	54.4	54.4	12.1	12.1
139	Slovenia	110.9	110.9	85.2	85.2	12.1	12.1
140	Solomon Islands	48.4	48.4	16.2	16.2	5.0	5.0
141	South Africa	98.2	98.2	19.7	19.7	10.3	10.3
142	South Sudan	40.7	40.7	17.2	17.2	5.4	5.4
143	Spain	131.1	131.1	87.1	87.1	9.8	9.8
144	Sri Lanka	99.7	99.7	20.7	20.7	10.8	10.8
145	St. Kitts and Nevis	91.5	91.5	79.1	79.1	8.4	8.4
146	St. Lucia	86.5	86.5	16.9	16.9	9.3	9.3
147	St. Vincent and the Grenadines	104.7	104.7	18.2	18.2	8.6	8.6
148	Sudan	40.7	40.7	16.9	16.9	3.1	3.1
149	Suriname	78.5	78.5	12.1	12.1	7.7	7.7
150	Swaziland	63.0	63.0	5.3	5.3	7.1	7.1
151	Sweden	128.5	128.5	63.4	63.4	12.3	12.3
152	Switzerland	96.3	96.3	56.3	56.3	13.8	13.8
153	Syria	50.5	50.5	34.5	34.5	6.3	6.3
154	Tanzania	32.3	32.3	3.6	3.6	5.1	5.1
155	TFYR Macedonia	82.8	82.8	39.4	39.4	9.3	9.3
156	Thailand	86.2	86.2	51.4	51.4	7.3	7.3
157	Timor-Leste	73.1	73.1	17.7	17.7	4.4	4.4
158	Togo	54.9	54.9	10.1	10.1	4.5	4.5
159	Tonga	90.6	90.6	6.3	6.3	10.7	10.7
160	Trinidad & Tobago	85.5	85.5	12.0	12.0	10.9	10.9

	Economy	Gross enrolment ratio				Mean years of schooling	
		Secondary		Tertiary			
		2014	2015	2014	2015	2014	2015
161	Tunisia	90.1	90.1	34.6	34.6	6.8	6.8
162	Turkey	114.6	114.6	79.0	79.0	7.9	7.9
163	Uganda	27.6	27.6	9.1	9.1	5.4	5.4
164	Ukraine	99.2	99.2	82.3	82.3	11.3	11.3
165	United Arab Emirates	83.6	83.6	22.0	22.0	9.5	9.5
166	United Kingdom	124.4	124.4	56.9	56.9	13.3	13.3
167	United States	95.9	95.9	88.8	88.8	13.6	13.6
168	Uruguay	90.3	90.3	63.2	63.2	8.6	8.6
169	Uzbekistan	105.2	105.2	8.9	8.9	10.9	10.9
170	Vanuatu	59.5	59.5	4.7	4.7	6.8	6.8
171	Venezuela	91.6	91.6	78.1	78.1	8.9	8.9
172	Viet Nam	77.2	77.2	30.5	30.5	7.5	7.5
173	Yemen	48.6	48.6	10.3	10.3	2.6	2.6
174	Zambia	45.5	45.5	2.4	2.4	6.6	6.6
175	Zimbabwe	47.2	47.2	5.9	5.9	7.3	7.3

Note: At the time of the calculation of the IDI 2016, UIS data for skills indicators were available for 2014 only. Therefore, 2014 data were used for both years. *Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Busan, 2014) of the ITU Plenipotentiary Conference.
Source: Gross enrolment ratio refer to latest available data from UIS. Mean years of schooling data are from UNDP HDR and UIS.

Notes

The notes are presented here as submitted by countries to ITU.

