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Foreword

I am pleased to present to you the 2018 edition of the Measuring the Information Society Report. Now in its tenth year, this annual report is widely recognized as the repository of the world's most reliable and impartial data and analysis on the state of global telecommunication/ICT sector. It aims to stimulate the ICT policy debate by providing an objective assessment of countries' ICT performance based on internationally comparable data and agreed methodologies and by highlighting areas that need further improvement.

The release of this report follows the ITU Plenipotentiary Conference 2018, held in Dubai, United Arab Emirates, where ITU Member States approved the four-year Strategic and Financial Plan, which includes a strong commitment to ITU's statistical work. The Plan also includes a number of specific targets in terms of ICT access and use, which this report reviews.

The Measuring the Information Society Report 2018 reveals that by the end of 2018, we will have passed a critical point as, for the first time, more than half the world's population will be using the Internet. This is a significant achievement towards a more inclusive information society that delivers new opportunities of development through ICTs. It is an important step towards leaving no one behind.

The report finds that there continues to be a general upward trend in the access to and use of ICTs. With the exception of fixed telephony, all indicators showed sustained growth over the last decade. Mobile access to basic telecommunication service is becoming ever more predominant. Broadband access continues to demonstrate sustained growth with mobile broadband penetration increasing from 4.0 subscriptions per 100 inhabitants in 2007 to close to 70 subscriptions per 100 inhabitants in 2018. In addition, most people worldwide can now access the Internet through a 3G or higher-speed network.

One of the reasons for the upward trend is that access to and use of ICTs have become more affordable, with a global drop in prices for mobile-cellular, mobile-broadband and fixed-broadband. However, for people to effectively use ICTs, there is an increased need for soft skills beyond technical and navigational skills, fundamental for achieving positive outcomes. More and better data are needed so that digital skills policies can address gaps in the labour market and concerns about widening social inequalities.

In 2017, ITU Member States agreed to a revised and expanded set of indicators for the ICT Development Index (IDI). The new IDI, based on the new indicators, promises to deliver an even better understanding of developments, opportunities and challenges within ITU Member States and the ICT industry at large. In order to smoothen the transition for Member States in terms of data collection, the IDI, which is normally included in the Measuring the Information Society Report, will only be launched in 2019.

As in the 2017 edition, Volume 2 of the Measuring the Information Society Report provides information on countries infrastructure developments, investments, government policies and initiatives to improve the access and use of ICTs for households and individuals. These profiles will help to identify good practices as well as opportunities specific to each country.

This report will be of great value to the ITU membership, including policy-makers, the ICT industry and others working towards building an inclusive digital economy.

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Key findings

More than half of the world's population is now online. At the end of 2018, 51.2 per cent of individuals, or 3.9 billion people, were using the Internet. This represents an important steps towards a more inclusive global information society. In developed countries, four out of five people are online, reaching saturation levels. In developing countries, though, there is still ample of room for growth, with 45 per cent of individuals using the Internet. In the world's 47 least-developed countries (LDCs), Internet uptake remains relatively low and four out of five individuals (80 per cent) are not yet using the Internet.

There continues to be a general upward trend in the access to and use of ICTs. With the exception of fixed-telephony, all indicators showed sustained growth over the last decade. However, in recent years, growth is slowing for most of the access indicators, particularly in countries where large parts of the population are already connected. Growth will need to pick up again if the ambitious targets of the ITU Connect 2030 Agenda and the Broadband Commission for Sustainable Development are to be met. These include a target of 70 per cent Internet penetration by 2023, and 75 per cent by 2025.

Mobile access to basic telecommunication services is becoming ever more predominant. While fixed-telephone subscriptions continue their long-term decline, mobile-cellular telephone subscriptions continue to grow. Although the number of mobile-cellular telephone subscriptions is already greater than the global population, the same is not true in all regions. It can be expected therefore that developing countries, and especially LDCs, will slowly catch up with the rest of the world.

Broadband access continues to demonstrate sustained growth. Fixed-broadband subscriptions are continuously increasing, without a slowdown in growth rates. Furthermore, almost all fixed-broadband subscriptions had download speeds of at least 2 Mbit/s, with a very substantial part having advertised speeds of more than 10 Mbit/s. In LDCs, there is still a significant pocket of subscriptions for the lowest speed tier (≥256 kbit/s to <2 Mbit/s), although that proportion is decreasing rapidly. The growth in active mobile-broadband subscriptions has been much stronger, with penetration rates increasing from 4.0 subscriptions per 100 inhabitants in 2007 to 69.3 in 2018.

Almost the whole world population now lives within range of a mobile-cellular network signal. In addition, most people can access the Internet through a 3G or higher-quality network. This evolution of the mobile network, however, is going faster than the growth in the percentage of the population using the Internet.

Internet access at home is gaining traction. Almost 60 per cent of households had Internet access at home in 2018, up from less than 20 per cent in 2005. Fewer than half of households had a computer at home, highlighting that a substantial number of households accessed the Internet (also) through other means, most importantly through mobile devices, often using the data plan of the mobile-broadband subscription. Three quarters of the world's population owned a mobile phone in 2017, but in LDCs this proportion stood at 56 per cent. Given the positive impacts of mobile phone ownership on development, this is an area where quick gains can be made.

Lack of ICT skills is an important impediment for people to access the Internet. Data show that, as activities get more complex, fewer people undertake these activities. More importantly, computer users in developed countries seem to possess more ICT skills than users in developing countries, pointing to a serious constraint on the development potential of developing countries and LDCs.

Growth in international bandwidth and Internet traffic has been even stronger than growth in access to ICTs and the percentage of the population using the Internet. This could be explained by the fact that people spend more time online, and more and more spend that time doing data-intensive activities, such as watching videos and playing interactive games.

Chapter 1. The Current State of ICTs

1.1 Introduction

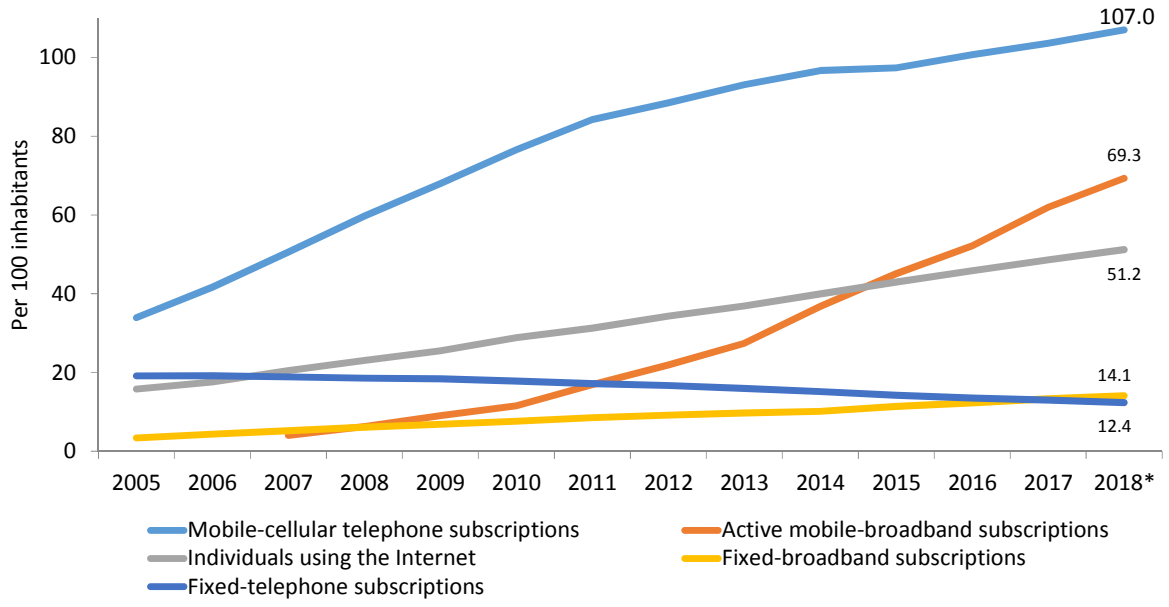
This chapter presents an overview of recent trends in the access to and use of information and communication technologies (ICTs), based on data collected by the International Telecommunication Union (ITU) from its Member States. This chapter sets the scene for the rest of this publication, providing the backdrop for the chapters on ICT skills (Chapter 2), ICT revenues and investment (Chapter 3), and ICT prices (Chapter 4). It is also a quantitative accompaniment of the country profiles in Volume 2, which are more qualitative in nature.

This introductory section will be followed by a section on the access to ICTs and a section on the use of ICTs. Since the subject of ICT skills has its own chapter, it will only be summarily dealt with in this chapter. Data will be presented at the global and regional level and by development status.

Before entering into a more systematic discussion indicator by indicator, Chart 1.1 shows the most important trends in the access to and use of ICTs at the global level since 2005. The chart shows that the three main trends that were observed in the previous edition of this report (ITU, 2017a) continue to be valid.

First of all, there continues to be a general upward trend in the access to and use of ICTs. Except for fixed-telephone subscriptions, all indicators have consistently been increasing, even when the world economy was going through one of the most serious financial crises ever. Most importantly, the world has crossed the halfway line in 2018 in terms of Internet use, with 51.2 per cent of the world population using the Internet. In recent years, however, growth rates for most indicators have been more modest than in the first decade of the century. This is because in many countries, especially in the developed ones, penetration rates are approaching saturation levels: if not in the whole country, at least in segments of the population.

Chart 1.1: Global ICT developments, 2005–2018*



Note: * ITU estimate.
Source: ITU.

Secondly, broadband access continues to grow strongly. This is necessary to satisfy the needs of today's data-hungry users, who increasingly use the Internet for streaming video, preferably in high-definition. In particular, the number of active mobile-broadband subscriptions keeps growing strongly. Since the start of its data collection by ITU in 2007, the compound annual growth rate (CAGR) in the number of active mobile-broadband subscriptions per 100 inhabitants has been 19.5 per cent. With the global penetration rate standing at 69.3 per cent at the end of 2018, there is still plenty of room for further growth in the years to come. In conjunction, the fixed-broadband penetration rate also grew rapidly, by 9.5 per cent CAGR from 2005 to 2018.

Thirdly, mobile access is becoming ever more predominant. Fixed-telephone subscriptions have been in decline for a long time, while mobile-cellular telephone subscriptions keep growing, even when there are already more subscriptions than people on Earth. To have a fixed-broadband connection at home is often problematic in developing countries, because of the high cost associated with it, or the general unavailability of the infrastructure, while this is much less the case for mobile-broadband, often offering the only real possible ICT access path in developing countries.

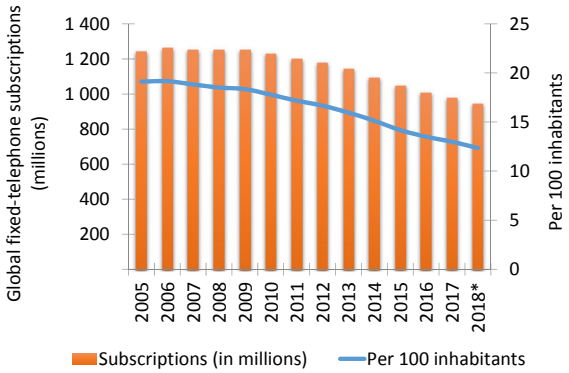
1.2 Access to ICTs

Fixed-telephone subscriptions

For a long time, fixed-telephone connections were one of the most important ways for people to communicate with each other. With the introduction of mobile-cellular technology, followed by the mass adoption of the Internet, multiple communication pathways opened up, leading to a decline in fixed-telephone penetration rates.

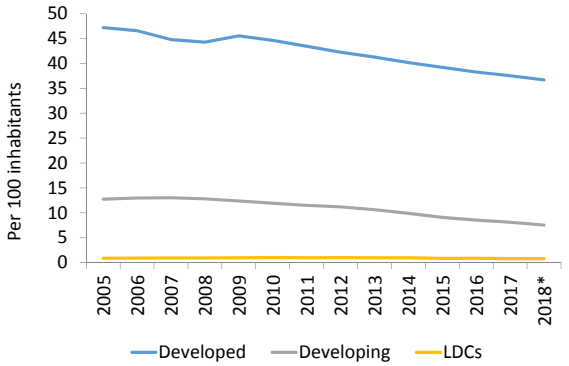
Chart 1.2 shows that the number of fixed-telephone subscriptions peaked in 2006, at 1.3 billion, equivalent to 19.2 subscriptions for every 100 inhabitants globally. In the 12 years that followed, the number of subscriptions declined by 319 million, leading to a penetration rate of 12.4 per cent in 2018.

Chart 1.2: Global fixed-telephone subscriptions, total and per 100 inhabitants, 2005–2018*



Note: * ITU estimate.
Source: ITU.

Chart 1.3: Fixed-telephone subscriptions per 100 inhabitants, by level of development, 2005–2018*



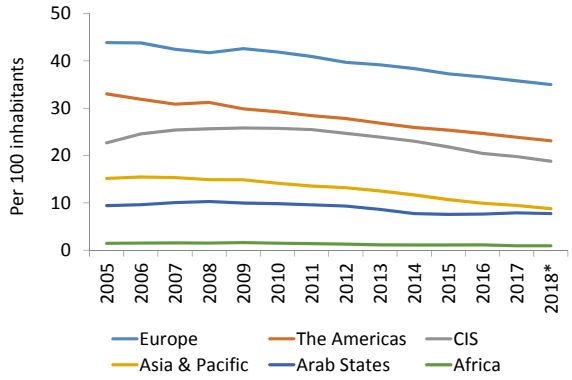
Note: * ITU estimate.
Source: ITU.

In developing countries, and especially in the least developed countries (LDCs), the high cost to establish the infrastructure has made fixed telephony either unavailable or unaffordable for large parts of the population. This is borne out by Chart 1.3, which shows low penetration rates in developing countries and almost non-existing penetration rates in LDCs. In developed countries as well, fixed penetration rates are going down, because of "cord-cutters", people who are resigning their fixed-telephone subscriptions, and "cord-nevers", young people who have never subscribed to a fixed line, and will most likely never do so.

Chart 1.4 shows that, in all regions of the world, fixed-telephone penetration rates declined. In relative terms, the largest reduction was reported for Asia and the Pacific, with a 42.2 per cent

decline from 2005 to 2018, while the lowest decline was observed in the Commonwealth of Independent States (CIS) region, at -17.1 per cent.

Chart 1.4: Fixed-telephone subscriptions per 100 inhabitants, by region, 2005–2018*



Note: * ITU estimate.
Source: ITU.

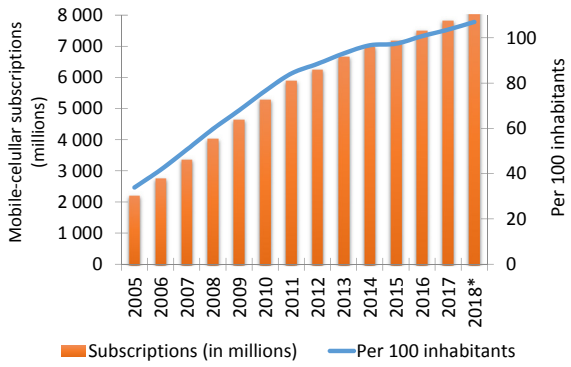
Mobile-cellular subscriptions

The main culprit of the decline in fixed telephony is of course mobile-cellular technology. Mobile phones allow people to be reachable individually and virtually everywhere, providing a great deal of flexibility. Also, in many places it is very expensive to get a fixed-line connection, waiting times can be very long, or the infrastructure is completely missing.[1] In contrast, as highlighted in Chapter 4, mobile-cellular prices have followed a sustained decreasing trend over the last decade.

Mobile services have great potential for development in reaching socially and geographically isolated people. The benefits for developing countries are major in – but not limited to – the agricultural, health and financial sectors (Boekestijn et al., 2017).

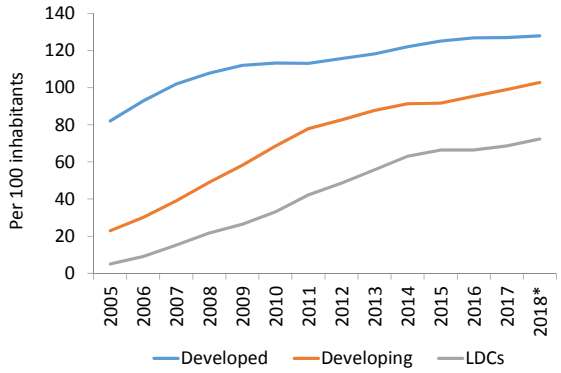
After strong increases in the number of mobile-cellular subscriptions during the early part of the century, growth seemed to be tapering off in 2014–2015. It picked up again, though, in the last three years, although at lower rates than from 2005 to 2015 (see Chart 1.5). There are now more mobile-cellular subscriptions than people on the planet. This is because many people have more than one subscription, to take advantage of competing voice or data plans of more than one operator, or because they may have a professional and a personal subscription. Therefore, this does not mean that everybody in the world is now connected. Evidence from ICT household surveys corroborates this number by estimating that 76.4 per cent of the world population owned a mobile phone (see Chart 1.22).

Chart 1.5: Global mobile-cellular subscriptions, total and per 100 inhabitants, 2005–2018*



Note: * ITU estimate.
Source: ITU.

Chart 1.6: Mobile-cellular subscriptions per 100 inhabitants, by level of development, 2005–2018*



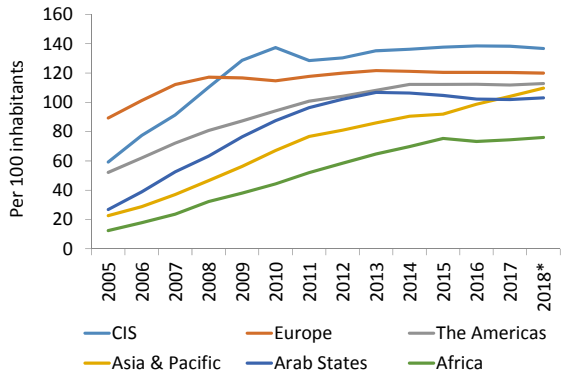
Note: * ITU estimate.
Source: ITU.

Chart 1.6 shows that saturation rates are being reached in developed countries, with only modest growth in the last five years. Growth in developing countries, and especially in the LDCs, was more sustained. Organic growth is still expected; developing countries and LDCs will continue to reduce the gap with developed countries.

Chart 1.7 shows that growth in mobile-cellar subscriptions in the last five years was driven by countries in Asia and the Pacific, and Africa. Growth was minor in the Americas and the CIS

region, while a decline was even observed in Europe and the Arab States.

Chart 1.7: Mobile-cellular subscriptions per 100 inhabitants, by region, 2005–2018*



Note: * ITU estimate.
Source: ITU.

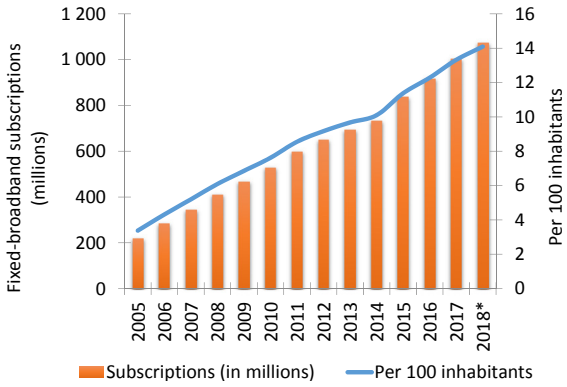
Fixed-broadband subscriptions

Broadband technologies are fundamentally transforming the way we live. Broadband infrastructure, applications and services offer important opportunities for boosting economic growth, enhancing communications, improving energy efficiency, safeguarding the planet and improving people's lives (Broadband Commission for Digital Development, 2013).

Fixed-broadband has had a significant impact on the world economy during the previous seven years of this study (2010–2017). An increase of 1 per cent in fixed-broadband penetration has been found to be associated with an increase in 0.08 per cent in gross domestic product (GDP), on average. This impact is guided by a return to scale effect, according to which the economic impact of fixed-broadband is higher in more developed countries than in less developed (ITU, 2018a).

While fixed-telephone subscriptions continue to decline, fixed-broadband subscriptions continue to increase. Continuing the trend reported last year for the first time, there were more fixed-broadband connections (1.1 billion) in 2018 than fixed-telephone connections (942 million). As can be seen from Chart 1.8, growth in fixed-broadband subscriptions has been sustained. Since 2005, a CAGR of 13 per cent was observed in the number of subscriptions. Expressed per 100 inhabitants, the penetration rate went up from 3.4 in 2005 to 14.1 in 2018.

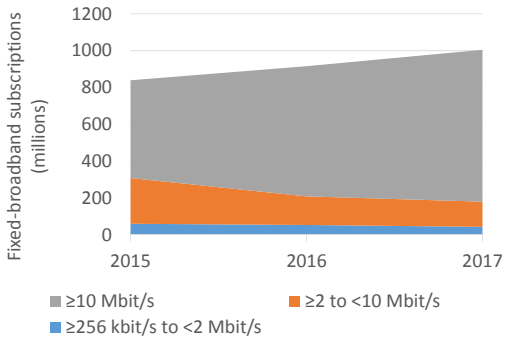
Chart 1.8: Global fixed-broadband subscriptions, total and per 100 inhabitants, 2005–2018*



Note: * ITU estimate.
Source: ITU.

In the early days of the Internet, access used to be through dial-up modems, which provided very slow connections and would block the telephone line from making voice calls. The Integrated Services Digital Network (ISDN) service solved the problem of blocking the phone line for voice calls, providing speeds higher than dial-up modems, although still very low, usually at 128 kbit/s. Over time, technologies were developed that provided faster and faster Internet access, including various types of digital subscriber line (DSL), cable and optical fibre. Traditionally, access through dial-up modems and ISDN used to be considered narrowband, while faster technologies were considered broadband. To distinguish between narrowband and broadband, it was agreed that speeds below 256 kbit/s would be narrowband, while faster speeds would be broadband.

Chart 1.9: Global fixed-broadband subscriptions, by speed, 2015–2017

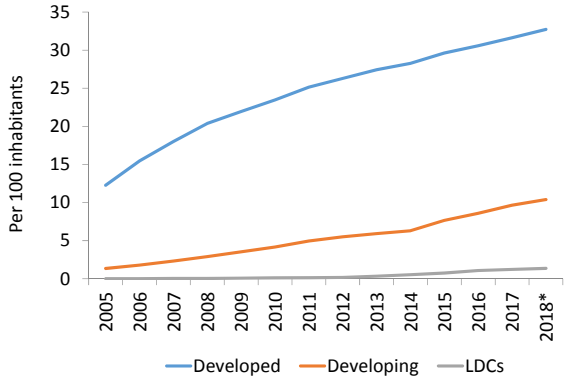


Source: ITU.

Obviously, in the current environment, 256 kbit/s is slow, and would not be considered broadband by many.

This debate appears to become less relevant, as illustrated by Chart 1.9, with speeds of 256 kbit/s at an all-time low. In 2017, 96 per cent of fixed-broadband subscriptions had a download speed of at least 2 Mbit/s. Furthermore, 82 per cent of subscriptions had advertised speeds of more than 10 Mbit/s in 2017, up from 63 per cent in 2015. In 42 per cent of countries, more than half of fixed-broadband subscriptions had a download speed of more than 10 Mbit/s, already surpassing the Connect 2030 Target of 40 per cent by 2023 (see Box 1.1).

Chart 1.10: Fixed-broadband subscriptions per 100 inhabitants, by level of development, 2005–2018*

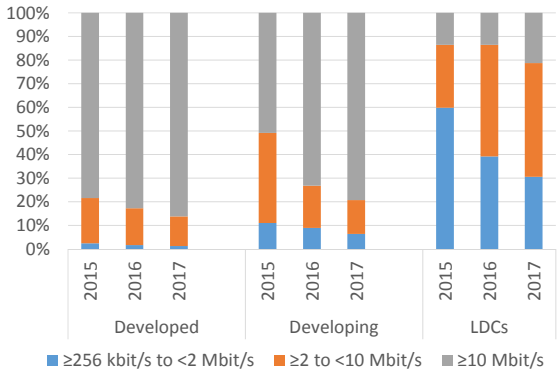


Note: * ITU estimate.
Source: ITU.

In developed countries, growth in fixed-broadband subscriptions is slowing, as these countries are getting closer to saturation levels. Since fixed-broadband connections are usually shared by all members in the household, penetration rates are unlikely to go over 50 per cent. Indeed, penetration rates in the highest-ranked countries were between 40 and 45 subscriptions per 100 inhabitants, compared with an average of 32.7 for all developed countries (see Chart 1.10). By contrast, in developing countries, after slowing in 2012 and 2013, growth has accelerated in the last five years, reaching 10.4 subscriptions per 100 inhabitants in 2018. This still leaves plenty of room for further growth. In LDCs, growth was strong as well, albeit from a very low base.

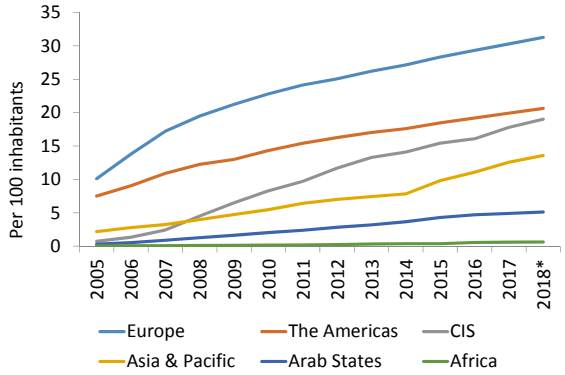
While subscriptions for the lowest speed tier (≥256 kbit/s to <2 Mbit/s) have virtually disappeared from developed countries, it is still very much a reality in LDCs, where in 2017 30 per cent of fixed-broadband connections were still at speeds below 2 Mbit/s (see Chart 1.11). But it is in rapid decline, given that, in only two years, the share was halved from 60 to 30 per cent.

Chart 1.11: Fixed-broadband subscriptions by speed, by level of development, 2015–2017



Source: ITU.

Chart 1.12: Fixed-broadband subscriptions per 100 inhabitants, by region, 2005–2018*

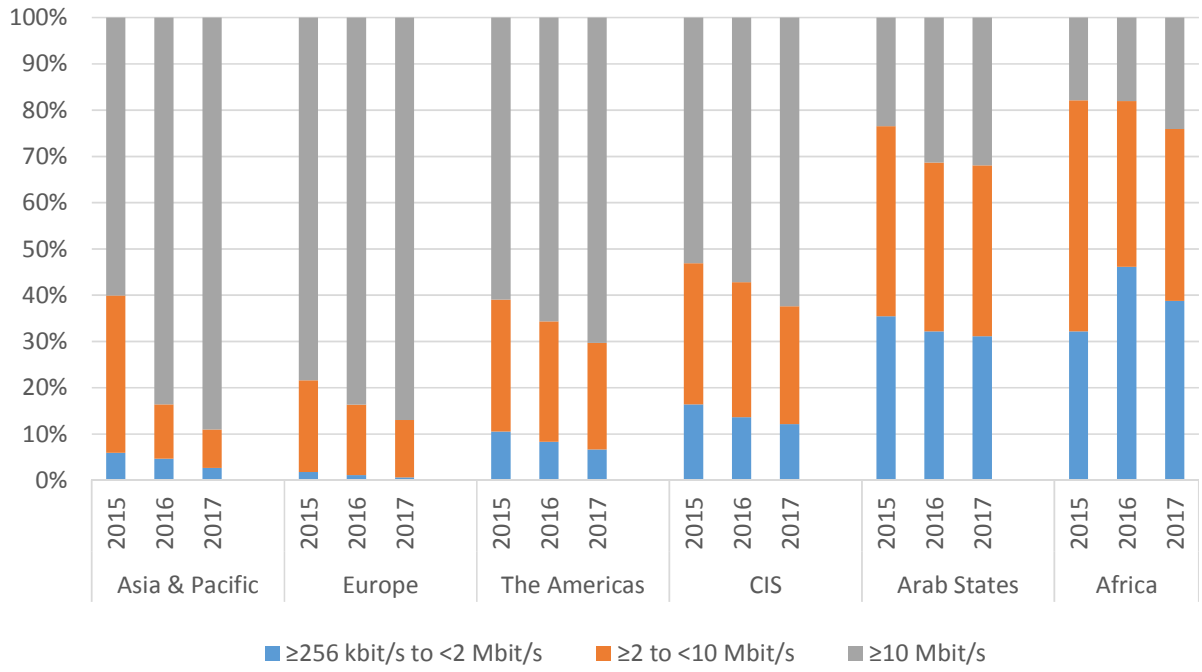


Note: * ITU estimate.
Source: ITU.

The distribution of fixed-broadband subscriptions by region, as shown in Chart 1.12, broadly confirms the trends noted by development status. In Europe and the Americas, growth is slowing, with Europe moving towards saturation level. Growth in the other regions has been much stronger, although absolute levels in Africa and, to a lesser extent, the Arab States are very low.

In terms of speed, Asia and the Pacific had the highest share of fixed-broadband subscriptions at speeds equal or above 10 Mbit/s in 2017, at 89 per cent,[2] closely followed by Europe at 87

Chart 1.13: Fixed-broadband subscriptions by speed, by region, 2015–2017



Source: ITU.

per cent (see Chart 1.13). At the other end of the scale, in Africa and the Arab States, high shares of subscribers still had subscriptions at speeds below 2 Mbit/s in 2017, at 39 and 31 per cent, respectively.

Mobile network coverage

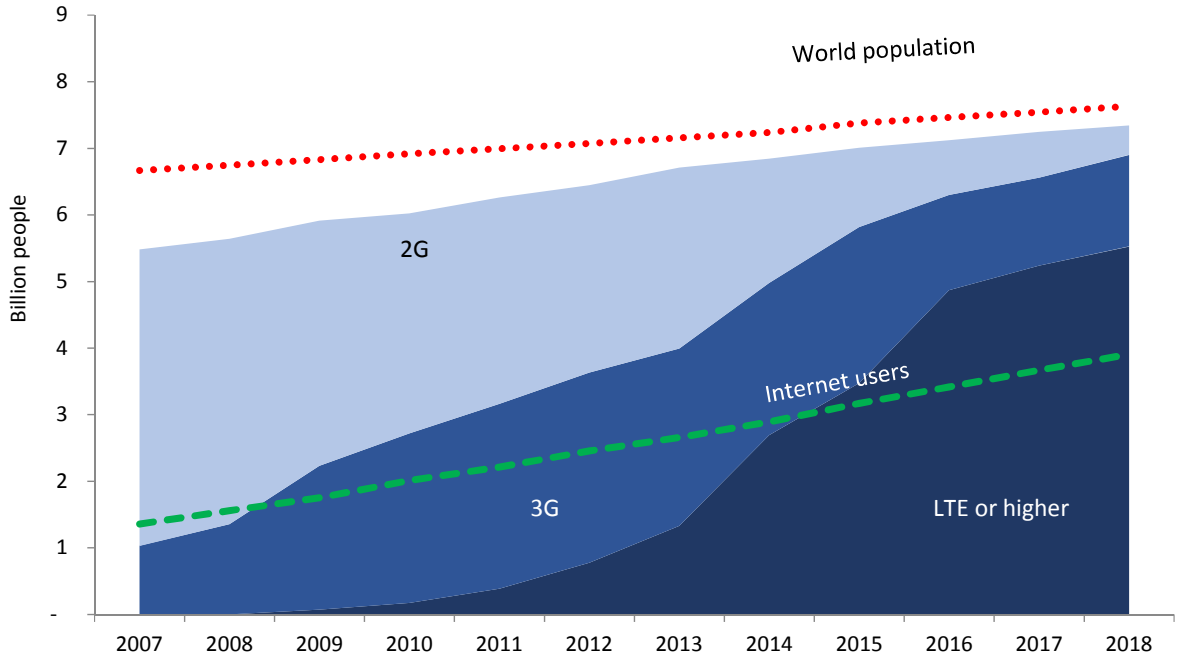
The importance of mobile access relative to fixed access has been highlighted already in this chapter, and in previous editions of this report (e.g. ITU, 2017a). To access the Internet, mobile access provides flexibility that cannot be provided by fixed-broadband, so many people are opting to have mobile access in addition to fixed. In places where fixed-broadband is not available or is unaffordable, mobile-broadband may be the only feasible pathway to Internet access. But this is only possible if the area where someone tries to make a mobile phone call or access the Internet on a mobile device is covered by a network.

Chart 1.14 shows the percentage of the population that lives within range of a mobile-cellular network signal, regardless of whether they actually subscribe to the service or use it, broken down by type of network. The chart demonstrates that almost the whole world population, 96 per cent, now lives within reach of a mobile-cellular network. Furthermore, 90 per cent of people can access the Internet through a 3G or higher-quality network. This is not far off the Connect 2030 Agenda Target of 96 per cent of the world population covered by broadband services by 2023. This evolution of the mobile network, however, is going faster than the growth in the percentage of the population using the Internet.

Active mobile-broadband subscriptions

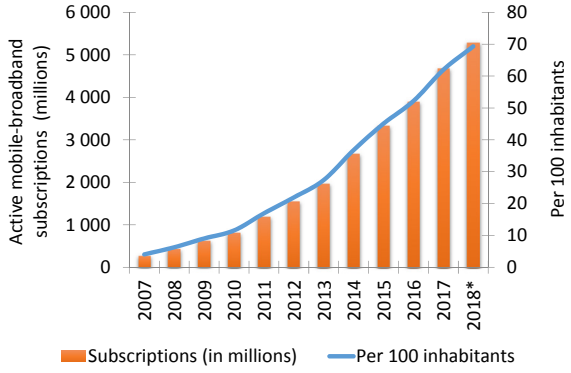
Since its introduction about 15 years ago, mobile-broadband has become one of the defining features of today's information society. Mobile access is more flexible and more accessible than fixed-broadband. Access to fast Internet is essential for many people, and has beneficial effects on the world economy. Recent research estimates that an increase of 1 per cent in mobile-broadband penetration is associated with an increase in 0.15 per cent in GDP. It was also noted that the economic impact of mobile-broadband depicts a saturation effect, according to which its contribution is higher in less developed countries than in more developed (ITU, 2018a). Mobile access is also increasingly getting more affordable, which is further elaborated in Chapter 4.

Chart 1.14: Mobile coverage by type of network, 2007–2018*



Note: * ITU estimate.
Source: ITU.

Chart 1.15: Global active mobile-broadband subscriptions, total and per 100 inhabitants, 2007–2018*

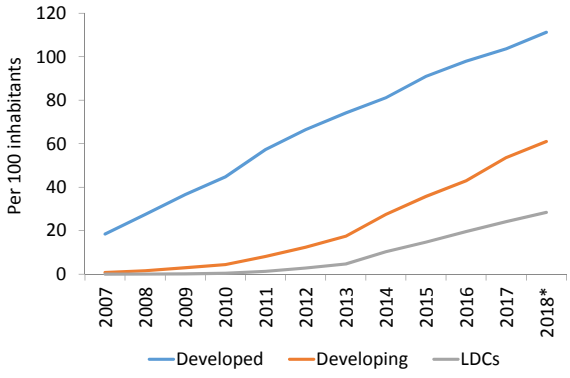


Note: * ITU estimate.
Source: ITU.

Chart 1.15 illustrates the rapid growth in active mobile-broadband subscriptions, from 268 million in 2007 to 5.3 billion in 2018, a CAGR of 31.1 per cent. Although the very high growth rates of the first few years are not attained any more, growth rates in recent years are still strong, at 17.1 per cent, 20.1 per cent and 13.1 per cent respectively. These subscription numbers translate into penetration rates that increased from 4.0 subscriptions per 100 inhabitants in 2007 to 69.3 in 2018.

Since 2017, although there are more active mobile-broadband subscriptions than people in developed countries, there is still no end in sight to its growth in these countries (see Chart 1.16).

Chart 1.16: Active mobile-broadband subscriptions per 100 inhabitants, by level of development, 2007–2018*



Note: * ITU estimate.
Source: ITU.

In developing countries, growth has been much faster than in developed countries, with the result that penetration rates have reached 61 per 100 inhabitants in 2018. Nevertheless, there is still much scope for further growth in coming years. This holds even stronger for LDCs, where the

Box 1.1: ICT benchmarks

ICTs are an important enabler of economic growth and development. Various benchmarks and targets underline this importance, including the Sustainable Development Goals, the Connect 2020 Agenda and the Broadband Commission for Sustainable Development 2025 Targets.

Sustainable Development Goals

In September 2015, at the General Assembly of the United Nations, world leaders adopted the 2030 Agenda for Sustainable Development, containing 17 Sustainable Development Goals and 169 associated Targets (United Nations, 2015a). In the Draft outcome document of the United Nations summit for the adoption of the post-2015 development agenda, it was recognized that "the spread of information and communications technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies, as does scientific and technological innovation across areas as diverse as medicine and energy" (United Nations, 2015b). Despite this, there is no Goal specifically dedicated to ICTs, because of its cross-cutting nature, but ICTs can be found in various Targets. In March 2017, the global indicator framework, developed by the Inter-Agency and Expert Group on Sustainable Development Goals Indicators, was agreed upon at the 48th session of the United Nations Statistical Commission (United Nations, 2017). Out of the 232 agreed indicators, 7 specifically refer to ICTs. These include the proportion of schools with access to computers and to the Internet, the proportion of individuals with ICT skills, the proportion of individuals who own a mobile telephone, the percentage of the population covered by a mobile network, fixed Internet broadband subscriptions broken down by speed and the proportion of individuals using the Internet.

Connect 2020 Agenda

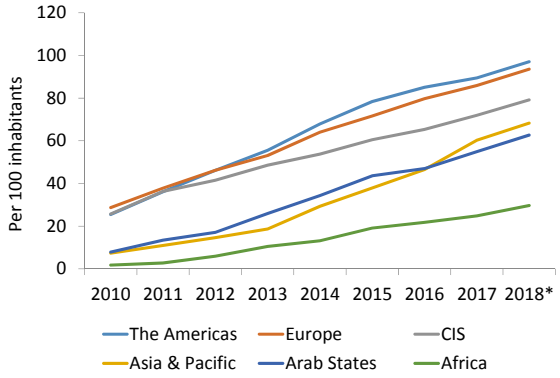
During the 2014 Plenipotentiary Conference (Busan, 2014), the ITU membership set out an ambitious vision for the ICT sector for the year 2020.[3] The vision – "an information society, empowered by the interconnected world, where telecommunication/ICTs enable and accelerate social, economic and environmentally sustainable growth and development for everyone" – was branded as "Connect 2020". It is a framework based around four complementary goals to be achieved by 2020: growth, inclusiveness, sustainability and innovation, and partnership. Each goal has a number of measurable targets associated to it, including some that are covered in this chapter and in Chapter 4, such as the percentage of the rural population with access to broadband, the percentage of households with access to the Internet, the percentage of individuals using the Internet, affordability of ICT services, and gender equality in Internet use. During the 2018 Plenipotentiary Conference (Dubai, 2018), the Connect 2020 agenda was revised and updated to the "Connect 2030 Agenda for global telecommunication/information and communication technology, including broadband, for sustainable development". The targets were revised as well, which now have an expiration date of 2023.

Broadband Commission for Sustainable Development 2025 Targets

Half the world's population is now connected to the Internet, but this leaves the other half – an estimated 3.8 billion people – unconnected and unable to benefit from key social and economic resources in our expanding digital world. In response to this challenge, the Broadband Commission for Sustainable Development has set seven ambitious targets for 2025, under the title: "Connecting the Other Half" (Broadband Commission for Sustainable Development, 2018). The seven targets are concerned with national broadband plans; affordability of broadband services; broadband Internet user penetration; digital skills; digital financial services; connectedness of Micro-, Small- and Medium-sized Enterprises; and gender equality.

penetration rate went up from virtually zero in 2007 to 28.4 subscriptions per 100 inhabitants in 2018. A difference can be observed with fixed-broadband penetration, where the uptake and growth in LDCs is much lower. This reflects the more affordable prices for mobile-broadband compared with fixed-broadband, as well as broader availability.

Chart 1.17: Active mobile-broadband subscriptions per 100 inhabitants, by region, 2010–2018*



Note: * ITU estimate.
Source: ITU.

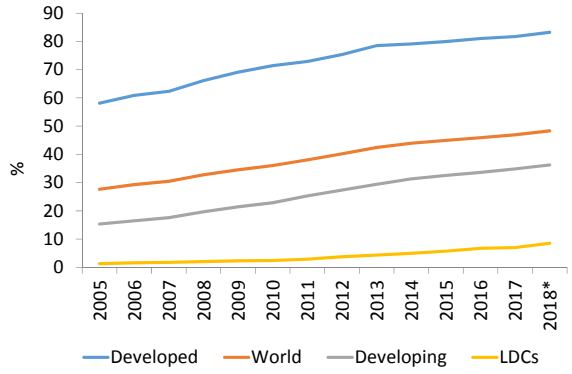
Chart 1.17 shows that in all regions of the world there was a strong growth in mobile-broadband take-up, but with a catching-up process at work. The strongest growth was observed in the three regions that started from the lowest base: Asia and the Pacific, the Arab States and Africa.

Households with a computer

Not too long ago, a computer was needed to go on the Internet, usually through a fixed connection. With the rise of smartphones and a plethora of Internet-enabled devices, coupled with mobile-broadband, this is no longer the case. Nevertheless, computers still allow users to do things that can be challenging on smaller screens, such as programming, creating presentations, or writing documents with the aid of a keyboard.

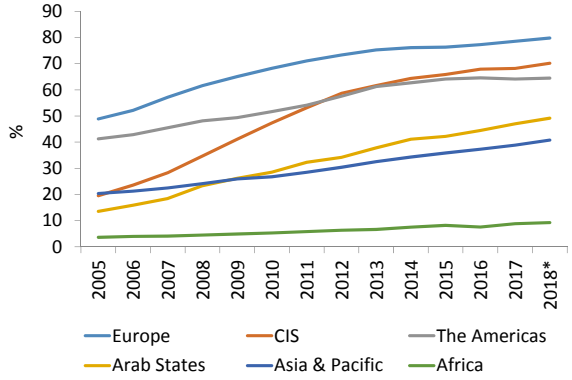
Chart 1.18 shows that, globally in 2018, almost half of all households had at least one computer,[4] up from just above a quarter in 2005. In developed countries, 83.2 per cent of households possessed a computer in 2018, compared with 36.3 per cent in developing countries. LDCs showed the strongest growth during the period 2005–2018, albeit from a low starting base. In 2018, less than 10 per cent of households in LDCs had a computer at their disposal.

Chart 1.18: Percentage of households with a computer, 2005–2018*



Note: * ITU estimate.
Source: ITU.

Chart 1.19: Percentage of households with a computer, by region, 2005–2018*



Note: * ITU estimate.
Source: ITU.

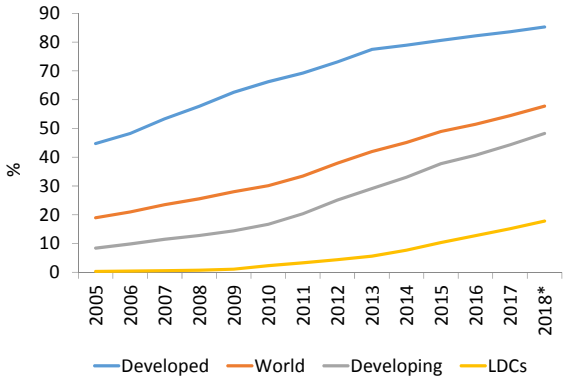
From a regional perspective, the strongest growth rates in the percentage of households with a computer were observed in the Arab States and the CIS region (see Chart 1.19). This allowed the CIS region to overtake the Americas and almost close the gap with Europe. In Africa, the proportion of households with access to a computer increased from 3.6 per cent in 2005 to 9.2 per cent in 2018.

Households with Internet access

There are many places where people may access the Internet. People may access the Internet at

work (mainly for work purposes) or at their place of education (for learning purposes), but the prime location to access the Internet remains at home. Having access to broadband or the Internet at home is the most inclusive way of bringing people online. At home, all household members have a chance to go online, no matter whether they have jobs, go to school, are male or female, children, adults or the elderly. Research has shown that children with Internet access at home perform better in school. Furthermore, children who are starting to use the Internet will be under parental guidance at home and therefore it is a safer way to bring young children online (Broadband Commission for Digital Development, 2012).

Chart 1.20: Percentage of households with Internet access at home, 2005–2018*

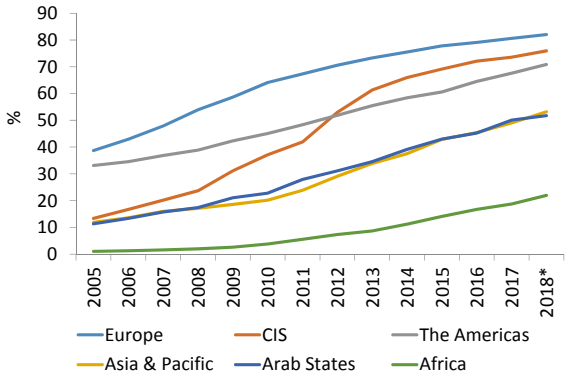


Note: * ITU estimate.
Source: ITU.

As mentioned, computers are no longer needed to access the Internet, as confirmed by Chart 1.20 in comparison with Chart 1.18. While less than half of households had a computer at home, 57.8 per cent had Internet access at home in 2018, up from only 18.9 per cent in 2005.[5] This already surpasses Connect 2020 Target 1.1, which was set at 55 per cent by 2020, and is well on track to reach the Connect 2030 Target of 65 per cent by 2023. Developed countries moved towards saturation, standing at 85.3 per cent in 2018. In developing countries, almost half of all households had Internet access at home, a considerable increase compared with 8.4 per cent in 2005, and a good step forward to reaching the Connect 2030 Target of 60 per cent by 2023. In LDCs, access went up to 17.8 per cent from virtually zero a decade earlier. This is impressive growth, but still falls well short of the Connect 2030 Target of 30 per cent by 2023. Given that Internet access can account for a relatively large share of the family budget in LDCs, this shows the importance attached to Internet access at home.

Chart 1.21 illustrates that regional developments broadly follow the trends observed for households with computers. Because of modest growth in Europe and the Americas, and strong growth in the other regions, the CIS region has overtaken the Americas.

Chart 1.21: Percentage of households with Internet access at home, by region, 2005–2018*



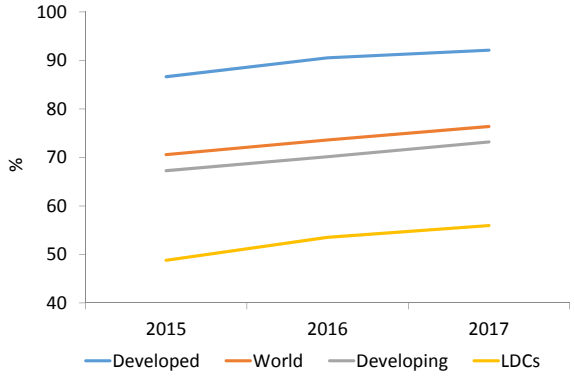
Note: * ITU estimate.
Source: ITU.

Individuals owning a mobile phone

Muhammad Yunus, Nobel Peace Laureate and Founder of the Grameen Bank, famously said that "the quickest way to get out of poverty right now is to have one mobile telephone". Ownership of mobile phones is also an important tool to reduce gender inequality. Empowering more women with mobile phones can accelerate social and economic development (GSMA Intelligence, 2010). Studies of mobile phone use in African countries found that phones are important tools for social connection and are thus beneficial for maintaining family ties (Pearson et al., 2017).

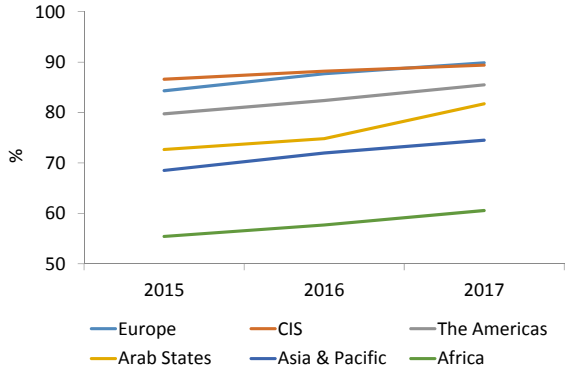
Although the global penetration rate of mobile-cellular subscriptions stands above 100 per cent, this does not mean everybody owns a mobile phone. Chart 1.22 shows that, in 2017, 76.4 per cent of the population owned a mobile phone, up from 70.6 per cent two years earlier. In developed countries, this percentage was as high as 92.1 per cent, while in LDCs it stood at 56 per cent. Given the positive impacts of mobile phone ownership on development, this is an area where quick gains can be made.

Chart 1.22: Percentage of individuals owning a mobile phone, 2015–2017



Source: ITU.

Chart 1.23: Percentage of individuals owning a mobile phone, by region, 2015–2017



Source: ITU.

The importance of mobile phone ownership is underlined by Chart 1.23, which shows that in four of the six ITU regions, mobile ownership stood above 80 per cent in 2017. Asia and the Pacific and Africa lagged these developments, but with relatively high rates – 75.5 per cent and 60.6 per cent respectively.

1.3 Use of ICTs

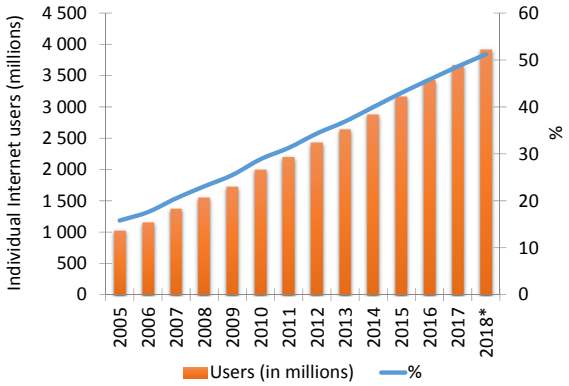
So far, this chapter has focused on the various ways in which people access ICTs. When people subscribe to a certain service, the objective is to also use this service. However, sometimes people have more than one subscription to a service, and sometimes, for whatever reason, people subscribe to a service but do not actually use it. The best way to find out how many people use ICTs, the various activities they undertake and their socio-demographic characteristics, is through surveys.

Alternative data sources provide information as well, and will certainly become more important in the future, but they cannot match the breadth and width of dedicated surveys, where people are asked directly about their access to and use of ICTs.

Individuals using the Internet

One of the most sought-after statistics in the field of ICTs is the percentage of the population using the Internet. The Broadband Commission for Sustainable Development remarks that "half the world's population is expected to be connected to the Internet by the end of 2019 at the latest. This leaves the other half – an estimated 3.8 billion people – unconnected and unable to benefit from key social and economic resources in our expanding digital world" (Broadband Commission for Sustainable Development, 2018). The Connect 2030 Agenda has set a target of 70 per cent of individuals using the Internet by 2023, while the Broadband Commission for Sustainable Development has set a target of 75 per cent by 2025.

Chart 1.24: Individuals using the Internet, world, 2005–2018*

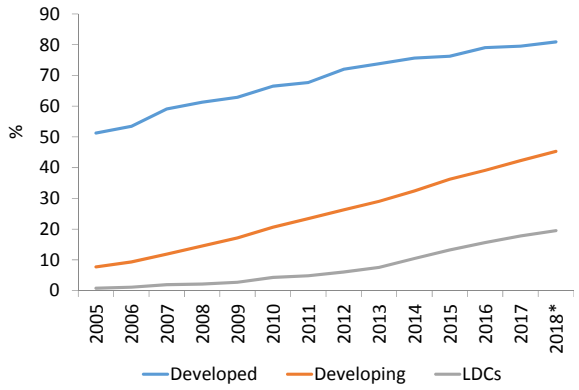


Note: * ITU estimate.
Source: ITU.

Chart 1.24 shows that half of the world population is already using the Internet by the end of 2018. By the end of 2018, 3.9 billion people are using the Internet, up from 1 billion in 2005. This translates into a CAGR of 10.8 per cent. Expressed as a percentage of the population, the penetration rate increased from 15.8 per cent in 2005 to 51.2 per cent in 2018. Although this crosses an important threshold, there is still much progress to be

achieved to reach the Connect 2030 Agenda and Broadband Commission targets.

Chart 1.25: Individuals using the Internet by development status, 2005–2018*

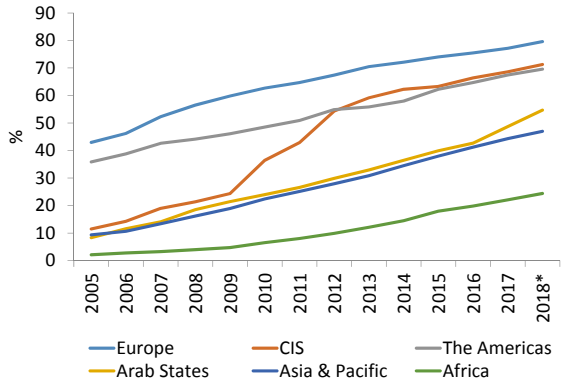


Note: * ITU estimate.
Source: ITU.

In developed countries, slow and steady growth increased the percentage of population using the Internet, from 51.3 per cent in 2005 to 80.9 per cent in 2018 (see Chart 1.25). Given that the very young usually do not use the Internet yet, this is approaching saturation. Indeed, in the last few years, growth has been very subdued. In developing countries, growth has been much more sustained. From 7.7 per cent in 2005, the penetration rate moved up to 45.3 per cent in 2018. This equals a CAGR of 14.6 per cent. Given that the level in developing countries stands at just over half the level in developed countries, the expectation is that this growth will continue strongly in the foreseeable future, needed to reach the Agenda 2030 Target of 60 per cent by 2023. This holds even stronger for the subset of LDCs, where the penetration rate grew from 0.8 per cent in 2005 to 19.5 per cent in 2018, also still well short of the Agenda 2030 Target of 30 per cent by 2023.

From a regional perspective, in just a few years, the CIS region made a giant leap to catch up with and overtake the Americas (see Chart 1.26). Earlier in this chapter, strong growth was observed for this region in fixed-broadband subscriptions and the percentage of households with Internet access. It is therefore logical that the percentage of the population using the Internet increased strongly as well. Of all regions, however, the strongest growth was reported in Africa, where the percentage of the population using the Internet increased from 2.1 per cent in 2005 to 24.4 per cent in 2018. The regions with the lowest growth rates were Europe and the Americas, with Europe getting close to saturation rate.

Chart 1.26: Individuals using the Internet, by region, 2005–2018*

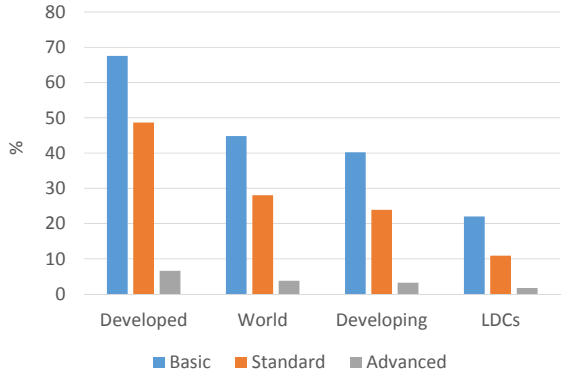


Note: * ITU estimate.
Source: ITU.

ICT skills

ICT skills are fundamental for participation in today's information society, and correlate positively with social well-being and economic productivity. Chapter 2 explains in depth the importance of ICT skills and the social and economic impacts they have. In this chapter, only the broader picture is discussed.

