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ICT TRENDS AND DEVELOPMENTS IN EUROPE

Summary:

This document provides an overview of trends and developments in ICT infrastructure, access and use in Europe, which includes 43 countries and is home to a population of 631 million people. The document highlights how the ICT sector has continued its remarkable growth and development since the last World Telecommunication Development Conference in 2014 (WTDC-14). It also tracks the evolution of regulation.

Expected results:

Serve as an authoritative reference for shaping the future of ICT development in Europe.

References:

Data and analysis from the ITU ICT Facts and Figures 2016 (ITU, 2016b), Measuring the Information Society Report 2016 (ITU, 2016a) and Trends in Telecommunication Reform 2015 (ITU, 2015).

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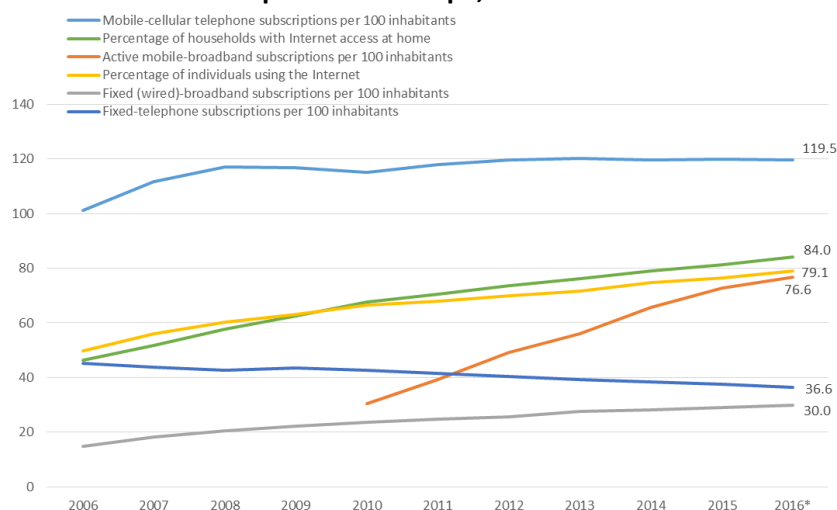
ICT Trends and Developments in Europe¹

1. Overview of ICT developments

Over the last ten years, the Europe region, which includes 43 countries and is home to a total population of 631 million, has seen growth in most areas of ICT infrastructure, access, and use (Chart 1.1). The percentage of individuals using the Internet has increased from 46.3 per cent in 2005 to an estimated 79.1 per cent at the end of 2016. This trend closely mirrors the steady increase in households that have Internet access at home, which increased from about 42 per cent in 2005 to an estimated 84 per cent by end of 2016. Both the fixed and mobile broadband markets have grown significantly. Fixed-broadband subscriptions per 100 inhabitants tripled since 2005, increasing from 10.9 per 100 inhabitants to 30 per 100 inhabitants. Between 2010 and 2016, active mobile-broadband subscriptions increased from 30.5 subscriptions per 100 inhabitants to almost 76.6 subscriptions per 100 inhabitants. About 98 per cent and 83 per cent of the population are now within the reach of a 3G and LTE mobile-broadband signal, respectively. In contrast, the mobile voice market is already saturated and experienced relatively flat growth. Mobile-cellular subscriptions went from 91.7 per 100 inhabitants in 2005 to 119.5 per 100 inhabitants in 2016.

The majority of the countries in Europe are high-income economies. According to World Bank data, the average (nominal) GNI p.c. of countries in the region is about USD 34'766. Seventeen of the 43 countries in Europe have a nominal GNI p.c. equal to or greater than USD 34'766. Only six countries, namely, Albania, Bosnia and Herzegovina, Bulgaria, Montenegro, Serbia and TFYR Macedonia are classified as middle-income economies. Germany, France and the United Kingdom are the largest telecommunications markets in the region, given the combination of their income levels and population size. Together, they account for close to half of the region's total economic output.

Chart 1.1: ICT developments in Europe, 2006-2016*



Source: ITU.

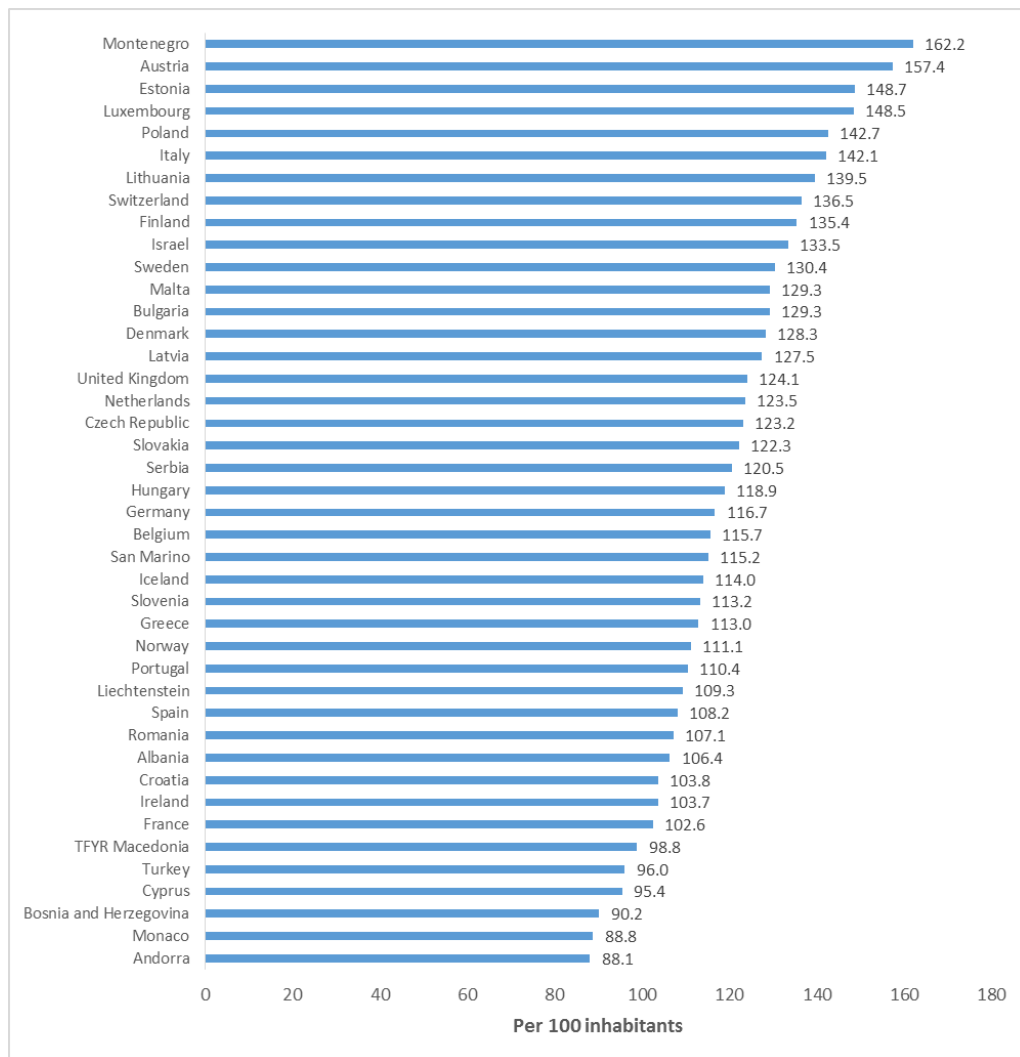
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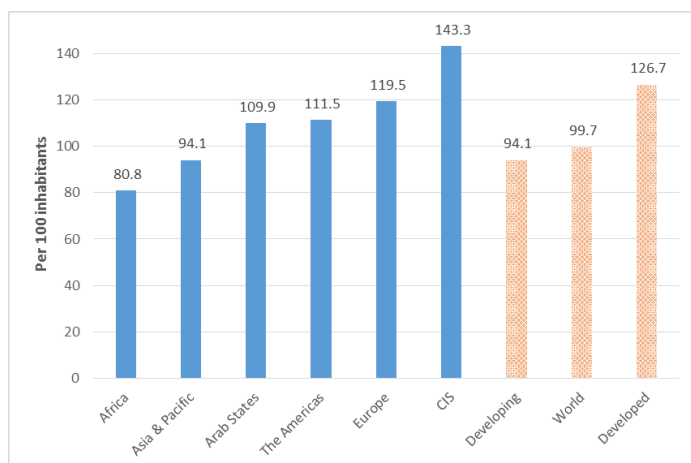
¹ This document was prepared for the ITU Regional Preparatory Meeting (RPM) for Europe, 27 to 28 April 2017, Vilnius, Lithuania. It is based on data and analysis from the ITU ICT Facts and Figures 2016 (ITU, 2016b), the Measuring the Information Society 2016 report (ITU, 2016a) and Trends in Telecommunication Reform 2015 (ITU, 2015).

Mobile market developments

Europe has a relatively saturated voice mobile market. The region has higher penetration levels for mobile-cellular compared to the global average (see Chart 1.2) with 36 out of 43 countries in the region exceeding the global average for mobile cellular subscriptions per 100 inhabitants. Some countries such as Albania, Bosnia and Herzegovina, Monaco, San Marino, and TFYR Macedonia, which still had room for growth in their mobile markets in 2005 had already reached saturation by 2016. Around 18 countries in Europe reported a decline in mobile cellular subscription rates from 2014 to 2015. The reasons for the reported decrease are varied. In a number of countries, the decrease in mobile-cellular subscriptions resulted from the exclusion of specific types of subscriptions such as machine-to-machine (M2M) and data-only subscriptions in order to better comply with internationally harmonized definitions. For other countries experiencing a minor decrease in subscription rates, the increase in population outpaced subscription growth. The rest of the countries experiencing a decreased subscription rate were also countries with current mobile-cellular subscriptions rates greater than 120 per cent, and therefore, potentially saturated voice-mobile markets.

Chart 1.2: Mobile-cellular subscriptions in Europe, 2015 (top) and by region, 2016* (bottom)



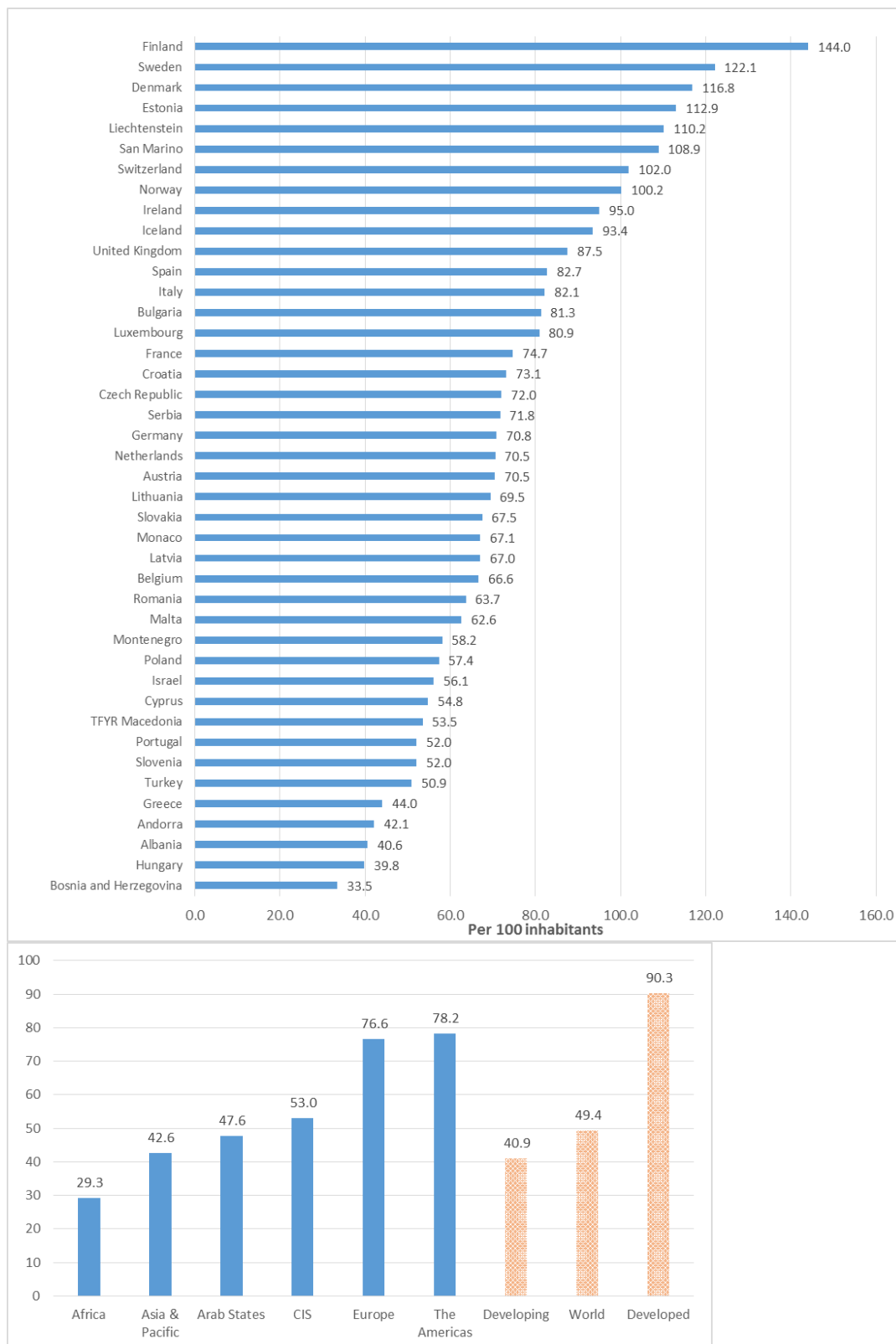


Source: ITU.

Note: * Estimate.

Among the regions, Europe has the second highest mobile-broadband subscription rates. By end 2016, ITU estimates that mobile-broadband subscriptions for Europe reached more than 76 per 100 inhabitants. Within the region, 37 out of 43 countries have mobile-broadband penetration rates higher than the world average of 49 per cent (see Chart 1.3). From 2010 to 2015, Croatia, Lithuania and Belgium saw the most rapid increases in mobile-broadband subscriptions, outpacing countries with higher mobile-broadband penetration levels in 2010. More recently, Montenegro, Bulgaria and Romania experienced the most rapid increases in mobile-broadband uptake. If current growth trends continue, the five countries in Europe with mobile-broadband penetration rates of less than 50 per cent, namely Greece, Andorra, Albania, Hungary, and Bosnia and Herzegovina could also be expected to exceed 50 per cent within five years. Overall, the mobile-broadband market in Europe still has some potential for expansion.