Access indicators

Fixed-telephone subscriptions per 100 inhabitants, 2014

1) Includes 272'960 WLL subscriptions. 2) Includes PSTN and other fixed-line telephone services. Due to a methodology change in 2014, data reported for 2014 differs from data reported in previous communications reports. In 2014, the total resale (retail services directly connected via another network) and retail services in operation are reported. In previous communications reports, wholesale and retail totals were reported. 3) Incl. ISDN channels measured in ISDN B channels equivalents. 4) Incl. VoIP. 5) Obtained from URCA's Licensees. 6) Bhutan Telecom is the only service provider in Bhutan. 7) December 2014. 8) Total retail access lines. 9) Source: Colombia TIC. 10) Counting voice channel equivalents, 1'500'563 is the number of subscriptions. 11) Incl. IP lines. 12) Incl. public payphones. 13) Including ISDN voice-channel equivalents. Data based on estimates. 14) Providers data. 15) New tax on numbering resources, which has prompted operators to return several numbers, either inactive ones or with low consumption. 16) December 2014. Excluding fixed wireless local loop (WLL) subscriptions, ISDN voice-channel equivalents. 17) Incl. PSTN lines, ISDN paths, FWA subscriptions, public payphones and VOIP subscriptions. 18) The number of fixed public payphones is as of March 2014.(This data is reported by carrier every March). 19) Data from 4 main operators, LTC, BEELINE, UNITEL, ETL. 20) Including digital lines. Without including separate ISDN channels (abonnements au téléphone fixe). 21) Excl. ISDN channels and fixed wireless subscriptions. 22) From ICT Indicators Survey by PPPC. 23) December 2014. Source: January 2015 Management Information System Report. 24) Based on ACM 2014Q4 data. 25) Estimate. 26) Refers to active Fixed Wired/Wireless lines. 27) Figures are as on 31st December, 2014 based on data received from Fixed Line Operators. 28) Preliminary. 29) POTS, ISDN BRA & ISDN PRA. 30) Operators' data. 31) Sudatel terminated its fixed landline, CDMA and GSM Services in South Sudan in Oct 2012. 32) Base on ECTEL's research. 33) Refers to March 2014. 34) Estimates. 35) Preliminary data. 36) December. 37) Telecommunications Regulatory Authority (TRA). 38) FCC trend-based estimate using recent historical data.

Fixed-telephone subscriptions per 100 inhabitants, 2015

1) Includes 254132 WLL subscriptions. Source: ARPT/Algérie Télécom. 2) Preliminary. 3) Includes PSTN and other fixed-line telephone services. Due to a methodology change in 2014, data reported here differs from data reported in previous communications reports. In 2014, the total resale (retail services directly connected via another network) and retail services in operation are reported. In previous communications reports, wholesale and retail totals were reported. 4) Incl ISDN channels measured in ISDN B channel equivalents; corrected data for 2014: 3.518.900. 5) December 2015. 6) Bhutan Telecom is the only service provider for fixed-lines in Bhutan. 7) Preliminary. 8) Decrease due to the reduction of FWLL services which contributes to 78% of the entire fixed telephone subscription. 9) Sept. 10) Source: Sistema de Infromación Integral Colombia TIC. 11) Preliminary. 12) Estimates. 13) Incl. IP lines. 14) Incl. public payphones. 15) Including ISDN voice-channel equivalents. Data based on estimates. 16) As at 30/6/2015. 17) December 2015. 18) Incl. PSTN lines, ISDN paths, FWA subscriptions, public payphones and VOIP. 19) Including PRI access lines. 20) Source: AGCOM. 21) December 2015 The number of fixed public payphones is as of March 2015.(This data is reported by carriers every March). 22) The major fixed network provider shut down its fixed wireless network and migrated the subscibers to its GSM network. 23) Data from 4 main operators, LTC, BEELINE, UNITEL, ETL. 24) Data to 1.07.2015, source- Public Utilities Commission. 25) Including digital lines. Without including separate ISDN channels (abonnements au téléphone fixe). 26) Excl. ISDN channels and fixed wireless subscriptions. 27) December 2015. Source: January 2016 Management Information System Report. 28) Estimate. 29) First half 2015. 30) Figure is based on data received from Fixed Line Operators. 31) Estimate. 32) Inactive fixed telephones were disconnected. 33) Figures obtained from Bluesky and Digicel. 34) Q4 (consolidated end 2015 data not available yet). 35) Strong decrease due to the disconnection of inactive subscriptions. 36) Estimates. 37) Preliminary data. 38) December. 39) FCC trend-based estimate using recent historical data. 40) Preliminary. 41) Estimated.