Chart 1.27: Percentage of individuals with ICT skills, by development status, 2017

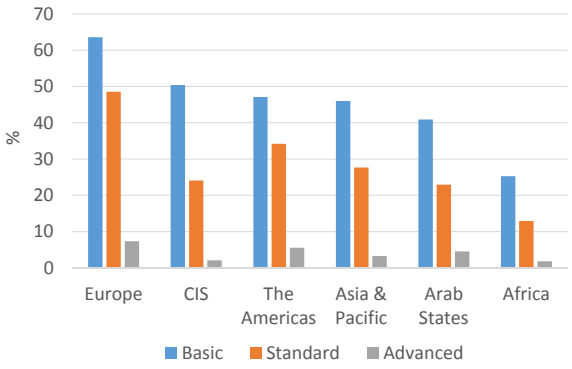


Note: For each country, the value for basic skills is the highest value among the following four computer-based activities: copying or moving a file or folder, using copy and paste tools to duplicate or move information within a document, sending e-mails with attached files, and transferring files between a computer and other devices. The value for standard skills is the highest value among the following four computer-based activities: using basic arithmetic formula in a spreadsheet;

connecting and installing new devices; creating electronic presentations with presentation software; and finding, downloading, installing and configuring software. The value for advanced skills is the value for writing a computer program using a specialized programming language.
Source: ITU.

Chart 1.27 first shows that there is a progression from basic skills to advanced skills, which is observed at all levels of development. In particular, there is only a small part of the population that has written a computer program in the last three months. The second observation is that, for each skill category, more individuals in developed countries possessed those skills than individuals in developing countries. The percentages in LDCs were again lower than the percentages in all developing countries. Given the importance of ICT skills for social and economic development, this is a serious constraint on the development potential of developing countries and LDCs.

Chart 1.28: Percentage of individuals with ICT skills, by region, 2017



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

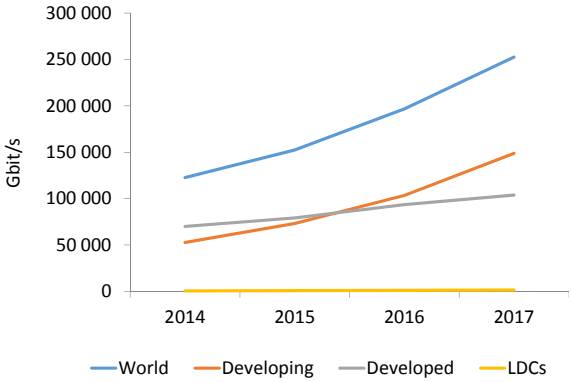
Source: ITU.

Chart 1.28 illustrates ICT skills in the various regions of the world. For all three skill categories, the highest skill levels were reported in Europe, and the lowest in Africa. In between, the picture is less clear. While in the CIS region high basic skills were reported, the Americas and Asia and the Pacific scored higher on standard skills and advanced skills.

International bandwidth

Domestic and international backbones are important building blocks of Internet infrastructure. Backbone transmission bandwidth affects the speed at which information is delivered to, and sent from, users. International bandwidth refers to the total used capacity of international connections between countries for transmitting Internet traffic as well as other traffic (e.g. international private leased circuit, Internet Protocol Virtual Private Networks and voice-over Internet protocol) (ITU, 2011). This indicator therefore provides information on the speed and quality with which the population of a country can use the Internet and other international data connections.

Chart 1.29: International bandwidth usage in Gbit/s, 2014–2017

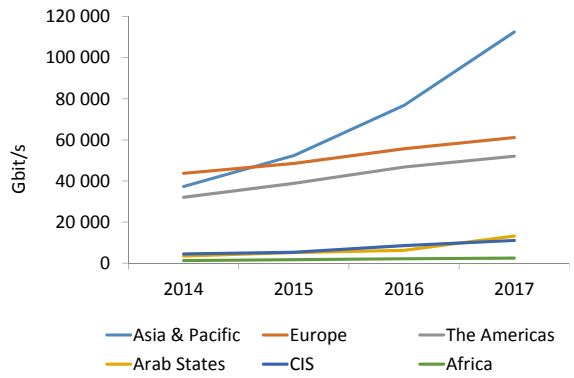


Source: ITU.

Chart 1.29 shows that, in line with the increases in fixed- and mobile-broadband subscriptions and percentage of the population using the Internet, international bandwidth usage increased strongly as well, to satisfy the growing data needs of a larger population of Internet users. Globally, international bandwidth usage grew from 122 570 Gbit/s in 2014 to 252 575 Gbit/s in 2017, a CAGR of 27.3 per cent. Growth in LDCs was strongest (54 per cent CAGR), albeit from a very low base, followed by developing countries (41.4 per cent) and developed countries (14.1 per cent).

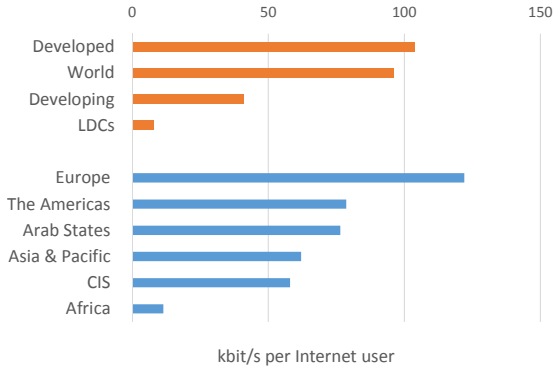
From a regional perspective, growth was strongest in the Arab States, with a CAGR of 56 per cent, followed by Asia and the Pacific (44.5 per cent) and the CIS region (35.4 per cent) (see Chart 1.30).

Chart 1.30: International bandwidth usage in Gbit/s, by region, 2014–2017



Source: ITU.

Chart 1.31: International bandwidth usage per Internet user (kbit/s), 2017



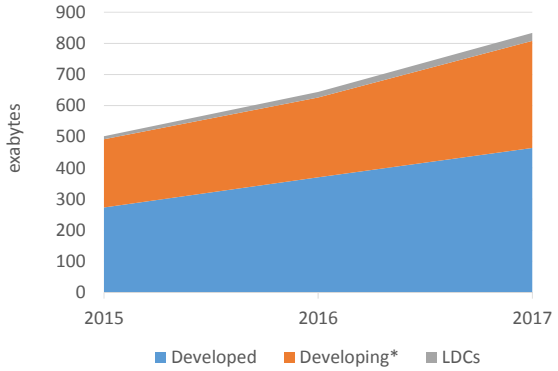
Source: ITU.

A commonly used benchmark is to divide the international bandwidth usage by the percentage of the population using the Internet in the country. In developed countries, Internet users had the highest international bandwidth at their disposal in 2017, at 104 kbit/s, 2.5 times the available bandwidth in developing countries and 13 times the amount in LDCs (see Chart 1.31). In the regions, the highest international bandwidth per Internet user was reported in Europe (122 kbit/s), followed by four regions with rates between 58 and 79 kbit/s. In Africa, the corresponding figure was only 11 kbit/s.

Fixed-broadband Internet traffic

All Internet indicators analysed in this chapter have shown growth over the last decade. Fixed- and mobile-broadband subscriptions, Internet usage, international bandwidth and fixed-broadband speeds all increased, often significantly. Moreover, traffic is shifting ever more to data-intensive services, in particular video. According to the Cisco Visual Networking Index, "globally, IP video traffic will be 82 per cent of all consumer Internet traffic by 2021, up from 73 per cent in 2016" (Cisco, 2017a). It is no wonder therefore that traffic measures also demonstrated strong growth.

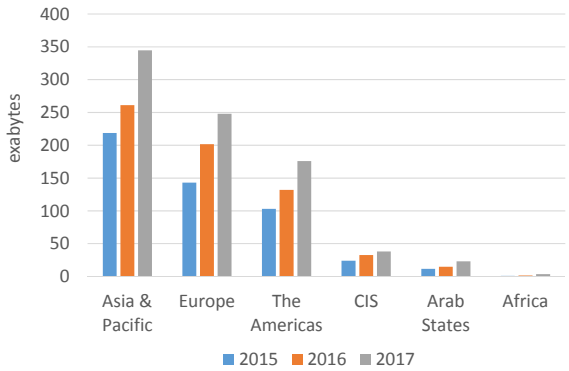
Chart 1.32: Fixed-broadband traffic, exabytes, 2015–2017



Note: * Excluding LDCs.
Source: ITU.

Chart 1.32 shows that the world consumed about 833 exabytes (EB)[6] over fixed-broadband connections in 2017, up from 644 EB in 2016 and 502 EB in 2015. Developed countries accounted for almost 56 per cent of the total in 2017, while LDCs accounted only for 3 per cent.

Chart 1.33: Fixed-broadband traffic, by region, exabytes, 2015–2017



Source: ITU.

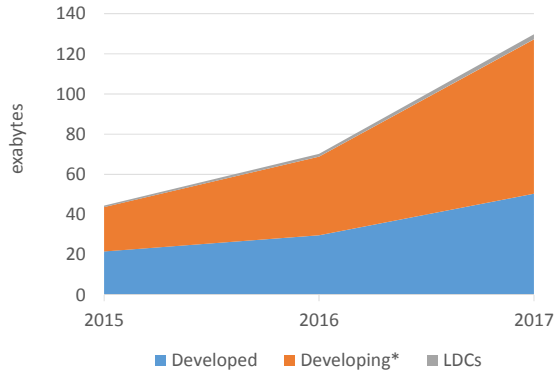
The largest region, Asia and the Pacific, also reported the highest fixed-broadband traffic, before Europe and the Americas, and more than 300 times as much as in Africa, where very few

fixed-broadband connections are active (see Chart 1.33).

Mobile-broadband Internet traffic

Mobile-broadband is quickly becoming the most ubiquitous way through which people access the Internet. However, limitations in screen size, bandwidth and data allowances restrict the amount of data used over mobile-broadband connections. From the supply side, the main reason that explains the data limits imposed on customers is the fact that, in mobile-broadband networks, the access part (i.e. the air interface between the mobile phone and the base station) is shared, unlike in fixed networks, where the access part is either dedicated per customer or has a very large bandwidth.

Chart 1.34: Mobile-broadband traffic, exabytes, 2015–2017

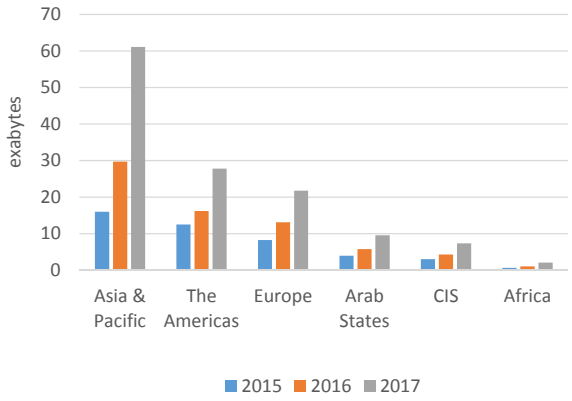


Note: * Excluding LDCs.
Source: ITU.

Chart 1.34 demonstrates that traffic channelled through mobile-broadband networks stood at 130 EB in 2017, compared with 833 EB over fixed-broadband. In contrast with fixed-broadband, developing countries (excluding LDCs) accounted for the largest share of this total, 59 per cent.

As with fixed-broadband, Asia and the Pacific was also the region with the highest mobile traffic, followed by the Americas and Europe (see Chart 1.35). Africa and the Arab States had a higher share for mobile traffic than for fixed, showing the relative importance of mobile-broadband in these regions. In some Arab States, mobile technologies (such as Long-Term Evolution (LTE)) are being used to deliver fixed-broadband services, which may explain the high values reported for mobile-broadband traffic.

Chart 1.35: Mobile-broadband traffic, by region, exabytes, 2015–2017



Source: ITU.

1.4 Summary and conclusion

ICTs have a demonstrated positive impact on economic growth. Social impacts are harder to measure, but there are also many social benefits associated with the use of ICTs. It therefore does not come as a surprise that access to and use of ICTs have been growing strongly over the last decade, even when the world was going through one of the biggest financial crises ever. As a result, more than half of the world's population is now online. However, growth has been slowing for a number of indicators, especially in the most developed countries, where saturation rates are coming into sight. This is allowing developing countries, including LDCs, to take steps to reduce the digital divide. However, sustained efforts are needed to reach the ambitions targets of the Connect 2030 Agenda and of the Broadband Commission for Sustainable Development.

Several long-term trends that have been reported upon in previous editions of this report have been confirmed once more. Access to telecommunication networks continues to increase, in particular for mobile connections, which is the preferred access path, especially in developing countries. This has gone hand in hand with an expansion of the mobile-cellular network, which now covers almost the whole world population, offering access to a 3G or higher-quality network to 90 per cent of all people. Access to the Internet continues to increase as well, with

more than half the world's population using the Internet. Most Internet users will connect through a broadband connection, mobile-broadband accounting for an ever-increasing share.

New indicators show that, in developed countries, most fixed-broadband connections offer speeds of more than 2 Mbit/s, but that in many of the developing countries, especially in LDCs, substantial pockets of the population are still suffering from slower broadband connections, as confirmed by global estimates for international bandwidth. Today's penchant for watching videos online as one of the most popular Internet activities is translated by very strong growth in fixed- and mobile-broadband traffic.

Endnotes

[1] One should be careful, though, not to directly compare penetration rates, because fixed connections are often shared, while mobile-cellular subscriptions are usually individual.

[2] This is particularly because, in China, almost all fixed-broadband subscriptions are at speeds equal to or above 10 Mbit/s. Without China, the corresponding percentage for Asia and the Pacific would be 70 per cent.

[3] See https://www.itu.int/en/connect2020/Pages/default.aspx (accessed 12 October 2018).

[4] A computer in this case refers to a desktop computer, a laptop (portable) computer or a tablet (or similar handheld computer) (ITU, 2014a).

[5] Internet access at home can be via a fixed or a mobile network.

[6] 1 exabyte = 1 000 petabytes = 1 million terabytes = 1 billion gigabytes.

Chapter 2. ICT Skills for the Future

Key findings

There is an increased need for "soft" skills beyond technical and navigational skills. A breadth of skills – including technical operational, information management, social and content-creation skills – will be fundamental for achieving positive and avoiding negative outcomes. Furthermore, algorithms, the proliferation of bots, and a shift to the Internet of Things and Artificial Intelligence, augment the need for critical information and advanced content-creation skills. With the increased complexity of ICT systems, and an exponential increase in the amount of data being collected, transferable digital skills and lifelong learning are indispensable.

ITU data and other cross-nationally comparative data sources show that there are considerable gaps across the board in the skills needed at all levels. A third of individuals lack basic digital skills, such as copying files or folders or using copy and paste tools; a mere 41 per cent have standard skills, such as installing or configuring software or using basic formulas on spreadsheets; and only 4 per cent are using specialist language to write computer programs.

Scarce data suggest developing countries are particularly disadvantaged when it comes to digital skills. There is a lack of data collected on skills in developing regions, but the available data suggest that inequalities reflect other inequalities between the different regions of the world, particularly in relation to basic skills. The patterns for standard skills are less clear.

Within-country inequalities in basic and standard skills reflect historical patterns of inequality. On average, those in employment were ten percentage points more likely to have a skill than the self-employed, who are in turn ten percentage points more likely than the unemployed to have a skill. Those with tertiary education are around 1.5 to 2 times as likely to have a skill than those with upper secondary education, and 3.5 to 4 times as likely as those with only primary education. Individuals in rural areas are about ten percentage points less likely than urban dwellers to have a skill. Finally, there is a five percentage point difference between men and women in having a certain skill.

There are skill inequalities between children as much as there are between adults. While little data are available on this outside of Europe, available data suggest that digital inequalities are not a generational thing and will persist into the future.

There are clear gaps in data collection for certain countries and groups, and a limited range of methodological tools is used to collect these data. Proxy survey measures (e.g. asking about use to measure skill) and self-reported skill measures are most common. Recently, self-reported skill measures using scales that have been validated through performance tests (performance test survey proxies) have been developed. The least common are actual performance tests or formal exams; in most cases, these are sector- and context-specific. It is recommended to develop survey measures that can be used for larger populations that have been validated to avoid response biases.

There is an urgent need for the development of measures across the range of operational, information management, social and content-creation skills. These items should be device- and platform-independent, measure skills rather than activities, and limit social desirability bias in the design of their answer scales. Furthermore – to understand the skills gap in relation to a potential future in which ICTs are embedded and invisible – the development of critical information, communication and data management, and production skills measures is desperately needed.

Survey measures used in most internationally comparative studies have severe shortcomings. They lack variety (measure only a narrow range of operational skills), comparability (have not been tested to be fit for cross-cultural comparisons), adaptability (are not transferable, as they are associated with specific platforms or activities rather than a core "curriculum" of future proof skills) and equity (have not been validated as comparable assessment tools for different subgroups across highly diverse populations).

The utmost priority is to make digital skills policies in relation to gaps in the labour market and concerns about widening social inequalities more effective. This can be done by (a) collecting higher-quality and more reliable data on the full range of digital skills in different sectors; (b) targeting specific groups depending on need and outcomes to be achieved, rather than following a one-size-fits-all approach; and (c) instead of establishing funding principles and incentives around success, where only best practices are shared, by stimulating multisectoral stakeholder partnerships with a continuous exchange of lessons learned and improvements made.

Chapter 2. ICT Skills for the Future

2.1 Introduction

The skills to use information and communication technology (ICT) are fundamental for participation in an increasingly digital world. They have been linked, at the individual level, to higher social and economic well-being and, at the national level, to a more dynamic and competitive economy. These digital skills can be defined as the ability to use ICTs in ways that help individuals to achieve beneficial, high-quality outcomes in everyday life for themselves and others, now and in an increasingly digital future. In other words, they comprise the extent to which one is able to increase the benefits of ICT use and reduce potential harm associated with more negative aspects of digital engagement.

Global developments in everyday life and in the labour market stress the importance of digital skills. The following trends at the individual level demonstrate how digital skills will be linked increasingly to social and economic well-being:

(a) Internet access is rapidly increasing: As highlighted in Chapter 1, ITU estimates that in 2018 more than half of the world's households (58 per cent) had access to the Internet at home. Several countries have home connection rates of more than 95 per cent, and in developing countries Internet use is diffusing rapidly due to mobile Internet access (103 mobile-cellular and 61 active mobile-broadband subscriptions per 100 inhabitants in 2018). It is further estimated that more than 51 per cent of the world population has used the Internet in 2018.

(b) ICT costs have gone down and capacity has increased exponentially: Mobile devices such as smartphones and tablets are taking over activities traditionally undertaken on PCs and laptops. These devices have lower costs associated with their purchase and maintenance, and offer easier access to a range of services and content. However, smaller, cheaper mobile devices also have less advanced applications and content availability, smaller screen sizes, greater scrolling requirements and less functionality (Napoli and Obar, 2014). This impacts the skills needed to operate them, usage patterns and, consequently, what the outcomes are of their use.

(c) Content and services are moving online, replacing offline information and services provided, for example, over the telephone or at the counter: Public and private organizations distribute as much online as possible. In developed countries, it has become almost impossible to do transactions with and access the commercial sector, the third (i.e. non-profit and non-governmental) sector and government sector services without using ICTs.

(d) Using social media and creating content have become common activities: New social media and video platforms emerge, but most regions have seen the rise of a few dominant players that seem to have staying power (e.g. Facebook, YouTube, Weibo and WeChat).

(e) Algorithms influence what content people see and who they are likely to connect with: This means that individuals are more likely to be confronted with information and interact with individuals that confirm views and knowledge that they already hold. Associated "filter bubbles" are related among other things to an increased susceptibility and sharing of "fake" news because people are less critical of these views that are dissociated from their source (Parissier, 2012; Bozdag and Hoven, 2015).

(f) The proliferation of bots that impersonate users and are programmed to promote extreme views or reinforce behavioural trends unbeknown to users are related to polarization of views and tribalization.

(g) There is a shift to the Internet of Things (IoT) and Artificial Intelligence (AI): These technologies, also known as Web 4.0,[1] create anytime, anywhere connections between humans and ICTs feeding data into personalized services. The IoT can be defined

as *systems* containing ubiquitous "everyday" objects (e.g. mobile phones, cars, wearables, home appliances, toys, etc.) accessible through the Internet and equipped with (a) sensing, storing and processing capabilities that allow these objects to "understand" their environments; and (b) identifying and networking capabilities that allow them to communicate information about themselves and make autonomous decisions (Van Deursen and Mossberger, 2018).

(h) ICTs are increasingly invisible: Whereas previous technologies typically required a fully aware user to operate a device, with these new ICTs, individuals might become more passive and unaware of what ICTs do and how they operate. Individuals are likely to step back and allow technology to do everything for them (ibid.).

(i) Security and privacy risks are magnified in complex ICT systems: There is an exponential increase in the amount of data being collected, also known as "big data". Devices and systems create networks of interconnected users, organizations and stakeholders. The goals behind the gathering of data in these networks of humans and technologies are extremely diverse, creating mash-ups of different sources, which result in databases more all-encompassing and potentially more powerful than any data collection could be on its own. Concerns are therefore raised about ownership and control over these data. Citizens engaging with these systems may not know what data are being collected, how they are being used, and with whom they are being shared (Federal Trade Commission, 2015; Internet Society, 2015).

At the organizational level, the following labour market trends also imply the increased importance of digital skills:

(a) The rapid increase in access to technology empowers existing trends of *globalization*, and organizations are rethinking their methods of business in order to remain competitive. The production of goods and services and jobs, particularly in the manufacturing industry, are being reallocated from the industrialized countries to developing nations (Anderson, 2008). On the other hand, many countries see the creation of an ICT industry as their chance to leapfrog economically, creating their version of Silicon Valley and looking to educate and attract highly skilled IT sector workers.

(b) Technology affects an ever-growing number of jobs in all types of industries (e.g. charity and commercial sector) and all organizations (e.g. small and medium-sized enterprises, multinationals). The call for digital skills education and training is often linked to work in the tech industry. Yet digital skills are no longer limited to technical jobs. By 2020, more than 90 per cent of jobs in the European Union will require digital skills.[2] Basic and intermediate digital *skills are required everywhere for everyone*.

(c) In developing countries, digital skills are in high demand and greatly improve prospects for decent employment.[3] Digital skills can be directly linked to higher earning potential. Increasingly, new jobs are available (some of them are actually going unfilled) and digital skills become part of a solution to unemployment (Anderson, 2008).

(d) Lifelong learning – that is, formal and informal learning throughout people's lives to develop the knowledge and skills needed to participate fully in society (Laal, 2011) – has become central to people's professional development (European Commission, 2001). This is partly because ICT devices, platforms and content are ever-changing and multiplying. People need to update their skills as much as they need to update their devices to be able to continue to participate in the workforce.

(e) Flexible production and service delivery systems facilitated through ICTs create the opportunity for profound *changes in the workplace,* such as flatter management structures, decentralized decision-making, information-sharing and task teams, cross-organizational networking and flexible work arrangements.[4] This means that networking, collaborative and teamwork skills become increasingly relevant.

(f) The level of digital skills relates to the likelihood of individuals' propensity to engage in *entrepreneurial activity* (Robinson et al., 2015). Digital skills are required for interacting

with stakeholders and clients, raising financial capital, developing business plans, devising business models, and building social professional networks and relationships (Chen, 2006). Crowdfunding platforms, for example, allow nascent entrepreneurs to raise funds from geographically distant actors (European Commission, 2001).

(g) The *boundaries between work and private life* have blurred (Wajcman, 2015). While ICTs make flexible working, working from home and freelance work easier, work also feeds into what used to be private spaces. Simultaneously, organizations are concerned that increased use of ICTs at work for personal affairs reduces productivity. Many companies are developing policies around work–life balance and netiquette rules on how to behave professionally online.

(h) *Automation and robotization* have the potential to increase efficiency and reduce errors, but also lead to the replacement of humans in many sectors. On the other hand, new jobs and sectors are created around the programming and managing of these new ICTs. It is likely that the replacement of jobs will be especially in routine, repetitive jobs, jobs that require pattern recognition and those that require a precision that is hard for humans to achieve. However, replacements can also be seen in sectors with a labour shortage and that require long working days, such as nursing.

The rest of this chapter elaborates on these trends and the importance of digital skills for participation in society. Section 2.2 starts with a more elaborate conceptualization of digital skills. Section 2.3 presents available data on the state of digital skills among individuals with different backgrounds and in different countries and regions of the world. Section 2.4 discusses how digital skills are typically measured, including self-assessments, indirect measures and performance tests. Each method's pros and cons are discussed, with a particular emphasis on the feasibility for regular and global monitoring. Finally, section 2.5 discusses the implications of all this for policy and initiatives aimed at measuring and increasing citizens' level of digital skills across different regions of the world.

2.2 The importance of digital skills in society

The trends discussed in the previous section imply that, to lead fulfilling lives, individuals have to be able to use ICTs. It is clear that having access to ICTs on its own is not enough for this to happen. After providing a detailed definition of digital skills, this section discusses why and which digital skills matter for different regions of the world, for employment and for everyday life now, but also in an even more digital future.

ICT-related skills necessary for individuals in society

In defining digital skills and why they matter, direction should be taken from discussions around which skills allow us to engage with a broad range of activities. That is, what are the transferrable skills that allow individuals, organizations and nations to function in and adapt to new contexts? Many academic and (increasingly) policy and commercial initiatives are engaged in fleshing out conceptualizations of digital skills. Earlier conceptualizations often only considered a person's ability to work with or manage (PC-based) hardware and software. That this is too limited is demonstrated by the research examining the multivariate nature of digital skills; they are now generally understood to have technical and more content-related elements (for example, Hargittai and Walejko, 2008; Litt, 2013; Van Laar et al., 2017). The Digital Competencies (DigComp) framework of the European Commission is a prominent framework and describes data and information, communication and collaboration, content creation, safety, and problem-solving as the five pillars of digital literacy.[5] Van Deursen et al. (2016) conceptualized a digital skills framework based on a review of the academic literature consisting of four types of skills applicable to the general ICT user population (as part of the Digital Skills to Tangible Outcomes (DiSTO) project[6]). This framework was originally designed and validated for the Internet, but has been tested for a broad range of ICTs, including mobile phones and other interactive technologies (Van Dijk and Van Deursen, 2014). They have since shown that operational and information navigation skills (related to Web 1.0 activities) are a foundation for social and creative skills (Web 2.0 related), which in turn are key to a broad use of ICTs that leads to

beneficial outcomes. Here, digital skills are defined within a framework that combines the DigComp and the DiSTO conceptualizations. Figure 2.1 shows this framework.

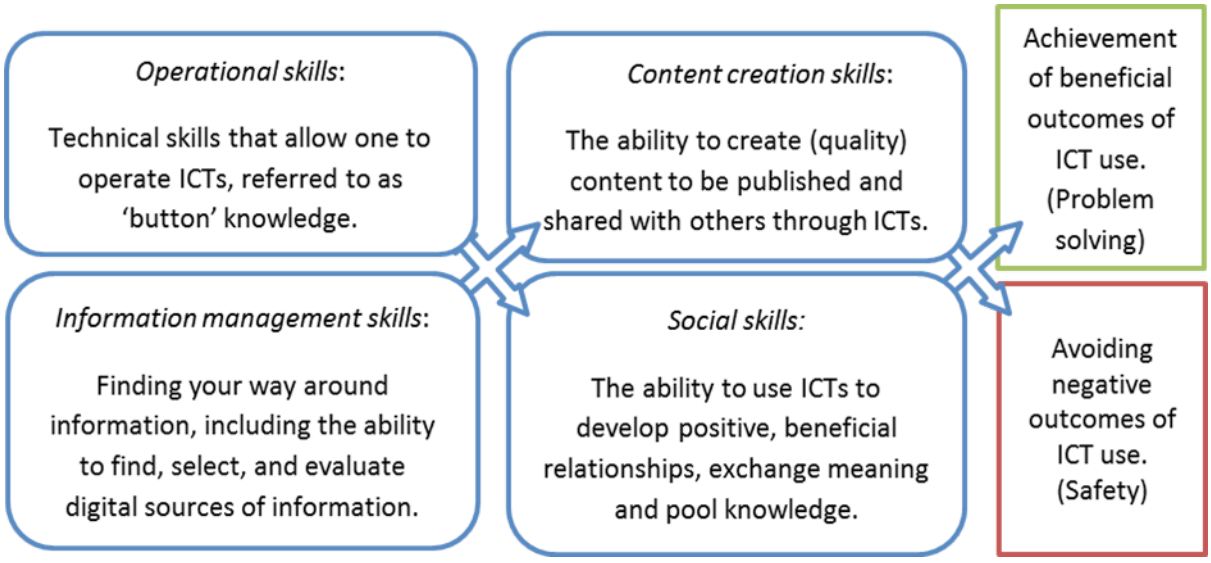
The model accounts both for aspects related to the use of ICTs as a medium (operational) and substantive aspects related to the content accessible through ICTs (information navigation, social and creative). For all of these aspects of skills, there is a range from more basic to more advanced levels. While all of them are needed to participate fully in digital societies, the level at which they are required will depend on the outcomes to be achieved and the sector the person is in.

In business settings, the concept of "twenty-first century skills" is often used to refer to new skill requirements that are different from "those of the past century characterized [by] an industrial mode of production" (Van Laar et al., 2017). How to equip students and the current labour force with twenty-first century skills and how to anticipate the ever-changing demands of the global market is a subject about which much has been written. A recent literature review revealed that seven core twenty-first century skills can be identified: technical, information management, communication, collaboration, critical thinking, problem-solving and creativity (European Commission, 2001). All these twenty-first century skills have a digital component, with digital operational, information navigation, social and content creation skills feeding into safer and more beneficial use of ICTs.

Making a distinction between different types and levels of skills is also highly relevant for when IoT and AI become embedded in our everyday environments. There is a persistent belief that these new technologies lessen the need for digital skills among the general population, since they work autonomously. However, scholars recently suggested that this is only the case for basic operational skills, since these are required for initial set-up of devices, which will be needed to a lesser extent (Bozdag and Hoven, 2015). Due to an increase in the complexity of and risk associated with data being gathered and more limited control over what content will be delivered to and created by an individual, there will be much more emphasis on the content-related skills (Van Deursen and Mossberger, 2018). An individual's level of these skills will determine the outcomes of voluntarily or involuntarily engaging with ICTs to perhaps an even greater degree than they do in the current digital age.

Now that a definition of skills is established, it is time to discuss why they matter – that is, what outcomes are governments, organizations, businesses and individuals likely to see from improvements in digital skills. Next, this chapter discusses the importance of digital skills in different regions, followed by the importance for employment and labour and – last but not least – for the more general well-being of the individual.

Figure 2.1: Different digital skills, their definition and role in societal participation



Source: Adapted from Van Deursen et al., 2017.

The importance of digital skills in different regions

Different regions have different levels of diffusion of ICTs. In poorer countries with lower levels of diffusion, concerns about infrastructure gaps often take priority over digital skills gaps. However, the surge of (cheaper) smartphones has meant that access to ICTs is within reach for many in developing countries for whom it was not before. Here, many people have mobile phones as their only access device. As argued before, these seemingly easier access platforms still require a variety of digital skills to be able to take advantage of the opportunities on offer. At the moment, there are still many offline routes to achieve these benefits, but there is a very strong push to make everything digital by default, which means that these individuals and the countries they live in are in danger of being left behind. There is an interest in setting up ICT employment and education opportunities in Silicon Valley-style hubs, to leapfrog and pass developed countries through high-end digitization. However, there is less interest in preparing the general population for a changing labour and everyday life environment in these regions. Especially relevant for developing countries is that billions of young people will enter the job market in the coming decades. If the next generation is not equipped with the digital skills required for a changing global work environment, it is likely that these countries will be left behind. Furthermore, a brain drain might occur when those who do have the skills but no opportunity to use them where they live, leave. This means that there is a need for education in basic as well as advanced technical and content-related digital skills.

An Organisation for Economic Co-operation and Development (OECD) report (2017) summarized the importance of digital skills and changing global labour circumstances as follows: in the short term, automation might reduce the need for migrant labour to supplement labour forces in developed countries. This means a diminished opportunity for upskilling in the form of return migrants with higher skills. On the other hand, while workers in developed countries are more likely to feel the immediate implications of digitization and automation, the long-term effects might be larger in the developing world, as there are more people in the types of jobs that are easily affected by these processes (Ilavarasan, 2017). Thus, upskilling will be even more important there than in developed countries.

The importance of digital skills for employment

That digital skills are high on national political agendas is evidenced in policy documents that express concern about the "digital skills gap" or "skills deficit" assumed to be holding countries, businesses and individuals back from progress (OECD, 2016a). Most of the focus there is on economic, labour force and educational participation. For example, the Sustainable Development Goals (target 4.4) include the affirmation that countries need to "substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship" by 2030.

Discussions around skills gaps are not new. Capelli (2015) identifies three types of problems historically associated with skills and employment that have resurfaced in relation to digital skills:

(a) Skills gap: Widespread shortfalls in the basic skills of future employees caused by faults in secondary and further education;

(b) Skills shortage: Shortage of job-specific skills such as engineers or information technology specialists, which is seen as a socio-economic problem caused by rapid growth in certain sectors or low entry into certain degrees or changes in demographics;

(c) Skills mismatch: The supply of skills and the demand for skills could be out of sync in either direction – oversupply or undersupply caused by skills gaps and shortages.

The Hays Global Skills Index (Hays, 2017) reports annual increases in "talent" mismatches with an undersupply of individuals with digital skills in relation to the need companies say they have. However, in 2017, for the first time, this was the case only for Europe and the Middle East, but not in Asia and the Americas. Nevertheless, it remains a problem even in those regions where there was no increase. Hays attributes this mismatch mostly to vacancies in positions for which higher education is required and in tech-related sectors.

Many countries' digital agendas now incorporate some form of ICT skills training and link it to employment (Bui et al., 2016). The European Commission has launched the Digital Skills and Jobs Coalition[7] to develop a large digital talent pool and ensure that individuals and the labour force are equipped with adequate digital skills. While the most emphasis is on technical or operational ICT skills in these policy documents, there is a growing realization of the increased importance of skills commonly referred to as soft skills or higher order skills, such as communication, content creation and problem-solving skills.

For many digital/ICT jobs, there is no need for specialized computer or technology experts. These jobs are often filled successfully by those who have acquired the transferrable twenty-first century skills discussed at the beginning of this section. That is, the modern workplace presents increasingly complex and interactive tasks, and all workers will be expected to weave their way through knowledge from the avalanche of information, and effectively apply such knowledge. Higher-order skills with a strong digital component – such as problem-solving, critical thinking and creativity – will be essential for the flexibility required by future workplace demands. This suggests that, to understand the types and level of skills required to grow a country's digital economy, it is important to distinguish between the "ordinary" citizens and specialists as the skill level required of each is very different (Dahlman et al., 2016). Those who engage with ICTs may be further distinguished between those who use digital services extensively in the course of their work and those who use digital services mostly to address personal needs. In summary, different types of users will require different skill sets and – while not everyone needs to know how to program – everyone will need to have an understanding of how content is created and how to navigate it.

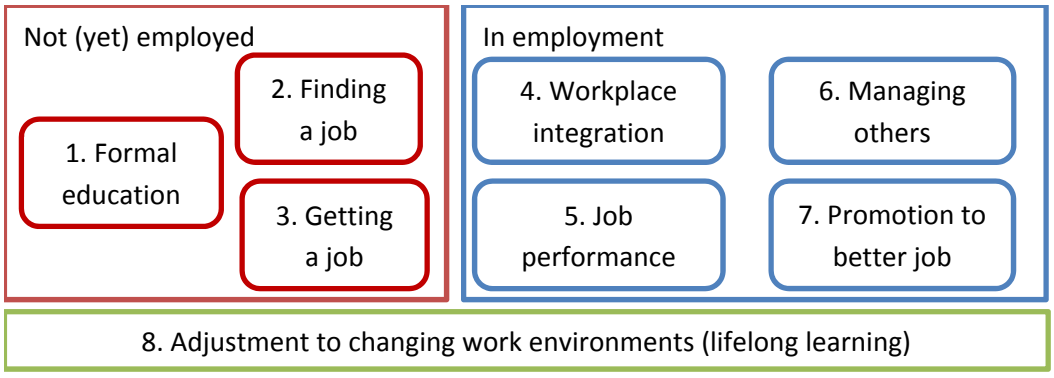
Besides the growing importance for all workers, digital skills play an important role in the whole employment process, as shown in Figure 2.2. This figure shows key points around the ways in which digital skills are important for outcomes at different stages.

(a) People with more digital skills do better in formal education (Underwood, 2009)[8]: ICTs are increasingly part of how learning takes place, including homework. Teachers and students need to have a sufficient level of digital skills to be able to do more complex tasks using ICTs.

(b) Technical (e.g. operating the devices to access job adverts and openings), information navigation (e.g. finding high quality jobs), social (e.g. networking) and content creation skills (e.g. creating and managing a professional profile and CV) are key to being able to use ICTs to look for jobs: Studies in the United Kingdom with disadvantaged young people indicate that, while they are very likely to use ICTs to look for jobs, they are much less successful in finding them (Helsper, 2016; Social Tech Trust, 2018).

(c) Having digital skills makes it easier to get a job: For example, in the United States, employment grew much more for jobs that required average or above average social skills (83 per cent) – such as interpersonal, management and communication skills – and those that required higher levels of analytical skills (77 per cent), such as critical thinking and

Figure 2.2: Skills are important at every stage of employment



Source: Authors.

computer skills,[9] while employment was up by only 18 per cent in occupations depending on physical skills.

(d) Digital skills can improve integration into the workplace and job satisfaction through better access to information and learning opportunities, and faster and more efficient forms of communication: They allow individuals to adapt to flexible work cultures that rely heavily on ICTs and allow a growing body of self-employed workers to get in touch with and stay connected with their colleagues and the latest developments in their fields. The right kinds of digital skills also allow a person to create a better work–life balance in deciding when to (not) use ICTs for professional and personal purposes.

(e) The tools that are used for work are changing and these changes are (ICT) skill-biased: As such, job performance is increasingly dependent on digital skills.

(f) Understanding which skills are important and which are missing, and having digital skills oneself, allow individuals to be better managers of others and take up managing positions: For example, computerization enables organizations to use high-skilled workers more effectively as a result of the diminishing importance of routine tasks, and employers are looking for adaptable employees. However, commercial and industry research suggests there is a gap in knowledge about which skills are missing. In PwC's 2017 Global Digital IQ Survey (PwC, 2017), 52 per cent of the participating technology executives rated their companies' digital IQ as strong, identifying critical skill gaps such as cybersecurity and privacy, compared with 67 per cent in 2016 and 66 per cent in 2015.

(g) Promotion and pay are related to digital skills: Studies have shown that digital skills yield a skill premium for wages, and workers who use ICTs effectively have been shown to obtain more generous performance rewards (DiMaggio and Bonikowski, 2008).

(h) Digital skills support lifelong learning, which is required to excel in the new labour market: Jobs that traditionally did not require ICTs now increasingly do. On-the-job training becomes much more important, and companies and individuals cannot rely on the education sector to do this, since continued learning needs to take place. Though automation and robotization have taken over some of the traditional jobs, digital skills remain of utmost importance, across all industries, organizations and workers. Educators, government institutions working with those trying to enter the labour market, and organizations and companies providing jobs, all need to put in a joint effort to create a workforce with transferrable skill sets that will allow people to adjust to a digital work future.

The importance of digital skills for general well-being

To understand the importance of digital skills in everyday life, the debate should revolve around the tangible, "real" outcomes that digital inclusion can bring. In other words, the relevance of digital skills becomes apparent in the examination of the types of benefits ICTs might bring and how these are linked to the particular skills and various forms of engagement needed to achieve these outcomes. This section is organized along six types of benefits that have received the bulk of academic, policy, commercial and third sector attention: economic, educational, political, civic, social and creative/leisure participation (Helsper et al., 2015).

(a) Economic participation: This relates to poverty, joblessness and wealth (Helsper, 2012). Digital skills are crucial to employment and work, as described in the previous section. On the financial side, information navigation, and social and content creation skills, can increase wealth through, for example, more savvy buying of products, finding insurance or financial products, obtaining discounts or recommendations from contacts, selling goods by creating an online sales platform, and creating discounts by collaborating with others. They are also important to guarantee safe transactions.

(b) Educational participation: Increasingly, schools in developed countries, at all levels of education, include the use of the ICTs in their curricula (Van Dijk and Van Deursen, 2014). As indicated before, digital skills are generally

believed to contribute to better learning outcomes and successful school careers; this includes all types of skills, not just the obvious information navigation or technical skills. For example, content creation skills are important for the submission of high-quality homework, and social skills will allow young people to be successful in collaborative projects and crowdsourcing knowledge and resources for assignments. Informal learning outside of the classroom using ICTs was also shown to be related to better educational outcomes.

(c) Political participation: This includes engagement with formal political processes and institutions (e.g. voting, being a member of a political party) and less formally organized politics (e.g. opinion formation and engagement with political issues outside formal political structures).[10] However, contrary to popular expectations in the 1990s, the Internet is not drawing more people into the political process. One of the reasons is a lack of digital skills, especially skills related to the creation of digital content and information navigation (Underwood, 2009).

(d) Civic participation: This includes engaging with government and health services.[11] Public institutions often seem to believe that they can reach the entire population with online public services and close the traditional channels of service provision. However, individuals who are not able to engage in these online activities – due to a lack of, for example, information navigation skills – receive fewer public, social and financial (e.g. tax) benefits (ibid.).

(e) Social participation: This reflects involvement in and attachment to networks that give a person access to the knowledge and support of others (Social Tech Trust, 2018). Research shows that ICT use is related to increased social contact, civic engagement and sense of community (Quan-Haase et al., 2018). However, increasingly more voices are being heard about the need to take back control over social technologies and the pressure to be connected 24 hours, as well as invasions of privacy (including those of work into private life) (Robinson et al., 2015). It is clear that social digital skills are important for taking up the beneficial social opportunities online, and new research is underway examining whether these also help avoid some of the pitfalls that come with increased mediation of socialization (e.g. depression, anxiety or lower self-esteem through confrontations with others' seemingly better lives, cyberbullying, privacy violations).

(f) Creative/leisure participation: This involves the pursuit of common leisure activities, such as undertaking sports, watching television, going to events and other relaxing activities (Social Tech Trust, 2018). Besides the obvious need for critical information navigation skills, content creation skills are needed to make sure that this content is not created by and directed at specific groups in society.

2.3 Digital skills across the world

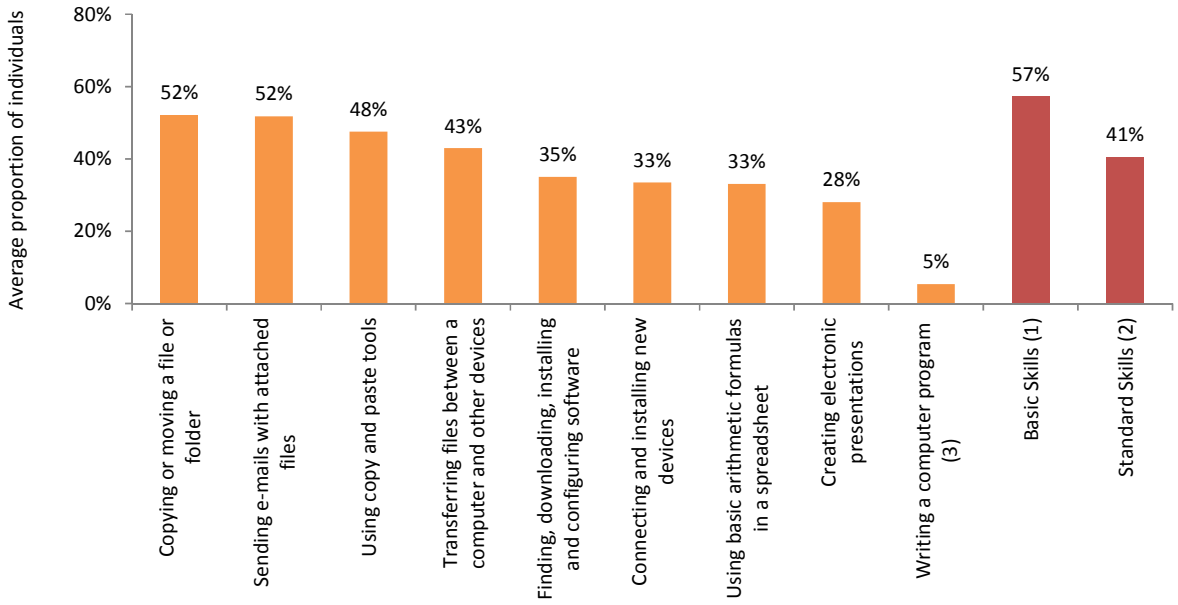
The outlined importance of digital skills in the previous section illustrates that the stakes of not having access to digital media and not being able to work with them are high. That same section argued that all individuals will need a variety of skills to be able to participate in digital societies and hinted at the fact that digital skills are not equally distributed. Research suggests that inequalities in digital skills might increase inequalities between developing and developed countries (Cruz-Jesus et al., 2017) and between socio-economic and socio-cultural groups (Van Deursen et al., 2017). In effect, a lack of a variety of digital skills is now widely seen as an important barrier to participation at work or school, in society in general and at home, in private life. A part of the growing income inequality in the United States since the 1970s is accounted for by unequally divided digital skills in jobs (Goldin and Katz, 2009). A study in Latin America indicates that the earnings return to Internet usage and skills reaches even higher levels in developing countries (Navarro, 2010). In the United States, results from a 2015 Pew study[12] revealed that about a third of workers (35 per cent) said they did not currently have the education and training they needed to get ahead. Yet many are trying to do something about it: 45 per cent of employed adults reported they pursued extra training to maintain or improve their professional skills in the past year.

While a lack of interest is an important barrier to getting access or to start using ICTs, digital skills are a key factor in determining whether

individuals can translate this use into real benefits (Van Deursen and Helsper, 2018). The distribution of these skills is, therefore, the main focus in research around the digital divide and digital inequality. Those who lack skills are disadvantaged in absolute terms: when services or products are no longer available or become more expensive offline, an inability to find or acquire these online means they are deprived of economic and social benefits. Those with low skills also suffer in relative terms: although they might get some benefit from ICT use, those with better skills are able to get relatively more out of this same use. Recent findings suggest the skills people have are more important than who they are (in socio-economic demographic terms) when it comes to inequalities in outcomes of ICT use (PwC, 2017). This has important consequences for social inequality. Digital skills should be understood as an asset to maintain class privilege and power, and inequalities in digital skills strengthen existing social inequalities. ICTs offer more capital-enhancing opportunities for those with higher levels of digital skills (Chen, 2006).

As a result of the heightened attention and concern around digital skills as an indicator of progress and "future readiness" of both individuals and countries, there are several global measures of digital skills which benchmark countries calling for those who lag behind to catch up and make sure that they do not get left behind in the digital future. This section relies mostly on recent ITU data on skills (see section 2.4 for a discussion of this indicator[13]), but also refers to other datasets that contain internationally comparative data on digital skills. The ITU skills indicator is based on nationally representative household surveys, and measures the following digital skills: (a) copying or moving a file or folder; (b) finding, downloading, installing and configuring software; (c) sending e-mails with attached files (e.g. document, picture or video); (d) connecting and installing new devices (e.g. a modem, camera or printer); (e) creating electronic presentations with presentation software (including images, sound, video or charts); (f) writing a computer program using a specialized programming language; (g) using copy and paste tools to duplicate or move information within a document; (h) using basic arithmetic formulas in a spreadsheet; and (i) transferring files between a computer and other devices.

Chart 2.1: Distribution of specific digital skills among individuals, 2017



Note: All countries N=52. Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017. For example, writing a computer program, considered an advanced skill, was measured in 49 countries. The 5 per cent that had this advanced skill is calculated with those 49 as a base.
(1) Basic skills are measured by the highest proportion on the first four skills within a country.
(2) Standard skills are made up of the highest proportion in the next four skills (starting at finding, downloading, installing and configuring software).
(3) Writing a computer program is the only advanced skill measured.
Source: ITU.

In 2017 and early 2018, 52 countries provided data[14] on at least one of these measures, and Chart 2.1 shows how they are distributed for individuals living in those countries.

The dropoff from basic to standard to advanced skills is quite steep, with on average 57 per cent of individuals having basic skills such as copying files or folders or using copy and paste tools, and 41 per cent with standard skills such as installing or configuring software or using basic formulas on spreadsheets and only 4 per cent using specialist language to write computer programs.

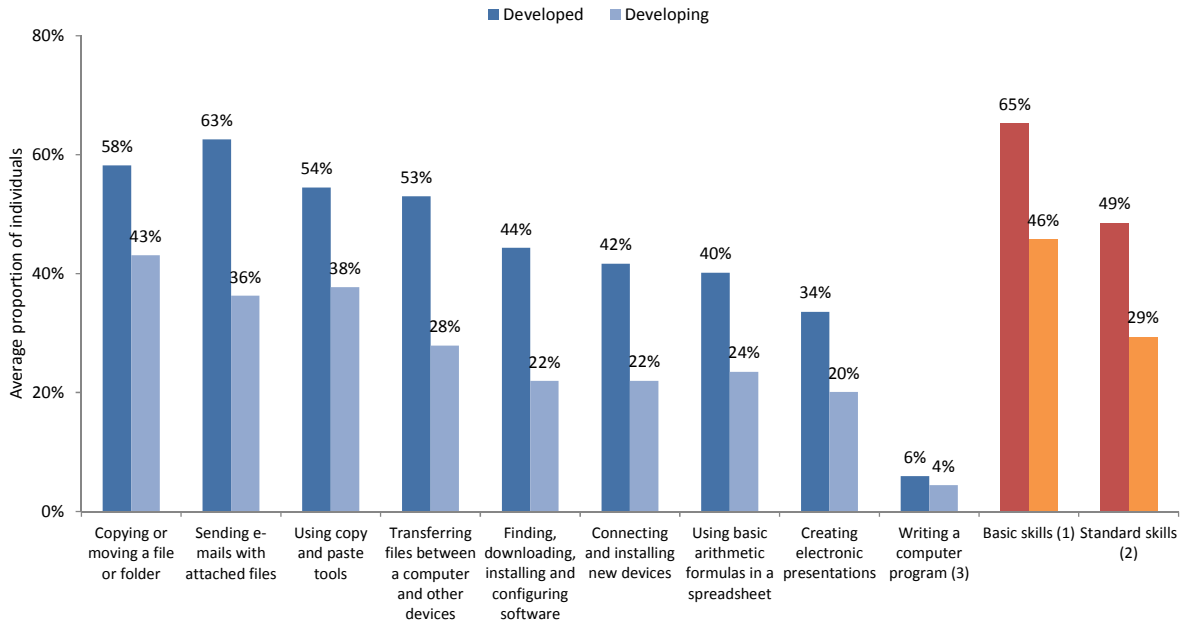
Digital skills in different regions

While mobile phones are now pervasive in many countries, Internet use is not. For example, there are now 76 mobile-cellular subscriptions per 100 inhabitants in sub-Saharan Africa, where only 23.5 per cent of the population has used the Internet in the previous three months. (In Europe, the region with the highest Internet use penetration, this is 124 and 80.6 per cent, respectively.) While the cost of data plans is one factor limiting people's Internet use on mobile devices in developing countries (see Chapter 4), digital skills also contribute to lower use rates. While there are skills indicators that are part of the IDI, these are indirect measures of digital skills – that is, they measure things such as educational levels and literacy as proxies for digital skills. Differences in specific digital skill levels based on the ITU data paint a clearer and more nuanced picture about the distribution of the different skills in developed and developing countries (see Chart 2.2).

It is clear that, in terms of skill levels, the developed countries are ahead. The proportion of the population with basic and standard skills is around 20 per cent higher there. The smallest difference in percentage points can be found for the advanced skill in programming, due to its very low levels.

Unfortunately, it is not possible to provide more detailed regional comparisons, since many countries within regions do not collect data on skills. In the Asia and Pacific region, countries that did submit data to ITU (including India, Indonesia,

Chart 2.2: Distribution of skills in developed and developing countries, 2017



Notes: All countries N=52 (30 developed and 22 developing countries). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017.
(1) Basic skills are measured by the highest proportion on the first four skills within a country.
(2) Standard skills are made up of the highest proportion in the next four skills (starting at finding, downloading, installing and configuring software).
(3) Writing a computer program is the only advanced skill measured.
Source: ITU.

Japan, the Philippines, the Republic of Korea, Malaysia and Singapore) have populations with higher levels of basic skills, comparable to Europe (where most countries submitted) in standard and advanced (programming) skills. The submitting countries in the Africa region (i.e. Côte d'Ivoire, Niger and Togo) show much lower levels of skills. The countries from the Americas that submitted data (i.e. Bolivia (Plurinational State of), Chile and Mexico) are interesting in that their populations have lower levels of basic skills but higher standard and advanced skill levels as compared with countries in the Arab and CIS region (i.e. Djibouti, Kuwait, Saudi Arabia, Tunisia and the United Arab Emirates).

The literature suggests that inequalities in ICT use will reflect other inequalities, such as those related to education, wealth and gender between the different regions of the world. An examination of individual economies echoes this hypothesis, although the pattern for the distribution of basic skills is different from that of standard skills (see Chart 2.3).

Other data sources back up that differences in digital skill levels within the global regions are significant even in regions where ICT infrastructure is well developed. For example, Eurostat data reveal that, within Europe, the Nordic countries have the most skilled citizens, while the Southern and Eastern European countries have the fewest citizens with high skill levels (see Chart 2.4). These patterns replicate traditional patterns of inequality within Europe but there are also surprises. Latvia, for example, performs better than other Baltic countries, while Ireland and France are below Slovenia in terms of their populations' skill levels.

That there is inequality between high-diffusion countries is clear not only among the adult but also among younger populations. Spain's children (4 to 14 years of age) are highly ranked in terms of social skill levels but low on their mobile skills, while Dutch parents estimate their children's mobile and operational digital skills levels to be relatively high but are lower ranked in comparison with other countries when it comes to social digital skills (see Chart 2.5).

Within-country differences

Besides differences between countries, there are within-country differences. This has been the focus of most digital inequality research into digital skills. In what follows, differences between employment and education status groups, between rural and urban areas, men and women, and younger and older sections of the population are explored using ITU data.

Digital skills and employment

There are significant correlations between unemployment and basic skills within a country, while the correlation with standard skills is not significant. A similar trend can be observed whereby skill levels drop strongly between national unemployment levels of 2 per cent and 6 per cent, but stay more or less stable at higher unemployment levels (see Chart 2.6). There is no significant correlation with advanced skill levels that can be explained by the very low overall level.