Chart 1.3: Active mobile-broadband subscriptions per 100 inhabitants by country in Europe, 2015 (top) and by region, 2016* (bottom)

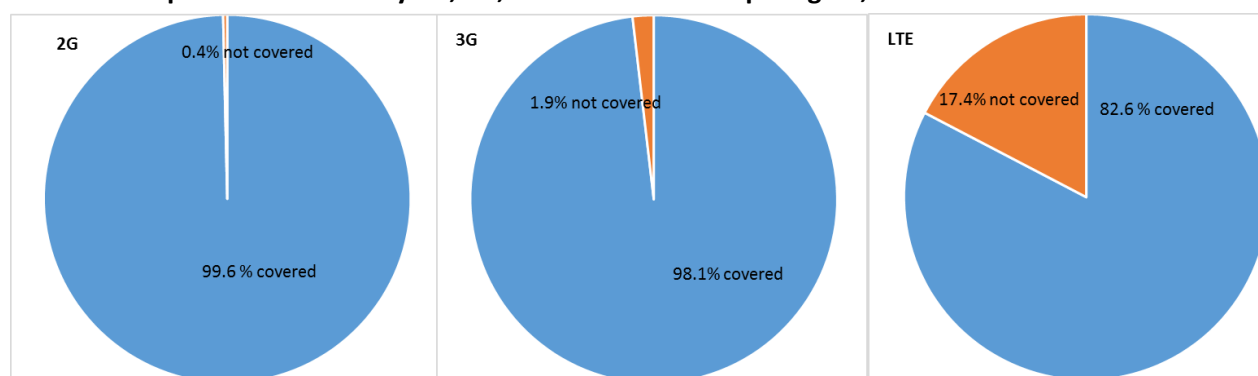


Source: ITU.

Note: * Estimate.

Investments in mobile infrastructure, which are already in place in most countries in Europe, will enable these countries to further expand their mobile-cellular and mobile-broadband uptake. In 2015, close to 100 per cent of the population in Europe were covered by second-generation (2G) mobile networks. At the same time, mobile-broadband coverage has expanded rapidly and 98 per cent of the population are already within the reach of at least a 3G mobile signal (Chart 1.4). Among the 41 countries in Europe that submitted data for their 3G coverage in 2015, all except San Marino reported 3G coverage rates of at least 95 per cent. Similarly, 27 out of 41 countries that submitted data for LTE/4G coverage, reported coverage rates of at least 90 per cent. There is still room to expand LTE/4G network infrastructure in a number of European countries.

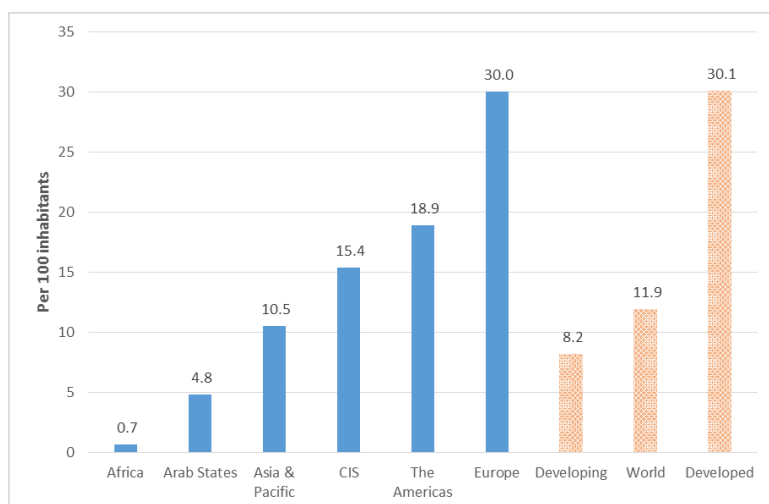
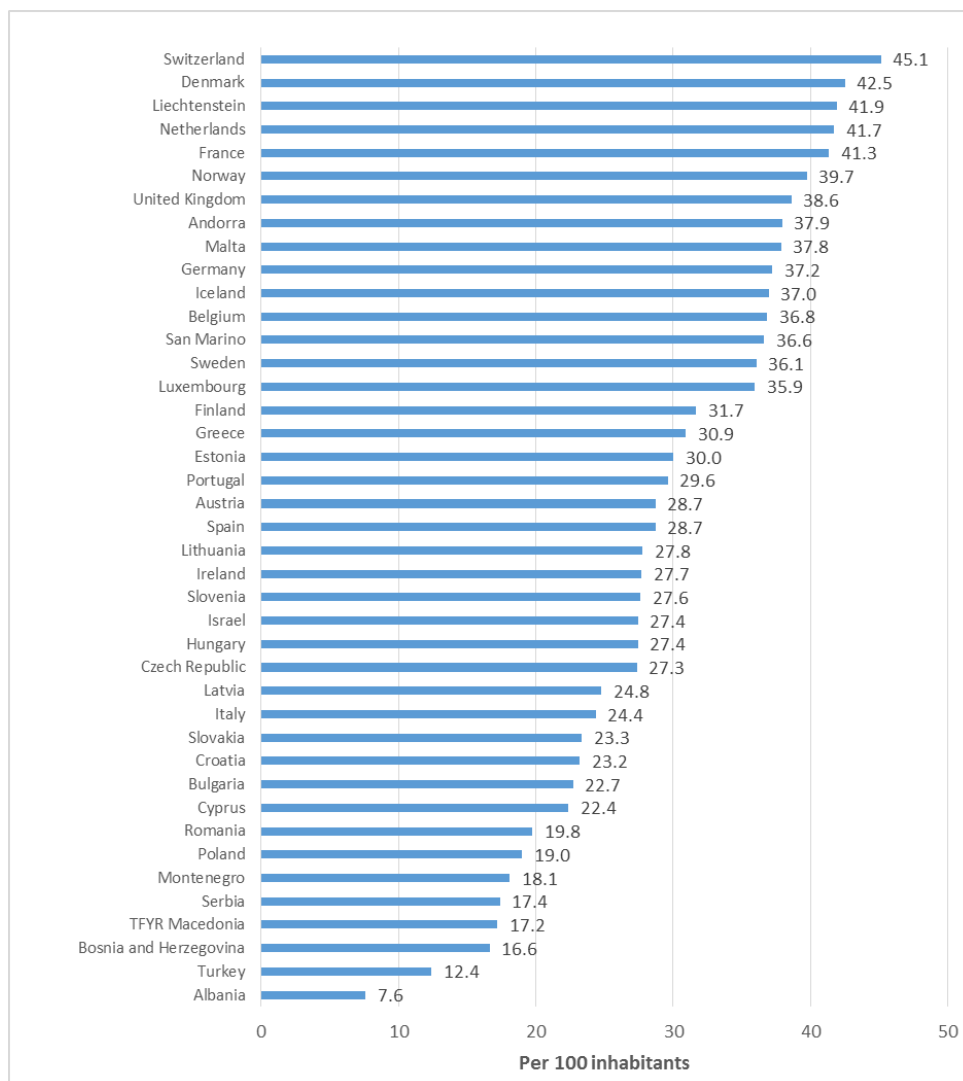
Chart 1.4: Population covered by 2G, 3G, and LTE in the Europe region, 2015



Source: ITU.

Fixed-broadband and international Internet bandwidth

Compared with other regions, Europe has the highest fixed-broadband subscription rates. ITU estimates a fixed-broadband penetration level of 30 per cent for Europe as a whole in 2016, a figure far above the global average of 12 per cent. Within the region, all countries except Albania have achieved a level of fixed-broadband penetration greater than the global average. Between 2010 and 2015, Europe experienced an average of 30 per cent growth in fixed-broadband subscriptions per 100 inhabitants. While Albania experienced the fastest growth rates in fixed-broadband subscriptions per 100 inhabitants from 2010 to 2015, this growth has slowed slightly in recent years. If current trends continue, fixed-broadband subscriptions per 100 inhabitants in Albania may remain below the world average in the next five years.

Chart 1.5: Fixed-broadband subscriptions in Europe, 2015 (top) and by region, 2016* (bottom)

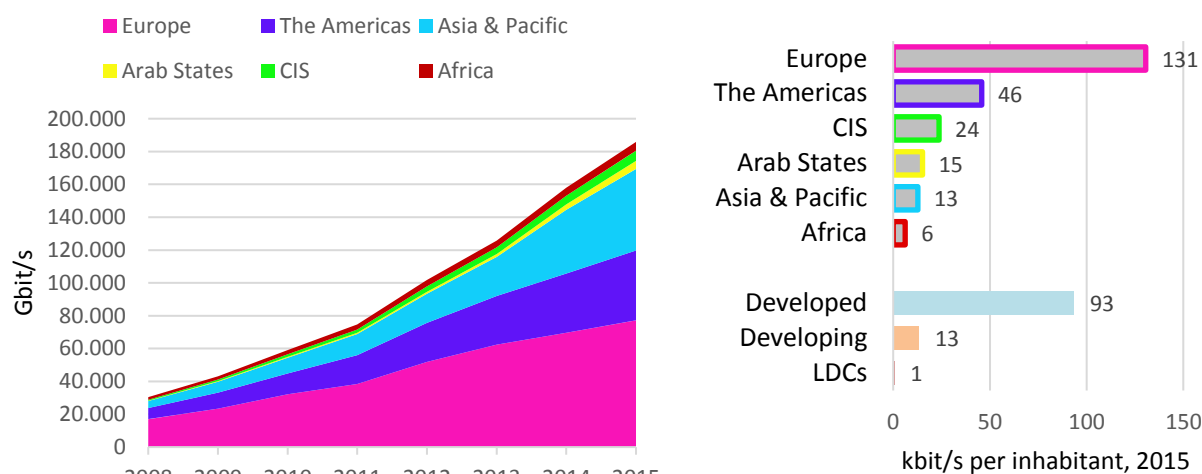
Source: ITU.

Note: * Estimate.

The availability of international Internet bandwidth continues to be an important area for policy and investment, especially given the rising amount of data-intensive applications, cloud-based services and

increasing numbers of Internet users desiring better international connectivity. Europe experienced a four-fold increase in the total amount of international Internet bandwidth between 2010 and 2015. The region now has a total of 77'160 Gbit/s of used international Internet bandwidth. However, due to the increase of bandwidth in other regions, Europe's share of the world's total used international Internet bandwidth has been steadily decreasing from 56 per cent in 2008 to 42 per cent in 2015. In 2015, the amount of international Internet bandwidth per inhabitant in Europe was 131 kbits/s, a figure that is significantly higher than all the other regions (see Chart 1.6).

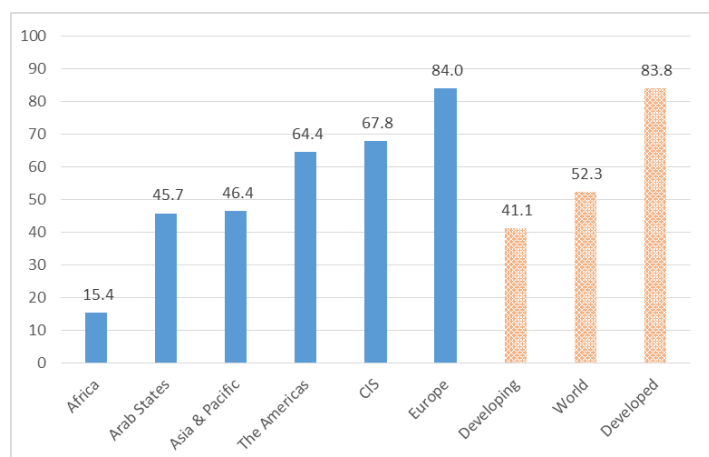
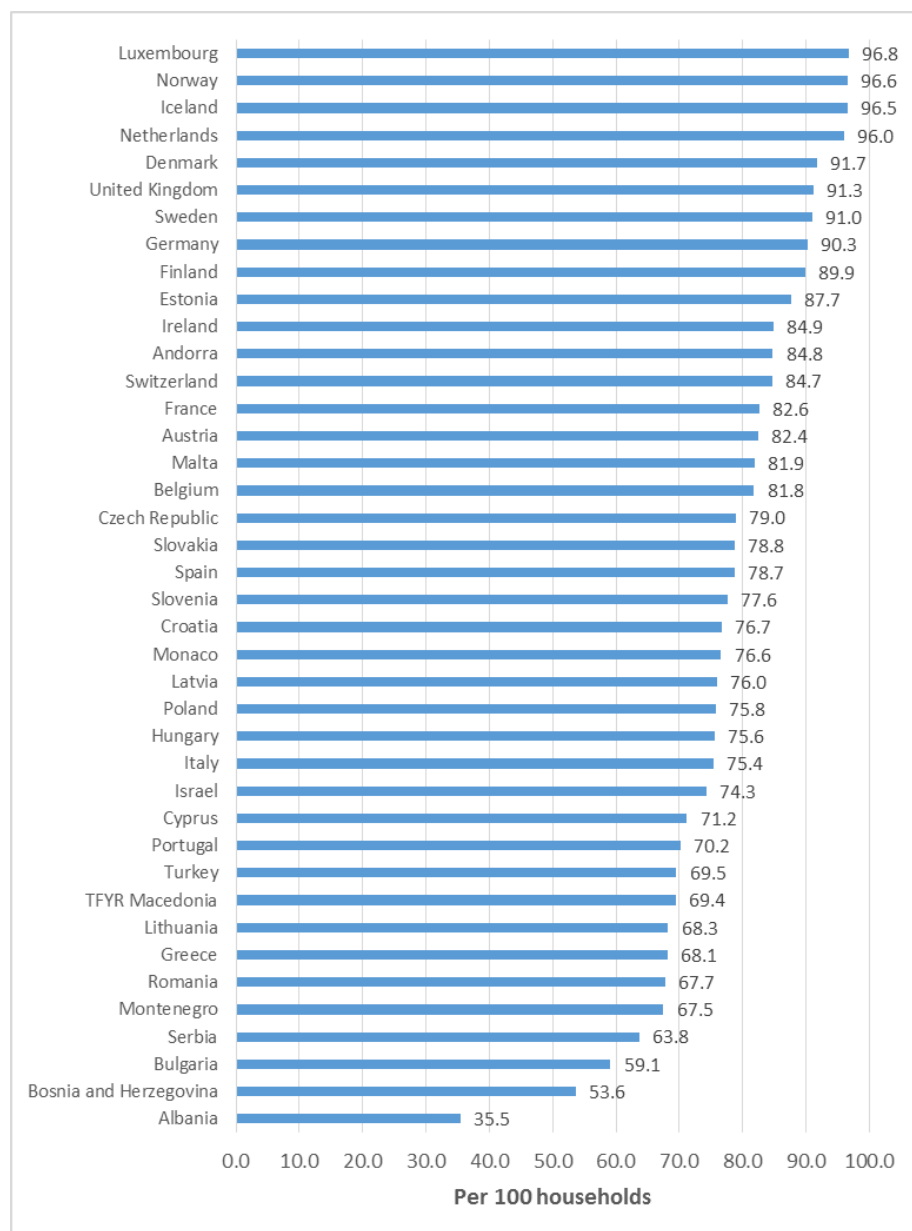
Chart 1.6: International Internet Bandwidth by regions, 2015



Source: ITU.