Mobile-cellular subscriptions per 100 inhabitants, 2014

1) Internet Activity Survey. 2) Obtained from URCA's Licensees. 3) Break in comparability: from this year, incl. only active prepaid subscriptions. Total: 10.56M. 4) For both Bhutan Telecom and Tashi Cell. 5) Break in comparability: previous year data refer to total number of configured sim instead of active subscriptions. 6) Incl. all mobile-cellular subscriptions that offer voice communications, but excludes mobile data subscriptions (via data cards, USB modems and M2M cards). 7) Preliminary. 8) Validation process of mobile accounts carried out in 2014, resulting in unverified accounts being disactivated. 9) Excl. 3 135 687 prepaid cards that are used to provide Travel SIM/WorldMobile service. 10) Reduction in multiple sim usage per subscriber (of different network operators). 11) Excludes data-only subscriptions. 12) Excl. data-only SIM cards and M2M cards. Data in line with ITU definition. Data before 2010 not in line with present ITU-Definition (it included non-active cards). 13) Providers data-NTRC Grenada. 14) New tax on numbering resources, which has prompted operators to return several numbers, either inactive ones or with low consumption. 15) December 2014. Including fixed wireless local loop

(WLL) subscriptions. 16) MCIT. 17) Estimate. 18) Dec.2014. Including PHS and data cards, undividable. 19) There are Ref. no from 4 main operators, LTC, BEELINE, UNITEL, ETL. 20) Active subscriptions. 21) December. 22) December 2014 Source: NTA Management Information System Report. 23) Q3 data. Excl. M2M and dedicated mobile broadband. 24) Estimate of subscriptions active in last 90 days. 25) Estimate. Incl. inactive. 26) Figures are as on 31st December, 2014 based on data received from Cellular Mobile Operators. 27) Preliminary. 28) From this year excl. data-only subscriptions. 29) Break in comparability: from this year, excl. M2M. 30) Excl. 495 811 M2M subscriptions. 31) Active subscriptions. 32) Includes active (in the last 6 months) prepaid accounts. 33) Decline was due to the regulatory controls on prepaid SIM cards which restricts each end user to hold no more than 3 prepaid cards. 34) 4 operators. 35) As researched by ECTEL. 36) Reduction due to change in accounting method for prepaid subs by major provider. 37) Estimates. 38) Preliminary data. 39) December. 40) Reported CTIA numbers. 41) Incl. dedicated data subscriptions.

Mobile-cellular subscriptions per 100 inhabitants, 2015

1) Break in comparability: Active subscriptions. 2) Preliminary. 3) Internet activity survey June 2015. 4) December 2015. 5) Bhutan Telecom and Tashi Cell combined. 6) Preliminary. 7) Sept. 8) Preliminary. 9) Estimates. 10) Operators cleaned inactive lines. 11) Excl. 2 351 881 prepaid cards that are used to provide Travel SIM/WorldMobile service. 12) There was A Telecom Expansion Project (TEP) ongoing which results in about 12 Million new subscriber than the previous year. 13) Excludes data-only subscriptions. 14) Excl. data-only SIM cards and M2M cards. Data in line with ITU definition. Data before 2010 not in line with present ITU-Definition (it included non-active cards). 15) 4 players compete on the local market. The latest player entered the market at the 4 quarter of 2014. Data on the new entrant concern the 9th month of 2015. 16) Les donnes sont relatives aux deux operateurs (Orange et MTN). Le troisième opérateur n'est plus en service (Guinétel). 17) December 2015. 18) Estimate. 19) Source: AGCOM. 20) December 2015 including PHS and data cards, undividable. 21) Data to 1.07.2015, source- Public Utilities Commission. 22) Decline due to a new law regarding the identification of all subscribers. 23) Active subscriptions. 24) Information and Communication Technologies Authority of Mauritius. 25) Preliminary. 26) December 2015 Source: NTA Management Information System Report. 27) Incl. inactive. 28) First half 2015. Figure for 2014 needs to be revised. 29) Figure is reported after biometric re-verification of SIMs in 2015 by all Cellular Mobile Operators. 30) Estimate. 31) Excl. 492.761 M2M subscriptions. 32) Includes active (in the last 6 months) prepaid accounts. 33) Figures obtained from Bluesky and Digicel. 34) Estimated using Dec 2015; data as at end Mar 2016 is not available yet. 35) Estimates. 36) Preliminary data. 37) December. 38) UBS Investment Research Data as of 6/30/15 as reported in the FCC's Eighteenth Mobile Wireless Competition Report. 39) Incl. dedicated data subscriptions. 40) Preliminary. 41) Estimated.