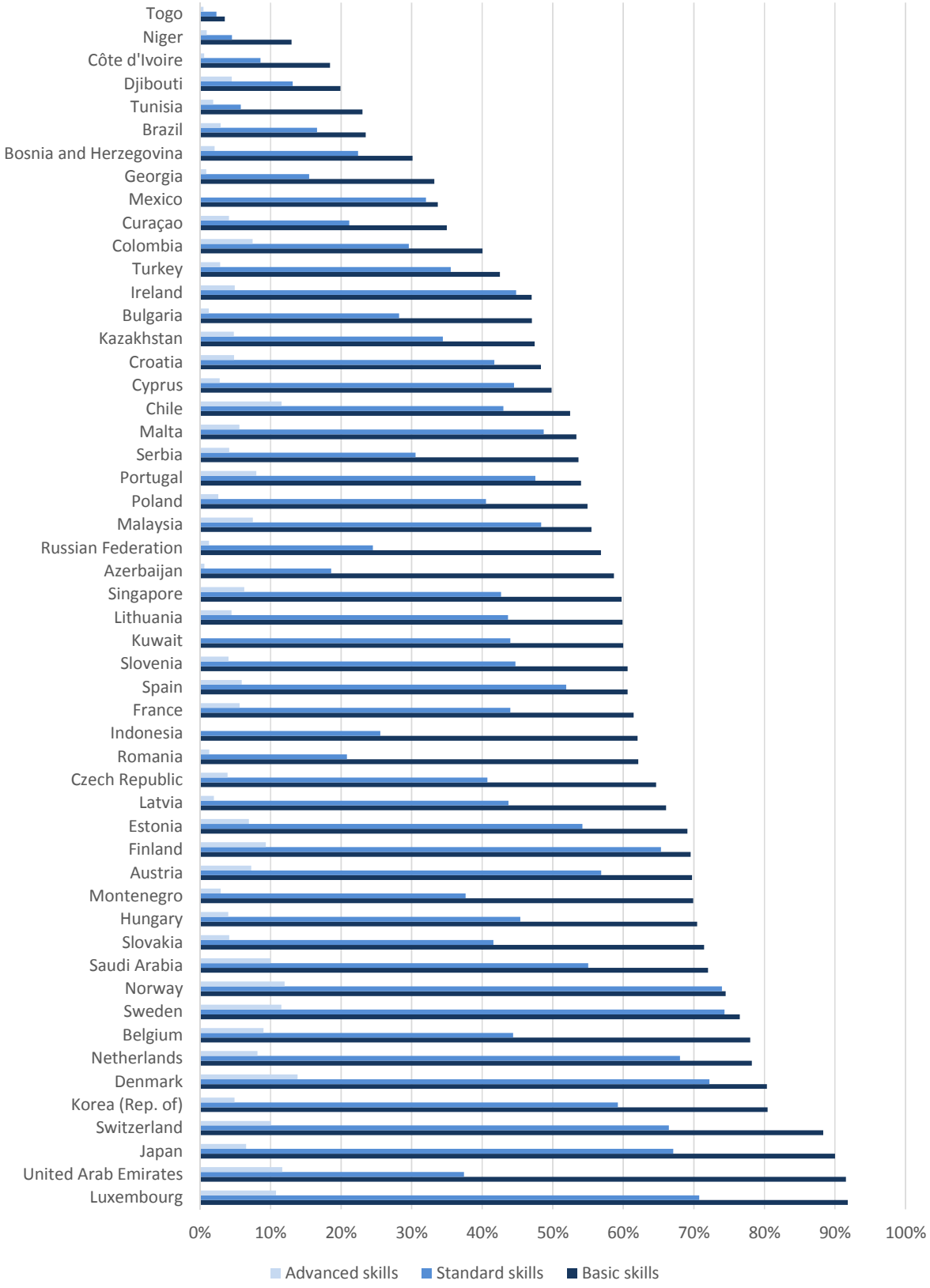
Across the board for all individually measured skill levels, those individuals who are unemployed have lower skill levels than those who are either self-employed or employed (see Chart 2.7). That self-employment does not indicate a booming entrepreneurial tech sector can be derived from the fact that the self-employed are also less likely to have a certain skill than those who are employed.

Digital skills and education

One of the strongest indicators of digital skills is the level of educational attainment. It is probably the most consistent global predictor of the skilled use of ICTs. Countries in which a larger section of the population has tertiary education also tend to have a population with higher skill levels, confirming that digital literacy cannot be seen separately from traditional literacy at the country level (see Chart 2.8).

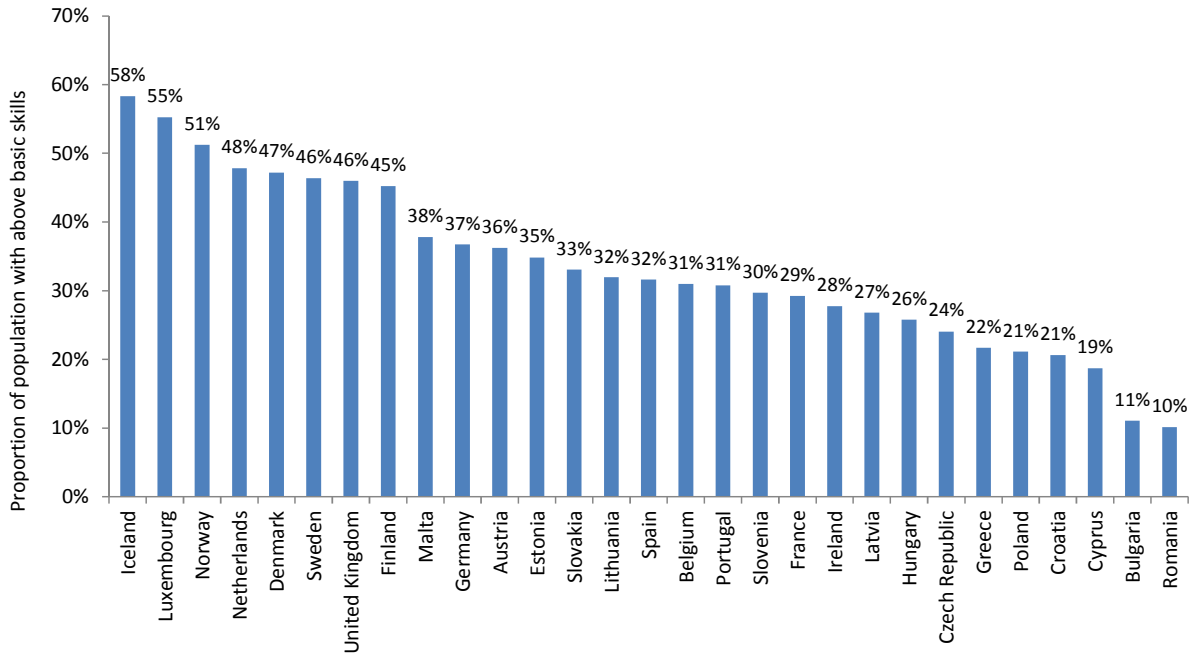
These differences in the estimation of skill levels also become clear when comparing individuals with different levels of education across the world. Individuals with higher levels of education, especially tertiary education or higher, are much more likely to have all digital skills (see Chart 2.9). The standard skills are often held by

Chart 2.3: Proportion of the population in each economy with basic, standard and advanced skill levels, 2017



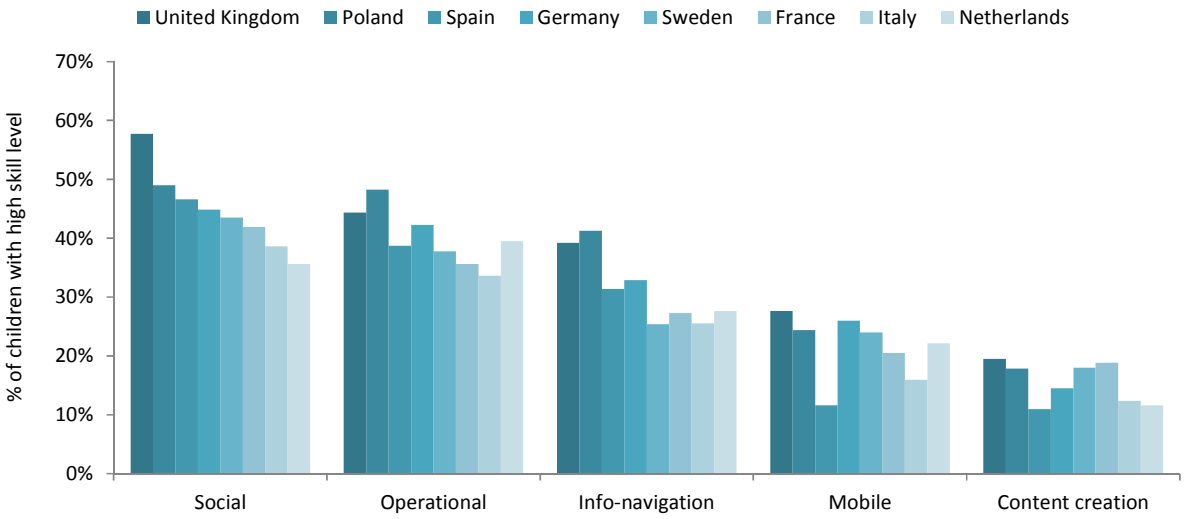
Note: Not all economies submitted data for all skill types and, for some, data were used from previous years because no data were available for 2017.
Source: ITU.

Chart 2.4: Internet users with above basic digital skill levels in European countries, 2017



Note: Eurostat defines the following as above basic skill levels: "Individual having 'above basic' skills in ALL the four Digital Competence domains included in the index: information, communication, content-creation and problem-solving".[15]
Source: Eurostat.[16]

Chart 2.5: High digital skill levels of children in eight European countries, 2016



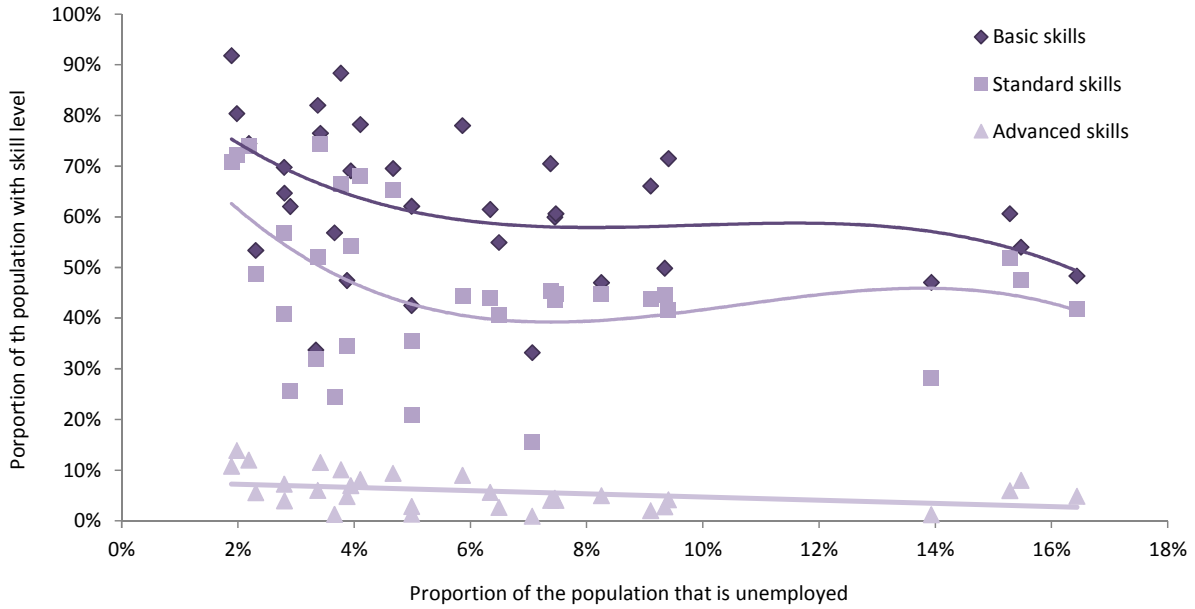
Note: High skill levels of children (4 to 14 years of age) are the proportion of children with scores higher than 4 on the aggregate skills measures: social, operational, information navigation and mobile skills. These are parents' estimates of their children's skills.
Source: European Commission (2016).

up to twice the proportion of individuals with tertiary education as compared with those who have upper or lower secondary education. The differences become even larger when compared with those who only have primary education.

Digital skills and rurality

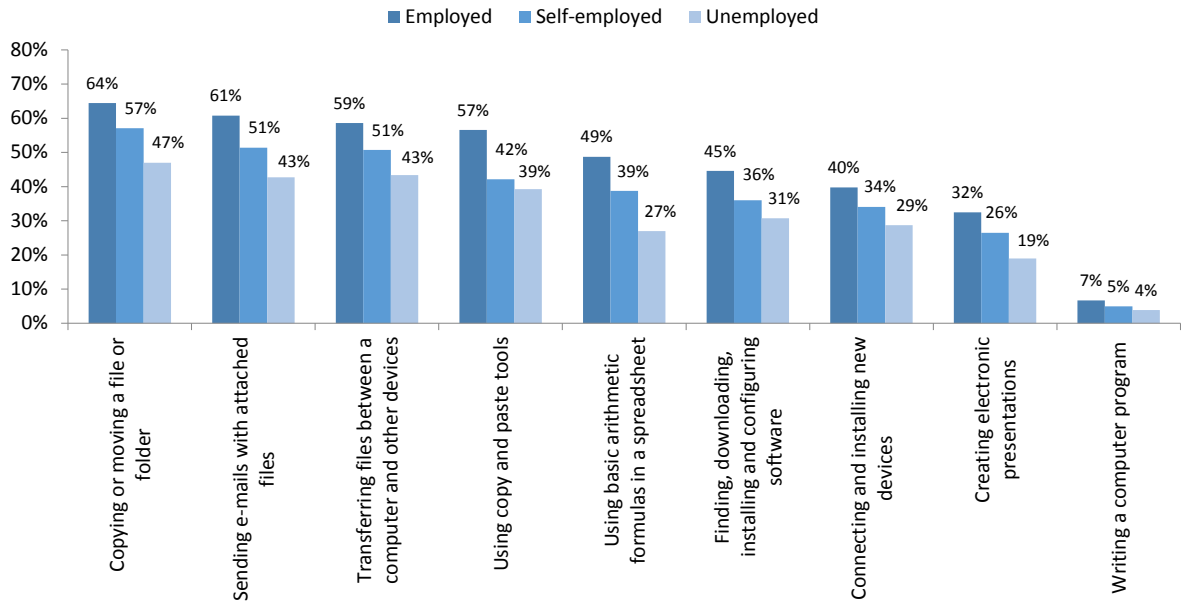
There is a significant correlation between the rurality of a country and its population's digital skill level. The more rural a country is, the lower the percentage of the population with basic and standard skills. This relationship is not very stable,

Chart 2.6: Rate of unemployment and basic, standard and advanced skill levels, 2017



Note: All countries that provided data for different employment status groups in each country (N=34). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017.
Source: ITU.

Chart 2.7: Skills by employment status, 2017



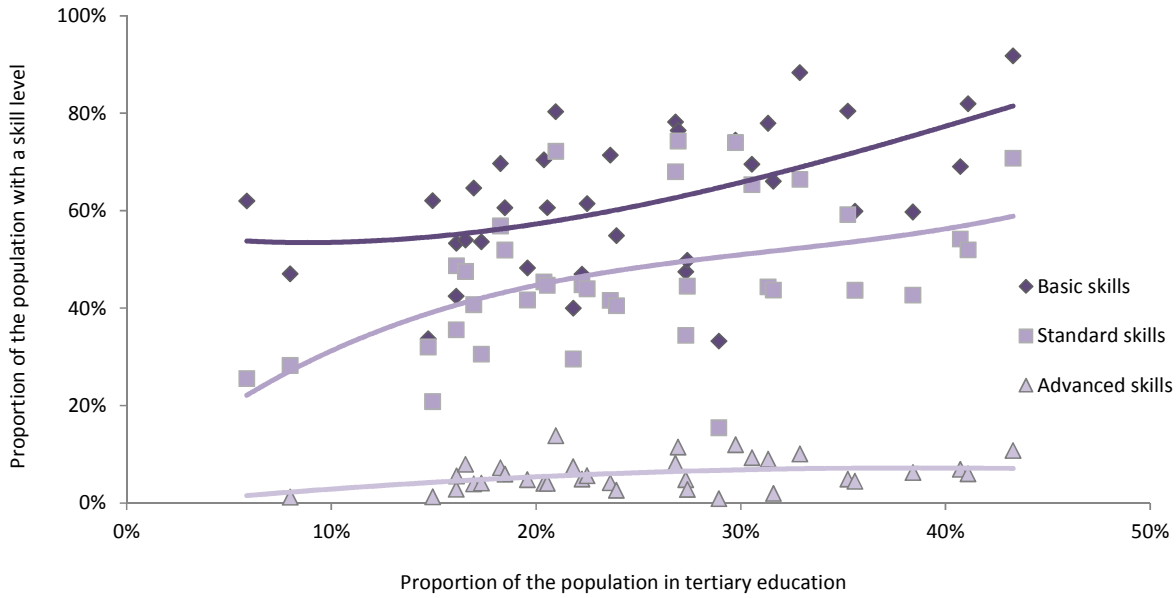
Notes: All countries that provided data on skills for different employment status groups in each country (N=34). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017. Proportions are based on country averages for individuals with a certain employment status who have the skill.
Source: ITU.

though, and there are many exceptions to this rule, as shown in Chart 2.10.

The relationship between living in urban areas and having high skill levels is more striking when looking at within-country data (see Chart 2.11).

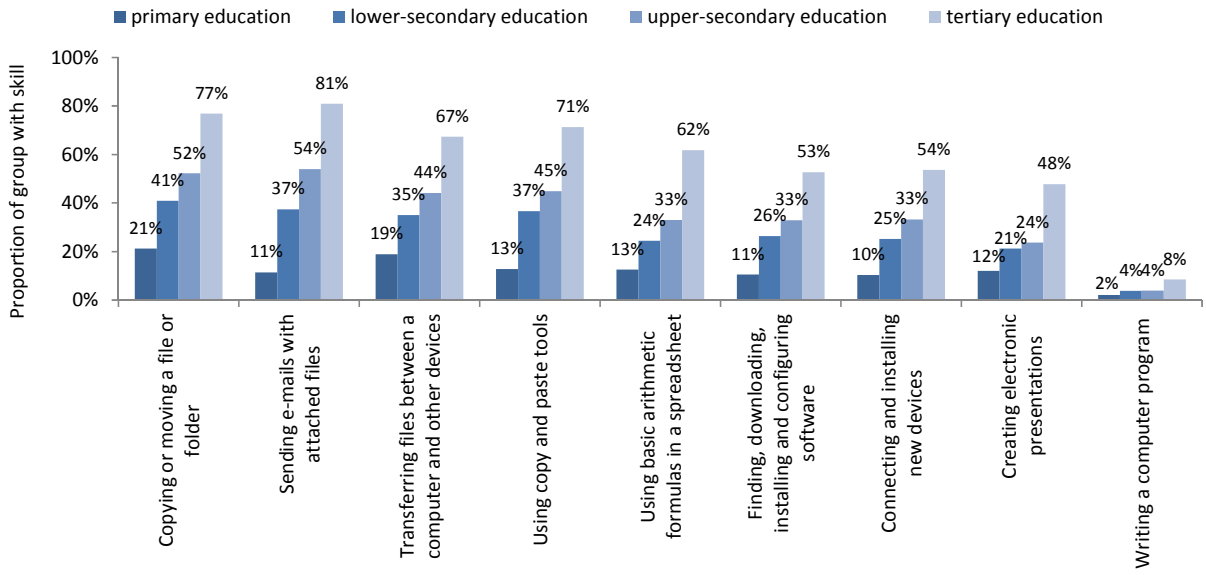
Individuals living in urban areas are much more likely to have basic and standard skills than those living in urban areas.

Chart 2.8: Relationship between level of education and skill levels in a country, 2017



Note: All countries that provided data on education level groups in each country (N=37). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017.
Source: ITU.

Chart 2.9: Level of education and digital skills, 2017

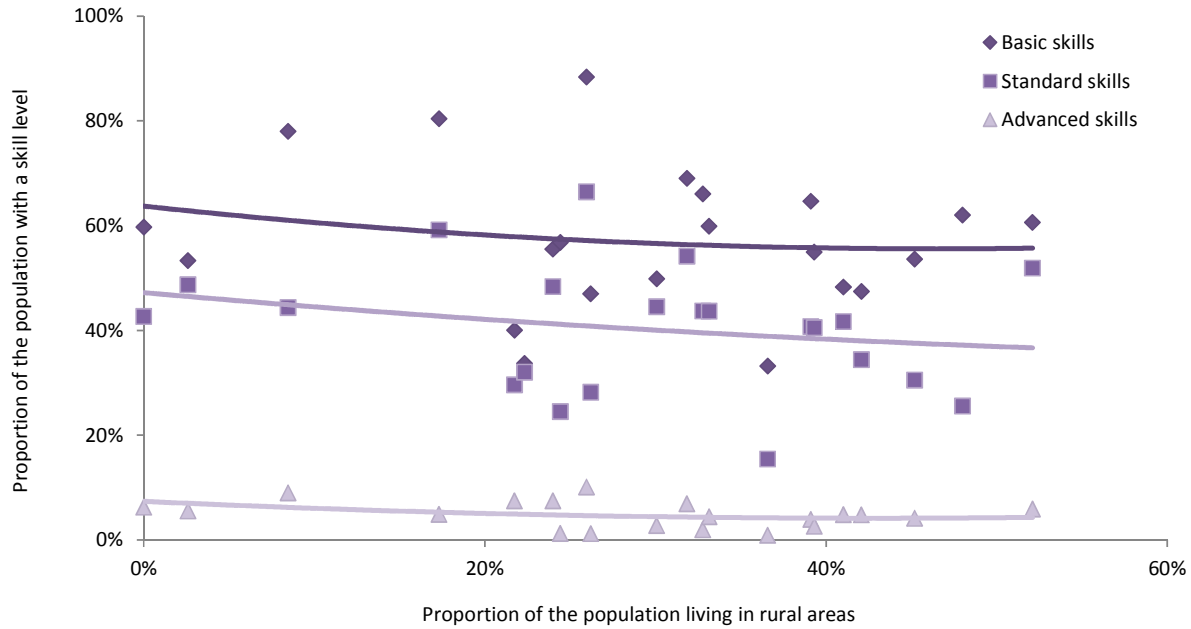


Notes: All countries that provided data on skills for different education level groups in each country (N=37). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017. Proportions are based on country averages for individuals with a certain education level who have the skill.
Source: ITU.

Digital skills and gender

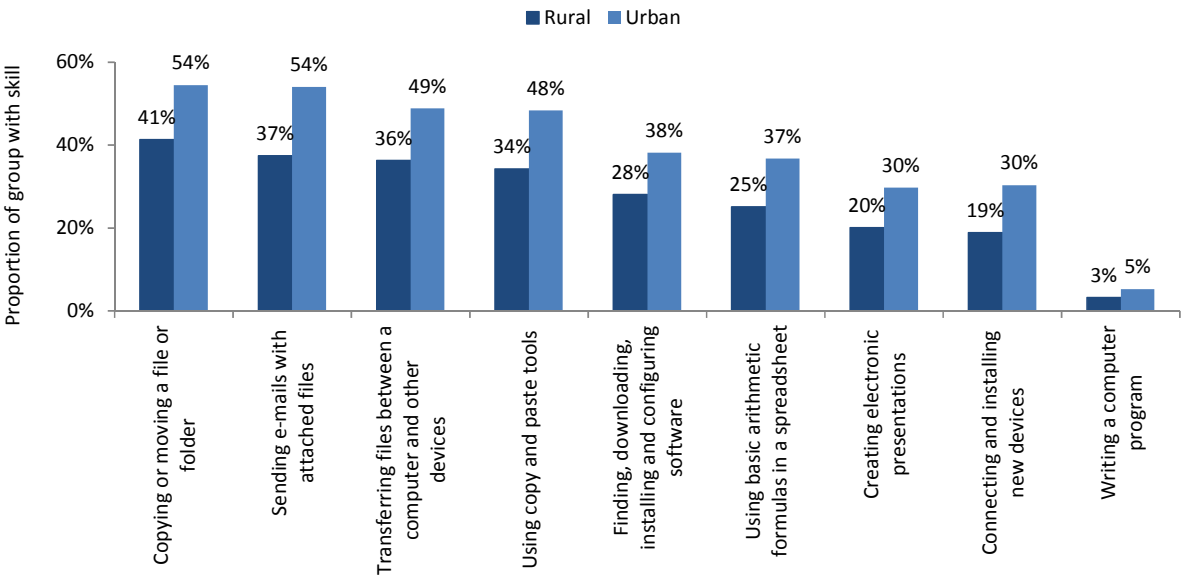
Since gender is equally distributed in most countries, this section does not compare the gender composition of the country with the level of skill. The focus is on gender inequality in relation to overall skills. The countries with the largest differences in skills between men and women are also those that have high levels of gender inequality (United Nations Development Programme, 2017), although the correlation with gender inequality is very low for basic skills, but strong for standard skills. The European countries with the higher levels of gender equality also tend

Chart 2.10: Relationship between rurality of the population in a country and skill levels, 2017



Note: All countries that provided data on the distribution of oral and rural residents in each country (N=23). Extreme outliers were removed (i.e. Japan). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017.
Source: ITU.

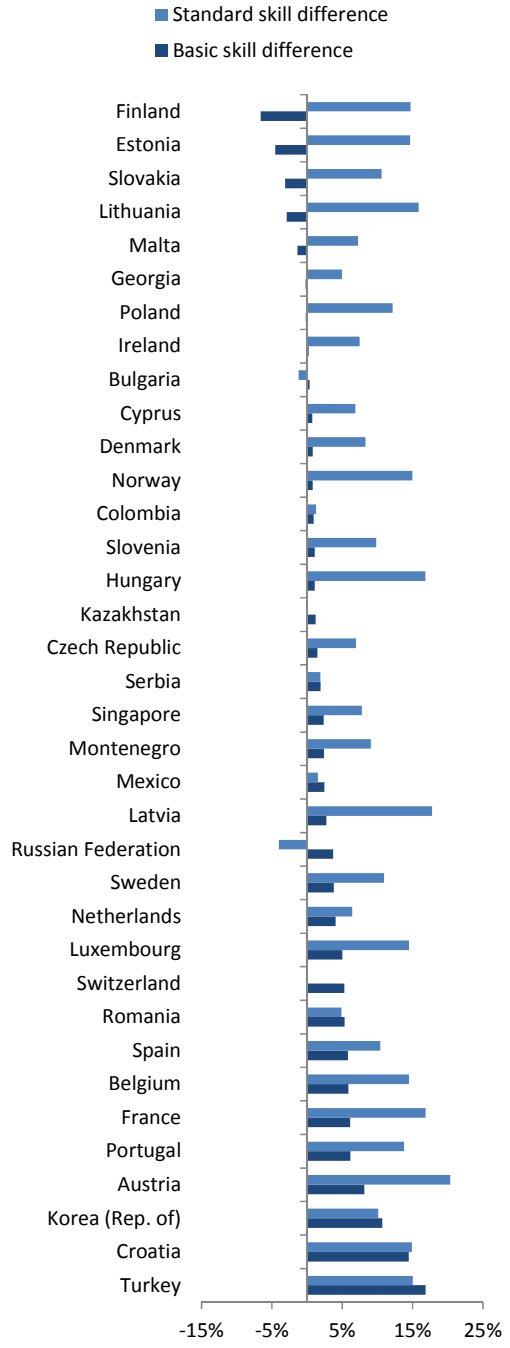
Chart 2.11: Average proportion of the population in rural and urban areas with a specific skill, 2017



Notes: All countries that provided data on skills for individuals living in rural and urban areas in each country (N=23). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017. Proportions are based on country averages for individuals living in an urban or rural area who have the skill.
Source: ITU.

to have smaller differences in basic skills, including fewer men indicating having basic skill levels than women in some countries (see Chart 2.12). This is mostly true for basic skills, though for standard skills, the differences between men and women tend to be larger. Only in the Russian Federation and in Bulgaria do women indicate having more standard skills. The patterns of the gaps in standard skill inequalities are also considerably different from those in basic skills; the Baltic and

Chart 2.12: Differences in proportion of men and women with basic and standard skill levels per country, 2017



Notes: All countries that provided data on skills for men and women in each country (N=36). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017.
A positive difference indicates a larger proportion of men having a skill and a negative difference a larger proportion of women with those skills. The difference is a percentage point difference – that is, if 55 per cent of men have a certain skill and 50 per cent of women do, then the difference is 5 per cent.
Source: ITU.

Scandinavian countries in general have a small gender gap in basic skills and a big gender gap in standard skills.

Chart 2.13 shows that men indicate higher levels for all skills,[17] though this difference is less pronounced when looking at inequalities within countries. This is probably because the differences between men and women vary widely between countries (see Chart 2.12) and even each other out globally.

Digital skills and age

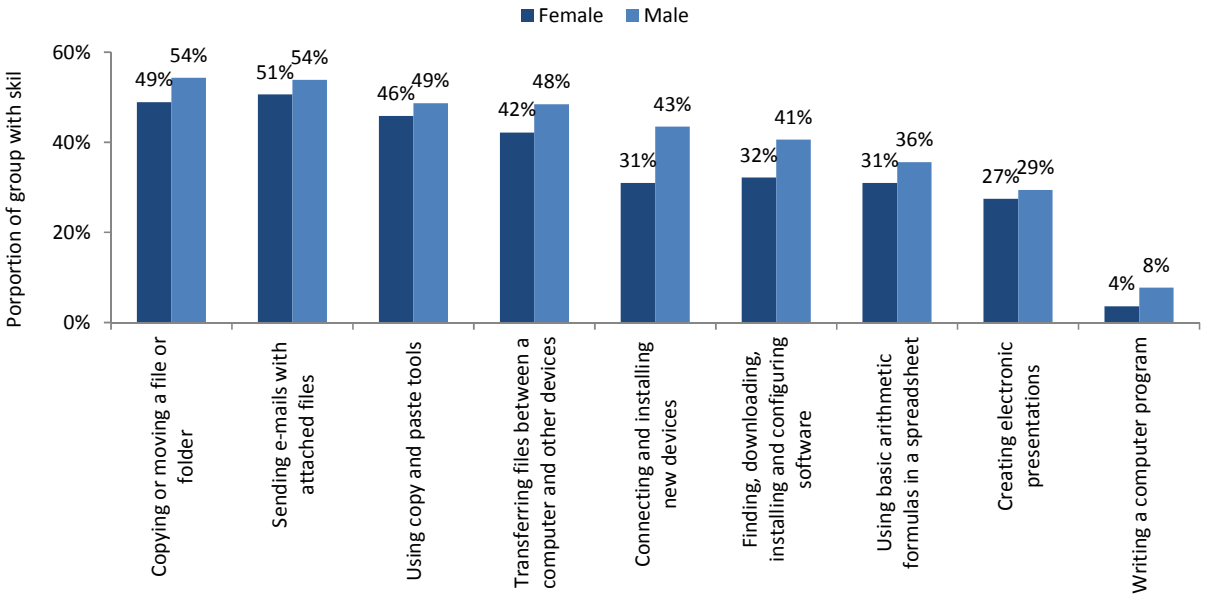
One indicator that has always been related to digital skills is age. Without fail, older generations are less likely to be online. However, overall, the age distribution of a country is not significantly correlated with its skill level. There is not a lot of variation in the age distribution of the different countries but, contrary to expectations, those countries with the highest proportion of the population from 15 to 24 years of age seem to have overall populations with lower skill levels (see Chart 2.14). Thus, having a young, digitally native population is not a predictor of high skill levels. Other circumstances (such as educational levels and rurality of a country) are more important.

When looking at specific skills and the gap between younger and older individuals, the differences are larger (see Chart 2.15). That is, those who are younger are more likely to have a specific skill than are those in the older generation. This is true across the board, with differences in some cases twice the proportion of young people indicating standard and advanced skill levels in comparison with the proportion of older generations. However, recent research shows that it is not age but social isolation, health, lower education and other issues that make this group more likely to be offline and have lower skills of certain kinds, rather than age itself (Van Deursen and Helsper, 2015).

2.4 Measuring digital skills

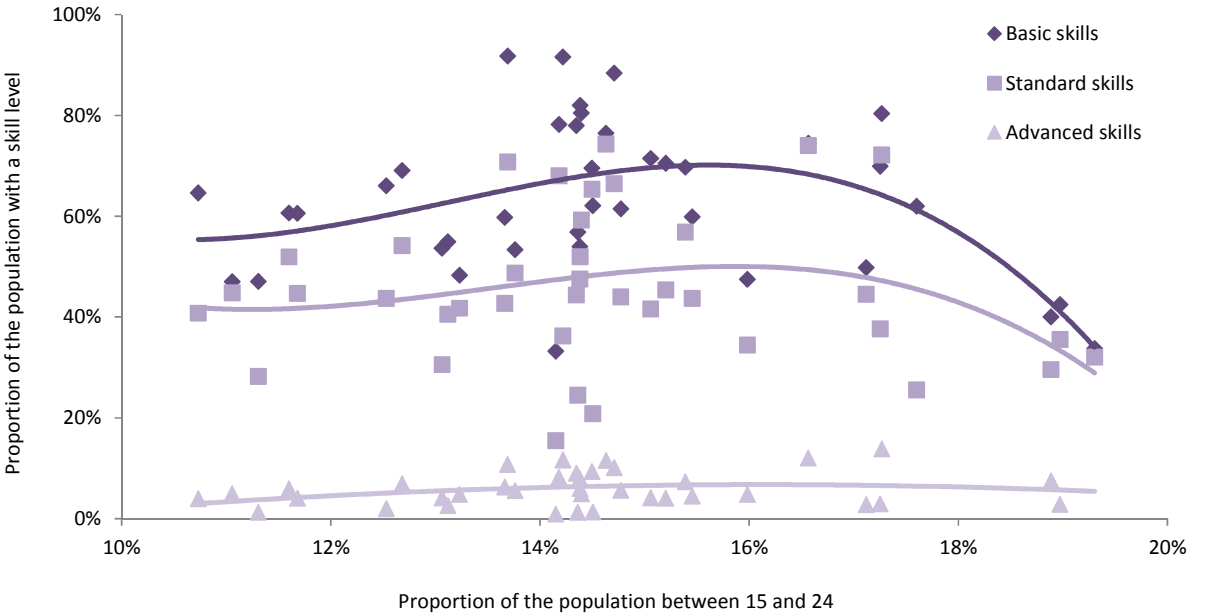
In the previous section, differences in the level of digital skills were mapped for countries and socio-demographic groups. However, the measures used to present this picture have their limitations. A general problem for digital skills has been that there is not enough theoretical clarity

Chart 2.13: Gender differences in digital skills, 2017



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

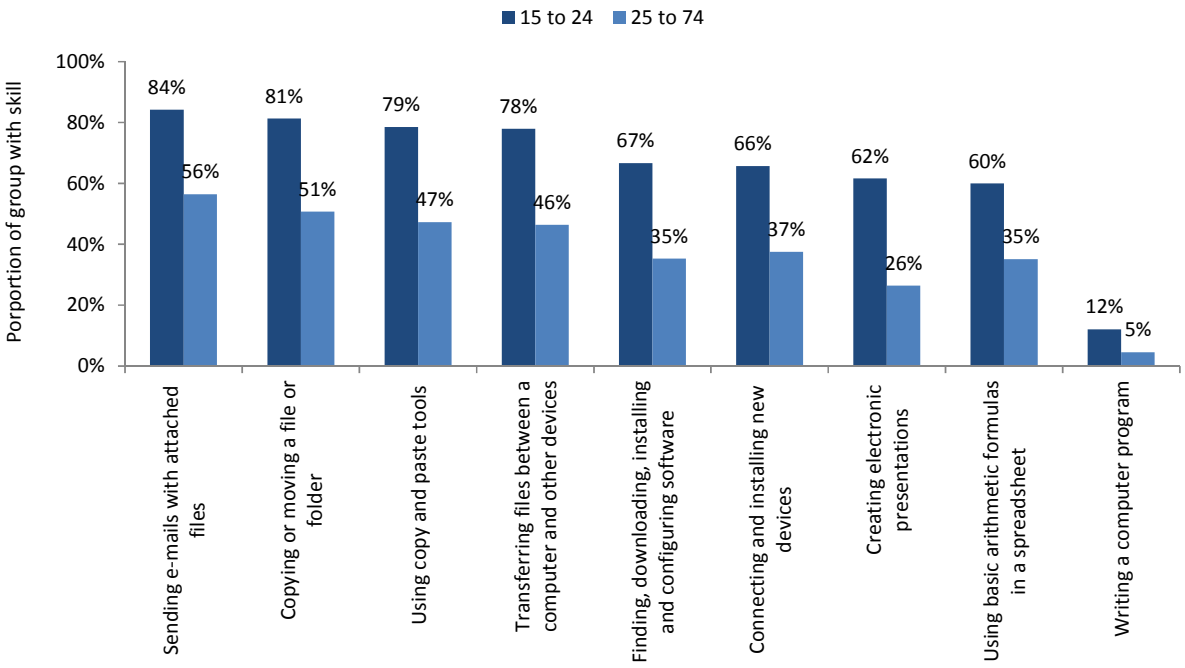
Chart 2.14: Relationship between age of the population in a country and skill levels, 2017



Note: All countries that provided data on skills for age groups 15 to 24 and 25 to 74 in each country (N=36). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017.
Source: ITU.

about how individuals' skills should be defined, and another issue is that it is not clear how they should be measured. In section 2.2, a definition of digital skills was provided. While it is now widely acknowledged that skills are an elaborate concept, most benchmarks are still limited in the sense that they measure primarily technical or information searching aspects of digital skills. That is, creative and communicative skills related to Web 2.0 activities are not always included, and management and critical skills related to Web 4.0, IoT and AI are even less likely to be measured.

Chart 2.15: Age differences in specific skills, 2017



Notes: All countries that provided data on skills for age groups 15 to 24 and 25 to 74 in each country (N=36). Not all countries submitted data for all skill types (i.e. Ns vary) and for some countries data were used from previous years because no data were available for 2017. Proportions are based on country averages for individuals within age bracket that has the skill.
Source: ITU.

This section will discuss measurement issues and solutions (beyond the conceptual issues) by looking at the data collection methodologies, the questionnaire items included and the formulation of these.

Methods used to collect data on digital skills

There are several methods that can be used to measure digital skills, but only few have been broadly applied and tested in existing research. The main data collection methods in surveys and performance tests in which a variety of indicators have been used are the following:

(a) Proxy survey measures: Several larger benchmarks use surveys in which respondents are asked which of a number of activities they have carried out online.[18] These measures derive the level of digital skills from the intensity (e.g. frequency) of engagement and the variety (e.g. number) of different activities undertaken using ICTs. Other approaches are even further removed from measuring ICT-related skills and capture these by, for example, combining the mean years of schooling. This data collection method facilitates large-scale, cross-sectional, and cross-national skills assessment. Another advantage is that people are generally able to recall whether or not they have undertaken an activity and what their level of education is. It is harder for individuals to remember correctly how often they undertake them. Of course, the issue with these proxy measures is that, although they are correlated to skills, they do not measure actual digital skills. If someone undertakes an activity (frequently), this might not mean that they are skilled at doing this, nor does not undertaking an activity mean that someone lacks the skills to do so if they needed or wanted to.

(b) Skill self-assessments in surveys: Most digital skill measurements present people with a list of skills. They are then asked to evaluate how well they perform. Advantages of such self-assessment questionnaires are the ability to present a large number of questions on a wide range of skills in a relatively short time, simple scoring and processing. A disadvantage is that people have difficulties judging their own skills because their interpretations are background-

and context-dependent. Interpretations depend, for example, on gender and age: men and younger people tend to overestimate their skill level (Van Deursen et al., 2011). In addition, skills estimations can depend on the comparison group: those who have their colleagues at a tech start-up as a reference group are likely to estimate their skill levels lower than those working at a construction site even if their actual skill levels are similar (Talja, 2005). Many digital skill self-assessment measures suffer from social desirability bias in ways that are unequally distributed among individuals from different groups and thus these often do not correlate very strongly with actual performance on ICT-related tasks.

(c) Performance tests or observational studies: These are the most valid methods for obtaining a view of people's actual digital skills. Performance tests have shown that men and women do not differ much in terms of digital skills, in contrast to what was found in self-assessment studies (Hargittai and Shafer, 2006). However, their design and implementation is highly labour-intensive, which makes the costs of large-scale, benchmarking-type data gathering at the population level prohibitive. Performance tests also show older people (with adequate levels of operational Internet skills) outperforming their younger counterparts on content-related digital skills, again in contrast to what is often found in self-assessment studies. However, these tests are more easily designed for advanced skills and for very specific tasks, but are more difficult to design for general engagement with ICTs among a broad section of the population.

(d) Performance test survey proxies: Some scholars have proposed self-assessment scales that are validated through performance tests. Since only the self-assessment items that show high correlations with outcomes achieved in performance tests are selected, this improves the quality (Van Deursen et al., 2014). Another proxy for performance tests that could be applied at a larger scale are scenario-based performance tasks, which have the additional benefit that they can be completed online. Here individuals are asked to solve problems either using simulated software – such as e-mail, web browser, or presentation software – or by being presented with written scenarios and asked to describe how they would use ICTs to solve a problem, find the information or what the issue might be in the way that an ICT-based activity is carried out.[19] A disadvantage of the latter approach is that it mostly fits educational settings because they require problems with a solution such as critical information skills or operational skills. Social and content-creation skills can be measured through self-assessment proxies, but are harder to test through scenarios.

The other set of data collection methods that measure skills consist of *counterfactual and experimental studies*. Their principal aim is not to collect data on skills, but to understand the effects of social and technical change on individual circumstances and the effectiveness of training and interventions. Counterfactual studies look at the digital skill and engagement levels of similar individuals living in different circumstances or whose circumstances have drastically changed. Experimental studies compare the skill levels of those who have been exposed to training or interventions and those who have not. Ideally, these are longitudinal studies to understand whether changes in people's social circumstances lead to change in their skill levels, or whether changes in skill levels lead to changes in their everyday lives. Such studies provide valuable insights for policy and intervention evaluation. For example, a recent study compared differences in digital skills and uses in different neighbourhoods. The selected neighbourhoods have varying ICT infrastructures, different ICT use and skill-related profiles, or different socio-demographic make-ups. These characteristics influence individuals' ICT use as much as their personal characteristics.[20] However, these are also less useful for large-scale studies, since they are very costly because of the local level at which data on skills have to be collected or the skills data cannot be generalized because they focus on particular case studies or interventions.

Most studies and benchmarks rely on indirect and self-assessment measures in surveys. They remain the most cost-effective and reliable way of measuring digital skills in large-scale cross-sectional and cross-national studies (Covello, 2010). There are many factors that influence which specific survey measures are used and many ways in which they are implemented; this

is important, because the shape these measures take determines the validity and therefore the usefulness of these results.

Existing survey measures skills in populations at large

Determining actual levels of digital skills is not an easy undertaking. As a result, empirical evidence and measurements that allow for large-scale, cross-national or cross-cultural comparisons are relatively scarce. This is even more the case for younger generations. Among older generations, it is typically difficult to distinguish between age groups (often 55 or 66 years and over are considered).

In past years, several scholars have attempted to create survey instruments to measure digital skills. Hargittai, for example, proposed survey items for measuring people's web-use skills and knowledge (Hargittai, 2005; Hargittai and Hsieh, 2012). Recently, van Laar et al. (2018) proposed a twenty-first century digital skills instrument aimed at working professionals. Another example is the skills measures developed based on the DiSTO project (Van Deursen et al., 2016). Besides these academic attempts, several benchmarks were developed by governing or commercial bodies with the goal to facilitate international comparisons such as those of ITU. They can be mapped onto the framework presented in Figure 2.1. A selection of broadly used benchmark studies is classified in Table 2.1 (see footnotes for question formats).

The examples in Table 2.1 show that a strength of most of the benchmarks is that they now address a multitude of skills. Remarkably, operational skills measures seem to be absent often (especially in terms of their applicability to mobile technologies). Yet, most benchmarks include a measure of information navigation, and social and creative skills. DiSTO, for example, includes knowing what information should and should not be shared online as a social skill, and ITU includes creating electronic presentations, which can be considered a creative skill. On the downside, however, a more in-depth look reveals that, conceptually, it often remains unclear why specific skills are chosen and that many of the social and creative skills measure technical aspects (e.g. managing privacy settings, uploading a picture) rather than the strategic and critical aspects of these skills (e.g. netiquette, effective distribution to an audience, understanding the political economy and regulation of online content production). This mostly results from the lack of a strong theoretical foundation. As a result, most skill measures are incomplete or very general. Another reason can be found in the limitations of available methods. Most of the surveys use activities as a proxy for skills or self-assessments that are not validated by performance tests. But even in performance tests – for example, those used by ICILS in which respondents are asked to complete tasks – the social and creative skills accounted for are very basic. In fact, it is difficult to, for example, measure social skills in performance tests, as interaction will be required. As a final remark, some benchmarks include outcomes of Internet use. DiSTO, for example, distinguishes between economic, social, cultural and personal outcomes, and DigComp has safety and problem-solving as potential outcomes (though they classify these as skills).

How to measure digital skills among populations at large

Since measuring digital skills in the population at large through performance tests and counterfactual studies is not really feasible, most benchmark studies rely on survey measures that are by definition based on self-reporting. Besides validating these measures through performance tests, there are several ways in which survey measures can be improved that counteract some of the validity and reliability issues that they currently have. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2016), a global assessment of digital skills should ideally have the following features:

(a) Variety: It should cover all aspects of digital and digital skills ranging from basic skills to more advanced competent use of ICT;

(b) Comparability: It should allow robust comparisons between vastly diverse countries ranging from low-income, developing countries to those that are industrialized with average high-income levels;

(c) Adaptability: It should allow the inclusion of new aspects in any future assessments so that new developments in this rapidly

Table 2.1: Comparison of international comparative surveys

	GKO/DiSTO[a]	DigComp[b]	ITU[c]	PISA[d]	Eurostat[e]	International Computer and Information Literacy Study (ICILS)[f]
Operational skills						
Button knowledge	■		■			
Technical understanding						■
Programming	■		■			■
Information skills						
Navigation	■				■	
Evaluation	■	■				■
Management						■
Social skills						
Management	■	■		■	■	■
Netiquette	■					
Creative skills						
Development	■	■	■		■	■
Knowledge	■					
Outcomes	Economic, social, cultural, personal	Safety, problem-solving			Problem-solving	Using information safely and securely

Notes: The sub-conceptualization of skills is derived from the DigComp framework.
Legend: Green means the skill is covered by the survey; grey means it is not covered.
[a] Question format: Please indicate how much the following statements apply to you when thinking about how you use technologies such as mobile phones and the Internet. Keep in mind that these are things that you should be able to do now and without help. (If you don't get what the question is referring to, tick the last box in the row "I do not understand what you mean by this". If you have never done this then reply thinking about how much this would apply to you if you had to do this now.). Source: Van Deursen et al., 2016.
[b] For question format, see https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework.
[c] Question format: For which of the following activities did you use the Internet for private purposes (from any location) in the last three months? And (skills): Which of the following computer related activities have you carried out in the last three months?
[d] Question format: Thinking about your experience with digital media and digital devices: to what extent do you disagree or agree with the following statements? Sources: https://www.oecd.org/pisa/data/PISA-2018-draft-frameworks.pdf and https://read.oecd-ilibrary.org/education/students-computers-and-learning_9789264239555-en#page1.
[e] Question format: For four domains, a set of activities have been selected (between 4 and 7) to reflect the skills of the Digital Competence Framework, with the purpose of discriminating between people having, or missing, the basic skills. When there is evidence about the variety of tasks accomplished or about their complexity, a flag "above basic" is also attributed. Once these three levels of skills ("none", "basic" and "above basic") are computed for each of the four dimensions, an overall composite indicator is computed. See https://digital-agenda-data.eu/charts/maps-by-country.
[f] Question format: Information-based response tasks that use computer technology to deliver pencil-and-paper-like questions. Skills tasks that require students to use interactive simulations of generic software or universal applications to complete an action. Authoring tasks that require students to modify and create information products using authentic computer software applications. See https://www.iea.nl/icils.

changing domain can be incorporated when appropriate;

(d) Equity: It should permit an assessment of all subgroups in the target population while still producing comparable measures across a highly diverse populace.

Most of these issues with digital skills measures relate to a lack of transferability. That is, they only apply to a very specific set of circumstances and are not useful for, for example, a different set of devices or as of yet unknown domains of digital engagement, and they suffer from an unequally distributed social desirability bias where different groups will answer the questions differently

in ways that are unrelated to their actual skill level. There are three ways in which this can be remedied:

(a) Make measures device- and platform-independent: Often, measures refer to activities on specific platforms, devices or apps, whichever is the latest to have become popular. This means that they measure whether someone is able to use a particular device but not whether they possess the more general skills that would allow them to participate in a range of activities and achieve a range of beneficial outcomes in a variety of possible digital futures.

(b) Measure skills rather than activities: Sometimes, it is not directly obvious that items measure activities rather than skills. For example, the nine ITU items used in the previous section to compare digital skills across regions and socio-demographic groups are related to activities rather than skills.[21] Even when questions ask whether someone is *able to* perform an activity, this does not provide clear indication of the skills someone might be missing when they say they cannot. If someone is not able to attach a document to an e-mail or create an electronic presentation, then it is not clear whether this is due to a lack of technical skill (e.g. they do not know which buttons to push), a communicative skill (e.g. they do not feel comfortable formulating or sharing things digitally) or a content-creation skill (e.g. they do not know how to create documents or visuals).

(c) Reduce social desirability bias: For measuring digital skills among cross-sections of populations, self-assessments are the best and often the only feasible option. Ideally, these self-assessments should be validated using performance tests as comparison. There are different ways of designing and formulating self-assessment questions. A typical problem that should be accounted for is social desirability, with individuals overrating or underrating their skills depending on prevailing social norms. This means measures need to be tested on a broad cross-section of the population to make sure they measure actual and not desired or appropriate skill levels. For example, operational, information navigation, social and creative skills measures have been validated by performance tests (Livingstone et al., 2017). DiSTO measures are updated constantly as more countries apply them among different user populations. The measures use response items that focus on truth claims to counter social desirability (e.g. a statement could be answered with "True of me"). Furthermore, the scales encourage respondents to reflect on themselves, and avoid using terms that more easily evoke comparison with others (e.g. "expert") (Van Deursen et al., 2016).

While solutions (a) and (b) are becoming part of common practice for benchmarking studies, (c) is rarely incorporated. Most measures, even in academic research, are used without the formulation of the answer options, and answer scales having been properly piloted in different populations.

2.5 Policy implications and initiatives

This chapter has argued that the need for sufficient levels of digital skills will increase both in developing and developed countries. A clear consequence of insufficient levels of digital skills is exclusion from contemporary and even more digital future societies, since digital skills offer real tangible benefits for general well-being related to economic, educational, political, civic, social and creative/leisure participation, and for all aspects of employment from completing a degree to looking for jobs to getting promoted. It is especially important to deal with inequalities in skills related to content creation and social interaction; if not, the risk is that those already marginalized will be further alienated in digital societies where ICTs (and those who design these systems) control them rather than empower them (Niklas and Gangadharan, 2018).

Research shows that inequalities in digital skills are likely to further exacerbate already existing socio-economic and socio-cultural inequalities. Therefore, there is a strong need for policies that attempt to counter low digital skills levels. These policies and interventions should take the literature and evidence related to the measurement of digital skills presented in this chapter into account. A review of current practice suggests three broad areas in which the use of evidence in policy-making and interventions can

be improved to aid the design and evaluation of effective policies and interventions, and improve accountability: broadening the scope, targeting policies and interventions better, and improving evaluation (see Figure 2.3).

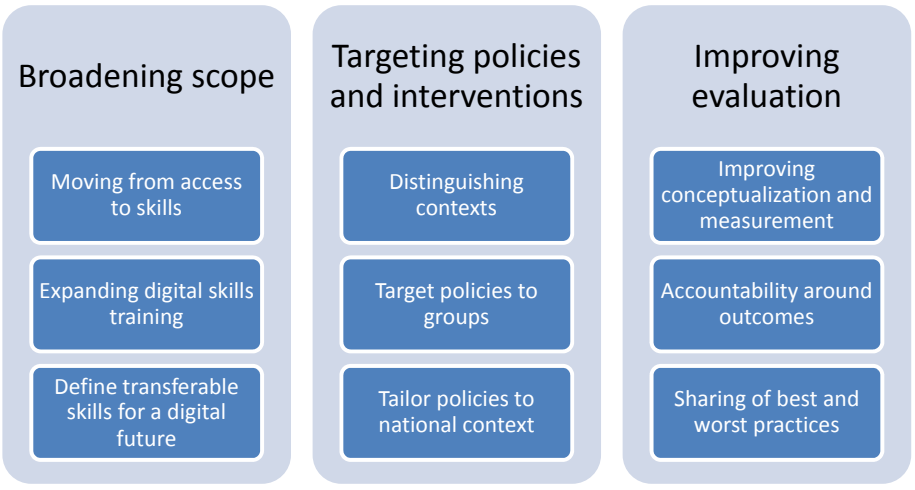
(a) Move from access to skills: Although many (developed and developing) countries now have policies on skills and policy-makers are aware of the wider social implications, actual implementations often focus on the expansion of infrastructure and access(ibility) – e.g. ensuring broadband Internet access. This is true for schools, both in developed and developing countries, where the main policy so far has been to equip students or schools with a preset number of computers and Internet connections (Selwyn, 2012). Although adequate infrastructure and access are necessary conditions for acquiring ICT skills, it is not sufficient to develop a broad range of ICT skills.

(b) Broadening skills policy and training: Policy and interventions related to improving ICT skills education and acquisition need to be designed and evaluated around a broad definition of skills. Specific training that only considers technical skills will only have a small and temporary effect (Helsper, 2016). Technical as well as content- and interaction-related skills are needed to fully participate in society; technical or operational skills on their own are not sufficient to achieve high quality outcomes of ICT use in the economic and general sense of well-being. In fact, research shows that it is the "soft" skills that make the real difference for reaping a broad range of benefits from digital engagement (Van Deursen et al., 2017). Currently, critical information, social and more everyday content-creation skills are absent in most curricula of professional organizations and educational institutions that offer ICT skills training (Helsper, 2016; Van Dijk and Van Deursen, 2014). Digital agendas, policies and skills acquisition programmes should thus explicitly incorporate the full range of skills and make this operational through standardization, certification and curriculum development.

(c) Define transferrable skills for a digital future: Lifelong learning will be an inherent part of the everyday lives of people globally, and the digital environment will keep changing. Interventions and policies focusing on skills that might work and be valuable now might not be sufficient or effective in the future. Continuous updating is therefore necessary for policy-makers, the commercial and the third sector. However, it is also fundamental that work starts as soon as possible to define transferrable, fundamental skills that that will make individuals ready to adapt to whatever digital future is ahead and integrate these into policies and curricula.

(d) Distinguish (professional) contexts: Not only should a broader range of skills beyond technical skills be considered when assessing digital skill levels, there should also be a differentiation between skills needed in everyday life (including most forms of

Figure 2.3: Pillars for improvement of policies tackling digital skills



Source: Authors.

employment) and skills needed for work in the IT sector. In formal education, emphasis is on coding skills or technical skills linked to employability and (re)integration into the marketplace. More attention should go to digital skills relevant for all, to use ICT for daily activities at home and different types of work. In other words, skills training should be more clearly linked to professional and personal well-being in the general population rather than just focus on workers in the ICT industry and specific short-term economic outcomes. This overly technical orientation on digital skills learning neglects the broader social and cultural environment (Helsper, 2016).

(e) Target policies and interventions to specific groups: More data are needed on which specific skills are needed and which are lacking for which groups of individuals and sectors (Law et al., 2018; OECD, 2016b). This implies cross-departmental government and multi-stakeholder collaborations, as there will not be a one-size-fits-all solution. Special tailored digital skills training and learning formats are required for specific disadvantaged groups, such as the unemployed, lower educated, elderly, disabled, illiterate, migrants and families in precarious conditions. Targeted strategies should be adopted across organizations and sectors that complement and build on each other. Relatedly, policies should account for people who are simultaneously economically, socially and personally disadvantaged (Helsper, 2011). Identifying these individuals is difficult but fundamentally important for effective policy and interventions at a national level.

(f) Tailor policies and interventions to national contexts: Available data show large differences in skill levels between countries, suggesting country-specific interventions. Target groups as those identified in the previous bullet point are not equally disadvantaged, nor are they likely to benefit equally from increased levels of digital skills in different countries. Similarly, the desired outcomes for the diverse target groups in different countries vary. One example is gender inequalities in ICT skills, which can be large within countries while globally they are not as pronounced, especially in relation to standard skills (see section 2.3). Thus, whether a group is likely to need a policy associated with it depends on the country context.

(g) Improving conceptualization and measurement: The theoretical lack of clarity and consistency around digital skills has made the determination of absolute levels of digital skills difficult, as measures often lack validity and offer few possibilities for comparison. Policies that anchor their design to ICT skill levels in large, diverse populations should use indicators that measure a broad range of skills with items that are validated through performance tests and which have been shown to be less subject to social desirability. A clear conceptual framework and valid measures shared among stakeholders and countries can be used to gain a better understanding on which specific digital skills are required for which groups of individuals and sectors. This will help to improve the design and evaluation of interventions and policies.

(h) Formulating accountability and benchmarking around outcomes: In order to have accountability for the effectiveness of policies and interventions, and to understand which skills are needed for which groups, design and evaluation should refocus around the tangible, "real" outcomes that digital inclusion policies and interventions can address. Policy initiatives need to start from an understanding of the outcomes that they are trying to achieve through improving engagement with ICT. ICT access – simple counts of users or how many people passed through ICT training – is not relevant if it does not lead to improvements in everyday life. When developing benchmarks around outcomes, it is important to think about the best methods and practices. The benchmark should account for (i) organization of data collection in different national contexts and priorities, and (ii) ensuring reliability, as different benchmarks tend to produce different results.