Internet access, use, and gender gap

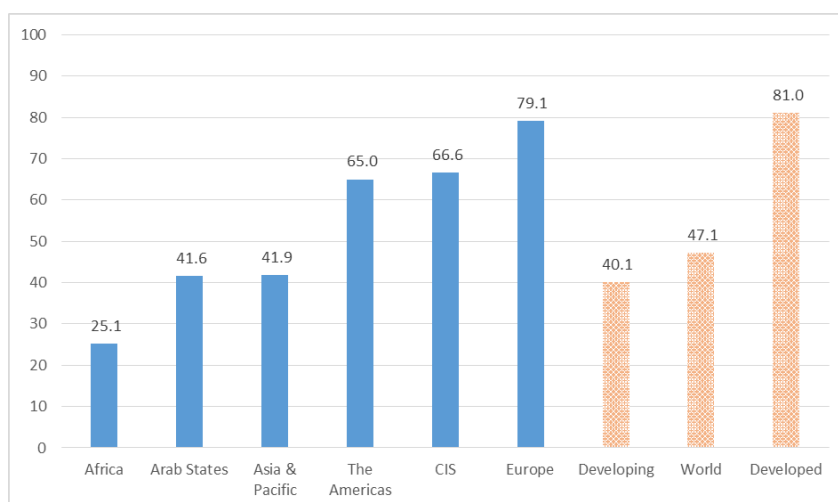
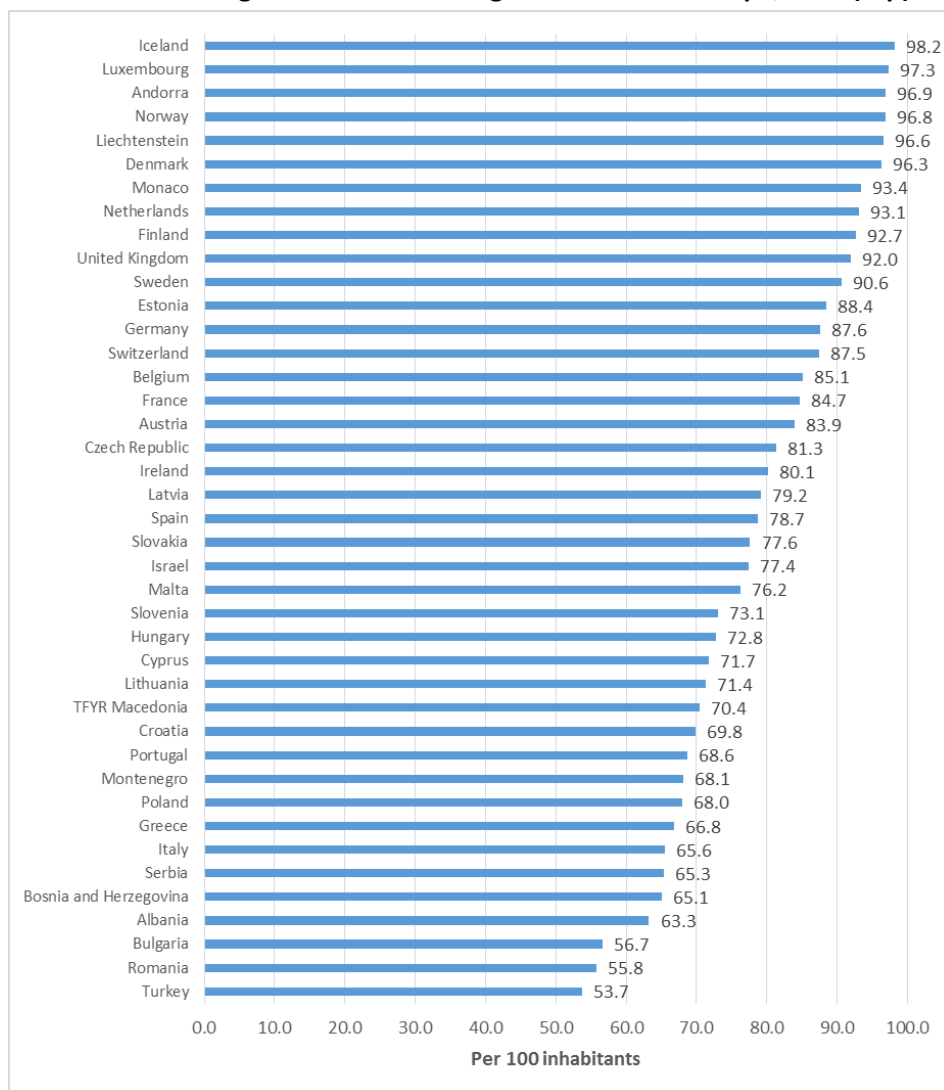
The proportion of households with Internet access at home in Europe as a whole is 84 per cent, a figure significantly higher than the world average of 52.3 per cent (see Chart 1.7). In all European countries, except Albania, more than half of the households are connected to the Internet. Luxembourg, Norway, Iceland and the Netherlands top the list with more than 95 per cent of households with Internet access. Countries where the proportion of households with Internet access is below 70 per cent experienced the fastest growth rates in household connectivity between 2010 and 2015. This suggests that these countries are converging towards the regional average in terms of the proportion of households with Internet access at home. From 2014 to 2015, close to 92 per cent of newly connected households in Europe came from Turkey, Spain, Italy and Romania. In Turkey alone, about 1.7 million new households acquired Internet access at home during this period, representing 42 per cent of newly connected households in the region.

Chart 1.7: Households with Internet access in Europe, 2015 (top) and by region, 2016* (bottom)

Source: ITU.

Note: * Estimate.

The ITU estimates that in 2016, about eight out of ten individuals in Europe were using the Internet. This places the region well above the global average of 47 per cent of individuals reported as Internet users. All countries in the region have individual Internet penetration rates higher than the global average (see Chart 1.8). However, there are still opportunities for expanding the number of Internet users in Europe, especially in countries where the individual Internet penetration rates are below the regional average. Countries in the region increased their Internet penetration rates from an average of 67 per cent to an average of 79 per cent, during the period 2010 to 2015. Countries such as Montenegro, Greece, Serbia and Bosnia and Herzegovina experienced the strongest increases in individual Internet penetration rates during the same period. However, the largest numbers of new Internet users in Europe came from populous countries such as Italy, Spain and Turkey. Together, these three countries account for half of all new Internet users in Europe.

Chart 1.8: Percentage of individuals using the Internet in Europe, 2015 (top) and by region, 2016* (bottom)

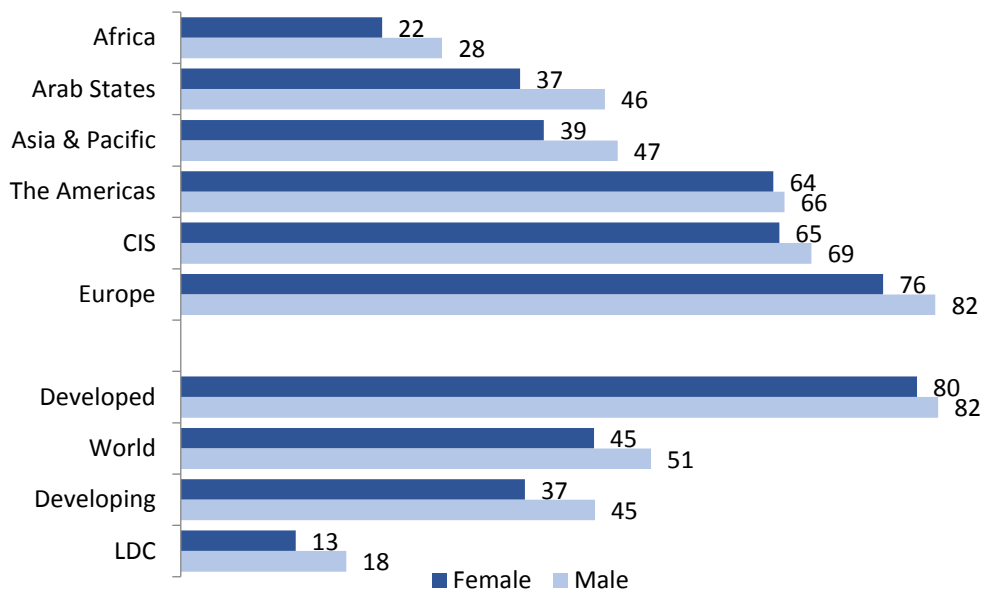
Source: ITU.

Note: * Estimate.

ITU data show that at the end of 2016, proportionally more men than women used the Internet in all regions of the world. Europe has the third smallest gender gap in Internet use among all regions (Chart 1.9).

Between 2013 and 2016, Europe was one of the regions that saw a narrowing of its Internet user gender gap, along with CIS and the Asia-Pacific region (Chart 1.10). Europe experienced two and a half percentage points decrease in its gender gap in the last three years.

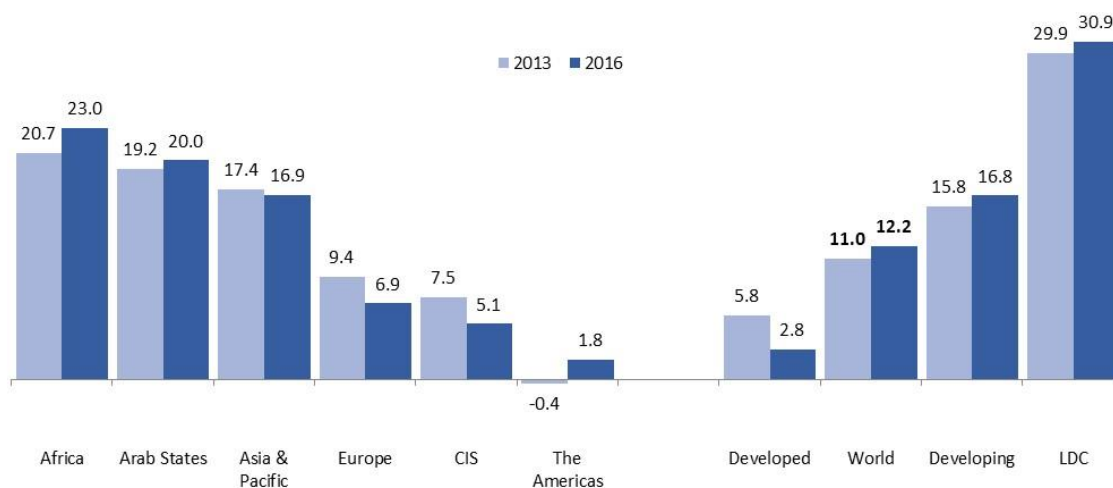
Chart 1.9: Proportion of individuals using the Internet by region, by gender, 2016*



Source: ITU.

Note: * Estimate

Chart 1.10: Internet user gender gap (%), 2013 and 2016*



Source: ITU.

Note: * Estimate. The gender gap represents the difference between the Internet user penetration rates for males and females relative to the Internet user penetration rate for males, expressed as a percentage.

The following two sections feature a regional analysis of the ITU ICT Development Index (IDI) and an overview of the price and affordability of ICT services in the region.

2. The ICT Development Index (IDI)

The ICT Development Index (IDI)¹ is a composite index that combines 11 indicators into one benchmark measure that can be used to monitor and compare developments in information and communication technology (ICT) between countries and over time (Figure 2.1). 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. In the following analysis, the 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).

The main objectives of the IDI are to measure:

- the *level and evolution over time* of ICT developments within countries and the experience of those countries relative to others;
- progress in ICT development *in both developed and developing countries*;
- 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 reflect changes taking place in countries at different levels of ICT development. By looking at the regional level, it is possible to highlight trends and identify reasons why some countries are doing better than others, or lagging behind.

This section will present the results of the regional IDI analysis, and be followed by the analysis of the Europe region. This section will also outline the countries in the Europe region that have improved their position in the overall IDI rankings most dramatically since 2015.

Figure 2.1: 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 bandwidth (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

Source: ITU

IDI 2016 regional 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.²

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 Europe. 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.