International Internet bandwidth Bit/s per Internet user, 2014

1) Total purchased international capacity contracted with operators outside Bulgaria. 2) Break in comparability: from this year, used capacity. 3) Contracted capacity. 4) Break in comparability: from this year used capacity. 5) Including Yahsat & Thuraya. 6) Installed capacity.

International Internet bandwidth per Internet user, 2015

1) Dec 2015. 2) 2867.2 Mbit/s for Bhutan Telecom and 600 Mbit/s for TashiCell. 3) Ref. LTC&UNITEL. 4) As a policy more international capacity is acquired by the operators when the traffic load reaches 80% of the provisioned capacity. 5) As per data received from PTCL and TWA. 6) Contracted capacity. 7) Figures obtained from Bluesky and Digicel. 8) Downlink capacity. 9) Tonga Cable Limited. 10) December. 11) Including UAEs Yahsat & Thuraya. 12) Installed capacity.

Percentage of households with computer), 2014

1) Country estimate. 2) Preliminary. Number to be revised. 3) A household is considered to have access only when it is available to all household members at any time. 4) ICT market survey. 5) Refers to urban households. 6) Incl. desktop, notebook and tablet, and excl. PDA and smartphone. 7) Excluding households who reside on the territory of temporary occupied Autonomous Republic of Crimea, in the city of Sevastopol and in a part of the zone where anti-terrorist operation is conducted. 8) American Community Survey.

Percentage of households with computer, 2015

1) Estimate. 2) As of 2015, inc. tablets. 3) Preliminary estimate based on ICT HH survey. 4) Incl. desktop, notebook and tablet, and excl. PDA and smartphone.

Percentage of households with Internet, 2014

1) Country estimate. 2) Inc. through computer or mobile. 3) Incl. access via mobile phones. 4) Break in comparability. A household is considered to have access only when it is available to all household members at any time. 5) ICT market survey. 6) Refers to urban households. 7) Excluding households who reside on the territory of temporary occupied Autonomous

Republic of Crimea, in the city of Sevastopol and in a part of the zone where anti-terrorist operation is conducted. 8) Incl. access to Internet via mobile phone. 9) American Community Survey.

Percentage of households with Internet, 2015

1) Preliminary estimate based on ICT HH survey.

Use indicators

Percentage of individuals using the Internet, 2014

1) Census. 2) All population. 3) Population age 16-74. 4) Population age 7+. 5) Population age 15+. 6) Population age 6+. 7) Population age 16-74. 8) Population age 5+ in the last 3 months. 9) Population age 10+.) 10) Population age 16-74. 11) Population age 15+. 12) Permanent residents at the age of 6 or above. In the last 6 months. 13) Population age 5+. 14) Population age 16-74. 15) Population age 6+. 16) Population age 16-74. 17) Population age 16-74. 18) Population age 16-74. 19) Population age 5+. 20) Population age 6+. 21) Population age 10+. 22) Population age 16-74. 23) Population age 16-74. 24) Population age 16-74. 25) Survey value is 49.1% for population age 6+ using Internet in the last 12 months. The current value is an ITU estimate provided for comparability reasons with 2015 value, which corresponds to users in the last 3 months. 26) Population age 16-74. 27) Population age 16-74. 28) Population age 10+. 29) Population age 16-74. 30) Population age 16-74. 31) Population age 5+. 32) Country estimate. 33) Population age 16-74. 34) Population age 20+. 35) Population age 16-74. 36) Population age 14+. 37) Population age 6+. 38) Population age 5+. 39) Population age 16-74. 40) Population age 16-74. 41) Population age 16-74. 42) Population age 16-74. 43) Population age 3+. 44) Population age 15+. 45) Population age 16-74. 46) Population age 5+. 47) Population age 6+. 48) All population. 49) Population aged 5 to 75 using Internet in the last 3 months. 50) Population age 16-74. 51) Population age 16-74. 52) Population age 10+. 53) Population age 10+. 54) Population age 10+ using internet in the last 3 months. 55) Population age 6+. 56) Population age 16-74. 57) Population age 16-74. 58) Population age 16-74. 59) Population age 15-72 who used the Internet in the last 12 months. 60) Population age 12-65 over total population. 61) Refers to total population. 62) Population age 16-74. 63) All population. 64) Population age 16-74. 65) Population age 16-74. 66) Population age 16-74. 67) Population age 16-74. 68) In the last 6 months. Population age 14+. 69) Population age 16-74 using in the last 3 months. 70) Population age 6+. Slight break in comparability since total population estimates were revised and they are lower than in 2013. 71) Population age 16-74 in the last 12 months. 72) All population. 73) Population age 15-74 in the last 3 months. 74) Population age 16-74. 75) Population age 6+. 76) Population age 3+.