(i) Stimulating best *and* worst practice sharing: There is not enough evidence about which types of policy initiatives and interventions are effective and efficient in improving different types of ICT skills. However, there is even less sharing of less successful initiatives and the lessons learned from them. Governing bodies

should create financial and logistical tools that stimulate sharing and learning from best and worse practice in relation to digital skills training and development.

Following these suggestions for the improvement of benchmark studies and the use thereof to design digital skills policies and interventions will lead not only to more effective interventions but also to meaningful accountability and direct improvements in future design. When these changes have been implemented, the following five key steps should be followed in the design and improving policies around digital skills (Helsper, 2014):

(a) Identify the main challenges socio-demographic and socio-cultural groups face in terms of economic and general well-being;

(b) Identify to what extent a lack of digital skills inhibits reaching those desired for these particular groups;

(c) Identify the best organizations, locations and platforms to reach and help these target groups (for many groups this will not be through formal education);

(d) Provide tailored technical, and content- and interaction-related skills training to specific (sub)groups through relevant organizations, in relevant locations as identified under points (a) through (c);

(e) Evaluate these initiatives by measuring whether the groups improved their economic, social, civic, cultural and personal well-being as a result of increased ICT skills (and not just whether they have successfully completed the skills training). This means measuring the ICT skills and economic and general well-being levels of groups that were identified under (a) before interventions take place, then study which of these individuals (were) enrol(led) in ICT skills programmes and comparing their levels of ICT skills, economic and general well-being before and after they have gone through these skills training or interventions.

2.6 Summary and conclusion

The evidence presented in this chapter shows that inequalities between and within countries in terms of employment, education, gender and geography are replicated in digital skills distributions. Based on previous research, it argued that a combination of technical, information management, social *and* content-creation skills is needed for everybody to be able to solve problems and create a safe living environment in increasingly digital societies. The identification of gaps and inequalities in these specific skills and the design of programmes around core, transferable skills will be of fundamental importance to develop a digitally savvy citizenship that is ready to reap the benefits and avoid the more negative aspects that come with increased digitization of society.

This chapter has argued that the most cost-effective tools to determine which skills are important to achieve particular outcomes and to identify who is lacking these skills are large-scale, comparable surveys with indicators validated through smaller-scale performance tests, collecting data from representative samples of the population. There are many statistics offices that measure ICT access and simple use, but skills are often not covered. If they do, more often than not they do not follow best practice in the field, often considering only a narrow range of skills, rarely validating these measures through smaller scale performance tests.

Besides rarely measuring the broad range of skills needed to survive in digital societies, and measures are rarely being validated for the different languages in which they are asked, there are a number of additional issues in the measurement of digital skills that hinder a full understanding of which skills gaps exist and who is more likely to be affected by them. In this chapter, three aspects of current indicators have been identified as particularly problematic. Such measures:

(a) Are often device- and platform-dependent, which makes them obsolete as devices, platforms or apps are replaced by newer versions;

(b) Measure activities rather than skills, which is problematic because people may use digital media intensely or broadly without skills or, on

the contrary, have critical skills that lead them to distrust certain platforms or consider them unsafe and therefore steer away from using them. In other words, use of ICTs does not necessarily result in skilled use with positive outcomes; and

(c) Are subject to social desirability bias, creating overestimations of skill levels and making misidentification of skill gaps likely favouring those who come from advantaged backgrounds, even if they do not have the actual skills.

This chapter described several initiatives that aimed at tackling these issues and designing better measures with promising results. However, until these are systematically integrated into broader development indicators and are subsequently collected for a truly representative cross-section of the population, it will be impossible to gather the kinds of data that allow governments, commercial and non-profit organizations to understand where they stand, and design the kinds of initiatives that create a digitally ready workforce and citizenship that are able to achieve positive socio-economic and socio-cultural well-being outcomes.

This stresses the urgency for more countries to start measuring the full range of digital skills among their populations, trying to adhere to the principles of *variety*, *comparability*, *adaptability* and *equity* stipulated in this chapter. To be able to understand what an even more digital future might look like in which the Internet of Things, Artificial Intelligence and Virtual Reality are part of many people's everyday lives, governments should start to collect cross-generational data. Research in the few countries where research with younger populations has been done shows that skills are unequally distributed along socio-economic, educational, gender and other traditional disadvantage lines, even among so-called digital natives. To counter the current vicious cycles between traditional and digital inequalities, the lack of good measurement and thus of evidence for policy-makers on the digital skills base across generations has to be addressed.

To summarize, while much is already being done to develop better skills measurement, further discussion around which skills allow people to adapt to quickly changing environments is desperately needed. The burning question to be answered in the upcoming years is: What is the core digital curriculum that will not become obsolete in the near future and that can be distributed through formal and informal lifelong learning opportunities to reach the whole population?

Endnotes

1 Web 1.0 was also known as the "read-only" web. For users, the web was limited to reading information provided on static websites that were connected through hyperlinks. Web 2.0 can be described as the "interactive" web, where users had the opportunity to read and create content, and interact with others on social platforms. Web 3.0 was described by Tim Berners-Lee as the read-write-execute web and by others as the semantic or contextual web, as it provides information and services tailored to the user. Through algorithmic decision-making, Web 3.0 is able to decide on what content is important and relevant and what is not (e.g. spam, fake news). Web 4.0 is the mobile and embedded version of Web 3.0. Scientists imagine a future Web 5.0 in which there will be emotional interactions and connections between Web 4.0 technologies and humans.

2 See European Commission, "Commission launches 'Opening up Education' to boost innovation and digital skills in schools and universities", available at http://europa.eu/rapid/press-release_IP-13-859_en.htm (accessed 12 November 2018).

3 See, for example, UNESCO, "Digital skills critical for jobs and social inclusion", available at https://en.unesco.org/news/digital-skills-critical-jobs-and-social-inclusion (accessed 12 November 2018).

4 Partnership for 21st century learning, available at http://www.p21.org/ (accessed 12 November 2018).

5 See European Commission, "The Digital Competence Framework 2.0", available at https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework (accessed 12 November 2018).

6 See London School of Economics and Political Science, "From digital skills to tangible outcomes- Improving measures and models of digital engagement", available at www.lse.ac.uk/media@lse/research/DiSTO/Home.aspx.

7 See European Commission, "The Digital Skills and Jobs Coalition", available at https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition (accessed 12 November 2018).

8 There is a cause and effect issue: skilled learners are also likely to acquire digital skills more easily.

9 See Pew Research Center, "Key findings about the American workforce and the changing job market", available at www.pewresearch.org/fact-tank/2016/10/06/key-findings-about-the-american-workforce-and-the-changing-job-market/ (accessed 12 November 2018).

10 See European Commission, "The Digital Skills and Jobs Coalition", available at https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition (accessed 12 November 2018).

11 Ibid.

12 See Pew Research Center, "Key findings about the American workforce and the changing job market", available at http://www.pewresearch.org/fact-tank/2016/10/06/key-findings-about-the-american-workforce-and-the-changing-job-market/ (accessed 12 November 2018).

13 The indicator is currently under revision to cover a broader range of skills and adapt it to mobile technologies.

14 Data received after 27 July 2018 have not been included in the aggregates included in this chapter.

15 Eurostat calculates skills in the following way: "Persons that have been using Internet during last 3 months are attributed a score on four digital competence domains: information, communication, content-creation and problem-solving, depending on the activities they have been able to do. The scores are basic, above basic and below basic. Individuals not using the Internet are classified without digital skills. The four digital competence domains are aggregated in four logical groups."

16 See European Commission, "Maps by country", available at https://digital-agenda-data.eu/charts/maps-by-country (accessed 12 November 2018).

17 It is known that gender bias is particularly strong in the estimation of skills, with men overestimating and women underestimating their skill levels. This can be countered by different ways of asking questions and especially with different answer categories (see section 2.4).

18 Eurostat and ITU (for example) collect the results from their Member States.

19 OECD's Programme for the International Assessment of Adult Competencies' module "Problem solving in technology rich environments" is a good example of this. See www.oecd.org/skills/piaac/samplequestionsandquestionnaire.htm (accessed 13 November 2018). For the OECD Programme for International Student Assessment digital reading scenarios and tasks, see www.oecd.org/pisa/data/PISA-2018-draft-frameworks.pdf (accessed 13 November 2018).

20 See, for example, the Connected Cities and Heatmaps of Exclusion in Digital Societies Projects at http://heatmap.thetechpartnership.com/ and http://arnicusc.org/research/connected-cities/ (both accessed 13 November 2018).

21 ITU is currently revising this methodology.

Chapter 3. ICT Revenue and Investment Trends

Key findings

The telecommunication sector plays an important role in the global economy, with global retail telecommunication revenues reaching USD 1.7 trillion in 2016, representing 2.3 per cent of global GDP. At regional level, the importance of the sector in driving economic growth is clearly noticeable, especially in the developing world. Telecommunication revenues in 2016 represented on average 3 per cent of GDP in Africa and the Arab States, compared to 2 per cent in Asia and the Pacific and the Americas (excluding the United States and Canada), and less than 2 per cent in the CIS and Europe.

However, hit by greater market maturity levels, the telecommunication sector has reported sluggish performance between 2014 and 2016. Global retail telecommunication revenues declined by 5 per cent during the period, as mobile-cellular penetration crossed the 100 per cent mark in 2016. In parallel, the number of full-time equivalent employees working for telecommunication operators declined by 6 per cent globally between 2014 and 2016.

Fixed-line revenue represented half of telecommunication revenues generated in 2016 worldwide. Fixed-mobile convergence, multi-play services and the race to deliver on the promise of smart societies, are gaining in importance in mature markets, where subscriptions and revenue growth are stalling. For instance, in Europe, consolidation and the ability of converged operators to leverage ownership of fixed assets and content to support mobile is seen as a way of promoting more sustainable mobile markets.

Globally, mobile revenues declined by 7 per cent between 2014 and 2016, from USD 924 billion in 2014 to USD 859 billion in 2016. As mobile becomes ubiquitous across most regions, growth in mobile revenues is stalling. Between 2014 and 2016, mobile revenues declined by 10 per cent in the developing world, compared to 5 per cent in the developed world. There is a correlation between economic growth and mobile revenue growth in markets where prepaid is dominant – more than four in every five mobile subscriptions in the developing world were prepaid in 2016.

Mobile revenue growth is reliant on the monetization of mobile Internet services. However, between 2014 and 2016, the global increase in data revenues (USD 70.2 billion) was lower than the loss recorded in voice revenues (USD 114.6 billion). In fact, Asia and the Pacific and the United States/Canada were the only two regions in which the increase in mobile data revenues during the period was greater than the loss in voice revenues. Overall, the relative importance of data revenues over mobile revenues is correlated with a country's Internet penetration. In most developing economies, mobile-broadband subscriptions have grown enormously, countering the slowdown recorded in mobile-cellular subscription growth and supporting the growth in data revenues.

Mobile revenue growth is impacted by the uptake in over-the-top (OTT) services. The success of IP-messaging apps is often to the detriment of traditional text usage and the associated revenue. Globally, the number of SMS messages sent fell by half between 2014 and 2016, from 6 trillion text messages in 2014 to just under 3 trillion in 2016. As a result, global SMS revenues fell from USD 82 billion in 2015 to USD 75 billion in 2016, and analysts expect that global SMS revenues will continue to decline in the next few years.

The ICT sector is characterized by large infrastructure investments, with growth in telecommunication capital expenditure (capex) driven largely by data demand in developing economies – where mobile-broadband penetration remained below the 50 per cent mark in 2016. Globally, telecommunication capex went up by 4 per cent between 2014 and 2016, from USD 340 billion in 2014 to USD 354 billion in 2016. Investments in developing economies are largely driving this growth, with capex increasing by USD 23.5 billion during this period, compared to a USD 10 billion reduction in the developed world.

These trends denote a market context in which financial pressures and intensifying competition are forcing service providers to transform their business models to look for new revenue streams. Growth of the Internet of Things (IoT) and machine-to-machine (M2M) communications is creating revenue opportunities for service providers operating in mature markets, which may help to offset declining revenue trends in core business segments. As IoT revenue and investment opportunities are scaling up, certain enablers, such as Artificial Intelligence, big data analytics (BDA) and Blockchain, are gaining momentum. These emerging solutions are helping businesses to boost revenues, lower their cost base, and gain in efficiencies and competitive edge, while laying the foundation for "smart societies".

Chapter 3. ICT Revenue and Investment Trends

3.1 Introduction

The ICT sector is powering the global economy as industry players are connecting consumers across the globe to smart societies, leaving barely any area of the economy and society untouched. This illustrates the rapid transformation experienced by the sector, from the analogue era of the 1970s to the convergence era of the early 2000s, all powered by the advent of the Internet, and the digital transformation phase which the sector has been experiencing since 2010.

This chapter covers the role of the ICT sector in the economy, and highlights the direct impact of the ICT sector on the economy and on the jobs market. This impact is grounded in industry players' investments in technological improvements which enable innovative products and services. ICTs are playing an enabling role in unlocking economic growth, jobs and efficiencies in other sectors; these indirect and productivity impacts on the economy are often much more significant than the ICT sector's direct contribution.

The promises behind smart societies – to be powered by 5G and IoT networks and services – exemplify the impact yet to come on our digital economy and society. In stark contrast with the promises of the fourth industrial revolution (WEF, 2016), a review of the recent financial performance of the telecommunication sector shows that industry players operate in an increasingly mature and challenging environment characterized by stalling revenue growth and difficulties in balancing investments and profitability.

In the following sections, this chapter analyses reported financial data to identify trends in telecommunication revenue and investments, pointing to a phase of slow growth experienced by most regions between 2014 and 2016, along with signs of the commoditization of mobile services globally. The analysis of financial trends in this chapter is based on reported revenue and investment data available from 156 countries, representing altogether over 80 per cent of global GDP. Estimates have been made for countries that do not report revenue or capital expenditure information, in order to complete regional aggregations.

The chapter then highlights certain trends in mobile revenue, specifically highlighting signs of intensifying competition and analysing the relative weight of the mobile ecosystem in the overall telecommunication sector. Mobile technology has been the engine fuelling access to Internet services, notably in developing economies, where mobile tends to be the primary means for accessing the Internet. However, with global subscription penetration crossing the 100 per cent threshold in 2016, mobile markets in both developed and developing economies are poised for slow or declining revenue trends in the near future. With greater maturity levels comes increasingly intense competition, forcing service providers to transform their business models and seek alternative sources of revenue and efficiencies.

The mobile ecosystem has witnessed a drastic shift from voice to data services as access to the mobile Internet continues to grow. Mobile phone usage patterns reflect the growing consumer appetite for mobile Internet services fuelled by the wider availability of affordable smartphones and richer media content platforms and applications. Similarly, the shift from voice to data services is also taking place in the fixed-line business, as growth in fixed-telephone subscriptions is stalling while fixed-broadband subscriptions are on the rise. The analysis will depict the impact of such transformations on the financial performance of service providers, along with the influence of over-the-top (OTT) providers on the mobile industry, particularly on traditional messaging revenues.

The final sections of the chapter cover trends in ICT investment, including foreign direct investment (FDI), and will point towards ways in which emerging solutions such as the Internet of Things (IoT), Artificial Intelligence (AI), big data or Blockchain, will support revenue growth. Lastly, the chapter concludes by providing some policy suggestions based on data findings.

3.2 The telecommunication market

From a hardware-centric to a software-centric sector

International organizations have described the ICT sector as one of the most dynamic sectors in the economy, and emphasized a clear shift in recent years from a hardware-centric to a software-centric sector. Along with software publishing and three other activities, telecommunications are part of the ICT services industries, one of the three pillars shaping the ICT sector (Box 3.1). However, despite the fact that ICT services as a subsector have reported the fastest growth in value added in comparison to other ICT subsectors, telecommunications and ICT manufacturing reported sluggish performance between 2008 and 2015 (OECD, 2017b).

The OECD (2017b) has stated that in 2015, the ICT sector accounted on average for 5.4 per cent of total value added for its Member States, adding that growth in the sector is increasingly driven by software production and services, the latter accounting for more than 80 per cent of total ICT value added (OECD, 2017b). Between

Box 3.1: Understanding the classification and boundaries of the ICT sector

Over the past decade, the ICT sector has had a revolutionizing impact on our economies and societies, and further disruptive innovations and changes are expected in the near future. This fast-moving economic and societal transformation continues to challenge industry players as well as national and international bodies in terms of accurately measuring the state of the information society, and has led to some discussion on the interpretation of industry components belonging to the information economy and its boundaries. The comprehensive definition of the ICT sector has evolved over time, and its inherent economic activities are grouped into three areas: ICT manufacturing industries, ICT trade industries and ICT services industries (OECD, 2017a).

The level of sector disaggregation required to assess the role and impact of the ICT sector goes well beyond traditional telecommunication activities. While harmonizing international classifications is crucial to obtaining comparable data, it requires a wide reach of supply-side and demand-side data which can be challenging to collect. For instance, the lack of reported data – particularly in developing economies – prompted the European Commission to develop what it considered to be a more "feasible" sector disaggregation. The EU's operational definition (European Commission, 2012) differs from the OECD's comprehensive definition in that it excludes the *ICT trade industries* and the *Manufacture of magnetic and optical media* (see Table Box 3.1), owing mainly to the lack of reported information for these two subsectors.

It is important to grasp the subtleties inherent in these definitions, as this will help us to understand how to capture and measure the impact of the ICT sector on economic and societal development. The weight of the sector's activities can differ considerably by region and country and evolves rapidly owing to the fast-moving nature of the industry. International organizations have described the ICT sector as one of the most dynamic sectors in the economy, while emphasizing the expectation that the boundaries and classification that currently shape the ICT sector will have to adapt to the digital economy.

As a substantial step in this direction, the United Nations Conference on Trade and Development (UNCTAD) made some recommendations to develop international indicators for measuring trade in ICT services and ICT-enabled services. The proposed indicators from the Partnership on Measuring ICT for Development were described in UNCTAD technical notes in 2015 (UNCTAD, 2015), while the results of pilot surveys were published in 2017 (UNCTAD, 2017b) and 2018 (UNCTAD, 2018a). UNCTAD surveys have found among other things that, across Costa Rica, India and the United States, potential ICT-enabled services represented 39 per cent, 70 per cent and 50 per cent, respectively, of total services exports in 2016 (UNCTAD, 2018b).

Table Box 3.1: ICT sector classification and definitions

Sector and industries classification based on	**OECD comprehensive definition**	**EU operational definition**
	ISIC Rev.4	*NACE Rev.2*
ICT manufacturing industries		
Manufacture of electronic components and boards	x	x
Manufacture of computers and peripheral equipment	x	x
Manufacture of communication equipment	x	x
Manufacture of consumer electronics	x	x
Manufacture of magnetic and optical media	x	
ICT trade industries		
Wholesale of computers, computer peripheral equipment and software	x	
Wholesale of electronic and telecommunication equipment and parts	x	
ICT services industries		
Software publishing	x	x
Telecommunications	x	x
Computer programming, consultancy and related activities	x	x
Data processing, hosting and related activities; web portals	x	x
Repair of computers and communication equipment	x	x

Source: OECD (2010), European Commission (2012).

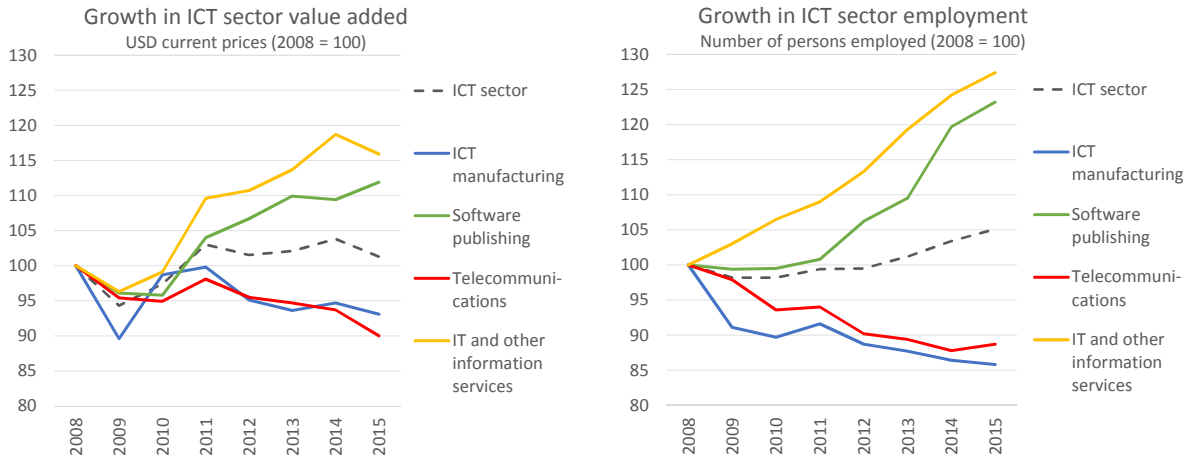
2008 and 2015, value added decreased in the ICT sector's traditional branches such as computer and electronics manufacturing (-7 per cent) or telecommunications (-10 per cent). In contrast, value added increased by 12 per cent in software and 16 per cent in IT services during the same period.

This trend can also be illustrated by analysing the impact of the ICT sector on employment. UNCTAD estimates that, in 2015, ICT services accounted for 1.5 per cent of global employment on average (UNCTAD, 2017a), while the OECD showed that ICT services represented almost 80 per cent on average of total ICT employment. Employment in the sector proved resilient to the 2007 financial crisis and grew faster than total employment between 2008 and 2015 (OECD, 2017b). That growth, however, is largely fuelled by employment in services and software, while employment in manufacturing and telecommunications continues to decline, as these two subsectors have shown no signs of recovery in terms of employment since the crisis (Chart 3.1).

Data collected by ITU show that the number of full-time equivalent employees working for telecommunication operators declined by 6 per cent globally between 2014 and 2016. This trend affects both developed and developing countries, with hiring by operators decreasing by 5 per cent and 6 per cent respectively during the same period.[1]

The nature of the ICT sector varies by country, with manufacturing concentrated in a few countries mainly in Asia and the Pacific, showing the sector's widely varying role and impact across regions and countries. For instance, OECD noted that, in 2015, the sector's share of total value added ranged from over 10 per cent in the Republic of Korea to less than 3 per cent in Mexico and Turkey. In the former, 69 per cent of value added in the ICT sector in 2015 came from manufacturing, while in Mexico 63 per cent came from telecommunication activities. In contrast, the United States experienced a more balanced spread among the ICT sector's industries, with 35 per cent of the sector's value added generated by services, 28 per cent by telecommunications, 26 per cent

Chart 3.1: Growth in ICT sector value added and employment, by subsector



Source: OECD (2017b).

by manufacturing and 11 per cent by software publishing (OECD, 2017b).

The value added of computer, electronic and optical products and of ICT services totalled altogether around USD 5.1 trillion worldwide in 2014, representing around 6.4 per cent of global GDP (UNCTAD, 2017a). Manufacturing played an important role in economic development, but with the transformation taking place across the sector and the wider digital economy, most observers are noting that manufacturing activities have shifted to a few countries located mainly in Asia. This is confirmed by the fact that 92 per cent of mobile handset models released in 2014 came from Asia-based vendors (GSMA, 2015a).

China and India have shown very dynamic behaviour as reflected by ICT sector variables and based on the European Commission's operational classification. The share of ICT value added over GDP averaged 5 per cent in both countries in 2015, on a par with the United States. Between 2006 and 2015, both countries presented the highest growth rates for value added and employment, both in the ICT sector and the economy as a whole (European Commission, 2018).

In 2014, China was by far the largest manufacturer, with a value added for this subsector[2] estimated at USD 558 billion (UNCTAD, 2017a). Value added in China alone is equal to the combined value added of the United States, the European Union, the Republic of Korea and Japan. Fast-growing Asian markets such as China and India are described as transitioning to higher value-added activities – breaking the stereotypes of these countries as the "factories of the world".

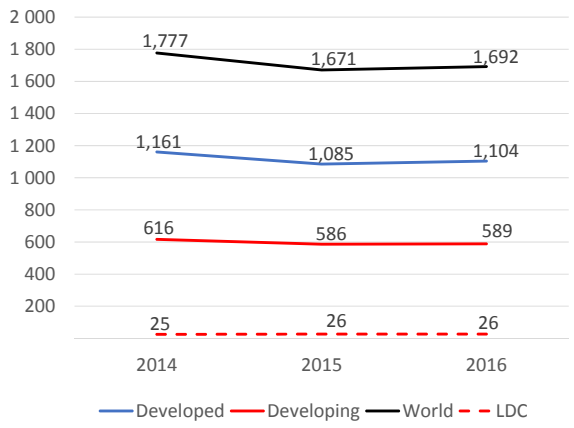
The impact of greater market maturity

Global retail telecommunication revenues[3] reached USD 1.7 trillion in 2016, following a sluggish performance since 2014 (Chart 3.2). The United States remains the largest market worldwide in terms of telecommunication revenues, followed by China, which has overtaken Japan. The United States reached USD 614 billion in revenue in 2016, compared to under USD 200 billion in both China and Japan. Altogether, these three countries accounted for 54 per cent of global telecommunication revenues in 2016.

Global revenues fluctuated during the period 2014-2016, decreasing by 6 per cent in 2015 and increasing by 1.3 per cent the following year, but remaining below the USD 1.8 trillion total revenues recorded in 2014. This is largely influenced by revenue declines in the developed world, which lost around USD 75 billion in revenues between 2014 and 2015, before stabilizing in 2016 with annual growth of 1.7 per cent.

These fluctuations in telecommunication revenue recorded between 2014 and 2016 are the result of a combination of factors affecting both developed and developing markets, including increasing market saturation, weakening macroeconomic growth, intensifying competition and a continued pressure on retail prices.

Chart 3.2: Total telecommunication revenues (USD billion), 2014-2016



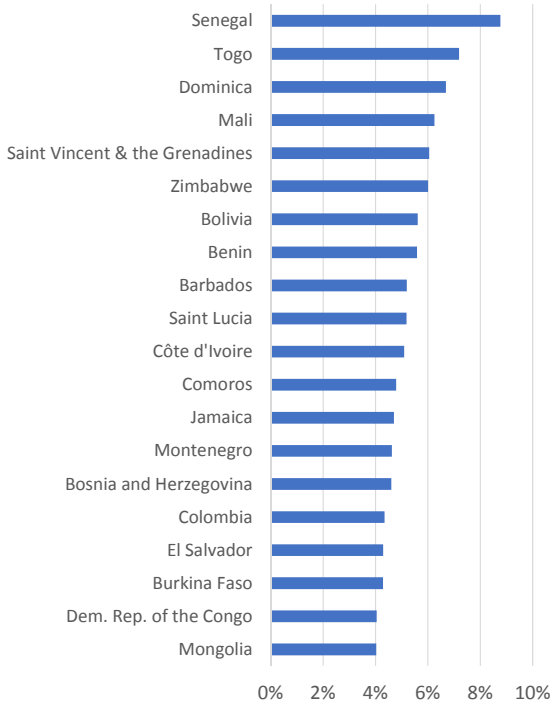
Source: ITU.

Of these market drivers influencing revenue growth, the phenomenon of market saturation now applies also to the developing world, which radically contrasts with the high-growth era experienced by developing countries over the past few years. The role of mobile services in the sector is critical, given that there are fewer than ten fixed lines per 100 inhabitants in developing countries, compared to 96 mobile-cellular subscriptions per 100 inhabitants in 2016. With such high mobile penetration rates in the developing world, total subscriptions and revenue growth are slowing down, which shows that the region is entering a phase of greater market maturity in which market players will be focused on balancing infrastructure spending and profitability in price-sensitive countries. This is a challenge that already affects most industry players in the developed economies.

While the developing world dominates in terms of market size as measured by subscriptions (accounting for almost four in every five mobile subscriptions worldwide), it represented only just over one-third (35 per cent) of global telecommunication revenues in 2016. With annual mobile-cellular subscription growth in single digits each year since 2012, developing countries have entered a phase of maturity and slower growth which contrasts with the past high-growth era in which the developing world was outperforming the developed world in terms of both subscription and revenue growth. Nevertheless, mobile-broadband subscriptions are still seeing double-digit growth in developing countries, whereas in developed countries growth has slowed to single-digits.

Telecommunications represent a substantial share of GDP for several economies in the developing world. The great majority of the top 20 countries with the highest ratio of telecommunication revenues to GDP in 2016 (Chart 3.3) are located in the developing world, showing the importance of the telecommunication sector in driving economic growth for most countries in this category. Senegal appears to have the highest ratio, with telecommunication revenues representing 8.8 per cent of GDP in 2016, closely followed by Togo (7.2 per cent), Dominica (6.7 per cent), Mali (6.2 per cent) Saint Vincent and the Grenadines (6.1 per cent) and Zimbabwe (6.0 per cent). Most countries in the top 20 list are located in Africa or the Americas, with Comoros (Arab States), Mongolia (Asia and the Pacific), Bosnia and Herzegovina, and Montenegro (Europe) as the only countries from other regions.

Chart 3.3: Top 20 countries with highest ratio of telecommunication revenues to GDP, 2016



Source: ITU.

At a regional level, the importance of the telecommunication sector in driving economic growth in the developing world is clearly noticeable when we compare regional trends. In 2016 telecommunication revenue represented on average around 3 per cent of GDP in Africa and the Arab States, compared to 2 per cent in Asia and the Pacific and in the Americas (excluding the

United States and Canada), and less than 2 per cent in the CIS and Europe (Chart 3.5).

Asia and the Pacific and the Arab States have shown relative resilience in telecommunication revenue growth, with both regions reporting single-digit declines in revenue between 2014 and 2016 of -1.4per cent and -4.3 per cent respectively (Chart 3.4). In contrast, revenues fell by 10 per cent in Africa, 18 per cent in the Americas (excluding the United States and Canada), 14.7 per cent in Europe and 36.5 per cent in the CIS. Thus, while the role of the sector remains critical in driving economic, employment and societal growth in developing economies, the sector is reporting sluggish performance and a high level of maturity in which market players face intensifying financial pressures.

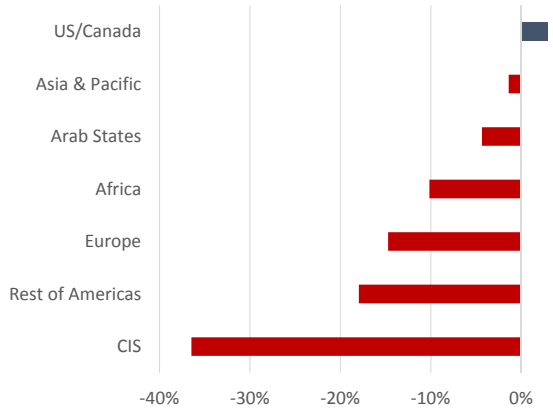
Most large African markets recorded a consistent telecommunication revenue trend in USD terms between 2014 and 2016, either declining (as in Cameroon, Senegal, South Africa, Tanzania, and Zimbabwe), or increasing (e.g. the Democratic Republic of the Congo, Ethiopia and Kenya).[4] The regional revenue growth fluctuation recorded between 2014 and 2016 was driven largely by revenue growth in Nigeria, where revenues topped USD 12 billion in 2015, almost twice the amount reported in both 2014 and 2016.

In Asia and the Pacific, fluctuations in USD terms have also been recorded, with revenues declining in 2015 and moving back up in 2016, as was the case in several countries such as India, Islamic Republic of Iran, the Republic of Korea, New Zealand, Pakistan and Thailand. At a regional level, the fluctuation was driven largely by revenues in Indonesia and Japan.[5]

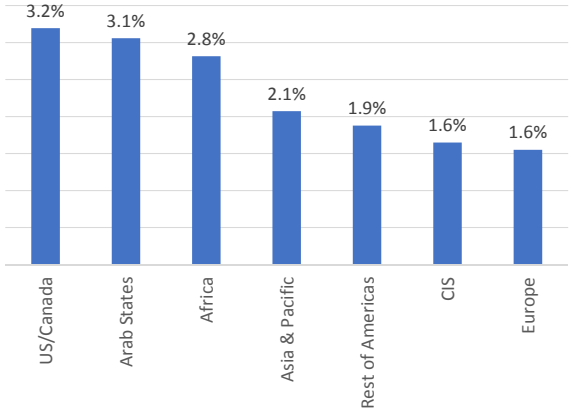
In the Arab States, most countries reported consistent declines in total revenue between 2014 and 2016, with some exceptions, such as Saudi Arabia and the United Arab Emirates, the first and third countries, respectively, in revenue terms. The former recorded a 0.6 per cent decline only in 2016, and the latter reported constant single-digit increases since 2014. Meanwhile, a number of countries in the Americas (excluding the United States and Canada) have recorded consistent declines in total revenue, whereas Colombia, Bolivia (Plurinational State of) and Ecuador showed a fluctuation in revenues, declining in 2015 but followed by signs of recovery in 2016.

At the country level, there is some significant variance within the developing world, as several countries follow different trends from their regions. These include Bolivia (Plurinational State of), the Democratic Republic of the Congo, Mongolia, Ecuador and the Central African Republic. These markets all reported double-digit growth in telecommunication revenue between 2014 and 2016 and boast a revenue to GDP ratio that is higher than the average for the developing world (Chart 3.6). This shows the diversity that exists in the regions in terms of market maturity levels, which is further illustrated by the analysis of the role of the ICT sector in some of the most populous countries worldwide (see Box 3.2).

Chart 3.4 (left): Regional growth in telecommunication revenues, 2014-2016
Chart 3.5 (right): Regional percentage of telecommunication revenues to GDP, 2016

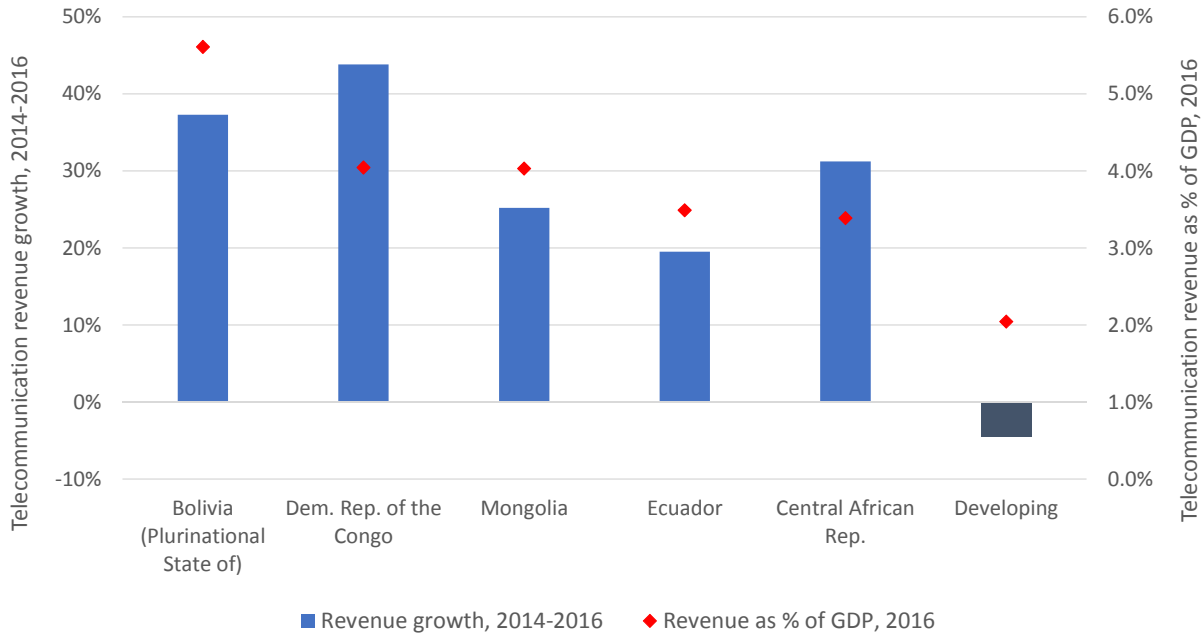


Source: ITU.



Source: ITU.

Chart 3.6: Telecommunication revenue growth, selected developing countries, 2014-2016



Source: ITU.

The United States and Canada recorded a positive growth in telecommunication revenues between 2014 and 2016, further countering the declining trend seen in the Americas and across developed countries. Revenue increased by USD 18.2 billion between 2014 and 2016 in the United States and Canada, compared to a USD 50.7 billion decrease in Europe over the same period (Chart 3.4). The aggregate for both the United States and Canada also shows the sector's continued role in driving economic growth, as telecommunication revenues made up a higher share of GDP (3.2 per cent) than in Europe (1.5 per cent) or in any other region worldwide in 2016 (Chart 3.5).

Markets like Portugal, the Czech Republic, Romania, and the United Kingdom, show the extent to which the developed world has matured, with telecommunication revenues in terms of USD declining quite rapidly, while the proportion of telecommunication revenues to GDP remains relatively high for developed countries (Chart 3.7).[6] The United Kingdom has shown relative resilience in terms of revenue growth, recording lower declines (-6 per cent) between 2014 and 2016 than the average for the these countries (-23 per cent), further positioning the telecommunication sector in the United Kingdom as dynamic despite the high level of market saturation and the intensifying financial pressures faced by market players.

With mobile-cellular penetration way above the 100 per cent mark in the developed world and close to that threshold in developing countries, market transformation is accelerating and service providers are looking at innovative ways to generate revenues. Mergers and acquisitions (M&A) suggest the pace of change taking place in the sector globally, and highlight the growing importance of fixed-mobile convergence and the race to deliver on the promise of smart societies. In 2016, M&A swept the ICT landscape, and market consolidation within the same line of business has been intense, with operators scaling up in core market segments – particularly in mobile and fibre (ITU, 2018b). For example, in March 2016, Vodafone India signed an agreement to acquire cable firm YOU Broadband to boost its fixed-line offers (Mobile World Live, 2016). Similarly, in mid-2016, Orange Moldova acquired cable provider Sun Communications as part of Orange's plans to offer a converged package of fixed-line and TV services in the country (Telegeography, 2016a). As of 2018, close to one in every two mobile operators globally offer both mobile and fixed services, with around half of them also offering pay-TV packages (GSMA, 2018b).

Box 3.2: The role of the ICT sector in the BRIC countries

Telecommunication revenue trends in the "BRIC" countries (Brazil, the Russian Federation, India and China) exemplify the role of the ICT sector in the economy but also illustrate some of the sectoral shifts from hardware to software now taking place within these four countries.

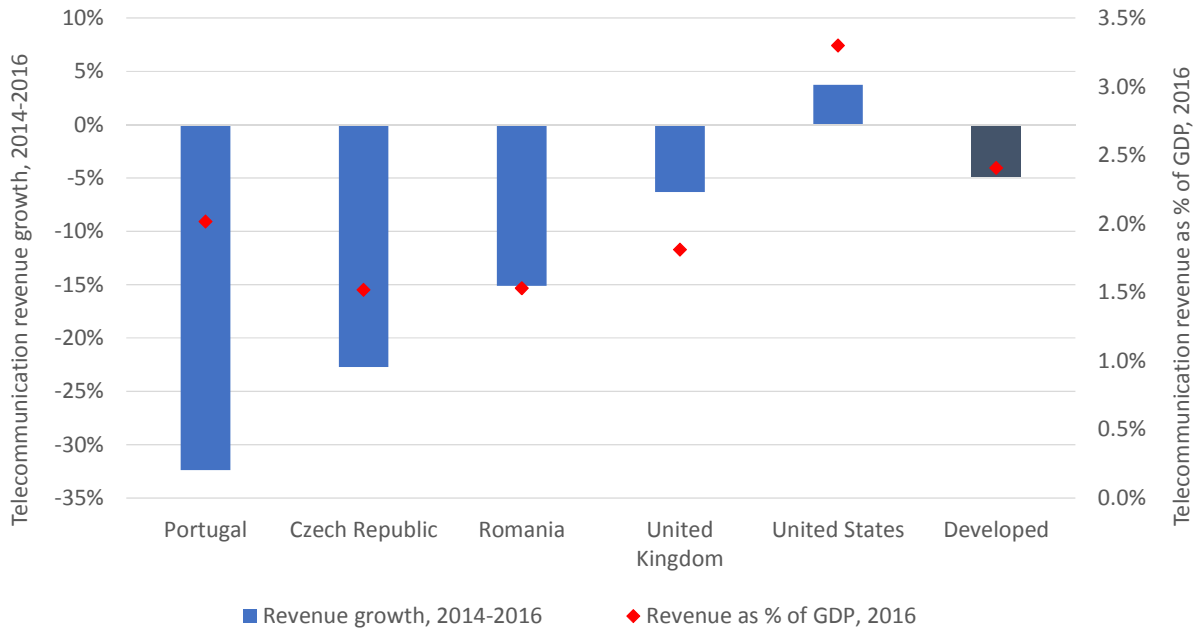
In 2015, ICT services represented the vast majority (91 per cent) of total value added in the ICT sector (based on the European Commission's operational definition of the sector; see Box 3.1). Within ICT services, the relative weight of telecommunications varies within the BRIC countries (50 per cent on average in both the Russian Federation and China, 39 per cent in Brazil and 24 per cent in India) (European Commission, 2018). In parallel, telecommunication revenues represent 1.7 per cent of GDP for the BRIC countries on average (Chart 3.8).

ICT manufacturing value added declined between 2014 and 2015 by 7 per cent in Brazil and 24 per cent in the Russian Federation. However, both Asian markets are heavily reliant on value added generated from manufacturing which went up by 17 per cent and 30 per cent in China and India respectively over the same period. However, value added generated from telecommunication services in China grew by 31 per cent in 2015, outperforming value-added growth from ICT manufacturing and reflecting the country's efforts to reduce its reliance on manufacturing. India also saw its telecommunication value added grow by 29 per cent in 2015, in comparison with Brazil and the Russian Federation, where it fell by 16 per cent and 35 per cent respectively, indicative of a sluggish performance in telecommunication services in line with the trends seen in most mature and saturated telecommunication markets.

India is often described as a very dynamic market, and its outlook is positive when we consider the room for mobile growth in the country: in late 2016, more than 600 million inhabitants of that country were yet to subscribe to mobile services (GSMA, 2018b). India saw its global rank in terms of telecommunication revenues rise consistently over the past decade, moving from 14th position globally in 2010, to tenth in 2014 and seventh position in 2016 – overtaking countries like France, Canada and Australia. India is also the only BRIC country that recorded positive growth in telecommunication revenues (15 per cent in USD terms) between 2014 and 2016, compared to China, which saw a decline of 4 per cent, and Brazil and the Russian Federation, which were exposed to greater revenue losses (26 per cent and 42 per cent respectively in USD terms). However, revenues in local currency increased in Brazil and the Russian Federation between 2014 and 2016, suggesting that the decrease in revenues in USD terms can be explained by changes in exchange rates.

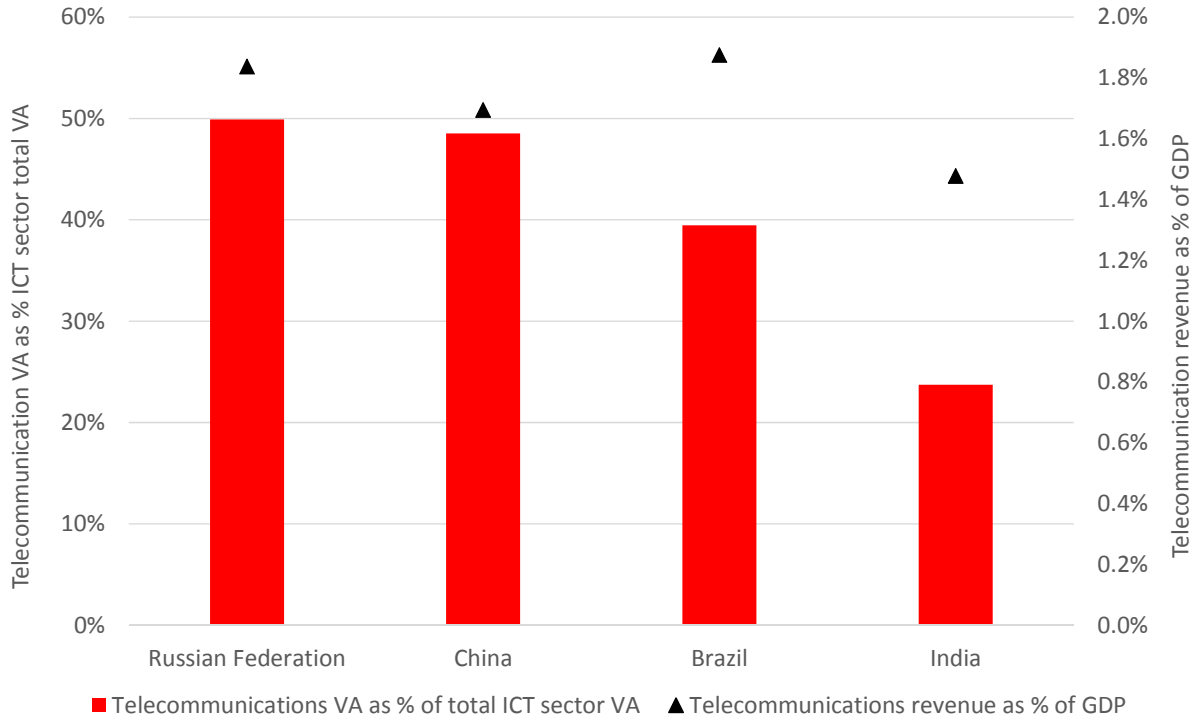
As the telecommunication sector in the BRIC countries continues to mature and subscription penetration keeps reaching new heights, revenue growth is likely to continue to stall or decline, further pointing to the importance of the sectorial transformation required for market players to find alternative revenue sources.

Chart 3.7: Telecommunication revenue growth, selected developed countries, 2014-2016



Source: ITU.

Chart 3.8: Telecommunication revenues and value-added contribution to the economy, BRIC countries, 2015



Source: European Commission, ITU.

Table 3.1: Total telecommunication revenues (USD millions), 2014-2016

Economy	2014	2015	2016
United States	592 229	601 806	614 349
China	187 874	187 507	180 996
Japan ^	156 228	138 825	156 929
Korea (Rep. of)	55 030	51 523	53 652
United Kingdom	51 217	47 846	47 985
Germany	55 716	44 252	45 122
Canada ^	41 501	37 370	36 755
India	*31 886*	30 884	36 513
France	44 341	36 098	35 647
Australia ^	*44 725*	43 838	31 865
Brazil ^	39 365	33 825	29 265
Italy	29 090	24 100	29 047
Indonesia	*18 046*	9 690	25 691
Mexico ^	32 659	28 190	24 469
Russian Federation ^	39 506	25 089	22 778
Spain	25 519	20 941	20 743
Saudi Arabia	16 028	16 464	16 370
Switzerland	16 308	15 615	15 453
Turkey ^	15 378	14 551	15 036
Kuwait	*14 967*	14 320	*13 695*
Netherlands ^	16 688	13 492	12 487
Argentina ^	12 451	13 392	*12 061*
Malaysia	12 726	12 287	11 816
Poland ^	12 567	10 517	10 040
United Arab Emirates	9 137	9 498	9 683
Thailand	9 246	9 036	9 373
Singapore	11 003	9 028	*9 103*
South Africa	*10 965*	9 630	9 006
Iran (Islamic Republic of)	7 733	7 379	7 822
Belgium	8 052	6 893	6 950
Nigeria	7 715	12 408	6 700
Sweden	7 685	6 172	6 082
Philippines	5 510	6 079	*5 863*
Greece	6 992	5 551	5 598
Peru ^	6 136	5 634	*5 481*
Egypt	6 604	6 225	5 377
Israel	*6 321*	*5 620*	5 286
Denmark	6 410	5 272	5 084
Pakistan	4 614	4 284	4 459
Portugal	6 115	4 186	4 134
Austria	4 777	3 994	3 936
Norway	4 874	3 921	3 903
Algeria	6 180	5 283	3 756
New Zealand	4 290	3 564	3 674
Bangladesh	3 270	3 564	3 672
Ecuador	2 880	2 614	3 441
Ireland	4 009	3 369	3 400
Morocco	3 856	3 265	3 271
Finland	3 660	3 105	3 230
Lebanon	*3 036*	3 157	*3 141*
Czech Republic	3 836	3 039	2 964
Hungary ^	4 037	3 078	2 931
Romania	3 380	2 840	2 869
Qatar	2 577	2 752	2 789
Uzbekistan	1 362	1 742	*2 191*
Oman	2 098	2 066	2 179
Kazakhstan ^	3 799	3 167	2 111
Angola	2 239	2 366	1 983
Ukraine ^	3 485	2 033	1 910
Bolivia (Plurinational State of)	1 382	1 341	1 897
Slovakia	2 240	1 840	1 863
Côte d'Ivoire	1 989	1 798	1 853
Dominican Rep. ^	1 860	1 757	1 851
Serbia ^	2 013	1 719	1 702
Costa Rica	1 572	1 753	1 680
Kenya	1 324	1 634	1 650
Bahrain ^	1 144	1 197	*1 569*
Ethiopia	1 050	1 190	1 501
Dem. Rep. of the Congo	995	1 095	1 431
Sudan	1 209	*1 304*	1 423
Croatia	1 606	1 337	1 388
Tunisia	1 521	1 333	1 293
Senegal	1 525	1 291	1 288
Uruguay ^	1 379	1 221	1 207
Bulgaria	1 502	1 236	1 197
El Salvador	1 615	1 146	1 150
Panama	*906*	1 084	1 121
Jordan	1 465	942	1 114
Belarus	1 402	1 096	1 084
Nepal (Republic of)	884	964	*1 036*
Azerbaijan	2 185	1 602	1 005
Zimbabwe	1 187	1 057	998
Cameroon	1 120	971	955
Honduras ^	902	853	888
Mali	898	808	877
Trinidad & Tobago	718	818	837
Slovenia	1 043	858	825
Latvia ^	702	597	798
Afghanistan	312	941	786
Bosnia and Herzegovina	984	823	778
Lithuania	640	515	733
Sri Lanka	*1 103*	898	*710*
Jamaica	582	700	661
Estonia	744	683	649
Luxembourg	660	563	564
Zambia	553	591	559
Syrian Arab Republic	899	832	507
Burkina Faso	622	490	502
Benin	509	490	479
Mongolia	*360*	404	451
Gabon	*575*	450	421
Bahamas	645	*527*	410
Kyrgyzstan ^	519	418	368
Chad	360	304	*326*
Togo	380	337	316
The Former Yugoslav Rep. of Macedonia	434	319	310
Georgia	420	311	310
Armenia	382	316	288
Mauritius	302	271	268
Botswana ^	n/a	415	253
Malta	283	242	246
Malawi ^	177	255	243
Iceland	253	232	242
Barbados	216	*226*	235
Moldova	325	260	225
Rwanda ^	221	266	210
Namibia	346	221	203
Montenegro	253	243	202
Madagascar	349	250	191
Albania	229	178	174
Lao P.D.R.	380	442	144
Guyana	*145*	142	139
Andorra	120	109	115
Monaco	*161*	107	*107*
Gambia	79	90	*88*
Saint Lucia	88	*87*	86
Burundi	108	145	82
Lesotho	83	*66*	*68*
Cabo Verde	74	80	62
Central African Rep.	45	52	59
Liechtenstein	51	48	58
Bhutan	46	56	56
Saint Vincent and the Grenadines	45	*46*	46
Dominica	*34*	36	39
Vanuatu	*39*	36	*37*
Comoros	*55*	68	30

Source: ITU.
Notes: Data in italics are ITU estimates; ^ Country includes wholesale services.

Declining mobile markets

Globally, mobile revenues fell by 7 per cent between 2014 and 2016, from USD 924 billion in 2014 to USD 859 billion in 2016 (Chart 3.9). Mobile revenues represent half of all telecommunication revenues generated in 2016, a trend aligned with mobile operators' contribution to the value added generated by the overall mobile ecosystem (Box 3.3). The relative weight of mobile has, however, been in decline since 2014, particularly in the developing world.

As mobile becomes ubiquitous across most regions, mobile revenue growth is stalling. Between 2014 and 2016, mobile revenues declined by 10 per cent in the developing world, compared to a fall of 5 per cent in the developed world, where revenue growth stalled on an aggregate level. With global mobile subscription penetration crossing the 100 per cent mark globally in 2016,

Box 3.3: Measuring the economic impact of the mobile ecosystem

The mobile ecosystem consists of mobile operators, infrastructure providers, retailers and distributors of mobile products and services, mobile device manufacturers, and mobile content, application and service providers. The direct economic contribution to GDP of these firms was estimated by measuring their value added to the economy, including employee compensation, business operating surplus and taxes. Mobile operators accounted for 60 per cent of total value added by the mobile ecosystem in 2017, which in turn represented 1.4 per cent of GDP (GSMA, 2018b).

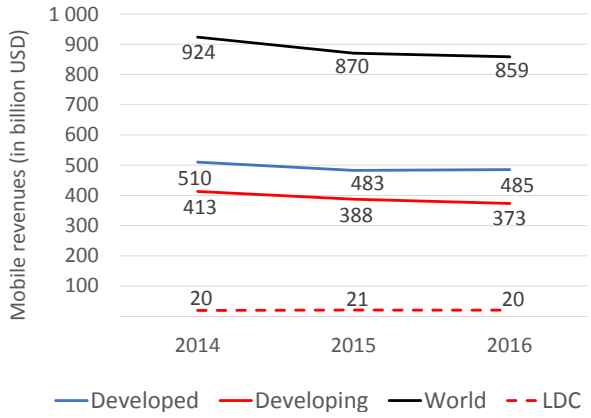
In addition, the indirect economic activity generated by the mobile ecosystem reached 0.6 per cent of global GDP last year (GSMA, 2018b). This indirect contribution represents inputs purchased by the mobile ecosystem from their providers in the supply chain, along with profits and earnings generated by the mobile ecosystem which are spent on other goods and services, stimulating further economic activity in those sectors. Lastly, the use of mobile technology also drives improvements in productivity and efficiency for workers and firms. Together, these productivity impacts generated 2.5 per cent of global GDP in 2017 (GSMA, 2018b).

A recent ITU report (ITU, 2017c) also demonstrates that computing, broadband and mobile telephony networks have been instrumental in relaxing scalability constraints and allowing traditional sectors to grow more rapidly. The study highlights evidence of the social and economic impact of ICTs, notably regarding the impact on productivity, revenue growth and the composition and deployment of industrial value chains. The report also cites findings from Katz and Callorda (2017), who estimate that a 1 per cent increase in the digital ecosystem development index yields a 0.13 per cent increase in per capita GDP growth.

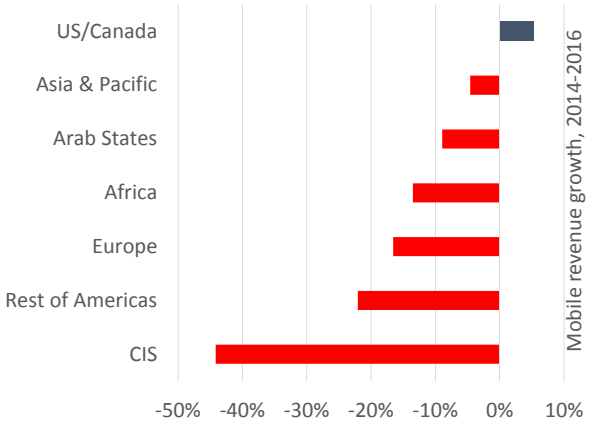
It is estimated that in 2017, the mobile ecosystem provided direct employment for almost 12 million people across the world, while indirectly supporting another 17 million jobs, thus producing a total impact (both direct and indirect) equivalent to 29 million jobs (GSMA, 2018b). Similarly, findings from Katz and Callorda (2016) show that between 2004 and 2015, an increase of 1 per cent in the digitization of consumption index results in a 0.07 per cent reduction in the unemployment rate worldwide.