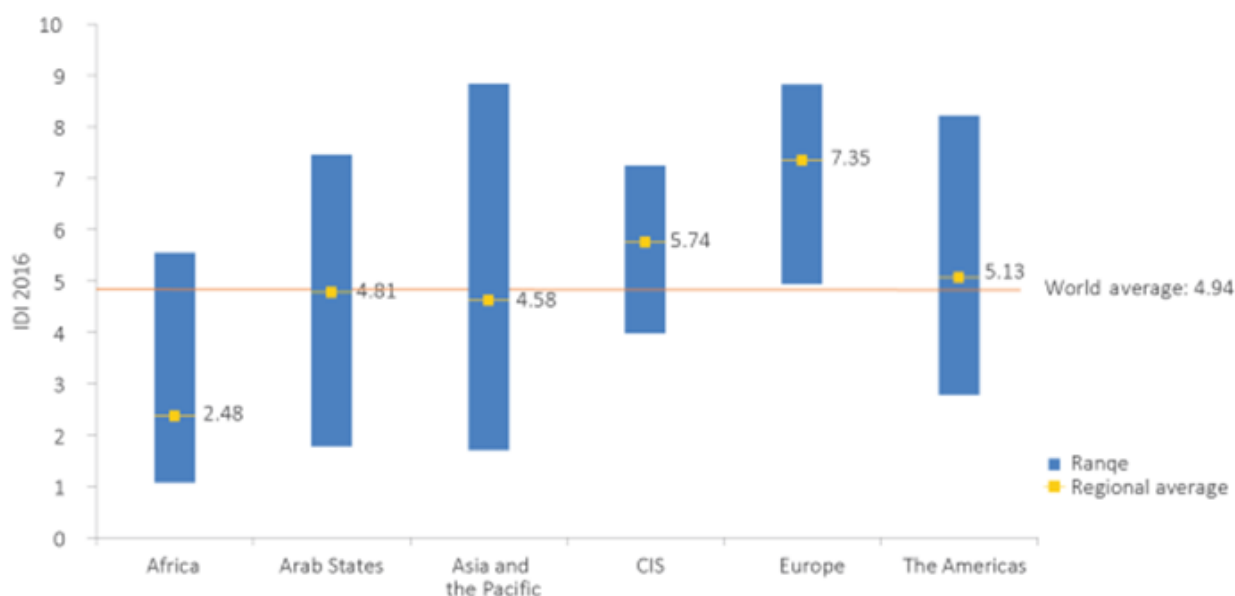
Table 2.1: IDI by region, 2016 and 2015

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.

As in previous years, Europe 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.

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	Regional IDI rank	Country	IDI	Global IDI rank
Europe				Arab States			
1	Iceland	8.83	2	1	Bahrain	7.46	29
2	Denmark	8.74	3	2	United Arab Emirates	7.11	38
3	Switzerland	8.68	4	3	Saudi Arabia	6.90	45
4	United Kingdom	8.57	5	4	Qatar	6.90	46
5	Sweden	8.45	7	5	Kuwait	6.54	53
36	Montenegro	6.05	62	14	Syria	3.32	122
37	TFYR Macedonia	5.97	65	15	Sudan	2.60	139
38	Turkey	5.69	70	16	Mauritania	2.12	151
39	Bosnia and Herzegovina	5.25	80	17	Yemen	2.02	155
40	Albania	4.92	91	18	Djibouti	1.82	161
Asia & Pacific				CIS			
1	Korea (Rep.)	8.84	1	1	Belarus	7.26	31
2	Hong Kong, China	8.46	6	2	Russian Federation	6.95	43
3	Japan	8.37	10	3	Kazakhstan	6.57	52
4	New Zealand	8.29	13	4	Azerbaijan	6.28	58
5	Australia	8.19	14	5	Moldova	5.75	68
30	Bangladesh	2.35	145	6	Armenia	5.60	71
31	Pakistan	2.35	146	7	Georgia	5.59	72
32	Kiribati	2.06	152	8	Ukraine	5.33	76
33	Solomon Islands	2.04	153	9	Uzbekistan	4.05	110
34	Afghanistan	1.73	164	10	Kyrgyzstan	3.99	113
The Americas				Africa			
1	United States	8.17	15	1	Mauritius	5.55	73
2	Canada	7.62	25	2	Seychelles	5.03	87
3	St. Kitts and Nevis	7.21	34	3	South Africa	5.03	88
4	Barbados	7.18	35	4	Cape Verde	4.60	97
5	Uruguay	6.79	47	5	Botswana	4.17	108
30	Guyana	3.52	121	35	Burundi	1.42	171
31	Guatemala	3.20	123	36	South Sudan	1.42	172
32	Honduras	3.09	126	37	Guinea-Bissau	1.38	173
33	Nicaragua	2.88	131	38	Chad	1.09	174
34	Cuba	2.73	135	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 relative importance of growth in mobile-cellular subscriptions in the

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



The smoothest distribution of results across the range of indicators – with relatively high performance across the board – is observed in Europe. 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.

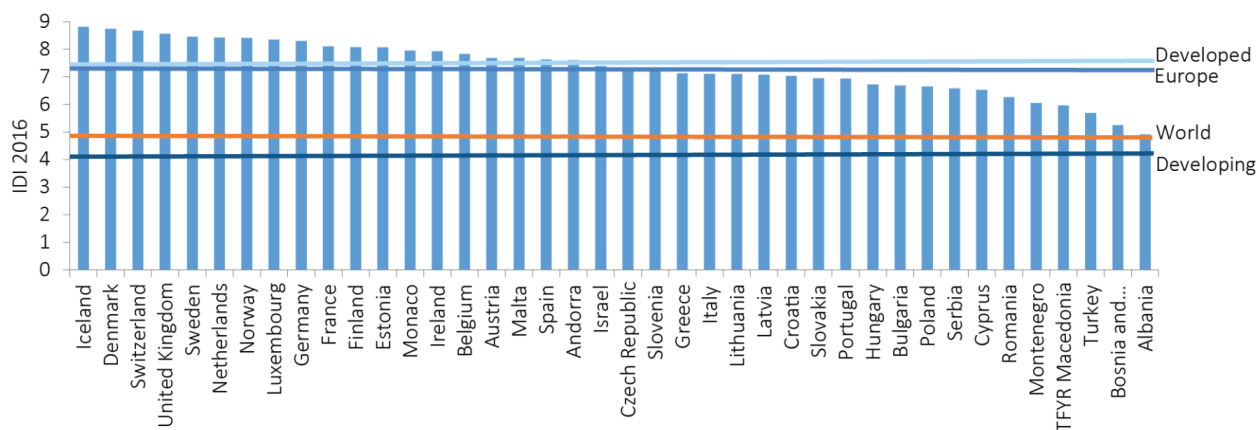
The spider chart for the Africa region is much less smooth than those for other regions. This reflects particularly low indicator values in Africa for fixed-telephone and fixed-broadband subscriptions and for household Internet and computer access, as well as for enrolment in tertiary education. The 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 IDI 2016 in Europe

IDI values and rankings for Europe are set out in Chart 2.3 and Table 2.3.

Europe is the region which boasts the highest average IDI value, at 7.35, just below the developed-country average of 7.40. 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 Europe with an IDI value below the global average (4.92, as against a global average of 4.94).

Chart 2.3: IDI values, Europe, 2016



Source: ITU.

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 2.3: IDI rankings, Europe, 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.

Europe: most dynamic countries in the IDI

The average increase in IDI values in Europe 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 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.

Box 2.1: 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.

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).³ 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 2.2: 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 (Telia⁴, TDC⁵ and Telenor⁶) 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 2020.⁷

Table 2.4 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 below).

Table 2.4: Most dynamic countries by IDI ranking and IDI value, Europe, 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.

Chart 2.4 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.

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

Chart 2.4: IDI values, selected countries, Europe region, 2015-2016

Source: ITU.

High-income developed countries in Europe – with some exceptions (see above) – 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.

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. Further information about Romania and Albania can be found in Boxes 2.1 and 2.4 below.

Box 2.3: 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).⁸ Later in 2015, it launched LTE, the last operator in the country to do so.⁹ In September 2015, Orange launched VoLTE services in the country.¹⁰

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.

Box 2.4: ICT and IDI developments in Albania

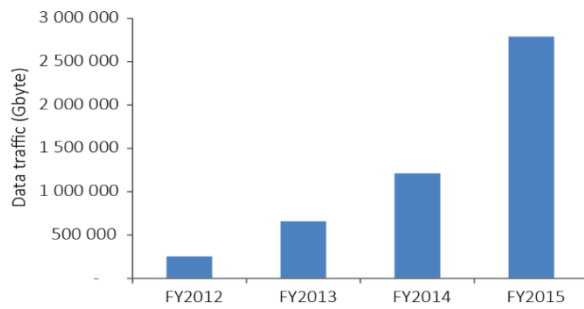
Albania ranks 91st in IDI 2016, and has improved its IDI value from 4.62 in IDI 2015 to 4.92 in IDI 2016. The most significant progress in the country has been made in Internet uptake and in the growth of households with a computer, the latter having risen from just 4.9 per cent in 2006 to 25.7 per cent 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.¹¹ Telekom Albania (OTE) was the first operator in Albania to launch LTE in July 2015 and LTE-A in September 2015,¹² followed by ALBtelecom and Vodafone which both launched LTE in September 2015.¹³ 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 3.12).

Chart Box 2.4: Growth in data traffic in Albania



Source: OTE (2016).

3. Monitoring the price and affordability of ICTs in Europe

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.¹⁴ 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.

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, 2015a).

To identify trends and track the affordability of ICT services, ITU collects and publishes price data for fixed-telephone, mobile-cellular and fixed- and mobile- broadband services.

The following section, which is based on prices collected at the end of 2015, will look at the development of mobile-cellular prices in the Americas region and show some regional differences in the affordability of mobile- cellular prices, based on the mobile-cellular price basket. This will be followed by an analysis of prices in the fixed- and mobile broadband market, and some pricing trends in the dynamic mobile-broadband services segment.

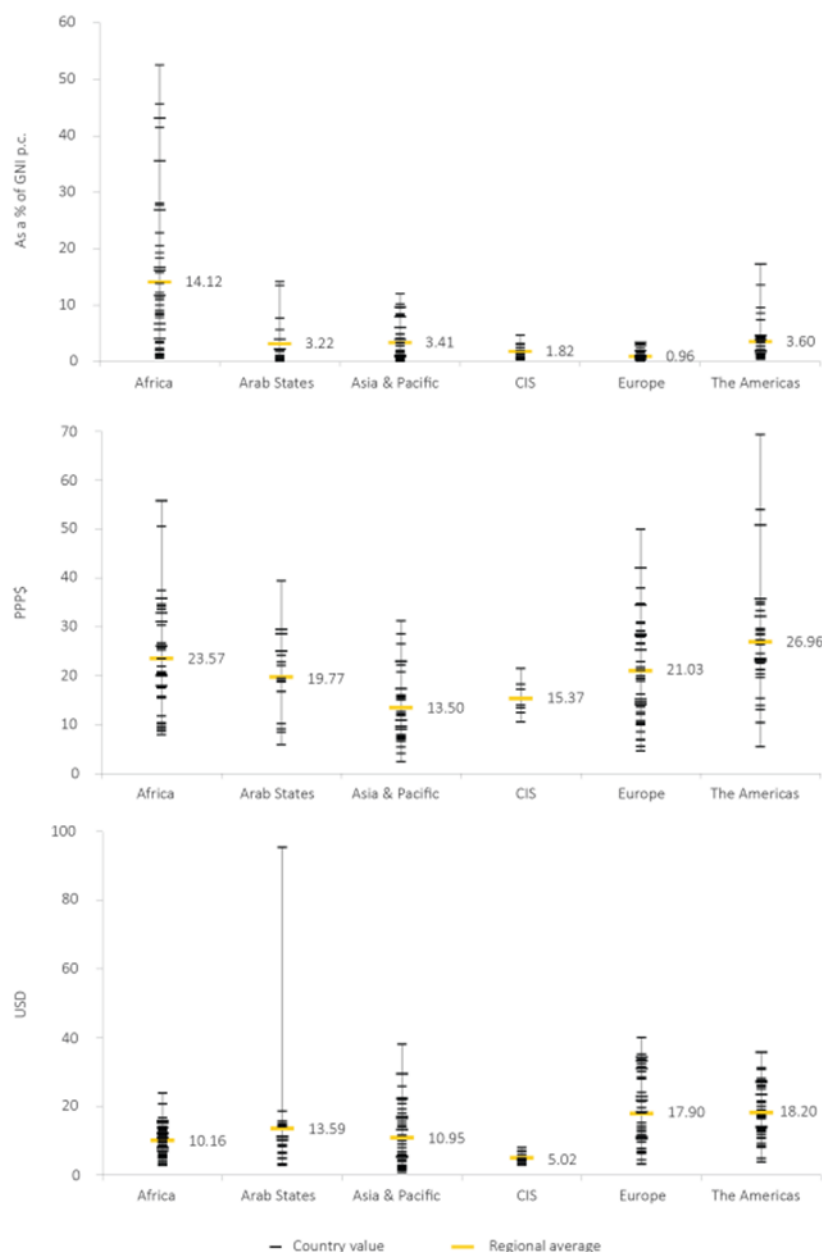
Mobile-cellular prices in Europe

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.

A regional analysis of mobile-cellular prices reveals some differences across and within regions (see Chart 3.1). 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.

Chart 3.1: Mobile-cellular prices as a percentage of GNI p.c. (top chart), in USD (middle chart), and PPP\$ (bottom chart) 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.

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.

Table 3.1: Top five countries with the cheapest mobile-cellular services in each region, PPP\$, 2015

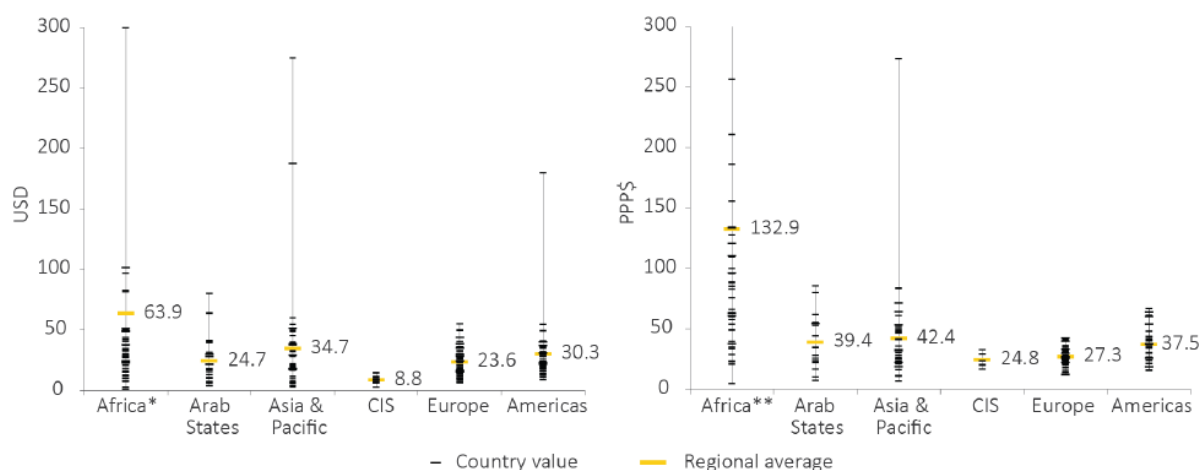
Europe		Asia & Pacific		The Americas	
Country	PPP\$	Country	PPP\$	Country	PPP\$
Estonia	4.67	Sri Lanka	2.45	Costa Rica	5.51
Lithuania	5.59	Bangladesh	4.14	Venezuela	10.41
Latvia	6.84	Iran (I.R.)	5.43	Paraguay	10.45
Austria	6.97	China	6.63	Jamaica	13.10
Cyprus	8.56	Pakistan	7.04	Mexico	13.90
Arab States		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 CIS countries.
Source: ITU

Fixed-broadband prices in Europe

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.