Percentage of individuals using the Internet, 2015

1) Population age 15+. 2) Population age 16-74. 3) Population age 7+. 4) Population age 15+. 5) Population age 6+. 6) Population age 16-74. 7) Population age 16-74. 8) Permanent residents at the age of 6 or above. In the last 6 months. 9 Population age 5+. 10) Population age 5+ in the last three months. 11) Population age 16-74. 12) Population age 16-74. 13) Population age 16-74. 14) Population age 16-74. 15) Population age 12+. 16) Population age 5+. 17) Population age 16-74. 18) Population age 16-74. 19) Population age 16-74. 20) Population age 6+. Break in comparability, reference period in the last 3 months. 21) Population age 16-74. 22) Population age 16-74. 23) Population age 10+. 24) Population age 16-74. 25) Population age 5+. 26) Population age 16-74. 27) Population age 16-74. 28) Population age 6-74. 29) Population age 16-74. 30) Population age 16-74. 31) Population age 16-74. 32) Population age 16-74. 33) Population age 3+. 34) Population age 15+. 35) Population age 16-74. 36) Population age 5+. 37) Population age 6+. Break in comparability: as of 2015 the respondent of ICT use questions is a self-respondent randomly selected and the survey is a stand-alone ICT survey. Before the ICT survey was a module attached to a main survey and respondent was an informed person of the household who responded about self and the other members of the household. 38) All population. 39) Population age 5+ using Internet in the last 3 months. 40) Population age 16-74. 41) Population age 16-74. 42) Preliminary estimate based on ICT HH survey, population aged 10+. 43) Population age 10+. 44) Population age 6+. 45) Population age 16-74. 46) Population age 16-74. 47) "Mainstream" population age 15+ living in households. 48) Population age 16-74. 49) Population age 15-72 who used the Internet in the last 12 months. 50) Population age 12-65 over total population. 51) Population age 16-74. 52) Population age 16-74. 53) Population age 16-74. 54) Population age 16-74. 55) In the last 6 months. Population age 14+. 56) Population age 16-74. 57) Population age 6+. 58) Population age 16-74. 59) Population age 16-74. 60) Population age 3+. 61) Population age 6+.

Fixed-broadband subscriptions per 100 inhabitants, 2014

1) Preliminary. 2) Internet Activity Survey, June 2014. 3) Obtained from URCA's Licensees. 4) Estimate. 5) Information provided by 85,4% of all ISPs. 6) ADSL, ADSL+, CDMA. 7) "Excluding satellite broadband users, the ground fixed wireless broadband". 8) Incl. WiFi subscriptions (not WiFi hotspots). 9) Incl. 144 kbit/s to less than 256 kbit/s. Excl. subscriptions with unspecified download capacity. 10) Estimate. 11) Fixed wimax. 12) "December 2014. These are the subscriptions with the minimum download speed of 512 kbps. This is as per the revised definition of Broadband (>= 512kbps) in India " 13) Incl. DSL and cable. 14) There are Ref.no from 4 main operators, LTC, BEELINE, UNITEL, ETL. 15) From this year incl. Internet cable subscriptions

(596'663) that were not included before. In 2014, for the first time MOT issued licences to cable operators to allow them to offer Internet services. 16) The number of subscriptions in 2014 went down because from 2014 WiFi services that are used as ad-on to subscriptions to other internet access services are no longer included. 17) Incl. non-residential customers (ca 25'000). 18) December 2014. Source: Management Information System Report. 19) Q3. 20) Estimate. 21) Figures are as on 31st December, 2014 based on data received from Broadband Operators. 22) Preliminary. 23) Incl. subscriptions at downstream speeds equal to or greater than 144 kbit/s (the number of subscriptions that are included in the 144-256 range is insignificant). 24) Estimates. 25) December. 26) Include 2,878 WiMax subscriptions, and 1850 Satellite subscriptions. 27) Please note that FCC collects information about broadband Internet access subscriptions in service that have downstream bandwidths exceeding 200 kbps, rather than 256 kbps. 28) Incl. ADSL and FTTH + LMDS. 29) Includes xDSL, fixed wireless data subscription and fixed broadband internet subscribers. The figure excludes prepaid wireless internet subscriptions. Increase from 2013 has been due to operators investing in fiber optic cable and landing of the submarine cable in Vanuatu in Jan 2014 has increased capacity and reduced price thus increasing the number of subscribers. 30) ISP subscribers with internet speed of at least 256 kbps.