The mobile ecosystem also contributes significantly to public sector funding through general taxation. In most countries, this includes value-added tax or sales tax, corporation tax, income tax and social security paid out of firms' and employees' contributions. It is estimated that the mobile ecosystem made a tax contribution to governments' public finances of USD 500 billion in 2017. Overall, taking into account all direct, indirect and productivity impacts (Chart 3.15) in 2017, analysts estimate that the mobile industry made a total contribution of USD 3.6 trillion in value-added terms, equivalent to 4.5 per cent of global GDP (GSMA, 2018b).

Chart 3.9 (left): Mobile revenues (USD billions)
Chart 3.10 (right): Mobile revenue growth, 2014-2016



Source: ITU.



Source: ITU.

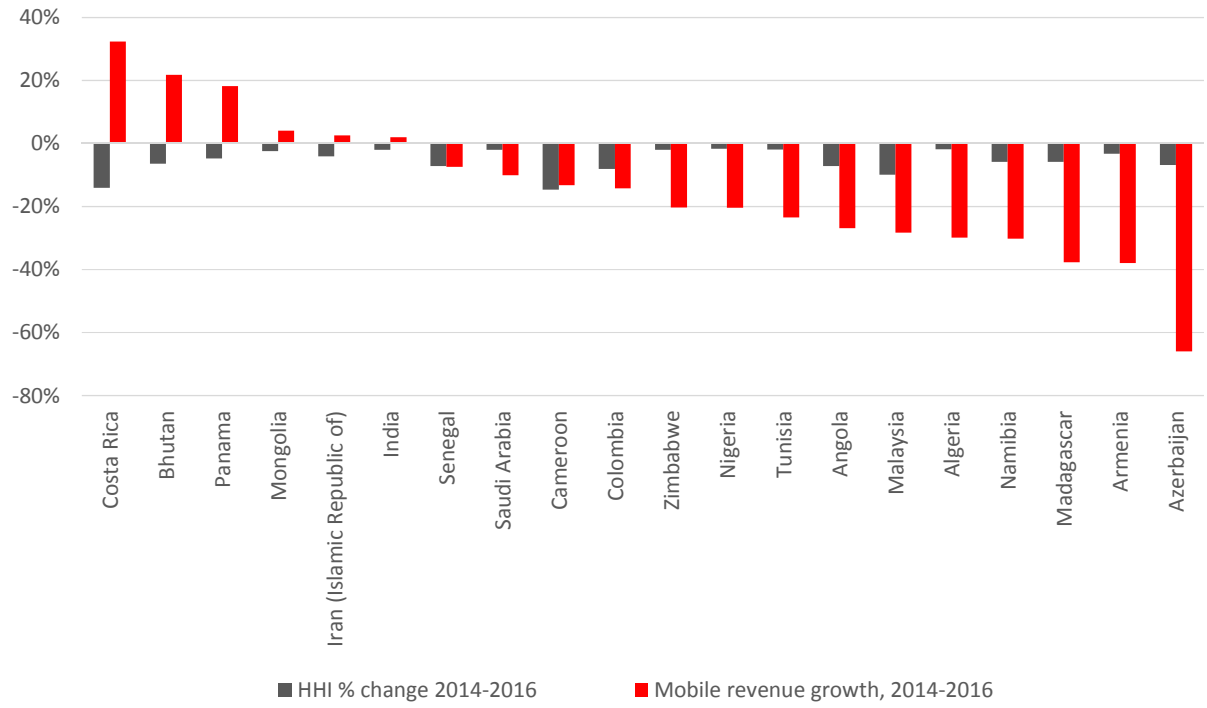
competition is intensifying in both developed and developing economies, which are consequently facing slower growth in revenues or declining revenue trends in the near future.

The CIS region witnessed the largest mobile revenue decline between 2014 and 2016, of -44 per cent (Chart 3.10). The Russian Federation and Azerbaijan each reported over USD 1 billion in losses in mobile revenues during that period, followed by Kazakhstan, with just over USD 800 million lost mobile revenues. The region can be described as highly saturated, with stalling growth in mobile subscriptions (1.8 per cent between 2014 and 2016) and regional mobile-cellular penetration reaching 141 per cent in 2016, while mobile-broadband subscriptions continue to drive regional growth for the mobile ecosystem (from 47.3 to 59.7 per 100 inhabitants in the period 2014-2016). Uzbekistan is the only country in the region that has a mobile-cellular penetration rate below 90 per cent of the population (74 per cent in 2016), with mobile revenues increasing by around 30 per cent between 2014 and 2016, according to latest estimates. However, as market maturity levels and competition intensify in the country, its revenue growth outlook is less positive. This is particularly true as the country recorded the sharpest decline in the Herfindahl-Hirschman Index (HHI)[7] in the region during this period (-16 per cent as opposed to the regional average of -3 per cent), a sign that competition levels are increasing in Uzbekistan. This, coupled with a reduction in retail prices, has an impact on revenue growth[8].

As mobile is becoming ubiquitous across economies in the developing world, with mobile penetration topping 100 per cent in 2016, the evolution of the HHI shows that competition has intensified, in turn forcing mobile revenues downwards. Between 2014 and 2016, the HHI decreased in 54 developing economies, representing altogether almost one-third of all countries in the developing world, close to half of regional mobile subscriptions, and 38 per cent of regional GDP[9].

The top 20 countries in terms of sharp declines in HHI are evenly spread among Africa, the Americas (excluding the United States and Canada), the Arab States, Asia and the Pacific, and the CIS (Chart 3.11). On average across these 20 markets, all of which are in the developing world, mobile revenues declined by 9 per cent between 2014 and 2016. Cameroon and Malaysia recorded a 15 per cent and 10 per cent decline in HHI, respectively, during the period[10], driving mobile revenue down by 13.2 per cent and 28.3 per cent respectively. Despite a mobile-cellular penetration level of 80 per cent in 2016 in Cameroon – below the 100 per cent threshold – the market has reported intensifying competition, with the entry, in the third quarter of 2014, of a fourth operator Nexttel (Viettel), which had garnered over 10 per cent of market share two years after launch[11]. By contrast, mobile-cellular penetration in Malaysia was almost 140 subscriptions per 100 inhabitants in 2016, and competition continues to intensify in a country that is home to nine mobile operators. Three of them (Maxis, DiGi and Celcom (Axiata)) controlled just over 82 per cent of the mobile market in

Chart 3.11: HHI vs mobile revenues, selected countries, percentage change 2014-2016



Source: Revenue data from ITU; HHI statistics from GSMA.

Malaysia in 2016[12], while the remainder of the market is controlled by U Mobile and five smaller players, two of which entered the market in mid-2014.

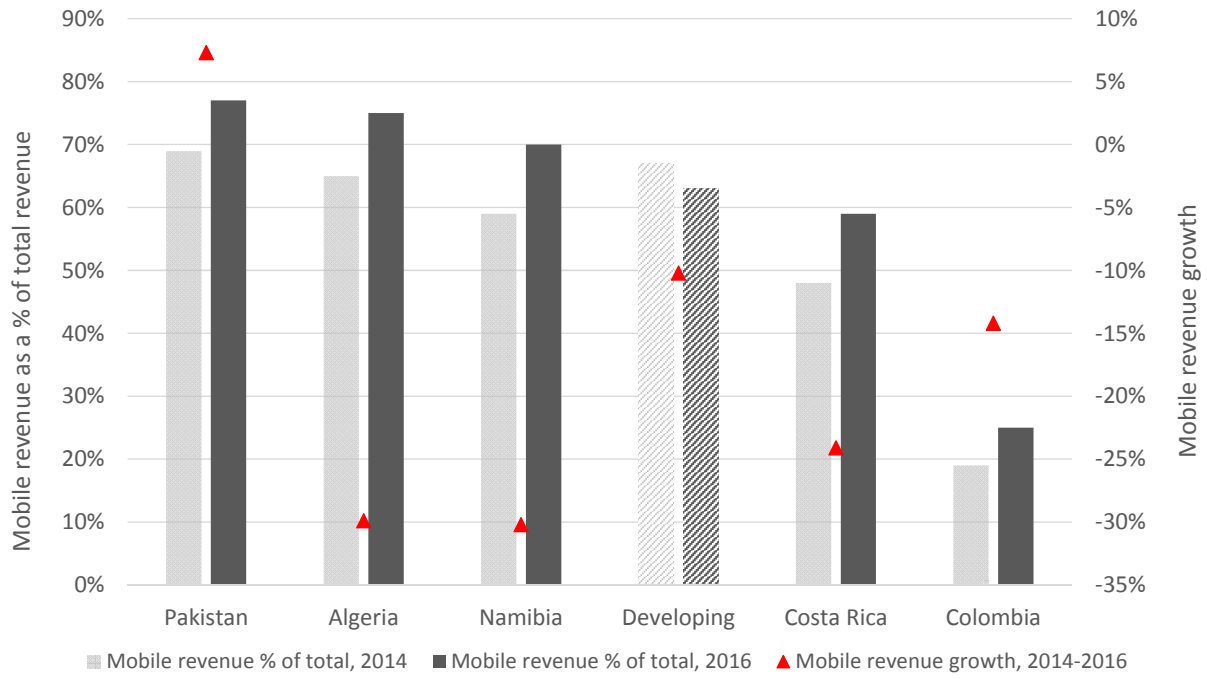
It is important to note that in most developing economies, mobile-broadband subscriptions have grown enormously, countering the slowdowns recorded in mobile-cellular subscription growth and supporting the growth in data revenues. In Malaysia, mobile-broadband subscriptions grew by 62 per cent between 2014 and 2016, compared to a 2 per cent decline in overall mobile subscriptions. In Cameroon, mobile-broadband was launched in 2014 and reached over 2.5 million subscriptions by 2016, according to ITU estimates, while overall mobile-cellular subscriptions recorded 1.7 million net additions between 2014 and 2016.

Costa Rica is one exception to the rule, as mobile revenues there grew by 32 per cent during the period under review, while HHI decreased by 14 per cent and mobile-cellular penetration passed the 170 per cent mark in 2016. Two-thirds of the population used the Internet in the country by the end of 2016, supported by the launch of LTE networks in late 2013. Mobile revenues in Costa Rica also recorded a greater weight in telecommunication revenues, jumping from 48 per cent to 59 per cent of telecommunication revenues between 2014 and 2016, showing the greater role that mobile continues to play in the telecommunication market in developing economies.

Other developing economies that recorded a greater weight of mobile revenues in total telecommunication revenues include Pakistan, Algeria, Namibia and Colombia (Chart 3.12). In these countries, the share of mobile revenues as a proportion of total telecommunication revenues increased by around 9 percentage points on average between 2014 and 2016, whereas the regional average declined by 4 percentage points. Nevertheless all these countries, with the exception of Pakistan, reported a decline in mobile revenues in USD terms over this period.

Pakistan recorded a 7.3 per cent increase in mobile revenues between 2014 and 2016 and its share of mobile revenues to total telecommunication revenues rose from 69 to 77 per cent. In contrast, mobile revenues declined by 14.2 per cent in Colombia, despite its share of mobile growing from 19 to 25 per cent of total telecommunication revenues.[13] Along with neighbouring countries such as El Salvador and Bolivia (Plurinational State of), Colombia has a proportion of mobile

Chart 3.12: Mobile revenue growth in selected developing countries, 2014-2016



Source: ITU.

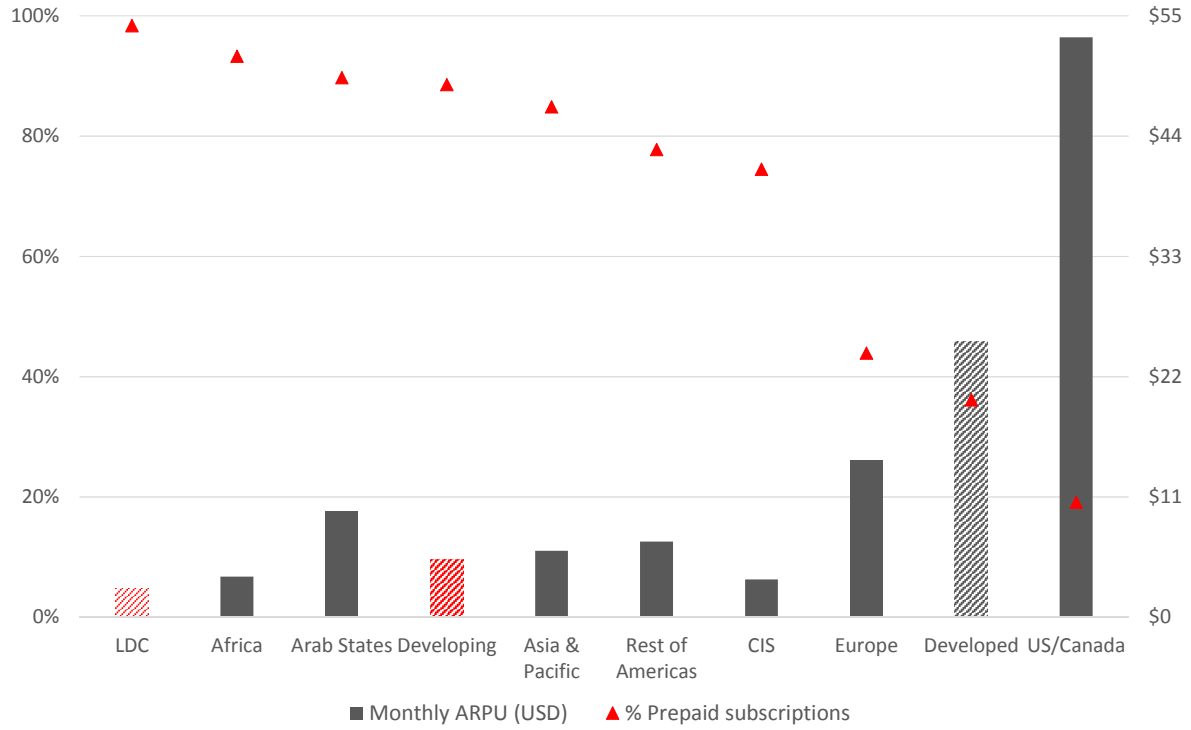
to total telecommunication revenues of below 50 per cent – on a par with developed markets such as Switzerland, Portugal or the United States. Colombia consequently has a greater fixed-line and fixed-broadband penetration (12 per cent and 15 per cent respectively in 2016) than the averages in the developing world (9 per cent in both cases), showing that the country is home to a well-established fixed-line market.

In developing economies, most service providers operate in price-sensitive markets, which makes it challenging to tap into alternative revenue sources in order to sustain revenue growth. According to ITU estimates, more than four in every five mobile subscriptions in the developing world were prepaid in 2016, and a mobile tariff typically accompanied by low average revenue per user (ARPU). In the developing world in 2016, monthly ARPU was USD 5, compared to USD 25 in the developed world (Chart 3.13). It is important to note that in low-income economies, low ARPU is essential to connect the poorest population groups to mobile services.

Prepaid subscriptions allow users the flexibility to alter their mobile usage patterns in response to short-term changes in their financial situation. This means that there is a correlation between economic growth and mobile revenue growth in markets where prepaid is dominant. This is the case, for example, in seven African countries, namely Benin, Burkina Faso, Côte d'Ivoire, Cameroon, Mali, Senegal and Togo. In this group, GDP declined between 2014 and 2015 (by 11 per cent on average across these seven countries), before returning to positive territory in 2016 (7.4 per cent growth on average between 2015 and 2016). This fluctuation was reflected in mobile revenue patterns, with the value of mobile markets declining over the period 2014-2015 (by 13.8 per cent on average) before stabilizing the following year as the economy recovered (1.8 per cent growth on average over the period 2015-2016).

Africa and the CIS show the lowest ARPU levels (well below USD 5 per month), followed by Asia and the Pacific and the Americas (excluding the United States and Canada) at around USD 6 on average in both regions in 2016. Given the diversity of incomes in the Arab States, regional ARPU is about USD 10 per month, but that figure is skewed by the relatively higher ARPU in mature and wealthy markets such as Saudi Arabia (USD 17) and the UAE (USD 27). In contrast, ARPU tops USD 14 in Europe and USD 53 in the United States and Canada, where postpaid tariffs account for 57 per cent and 81 per cent respectively of mobile subscriptions (based on ITU estimates).

Chart 3.13: Share of prepaid subscriptions vs monthly ARPU (in USD), 2016



Source: ITU.

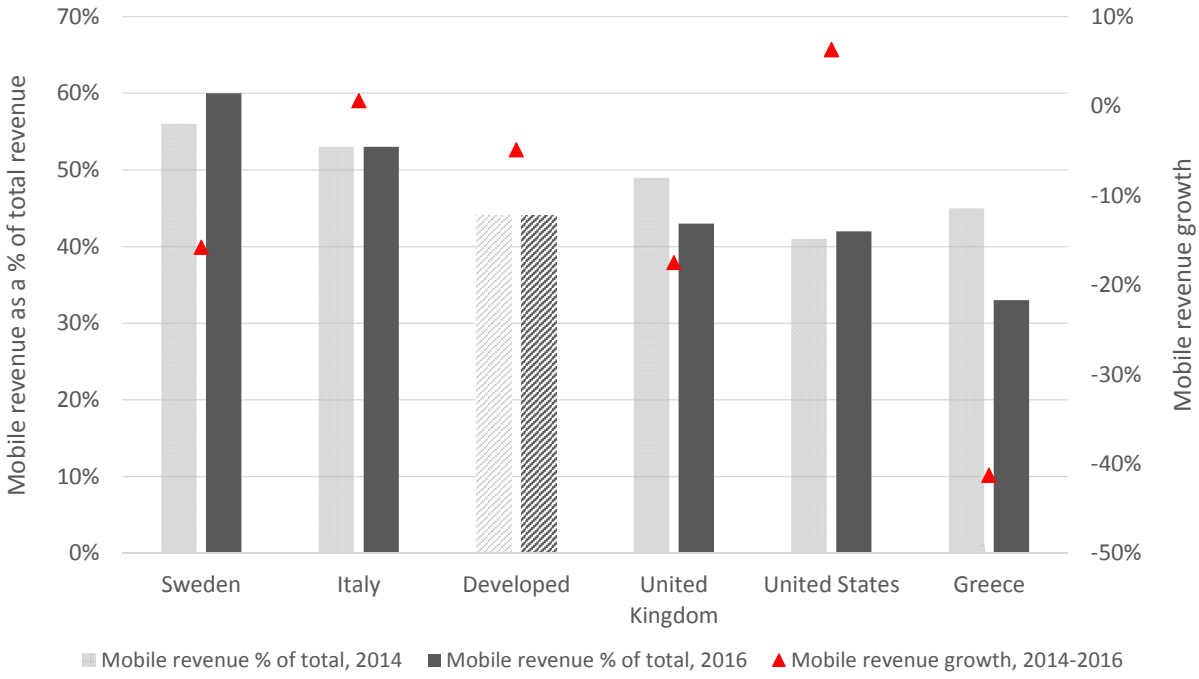
In Brazil, the weight of prepaid declined by 8 percentage points between 2014 and 2016, while monthly ARPU continued to fall from USD 8 to USD 5. Analysts have noted that despite declines in market revenues and ARPU in the country, some operators have succeeded in generating premium pricing. Market leader Vivo (Telefonica) increased its share in Brazil's postpaid market and ARPU between 2014 and 2016 following its investments in mobile-broadband and the introduction of converged and integrated service offers in new sectors such as m-books, M2M and m-learning (PwC, 2017a).

Mobile "churn"[14] in developing economies also tends to be greater than in developed markets, where customer turnover is less volatile. For instance, mobile churn in the Americas (excluding the United States and Canada) and in Asia and the Pacific averaged 4 per cent and 3 per cent respectively in each quarter during 2016, compared to 2 per cent on average across developed economies. This illustrates the challenge facing operators in retaining customers in price-sensitive and prepaid markets, a situation which reflects increasing market maturity levels and slower revenue growth.

The share of prepaid fell by 4 percentage points in the developed world between 2014 and 2016, as consumers transitioned to higher-value postpaid tariffs, typically centred on access to mobile-broadband data plans and multi-play packages from converged operators (fixed, mobile, broadband and TV). ARPU keeps falling in the region, driven by downward pressures on retail prices and a greater presence of low-cost operators. For instance, in France all three incumbent operators have launched their own low-cost brands (Sosh for Orange, Red for SFR and B&You for Bouygues). These brands were introduced in the market ahead of the entry of the fourth market player Free Mobile in 2012 (GSMA, 2011), whose low-cost tariffs drove ARPU down by USD 6 between 2014 and 2016. This type of strategy is being applied in other European markets such as the United Kingdom and Switzerland, and shows the financial pressure facing mobile operators as prices and revenue continue to decline and balancing investments and profitability becomes increasingly challenging.

In a number of European markets the relative weight of mobile revenues declined between 2014 and 2016; these markets included the United Kingdom, Greece, Spain and several

Chart 3.14: Mobile revenue growth in selected developed countries, 2014-2016

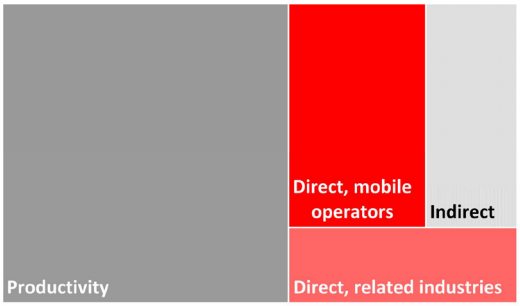


Source: ITU.

markets in Eastern Europe (Chart 3.14). This is largely the result of market saturation, the proliferation of converged multi-play offerings and the investments made in fixed-broadband networks. In fact, between 2014 and 2016, fixed-broadband penetration increased by 2 percentage points in Spain and the United Kingdom and by 4 percentage points in Greece, which shows the importance of fixed-line assets in driving telecommunication revenue growth in mature developed countries.

Interestingly, in Sweden, fixed-broadband penetration increased by 3 percentage points without any decline in the relative weight of mobile revenues compared to total telecommunication revenues (from 56 to 60 per cent). This is driven mainly by faster growth in mobile revenues than in fixed-broadband revenues, supported by growth in M2M revenues which are included in total mobile revenue, representing around 3 per cent of total mobile revenue in 2016 (PTS, 2017). In other markets such as Turkey, Brazil, and South Africa, cellular M2M

Chart 3.15: Total contribution to GDP (per cent of GDP), 2017



Source: GSMA.

services also play an important role in balancing out stalling revenue growth in core business segments. In these countries, cellular M2M revenue represented 2.3 per cent of total mobile revenues in 2016 for Turkcell, 2.1 per cent for Vivo and 1.1 per cent for Vodacom, with growth of 1 percentage point between 2014 and 2016 in the Turkish operator, 0.4 percentage points for Vivo in Brazil, and only 0.1 percentage points for South Africa's Vodacom[15].

Table 3.2: Mobile revenue (USD millions), 2014-2016

Economy	2014	2015	2016
United States	240 332	257 806	255 405
China	139 986	132 006	129 552
Japan ^	*65 520*	58 221	66 228
India	22 753	22 873	23 204
Korea (Rep. of)	23 662	21 345	21 241
Germany	25 398	20 584	21 084
United Kingdom	25 096	23 188	20 714
Canada ^	18 942	17 606	17 540
France	20 671	16 723	16 383
Italy	15 287	12 777	15 381
Brazil ^	26 927	25 305	15 128
Mexico ^	18 332	16 009	13 560
Indonesia	10 252	6 600	11 693
Australia ^	*13 588*	*12 220*	*10 860*
Spain	12 956	10 210	10 004
Russian Federation ^	18 838	10 853	9 716
Saudi Arabia	10 664	8 425	9 589
Kuwait	*9 501*	9 091	*8 694*
Argentina ^	9 045	9 595	8 639
Turkey ^	7 208	7 345	7 461
Thailand	6 455	6 319	6 844
United Arab Emirates	6 951	6 357	6 499
South Africa	*8 108*	7 149	6 417
Netherlands ^	7 690	*6 355*	6 011
Nigeria	7 365	7 529	5 867
Iran (Islamic Republic of)	5 527	5 398	5 669
Malaysia	7 347	6 142	5 268
Switzerland	4 997	4 334	4 619
Philippines	*4 224*	*4 484*	4 262
Poland ^	5 612	4 564	4 246
Egypt	4 611	4 374	3 706
Sweden	4 318	3 626	3 636
Pakistan	3 187	3 202	3 421
Peru ^	3 276	3 334	3 407
Belgium	3 812	3 310	3 297
Colombia	3 589	*2 735*	3 079
Algeria	4 021	3 377	2 820
Bangladesh	3 024	2 995	2 816
Austria	3 001	2 532	2 595
Ecuador	1 856	2 013	2 262
Morocco	2 988	2 441	2 261
Israel	*2 876*	*2 490*	2 226
Norway	2 802	2 166	2 188
Qatar	1 841	1 934	1 978
Hungary ^	2 396	1 827	1 887
Myanmar	*979*	*1 716*	1 885
New Zealand	2 066	1 771	1 865
Greece	3 150	1 828	1 850
Finland	1 976	1 719	1 847
Czech Republic	2 519	1 831	1 793
Ireland	2 056	1 736	1 729
Romania	1 950	1 623	1 688
Denmark	2 169	1 721	1 684
Lebanon	*1 616*	1 681	*1 673*
Oman	1 414	1 536	1 560
Portugal	2 372	1 627	1 509
Côte d'Ivoire	1 927	1 429	1 471
Dem. Rep. of the Congo	987	1 091	1 382
Uzbekistan	1 045	1 079	*1 357*
Sudan	1 127	1 215	1 337
Angola	1 696	1 902	1 239
Ukraine ^	2 261	*1 266*	1 201
Ethiopia	732	814	1 084
Slovakia	1 361	1 129	1 079
Tanzania	*1 290*	*1 142*	1 033
Serbia ^	1 124	1 000	1 004
Dominican Rep. ^	1 054	1 029	998
Costa Rica	752	1 091	995
Cameroon	1 094	957	950
Nepal (Republic of)	492	759	816

Economy	2014	2015	2016
Mali	833	753	814
Croatia	901	750	806
Bulgaria	1 019	800	762
Uruguay ^	842	723	754
Tunisia	980	824	750
Jordan	900	815	730
Senegal	784	697	726
Zimbabwe	907	745	723
Kazakhstan ^	1 565	1 161	718
Afghanistan	*198*	851	700
Panama	*584*	670	691
Bolivia (Plurinational State of)	766	999	669
Belarus	853	646	633
Honduras ^	651	627	629
Azerbaijan	1 519	852	517
Paraguay	719	583	*506*
Bahrain	511	*497*	*484*
Burkina Faso	567	459	456
Benin	485	445	444
Zambia	508	537	433
Sri Lanka	*706*	540	*427*
Jamaica	418	471	422
Syrian Arab Republic	808	621	418
Lithuania	320	271	398
Slovenia	543	426	398
Trinidad & Tobago	344	403	374
El Salvador	768	397	369
Gabon	*500*	392	364
Bosnia and Herzegovina	363	383	346
Chad	343	290	311
Luxembourg	310	274	277
Togo	284	255	253
Latvia^	364	308	252
Estonia	273	258	241
Kyrgyzstan ^	345	293	239
Mongolia	*224*	251	233
Malawi ^	166	227	202
Bahamas	253	*223*	194
Rwanda ^	153	246	186
Armenia	286	210	177
Georgia	258	177	177
Madagascar	254	190	158
Namibia	*205*	156	143
Mauritius	176	147	142
Albania	182	138	138
Moldova	176	137	134
The Former Yugoslav Rep. of Macedonia	171	126	122
Malta	135	118	122
Iceland	121	109	116
Montenegro	*158*	152	111
Barbados	127	*118*	109
Guyana	*81*	*80*	82
Burundi	102	141	60
Gambia	54	59	59
Andorra	*54*	*54*	*56*
Central African Rep.	42	51	56
Monaco	70	56	*56*
Bhutan	39	46	48
Saint Lucia	47	*45*	44
Cabo Verde	47	38	42
Lao P.D.R.	308	*170*	34
Comoros	*46*	57	25
Saint Vincent and the Grenadines	23	*23*	*24*
Vanuatu	*24*	21	21
Dominica	*18*	20	19
Liechtenstein	10	7	8

Source: ITU.
Notes: Data in italic are ITU estimates. ^ Country includes wholesale services.

Table 3.3: Average revenue per user (ARPU), mobile subscriptions, 2014-2016

Economy	USD / subscription / month		
	2014	2015	2016
Monaco	172.6	136.7	*139.3*
Kuwait	*104.2*	129.6	*134.3*
Andorra	*67.9*	*62.9*	*61.8*
United States	56.3	56.2	53.8
Canada	54.8	49.3	47.5
Qatar	46.4	43.1	45.1
Bahamas	67.0	*59.8*	44.8
Switzerland	37.3	32.1	34.2
Australia	*45.2*	*39.5*	*34.1*
Japan	*34.6*	30.2	33.1
Norway	40.7	31.6	31.9
Luxembourg	32.2	28.3	30.2
Ireland	34.9	29.5	29.5
Korea (Rep. of)	34.4	30.2	28.9
Lebanon	*30.7*	30.1	*28.5*
Barbados	34.7	*29.3*	27.3
United Arab Emirates	34.4	29.5	27.2
New Zealand	33.8	26.4	26.8
Sweden	29.2	23.9	24.2
Iceland	27.2	23.7	24.1
Netherlands	32.8	*25.4*	24.0
Belgium	24.9	21.6	21.9
United Kingdom	26.7	24.4	21.9
Finland	21.7	19.4	20.9
Saint Lucia	20.7	*20.2*	20.7
Dominica	*20.7*	21.1	20.6
France	26.3	20.9	20.2
Denmark	25.2	20.3	20.1
Oman	19.0	19.3	18.9
Malta	20.7	18.8	18.0
Saint Vincent and the Grenadines	16.6	*17.2*	*17.6*
Israel	*25.2*	*19.6*	17.5
Germany	21.3	17.8	17.0
Saudi Arabia	16.9	13.3	16.7
Spain	21.3	16.7	16.2
Croatia	16.8	14.1	15.2
Austria	19.3	15.7	15.2
Italy	14.2	12.1	14.9
Liechtenstein	19.7	14.9	14.7
Trinidad & Tobago	14.5	15.8	14.4
Slovenia	19.4	15.1	13.9
Ecuador	9.3	13.0	13.6
Bahrain	18.3	*16.4*	*13.5*
Hungary	17.0	12.9	13.4
Slovakia	17.8	14.1	12.9
Greece	21.6	12.1	12.3
Uruguay	12.8	11.7	12.3
Czech Republic	15.1	12.3	12.0
Guyana	*11.9*	*12.2*	11.6
Argentina	12.3	12.9	11.3
Panama	*7.1*	9.7	11.2
Portugal	16.6	11.6	10.9
Jamaica	11.6	12.5	10.8
Estonia	12.0	11.3	10.6
Gabon	*14.2*	11.6	10.2
Mexico	14.6	12.4	10.1
Malaysia	13.6	11.6	10.1
Costa Rica	8.9	12.1	10.0
Dominican Rep.	10.6	9.7	9.5
Serbia	10.0	9.1	9.2
Montenegro	*13.0*	12.6	8.9
Bosnia and Herzegovina	8.7	9.3	8.5
Turkey	8.4	8.3	8.3
Angola	10.1	11.4	7.9
Vanuatu	*12.9*	9.8	7.9
Latvia	12.7	9.9	7.9
China	9.1	8.5	7.9
Lithuania	6.2	5.4	7.9
Peru	8.6	8.1	7.7
Bulgaria	8.9	7.3	7.1
Honduras	7.0	6.5	6.7
Poland	8.2	7.0	6.7
Mauritius	8.9	7.0	6.5
South Africa	*8.5*	6.8	6.5
Jordan	6.8	4.9	6.2
Romania	7.1	5.8	6.1
Iran (Islamic Republic of)	6.7	6.1	5.9
Cabo Verde	6.4	5.2	5.8
Mongolia	*6.2*	6.8	5.8
Bhutan	5.2	5.7	5.7
Paraguay	8.2	6.6	*5.6*
Bolivia (Plurinational State of)	6.1	8.2	5.5
Brazil	8.0	8.2	5.2
Algeria	7.7	6.5	5.0
The Former Yugoslav Rep. of Macedonia	6.4	5.0	5.0
Uzbekistan	4.0	4.1	*4.9*
Thailand	5.5	5.1	4.8
Zimbabwe	6.4	4.9	4.7
Chad	5.4	4.4	4.6
Belarus	6.2	4.7	4.6
Morocco	5.6	4.7	4.5
Comoros	*9.9*	11.2	4.5
Namibia	*6.4*	5.1	4.5
Côte d'Ivoire	7.3	4.7	4.5
Tunisia	5.7	4.7	4.4
Colombia	5.4	*4.0*	4.4
Armenia	6.9	5.0	4.3
Cameroon	5.4	4.4	4.2
Azerbaijan	12.0	6.6	4.2
Benin	4.7	4.0	4.2
Sudan	3.4	3.6	4.0
Dem. Rep. of the Congo	2.2	2.4	4.0
Senegal	4.5	3.9	4.0
Togo	5.2	4.4	3.8
Central African Rep.	3.1	3.4	3.8
Russian Federation	7.1	4.0	3.5
Albania	4.5	3.4	3.4
Mali	3.0	2.8	3.4
El Salvador	7.0	3.5	3.2
Nigeria	4.4	4.2	3.2
Egypt	4.0	3.9	3.2
Myanmar	*2.8*	*3.5*	3.1
Zambia	4.2	3.9	3.0
Philippines	*3.2*	*3.2*	3.0
Moldova	3.9	3.1	2.9
Afghanistan	*0.9*	3.6	2.7
Georgia	4.0	2.7	2.7
Kyrgyzstan	3.8	3.2	2.6
Syrian Arab Republic	4.8	3.6	2.6
Indonesia	2.6	1.6	2.5
Burkina Faso	3.8	2.6	2.5
Malawi	2.5	2.9	2.3
Kazakhstan	4.6	3.7	2.3
Tanzania	*3.4*	*2.4*	2.1
Nepal (Republic of)	1.8	2.3	2.1
Pakistan	2.0	2.1	2.1
Ukraine	3.1	*1.7*	1.8
Ethiopia	2.0	1.6	1.8
Rwanda	1.6	2.3	1.7
Gambia	2.0	1.8	1.7
Bangladesh	2.0	1.9	1.7
India	2.0	1.9	1.7
Madagascar	2.2	1.5	1.7
Sri Lanka	*2.7*	1.9	*1.4*
Burundi	2.7	2.4	0.9
Lao P.D.R.	5.6	*3.8*	0.7

Source: ITU.
Notes: Data in italic are ITU estimates.

From voice to data revenues

The current transformation in the telecommunication industry is prompting service providers to consider innovative revenue sources in order to offset the decline in mobile revenue, and this in turn produces a radical shift in traditional business models. This is particularly visible when we analyse trends in revenue generated from traditional mobile voice services, which declined globally by more than USD 100 billion between 2014 and 2016 (falling below 50 per cent of total mobile revenue in 2015 -Chart 3.16).

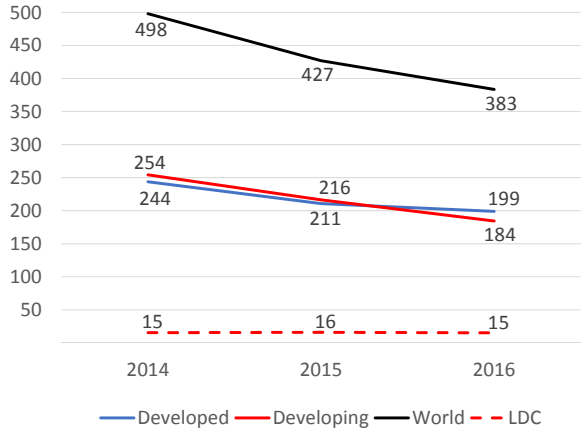
In 2015, both developed and developing countries witnessed a similar decline in voice revenues (about -14 per cent annually on average in both cases), but the decline continued in the developing world the following year, with a 15 per cent reduction in mobile voice revenues recorded in 2016, compared to a 6 per cent fall in the developed world. In 2016, voice revenues accounted for 49 per cent of total mobile revenues on average across developing economies, compared to 41 per cent across the developed countries; that share had fallen from 62 per cent and 48 per cent respectively in 2014 (Chart 3.17).

Between 2014 and 2016, the regions that witnessed the fastest reductions in voice revenues were the CIS (48 per cent down), the Americas excluding the United States and Canada (33 per cent down), and Europe (30 per cent). In Asia and the Pacific, voice revenues fell by 25 per cent during the period, closely followed by Africa (21 per cent) and the Arab States (17 per cent). These reductions reflect record low levels in voice ARPU, which in 2016 was USD 3 per month in the developing world, compared to USD 11 per month in the developed world. These regional trends in mobile voice revenue show the extent to which mobile services are becoming commoditized, and the importance for mobile operators of offsetting such declines by generating revenue from services powered by mobile-broadband technologies.

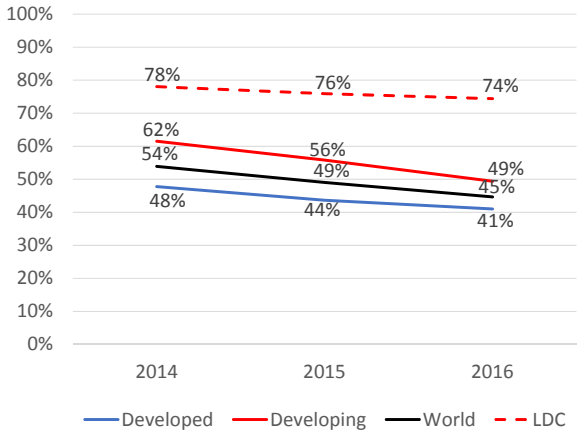
Overall, the 23 per cent reduction in voice revenues recorded globally between 2014 and 2016 was partly offset by a 23 per cent increase in mobile data revenue during the same period (Chart 3.18). However, the increase in data revenue (USD 70.2 billion) is 61 per cent lower than the loss recorded in voice revenue (USD 114.6 billion). In fact, Asia and the Pacific and the United States and Canada are the only two zones in which the increase in mobile data revenues between 2014 and 2016 was greater than the loss in voice revenue. Asia and the Pacific broke even, with a USD 39.6 billion loss in voice revenue and a USD 40.3 billion increase in data revenue, while in the United States and Canada voice revenues declined by USD 12.5 billion and data revenue increased by USD 23.5 billion.

China accounts for 70 per cent of the gain in data revenues recorded between 2014 and 2016 in Asia and the Pacific, while gains in the Republic of Korea, Japan, Indonesia, and Thailand make up most of the remainder. In 2016, mobile revenue in China alone represented half of mobile revenue in the United States and close to the entirety of

Chart 3.16 (left): Mobile voice revenue (USD billions)
Chart 3.17 (right): Voice revenues as a percentage of mobile revenues

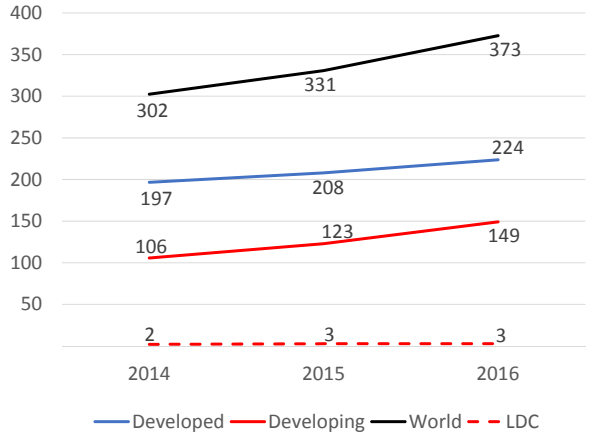


Source: ITU estimates based on GSMA data.

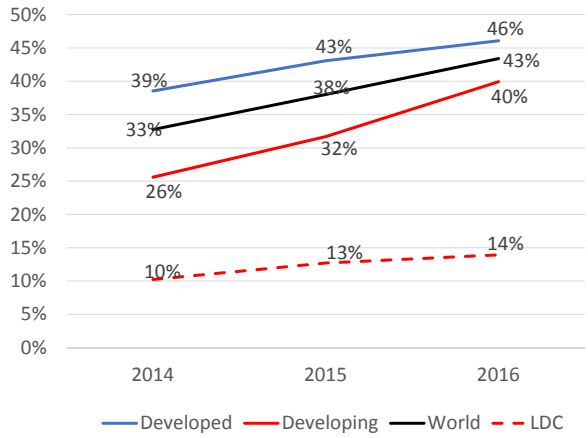


Source: ITU estimates based on GSMA data.

Chart 3.18 (left): Mobile data revenue (USD billions)
Chart 3.19 (right): Data as a percentage of mobile revenue



Source: ITU estimates based on GSMA data.



Source: ITU estimates based on GSMA data.

mobile revenue in Europe. However, data revenue estimates show that the value of mobile data services in China overtook that of Europe in 2016. The rapid pace of smartphone adoption in the country, investment in LTE and fibre technology, and positive economic growth in recent years, have all helped to fuel growth in data services in the country, with the entire Chinese mobile ecosystem now looking at playing a leading role in the introduction of 5G networks and services.

In price-sensitive Asian markets, where high infrastructure investments are needed to boost mobile-broadband adoption, cuts in data tariffs are putting pressure on operators' financial indicators. In India, for example, the launch of Reliance Jio in September 2016, offering cut-price LTE services, put significant pressure on incumbent operators' revenues, with the annual increase in data revenue in the country estimated at 11 per cent in 2016, compared to 37 per cent the previous year.

The United States and Canada are the only countries to go against global revenue trends, with a 5.3 per cent growth in mobile revenue between 2014 and 2016. The 10 per cent fall in revenue in voice services was offset by a 24 per cent increase in data revenue. In the United States, the largest mobile market in the world in terms of revenue, increasing competition has forced prices (particularly roaming prices) downwards, while also driving an evolution in business models with the widespread adoption by operators of handset financing schemes, thus moving away from the traditional handset subsidy model. SIM-only plans are becoming popular in the United States, a country where the predominant model is postpaid (80 per cent of mobile-cellular subscriptions in 2016). Analysts estimate that the rate of SIM-only adoption reached 14 per cent of mobile subscribers in mid-2016 (GSMA, 2016).

In recent years, operators in the United States have introduced innovative data offerings that have later been replicated by their European counterparts – from shared data plans to tiered pricing, handset leasing and M2M offers (Box 3.4). Operators in the country are also bullish about 5G testing and deployments, having already made drastic decisions with the shutdowns of 2G and 3G legacy networks.

In Europe, mobile operators followed a similar strategy to offset increasing financial pressures, as mobile revenues in the region fell by 17 per cent between 2014 and 2016, voice revenues fell by 30 per cent, and data revenues increased by a mere 4 per cent. European operators have also transformed traditional business models to embrace tiered pricing, handset financing schemes, shared data plans and media content distribution, while M&A activity is showcasing the growing role of fixed-mobile convergence (FMC) in driving revenue growth and upselling services to consumers. In some markets such as Spain, Switzerland, France and Portugal, bundles without mobile have been marginalized and FMC has become the norm for consumers. For instance, in Spain there were nearly 12 million FMC bundle subscriptions at the end of 2017, marking an increase from just over 1 million in 2012 (GSMA,

Box 3.4: Mobile tariffs evolve to boost data usage and revenue growth

With the introduction of LTE networks, mobile operators in Europe started replicating innovative tariffs that originated in the United States, Japan or the Republic of Korea, including tiered pricing and shared data plans.

These new approaches to tariff-setting for services were designed to stimulate data usage on smart devices, and have played a key role in accelerating data revenue growth. The introduction of tiered pricing marks the transition away from traditional voice, SMS and data bundles, with tariffs then becoming increasingly data-centric; data allowance buckets were offered to consumers. For example, in 2012, Vodafone launched its Vodafone "Red" plans with tariffs incorporating unlimited voice minutes and SMS, and price scaling based on incremental data allowances. By mid-2014, Vodafone had more than 10 million customers on its Red plans, and noted that its simplified tariff structure was driving higher net promoter scores (NPS – a key metric used to measure customer satisfaction), lower churn, and greater data usage (GSMA, 2014).

Shared data plans were also introduced in Europe, following the success of these plans in the United States. A GSMA 2015 survey (GSMA, 2015b) found that the uptake of shared data plans was most prevalent in the United States (35 per cent of mobile users) and mature markets in the Arab States, such as Qatar (44 per cent), while uptake of these plans in European markets remained below 15 per cent of mobile users at the time. These new tariffs were equally designed to boost data usage, allowing users to share their data allowance across multiple devices. For example, Saudi Arabia's STC offered unlimited data with multiple SIMs as part of its "Postpaid 1000" plan in 2015.

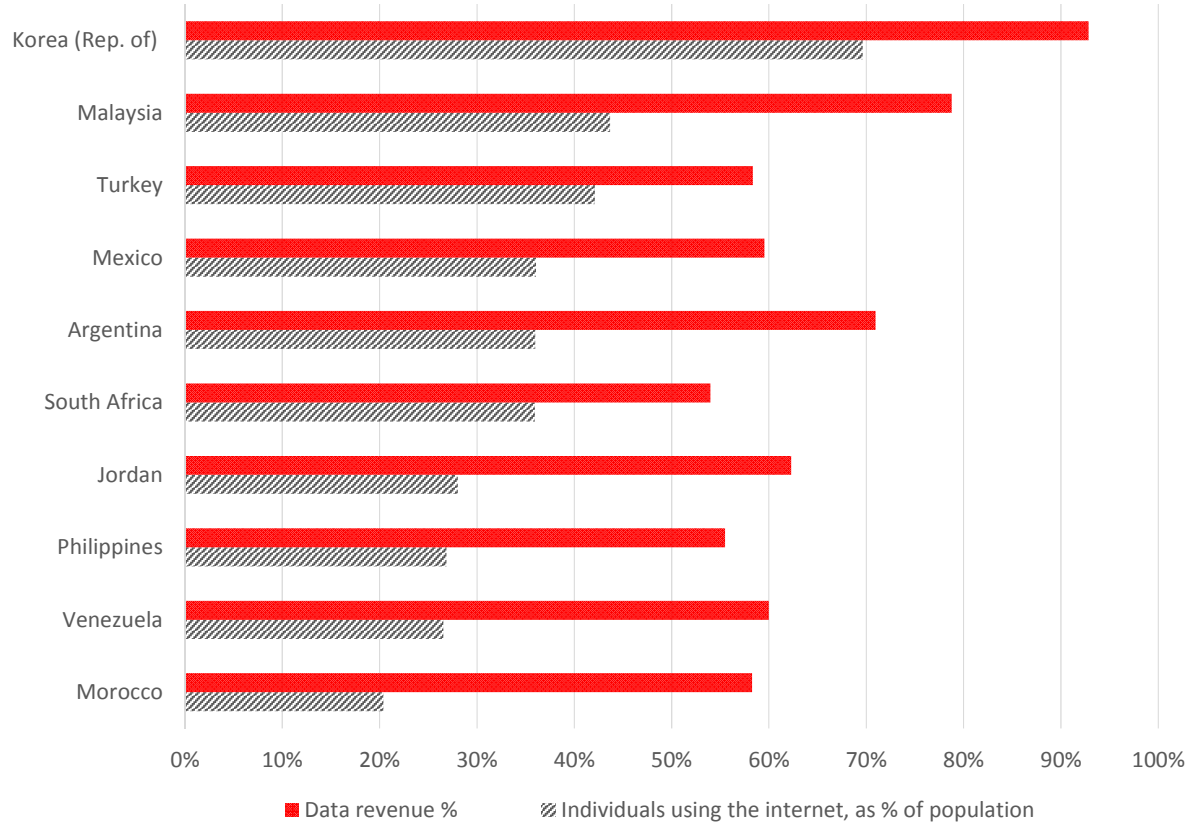
In some countries, these new data tariffs accelerated the commoditization of voice and SMS services, and were also positioned as a defensive move against over-the-top (OTT) providers that started introducing free IP-messaging services on smartphones – a trend described in the next section of this chapter.

2018a). In markets where such transformation occurs, service providers change their revenue reporting standards (GSMA, 2018a). For example, two of the three major mobile operators in Spain (Telefónica and Orange) have stopped reporting their mobile, fixed and pay-TV revenues on a standalone basis.

Overall, the relative weight of data revenue as a percentage of total mobile revenue is correlated with the country's Internet penetration (Chart 3.20). The analysis shows that among the 40 developing economies with high Internet penetration (above 50 per cent of the population) in 2016, data revenues tend to account for about one-third of mobile revenues, while Internet penetration is on average two-thirds of the population. In contrast, among the 80 developing economies with low Internet penetration (below 50 per cent of the population), data revenues were on average 15 per cent of mobile revenues in 2016, while Internet penetration averaged around one-quarter of the population. This shows that there is room for growth in data revenues in the latter group, as Internet penetration is expected to continue to grow, driven by mobile-broadband adoption.

Countries likely to witness growth in data revenues as a result of Internet penetration rapidly crossing the 50 per cent threshold over the coming years include Viet Nam, Thailand, Uzbekistan, Algeria and Egypt. Nevertheless, data ARPU will remain low in these countries and mobile operators will need support from local authorities to balance investments in mobile-broadband infrastructures against profitability in the interests of creating a sustainable market environment. This is particularly true in large countries such as India, Indonesia, the Democratic Republic of the Congo, and Nigeria, where Internet penetration is still well below the 50 per cent threshold owing to the high

Chart 3.20: Data revenues as a percentage of mobile revenues vs Internet penetration, 2016



Source: Internet penetration (percentage of individuals using the Internet)- ITU; share of data revenue- ITU estimates based on GSMA data.

level of investment needed for mobile-broadband infrastructure, and voice revenues still accounted for 80 per cent of mobile revenues as of 2016.

As mobile markets in developing economies become more mature, the financial pressure also forces a transformation of operators' traditional business models (albeit at a slower rate than in developed markets). In Africa, data revenue grew by only 6 per cent between 2014 and 2016, forcing service providers to look for innovative data tariffing to support data revenue growth, with barriers relating to affordability, digital literacy and the availability of local content hindering the adoption of data services. MTN group, for example, stated in its 2016 annual report that its data revenue growth was partly driven by the introduction of a new data bundle plan which "allows eligible customers to borrow data on credit and pay it back at their next recharge." The average smartphone price in Africa fell from USD 230 in 2012 to USD 160 in 2015, but overall adoption in 2015 was still only around half the global average (GSMA, 2017a). However, smartphone ownership is not the endgame in the region, as innovative data tariff setting plays a critical role in translating smartphone adoption into higher data usage and greater data revenue growth.

In addition, one area of potential growth for mobile operators in developed and developing economies alike is the enterprise sector, with notably MTN and Orange launching a range of connectivity, payments, and cloud storage solutions for businesses in Côte d'Ivoire, Ghana and Nigeria.

The impact of OTT services

The shift from mobile voice to data revenues goes hand in hand with mobile operators' strategies to monetize mobile Internet services with the objective of generating a return on the major network infrastructure investments that have been made in order to connect consumers to the mobile Internet. However, the monetization of mobile Internet services is largely influenced by the availability of over-the-top (OTT) services.[16]

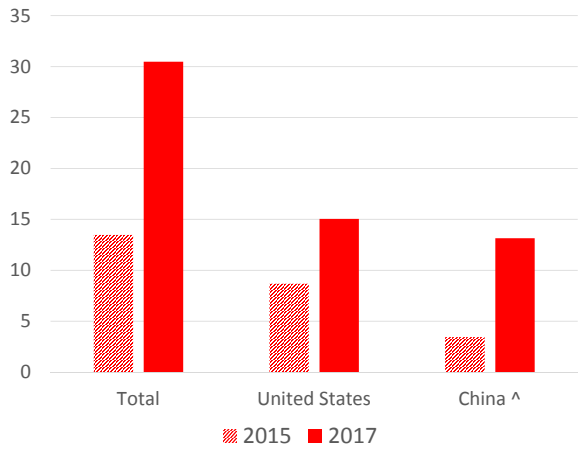
The size of the app economy[17] can be assessed by monitoring the number of mobile app downloads and revenues generated from the application stores available in the markets – which are largely dominated by iOS App Store and Google Play. An analysis of usage patterns across a selection of ten of the most dynamic mobile markets worldwide (representing 51 per cent of global GDP) shows that revenues generated from mobile application purchases more than doubled in the period 2015-2017, reaching USD 30.5 billion in 2017 (Chart 3.21). This revenue performance is linked to 57 billion mobile application downloads in 2017 across these countries, almost 20 billion more than in 2015 (Chart 3.22).

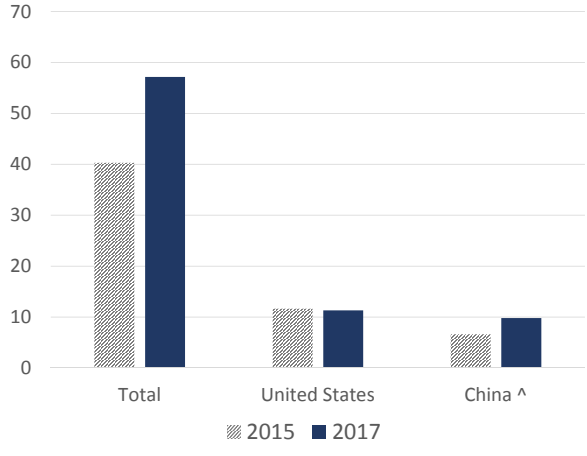
App Annie data show that the United States and China are the two largest countries in terms of mobile app revenues, accounting for 92 per cent of total revenue apps across the group of countries selected for the analysis. The United States – which, unlike China, is predominantly postpaid – topped USD 15 billion in app revenue in 2017, closely followed by China at USD 13 billion (Chart 3.21). Both countries boast a high smartphone adoption rate, at 80 per cent and 76 per cent of mobile subscriptions respectively in 2017[18]. Meanwhile, India exhibited tremendous growth in app downloads between 2015 and 2017 (214 per cent), crossing the 10 billion downloads per year threshold in 2017 (Chart 3.23). This growth is fuelled largely by growth in smartphone use, increasing from 23 per cent to 45 per cent of mobile subscriptions between 2015 and 2017[19], along with the availability of local brands delivering services and content tailored for the local market (e.g. Flipkart, JioTV). However, in terms of value, the mobile app market in India remains limited at just over USD 200 million (Chart 3.24), which is partly the effect of price-sensitivity in a mobile market that is predominantly prepaid, with one of the lowest ARPUs in the world (just under USD 2 per month).

Interestingly, the number of app downloads seems to have hit a ceiling around 2016 in Mexico and Turkey, with app downloads declining by 2 per cent in the former from 2016 to 2017 and growing by a mere 4 per cent in the latter[20]. Nevertheless, revenues generated from app purchases increased by 32 per cent and 15 per cent respectively during this period, reflecting the growing appetite for data services from higher-value smartphone users. A similar trend can be seen in the United States, which recorded a 4 per cent decline in app downloads between 2016 and 2017, while app revenues by contrast increased by 26 per cent.