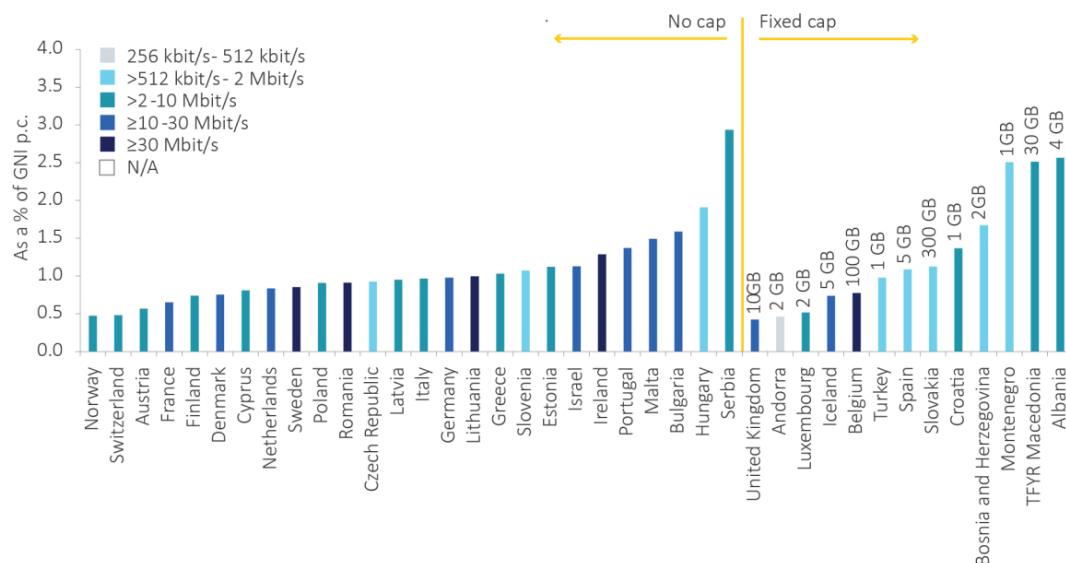
A regional comparison of fixed-broadband prices, speeds and data caps highlights important differences between, as well as within, regions. Africa remains the region with the greatest divergence in absolute and relative price for Internet access, while the CIS region has relatively low, and similar, 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 3.2).

Chart 3.2: 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 subscriptions 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

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 (PPP\$ 27) – high income levels make the service very affordable (Chart 3.2). 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 3.3)

Chart 3.3: 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.

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

Mobile-broadband prices in Europe

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.

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 3.2). 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.

Table 3.2: 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%

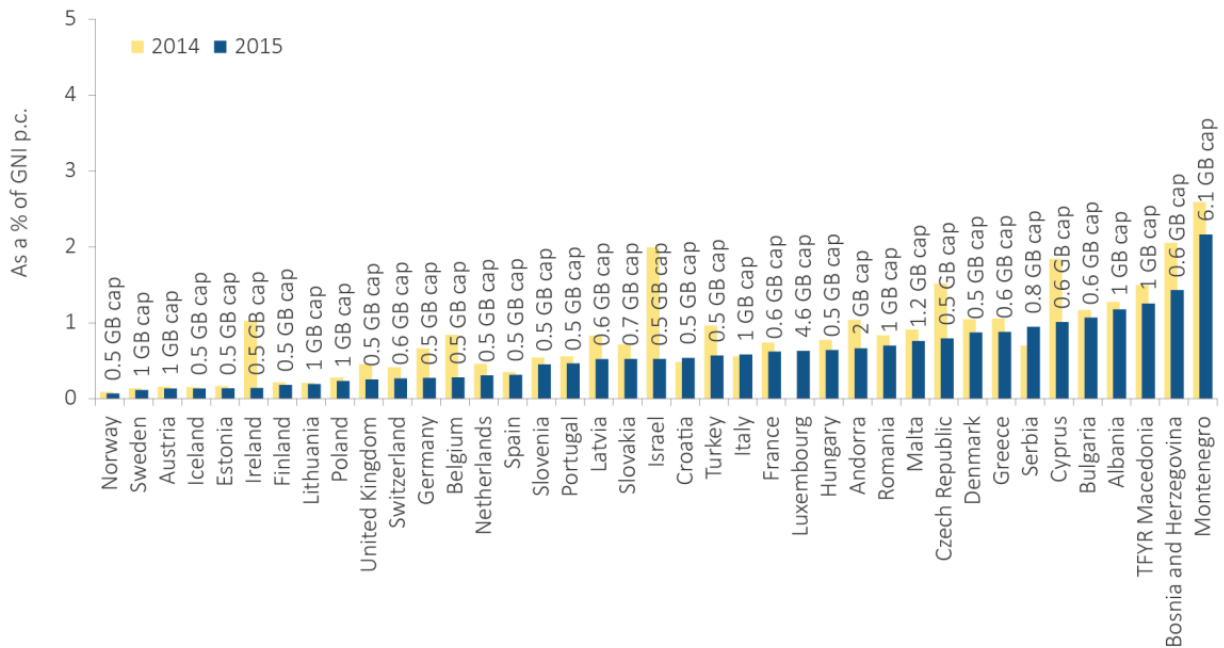
Note: * Simple averages based on 155 countries for which 2014 and 2015 price data for all mobile-broadband services were available.

Source: ITU

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.

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.¹⁵ 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 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 3.4).

Chart 3.4: Prepaid handset-based mobile-broadband prices (500 MB per month) as a percentage of GNI p.c. and data volume (cap) included, Europe, 2015 and 2014



Note: The caps indicated refer to the 2015 prices.

Source: ITU. GNI p.c. values based on World Bank data.

4. Regulatory trends

Communication networks and services have become more efficient with the use of digital technologies and have enabled the emergence of smart cities, smart nations and smart societies. This has benefitted people, businesses and government.

ICT policies and regulations have a crucial role to play to create an enabling environment to bridge the digital divide. The disruption of the ICT sector is putting ICT regulators and policy makers under pressure to continuously review, adapt and anticipate changes to ensure that their national ICT regulatory framework remains relevant.

In building smart connected societies and seeking to achieve the Sustainable Development Goals, policy makers and regulators together with all stakeholders face similar concerns requiring common solutions. There is a need to work together to create an enabling regulatory environment across the sectors and remove the barriers that hinder progress. Adopting more flexible and inclusive policy and regulatory frameworks and holding inclusive dialogues with relevant stakeholders to fully embrace the potential of the digital economy remains more critical than ever.

Regulators and policy makers also need to strengthen their enforcement powers to respond to the challenges of the dynamic digital environment. Sector reform is an ongoing process promoting social and economic development in the ICT sector and beyond through best-practice regulation.

Furthermore, the development of the global digital connected society requires trust and security, based on sound regulation of the use of personal data. Cultural and conceptual differences between countries on the issues of privacy and data have not allowed to shape a global regulatory framework. A way forward can be the global acceptance of a broad human rights-based concept of data protection that states must apply to everyone affected by their actions, irrespective of nationality or legal status or the place where they live.

The global digital connected society can only develop in and between states that accept this fundamental principle.

Tracking the evolution of regulation

The dawn of the global digital economy has opened the way to a ladder of regulation or five generations of ICT regulation. In response to market and technology developments, policy-makers and regulators face ever louder calls to ensure access to digital infrastructures, so that consumers and societies can be empowered and ICTs can be fully leveraged to achieve SDGs. Broadband networks and internet services are increasingly viewed as a commodity – while access to them has even become a right in some countries – their availability and performance impact every aspect of the development of the economy and society today.

The interaction of the ICT sector for stimulating growth in the digital economy alongside other sectors needs to be understood and, wherever possible, managed by policy and regulatory frameworks of a new kind. To shape these, however, it is essential to have a clear understanding of the complex relationships between regulatory policies and ICT growth. It is also important to quantify recent trends and learn from successful past experiences.

To do so, ITU has developed the ICT Regulatory Tracker, an evidence-based tool to help decision-makers and regulators to make sense of the rapid evolution of the ICT sector regulation. More than a look back, the Tracker, a powerful analytical tool, helps pinpoint the strengths and weaknesses of regulatory interventions to provide a learning curve for achieving a vibrant and innovative ICT sector (see Box 5.1).

Box 5.1: Making sense of regulatory trends: the ITU Regulatory Tracker

ITU has built a new tool to monitor and measure the changes taking place in the telecommunication/ICT regulatory environment. Using quantitative methods and data gathered through the annual ITU World Telecommunications/ICT Regulatory Survey, the *Tracker* makes both benchmarking and the identification of trends in legal and regulatory frameworks in the ICT sector possible. The countries included in the *Tracker* are split into score thresholds that relate to generations of regulation to help analyse the evolution of ICT regulation worldwide and its future perspectives.

The *Tracker* covers up to 156 countries out of the 193 ITU Member States or the period from 2003 through 2013, showcasing progress within the same country, amongst countries and regions as well as worldwide. The full set (50 indicators) is available for the period 2007-2013, and will be updated annually. It is built on self-reported data gathered yearly via ITU's World Telecommunication Regulatory Survey and on compiled desktop research.

The *Tracker* was established by assessing the various dimensions of the regulatory environment: the regulatory authority itself; which segments and services that are regulated; the scope and direction of the regulations; and the enabling of a competitive environment. A variety of traditional and new regulatory matters is included, in four clusters: the regulatory authority, regulatory mandates, the regulatory regime and competition framework in the ICT sector (see Table 5.1 below).

Table 5.1: ICT Regulatory Tracker summary structure (full set), 2007-2013

Cluster	Name	Nb indicators	Max score	Min number of indicators for countries to be ranked
1	Regulatory authority	10	20	3
2	Regulatory mandates	11	22	3
3	Regulatory regime	15	30	4
4	Competition framework	14	28	4
Totals	ICT Regulatory Tracker	50	100	14

Note: For the full set of indicators, see the technical notes in Trends in Telecommunication Reform 2015, Chapter 1

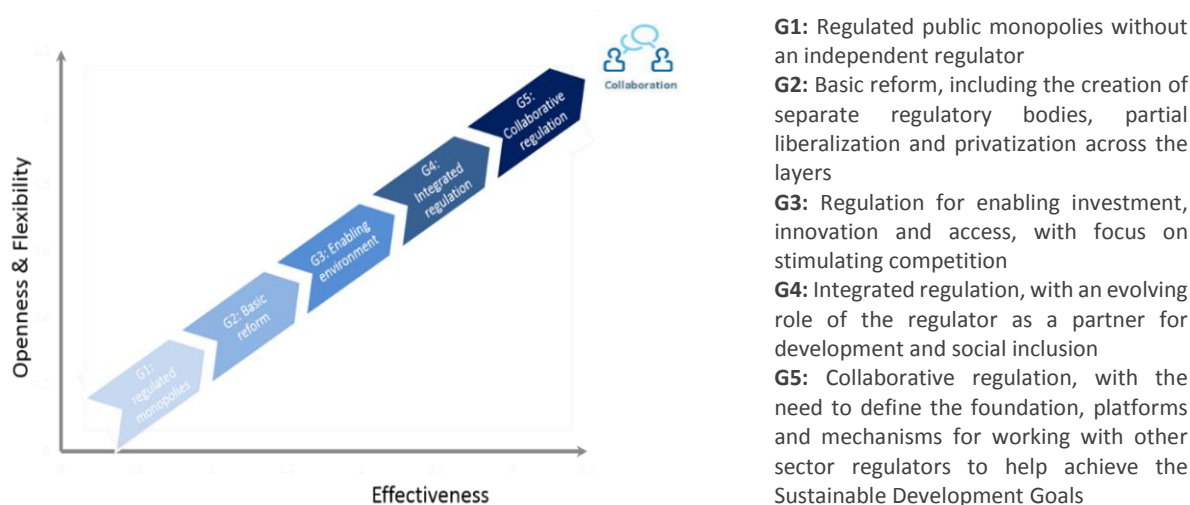
The assessment made by the Tracker is of both qualitative and quantitative order. All indicators have been scored between 0 and 2. The reference for the scoring is what is considered the best possible scenario-based on the internationally recognized regulatory best practices adopted by the global community of regulators at the annual ITU Global Symposium for Regulators.

The 2015 version of the ICT Regulatory Tracker was released in March 2017 in the ITU ICT Regulatory Outlook Report 2017. It covers 186 countries and economies and provides in-depth analysis on ICT market and regulatory trends.

Monopoly, private or publically-owned and managed utilities, were overseen by first generation regulations with the intent to encourage improvements in efficiency and service – in effect regulations simulated competition. With part privatization and licensing of competing infrastructure the second generation of regulations focused on ensuring the incumbent made its infrastructure available in a nondiscriminatory manner, often under pressure to look after the interests of Government shareholdings. With full privatization and a move towards service rather than infrastructure competition the independent third generation of regulations focused on net neutrality requiring protection of sustainable competition

in services and with the growth in content delivery, an increased need for consumer protection arose (see Chart 5.1).