Fixed-broadband subscriptions per 100 inhabitants, 2015

1) Internet activity survey June 2015. 2) December 2015. 3) Number is inclusive of WIMAX, wireless broadband, FTTB, FTTC and FTTH. 4) Estimate. 5) Estimate. 6) ADSL, ADSL+, CDMA. 7) Incl. WiFi subscriptions (not WiFi hotspots). Estimates. 8) Incl. 144 kbit/s to less than 256 kbit/s. Excl. subscriptions with unspecified download capacity. 9) Narrow band dial-up service is abandoned and all have migrated to broadband connection using ADSL, and this has increased the fixed broadband service subscription significantly. 10) Fixed wimax. Includes 861 subscriptions at speeds of 128-255 kbps. 11) December 2015. Subscription with download speeds of at least 256 kbit/s. 12) Dec. 2015- Inc. DSL and cable. 13) December 2015. 14) Incl. non-residential customers (ca 30'000). 15) Segregation of WiMAX services between mobile broadband and fixed broadband. 16) Information and Communication Technologies Authority of Mauritius. 17) Preliminary. 18) Estimate. 19) First half 2015. 20) Figure is based on data received from Broadband Operators. 21) Estimate. 22) Estimate. 23) Incl. subscriptions at downstream speeds equal to or greater than 144 kbit/s (the number of subscriptions that are included in the 144-256 range is insignificant). 24) Figures obtained from Bluesky and Digicel. 25) Estimated using Dec 2015; data as at end Mar 2016 is not available yet. 26) Q4 (consolidated end-2015 data not yet available). 27) Estimates. 28) Preliminary data. 29) December. 30) Include 2,359 WiMax subscriptions, and 389 Satellite subscriptions. 31) FCC trend-based estimate using recent historical data. 2015 data as of 6/30/15. Please note that FCC collects information about broadband Internet access subscriptions in service that have downstream bandwidths exceeding 200 kbps, rather than 256 kbps. 32) Incl. ADSL and FTTH + LMDS. 33) Includes xDSL, fixed wireless data subscription and fixed broadband internet subscribers. Numbers are believed to have dropped as some subscribers have preferred to switch to mobile broadband alternatives as prices for these services have fallen and quality has increased. 34) Preliminary. 35) Estimated. 36) ISP subscribers with internet speed of at least 256 kbps.

Active mobile broadband subscriptions per 100 inhabitants, 2014

1) Internet Activity Survey, June. 2) Break in comparability: from this year excl. GPRS/EDGE only connections. Activity criteria: data communication in the last month. 3) Preliminary. Counting plans that allow mobile-broadband access and are using LTE, WCDMA and CDMA2000 enabled devices. 4) Break in comparability: previous year data refer to total number of configured sim instead of active subscriptions. 5) January 2015. 6) 3G and other more advanced mobile connections of at least 256 Kbit/s. 7) Preliminary. 8) Providers Data-NTRC Grenada. 9) Does not incl. prepaid smartphones. 10) Speeds equal or greater than 1 Mbit/s. 11) December 2014. These are the subscriptions with the minimum download speed of 512 kbps. This is as per the revised definition of Broadband (>= 512 kbps) in India. 12) In 2014, 3G and 4G licenses were awarded to the two largest mobile operators (Hamrahe Avval and IranCell). 13) Users who have made a transaction in the last 90 days via a handset, dongle/USB modem or other mobile Internet device, whereby they accessed advanced data services such as web/Internet content, online multiplayer gaming content, VoD or other equivalent data services (excluding SMS and MMS). 14) Estimate. 15) December 2014. Including standard and dedicated mobile broadband Wimax. 16) Estimate. 17) There are Ref.no from 4 main operators, LTC, BEELINE, UNITEL, ETL. 18) 3G subscriptions (prepaid+postpaid) provided instead, as all 3G subscriptions provide download speeds of at least 256 kbits/s when enabled. Users may disable/enable their mobile-broadband functionality via USSD code, via service hotline or in person. The number of 3G subscribers who have disabled their mobile-broadband functionality is not collected. Internet usage statistics of individual users are not collected either. 19) Equal to dedicated mobile-broadband subs as CAM does not report on standard mobile-broadband pay-as-you-go subscriptions. 20) Includes primarily Orange customers. 21) Lignes ayant réalisé des connections data sur les 3 derniers mois. 22) Source: January 2015 Management Information System Report. 23) Q4 data. 24) Estimate. 25) Subscriptions generating >0.5MB/month + data-only subscriptions. 26) Figures are as on 31st December, 2014 based on data received from Broadband and cellular mobile Operators. 27) Preliminary. 28) Activity period: 6 months. 29) Break in comparability: from this year, incl. handset-based mobile broadband. 30) Includes active subs (in the last 6 months), by 3G and higher technologies. 31) Decline was due to the regulatory controls on prepaid SIM cards which restricts each end user to hold no more than 3 prepaid cards. 32) Estimates. 33) Preliminary data. 34) December. 35) Break in comparability: from this year, excl. M2M subscriptions. 36) Based on data from Ovum. 37) Incl. subscriptions with potential access. 38) Data refer to theoretical ability of subscribers to use broadband speed mobile data services, rather than the number of active users of such services. 39) Break in comparability: blackberry and all mobile broadband subscriptions incl. pay-per-use.