Social and messaging mobile applications are among the most commonly downloaded apps, particularly in price-sensitive prepaid markets, as IP-messaging apps allow smartphone and feature phone owners to share text and media-rich

Chart 3.21 (left): Total consumer spending on mobile apps, top ten selected countries (USD billions)
Chart 3.22 (right): Total mobile app downloads, top ten selected countries (USD billions)



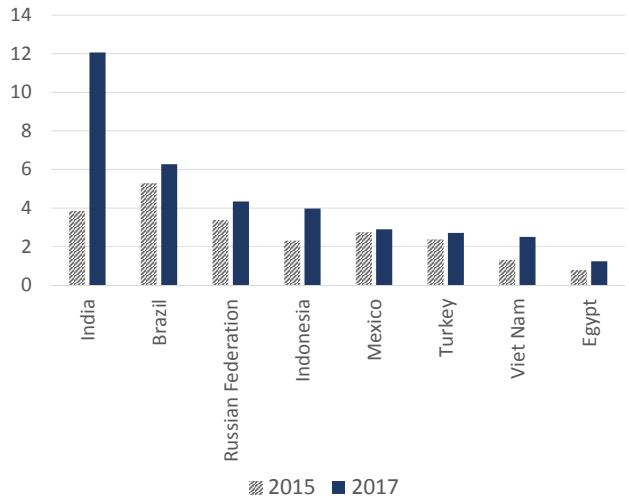


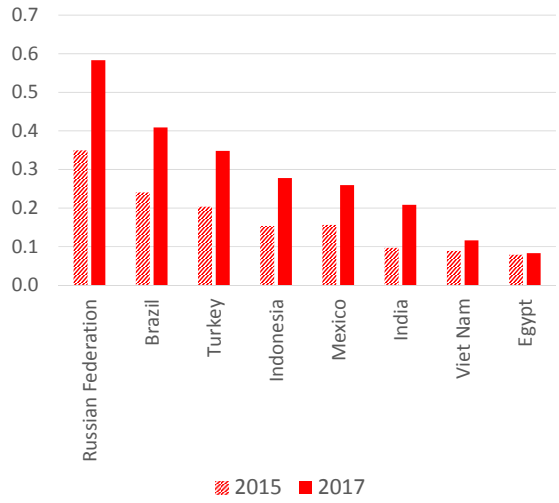
Source: App Annie

Source: App Annie.

Notes: Downloads across Google Play and the iOS App Store combined; ^ does not include third-party Android stores. Consumer spending is revenue before the App Stores take their cut, assuming the latter to be a uniform 30 per cent across all transactions. These graphs exclude the other eight countries, which are described separately in Charts 4.23 and 4.24.

Chart 3.23 (left): Total mobile app downloads, selected countries (in billions)
Chart 3.24 (right): Consumer spending on mobile apps, selected countries (USD billions)





Source: App Annie

Source: App Annie.

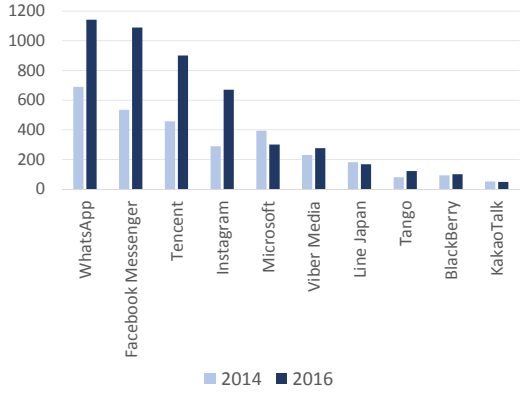
Notes: Downloads across Google Play and the iOS App Store combined. Consumer spend is revenue before the App Stores take their cut, assuming this cut to be a uniform 30% across all transactions. These graphs exclude the US and China given the sheer size of their respective app downloads and revenue markets in comparison to the other selected countries.

messages for free, while mobile operators charge for the use of traditional texts (SMS).

Globally, the largest OTT communication platforms are WhatsApp, Facebook Messenger, Tencent (the owner of China's WeChat messaging platform), and Instagram – each totalling over 1 billion monthly active users as of 2018, while WhatsApp is expected to surpass 2 billion monthly active users in 2020 (Chart 3.25).

WhatsApp (owned by Facebook) is the most popular IP-messaging app globally and India is its largest market, with currently over 200 million monthly active users. WhatsApp is the top ranking messaging app in the Russian Federation, Brazil, Turkey, Indonesia and Mexico. India overtook the United States in social app downloads in 2017, with 1.2 billion downloads recorded that year against 786 million in the United States. India and Brazil are two of the most dynamic social app markets, with Android users recording 60 billion hours spent on social apps in 2016 on average across both countries, almost twice as much as the time spent on social apps in the United States, Indonesia or Mexico that year[21].

Chart 3.25: Global number of monthly active users (in millions), selected OTT Communications Apps



Source: Ovum OTT Communications Tracker, 4Q17.

However, the success of IP-messaging apps often comes at the expense of the revenues generated by traditional texting. In 2018, 67 per cent of mobile users in the Americas (excluding the United States and Canada) said that they use instant messaging apps on a mobile phone at least once a month, which is as much as those who actively use their mobile phones to send or receive SMS/MMS messages[22]. This trend is particularly striking in Brazil (Box 3.5), where 65 per cent of mobile phone owners actively use IP-messaging apps, more than the number of mobile phone owners using SMS/MMS (56 per cent). In Asia and the Pacific, IP-messaging apps are actively used by on average 44 per cent of mobile phone owners in 2018 (73 per cent in China alone), compared to 34

Box 3.5: Investments in mobile-broadband networks in the Americas are paying off

Argentina, Brazil and Mexico are listed among the countries that have made significant progress in terms of ICT regulations in recent years (ITU, 2018b), with tangible improvements expected in their ICT sectors as well as the entire economy over the short- to medium term. LTE networks covered four out of every five inhabitants on average across these countries in 2017, supported by the allocation of relevant spectrum frequencies by local state governments.

In Brazil, LTE growth was fuelled by the early allocation of bandwidth in the Advanced Wireless Service (AWS) (1700/2100 MHz) and 2600 MHz frequency bands in 2012-2013, and the assignment by Argentina and Mexico of bandwidth in the AWS band in 2014-2015 and 2012, respectively. As mobile operators rapidly built their respective LTE infrastructures between 2015 and 2017, capital expenditure (capex) intensity averaged 24 per cent of telecommunication revenues across these three countries during the period in question.

These investments drove positive growth in the adoption of mobile-broadband services in these markets, catering to ever-increasing consumer demand for faster data services. Brazil boasts some of the most dynamic app usage patterns, reflecting the growing appetite for data services in that country. As a result, the number of mobile application downloads between 2014 and 2016 went up by 19 per cent, and app revenues increased by 70 per cent[24]. WhatsApp is the most popular messaging platform in the country, and in 2017 Brazilian Android users spent the most time on social apps (75 billion hours, twice as many as in the US).

All three countries have implemented their respective national broadband plans, which are focused on boosting LTE adoption, notably via the creation of synergies between the public and private sectors. More recently, Brazil introduced its "Internet for All" programme in mid-2018 (BrazilGovNews, 2018), launching its own satellite to foster digital inclusion for those living in more remote areas.

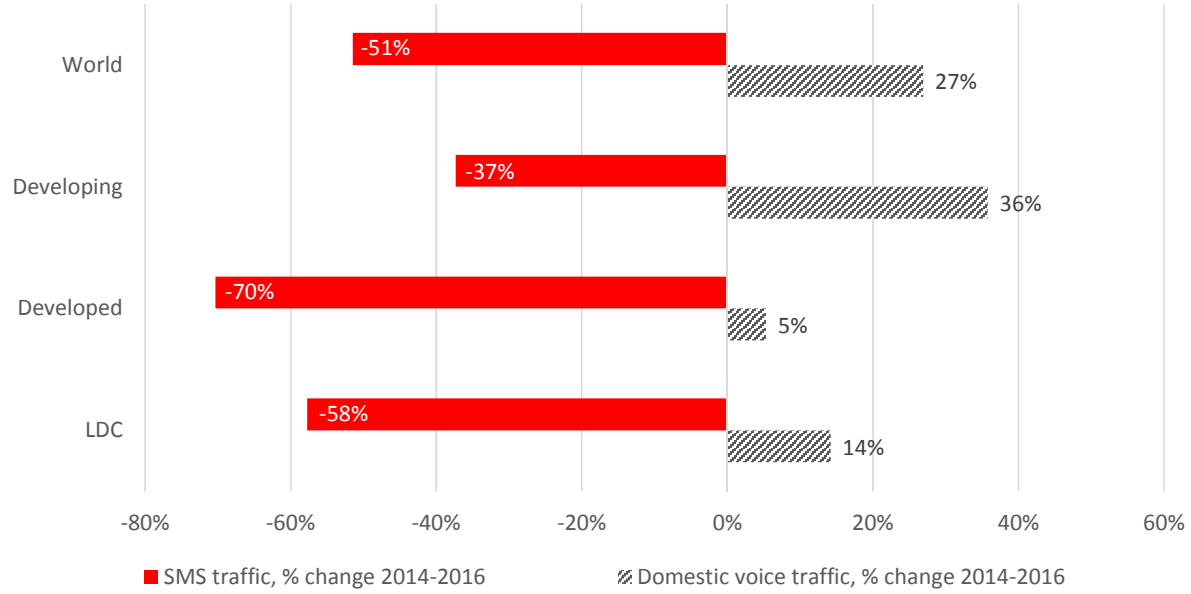
per cent in Africa, with the highest engagement level recorded in South Africa at 49 per cent[23].

Globally, the number of SMS sent decreased by half between 2014 and 2016, from 6 trillion text messages sent in 2014 to just under 3 trillion in 2016. SMS traffic was equally hit in both developed and developing economies, declining by 70 per cent during this period in the former, and by 37 per cent in the latter (Chart 3.26). In parallel, domestic voice traffic is also partly affected by OTT communication platforms that allow users to make free voice and video calls – a trend facilitated by the removal of regulatory barriers to the launch of voice over IP (VoIP) services. Indeed, the number of countries allowing individual users to use VoIP increased from 78 to 156 in the period 2007-2017.

Consumers spent 14 trillion minutes in phone calls in 2016 globally, with voice traffic continuing to grow reasonably rapidly in developing economies, compared to slower traffic growth recorded in the developed world (36 per cent and 5 per cent respectively between 2014 and 2016).[25]

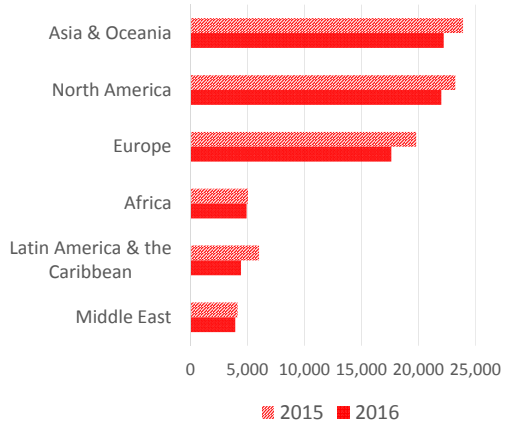
Along with the impact on SMS traffic, the growing use of these OTT services negatively impacts SMS revenues, which fell globally from USD 82 billion in 2015 to USD 75 billion in 2016 (Chart 3.27). At a regional level, the largest impact was recorded in the Americas (excluding the United States and Canada), with a 26 per cent decline in SMS revenues between 2015 and 2016, followed by Europe (a fall of 11 per cent). Over the coming years, this trend will become more marked as the number of OTT messaging apps users continue to grow – partly driven by the growing adoption of smartphones in developing economies and as more operators commoditize traditional text by offering "unlimited" SMS bundles. As a result, analysts expect that, in 2022, global SMS revenues will have halved compared to 2015[26].

Chart 3.26: Regional voice vs SMS traffic, percentage change 2014-2016



Source: ITU.

Chart 3.27: Regional person-to-person SMS revenues (USD millions), 2015-2016



Source: Ovum, Mobile Messaging Traffic and Revenues: 2017-22.
Notes: Regional groups are based on Ovum classification.

Initially, most OTT communication providers positioned their apps and services as a replacement for traditional voice and text, at a time when mobile operators were not offering large or "unlimited" voice and text bundles, as is the case today in many countries. Within a relatively short period of time, messaging platforms were able to build substantial user bases on the promise of free services, and later added new capabilities to enable features such as group messaging, media-rich content, as well as voice and video calling. Some messaging apps also allowed businesses to engage with end-users via mobile advertising and mobile payment services, enabling messaging platforms to tap into the e-commerce sphere.

With large subscriber bases, OTT communication platforms are taking on the data monetization challenge, which started initially in mature Asian markets (e.g. KakaoTalk in the Republic of Korea, Line in Japan, and WeChat in China) and is now being embraced by most large OTT providers such as WhatsApp, Facebook Messenger and Viber. Industry analysts noted that only a few OTT communication apps providers are generating revenues – KakaoTalk, Line, Rakuten Viber, WeChat and most likely Facebook Messenger – but only two players (Line in Japan, and Kakao Daum in the Republic of Korea) report revenue figures, making it difficult to estimate the global revenues generated by OTT providers[27].

In Japan, Line reported JPY 174.5 billion in revenue in 2017 (USD 1.58 billion), split across its core and strategic segments.[28] The former accounted for 89 per cent of revenues generated and comprises several activities that include advertising (e.g. official accounts, line accounts, advertising impressions) and communications and content (e.g. emoji and stickers, games, music). The remaining 11 per cent came from its strategic business segment, which comprises Line Friends, and a number of businesses in the Fintech (e.g. Line Pay and Line Financial for asset management, insurance and loans), AI (e.g. Clova Home, a virtual

assistant), commerce (e.g. Line Shopping), and mobile (e.g. Line MVNO).

In the Republic of Korea, Kakao Daum reported revenues of KRW 1.97 trillion (USD 1.77 billion) in 2017,[29] split across three business segments: advertising (e.g. advertising on portals, messenger, social networking services, shopping and video), content (e.g. games, music, web literature, emoticons) and others (e.g. commerce, mobility, Fintech). Its revenue mix remained stable throughout 2017, with its content segment representing around half of revenues, followed by its advertising segment (about 30 per cent) and its other segments (about 20 per cent).

The reported revenues of these two players totalled USD 3.35 billion in 2017. Industry analysts have estimated that, given the sheer size of its highly-engaged subscriber base, China's OTT provider WeChat is likely to generate at least USD 2 billion in revenues, putting total revenues from OTT communication apps at USD 5.5 billion globally as a minimum expectation[30].

OTT services are now expanding far beyond traditional voice and messaging services. Video is living up to its promise of being the "killer-app", to judge by the success of streaming services such as Netflix. In the first quarter of 2018, the US-based entertainment provider reported having 125 million members generating USD 3.6 billion in streaming revenues during that quarter, with an almost equal split between revenues generated from its domestic market and its international footprint (Netflix, 2018). Viewership on smartphones is gaining momentum, and United States consumers spent around 7.5 billion minutes watching Netflix on their phones in June 2017 (Recode, 2017), marking an increase of 73 per cent since 2014 (ComScore). This trend will continue to accelerate, as Netflix and Amazon are estimated to have spent USD 10.5 billion on video in 2017 (Business Insider, 2017).

3.3 Investment in the telecommunication sector

The ICT sector is characterized by major infrastructure investments, notably to deploy the network technologies that will power the use of fixed and mobile voice and data services. These investments are large and the constant evolution of network technology means that service providers have to maintain a steady level of investment to maintain or improve the quality and capacity of their networks. This can prove challenging in an increasingly difficult market environment in which telecommunication revenues are growing more slowly or declining.

In 2015, ICT investment in the OECD area represented 11 per cent of total investment and 2.3 per cent of total GDP. Almost 60 per cent of ICT investment was devoted to computer software and databases (OECD, 2017b), which once again shows the hardware to software shift under way in the sector. According to a European Commission study (2018) spanning 40 economies worldwide, almost one-quarter of total business expenditure in research and development (BERD) originates in the ICT sector alone, while the sector plays an important enabling role for innovation in other technological domains. In the European Union, the ICT sector spent EUR 30 billion on BERD in 2015, representing 15.7 per cent of total BERD.

In recent years, fixed and mobile-broadband penetration has accelerated, reaching a greater share of the population and more remote territories. In terms of fixed-broadband technology, digital subscriber line (DSL) still represents the largest category, although it is gradually being replaced by optical fibre as operators invest in faster networks (ITU, 2017b). Developing countries and LDCs are deploying fibre-optic infrastructure directly, leap-frogging cable and DSL. In 2016, the share of fibre to the home/building (FTTH/B) subscriptions per 100 inhabitants in the developing world (3.9 per cent) was greater than that of DSL Internet technology (2.8 per cent). The opposite is true in the developed world, where DSL Internet penetration (12.7 per cent) is greater than that of cable modem (8.8 per cent) and FTTH/B (6.7 per cent).

In parallel, the deployment of LTE networks is accelerating, fuelled by a wave of spectrum assignments across the globe. Just over half (53 per cent) of the population in the developing world was covered in 2015 (an increase from 31 per cent in 2014), while 88 per cent of the population living in the developed world had access to LTE in 2015 (based on ITU estimates). It is important to note that a complementarity exists between fixed and mobile-broadband, with smartphones often being used over fixed-broadband Wi-Fi and

mobile operators looking at Wi-Fi traffic offload as a way to manage network capacity. Thus, 60 per cent of total mobile data traffic was offloaded onto fixed networks through Wi-Fi or femtocell in 2016, representing a total of 10.7 exabytes of mobile data traffic offloaded onto the fixed network each month (Cisco, 2017b).

Investment in telecommunications can be measured by analysing reported capex data, which means the investment made by all businesses providing public telecommunication services for the purpose of acquiring or upgrading property and networks. Capex data should, however, be analysed with caution, as the impact of investment tends to extend beyond its particular year of allocation. For instance, capex might be first invested on a given date to start deploying LTE networks in a country, taking six to 12 months to build a substantial chunk of the infrastructure before commercial LTE services can be introduced for consumers. Current capex thus determines future rather than current ICT development. It is also important to note that capex intensity (capex as a share of revenue) can go beyond 100 per cent in cases where investment exceeds the revenue generated.

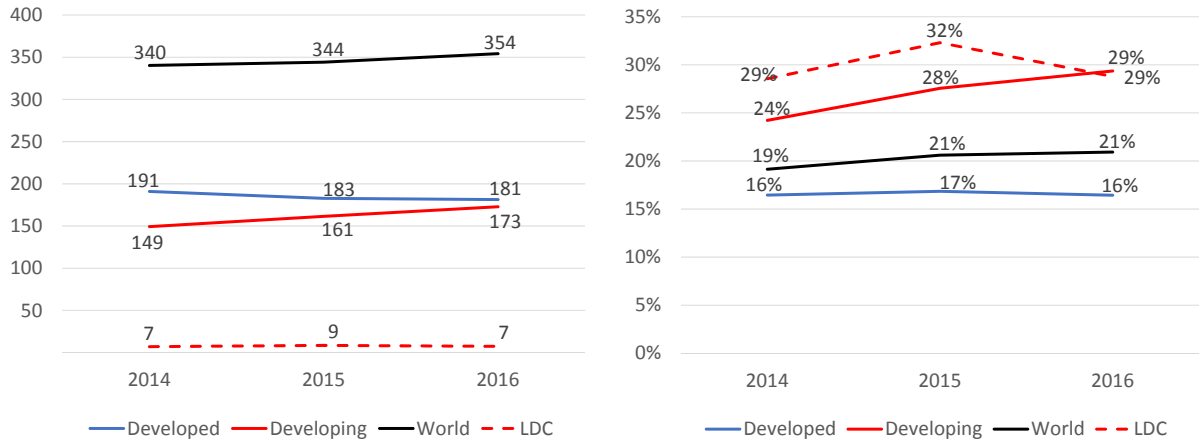
Data demand – a driver of investment

Globally, telecommunication capex rose by 4 per cent between 2014 and 2016, from USD 340 billion in 2014 to USD 354 billion in 2016. Investments in developing economies are largely responsible for driving that growth, with capex increasing by USD 23.5 billion in the developing world during the period in question compared to a USD 10 billion reduction in capital expenditure in the developed countries (Chart 3.28). Despite the reduction in the capex gap between the developed and developing economies between 2014 and 2016, the total telecommunication investment in the developing world did not overtake that recorded in the developed world.

Despite a high level of market maturity and declines in telecommunication revenue across the developed economies between 2014 and 2016, service providers have kept capex intensity stable at 16 per cent of total revenues each year. Convergence is at the centre stage of investment rationalization strategies in developed markets. For instance, with revenue growth stalling in Europe, consolidation and the ability of converged operators to leverage ownership of fixed assets and content to support mobile is seen as a way of promoting more sustainable mobile markets. Balancing investment and profitability is particularly important in a sector in which technology is in constant evolution, and 5G networks and services are due to be deployed by 2020, forcing service providers to take action on the switch-off of their legacy 2G and 3G networks in order to balance cost and capacity and satisfy an ever-increasing demand for faster and richer data services (GSMA, 2016).

In contrast, service providers in the developing world face the challenge of building the infrastructure that will help to connect a substantial base of low-ARPU consumers to

Chart 3.28 (left): Telecommunications capital expenditure (USD billions), 2014-2016
Chart 3.29 (right): Capex as % of telecommunication revenues, 2014-2016



Source: ITU.

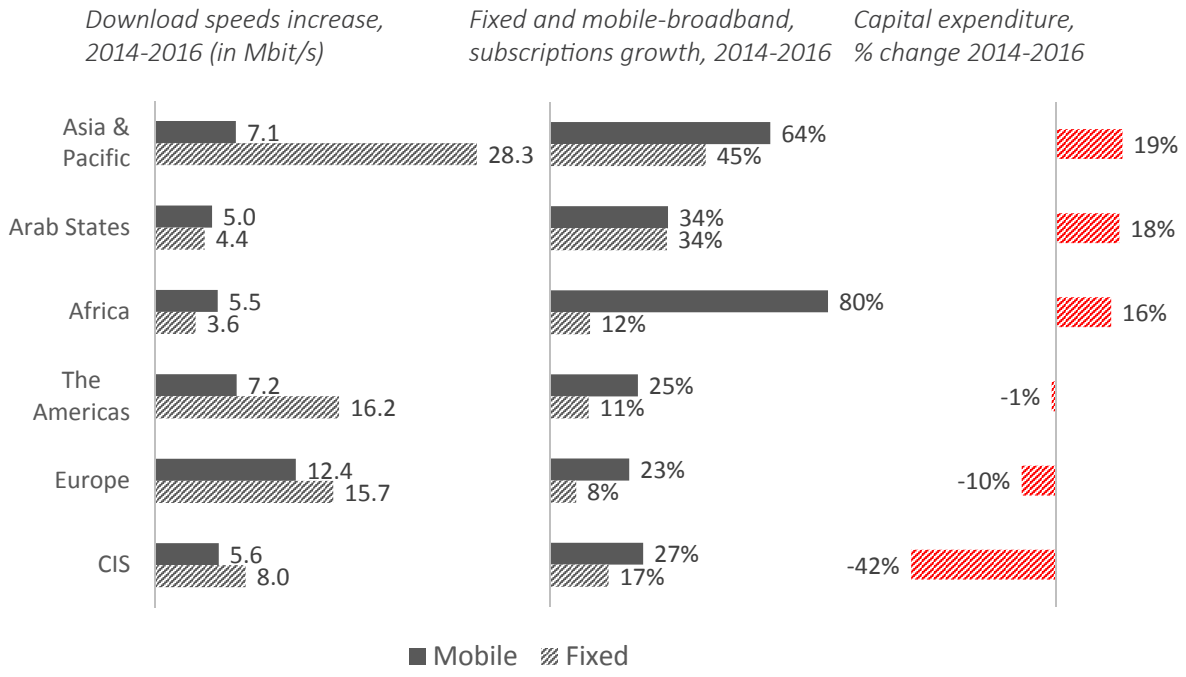
access Internet services for the first time. Mobile-broadband penetration in the developing world remained below the 50 per cent mark in 2016, compared to over 90 per cent in the developed economies; the same trend is evident in the number of individuals using the Internet. At the end of 2016, 4.0 billion people – 54 per cent of the world's population – were not using the Internet, the vast majority of them located in developing economies. Service providers in the developing world are tackling this challenge, and capex intensity rose from around one-quarter of telecommunication revenues in 2014 to 29 per cent in 2016 (Chart 3.29).

As mentioned earlier, current capex tends to determine future rather than current ICT developments. The impact of pre-2016 capex on the development and performance of telecommunication networks can be analysed by looking at the increase in fixed-line and mobile download speeds (Chart 3.30). This proxy shows that, between 2014 and 2016, mobile download speeds increased by 7 Mbit/s on average globally, compared to 13 Mbit/s on average for fixed-line download speeds[31]. This comes as a result of major investment in the continuous deployment and improvement of fixed and mobile-broadband infrastructures, across both developed and developing economies.

The largest mobile download speed increase was recorded in Europe, jumping from 11.7 Mbit/s in 2014 to 24.1 Mbit/s in 2016[32]. This is partly the result of LTE network upgrades. For example, the vast majority of European operators – as well as operators in key markets across Asia and the Pacific (e.g. Japan, the Republic of Korea, and China), the CIS and the Americas (e.g. the United States, Canada, Brazil, Argentina, Chile and Peru) – deployed LTE-Advanced between 2013 and 2016 (GSA, 2017; GSMA, 2018[33]). As a result, LTE download speeds increased from a theoretical 100 Mbit/s to 300 Mbit/s during this period. In parallel with these network investments, mobile-broadband penetration rapidly reached 80 per cent in Europe in 2016 (an increase from 65.6 per cent in 2014); the trend was similar to the one seen in the Americas (82.7 per cent mobile-broadband penetration in 2016).

Capex trends follow technology life-cycles. After the wave of LTE network deployments between 2009 and 2013 and the subsequent wave of

Chart 3.30: Regional growth in mobile download speeds, mobile-broadband subscriptions and capex, 2014-2016



Source: Capex and subscriptions data from ITU; Download speed data from Speedtest Intelligence® by Ookla®.
Notes: Speedtest Intelligence data for mobile download speeds include all mobile network technologies; across over 140 countries with speed test samples greater than 1,000, representing over 90% of GDP in each region in 2016. Country download speed averages have been weighted against subscriptions data to calculate regional aggregates.

LTE network upgrades between 2014 and 2016, mobile operators in mature mobile-broadband markets are rationalizing investment to focus on network maintenance, until investment for new infrastructures solutions (e.g. 5G) is required. This partly explains the decline in capex recorded in Europe, the Americas and the CIS region between 2014 and 2016.

By contrast, mobile download speeds across the Arab States, Asia and the Pacific and Africa increased by around 6 Mbit/s on average between 2014 and 2016. Mobile Internet access in these regions is expanding, with mobile-broadband subscriptions growing by as much as 80 per cent in Africa between 2014 and 2016, 64 per cent in Asia and the Pacific, and 34 per cent in the Arab States. In parallel with the fast growth in mobile-broadband adoption, and an increase of 5.5 Mbit/s in download speeds, Africa saw an increase in capex between 2014 and 2016 of 16 per cent. Investment in network infrastructure in the region is following a different pattern compared to other parts of the developing world, given that investment in the region's fixed-line infrastructure is low, and in most African countries data-ARPU figures are among the world's lowest, with a slow return on investment, all of which tends to hinder market development.

In the Arab States, countries have optimized the 25-km range for mobile-broadband, supporting greater levels of market penetration (45 per cent in 2016), while fixed-broadband penetration is lagging behind (4.7 per cent). It is important to note that the impact of capex spent in 2016 is likely to have an incidence on Internet adoption and network quality and capacity post-2016.

Estimates based on the analysis of Speedtest Intelligence® data by Ookla® show that the greatest increases in fixed-line download speeds were recorded in Asia and the Pacific (28 Mbit/ between 2014 and 2016), followed by the United States and Canada (26 Mbit/s) and Europe (16 Mbit/s). This trend reflects the impact of investment in optical fibre in these regions, and contrasts with the average 4 Mbit/s increase in download speeds recorded during the period across Africa, the Arab States and the Americas (excluding the United States and Canada); this reflects the lack of fixed-line infrastructure in most lower-income countries within these regions (Box 3.6).

Deploying and extending nationwide broadband infrastructure remains a priority in most countries, and broadband planning and policies are in place in 147 countries (ITU, 2018b). For instance, spectrum frequencies were assigned or renewed across 130 countries worldwide between 2014 and 2016, with 60 per cent of these spectrum assignments or renewals concerning the capacity bands (above 1 GHz) on which mobile-broadband networks tend to run[36].

Proximity to fibre nodes has surged, with around three-quarters (74.2 per cent) of the world's population living within 50 km of an operational fibre node in 2017 (based on ITU estimates). International Internet bandwidth grew by 32 per cent globally between 2015 and 2016 (ITU, 2017b), crossing the 200 000 Gbit/s threshold – up from 30 000 Gbit/s in 2008. Africa has the lowest level of international connectivity of all regions, while Asia and the Pacific boasts the highest optimization ratio[37] for fixed-broadband and the highest optimization ratio for mobile-broadband among developing economies (ITU, 2018b).

Capex intensity in Africa, the Americas (excluding the United States and Canada) and Asia and the Pacific averaged around 25 per cent of telecommunication revenues in 2016, compared to about 21 per cent in the Arab States and the CIS region. In India and China alone, capex intensity stood at 76 per cent and 37 per cent of revenues respectively in 2016 (Chart 3.31).

Capital expenditure in India increased more than threefold between 2014 and 2016, while the proportion of the population using the Internet increased from 21 per cent to 29 per cent during the same period. LTE represented only 8 per cent of mobile subscriptions in 2016 (GSMA, 2018), despite the fact that over 70 per cent of the population was covered by LTE network infrastructure. The vision of the country's Prime Minister, of transforming India into a digitally empowered society and knowledge economy ("Digital India"), is built around three key pillars: creation of digital infrastructure, digital delivery of services, and digital literacy. The latter is a barrier to mobile Internet adoption in many developing economies, and this is true in India, where 63 per cent of mobile phone owners who do not use the mobile Internet state that they do not know what the Internet is, while a further 23 per cent know

Box 3.6: Fuelling network investment in the least developed countries (LDCs)

ICTs play an important role in driving economic growth in the LDCs, where telecommunication revenues represented 2.8 per cent of GDP in 2016. Mobile-cellular penetration in the region reached two-thirds of the population in 2016, but mobile-broadband penetration remained below the 20 per cent threshold in 2016, while the low availability of fixed-broadband infrastructure makes the adoption of DSL or fibre marginal, with penetration levels around 1 per cent.

Thus, across the LDCs, mobile is the primary means of accessing the Internet, but data revenues remained relatively low, at 14 per cent of mobile revenues in 2016 (compared to 10 per cent in 2014). Voice services continue to be the main revenue contributor in LDCs, and mobile revenues stagnated, with a mere 3 per cent increase between 2014 and 2016. The vast majority of LDCs have predominantly prepaid markets and some of the lowest ARPU levels worldwide (USD 2.6 per month on average).

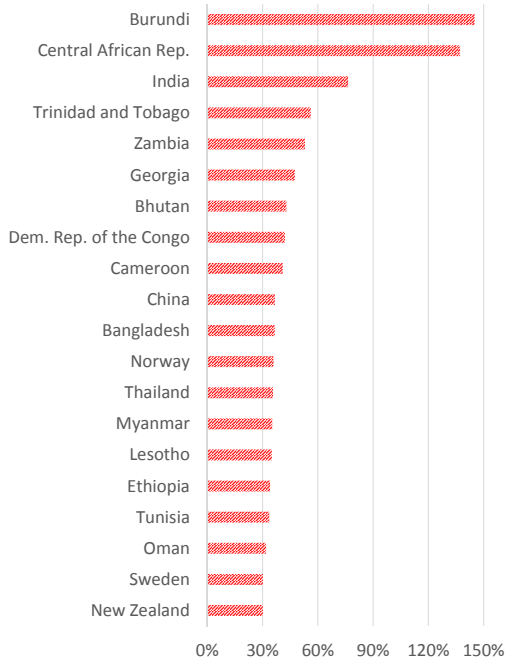
This creates a challenging market environment for service providers, which kept capex intensity at around 30 per cent of telecommunication revenue in 2016, while the prospects of returns on investment remain uncertain. Overall, mobile Internet adoption is hindered by barriers relating to affordability, digital literacy and lack of local content. In many cases, these barriers are exacerbated by uncertainty about future changes to tax regimes, sector-specific taxes, import duties on network equipment, and excessive spectrum fees, which all reduce the likelihood of successful investments (GSMA, 2017b).

Measuring the total cost of mobile ownership[34] (TCMO) in the LDCs helps in assessing the impact of the affordability factor on the sector's growth (Chart 3.32). For instance, a GSMA study (GSMA, 2017b) analysed 2016 TCMO levels based on two baskets: a medium-usage basket (1 GB of data, 250 minutes of voice and 100 SMS) and a low-usage basket (with 500 MB of data). The findings showed that in some LDCs, TCMO for the medium-usage basket could reach or surpass 100 per cent of monthly income. This was the case in the Democratic Republic of the Congo (134 per cent), Malawi (121 per cent) and Burkina Faso (95 per cent). On the other hand, TCMO for the low-usage basket may reach or surpass 20 per cent of monthly income, as seen in the Democratic Republic of the Congo (26 per cent), Malawi (22 per cent) and Togo (19 per cent).

In its *State of Connectivity 2015* report, Facebook (Internet.org by Facebook, 2015) noted that over 3 billion people could not readily afford mobile-broadband packages. It also showed that, in developing economies, people who already use the Internet spent on average 3.8 per cent of their household income per capita on mobile data services - twice as much as in developed economies. For example, in Kenya, the cost of 500 MB per month mobile connectivity (excluding device battery charging) is over 30 per cent of the median income, and for the poorest 10 per cent of the population is equivalent to individuals' entire income.

To surmount affordability and coverage barriers in the LDCs and support investment in network and coverage, governments have been encouraged to reform sector-specific taxation and fees, and to promote infrastructure sharing as a mechanism for reducing the cost of service provision (Alliance for Affordable Internet, 2017). For instance, between 2014 and 2016, eight LDCs reduced taxes on services (e.g. specific VAT on SMS, data or calls, connection tax, or SIM tax), namely Angola, Bangladesh, the Democratic Republic of the Congo, Mauritania, Nepal (Republic of), Niger, Senegal and Uganda[35]. In parallel, 45 per cent of countries covered in A4AI's 2017 research have developed plans to reduce costs by facilitating infrastructure and resource sharing (Alliance for Affordable Internet, 2017).

Chart 3.31: Ratio of capex to telecommunication revenues, selected countries, 2016



Source: ITU.

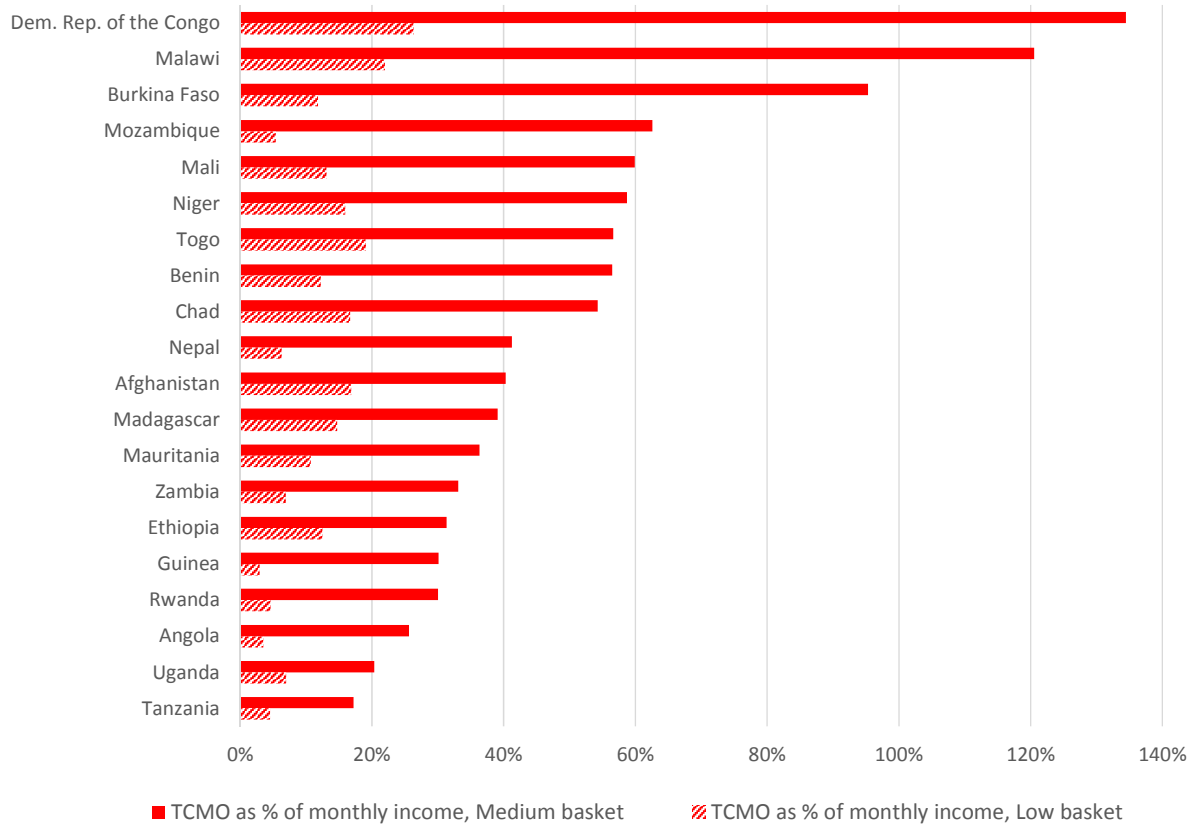
what the Internet is but not that they could access it on a mobile phone[38].

Telecommunication FDI trends

Foreign Direct Investment (FDI) measures cross-border capital movements by analysing the flows of financing between resident and non-resident businesses. FDI is an important source of capital, which in the telecommunication sector plays a strategic role, as it can underpin economic growth not only in the sector but also in adjacent industries that rely on ICT infrastructure.

FDI transactions can result either in the purchase of existing assets through mergers and acquisitions (M&A) or in the creation of new productive assets (known as "greenfield investments"). Foreign companies typically establish a presence abroad as a means of gaining access to new subscribers, while in return, they develop the telecommunication infrastructure necessary to meet demand.

Chart 3.32: Total cost of mobile ownership as percentage of monthly income, selected LDCs, 2016



Source: GSMA (2017).
Note: A medium-usage basket (1 GB of data, 250 minutes of voice and 100 SMS) and a low-usage basket (500 MB of data).

Table 3.4: Telecommunication capital expenditure (USD millions), 2014-2016

Economy	2014	2015	2016
United States	*85 819*	*87 184*	*86 405*
China	64 994	72 723	66 256
India	7 384	12 658	27 891
Japan	11 043	11 329	*11 949*
France	9 340	8 627	9 825
Germany	9 814	8 983	9 071
Canada	*8 480*	*8 152*	8 725
Italy	8 064	8 180	7 649
Australia	7 985	7 028	7 426
United Kingdom	*8 224*	*7 639*	*6 748*
Brazil	*7 225*	5 226	6 507
Spain	6 323	5 235	4 972
Korea (Rep. of)	5 263	5 038	4 808
Mexico	4 909	4 150	4 558
Russian Federation	7 735	4 763	4 004
Saudi Arabia	2 169	3 557	3 730
Switzerland	3 300	3 289	3 259
Argentina	2 641	2 966	*2 830*
Netherlands	3 729	*4 106*	2 622
Turkey	2 590	2 403	2 459
Malaysia	2 365	2 313	2 285
United Arab Emirates	1 432	1 303	2 002
Iran (Islamic Republic of)	*993*	*1 511*	1 848
Sweden	1 584	1 481	1 835
Nigeria	1 324	1 580	1 796
Belgium	1 968	1 563	1 754
South Africa	1 478	1 490	1 712
Poland	2 134	1 715	*1 610*
Egypt	2 196	1 910	1 584
Chile	1 859	1 473	1 427
Norway	1 423	1 205	1 401
Bangladesh	958	1 488	1 342
Greece	1 216	741	1 251
New Zealand	1 402	1 234	1 106
Denmark	1 115	982	1 001
Peru	1 271	1 071	*965*
Algeria	*858*	*761*	795
Czech Republic	1 062	592	695
Oman	570	554	695
Portugal	817	697	674
Pakistan	1 815	907	666
Austria	731	734	664
Finland	696	749	653
Ireland	751	618	625
Morocco	766	880	620
Dem. Rep. of the Congo	302	1 047	601
Romania	645	517	571
Angola	423	629	528
Bolivia (Plurinational State of)	459	635	524
Ethiopia	820	820	509
Côte d'Ivoire	263	197	473
Trinidad & Tobago	66	55	470
Hungary	713	520	*469*
Uzbekistan	331	360	*453*

Economy	2014	2015	2016
Tunisia	271	292	433
Ukraine	476	864	419
Dominican Rep.	266	271	399
Cameroon	400	503	390
Slovakia	418	348	390
Kenya	438	516	381
Croatia	327	*368*	374
Costa Rica	455	475	369
Qatar	485	379	343
Zambia	23	102	296
Serbia	249	310	278
Zimbabwe	206	318	276
Bulgaria	404	298	271
Slovenia	240	211	238
El Salvador	265	198	216
Uruguay	332	297	216
Tanzania	*369*	*333*	*215*
Jordan	225	185	*196*
Senegal	188	180	*182*
Bahrain	127	130	173
Luxembourg	285	189	163
Honduras	115	113	156
Georgia	107	226	147
Lithuania	109	87	147
Mali	142	131	128
Azerbaijan	393	327	125
Kazakhstan	648	409	123
Burundi	36	7	119
Mongolia	*93*	104	109
Bosnia and Herzegovina	184	114	105
Estonia	121	104	103
Botswana	14	107	87
Burkina Faso	58	*68*	87
Bahamas	54	*69*	83
Central African Rep.	7	6	82
Chad	129	88	*80*
Kyrgyzstan	*62*	2	79
Benin	86	60	78
Armenia	84	72	76
Moldova	169	110	73
Togo	39	53	69
Barbados	26	*43*	60
Iceland	52	48	59
Madagascar	76	87	53
Namibia	41	26	41
Rwanda	64	61	40
Malawi	146	152	39
Bhutan	19	28	24
Lesotho	29	23	*24*
Albania	73	54	23
Guyana	*19*	*18*	21
Cabo Verde	15	30	20
Liechtenstein	23	23	20
Dominica	*7*	8	14
Monaco	20	13	*13*
Saint Lucia	18	*14*	10
Gambia	6	7	*7*
Comoros	*8*	10	4
Lao P.D.R.	3	52	1

Source: ITU.
Notes: Data in italics are ITU estimates.

Table 3.5: Capex as a share of telecommunication revenue, 2014-2016

Economy	2014	2015	2016
Burundi	33.6%	4.7%	145.1%
Central African Rep.	15.2%	10.9%	137.2%
India	23.2%	41.0%	76.4%
Trinidad & Tobago	9.2%	6.7%	56.1%
Zambia	4.2%	17.3%	53.0%
Georgia	25.5%	72.7%	47.5%
Bhutan	42.2%	49.7%	42.9%
Dem. Rep. of the Congo	30.4%	95.7%	42.0%
Cameroon	35.7%	51.8%	40.9%
Myanmar	*57.3%*	*104.8%*	*38.8%*
China	34.6%	38.8%	36.6%
Bangladesh	29.3%	41.7%	36.5%
Norway	29.2%	30.7%	35.9%
Thailand	22.3%	*29.4%*	*35.7%*
Lesotho	35.0%	35.0%	*35.0%*
Dominica	*21.8%*	21.8%	35.0%
Liechtenstein	45.2%	49.2%	34.1%
Ethiopia	78.1%	68.9%	33.9%
Tunisia	17.9%	21.9%	33.5%
Cabo Verde	20.7%	37.0%	32.9%
Moldova	52.0%	42.2%	32.4%
Oman	27.2%	26.8%	31.9%
Sweden	20.6%	24.0%	30.2%
New Zealand	32.7%	34.6%	30.1%
Egypt	33.3%	30.7%	29.5%
Argentina	26.5%	27.7%	*29.3%*
Canada	*25.1%*	*27.0%*	29.2%
Australia	22.3%	20.0%	29.1%
Slovenia	23.0%	24.6%	28.9%
Luxembourg	43.2%	33.6%	28.8%
Brazil	*22.9%*	19.3%	27.8%
Bolivia (Plurinational State of)	33.2%	47.4%	27.6%
Zimbabwe	17.4%	30.1%	27.6%
France	21.1%	23.9%	27.6%
Madagascar	21.9%	35.0%	27.5%
Croatia	20.4%	*27.5%*	27.0%
Dominican Rep.	17.9%	19.3%	26.9%
Nigeria	17.2%	12.7%	26.8%
Kyrgyzstan	*15.0%*	0.6%	26.7%
Angola	18.9%	26.6%	26.7%
Italy	27.7%	33.9%	26.3%
Armenia	22.1%	22.9%	26.3%
Netherlands	27.9%	*38.0%*	26.2%
Philippines	30.6%	*26.2%*	*26.2%*
Ukraine	16.1%	50.0%	25.8%
Barbados	12.1%	*19.1%*	25.6%
Côte d'Ivoire	13.2%	11.0%	25.5%
Belgium	24.4%	22.7%	25.2%
Chad	35.9%	28.8%	*24.4%*
Iceland	20.3%	20.7%	24.2%
Mongolia	*25.7%*	25.7%	24.2%
Spain	24.8%	25.0%	24.0%
Botswana	5.1%	30.8%	23.7%
Iran (Islamic Republic of)	*12.8%*	*20.5%*	23.6%
Chile	30.8%	24.4%	23.6%
Czech Republic	27.7%	19.5%	23.5%
Mexico	18.8%	18.4%	23.3%

Economy	2014	2015	2016
Kenya	33.1%	31.6%	23.1%
Saudi Arabia	13.5%	21.6%	22.8%
Bulgaria	26.9%	24.1%	22.6%
Greece	17.4%	13.3%	22.3%
Uruguay	30.1%	30.4%	22.3%
Peru	25.9%	23.8%	*22.0%*
Costa Rica	28.9%	27.1%	22.0%
Russian Federation	24.5%	23.7%	22.0%
Honduras	16.0%	16.5%	22.0%
Togo	10.1%	15.8%	21.8%
Algeria	*13.9%*	*14.4%*	21.2%
Switzerland	20.2%	21.1%	21.1%
Slovakia	18.7%	18.9%	20.9%
Uzbekistan	24.3%	20.7%	*20.7%*
United Arab Emirates	15.7%	13.7%	20.7%
Serbia	15.5%	22.5%	20.4%
Bahamas	8.4%	*13.0%*	20.3%
Finland	19.0%	24.1%	20.2%
Rwanda	30.4%	24.1%	20.1%
Germany	17.6%	20.3%	20.1%
Namibia	11.8%	11.9%	20.1%
Poland	21.2%	20.4%	*20.0%*
Lithuania	17.1%	17.0%	20.0%
Hungary	22.1%	21.1%	*20.0%*
Romania	19.1%	18.2%	19.9%
Denmark	17.4%	18.6%	19.7%
Malaysia	18.6%	18.8%	19.3%
Turkey	19.8%	19.4%	19.2%
South Africa	13.5%	15.5%	19.0%
Morocco	19.9%	27.0%	19.0%
Tanzania	*27.2%*	*28.5%*	*18.9%*
El Salvador	16.4%	17.3%	18.8%
Ireland	18.7%	18.3%	18.4%
Jordan	15.4%	19.7%	*17.6%*
Burkina Faso	9.4%	*13.8%*	17.3%
Malawi	86.6%	62.6%	17.1%
Austria	15.3%	18.4%	16.9%
Benin	16.9%	12.3%	16.3%
Portugal	13.4%	16.6%	16.3%
Indonesia	*23.8%*	*49.2%*	*16.2%*
Estonia	16.2%	15.2%	15.9%
Pakistan	39.3%	21.2%	14.9%
Guyana	*12.8%*	*12.8%*	14.9%
Comoros	*13.9%*	14.6%	14.6%
Mali	15.8%	16.3%	14.6%
Senegal	12.3%	13.9%	*14.2%*
United States	*14.5%*	*14.5%*	*14.1%*
United Kingdom	*16.1%*	*16.0%*	*14.1%*
Bahrain	13.9%	13.6%	13.8%
Bosnia and Herzegovina	18.7%	13.8%	13.5%
Albania	32.0%	30.5%	13.3%
Monaco	12.5%	12.5%	*12.5%*
Azerbaijan	18.0%	20.4%	12.4%
Qatar	18.8%	13.8%	12.3%
Saint Lucia	20.4%	*16.3%*	12.1%
Japan	8.8%	10.2%	*9.5%*
Korea (Rep. of)	9.6%	9.8%	9.0%
Gambia	8.0%	8.2%	*8.2%*
Kazakhstan	21.3%	16.2%	7.3%
Lao P.D.R.	0.7%	11.7%	0.5%

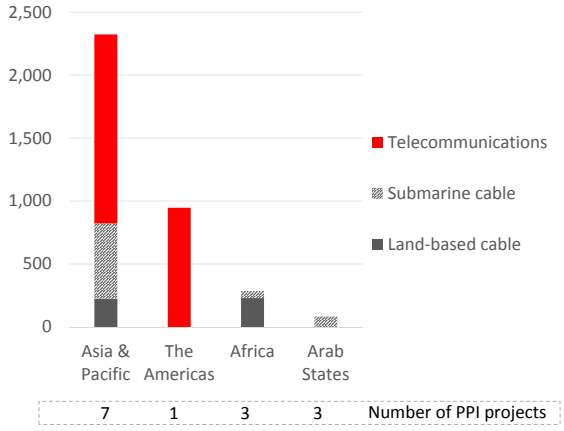
Source: ITU.
Notes: Data in italic are ITU estimates.

According to the ITU Regulatory Tracker, 142 countries allowed foreign players to invest in ICTs in 2015, and in 63 per cent of countries worldwide there were no regulatory restrictions on foreign ownership. This type of policy supports investment in the sector and the deployment of telecommunication infrastructure, and it is of particular importance when we consider that:

- the lack of international connectivity to ICT backbones is a major bottleneck in the Internet infrastructure of LDCs (ITU, 2017b);
- over the last five years, the ICT sector received the least government support (World Bank, 2018) for private participation infrastructure (PPI) projects in low- and middle-income countries, when compared to PPI projects in other sectors (World Bank, 2018).

In the ICT sector, a total of USD 3.6 billion was invested across 14 private-participation infrastructure (PPI) projects between 2016 and 2017 in low- and middle-income countries (Chart 3.33). These projects were implemented in 11 countries, with most of the investment in Asia and the Pacific and in the Americas (excluding the United States and Canada). Almost all (90 per cent) of these infrastructure projects were greenfield investments, and the vast majority of them related to submarine or land-based cable installations (World Bank, 2018).

Chart 3.33: Investments in private-participation infrastructure (PPI) projects in low- to middle-income countries (USD millions), 2016-2017



Source: World Bank PPI Database.

It is important to note that PPI data provided by the World Bank refer to contractual investment commitments in large telecommunication infrastructure projects in low- and middle-income countries. In addition to foreign investment commitments, these projects include domestic private capital participation, public-sector funding (in the case of joint public-private partnerships) and payments to the government (e.g. licence fees). PPI data are thus complementary but not directly comparable to trends depicted by FDI or capex information.

In 2017, investments in PPI in the ICT sector totalled USD 3 billion across five projects among low- to middle-income countries. Two of these five projects were for network infrastructure development, including a USD 1.5 billion project in Myanmar to construct over 5 000 base stations for an LTE network, and a USD 946 million project in Mexico to develop a national mobile network. These two projects encompassed 80 per cent of total PPI ICT investment among low- to middle-income countries in 2017 (World Bank, 2018).

If we analyse overall trends in FDI (across all sectors), we note that South Asia is the only subregion in Asia and the Pacific to have avoided a contraction in foreign investment between 2015 and 2016 (UNCTAD, 2017c). This trend is reflected in the analysis of telecommunication-specific FDI in India and Bangladesh (Chart 3.34). In India, telecommunication FDI decreased by 50 per cent between in the period 2014-2015 and spiked by 332 per cent annually in 2016 as a result of reforms undertaken in the telecom sector, including spectrum harmonization and spectrum trading and sharing. In parallel, telecommunication FDI increased by 197 per cent in Bangladesh in the period 2015-2016. In 2016, the country saw large investments in mobile-broadband infrastructure, along with substantial M&A activity as Malaysian-backed Robi and Indian-owned Airtel signed an agreement to merge in the country (under the name of Robi), thus forming the second largest mobile operator in the country.

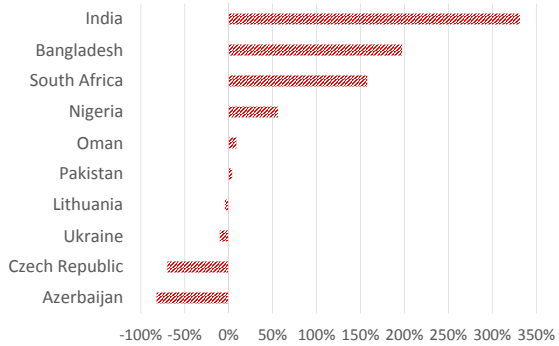
In Africa, overall FDI flows (all sectors included) continued to decline in 2016 as a result of the sluggish commodity prices which diminished economic prospects in sub-Saharan Africa and tempered investor interest in the subregion (UNCTAD, 2017). One notable trend is the prominence of African multinational businesses in buying assets located in Africa. In 2016, for example, Liquid Telecom, owned by Zimbabwe's

Econet Wireless, acquired the South African fixed-line operator Neotel for USD 430 million in a deal that will create the continent's biggest broadband network (Telegeography, 2016b). As a result of this M&A activity and major private spending in mobile-broadband and FTTH infrastructure improvements that year, telecommunication-specific FDI in South Africa increased by 332 per cent from 2015 to 2016.

Similarly, Nigeria recorded a 56 per cent increase in telecommunication FDI during the same period, a growth fuelled by a wave of LTE deployments in key urban areas throughout the country that year (with almost all mobile operators launching LTE by the end of 2016), along with M&A activity. In 2016, IHS Holding acquired Helios Towers Nigeria's portfolio of 1 211 tower sites throughout the country, while Bharti Airtel acquired Econet's 4.2 per cent stake in Airtel Nigeria.

Among transitioning economies such as Ukraine or Azerbaijan, the prospects for inward FDI (all sectors included) is moderately positive. In Ukraine, the business environment is characterized by slow reforms which limit greenfield investment. In Azerbaijan, FDI inflows are largely concentrated in the oil and gas sector (UNCTAD, 2017). These trends are largely reflected in telecommunication-specific FDI which, between 2015 and 2016, declined by 10 per cent in Ukraine and by 82 per cent in Azerbaijan.

Chart 3.34: Annual foreign investment in telecommunications, selected countries, % change 2015-2016



Source: ITU.

3.4 Revenue and investment in emerging technologies

The Internet of Things

The Internet of Things (IoT) is a term that describes the coordination of machines, devices and appliances connected to the Internet through multiple networks. It also reflects the new development phase which the ICT sector has now entered, one in which public and private stakeholders in the ICT sector are laying the foundations for smart societies. The impact of the ICT sector on economic and societal development continues to expand as companies from adjacent sectors and industries (including the automotive, healthcare, insurance, banking and public sectors) develop products and services that rely on IoT infrastructure – leaving virtually no areas of our economies and societies untouched.

As seen earlier in this chapter, IoT and machine-to-machine (M2M) growth is creating revenue opportunities for service providers operating in mature markets, which may help to offset declining revenue trends in core business segments. Industry analysts estimate that IoT revenues will generate USD 1.1 trillion in revenues globally by 2025, compared to USD 166 billion in 2016 (GSMA, 2018d). This revenue opportunity is expected to be fuelled over the next three years by investments of around USD 15 billion in IT consulting and systems integration services to build and implement IoT solutions (IDC, 2018). Furthermore, by 2021, it is predicted that over 85 per cent (or USD 1 trillion) of enterprise IoT project investments will be based on net new technology spending (IDC, 2018).

The IoT ecosystem has grown rapidly since 2010, with dedicated short-range network infrastructure such as LPWA, NB-IoT and LTE-M accelerating IoT network connectivity. However, the greater share of revenue opportunities does not reside in pure connectivity play, but in other growth areas such as platforms, applications and services (e.g. big data services, security, and industrial IoT applications).