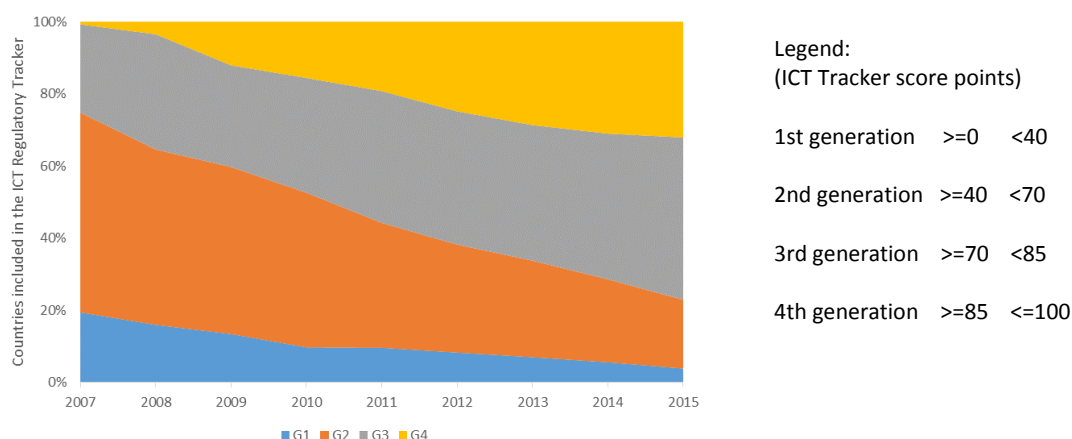
Chart 5.1: Generations of regulation



Source: ITU.

Greater complexity and a cross-sectoral view, expanding beyond ICTs, are some of the main features of fourth-generation regulation, leading to fifth generation collaborative regulation. Market and technology developments have stimulated a move to fourth generation regulators to tackle a different challenge – a challenge of regulatory purpose. Fourth-generation regulation characterized by agility and flexibility has been rapidly gaining momentum over the past decade. One out of four surveyed countries now enjoys a fourth-generation regulatory environment that allows for leveraging on the ICT sector to achieve economic growth and social development across the economy (see Chart 5.2). Not all of those countries have yet fully realized digital opportunities; however, they have opened a way to meaningful change and can expect tangible improvement of their ICT sectors as well as the entire economy over the short- to medium-term.

Chart 5.2: Evolution in ICT Regulation, 2007-2015



Source: ITU.

Overall, the regulatory environment is steadily enhanced in the great majority of countries worldwide, as countries have been gradually transitioning to higher generations of regulation. The number of countries in the first- and second-generation categories of regulation has been cut by half in less than a decade, going from two-thirds to less than one-third of countries. This positive outlook reflects the dynamic pace of technological and business innovation faced by telecom/ICT regulators, a reality that challenges them to adapt to the new digital world order.

We stand at the edge of fifth-generation regulation which builds on complementarity and synergies. Fifth-generation regulation is about cross-sectoral collaboration along with innovative regulatory approaches such as co-regulation and self-regulation, leading to new forms of collaborative regulation.

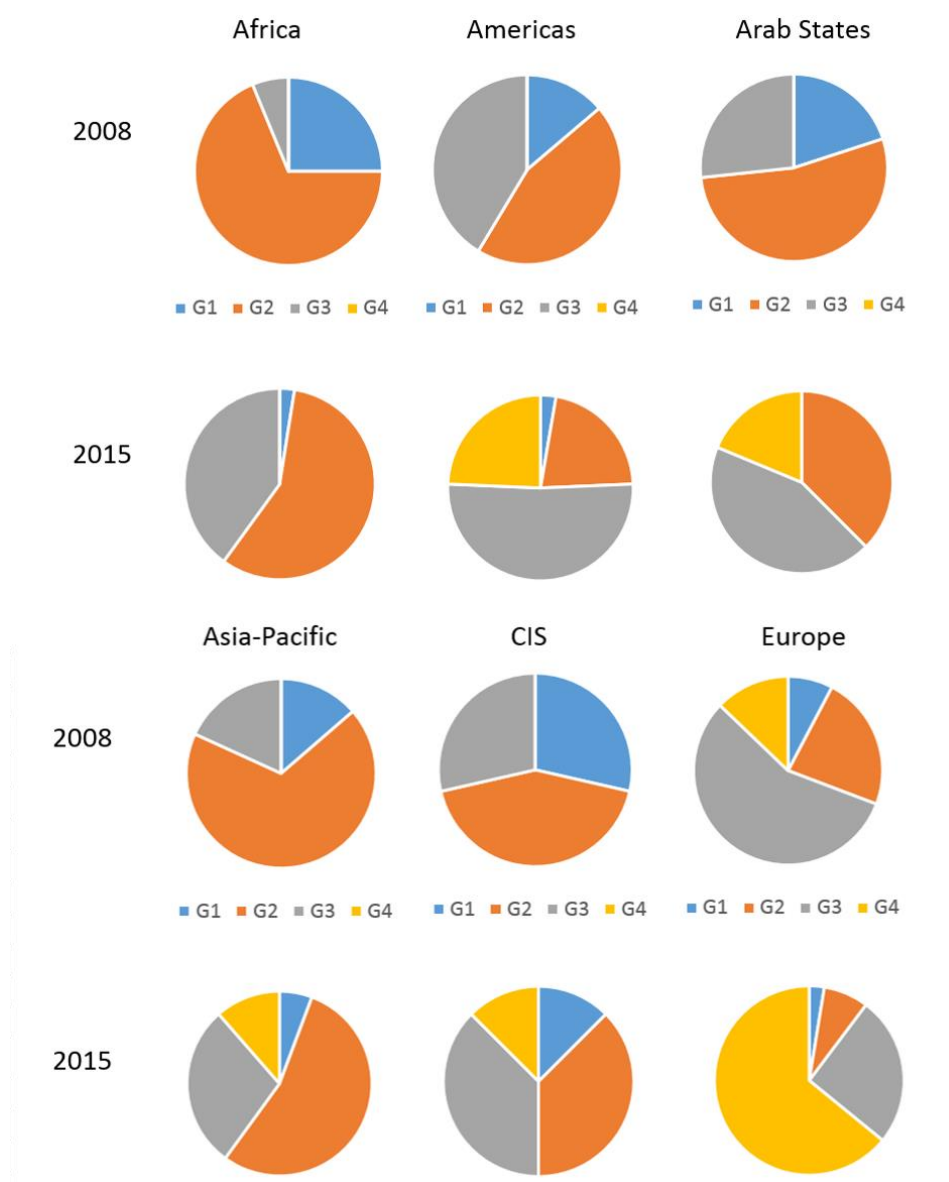
Trends as a result of the evolution of regulation

But what does the evolution of regulation mean, in real terms?

Looking closely at trends in regulatory evolution across different regions, it is evident that there are different tiers and speeds of regulatory development. Beginning from a largely unfavorable regulatory setting in 2008, which was dominated by second-generation regulation, Arab States has achieved a great leap forward. Asia-Pacific countries and Africa have followed a similar pattern over the same period, swiftly moving to higher generations of regulation. One out of five Arab States belongs today to the fourth generation of ICT regulation. CIS countries have evolved at a slower pace and in 2015 counts, roughly as many countries with first and second-generation regulation as with third and fourth (see Chart 5.4.5).

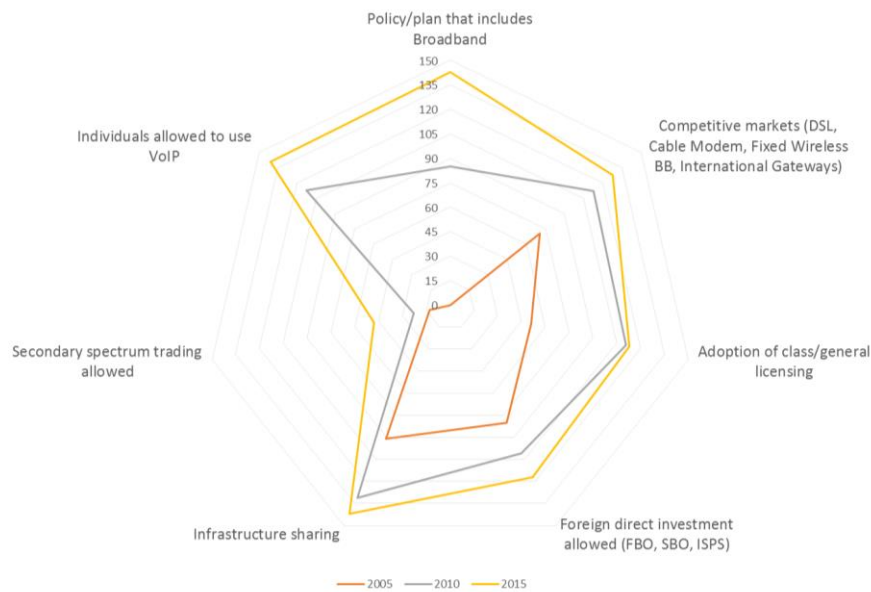
Europe has been the cradle of the fourth generation of regulation and not surprisingly, not only the transition has started earlier, but it has also been achieved much faster than in the other regions, with Europe counting two thirds of countries in the fourth-generation of regulation versus only 10 per cent of countries with either first or second generation. The overall level of regulatory maturity in the Americas was already higher than the other developing regions back in 2008 and the region remains the second most advanced worldwide in 2015, with two-thirds of countries with over third- and fourth-generation regulation (see Chart 5.3). Overall, the pace of regulatory change has been sustained and compared to other sectors of the economy, change has been happening more swiftly, raising expectations to ICT regulators and opening way to ever more impressive technologies and business models.

Talking about evolution, not all areas of ICT regulation have been evolving at the same pace. Quantitative mapping of key areas of regulation allows for tracking trends across the board (see Chart 5.5). Competition in end-user broadband markets, undoubtedly one of the most powerful boosters of connectivity and use of digital services, has been steadily expanding over the past decade, ruling over 128 markets in 2015. Infrastructure sharing has been gaining momentum, in particular in the aftermath of the global financial crisis of 2008, enabling the leveraging of established facilities to drive service innovation and diversify revenues. Licensing of operators and service providers has gone a long way since the advent of fixed and mobile broadband. The liberalization of licensing regimes has facilitated a crowded ICT market place today – from service-specific individual licenses to multi-service and class licenses to general authorizations.

Chart 5.3: Every region is different: improving regulatory patterns, 2008-2015

Source: ITU.

Some of the first converged digital services that used to be the privilege of the few users with broadband connection a decade ago have been widely democratized. Voice-over-IP (VoIP) has grown into one of the most popular free services. Regulation, or more accurately, the removal of regulatory barriers, has been an important facilitator. Other regulatory practices have experienced slower adoption and remain limited to relatively fewer jurisdictions. With spectrum trading or net neutrality, however, such practices can have a significant impact on the development of national markets. Last but not least, new policy instruments have also come of age, since new issues may need to be addressed in new ways. National broadband plans and related policies which mainly came to prominence after the 2008 global financial crisis as a means of channeling stimulus funding, have now widespread in 143 countries and are being used to reconnect economic sectors to improve efficiencies and create new business opportunities.

Chart 5.4: Screening regulatory practices: which regulations have shaped the ICT sector? 2005-2015

Source: ITU.

Box 5.2: Winning formulas for fixed and mobile broadband markets

It is widely recognized that the quality of regulation is a key success factor to the development of vibrant digital economies. Based on evidence produced with the *ICT Regulatory Tracker*, the choice of regulatory intervention(s) appears to have an equally strong impact on stirring up market growth.

More precisely, the combination of a handful of regulatory measures is closely associated with a catalytic effect on market take-up. With respect to mobile-broadband penetration, countries with a broadband plan, competition in both the mobile sector and international gateways, infrastructure sharing, mobile number portability and band migration, systematically outperform countries lacking some or all of those regulatory settings.

As of the end of 2013, countries having applied this “winning formula” to their mobile broadband markets had an average national penetration rate of close to 60 per cent compared to a world average of 27 per cent, or more than twice lower. In the short-term, these measures seem to have had a booster effect associated with the trebling of mobile-broadband penetrations (since 2011), an effect which tends to slow down slightly over the medium-term and, potentially, the long-term. In a similar way, fixed broadband markets seem to have their “winning formula”, too.

The top-five measures on record are a Broadband Plan, open competition in wireline broadband technologies, an advanced licensing framework (featuring either unified licenses or a general authorization regime) combined with an infrastructure sharing policy and provisions for fixed number portability.

Countries which have realized the potential of those regulatory pillars are associated with consistent performance above the curve, achieving, on average, fixed broadband penetrations 13 to 16 per cent higher than the global average.

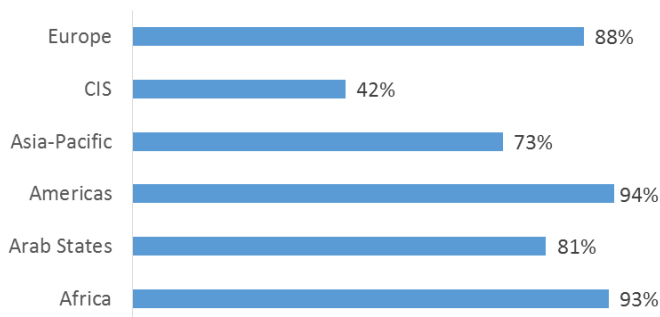
Within reasonable limitations, this quantitative evidence suggests that best-practice regulation does matter and both the design and the effective enforcement of regulatory frameworks are essential for broadband markets to thrive. The *ICT Regulatory Tracker* can serve as a sound benchmarking tool for a range of regulatory cases.

Source: ITU.

Regulatory trends in Europe

In Europe, 38 countries out of the 43 (or 88 per cent) have established a Telecommunication/ICT regulatory Authority (see Chart 5.5). All of them have today the power to enforce pro-competitive regulatory decisions, compared to 85 percent of them 10 years ago. This very positive trend witnesses the ever more important role of regulators in the digital era, which are expected to juggle competing interests, ensure a level playing field, promote transparency and create an environment that nurtures the technological and service innovation.