Active mobile broadband subscriptions per 100 inhabitants, 2015

1) Abonnés 3G. Source: ARPT/Opérateurs. 2) Preliminary. 3) Internet activity survey June 2015. 4) December 2015. 5) Combined number for two operators. The increase is due to increased growth of smart phones and increase in 3G network. 6) Activity criteria: data communication in the last month. 7) Preliminary. 8) Estimates. 9) Only postpaid mobile-broadband subscriptions. 10) The Telecom Expansion Project undertaken which includes 2G to 3G migration in all major cities throughout the country has resulted in over 4 million mobile broadband subscriptions than the previous year. 11) Before 2014, Mobitel offered only 2G. In 2015 it received an LTE license and launched the service. 12) Does not incl. prepaid smartphones. 13) December 2015. Subscription with download speeds of at least 256 kbit/s. 14) Users who have made a transaction in the last 90 days via a handset, dongle/USB modem or other mobile Internet device, whereby they accessed advanced data services such as web/Internet content, online multiplayer gaming content, VoD or other equivalent data services (excluding SMS and MMS). 15) Dec.2015 Including standard and dedicated mobile broadband Wimax. 16) There are Ref.no from 4 main operators, LTC, BEELINE, UNITEL, ETL. 17) 3G + LTE subscriptions (prepaid+postpaid) provided instead, as all 3G + LTE subscriptions provide download speeds of at least 256 kbits/s when enabled. Users may disable/enable their mobile-broadband functionality via USSD code, service hotline or in person. The number of 3G & LTE subscribers who have disabled their mobile-broadband functionality is not collected. Internet usage statistics of individual users are not collected either. 18) The increase was due to the attractive price offered in postpaid and prepaid packages; pay per use subscriptions and the introduction of LTE package. 19) Equal to dedicated mobile broadband subs as CAM does not report on standard mobile broadband pay-as-you-go subscriptions. 20) Includes both, Orange and Sotelma customers. 21) Q2 2015. 22) Information and Communication Technologies Authority of Mauritius. 23) Preliminary. 24) Estimation DCE. 25) First half 2015. 26) Figure is based on data received from mobile broadband operators. 27) Estimate. 28) Estimate. Activity period: 6 months. 29) Includes active subs (in the last 6 months), by 3G and higher technologies. 30) Figures obtained from Bluesky Samoa Digicel Samoa and Lesa Telephone Service. 31) Estimated using Dec 2015; data as at end Mar 2016 is not available yet. 32) Slight drop due to upgrades on data services network by the two operators in April, Sept, Dec. 33) Estimates. 34) Preliminary data. 35) December. 36) Excl. M2M subscriptions. 37) Based on data from Ovum as of 6/30/15. 38) Incl. subscriptions with potential access. 39) Preliminary. 40) Estimated.

International
Telecommunication
Union
Place des Nations
CH-1211 Geneva 20
Switzerland

ISBN: 978-92-61-21431-9

Printed in Switzerland
Geneva, 2016