In 2016, connectivity represented only about 10 per cent of total IoT revenues globally, and most of the revenue was generated from platforms, applications and services (GSMA, 2015c). Low

and declining ARPU levels have been affecting mobile operators in the IoT space, following similar trends affecting their core business segments. For instance, between 2005 and 2015, the price of 2G M2M modules decreased substantially, from around USD 55 to USD 10 (GSMA, 2015c), and continued to decline thereafter (GSMA, 2018d). Device price reductions support growth in the number of IoT devices connected to mobile networks, but the average revenue per licensed cellular IoT connection declined from USD 9 to USD 2 per month between 2010 and 2017 and is expected to continue to decline over the coming years (GSMA, 2018c). This trend is also partly linked to the nature of the short-range technologies being deployed, which focus on achieving data economics to transmit low data volumes at low speeds, but are consequently priced as a utility. Global M2M mobile-network subscriptions accounted for 6.5 per cent of total mobile-cellular subscriptions as of 2016 (compared to 5.5 per cent in 2015), according to ITU estimates.[39]

At a regional level, developed markets across Europe and the United States and Canada accounted for the great majority of global IoT revenues in 2016, although the fastest revenue growth is expected to come from Asian markets. Revenues in Asia and the Pacific are expected to grow at a compound annual growth rate (CAGR) of 29 per cent between 2016 and 2025 to reach USD 386 billion in 2025, a trend driven by government mandates and strong gowth in industrial IoT connections. The region is expected to overtake North America in terms of IoT revenue in 2023, becoming the largest IoT revenue market worldwide[40]. The developing world is expected to have a strong role in driving IoT revenue opportunities, fuelled by greenfield investments focused on connecting businesses and consumers to services for the first time.

Emerging AI, big data and Blockchain solutions

As IoT revenue and investment opportunities are scaling up, certain enablers, such as Artificial Intelligence, big data analytics (BDA) and Blockchain, are gaining momentum. These technological solutions are powering more intelligent ICT infrastructure, products and services, and are supporting businesses in deriving greater value from new segments such as IoT.

According to industry players, these advances in AI and IoT will accelerate growth towards a digital economy worth USD 23 trillion by 2025 (Huawei, 2018).

Businesses are incorporating Artificial Intelligence (AI) into IoT applications to boost revenues, lower their cost base, improve efficiencies and gain a competitive edge. The powerful combination of AI and IoT technology is helping companies to avoid unplanned downtime, increase operating efficiency, enable new products and services, and enhance risk management (Deloitte, 2017). Industry analysts predict that by 2022, more than 80 per cent of enterprise IoT projects will include an AI component, compared to only 10 per cent in 2017 (Gartner, 2017).

AI is notably powered by the use of machine learning techniques and algorithms, often running on cloud computing solutions made available by most tech giants. For instance, the application of predictive and "real-time" machine learning solutions can help businesses to fine-tune product quality, automate heavy processes, reduce energy costs, uncover price elasticity, reduce churn, improve the impact of marketing campaigns, and deliver a personalized shopping experience. Industry analysts estimate that machine learning can reduce supply chain forecasting errors by between 20 per cent and 50 per cent and reduce lost sales by up to 65 per cent, with better product availability (McKinsey, 2017a). In addition, machine learning can support R&D cost reductions of between 10 and 15 per cent and time-to-market improvements of up to 10 per cent, while automation rates of 30 per cent are possible across functions (McKinsey, 2017a).

In turn, the ICT shift from hardware to software (including cloud computing) fuels the IoT and AI revenue opportunities described previously, and creates additional revenue and investment streams in data analytics. Data are often referred to as "the new oil", presenting substantial revenue opportunities for businesses within and beyond the ICT sector. Most industries are investing in turning the massive amount of data flowing from IoT sensors, industrial meters, connected devices, smartphones, wearables, and any kind of web-based services, into actionable insights.

The increase in IoT data traffic and digital content consumption, coupled with the application of

AI and machine learning solutions, is expected to spur data analytics revenue, while businesses are gaining in operational efficiencies. For instance, within the telecommunication industry itself, data analytics is applied to reduce churn, retain and gain new customers, and plan and optimize network capacity. Industry analysts claim that telecom companies implementing a comprehensive, analytics-based approach to customer-base management can reduce their churn by as much as 15 per cent (McKinsey, 2017b).

Industry analysts further estimate that global revenues for BDA rose from USD 130.1 billion in 2016 to USD 150.8 billion in 2017, and may exceed USD 200 billion by 2020 (IDC, 2017). Global investments in BDA were estimated at USD 72.4 billion in 2017 in key industries (banking, manufacturing, public sector, professional services). Investments in software solutions are expected to grow rapidly – reaching USD 70 billion in 2020 globally – as businesses increase their spending on reporting and analysis tools, data warehouse management tools and cognitive software platforms.

Lastly, global IoT revenue opportunities will be powered by investments in Blockchain[41] technology, and more generally in Distributed Ledger Technology (DLT).[42] The increase in the number of IoT connected devices is expected to generate millions of so-called "digital twins" which store and transmit valuable data streams that form the substance for data analytics and predictive modelling (Deloitte, 2018). The term "digital twins" refers to virtual replicas of physical objects or systems: a physical object's status is mirrored in a digital "twin", which in return provides the capability of digital surveillance and manipulation of the counterpart in the physical world (Deloitte, 2017). Industry analysts estimate that, by 2020, up to 10 per cent of pilot and production Blockchain distributed ledgers will incorporate IoT sensors (IDC, 2017).

As a result, Blockchain is described as having "the potential to be for "value" what the Internet has been for "information"" (Deloitte, 2016). Blockchain is expected to generate cost reduction and revenue growth opportunities for telecommunication providers (Deloitte, 2016). For instance, Blockchain has the potential to reduce losses due to fraud, which has cost the industry as much as USD 38 billion annually (CFCA, 2015). In addition, service providers can generate additional revenue by providing an "identity as a service" solution for partners and consumers (Deloitte, 2016). Lastly, Blockchain is generating cost-efficiencies through self-managed networks, enabling secure and error-free peer-to-peer connectivity for vast numbers of IoT devices. Industry analysts estimate, for example, that by 2020, 50 per cent of all new operating assets will be self-sustaining (IDC, 2017).

One important factor, in the context of these new emerging technologies, is the difficulty for developing economies to access such solutions owing to the "data centre divide" (UNCTAD, 2013). Cloud computing infrastructure is a key enabler for IoT, AI, BDA and Blockchain solutions, but in many developing economies, infrastructure deficiencies hamper the uptake of such solutions. The lack of supporting infrastructure, such as Internet exchange points (IXPs), reliable and inexpensive electricity supply and robust fibre-optic backbones, affects the deployment of national data centres. Up to 85 per cent of data centres offering colocation services are in developed countries, a fact that illustrates the divide which will have to be overcome if developing economies (particularly in Africa) are to reap the benefits of emerging solutions.

3.5 Summary and conclusion

This chapter has shown the far-reaching impact which the ICT sector will continue to have on economies and societies, as public and private stakeholders enable the creation of smart societies providing greater benefits for consumers and businesses. This trend is taking place in a context of industry players transforming their business models to seek new revenue opportunities, and to streamline their cost base in response to greater levels of market maturity and intensifying competition.

Developing economies play an important role in driving global uptake of mobile subscriptions and services, but this chapter noted that industry players in the developing world are facing a decline in the value of telecommunication markets – a challenging situation already faced by service providers in developed markets for several years. For example, Africa is seeing a growing

shift to mobile-broadband services, especially among younger consumers, as smartphones become more affordable. However, most new subscribers in the developing world will come from lower-income groups, which are likely to spend less on mobile services than wealthier early adopters. This chapter showed that in most developing economies, growth in data services is slow in offsetting the sharp decline in voice revenues that is often due to high rates of adoption of free OTT services.

In an infrastructure business like telecommunications, investment is an essential factor for growth. As revenues and ARPU levels will continue to decline over the coming years, investments in network infrastructure will have to be balanced with profitability to create a sustainable market environment.

Fostering FDI is a key enabler of the transformation taking place in the sector. UNCTAD noted that the outlook for FDI in the ICT sector in developing economies is relatively positive, with telecommunications, data processing and software programming all emerging as attractive components of the industry in selected developing economies – confirming that the digital economy is growing in importance beyond developed economies. In addition, ITU analysis has demonstrated that removing restrictions on foreign investment is a regulatory measure that correlates directly with enhanced competition and helps to create a level playing field.

Policies over the past decade have been focused on supporting subscriber growth in a context of a fast-growing industry development centred on the objective of connecting consumers for the first time to voice and data services – thanks in most cases to greenfield investments. As global mobile-cellular subscription penetration has passed the 100 per cent threshold, revenue growth has slowed down in developed and developing countries alike, and the telecommunication sector is moving into a new phase of development and well-positioned, following the transformation of its business models, to ensure sustainability and support the maintenance and expansion of network infrastructure. Policy-makers will have to adapt to this development phase to ensure sustainability and foster the investment required to connect consumers and businesses to smart societies.

This is particularly relevant, as it is estimated that the telecommunication infrastructure will enable connected devices on the grid and in consumer homes to drive a potential USD 170 billion in cumulative energy cost savings for consumers over the coming decade (WEF and Accenture, 2017). This shows the scale of the potential impact of the ICT sector on economic and societal development over the coming years, if policy-makers foster market and investment sustainability.

This transformation in the sector – enhanced by the shift from manufacturing to software and services – is expected to accelerate. ITU has noted that the ICT sector is today spilling across multiple sectors, but over the next decade the scale of the current transformation means that ICT as a distinct industry sector will have dissolved and will be fully integrated into the local, national and global digital economy (ITU, 2018b). This transformation is fuelled by emerging solutions – enabling the Internet of Things – such as AI, big data analytics and Blockchain, which all present important policy questions and challenges, including policy and ethical questions linked to safety and security, data privacy, legal accountability and liability, as well as their potential impact on employment and skills.

Given the recent sector development described in this chapter – and the transformation to come – measuring the sector's financial performance remains a key priority for national regulatory authorities. Data on revenue is expected to change as technologies converge towards the delivery of multi-play services, blurring the line between revenue streams generated by fixed and mobile business segments. As this transformation occurs, the continued efforts by local authorities to collect more reliable data will help us to assess the pace of change and the uptake and impact of emerging technologies and solutions such as the Internet of Things.

Endnotes

1 This analysis is based on reported data available across 118 economies, representative of 82per cent of global GDP in 2016.

2 The sub-sector refers to manufacture of communication equipment, computers and other electronic equipment

3 According to OECD, ICT value-added is the difference between the ICT sector gross output and intermediate consumption. It differs from telecommunication revenue which (based on ITU definition) refers to revenue earned from retail fixed-telephone, mobile-cellular, Internet and data services offered by telecommunication operators (both network and virtual) providing services within the country during the financial year under review. It includes retail revenues earned from the transmission of TV signals, but excludes revenues from TV content creation. Rev-enue (turnover) consists of retail telecommunication service earnings (therefore excluding wholesale revenues, such as interconnection revenues) during the financial year under review. Revenues from device sales and rents, VAT and excise taxes should be excluded. Full methodology information available at https://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-ITC_IND_HBK-2011-C2-PDF-E.pdf.

4 In some of these countries, such as Senegal and South Africa, revenues in local currency followed a steady in-creasing trend, showing that the decreases recorded in USD were caused by changes in the exchange rates.

5 In some of these countries, such as India, Iran (Islamic Republic of), Japan and Korea (Rep. of), revenues in local currency followed a steady increasing trend, showing that the fluctuations recorded in USD were caused by fluctuations in exchange rates.

6 In the case of Romania and the United Kingdom, revenues in local currency remained stable between 2014 and 2016, but decreased in terms of USD because of the changes in the exchange rates.

7 HHI is a commonly used measure of market concentration, reflecting on changes in competitive pressures in a given country. The index tracks the distribution of market power among operators, represented on a scale of 0 (per-fect competition) to 10,000 (no competition).

8 Data source: GSMA database. Accessed in June/July 2018.

9 Data source: GSMA database. Accessed in June/July 2018.

10 Data source: GSMA database. Accessed in June/July 2018.

11 Data source: GSMA database. Accessed in June/July 2018.

12 Data source: GSMA database. Accessed in June/July 2018.

13 Revenues in local currency grew by 30 per cent between 2014 and 2016 in Colombia, but decreased in terms of USD because of a significant change in the exchange rate.

14 Mobile churn measures the percentage of subscribers that cease to use the company's service in a given timeframe. It is commonly calculated by dividing total gross disconnections per month by average total mobile-cellular subscriptions at the end of the period.

15 Data source: GSMA database. Accessed in June/July 2018.

16 Over-the-top (OTT) services can be defined as any service provided over the internet that bypasses traditional operators' distribution channel. It can include Voice-over-IP providers (e.g. Skype, Viber), IP-messaging providers (e.g. WhatsApp, Facebook Messenger, Kakao Talk, Line, Telegram), application providers (e.g. search portals, news portals, banking, weather, shopping), cloud services (e.g. Dropbox, Google Drive, Apple iCloud), and video and music streaming services (e.g. Netflix, YouTube, Amazon, Spotify, Deezer). Additional information available at https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg/201710/Documents/Park.pdf.

17 The app economy can be defined as the sum of all economic activity, products and services, required to deliver app functionality to end users via mobile broadband services. As such, an OTT provider is a major actor in the app economy as it delivers the aforementioned products and services. Additional information available at https://www.itu.int/en/ITU-D/Conferences/GSR/Documents/ITU_AppEconomy_GSR16.pdf.

18 Data source: GSMA database. Accessed in June/July 2018.

19 Data source: GSMA database. Accessed in June/July 2018.

20 Data source: App Annie. Accessed in June/July 2018.

21 Data source: App Annie. Accessed in June/July 2018.

22 Data source: GSMA database. Accessed in June/July 2018.

23 Data source: GSMA database. Accessed in June/July 2018.

24 Data source: App Annie. Accessed in June/July 2018.

[25] This mobile traffic analysis is based on reported data from 136 countries, representing altogether 90% of global GDP on average across both voice and SMS traffic datasets.

[26] Data source: Ovum. Accessed in June/July 2018.

[27] Data source: Ovum. Accessed in June/July 2018.

[28] For more information on Line's financial performance, see https://linecorp.com/en/ir/library/.

[29] For more information on Kakao Daum's financial performance, see https://www.kakaocorp.com/ir/referenceRoom/earningsAnnouncement?lang=en#none.

[30] Data source: Ovum. Accessed in June/July 2018.

[31] Data source: Ookla. Accessed in June/July 2018.

[32] Data source: Ookla. Accessed in June/July 2018.

[33] Data source: GSMA database. Accessed in June/July 2018.

[34] TCMO consists of the cost of purchasing a handset, the cost of activation or connection and the cost of service usage (voice, data and SMS).

[35] Data source: GSMA database. Accessed in June/July 2018.

[36] Data source: GSMA database. Accessed in June/July 2018.

[37] A high optimization ratio is considered when the number of fixed-broadband or mobile-broadband subscriptions per 100 inhabitants is close to the number of people living within a given range (in km) of a fiber node.

[38] Data source: GSMA database. Accessed in June/July 2018.

[39] The aggregated M2M mobile-network subscriptions global estimate is based on reported data covering 75 countries worldwide, encompassing altogether 81% of global GDP in 2016.

[40] Data source: GSMA database. Accessed in June/July 2018.

[41] According to the World Bank definition, a 'blockchain' is a particular type of data structure used in some distributed ledgers which stores and transmits data in packages called "blocks" that are connected to each other in a digital 'chain'. Blockchains employ cryptographic and algorithmic methods to record and synchronize data across a net-work in an immutable manner. More information available at http://documents.worldbank.org/curated/en/177911513714062215/pdf/122140-WP-PUBLIC-Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf.

[42] According to the World Bank definition, blockchain is one type of a distributed ledger. Distributed ledgers use independent computers (referred to as nodes) to record, share and synchronize transactions in their respective electronic ledgers (instead of keeping data centralized as in a traditional ledger). More information available at http://www.worldbank.org/en/topic/financialsector/brief/blockchain-dlt.

Chapter 4: ICT Price Trends

Key findings

Information and communication technology (ICT) prices have dropped globally in the last decade, in parallel with the increase in access to and use of ICT services. Improved ICT regulation and policy-making have played a pivotal role in creating the conditions for the reduction of prices seen in the period 2008–2017, ensuring that the efficiency gains of higher ICT adoption are partly passed on to customers.

Mobile-cellular prices followed a sustained decreasing trend in the period 2008–2015. From 2015, mobile-cellular prices have plateaued and the ITU mobile-cellular basket (51 minutes and 100 SMS messages per month) cost on average USD 12.5 per month at the end of 2017. This is half the average price of the fixed-broadband basket, but 35 per cent higher than the average for the handset-based mobile-broadband basket, thus suggesting that there is still room for lower mobile-cellular prices.

Some of the most populous countries worldwide – such as Bangladesh, China and India – stand out for having achieved mobile-cellular baskets under USD 3 per month and feature among the top 20 countries with the lowest prices. A number of least developed countries (LDCs) also offer prices below USD 3 per month, including Bhutan, Ethiopia, Myanmar, Nepal (Republic of) and South Sudan.

The price of a handset-based mobile-broadband basket including 500 MB per month followed a decreasing trend worldwide in the period 2013–2016, but plateaued at USD 9.3 per month in 2017. The global average was driven down by strong reductions in prices in developing countries (compound annual growth rate (CAGR)-24 per cent in USD terms from 2013 to 2016) and, in particular, in LDCs (CAGR-36 per cent in USD terms from 2013 to 2016). The price of a computer-based mobile-broadband basket including 1 GB per month followed a similar trend as the handset-based mobile-broadband basket. Despite the sustained decrease in prices in developing countries and LDCs, average data allowances continued to increase. For instance, in LDCs, data allowances increased from 800 MB per month in 2014 to 1 GB per month in 2017 for the handset-based mobile-broadband basket, and from 1.7 to 3.2 GB per month for the computer-based mobile-broadband basket.

In 2017, almost all developed countries had computer-based mobile-broadband prices corresponding to less than 2 per cent of gross national income (GNI) per capita (p.c.), thus already meeting the 2025 target set by the Broadband Commission. Similarly, 34 per cent of developing countries also offered computer-based mobile-broadband plans representing less than 2 per cent of GNI p.c. in 2017. On the other hand, most of the countries not yet having met the 2015 affordability target set by the Broadband Commission (i.e. broadband prices representing less than 5 per cent of GNI p.c.) were LDCs. The affordability of prepaid handset-based mobile-broadband services in these LDCs gives a strong indication that it might be the best vector for ensuring affordable Internet access to all, if operators in these countries are able to maintain current price levels while continuing the progressive increase in data allowances observed in previous years.

The price of an entry-level fixed-broadband plan has significantly decreased worldwide in the last decade, from more than USD 40 per month on average in 2008 to USD 25 per month in 2017. The most remarkable reduction in prices has been recorded in LDCs, where prices have been cut two-thirds since 2008. However, the price of an entry-level fixed-broadband plan corresponds on average to 12 per cent of GNI p.c. in developing countries, whereas evidence from household surveys shows that household expenditure on ICT as a percentage of total household expenditure is below 8 per cent in all countries with data available. This suggests that the economic commitment that an average family in the developing world would need to face to connect to the Internet at home is larger than the average share of budget allocated to ICTs in most countries.

More than one in four countries in the Commonwealth of Independent States, Asia and the Pacific, and the Arab States have entry-level fixed-broadband prices that represent less than 2 per cent of GNI p.c. In Europe, three out of four countries have fixed-broadband services meeting the 2 per cent target set by the Broadband Commission for 2025. Fixed-broadband prices are the least affordable in Africa, although countries such as Botswana, Cabo Verde, Gabon, Mauritius, Seychelles and South Africa have achieved prices below the 5 per cent threshold set by the Broadband Commission for 2015.

Chapter 4. ICT Price Trends

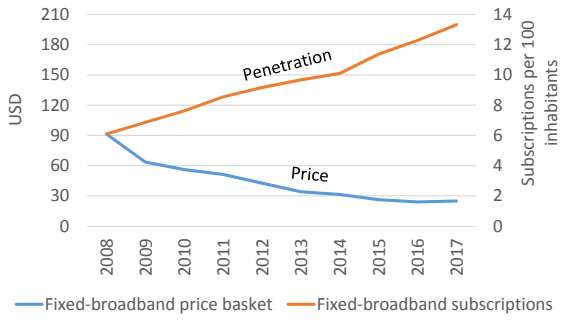
Affordable access to information and communication technologies (ICTs) has been recognized as a key enabler for ICT development by policy-makers at the national and international level. The 2030 Agenda for Sustainable Development, which was adopted by the United Nations in September 2015, recognizes 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." (United Nations, 2015a). This chapter presents the latest ICT price data collected by ITU and analyses the price and affordability of three key ICT services (mobile-cellular, fixed-broadband and mobile-broadband), benchmarking countries and regions, and highlighting key trends over time.

4.1 Background

ICT prices have dropped globally in the last decade in parallel with the increase in access and use of ICT services. Fixed-broadband services recorded the largest price drop of all ICT services analysed in this chapter from 2008 to 2017, while fixed-broadband subscriptions per 100 inhabitants doubled worldwide (Chart 4.1). Mobile-cellular prices maintained a steady downward trend in the period 2008–2017, in line with the continuous increase in mobile-cellular penetration (Chart 4.2). Lastly, mobile-broadband uptake has exploded in the last five years and mobile-broadband prices have plummeted (Chart 4.3).

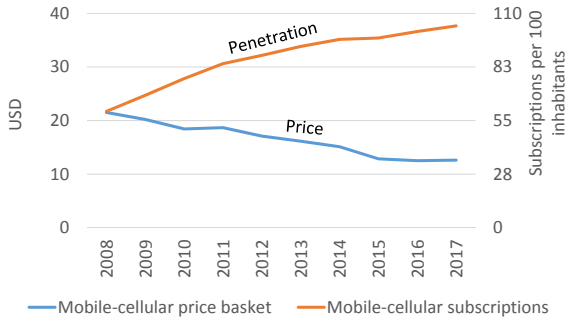
There is a two-way relationship between ICT prices and access to and use of ICT services. Lower prices make ICT services affordable to larger segments of the population, thus contributing to ICT adoption. Conversely, higher levels of ICT access and use create the conditions for solid business cases, which allow operators to benefit from economies of scale and scope. These efficiency gains can be passed on in terms of lower prices to customers. The combined effects of these two processes can lead to virtuous circles: lower prices drive ICT adoption up and, in turn, higher ICT adoption enables lower prices.

Chart 4.1: Global fixed-broadband price basket (left axis) and fixed-broadband subscriptions per 100 inhabitants (right axis), 2008–2017



Note: Prices are calculated based on simple averages of data from 144 economies for which data on fixed-broadband prices were available for 2008–2017. The two vertical axes are scaled proportionally based on the 2008 values, so that a 10 per cent increase in subscription penetration on the right axis takes the same range as a 10 per cent decrease in prices on the left axis.
Source: ITU.

Chart 4.2: Global mobile-cellular price basket (left axis) and mobile-cellular subscriptions per 100 inhabitants (right axis), 2008–2017

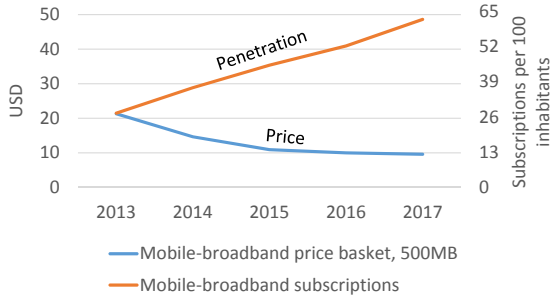


Note: Prices are calculated based on simple averages of data from 139 economies for which data on mobile-cellular prices were available for 2008–2017. The two vertical axes are scaled proportionally based on the 2008 values, so that a 10 per cent increase in subscription penetration on the right axis takes the same range as a 10 per cent decrease in prices on the left axis.
Source: ITU.

Improved ICT regulation and policy-making have played a pivotal role in creating the conditions for the reduction of prices seen in the period 2008–2017, ensuring that the efficiency gains of higher ICT adoption are partly passed on to customers, thus closing the virtuous circle. Indeed, regulators and policy-makers are responsible for awarding operating licences, allocating and assigning spectrum, ensuring interoperability,

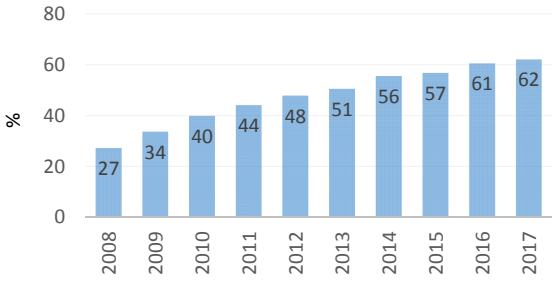
setting the conditions for infrastructure sharing and facilitating investment, among other key tasks. As a result, the structure of telecommunication markets depends to a large extent on their decisions. Data from the ITU ICT Regulatory Tracker show that, in 2008, only 27 per cent of countries had an open telecommunication sector enabling investment, innovation and access, compared with 62 per cent of countries having progressed to such an enabling regulatory environment in 2017 (Chart 4.4). This testifies to the improvement in the regulatory and policy context of many ICT markets worldwide.

Chart 4.3: Global mobile-broadband price basket, prepaid handset-based 500 MB (left axis), and mobile-broadband subscriptions per 100 inhabitants (right axis), 2013–2017



Note: Prices are calculated based on simple averages of data from 154 economies for which data on mobile-broadband prices, prepaid handset-based 500 MB, were available for 2013–2017. The two vertical axes are scaled proportionally based on the 2008 values, so that a 10 per cent increase in subscription penetration on the right axis takes the same range as a 10 per cent decrease in prices on the left axis.
Source: ITU.

Chart 4.4: Percentage of countries in third or fourth generation of ICT regulation,* 2008–2017



Note: *Countries in third or fourth generation of ICT regulation (G3 and G4) are those having ICT Regulatory Tracker scores equal to or above 70. G3 is defined as "Enabling investment, innovation and access; dual focus on stimulating competition in service and content delivery, and consumer protection". G4 is characterized by "Integrated regulation, led by economic and social policy goals".
Source: ITU ICT Regulatory Tracker, available at www.itu.int/net4/itu-d/irt. .

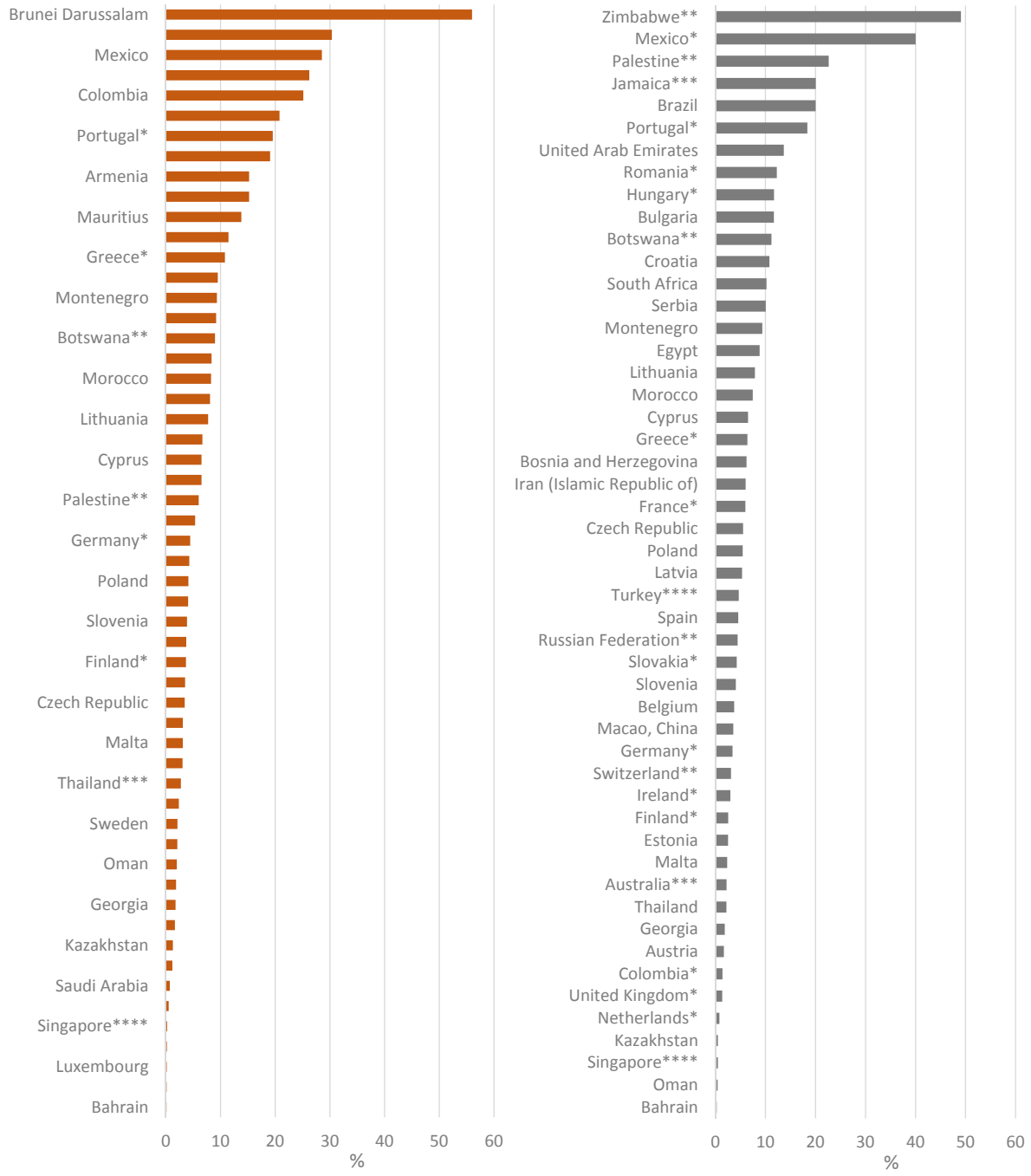
Despite the progress achieved in making ICT services affordable, data from ICT household surveys show that prices remain a barrier to ICT adoption in several countries. For instance, more than 20 per cent of households without Internet access cite the cost of the service as a barrier in Brunei Darussalam, Zimbabwe, Mexico, Brazil, Colombia and Romania (Chart 4.5).

Beyond the payment for the fixed or mobile Internet subscription, there are equipment costs that need to be added to the final household bill, such as the price of the smartphone, tablet, laptop or personal computer. In some economies – such as Zimbabwe, Mexico and Palestine[1] – these device costs represent a barrier to Internet access at home for a significant proportion of households without Internet.

In addition to being a potential barrier to ICT access, affordability is a strong determinant of ICT usage. For instance, depending on the price of mobile-broadband data packages, a household relying on a mobile connection to access the Internet may have to curtail the amount of content consumed online to make ends meet. This is indeed often the case in Argentina, Colombia, Ghana, Guatemala, Paraguay, Peru and Rwanda, where more than 50 per cent of households with Internet limit its use because of data costs (Chart 4.6).

Low Internet speeds may also have a negative impact on the user experience, thus becoming a de facto limitation for Internet use, as in the case of Cambodia. The Internet speed required for a satisfactory quality of experience depends on the activities performed on the Internet, with data-hungry applications such as video and online gaming the most demanding in terms of speed. Beyond Internet speed, other technical factors such as latency might be important for users of time-sensitive applications, such as over-the-top voice applications like Skype or Viber. Quality of service parameters, such as broadband speed and latency, may depend both on the ability of the Internet service provider to deliver on the advertised conditions and on the economic capacity of customers to pay for the plan that better meets their requirements.

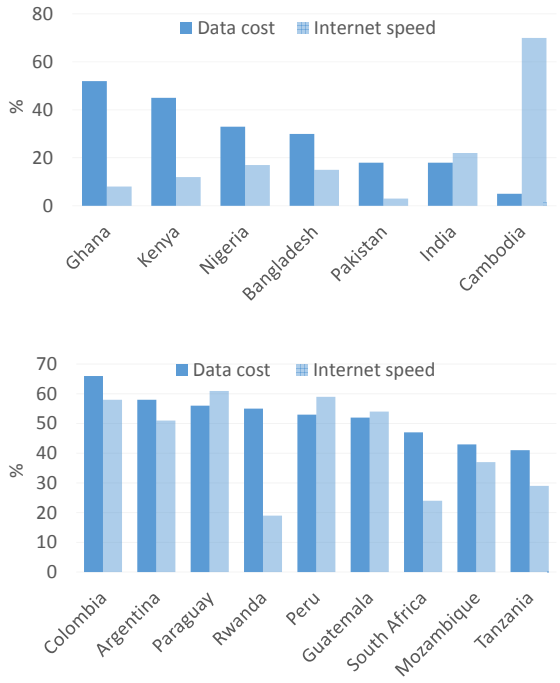
Chart 4.5: Percentage of households that do not have Internet because the cost of the service is too high (left) or the cost of the equipment is too high (right), out of total households without Internet, 2016 or latest available year



Notes: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference. * 2013 data. ** 2014 data. *** 2015 data. **** 2017 data.
Source: ITU.

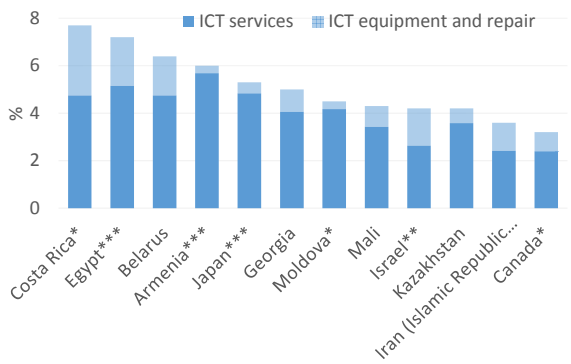
Data from official surveys on household expenditure further confirm that ICT services and equipment are a significant item in household budgets (Chart 4.7). Their share in total household expenditure ranges from 3.2 per cent in Canada to 7.7 per cent in Costa Rica. ICT services (i.e. the cost of the subscription) account for the lion's share, corresponding to more than 60 per cent of total household expenditure on ICT in all countries for which data are available.[2]

Chart 4.6: Reasons for not using the Internet more, single response (top) and multiple responses (bottom) given as a percentage of Internet users quoting them,* selected economies, 2017



Note: Data refer to the age range of 15 to 65 years.
*Top chart refers to the responses given to the survey question "What is your main limitation for your use of the internet? (Single response question)". Bottom chart corresponds to the survey question "I'm going to read some phrases that other people have mentioned like limits to use the internet. For each one, please, tell me if you consider it a limitation or not. (Multiple response question)".
Source: DIRSI, LIRNEasia and Research ICT Africa based on nationally representative ICT household surveys. See www.afteraccess.net..

Chart 4.7: Household expenditure on ICT as a percentage of total household expenditure, selected countries, 2016 or latest available year



Note: *2013 data. **2014 data. ***2015 data.
Source: ITU.

There is therefore ample evidence that ICT prices play an important role in households' and individuals' decisions concerning ICT access and use. Policy-makers and regulators have recognized this, as reflected by the prominent role that prices play in ICT national agendas. Likewise, global ICT development efforts, such as the ITU Connect 2020 Agenda and the Connect 2025 Targets of the Broadband Commission for Sustainable Development, also include affordability benchmarks (Box 4.1).

About this chapter

With the aim of contributing to the international, regional and national efforts to monitor the affordability of ICT services, this chapter will present and analyse price data for three key services: mobile-cellular (i.e. voice and short message service (SMS) services), fixed-broadband and mobile-broadband.

Prices in this chapter are expressed in three complementary units:

- In United States dollars (USD), using the International Monetary Fund annual rates of exchange.
- In international dollars (PPP$), using purchasing power parity (PPP) conversion factors instead of market exchange rates. The use of PPP exchange factors helps to screen out price and exchange-rate distortions, thus providing a measure of the cost of a given service taking into account the purchasing power equivalences between countries.[6]
- As a percentage of countries' monthly GNI p.c. (Atlas method).[7] Prices are expressed as a percentage of GNI p.c. in order to show them relative to the size of the economy of each country, thus pointing to the affordability of each ICT service at country level.

The prices collected for each service correspond to the cheapest plan offered by the dominant operator that fulfils the usage requirements of each basket. The methodological details of the ITU price baskets can be found in Annex 1.

This chapter will look first at the evolution of mobile-cellular prices over the period 2008–2017,

Box 4.1: How low should prices be to become affordable? International benchmarks

The affordability of ICT services has traditionally been measured as a ratio of two elements: the price of the service and the economic welfare of the customer. Because the underlying costs of providing ICT services tend to decrease with time (e.g. newer mobile networks are more cost-efficient for data services), there is a rational expectation that ICT prices will go down. Conversely, since economic development improves household and individual welfare, the acquisition power of customers is expected to rise (with the caveat of inequality in the distribution of welfare gains).

The interplay of these two trends makes affordability a moving target and explains the recent revision of international targets on ICT prices.

In 2010, the Broadband Commission for Digital Development (later renamed Broadband Commission for Sustainable Development), the ITU/United Nations Educational, Scientific and Cultural Organization-led initiative to increase awareness about the importance of broadband for achieving international development goals, identified four specific ICT targets. Target 2 was about making broadband affordable: "By 2015, entry-level broadband services should be made affordable (less than 5 per cent of average monthly income) in developing countries through adequate regulation and market forces."[3]

In 2014, the ITU Plenipotentiary Conference in Busan, Korea (Republic of), adopted the Connect 2020 Agenda for Global Telecommunication/ICT Development. Recognizing the relative nature of affordability targets, Target 1.3 of the ITU Connect 2020 Agenda stated that "Worldwide, telecommunications/ICTs should be 40 per cent more affordable by 2020". Following a similar formulation, Target 2.3.A declared that: "The affordability gap between developed and developing countries should be reduced by 40 per cent by 2020" (ITU, 2014b).

The ITU Connect 2020 targets on affordability resonate with the objective set forth in Target 9.C of the Sustainable Development Goals approved in 2015: "strive to provide universal and affordable access to the Internet in least developed countries by 2020" (United Nations, 2015a).

In 2018, the Broadband Commission for Sustainable Development agreed on new targets for 2025, including the new Target 2: "By 2025, entry-level broadband services should be made affordable in developing countries at less than 2 per cent of monthly Gross National Income (GNI) per capita."[4]

Apart from the affordability targets endorsed by the international community, there have been affordability targets proposed by other organizations. For instance, the Alliance for Affordable Internet – a broad coalition with more than 80 member organizations from civil society, and the public and private sectors[5] – has proposed the affordability target of "1 for 2": 1 GB of data for no more than 2 per cent of income (Alliance for Affordable Internet, 2017).

This report uses the Broadband Commission threshold values of 5 and 2 per cent of GNI per capita (p.c.) as benchmarks for the affordability of ICT services. The two benchmarks are considered given that there are a number of countries that have not yet achieved the 5 per cent target set for 2015 for broadband services, and therefore they are benchmarked against this goalpost. On the other hand, those countries having achieved the 5 per cent target are benchmarked based on their progress towards achieving the 2025 target of 2 per cent of GNI p.c.

Source: ITU.

in absolute and relative terms, for both developed and developing countries. It will include the presentation of the end 2017 mobile-cellular basket and country rankings, and show some regional differences in the affordability of mobile-cellular prices.

This will be followed by a more in-depth analysis of prices in the fixed-broadband and mobile-broadband markets. Country rankings will be presented for the fixed-broadband and mobile-broadband baskets, with the latter including both prepaid and postpaid packages and computer-based and handset-based plans. The analysis of fixed-broadband prices will include 2008–2017 price trends and a discussion on changes in broadband speeds (offered for minimum broadband plans) as well as developments in terms of the data volume included in broadband offers. A regional analysis will be provided for both fixed- and mobile-broadband services.

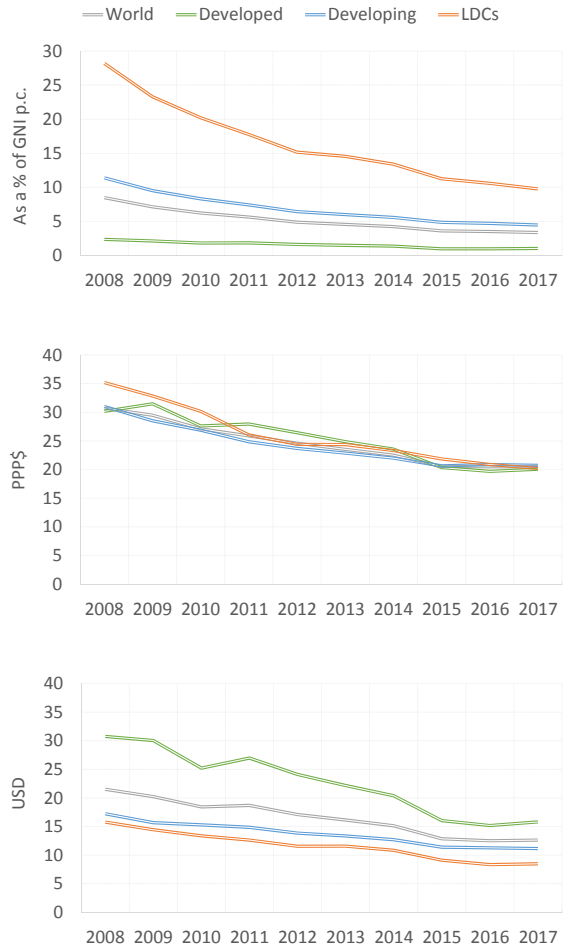
4.2 Mobile-cellular prices

Mobile-cellular prices followed a sustained decreasing trend in the period 2008–2015, with a compound annual growth rate (CAGR) of negative 6 per cent in PPP terms on average globally (Chart 4.8). From 2015, mobile-cellular prices have plateaued and the price of the ITU mobile-cellular basket (51 minutes and 100 SMS per month) has converged to PPP$ 20. This is half the average price of the fixed-broadband basket (Chart 4.22), but 25 per cent higher than the average for the handset-based mobile-broadband basket (Chart 4.12), thus suggesting that there is still room for lower mobile-cellular prices.

Given the convergence of prices in PPP$ terms, the disparity that persists in prices as a percentage of GNI p.c., particularly between least developed countries (LDCs) and the rest, may reflect as much differences in income as specific conditions in the ICT sector.

A closer look at the evolution of mobile-cellular prices from 2016 to 2017 confirms that only marginal differences were recorded: a slight increase in PPP$ prices in developed countries (1.8 per cent), partly compensated by the decrease in developing countries (-0.4 per cent) and, in particular, in LDCs (-1.5 per cent) (Chart 4.9). Prices as a percentage of GNI p.c. only changed perceptively in LDCs, where prices of the basket corresponded to 15.1 per cent in 2016 and decreased to 14.6 per cent in 2017.

Chart 4.8: Mobile-cellular basket, as a percentage of GNI p.c. (top), in PPP$ (middle), and in USD (bottom), 2008–2017

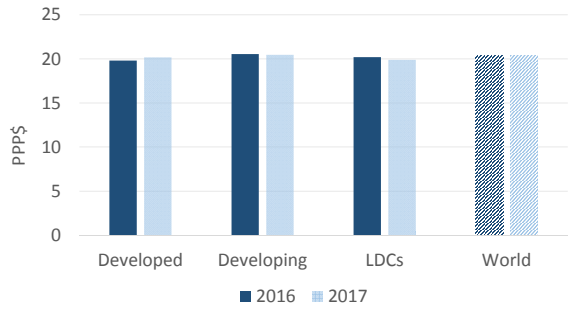


Note: Simple averages. Based on the economies for which data on mobile-cellular prices were available for the years 2008–2017: 139 economies for data in USD, 134 for data in PPP$ and 137 for data in GNI p.c. terms.
Source: ITU.

These sluggish trends in mobile-cellular prices suggest that a floor rate has been reached in several countries. However, this does not mean that mobile-cellular pricing schemes have remained unchanged in recent years: a detailed analysis shows that there has been a remarkable increase in the value for money of mobile-cellular plans in several countries. Indeed, although prices have remained stable, the increase in the offer of bundles and packages has made it possible for mobile customers in several countries to obtain more than what is included in the ITU mobile

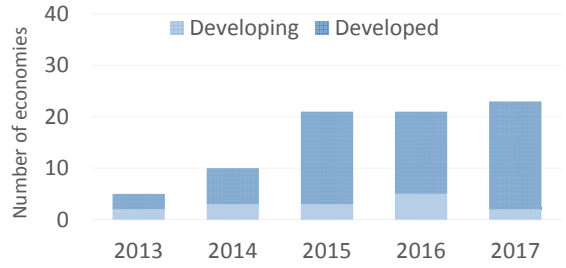
basket for the same price (Chart 4.10). This is particularly the case in developed countries, thus explaining the slight upturn in prices noticed in the developed world in 2017.

Chart 4.9: Mobile-cellular basket in PPP$, 2016–2017



Note: Simple averages. Based on 168 economies for which data on fixed-broadband prices in PPP$ were available for the years 2016 and 2017.
Source: ITU.

Chart 4.10: Number of economies with plans for the mobile-cellular basket exceeding the basket requirements, 2013–2017



Source: ITU.

In Australia, for instance, operator Telstra offered unlimited SMS and calls for PPP$ 43.7 in 2017. Similarly, the plans selected in 2017 for Ireland, the Republic of Korea, the United Kingdom and the United States included unlimited domestic voice minutes and SMS.

More prevalent than the trend towards flat rate plans observed in these high-income countries[8] is the progressive inclusion of data in most packages and bundles offered by mobile-cellular operators. As a result, the cheapest option for the monthly consumption defined in the ITU mobile-cellular basket (51 minutes and 100 SMS) includes in several countries some extra data allowance. In 2017, this was indeed the case in Albania (1.5 GB), Bosnia and Herzegovina (1 GB), Brazil (1 GB), Croatia (350 MB), Germany (1 GB), Greece (220 MB), Ireland (1 GB), the Republic of Korea (300 MB), Liechtenstein (300 MB), Malta (50 MB), Spain (1.5 GB), Sweden (500 MB) and the United Kingdom (500 MB).

Since plans exceeding the minimum requirements of the ITU mobile-cellular basket are more prevalent in developed countries (43 per cent of developed countries in 2017) than in developing countries (1 per cent of developing countries in 2017), caution must be exercised when making comparisons across different levels of development, as well as between countries with substantially different plan allowances. For instance, the plan offered by Verizon in the United States for PPP$ 50 per month in 2017 is significantly more expensive than the global average for that year (PPP$ 20.4), but it includes unlimited domestic voice and SMS, therefore offering a high value proposition to its customers.

Benchmarking countries

The price of a monthly basket including 51 minutes and 100 SMS ranges from less than USD 1 in South Sudan and Sri Lanka to more than USD 35 in Denmark, Israel and the United States. In PPP$ terms, the range spans from PPP$ 2.8 in Sri Lanka to more than PPP$ 50 in Bulgaria, Cabo Verde and Nicaragua (Table 4.1).

Some of the most populous countries worldwide – such as Bangladesh, China and India – stand out for having achieved prices under USD 3 per month and featuring among the top 20 countries with the lowest mobile-cellular prices. A number of LDCs also offer monthly prices below USD 3 per month, including Bhutan, Ethiopia, Myanmar, Nepal (Republic of) and South Sudan.

Such low mobile-cellular prices can sometimes be a mixed blessing: on the one hand, they bring mobile-cellular services to the reach of the lowest-income segments of the population; on the other hand, if prices are too low, they may threaten the long-term sustainability of the mobile market. It is the task of regulators and policy-makers to strike a balance between these two forces, and they have intervened in this regard in some countries, such as for instance in Sri Lanka (Box 4.2).

Table 4.1: Mobile-cellular basket, 2017

Rank	Economy	Mobile-cellular basket			Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$		
1	Macao, China*	0.10	5.65	6.97	0	65,130
2	Hong Kong, China	0.15	5.73	6.93	0	46,310
3	Singapore	0.17	7.92	9.32	7	54,530
4	Austria	0.17	6.63	6.89	20	45,440
5	United Arab Emirates	0.19	6.10	7.99	0	39,130
6	Estonia	0.22	3.38	4.95	20	18,190
7	Slovenia	0.24	4.45	5.86	22	22,000
8	Lithuania	0.26	3.27	5.64	21	15,200
9	Sweden	0.26	11.58	10.33	25	52,590
10	Iceland	0.27	13.84	9.16	24	60,830
11	Norway	0.28	17.66	13.91	25	75,990
12	Sri Lanka	0.30	0.94	2.84	50	3,840
13	Finland	0.30	11.22	10.23	24	44,580
14	Germany	0.31	11.26	12.02	19	43,490
15	Iran (Islamic Republic of)	0.34	1.53	4.26	9	5,400
16	Cyprus	0.35	6.91	8.72	19	23,719
17	Qatar	0.36	18.40	23.73	0	61,070
18	Brunei Darussalam	0.36	9.00	15.69	0	29,600
19	Luxembourg	0.40	23.18	20.43	17	70,260
20	China	0.40	2.91	5.11	0	8,690
21	Costa Rica	0.45	4.11	6.26	13	11,040
22	Switzerland	0.45	30.21	21.04	8	80,560
23	United Kingdom	0.46	15.44	14.96	20	40,530
24	Latvia	0.46	5.62	8.67	21	14,740
25	Ireland	0.49	22.54	20.09	23	55,290
26	Australia	0.54	22.99	18.71	10	51,360
27	Kuwait	0.54	14.14	21.82	0	31,430
28	New Zealand	0.55	17.95	15.41	15	38,970
29	Italy	0.56	14.54	15.96	22	31,020
30	Russian Federation	0.58	4.45	10.44	18	9,232
31	Bahrain	0.59	10.00	16.33	0	20,240
32	Mauritius	0.61	5.13	9.10	15	10,140
33	Croatia	0.64	6.60	11.00	25	12,430
34	Egypt	0.68	1.70	11.01	23	3,010
35	Romania	0.68	5.63	12.04	19	9,970
36	Malaysia	0.70	5.63	14.59	6	9,650
37	Kazakhstan	0.70	4.63	13.27	12	7,890
38	Maldives	0.71	5.67	7.30	6	9,570
39	Canada	0.74	26.39	25.27	13	42,870
40	Netherlands	0.74	28.47	28.29	21	46,180
41	Oman	0.75	9.00	17.36	0	14,440
42	Bahamas	0.77	18.79	16.46	8	29,170
43	Denmark	0.78	35.89	28.13	25	55,220
44	Malta	0.83	16.55	22.47	18	23,810
45	Japan	0.84	26.96	28.22	8	38,550
46	Saudi Arabia	0.84	14.13	27.38	0	20,080
47	Mongolia	0.86	2.36	6.81	10	3,290
48	Poland	0.87	9.19	18.46	23	12,710
49	Belgium	0.88	30.72	31.07	21	41,790
50	Turkmenistan	0.88	4.89		15	6,650
51	United States	0.90	43.55	43.55	9	58,270
52	Mexico	0.91	6.51	12.18	19	8,610
53	Armenia	0.91	3.04	7.46	20	4,000
54	Belarus	0.92	4.06	16.16	25	5,280
55	Greece	0.92	13.93	18.27	39	18,090
56	Tunisia	0.93	2.72	7.94	24	3,500
57	Spain	0.94	21.28	25.64	21	27,180
58	Azerbaijan	0.94	3.20	14.54	18	4,080
59	Bhutan	0.97	2.19	6.40	5	2,720
60	Slovakia	0.99	13.64	22.12	20	16,610
61	Portugal	1.02	16.84	22.11	23	19,820
62	Andorra**	1.02	31.49			36,987
63	France	1.08	34.20	34.96	20	37,970
64	Seychelles	1.09	12.94	20.45	15	14,180
65	Czech Republic	1.10	16.61	27.19	21	18,160
66	Chile	1.10	12.48	17.79	19	13,610
67	Israel	1.13	35.13	28.62	17	37,270
68	Libya	1.15	6.29		0	6,540
69	Jordan	1.16	3.83	8.20	46	3,980
70	Sudan	1.23	2.43		35	2,379

Table 4.1: Mobile-cellular basket, 2017 (continued)

Rank	Economy	Mobile-cellular basket			Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$		
71	Korea (Rep. of)	1.23	29.10	32.77	10	28,380
72	India	1.24	1.88	6.12	18	1,820
73	Panama	1.24	13.59	23.02	7	13,100
74	Namibia	1.28	4.90	10.35	15	4,600
75	Hungary	1.28	13.74	25.25	27	12,870
76	Trinidad and Tobago	1.29	16.46	19.68	13	15,350
77	Uruguay	1.39	17.64	21.59	22	15,250
78	Bangladesh	1.39	1.71	4.31	21	1,470
79	Uzbekistan	1.39	2.30		20	1,980
80	Georgia	1.47	4.65	13.71	21	3,790
81	Jamaica	1.56	6.16	9.88	25	4,750
82	Thailand	1.57	7.79	20.62	7	5,960
83	Brazil	1.58	11.28	16.40	40	8,580
84	Botswana	1.61	9.13	18.04	12	6,820
85	Myanmar	1.61	1.60	6.38	5	1,190
86	Montenegro	1.61	9.86	20.05	19	7,350
87	Paraguay	1.82	5.94	12.85	10	3,920
88	South Africa	1.84	8.33	17.68	14	5,430
89	Albania	1.87	6.72	14.36	20	4,320
90	Saint Kitts and Nevis	1.88	25.10	32.85		16,030
91	South Sudan*	1.94	0.63	4.66	13	390
92	Argentina	1.99	21.68		21	13,040
93	Ghana	2.03	2.51	7.79	24	1,490
94	Indonesia	2.03	5.99	16.09	10	3,540
95	Kenya	2.11	2.53	5.62	26	1,440
96	Peru	2.15	10.71	20.13	18	5,970
97	Pakistan	2.19	2.88	9.46	32	1,580
98	Lebanon	2.32	16.07	26.66	10	8,310
99	Ukraine	2.34	4.65	20.92	20	2,388
100	Dominican Rep.	2.40	13.27	28.36	30	6,630
101	Nauru	2.43	20.71		15	10,220
102	Algeria	2.47	8.15	23.56	19	3,960
103	Viet Nam	2.52	4.56	11.25	10	2,170
104	Antigua and Barbuda	2.55	30.12	37.17	15	14,170
105	Turkey	2.56	23.30	52.99	43	10,930
106	Suriname	2.61	13.11	30.23	8	6,020
107	Barbados	2.64	34.15	27.84	18	15,540
108	The Former Yugoslav Rep. of Macedonia	2.64	10.73	25.49	18	4,880
109	Colombia	2.72	13.23	28.48	23	5,830
110	Bosnia and Herzegovina	2.80	11.53	24.88	17	4,940
111	Tonga	2.81	9.39	12.72	15	4,010
112	Iraq	2.84	11.30	22.10	0	4,770
113	Philippines	2.96	9.02	23.02	12	3,660
114	Grenada	2.96	23.77	31.94	15	9,650
115	Gabon	3.07	16.93	26.63		6,610
116	Ecuador	3.07	15.09	24.87	12	5,890
117	Samoa	3.14	10.74	14.62	15	4,100
118	Serbia	3.34	14.41	31.34	20	5,180
119	Lao P.D.R.	3.53	6.67	17.16	10	2,270
120	Guyana	3.60	13.38	21.07	14	4,460
121	Tajikistan	3.61	2.98	10.92	23	990
122	Saint Lucia	3.77	27.56	35.35	15	8,780
123	Nepal (Republic of)	3.91	2.58	7.35	24	790
124	Bolivia (Plurinational State of)	3.96	10.32	20.77	13	3,130
125	Dominica	3.99	23.24	31.87	15	6,990
126	Bulgaria	4.00	25.84	60.39	20	7,760
127	Moldova	4.06	7.37	19.90	20	2,180
128	Fiji	4.25	17.61	28.34	9	4,970
129	Kyrgyzstan	4.26	4.01	13.34	17	1,130
130	Ethiopia	4.73	2.91	7.38	15	740
131	Saint Vincent and the Grenadines	4.73	27.54	38.26	2	6,990
132	Morocco	4.77	11.37	26.22	20	2,863
133	Nigeria	4.87	8.45	20.90	5	2,080
134	El Salvador	5.27	15.63	30.35	18	3,560
135	Marshall Islands	5.56	22.22		0	4,800
136	Angola	5.83	16.18	20.65	5	3,330
137	Micronesia	5.89	17.63		0	3,590
138	Palestine	5.90	15.63	22.10	16	3,180
139	Cambodia	6.68	6.85	16.88	10	1,230

Table 4.1: Mobile-cellular basket, 2017 (continued)

Rank	Economy	Mobile-cellular basket			Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$		
140	Guinea	6.90	4.71	10.78	11	820
141	Kiribati	6.96	16.12			2,780
142	Zambia	7.04	7.63	19.38	34	1,300
143	Yemen*	7.23	6.21		5	1,030
144	Honduras	7.49	14.05	28.08	15	2,250
145	Belize	7.56	27.68	48.57	13	4,390
146	Rwanda	7.71	4.62	12.65	28	720
147	Lesotho	7.81	8.33	23.76	5	1,280
148	Mozambique	8.32	2.91	9.53	17	420
149	Sao Tome and Principe	8.45	12.46	19.97	5	1,770
150	Solomon Islands	8.92	14.26	14.35	10	1,920
151	Vanuatu	9.19	22.35	20.46	13	2,920
152	Haiti	9.30	5.89	13.46	10	760
153	Guatemala	9.34	31.61	53.42	12	4,060
154	Timor-Leste	9.41	14.04	21.50		1,790
155	Afghanistan	10.09	4.79	15.69	0	570
156	Cabo Verde	10.33	25.74	55.09	15	2,990
157	Papua New Guinea	10.65	21.39	26.08	10	2,410
158	Uganda	10.96	5.48	16.39	18	600
159	Côte d'Ivoire	11.21	14.38	35.60	18	1,540
160	Djibouti	11.32	17.73	30.13	10	1,880
161	Cameroon	12.02	13.62	33.21	19	1,360
162	Benin	12.37	8.25	21.49	18	800
163	Sierra Leone	15.14	6.43	20.60	15	510
164	Madagascar	15.32	5.11	17.72	20	400
165	Senegal	15.62	12.37	30.60	23	950
166	Tanzania	15.89	11.99	33.01	33	905
167	Nicaragua	16.03	28.44	75.95	15	2,130
168	Comoros	16.46	10.43		0	760
169	Zimbabwe	17.72	13.44	26.48	25	910
170	Mauritania	19.11	17.52	45.96	18	1,100
171	Burkina Faso	19.49	9.91	26.41	18	610
172	Mali	19.60	12.58	33.46	18	770
173	Togo	20.15	10.24	25.50	18	610
174	Dem. Rep. of the Congo	25.20	9.45	23.66	26	450
175	Malawi	27.39	7.30	25.74	17	320
176	Burundi	30.03	7.26	18.52	18	290
177	Guinea-Bissau	31.46	17.30	41.28	17	660
178	Chad	36.20	19.00		18	630
179	Niger	36.82	11.05	29.12		360
180	Central African Rep.	38.48	12.50		19	390
181	Liberia	58.14	18.41	23.37	14	380
	Syrian Arab Republic***		2.57		0	-
	Somalia***		3.54		10	-
	San Marino***		14.57	16.77	0	-
	Cuba***		21.46		0	-
	Liechtenstein***		27.59		8	-
	Monaco***		28.16		20	-

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference. *Data correspond to the GNI p.c. (Atlas method) in 2016. **Data correspond to the GNI p.c. in 2016, sourced from the United Nations Statistics Division (UNSD). *** Country not ranked because data on GNI p.c. are not available.
Source: ITU. GNI p.c. and PPP$ values are based on World Bank data.