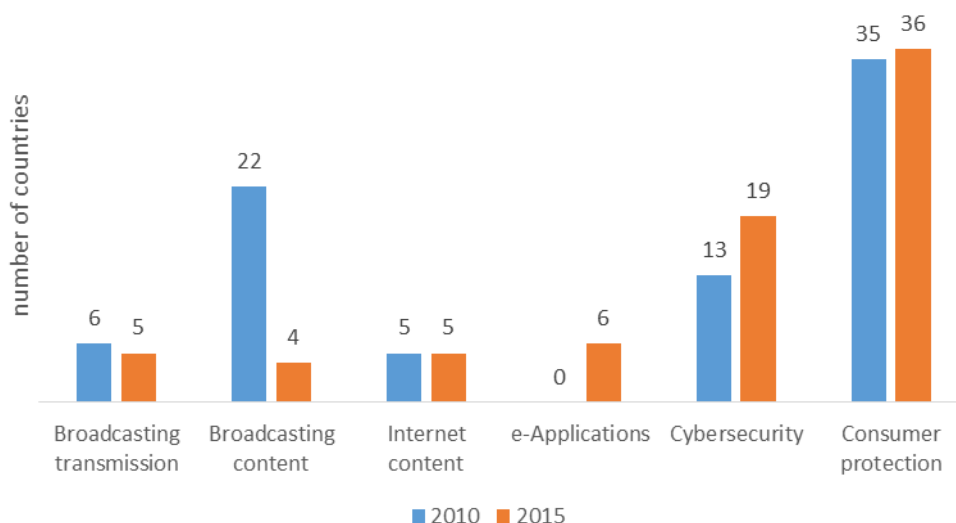
Chart 5.5: Countries with a separate regulator, by region, 2015



Source: ITU.

From the outset, the mainstay of regulators in Europe has been regulating access to telecommunication networks (including interconnection, licensing, quality of service monitoring, etc.) and prices of services. They have been called upon to pursue public policy objectives, such as universal ICT access or service, and new issues are being integrated into the expanding regulatory mandates. Some ninety per cent of regulators in Europe have also been empowered to deal with spectrum issues, such as allocation and assignment. More recently and increasingly, they have been tasked with overseeing adjacent areas such as cybersecurity and consumer protection.

Chart 5.6: Evolving mandate of the regulator in Europe, 2010-2015



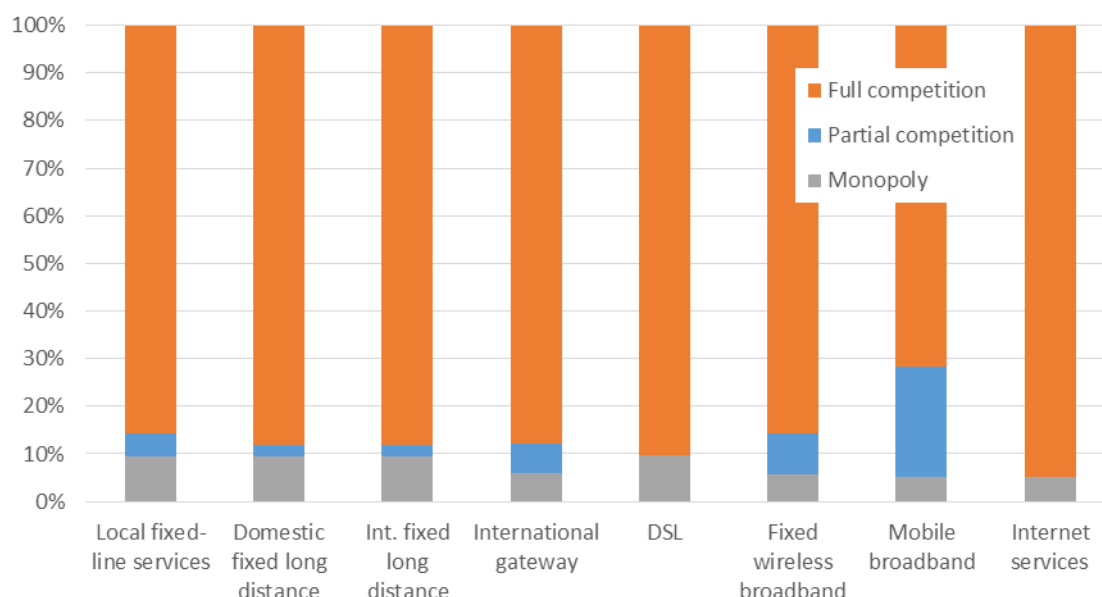
Source: ITU.

At the global level, there has been an outstanding trend towards expanding and diversifying the mandate of the regulator. This is very much linked to the technological transformation that has taken place in the

sector with the move towards IP-based networks, and the opportunities as well as the complexity it brings about. Rather than dumb pipes, broadband networks are today considered to deliver the lifeblood for the digital economy and society as a whole in the form of services, applications and content. Issues of electronic content, security and data protection as well as, ultimately, full-fledged consumer protection, have become key challenges for the healthy development of both networks and services, and require regulatory attention. The mandate of regulators in Europe has thus also evolved over the past 5 years or so (see chart 5.6).

Like their fellow regulators in the other regions, regulators in Europe share the belief that enhanced competition will allow for more abundant investment and boost the ICT development in the region. Competition in ICT services is the norm in the region, although ten percent of countries in the region still maintain monopolies in local and long distance fixed-line services as well as in the DSL market (see chart 5.7 below). One key challenge for many regulators in Europe is to further develop their regulatory frameworks to ensure more incentives are available for investors in advanced, high-capacity broadband networks.

Chart 5.7: Competitiveness of selected ICT market segments, Europe, 2015



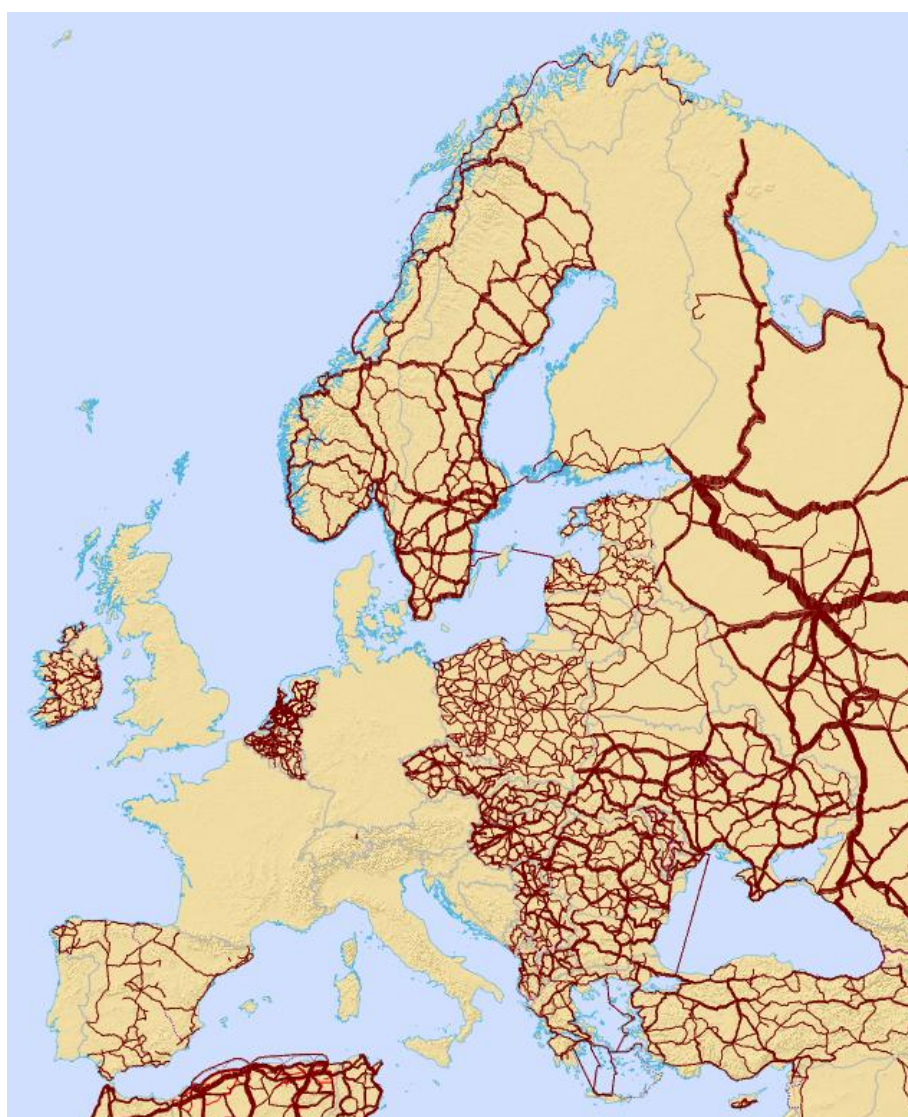
Source: ITU Telecommunications/ICT Regulatory Database.

Efforts that have been made over the past 20 years to liberalize international gateways in a majority of countries in the region have proved successful and less than five percent of national gateways remain under a monopoly controlled by the fixed line incumbent (see Chart 5.7). As a result, broadband growth across the region has been strong, also allowing economies to develop new services and employment opportunities. Moreover, foreign investors' interest in the majority of countries in the region has remained high thanks to the enabling environment for new entrants.

Internet services in particular, like in other regions, have been very competitive. There are virtually no monopolies today in fixed wireless broadband, mobile broadband and ISP services in Europe. Traditionally, there has been a preference for deploying full competition rather than partial – which has significantly contributed to the fast growth of both new services and the number of subscribers.

The adoption of simplified licensing regime encompasses further regulatory and institutional measures undertaken by governments to reform the sector. Many countries have eased their market entry processes by simplifying their licensing regime. The great majority of countries in the regions have established a general authorization regime with simple notification process or a class-licence regime. In some countries, such as Bulgaria and Ireland, there are parallel licencing tracks for different services, some falling under the general authorization regime and others requiring a multi-service or an individual licence. A number of countries have also introduced a licence-exempt regime for a range of wireless services, such as France, Bosnia and Herzegovina and Portugal. Building up a sound licensing framework has been essential to support the development of convergent services and the expansion of markets and competition, with the objective of promoting the provision of new and innovative services, the reduction of prices and an increase of efficiency in the provision of services, as well as increasing the variety of offerings for subscribers.

Chart 5.8: Submarine cables connecting parts of Europe, 2015



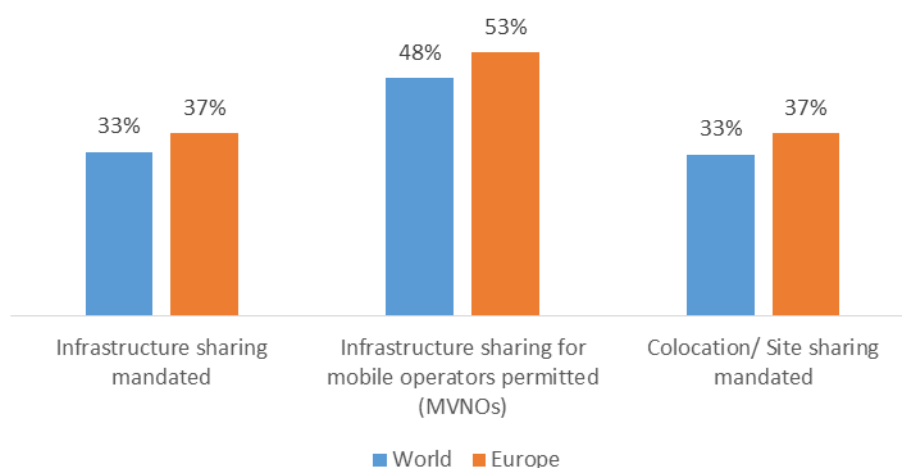
Source: ITU and Telegeography, <http://www.itu.int/itu-d/tnd-map-public/> (work in progress).

Over the last five years, additional international submarine cables were deployed throughout the region, increasing the options for international high-speed connectivity between various parts of Europe and the rest of the world (see Chart 5.8), thereby further reducing the costs of international bandwidth through the

availability of competitive offers. The challenge now is to ensure these cable landing stations are further connected to domestic broadband backbone networks.

Next-generation networks have been high on the policy agenda of European Union countries over the past decade. Their cost, however, remains a challenge in some markets. To bring costs down and to capitalize on the investments made, 37 percent of countries in the region have mandated passive infrastructure sharing and more than half of all countries permit mobile virtual network operators (MVNOs) in their markets, respectively in line with world average level of regulation in these areas (see Chart 5.9). Collocation or site sharing are, likewise, mandated in more than one third of countries, consistent with the world average.

Chart 5.9: Infrastructure sharing, Europe and worldwide, 2015

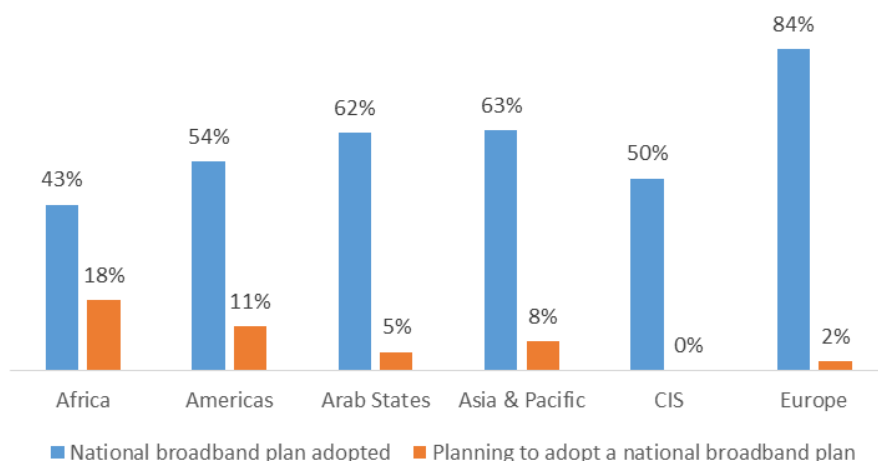


Source: ITU Telecommunications/ICT Regulatory Database.

To respond to the growing demand for spectrum, 29 regulators in Europe have introduced secondary spectrum trading and 33 countries have adopted some form of market based mechanisms by allowing in-band migration. Operators were assigned spectrum for mobile broadband services in virtually all countries in the region. Spectrum for WiMax services was assigned and commercially available in 60 percent of the countries in the region. Spectrum for LTE services was assigned and made available in some 70 percent of countries.

Acknowledging the key role broadband plays in today's digital economy, 36 countries in the region or 84 percent have adopted or are planning to adopt a national policy, strategy or plan to promote broadband (see Chart 5.10). Nationwide broadband infrastructure built-out ranks high as a goal within these plans, along with demand stimulation, through the adoption of online services and applications and the provision of public services using broadband. In addition, at least 25 countries in Europe include broadband as part of their universal service definition. With only 8 countries in the region having an operational Universal Service Fund (USF), however, Europe is the region with the lowest USF ratio at just below 19 percent and none of these funds are used to finance the national broadband band plan. Direct government funding, public-private partnerships and other custom-tailored mechanisms have been the main means of financing these plans.

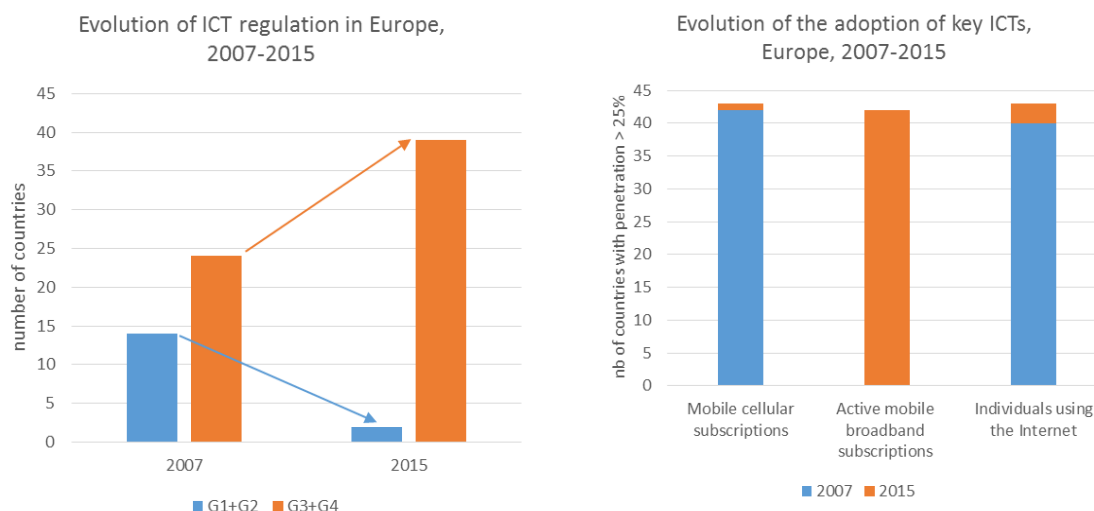
Chart 5.10: Broadband plans, by region, 2015



Source: ITU World Telecommunication/ICT Regulatory Database.

Overall, the gradual sector reform across Europe and the evolution of ICT regulation have had a positive impact on market developments. Looking back to 2008, one third of countries were either in the first or the second generation of ICT regulation (see Chart 5.11, left), only having a limited impact on the penetration of key ICT services. In 2015, virtually all countries in the region (except two) have joined the bandwagon of the third and fourth generation of regulation. As a result of the evolution of ICT regulation, the symbolic mark of 25 percent in penetration of mobile broadband services has been passed in almost all European countries, meaning that the majority of the population had daily access to mobile cellular services, mobile broadband applications and the Internet in 2015 (see Chart 5.11, right).

Chart 5.11: The evolution of ICT regulation as a lever of growth in access to ICTs in Europe, 2008 and 2015



Source: ITU.

Innovation, business disruption and fifth-generation regulation

Like in the ICT sector, policy and regulatory frameworks have evolved independently in many economic sectors over the past decade. As mentioned above, recognition has grown that there is an increasing interdependence between sectors. Technologic innovation and new business models are enabling effective global, regional and local development. The benefits range from enhanced knowledge management to

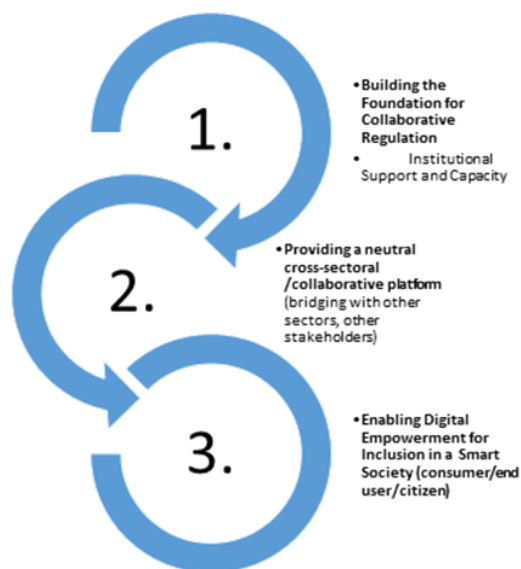
effective sharing and collaboration between all sectors and at all levels of government as well as with businesses and users. Policy makers and regulators from all sectors are now partners in the development process. This makes transparent, practical cooperation and communication across sectors as well as between stakeholders essential.

Collaboration within the ICT sector and across sectors has led to the growth of the digital collaborative economy, allowing an even greater level of experimentation, innovation and growth than ever before. A strong digital economy is vital for innovation, growth, jobs and competitiveness.

The success of smart connected digital societies and their economy will rest on trust as well as on regulation. The success or failure of collaborative businesses revolves around user trust, and appropriate regulation is a key element in those new models.

This new environment has put policy and regulatory frameworks under pressure, calling for more and more effective collaboration among sector regulators. Fifth-generation regulation means having the necessary tools for creating an enabling environment for effective collaboration across the sectors so as to include and empower citizens through ICTs. It also means adopting a holistic view so that ICTs can be leveraged across the sectors. The goal of using ICTs across the sectors as a tool for economic and social development requires coherent and strategic policy planning. Policy makers and regulators should work together to ensure people have access to new technologies, have the digital skills to use them and can trust ICTs (see Chart 5.12).

Chart 5.12: Fifth generation of collaborative regulation



Source: ITU.

This was also recognized by regulators at the 2016 Global Symposium for Regulators (GSR-16), where regulators identified and endorsed a forward-looking set of regulatory best practice guidelines¹⁶. Regulators from all regions recognized that a sound national framework for

collaborative regulation goes a long way towards creating working synergies and effectively enabling new services.

Box 5.3: Building bridges between ICT and financial regulators

In terms of digital financial inclusion, regulators at the 2016 Global Dialogue on Digital Financial Inclusion agreed that a collaborative policy framework could start with the harmonization of the Telecommunications/ICT Act with the relevant financial legislation and regulatory policies. In the same way, collaboration could be extended to critical cross-cutting areas such as consumer protection, cybersecurity, privacy and data protection. Ongoing dialogue and regulatory cooperation is needed regarding competition between financial and telecom service providers as well as over-the-top players. Periodic open consultations and meetings with stakeholders, public and private, have to be involved in both policy-making and monitoring of policy implementation.

A harmonization of legal and regulatory requirements for digital financial services at the regional or sub-regional level, regulators noted, can have a multiplier effect on innovation and investment in national markets, and thus needs to be brought to the agenda of Regulatory Associations and Regional Economic Communities in view of facilitating the spread and benefits of digital financial inclusion in developing regions.

Source: ITU, Guiding measures of the Global Dialogue on Digital Financial Inclusion, <http://www.itu.int/en/ITU-D/Conferences/GSR/Pages/GSR2016/GDDFI.aspx>

Quantifying the impact of regulation on ICT uptake

There is by now a large body of qualitative research investigating the causality and relationship between regulation and ICT adoption. Quantitative evidence, however, is considerably less extensive. In order to fill in the gaps in this important area and provide grounds for informed policy-making, ITU has developed two econometric models based on the ICT Regulatory Tracker, for fixed broadband and for mobile cellular, which suggest that a sound regulatory environment is significantly associated with a positive impact on ICT adoption (see *ITU Trends in Telecommunication Reform 2015*).

This recent ITU research suggests that a 10 per cent increase in the *ICT Regulatory Tracker* score (corresponding to an incremental enhancement of regulatory frameworks) is associated with an increase of 7.7 per cent in fixed-broadband penetration over the period 2008-2013¹⁷. To illustrate that, a country that has adopted some form of a broadband development strategy (a national broadband plan or digital agenda etc., that includes pro-active regulatory measures such as infrastructure sharing), countries which allow the use of VoIP services and promote a competitive environment for broadband technologies would have penetration levels 7.7 per cent higher on average than a country without these measures in place, other conditions being equal.

The model further suggests that a 1 per cent increase in the population living in urban areas is associated with a 7.8 per cent increase in fixed-broadband penetration, other things being equal. This high coefficient could be representative of the various characteristics urbanization is controlling for: infrastructure, commerce, investment in the Internet-intensive tertiary sector, etc.

Gross national income per capita also plays a valid role in explaining the levels of fixed-broadband penetration. A country that witnesses a 10 per cent increase in income per capita, for example from USD 10'000 to USD 11'000 is expected to have additional 9.4 fixed broadband users per every 100 people, other things being equal. This could be explained by different interpretations of the role Gross National Income (GNI) per capita plays in this model: as a proxy for economic development, a higher income could represent

a more developed economy, with intense use of ICTs in all areas; as a proxy for the individual purchasing power, higher incomes could stand for an increase in willingness to pay for the fixed-broadband subscriptions.

Best-practice regulation also has a beneficial impact on mobile-cellular penetration. The positive effect of regulation on mobile penetration is corroborated by the results of the economic regression model for mobile cellular¹⁸. A 10 per cent increase in a country's score in the Tracker is associated with an increase of 2.3 per cent in mobile-cellular penetration. For example, a country that has introduced mobile number portability, permitted infrastructure sharing for mobile operators, allowed foreign investment in operators that own spectrum, legally promoted a competitive environment and required interconnection prices to be made public would have penetration levels 2.3 per cent higher than a country without these measures in place, all other things being equal.

The impact of regulation on the mobile sector over the studied period is lower than for fixed broadband, since mobile-cellular services have been in place for longer and the effect of regulation has tended to peak few years after adoption, while fading out in the longer term. The mobile sector has also been subject to more incentive regulations rather than obligations imposed, as in the case of fixed networks. These are well-known facts remedied by regular reviews and upgrades of existing policy and regulatory settings, as well as by the adoption of new measures and policy initiatives to address the changing nature of the digital ecosystem.

Urbanization is one of the key determinants of mobile-cellular adoption; a 1 per cent increase in urbanization is associated with an increase equivalent to 4.7 per cent in mobile-cellular penetration, all other factors being equal. Evidences point to the role of network externalities in the use of mobile phones, for instance, the high amount of mobile-cellular users motivate those who have not adhered to the service to do so¹⁹. It is worth noting, nevertheless, that the impact of urbanization on the take up of mobile-cellular services is lower than on fixed-broadband penetration levels, mobile-cellular being less infrastructure-intensive and thus deployed at a lower cost beyond urban areas.

With regards to national wealth, the results of the regression model were highly predictable and confirm general assumptions. GNI per capita has a positive impact on mobile-cellular adoption: a 10 percent increase in income, for example from USD 10'000 to USD 11'000, is expected to generate 6.5 subscriptions per every 100 people, other things being equal. GNI per capita could be representative of the individual's purchasing power and his budget constraints, for both the individual that has the necessity of subscribing to mobile-cellular services for the first time and the individual that seeks more than one subscription.

Ensuring that consumers benefit from the wealth of opportunities brought by the digital economy in an informed, responsive and safe manner is a challenge that policy-makers and regulators from around the world are increasingly facing. Undoubtedly, this can only be achieved through effective and smart regulation targeted at empowering consumers, redefining responsibilities and creating the conditions for a data driven economy to flourish.

5. Conclusions

ICT access and use in Europe has steadily increased over the last years. In all key ICT indicators, such as mobile-cellular subscriptions, mobile-broadband subscriptions, fixed-broadband uptake, availability of international Internet bandwidth, household Internet access and individual Internet penetration rates, the

Europe region as a whole is already performing above the global average. Over the last years, the region has also achieved more gender equality in ICT uptake, especially with respect to Internet use.

Despite what looks to be a relatively saturated market, mobile remains a dynamic sector, with continued expansion in mobile-broadband services. Mobile technologies also continue to drive the spread of individual Internet access in the region, especially given the significant expansion in mobile-broadband infrastructure and access.

Although most countries in Europe have high-income levels and correspondingly high levels of ICT development, there continue to be disparities correlated with geographical location and relative income levels. The countries in the region which tend to perform well in terms of ICT access, use and skills also tend to be high-income countries in Northern and Western Europe. There remains a lot of scope for growth among countries in the Balkan and the Mediterranean regions. However, there appears to be increasing convergence in the level of ICT development within Europe, with countries such as Romania, Portugal, Albania, Montenegro and Greece showing the largest improvements since 2014.

Some of the key challenges that lie ahead is to increase fixed-broadband penetration rates and coverage in the region as a whole, to ensure equitable, high-speed and high-quality Internet access and ultimately bring more people online to benefit from and participate in the information society. Countries can also further leverage on the existing mobile-cellular networks and sustain the development of mobile markets by expanding mobile-broadband growth.

Given the cross-sectoral nature of ICT networks and online services, transparent, practical cooperation and communication between regulators and policy-makers as well as with other stakeholders is essential to ensuring that regulation is responsive to government policy decisions and the realities of the markets around the world. Such collaboration can contribute to achieving fifth generation regulation and constitutes a fundamental building block for smart societies in a connected world.

Cross-border harmonization of relevant regulatory policies as well as enhanced collaboration among national government agencies, regional and global organizations is essential for creating a global digital ecosystem while putting in place effective safeguards against fraud and abusive practices. Regulators have a role to play in building consumer trust and protecting security of services by appropriately addressing data protection, privacy issues and cybersecurity matters.

Incorporating mechanisms to engage citizens, including disadvantaged and vulnerable groups, is also a key element of collaborative regulation. This requires policies to enhance digital skills and using ICTs to promote empowerment.

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¹ More information about the methodology can be found in Chapter 2 and Annex 1 of ITU's *Measuring the Information Society Report 2016*.

² 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.

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