The countries with the least affordable mobile-cellular prices are LDCs. In some of them – such as the Democratic Republic of the Congo, Malawi and Burundi – the mobile-cellular sub-basket costs less than USD 10 per month, which is a relatively low rate considering the global average (USD 12.7). In other LDCs – such as Guinea-Bissau, Chad, Liberia and Mauritania – the price of the mobile-cellular basket is above the global average, suggesting that there is room for lower mobile-cellular prices in these countries and that policy attention should be focused on creating the conditions for achieving lower prices.

Regional analysis of mobile-cellular prices

Mobile-cellular prices differ significantly across and within regions and, as a result, so does the affordability of mobile-cellular services (Chart 4.11). The Commonwealth of Independent States (CIS) has the lowest average and median prices, at USD 4 per month. Africa, Asia and the Pacific

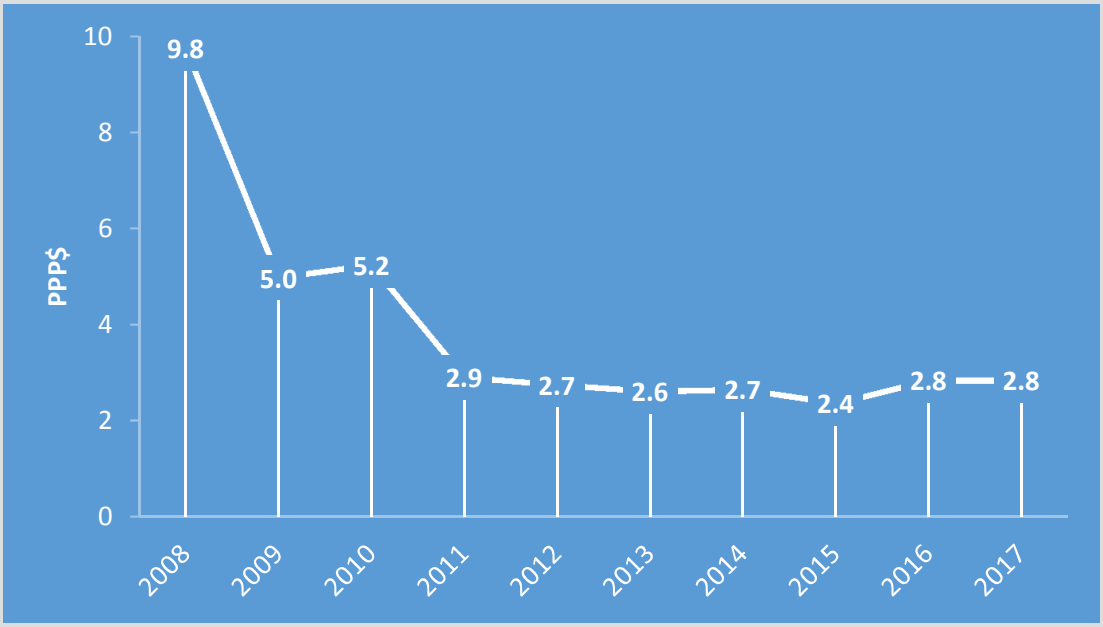
Box 4.2: Can mobile prices be too low? The cases of Sri Lanka and Pakistan

The anticipation of the arrival of the transnational operator Bharti Airtel in the already competitive Sri Lankan mobile market, which effectively took place in 2009, plunged mobile operators in the country into an aggressive price war (Galpaya, 2011). Mobile-cellular tariffs were cut by 80 per cent in the period 2005–2010 and the financial performance of the mobile industry suffered from this drastic reduction in margins (Telecommunications Regulatory Commission of Sri Lanka, 2012).

In order to revert the uncertainty that this situation created in the industry and the diminishing investments by mobile operators, the Telecommunication Regulatory Commission of Sri Lanka introduced floor rates in June 2009. Floor tariffs were initially set at USD 0.4 cents per on-net minute and USD 1.7 cents per off-net minute (ibid.). The rates were subsequently revised several times, the latest revision (2016) leading to a single price floor for on-net and off-net minutes at USD 1.0 cents.[9]

The regulatory intervention in Sri Lanka succeeded in stabilizing mobile-cellular prices in the country, yet at the lowest levels worldwide (Chart Box 4.1).

Chart Box 4.1: Mobile-cellular basket, PPP$, Sri Lanka, 2008–2017



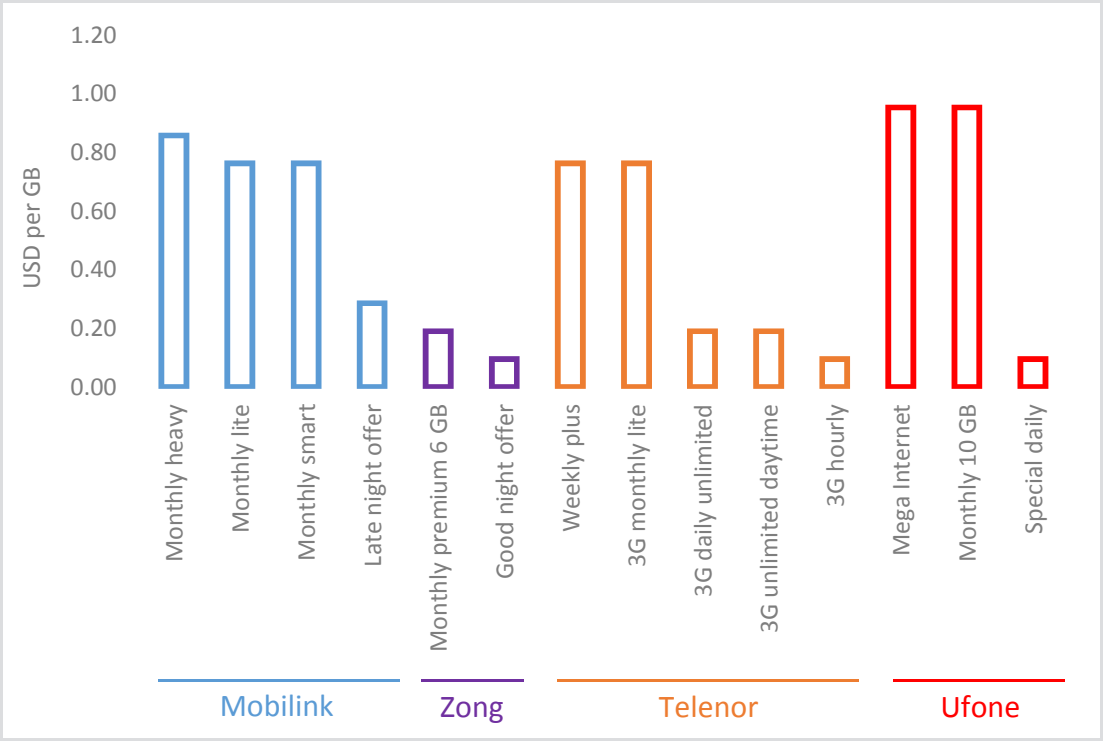
Source: ITU.

In 2016, the Pakistan Telecommunication Authority (PTA) launched a public consultation on the direct regulation of retail prices for mobile data services (Pakistan Telecommunication Authority, 2016).

PTA noted that mobile data usage was growing at a much higher rate than mobile data revenues (1,631 per cent compared with 84 per cent, respectively, in the period from June 2014 to June 2016) and thus leading to low prices per GB of mobile data (Chart Box 4..2). Building upon the experience in Sri Lanka, PTA feared the negative effect this might have on the long-term sustainability of the telecommunication industry in the country.

Box 4.2: Can mobile prices be too low? The cases of Sri Lanka and Pakistan (continued)

Chart Box 4.2: Price per MB, USD cents, Pakistan, 2016



Source: Pakistan Telecommunication Authority, 2016.

Following the public consultation, PTA did not implement any direct retail price regulation of mobile data services. Nevertheless, market forces by themselves have driven mobile data prices in Pakistan to levels comparable to those of other countries (see section 4..4).

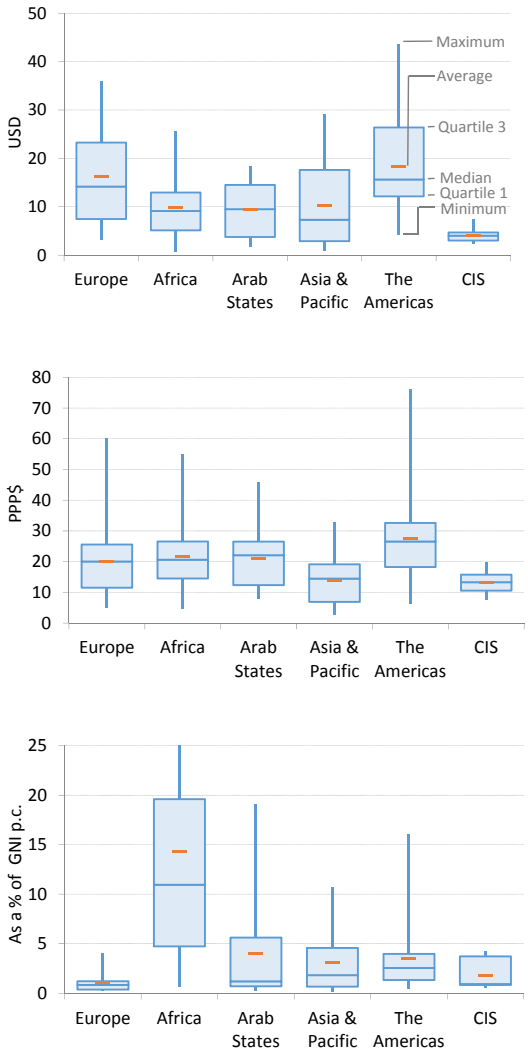
Source: ITU.

and the Arab States have average prices of about USD 10 per month. In the case of Africa, it is noteworthy the narrow range of prices when considering the interquartile range: from USD 5 (first quartile) to USD 13 (third quartile). This range is significantly larger in Asia and the Pacific (USD 3–18), testifying to the diversity in mobile-cellular markets within Asia and the Pacific. Europe and the Americas have the highest average prices of all regions, at USD 16 and USD 18 per month, respectively.

Data in PPP$ confirm that the Americas has the highest median and average prices of all regions, at PPP$ 27 and PPP$ 28 per month, respectively. The region also has the largest spread of prices in PPP terms, because of the relatively high prices (above PPP$ 45 per month) in three of the countries with the lowest incomes in the region: Belize, Guatemala and Nicaragua. Other countries with similar incomes in the Americas – such as Bolivia (Plurinational State of), Haiti and Honduras – demonstrate that mobile-cellular baskets below PPP$ 30 per month are possible in American countries with low incomes.

Africa, Europe and the Arab States have similar median and average PPP prices, ranging from PPP$ 20 to PPP$ 22 per month. The CIS and Asia and the Pacific have significantly lower median and average prices, at PPP$ 13–14 per month. In Asia and the Pacific, the highest prices in USD terms are found in Australia, Japan and the Republic of Korea, three countries which are fundamentally different

Chart 4.11: Mobile-cellular basket in USD (top), in PPP$ (middle) and as a percentage of GNI p.c. (bottom), by region, 2017



Source: ITU.

from most of the other economies in the region insofar as they are predominantly postpaid mobile markets and operators compete with higher-end offers. When analysed in PPP terms, the prices in these three countries are similar to those in other economies in the region, thus also contributing to the relatively low average price in Asia and the Pacific.

An analysis of mobile-cellular prices in terms of GNI p.c. highlights the disparity in the affordability of the service between Africa and the other regions: only one quarter of African countries have similar mobile-cellular prices in terms of GNI p.c. as the majority of countries in other regions. This difference is explained by the disparity in incomes between Africa and the other regions, rather than by causes specific to the ICT sector.

Median prices are at about 1 per cent of GNI p.c. in the Arab States, Europe and the CIS. However, the average is significantly higher in the Arab States, because two of the countries with the lowest incomes in the region, Djibouti and Mauritania, which are also LDCs, have the highest prices in PPP$ terms. Other Arab LDCs with comparable income levels – such as Comoros, Sudan and Somalia – have proven that lower mobile-cellular prices are possible even on the basis of a basket including 51 minutes and 100 SMS per month.

In 2017, the largest reductions in price of the mobile-cellular basket were recorded in Africa (Table 4.2). In Madagascar, operator Telma Mobile offered significantly lower voice rates in 2017, thus driving prices down by PPP$ 37.9 per month. In Sierra Leone, Africell advertised mobile-cellular tariffs in local currency in 2017, whereas in previous years, plans were advertised in USD. The shift to local currency led to a decrease in prices of PPP$ 10.5 per month. Other countries that recorded reductions in the price of the mobile-cellular basket of more than PPP$ 10 per month include Hungary, Spain and Chile. In Chile, operator Movistar offered a package of 100 SMS for PPP$ 4.4 in 2017, thus driving down the price of the mobile-cellular basket by PPP$ 11.0 per month.

Asia and the Pacific was home to the lowest prices for the mobile-cellular basket. Apart from Sri Lanka, which has consistently offered the lowest prices for the mobile-cellular basket worldwide in the last eight years, the Islamic Republic of Iran stood out for outstanding low prices (PPP$ 4.3 per month). The Mobile Communication Company of Iran, a subsidiary of the former incumbent telecommunication operator, now partly privatized, competes in the mobile market with Irancell, partly owned by the transnational operator MTN, as well as with a few smaller or regional operators. The de facto duopoly in the Iranian mobile market, coupled with the ICT policy framework in the country, has ensured sustained low mobile-cellular prices in the last four years, at PPP$ 5.5 per month or below.

Some African countries, such as South Sudan and Kenya, stand out for having some of the lowest prices worldwide for the mobile-cellular basket. In South Sudan, transnational operator Zain has

Table 4.2: Lowest mobile-cellular basket and largest price reduction (2016–2017), by region, 2017

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

Source: ITU.

been offering the lowest prices for the ITU mobile-cellular sub-basket of any country outside Asia and the Pacific since 2016. In Kenya, operator Safaricom reduced off-peak prices and the cost of off-net SMS, bringing them to the same price as on-net SMS. This reduction in prices was enforced in 2016 and maintained in 2017, making the mobile-cellular basket in Kenya one of the least expensive worldwide.

In Europe, Estonia and Lithuania stand out for having very low prices for the mobile-cellular basket, yet including a monthly consumption well beyond 51 minutes and 100 SMS per month. Such a high value proposition is possible because of bundled offers, which include packets of voice, SMS and, in the case of Estonia, also data.

In the Americas, Costa Rica has maintained the least expensive prices in the region since 2008. In 2017, Jamaica was the second country in the region to achieve a mobile-cellular basket below PPP$ 10.0. This was possible thanks to the "One Rate Plan" offered by operator Digicel, which led to a reduction of PPP$ 4.7 per month in the mobile-cellular basket of the country.[10]

In the Arab States, Tunisia and the United Arab Emirates were the two countries with the lowest PPP prices for the mobile-cellular basket, at about PPP$ 8. In the CIS, the countries with the least expensive mobile-cellular baskets were Armenia (PPP$ 7.5) and the Russian Federation (PPP$ 10.4). In the latter, operator MTS offered unlimited on-net minutes on top of the pay-per-use SMS and off-net minutes.[11]

4.3 Mobile-broadband prices

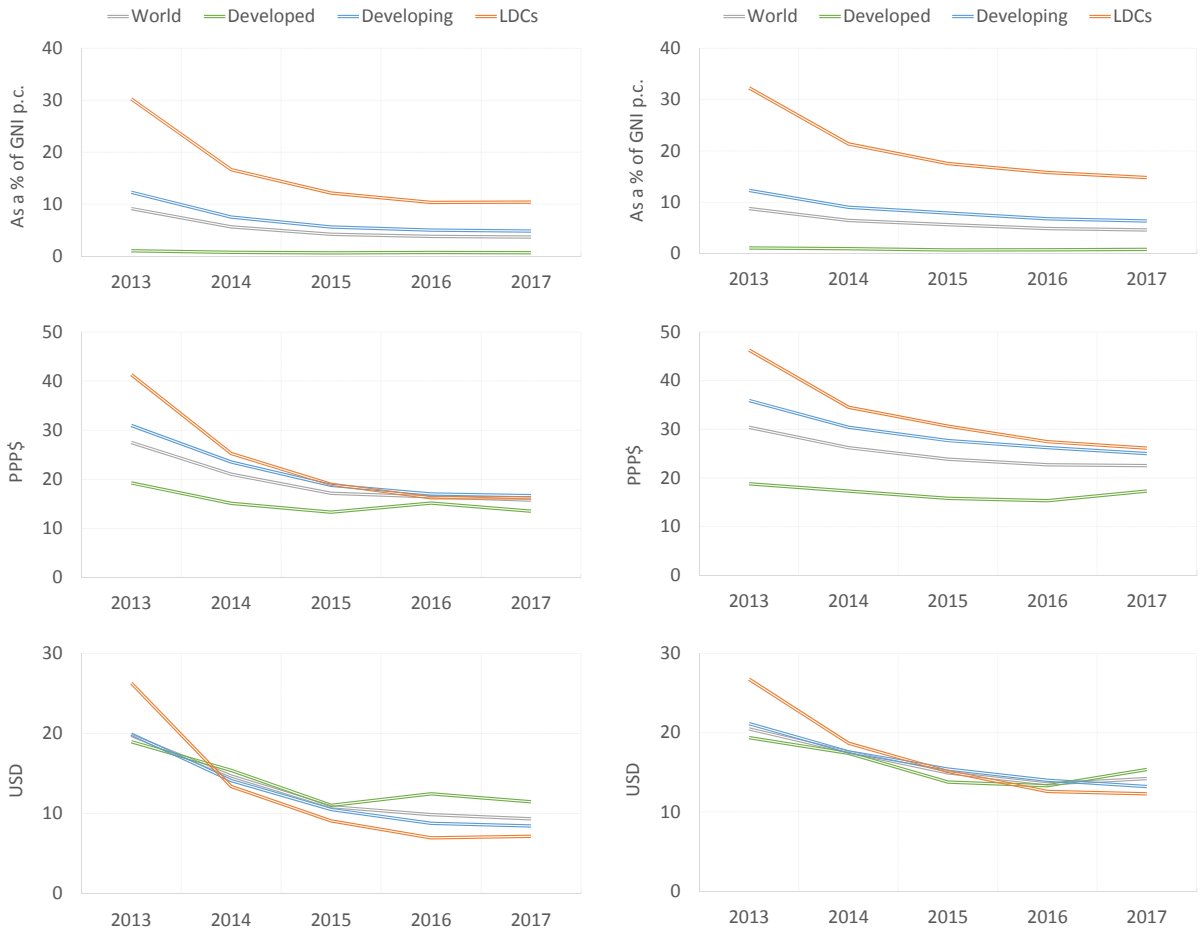
The price of a handset-based mobile-broadband basket including 500 MB per month followed a decreasing trend worldwide in the period 2013–2016 and plateaued in 2017 (Chart 4.12). The global average was driven down by strong reductions in prices in developing countries (CAGR -24 per cent in USD terms from 2013 to 2016) and, in particular, in LDCs (CAGR -36 per cent in USD terms from 2013 to 2016). On the other hand, developed countries recorded decreasing average prices in the period 2013–2015, followed by an upturn in the subsequent two years.

Despite these trends, average prices in PPP terms were still significantly higher in developing countries (PPP$ 16.7 in 2017) than in developed countries (PPP$ 13.5 in 2017), although the gap was remarkably reduced in the period 2013–2016. This explains the persisting differences in the affordability of mobile-broadband services between levels of development. By the end of 2017, average prices in developed countries in terms of GNI p.c. met the target set by the Broadband Commission for 2025 (i.e. 2 per cent of GNI p.c.). By the same year, the average in developing countries had reached the previous Broadband Commission target (i.e. 5 per cent of GNI p.c. by 2015), whereas the average in LDCs was still far from it, corresponding to 10 per cent of GNI p.c. in 2017.

The price of a computer-based mobile-broadband basket including 1 GB per month followed a similar trend as the handset-based mobile-broadband basket: a significant decrease worldwide in the period 2013–2016 driven by decreasing prices in developing countries (CAGR -13 per cent in USD terms) and, particularly, in LDCs (CAGR -22 per cent in USD terms), followed by a plateau in 2017. The latter was the result of a hike in prices in the developed world in 2017.

In 2017, the price of the computer-based mobile-broadband basket was on average 40 per cent

Chart 4.12: 500 MB handset-based (left) and 1 GB computer-based (right) mobile-broadband baskets, as a percentage of GNI p.c. (top), in PPP$ (middle), and in USD (bottom), 2013–2017



Note: Simple averages. Based on the economies for which data on mobile-broadband prices were available for the years 2013–2017. For 500 MB handset-based: 152 economies for data in USD, 142 for data in PPP$, and 150 for data in GNI p.c. terms; 1 GB computer-based: 147 economies for data in USD, 140 for data in GNI p.c. terms, and 143 for data in PPP$. Prices have been capped at USD 100, PPP$ 100 and 100 per cent of GNI p.c. in order to avoid an undue effect of outliers in the averages.
Source: ITU.

higher in PPP$ terms than the price of the handset-based mobile-broadband basket, but offered twice as much data. Differences between the price of the two mobile-broadband baskets were narrower in developed countries (the price of the computer-based basket being 28 per cent higher) than in developing countries (50 per cent) and, in particular, than in LDCs (61 per cent). This suggests that volume discounts for contracting 1 GB per month (computer-based basket) instead of 500 MB per month (handset-based basket) were larger in the developed world. Consequently, differences in average computer-based mobile-broadband prices remained large in 2017: the price of the basket was 45 per cent higher in developing countries than in developed countries in PPP$ terms, and 51 per cent higher in LDCs than in developed countries.

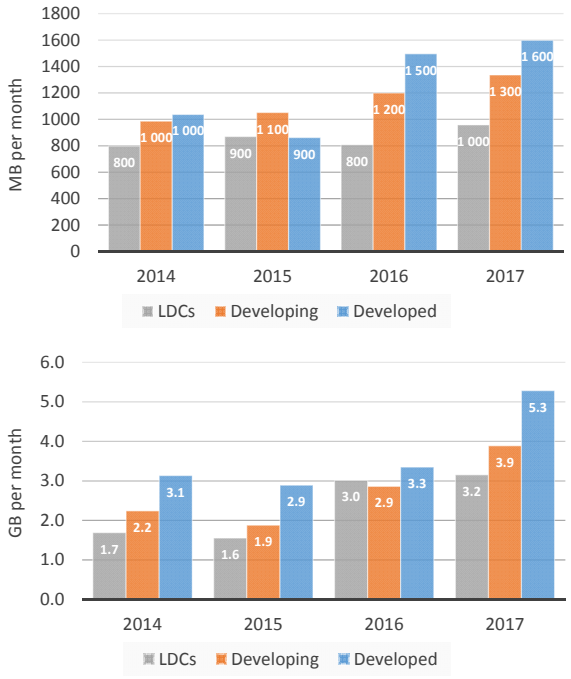
Higher prices for the computer-based mobile-broadband basket in the developing world have an impact on the affordability of the service. Indeed, the average in the developing world corresponded to more than 5 per cent of GNI p.c. in 2017, thus not yet meeting the target set by the Broadband Commission for 2015. In the case of LDCs, average prices represented almost 15 per cent of GNI p.c. in 2017, suggesting that 1 GB of data per month may be unaffordable for large segments of the population in LDCs.

A detailed analysis of the actual composition of the two mobile-broadband baskets reveals that, in most countries, they include more data than the minimum required by the basket. Indeed, as operators upgrade data packages to offer larger data allowances, the least expensive option to

contract 500 MB or 1 GB over a period of 30 days (i.e. considering plans with a validity of 30 days) is often to buy a package with a larger data allowance.

Chart 4.13 shows the evolution of the average monthly allowances for the two mobile-broadband baskets, and sheds some light on the hike in prices recorded in developed countries. Indeed, the significant increase in the average price for the handset-based mobile-broadband basket in the developed world in 2016 coincides with a large rise in the average data allowance. Likewise, the upturn in the average price for the computer-based mobile-broadband basket in developed countries in 2017 goes hand in hand with a significant increase in the average data allowance. These trends suggest that, despite the increase in prices, customers in the developed world are getting more value for money out of their mobile-broadband plans.

Chart 4.13: Average monthly data allowances, 500 MB handset-based (top) and 1 GB computer-based (bottom) mobile-broadband basket, by level of development, 2014–2017



Note: Based on the economies for which data on mobile-broadband data allowances were available for the years 2014–2017. For 500 MB handset-based: 164 economies; 1 GB computer-based: 162 economies.
Source: ITU.

It is noteworthy that, despite the sustained decrease in prices in developing countries and LDCs, average data allowances continued to increase in the developing world. In LDCs, for instance, data allowance increased from 800 MB to 1 GB per month for the handset-based mobile-broadband basket, and from 1.7 to 3.2 GB per month for the computer-based mobile-broadband basket.

Another factor that could be relevant in the evolution of handset-based mobile-broadband prices is the trend towards bundling data, voice and SMS into low-cost packages. However, given that the ITU handset-based mobile-broadband basket is based on prepaid plans, the impact of bundling on the basket prices has remained limited. Indeed, in 2017, only in eight developed countries (17 per cent of the total) and four developing countries (3 per cent of the total) was the ITU handset-based mobile-broadband basket calculated based on a plan that included voice minutes and SMS together with the data allowance.

Data plans offered by some mobile operators also feature the so-called zero-rated services, which are offered on top of the metered data allowance. This is the case, for instance, of operator Digicel, which offers unlimited WhatsApp messaging to their clients contracting a data package in Antigua and Barbuda, Jamaica and Saint Lucia.

Benchmarking countries

The price of a prepaid handset-based mobile-broadband basket (500 MB per month) ranges from less than PPP$ 3 per month in Cambodia, Poland and Myanmar to more than PPP$ 60 per month in Mauritania (Table 4.3). In the latter, operator Mauritel offers unlimited data with the plans “Comfort PASS” for USD 30.4 per month, therefore offering a high value proposition to customers, albeit at a relatively high price compared with the global average (USD 10.2).[12]

Almost three out of four countries worldwide offer handset-based mobile-broadband prices below PPP$ 20 per month, including LDCs such as Cambodia, Myanmar, Bhutan and Bangladesh, which are among the top 10 countries with the least expensive handset-based mobile-broadband baskets. These findings confirm the relatively low prices of handset-based mobile-broadband services in many countries worldwide, which

has been a key enabler for the spread of mobile-broadband services in recent years (see Chapter 1).

Prices of the postpaid computer-based mobile-broadband basket (1 GB per month) range from less than PPP$ 5 per month in Sri Lanka and Cambodia to more than PPP$ 60 per month in Antigua and Barbuda, Côte d'Ivoire, Haiti, Mauritania and Zimbabwe (Table 4.4). All these countries with high mobile-broadband prices for 1 GB of monthly consumption – except Mauritania – offer prices 40 per cent lower or more when the monthly data consumption is reduced to 500 MB. This suggests that operators in these countries have pricing schemes focused on lower data consumptions or validity periods shorter than a month. Indeed, this is a well-known commercial strategy in LDCs, where operators resort to innovative pricing schemes to make mobile-broadband services affordable to lower-income customers (Box 4.3).

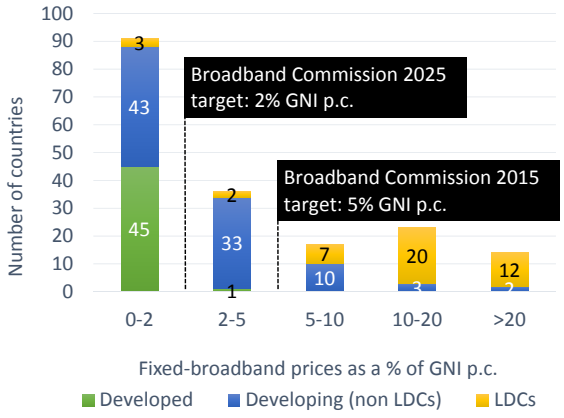
An analysis of handset-based mobile-broadband prices in GNI p.c. terms reveals that the most affordable prices are found in Macao (China), which is also the economy with the most affordable mobile-cellular prices (Table 4.1). This comes as no surprise given that Macao (China) has been the economy with both the highest mobile-cellular and mobile-broadband penetration worldwide since 2010. Despite the small size of the economy, Macao (China) is a world champion when it comes to competition in the mobile market, with four mobile operators competing in the sector, all of them having been granted LTE licences (see Volume 2).

A country that stands out in the global ranking for affordable handset-based mobile-broadband prices is Egypt: it is the only non-high-income country in the top 20. Vodafone Egypt has been offering mobile Internet bundles with 500 MB or 800 MB per month at a price below USD 5 since 2015. This coincides with a 2.4 fold increase in mobile data consumption in the country during the period 2015–2017, suggesting that the availability of affordable prepaid handset-based mobile-broadband packages is pushing up data consumption in the country.

The global ranking for the computer-based mobile-broadband basket is dominated by European countries, with Austria at the top with a price basket corresponding to 0.15 per cent of GNI p.c. Singapore and the Republic of Korea are the only non-European countries among the top 15.

Apart from top performers, a majority of countries (70 per cent) offered computer-based mobile-broadband plans in 2017, meeting the target set by the Broadband Commission for 2015, and about half of all countries in 2017 had already met the 2025 target set by the Broadband Commission (Chart 4.14). The proportion of countries meeting the affordability targets set by the Broadband Commission was significantly smaller in 2017 when considering fixed-broadband services (61 per cent met the 5 per cent target, and 39 per cent the 2 per cent target, see Chart 4.26).

Chart 4.14: Number of countries having achieved the Broadband Commission targets with computer-based mobile-broadband services (1 GB per month), 2017



Source: ITU.

In 2017, all developed countries – except one – had computer-based mobile-broadband prices corresponding to less than 2 per cent of GNI p.c., thus already meeting the 2025 target set by the Broadband Commission. Similarly, 34 per cent of developing countries also offered computer-based mobile-broadband plans representing less than 2 per cent of GNI p.c. in 2017.

On the other hand, most of the countries not yet having met the 2015 affordability target set by the Broadband Commission were LDCs. A closer look at mobile-broadband offers in these LDCs reveals that prices for the prepaid handset-based mobile-broadband basket in a number of them met the 5 per cent target in 2017. This was the case in Angola, Guinea, Haiti, Nepal (Republic of), Rwanda, Sao Tome and Principe, Sudan, Tanzania,

Table 4.3: Mobile-broadband basket, prepaid handset-based, 500 MB, 2017

Rank	Economy	Mobile-broadband, prepaid handset-based (500 MB)			Monthly data allowance (MB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
1	Macao, China*	0.07	3.61	4.46	500	0.0	65,130
2	Poland	0.12	1.32	2.66	500	23.0	12,710
3	Sweden	0.13	5.73	5.11	500	25.0	52,590
4	Switzerland	0.13	9.04	6.30	500	8.0	80,560
5	Denmark	0.15	6.82	5.34	500	25.0	55,220
6	Estonia	0.15	2.25	3.30	500	20.0	18,190
7	Austria	0.15	5.63	5.86	1024	20.0	45,440
8	Singapore	0.16	7.24	8.52	1024	7.0	54,530
9	Luxembourg	0.19	11.27	9.93	500	17.0	70,260
10	Hong Kong, China	0.25	9.75	11.78	600	0.0	46,310
11	Lithuania	0.27	3.38	5.84	1536	21.0	15,200
12	Uruguay	0.27	3.49	4.27	512	22.0	15,250
13	Iceland	0.28	13.95	9.23	1024	24.0	60,830
14	Brunei Darussalam	0.29	7.24	12.62	1024	0.0	29,600
15	Spain	0.30	6.76	8.15	1536	21.0	27,180
16	Qatar	0.32	16.48	21.25	1000	0.0	61,070
17	Egypt	0.34	0.84	5.47	500	15.0	3,010
18	Hungary	0.34	3.64	6.69	500	27.0	12,870
19	Netherlands	0.35	13.52	13.44	500	21.0	46,180
20	Latvia	0.37	4.49	6.92	600	21.0	14,740
21	Georgia	0.38	1.20	3.52	500	21.0	3,790
22	Belarus	0.38	1.68	6.70	500	25.0	5,280
23	New Zealand	0.42	13.50	11.59	1280	15.0	38,970
24	Turkey	0.42	3.84	8.73	500	23.0	10,930
25	Bahamas	0.44	10.75	9.42	2048	7.5	29,170
26	Russian Federation	0.45	3.43	8.04	2250	18.0	9,232
27	United States	0.45	21.76	21.76	1024	8.9	58,270
28	United Kingdom	0.46	15.44	14.96	500	20.0	40,530
29	Germany	0.47	16.87	18.01	600	19.0	43,490
30	Iran (Islamic Republic of)	0.47	2.11	5.86	600	9.0	5,400
31	Norway	0.48	30.10	23.71	500	25.0	75,990
32	Canada	0.49	17.41	16.67	500	13.0	42,870
33	Sri Lanka	0.49	1.56	4.71	2048	19.7	3,840
34	Slovakia	0.49	6.76	10.97	1024	20.0	16,610
35	Ireland	0.49	22.54	20.09	1024	23.0	55,290
36	Malaysia	0.49	3.94	10.22	1200	6.0	9,650
37	Slovenia	0.49	9.02	11.86	500	22.0	22,000
38	United Arab Emirates	0.50	16.34	21.38	500	0.0	39,130
39	Azerbaijan	0.51	1.74	7.92	500	18.0	4,080
40	Israel	0.54	16.67	13.58	500	17.0	37,270
41	Australia	0.54	22.99	18.71	3072	10.0	51,360
42	Finland	0.54	20.17	18.38	Unltd.	24.0	44,580
43	Portugal	0.55	9.00	11.82	1024	23.0	19,820
44	Czech Republic	0.56	8.51	13.93	1024	21.0	18,160
45	Croatia	0.58	6.04	10.07	500	25.0	12,430
46	China	0.61	4.44	7.80	500	6.0	8,690

Table 4.3: Mobile-broadband basket, prepaid handset-based, 500 MB, 2017 (continued)

Rank	Economy	Mobile-broadband, prepaid handset-based (500 MB)			Monthly data allowance (MB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
47	Kuwait	0.63	16.48	25.43	5120	0.0	31,430
48	Bahrain	0.63	10.64	17.37	4096	0.0	20,240
49	Greece	0.64	9.58	12.57	500	24.0	18,090
50	Italy	0.65	16.79	18.43	2048	22.0	31,020
51	Bhutan	0.67	1.52	4.44	855	5.0	2,720
52	Mauritius	0.67	5.68	10.07	800	15.0	10,140
53	Romania	0.68	5.63	12.04	4096	19.0	9,970
54	Kazakhstan	0.70	4.57	13.09	500	12.0	7,890
55	Myanmar	0.70	0.70	2.79	600	5.0	1,190
56	France	0.71	22.54	23.04	4096	20.0	37,970
57	Argentina	0.71	7.76		1400	21.0	13,040
58	Andorra**	0.73	22.54		2000	4.5	36,987
59	Bulgaria	0.80	5.17	12.08	1500	20.0	7,760
60	Belgium	0.81	28.17	28.49	500	21.0	41,790
61	Malta	0.82	16.23	22.03	500	18.0	23,810
62	Costa Rica	0.84	7.75	11.78	500	13.0	11,040
63	Ukraine	0.85	1.69	7.61	500	20.0	2,388
64	Maldives	0.86	6.82	8.80	500	6.0	9,570
65	Oman	0.86	10.40	20.07	600	0.0	14,440
66	Armenia	0.93	3.11	7.62	1000	20.0	4,000
67	Sudan	0.94	1.87		500	30.0	2,379
68	Chile	0.95	10.79	15.38	2048	19.0	13,610
69	Cambodia	0.98	1.00	2.46	700	10.0	1,230
70	Korea (Rep. of)	0.99	23.35	26.30	650	10.0	28,380
71	Saint Kitts and Nevis	1.03	13.70	17.93	1024	17.0	16,030
72	Serbia	1.07	4.64	10.09	800	20.0	5,180
73	Kyrgyzstan	1.08	1.02	3.38	500	17.0	1,130
74	Cyprus	1.08	21.41	27.02	540	19.0	23,719
75	Mexico	1.10	7.93	14.83	1500	16.0	8,610
76	The Former Yugoslav Rep. of Macedonia	1.12	4.55	10.82	1024	18.0	4,880
77	Antigua and Barbuda	1.13	13.33	16.45	3072	15.0	14,170
78	Pakistan	1.15	1.52	4.99	2000	19.5	1,580
79	Barbados	1.16	15.00	12.23	1536	17.5	15,540
80	Moldova	1.19	2.16	5.84	500	20.0	2,180
81	Seychelles	1.23	14.51	22.93	600	15.0	14,180
82	Gabon	1.25	6.87	10.81	500	18.0	6,610
83	Lao P.D.R.	1.27	2.39	6.16	540	10.0	2,270
84	Albania	1.28	4.62	9.87	1000	20.0	4,320
85	Libya	1.32	7.17		500	0.0	6,540
86	Panama	1.37	15.00	25.41	1024	7.0	13,100
87	Jamaica	1.38	5.47	8.78	800	16.5	4,750
88	Indonesia	1.39	4.11	11.03	1024	10.0	3,540
89	Brazil	1.40	10.01	14.57	1200	40.2	8,580
90	Tunisia	1.42	4.13	12.07	2048	23.9	3,500
91	Cabo Verde	1.44	3.58	7.66	500	15.0	2,990

Table 4.3: Mobile-broadband basket, prepaid handset-based, 500 MB, 2017 (continued)

Rank	Economy	Mobile-broadband, prepaid handset-based (500 MB)			Monthly data allowance (MB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
92	Lebanon	1.44	10.00	16.59	500	10.0	8,310
93	Japan	1.47	47.18	49.39	2048	8.0	38,550
94	Jordan	1.49	4.93	10.55	500	8.0	3,980
95	Bangladesh	1.51	1.85	4.68	500	21.0	1,470
96	Turkmenistan	1.55	8.57		500	15.0	6,650
97	Guyana	1.56	5.81	9.15	500	16.0	4,460
98	Saudi Arabia	1.59	26.67	51.69	560	0.0	20,080
99	Bosnia and Herzegovina	1.64	6.74	14.56	2048	17.0	4,940
100	South Africa	1.64	7.42	15.76	500	14.0	5,430
101	Saint Lucia	1.72	12.59	16.15	3072	15.0	8,780
102	Viet Nam	1.73	3.13	7.72	600	10.0	2,170
103	Thailand	1.75	8.70	23.04	4096	7.0	5,960
104	Palestine	1.82	4.83	6.84	800	16.0	3,180
105	India	1.83	2.78	9.06	1024	18.0	1,820
106	Peru	1.85	9.20	17.29	2048	18.0	5,970
107	Nigeria	1.89	3.27	8.09	1024	5.0	2,080
108	Philippines	1.94	5.93	15.15	3174	12.0	3,660
109	Dominican Rep.	1.98	10.93	23.35	1024	30.0	6,630
110	Morocco	2.16	5.16	11.89	5120	20.0	2,863
111	Tonga	2.17	7.25	9.82	500	15.0	4,010
112	Bolivia (Plurinational State of)	2.22	5.79	11.65	500	13.0	3,130
113	Ghana	2.22	2.76	8.55	720	17.5	1,490
114	Mongolia	2.47	6.76	19.53	3072	10.0	3,290
115	Iraq	2.55	10.14	19.83	500	0.0	4,770
116	Cameroon	2.58	2.92	7.12	500	19.3	1,360
117	Côte d'Ivoire	2.68	3.44	8.51	800	18.0	1,540
118	Timor-Leste	2.68	4.00	6.13	800	0.0	1,790
119	Angola	2.71	7.53	9.62	500	10.0	3,330
120	Namibia	2.72	10.44	22.06	800	0.0	4,600
121	Paraguay	2.72	8.90	19.25	1500	10.0	3,920
122	Nauru	2.78	23.66		1800	15.0	10,220
123	Fiji	2.80	11.59	18.65	3200	9.0	4,970
124	Tanzania	2.97	2.24	6.18	500	18.0	905
125	Colombia	2.99	14.54	31.28	2048	16.0	5,830
126	Vanuatu	3.10	7.53	6.90	800	12.5	2,920
127	Sao Tome and Principe	3.12	4.60	7.37	900	5.0	1,770
128	Uzbekistan	3.19	5.27		500	20.0	1,980
129	Algeria	3.28	10.81	31.24	1536	17.0	3,960
130	Dominica	3.50	20.37	27.92	1536	15.0	6,990
131	Montenegro	3.66	22.43	45.60	20000	19.0	7,350
132	Grenada	3.68	29.63	39.81	3000	15.0	9,650
133	Guatemala	3.98	13.47	22.77	2048	12.0	4,060
134	Suriname	3.99	20.03	46.19	7168	8.0	6,020
135	Rwanda	4.01	2.41	6.58	1024	18.0	720
136	Kenya	4.03	4.84	10.75	700	26.0	1,440
137	Nepal (Republic of)	4.07	2.68	7.64	1000	13.0	790

Table 4.3: Mobile-broadband basket, prepaid handset-based, 500 MB, 2017 (continued)

Rank	Economy	Mobile-broadband, prepaid handset-based (500 MB)			Monthly data allowance (MB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
138	Ecuador	4.07	20.00	32.97	4000	12.0	5,890
139	Belize	4.10	15.00	26.32	2400	12.5	4,390
140	Congo (Rep. of the)	4.24	4.81		600	18.0	1,360
141	Haiti	4.39	2.78	6.35	1000	10.0	760
142	Samoa	4.63	15.82	21.53	2080	15.0	4,100
143	Guinea	4.71	3.22	7.37	900	20.0	820
144	El Salvador	4.72	14.00	27.18	2000	13.0	3,560
145	Tajikistan	4.96	4.09	15.01	1500	23.0	990
146	Botswana	5.10	28.99	57.26	500	12.0	6,820
147	Saint Vincent and the Grenadines	5.49	32.00	44.46	6144	15.0	6,990
148	Papua New Guinea	6.25	12.54	15.29	600	10.0	2,410
149	Ethiopia	6.27	3.87	9.80	500	15.0	740
150	Kiribati	6.62	15.33		1800		2,780
151	Lesotho	7.03	7.50	21.40	1024	5.0	1,280
152	Mozambique	7.19	2.52	8.24	1536	17.0	420
153	Benin	7.73	5.15	13.43	600	18.0	800
154	Yemen*	8.13	6.98		500		1,030
155	Nicaragua	8.25	14.64	39.09	3000	15.0	2,130
156	Burkina Faso	8.45	4.29	11.45	500	18.0	610
157	Senegal	8.68	6.87	17.00	1200	23.0	950
158	Honduras	9.08	17.03	34.03	1024	15.0	2,250
159	Burundi	9.57	2.31	5.90	500	18.0	290
160	Zambia	9.99	10.82	27.50	500	33.5	1,300
161	Micronesia	10.03	30.00		2048	0.0	3,590
162	Afghanistan	10.83	5.15	16.84	1500	0.0	570
163	Uganda	11.08	5.54	16.57	500	18.0	600
164	Gambia	11.16	4.18	14.37	500	21.3	450
165	Niger	11.45	3.44	9.06	1000	19.0	360
166	Madagascar	11.55	3.85	13.36	500	20.0	400
167	South Sudan*	12.27	3.99	29.42	500	13.0	390
168	Guinea-Bissau	12.49	6.87	16.40	600	15.0	660
169	Mali	12.58	8.07	21.48	500	18.0	770
170	Sierra Leone	14.66	6.23	19.95	500	15.0	510
171	Comoros	15.19	9.62		600		760
172	Liberia	15.79	5.00	6.35	2048	15.0	380
173	Togo	16.90	8.59	21.38	1536	18.0	610
174	Solomon Islands	17.43	27.89	28.06	3277	10.0	1,920
175	Djibouti	17.96	28.13	47.80	500	10.0	1,880
176	Malawi	17.97	4.79	16.89	1229	16.5	320
177	Chad	19.63	10.31	20.90	512	18.0	630
178	Zimbabwe	26.37	20.00	39.40	850	20.0	910
179	Mauritania	33.19	30.43	79.82	Unltd.	18.0	1,100
180	Central African Rep.	52.86	17.18		2560		390
181	Dem. Rep. of the Congo	53.33	20.00	50.07	800	13.0	450
	Cuba***		8.00		600		
	Syrian Arab Republic***		9.14		600	0.0	

Table 4.3: Mobile-broadband basket, prepaid handset-based, 500 MB, 2017 (continued)

Rank	Economy	Mobile-broadband, prepaid handset-based (500 MB)			Monthly data allowance (MB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
	Somalia***		10.00		3072	10.0	
	San Marino***		22.54	25.94	3072	0.0	
	Monaco***		56.33		20480	20.0	

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference. Unltd: unlimited data allowance. *Data correspond to the GNI p.c. (Atlas method) in 2016. **Data correspond to the GNI p.c. in 2016, sourced from UNSD. ***Country not ranked because data on GNI p.c. are not available.
Source: ITU. GNI p.c. and PPP$ values are based on World Bank data.

Timor-Leste and Vanuatu (Table 4.3). Moreover, the handset-based prepaid basket already included 1 GB per month in Haiti, Nepal (Republic of) and Rwanda, and therefore can be considered on equal terms as the postpaid computer-based basket in these countries.

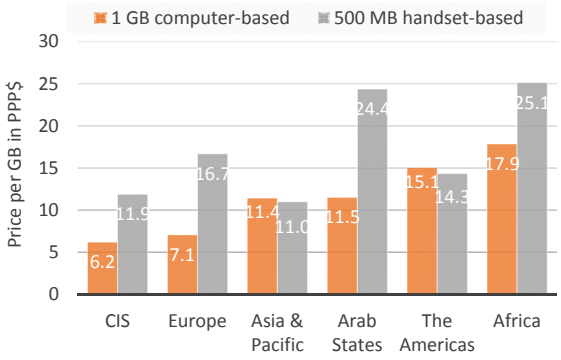
The affordability of prepaid handset-based mobile-broadband services in these LDCs gives a strong indication that it might be the best vector for ensuring affordable Internet access to all if operators in these countries are able to maintain current price levels while continuing the progressive increase in data allowances observed in previous years (Chart 4.13).

An analysis of data allowances for the mobile-broadband baskets indicates that the largest data caps are offered when plans are based on LTE technologies. For instance, in Montenegro, operator Telenor was the first to launch LTE services in 2012 and, in 2017, it offered a prepaid Internet package including 10 GB of data at LTE speeds for USD 22.4 per month. In Kuwait, the assignment in 2016 of frequencies for LTE services in the 1 800 MHz band to the three mobile network operators in the country led to a surge in the data allowances offered by operators. This is particularly true for computer-based mobile-broadband plans, which are a very popular means of accessing the Internet in Kuwait.[15] In this context, operator Zain offered a postpaid computer-based plan with 500 GB per month at LTE speeds for USD 19.8 in 2017, and a plan with 1 TB per month at USD 33.1. Such high data allowances explain why Kuwait has one of the highest mobile data consumptions per subscription in the world.[16]

Regional analysis of mobile-broadband prices

A regional analysis of the mobile-broadband baskets reveals that the average price paid per GB of data varies significantly across regions (Chart 4.15).

Chart 4.15: Average mobile-broadband prices in PPP$ per GB, by region, 2017



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

As could be expected, the average price per GB was lower for the basket including the largest data allowance (i.e. the computer-based mobile-broadband basket) in most regions, given the volume discounts that operators offer to customers contracting larger data allowances. The exceptions were the Americas and Asia and the Pacific, where large data allowances and low prices for prepaid handset-based mobile-broadband plans made the differences in volume less significant.[17]

The lowest average price per GB was recorded in the CIS, followed by Europe, both regions having average prices below PPP$ 10 per GB for computer-based plans. In the Americas and Africa,

Table 4.4: Mobile-broadband basket, postpaid computer-based, 1 GB, 2017

Rank	Economy	Mobile-broadband, postpaid computer-based (1 GB)			Monthly data allowance (GB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
1	Austria	0.15	5.63	5.86	1	20.0	45,440
2	Luxembourg	0.19	11.27	9.93	2	17.0	70,260
3	Poland	0.25	2.64	5.31	10	23.0	12,710
4	Sweden	0.26	11.58	10.33	6	25.0	52,590
5	Australia	0.27	11.50	9.35	1	10.0	51,360
6	Iceland	0.28	13.95	9.23	1	24.0	60,830
7	Singapore	0.32	14.41	16.95	2	7.0	54,530
8	France	0.36	11.26	11.51	2	20.0	37,970
9	Norway	0.38	24.06	18.95	5	25.0	75,990
10	Denmark	0.39	18.02	14.13	10	25.0	55,220
11	Korea (Rep. of)	0.41	9.73	10.96	1	10.0	28,380
12	Slovenia	0.43	7.88	10.37	1	22.0	22,000
13	Italy	0.44	11.27	12.37	4	22.0	31,020
14	Israel	0.44	13.61	11.09	5	17.0	37,270
15	Romania	0.44	3.67	7.85	10	19.0	9,970
16	United Kingdom	0.46	15.44	14.96	2	20.0	40,530
17	Germany	0.47	16.89	18.04	1	19.0	43,490
18	Costa Rica	0.48	4.41	6.70	1	13.0	11,040
19	Belgium	0.49	16.90	17.10	2	21.0	41,790
20	Qatar	0.49	24.73	31.88	8	0.0	61,070
21	Sri Lanka	0.49	1.56	4.71	2	19.7	3,840
22	Andorra**	0.50	15.31		1	4.5	36,987
23	Egypt	0.50	1.27	8.21	1	15.0	3,010
24	Ireland	0.54	24.79	22.10	15	23.0	55,290
25	Malta	0.57	11.27	15.30	5	18.0	23,810
26	Switzerland	0.59	39.61	27.59	10	8.0	80,560
27	Estonia	0.59	9.00	13.19	2	20.0	18,190
28	Uruguay	0.60	7.67	9.39	3	22.0	15,250
29	Finland	0.62	23.19	21.13	1	24.0	44,580
30	Trinidad and Tobago	0.64	8.13	9.72	1	12.5	15,350
31	Georgia	0.64	2.02	5.94	1	21.0	3,790
32	Hong Kong, China	0.66	25.41	30.69	1	0.0	46,310
33	Iran (Islamic Republic of)	0.67	3.01	8.37	2	9.0	5,400
34	United States	0.67	32.64	32.64	10	8.9	58,270
35	New Zealand	0.68	22.02	18.91	1	15.0	38,970
36	Azerbaijan	0.68	2.32	10.55	1	18.0	4,080
37	Macao, China*	0.68	37.13	45.81	1	0.0	65,130
38	Kazakhstan	0.70	4.57	13.09	5	12.0	7,890
39	Lithuania	0.70	8.90	15.38	50	21.0	15,200
40	Netherlands	0.73	28.17	27.99	2	21.0	46,180
41	Spain	0.75	16.90	20.37	2	21.0	27,180
42	Kuwait	0.76	19.78	30.51	500	0.0	31,430
43	Russian Federation	0.78	6.00	14.07	3	18.0	9,232
44	Slovakia	0.81	11.26	18.26	2	20.0	16,610
45	Brunei Darussalam	0.82	20.28	35.34	2	0.0	29,600
46	United Arab Emirates	0.83	26.96	35.28	1	0.0	39,130

Table 4.4: Mobile-broadband basket, postpaid computer-based, 1 GB, 2017 (continued)

Rank	Economy	Mobile-broadband, postpaid computer-based (1 GB)			Monthly data allowance (GB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
47	Argentina	0.83	9.06		1	27.0	13,040
48	Cyprus	0.86	16.90	21.33	1	19.0	23,719
49	Bahamas	0.88	21.49	18.82	1	7.5	29,170
50	Latvia	0.92	11.27	17.38	15	21.0	14,740
51	Belarus	0.93	4.09	16.28	4	25.0	5,280
52	Ukraine	0.94	1.88	8.46	2	20.0	2,388
53	Greece	0.96	14.54	19.07	3	24.0	18,090
54	Czech Republic	0.99	14.93	24.44	2	21.0	18,160
55	China	1.02	7.40	13.00	1	6.0	8,690
56	Portugal	1.02	16.90	22.20	5	23.0	19,820
57	Mauritius	1.03	8.67	15.37	1	15.0	10,140
58	Bulgaria	1.07	6.91	16.15	2	20.0	7,760
59	Oman	1.08	13.00	25.08	1	0.0	14,440
60	Saint Kitts and Nevis	1.08	14.44	18.90	1	17.0	16,030
61	Canada	1.10	39.18	37.52	3	13.0	42,870
62	Mexico	1.10	7.87	14.73	1	16.0	8,610
63	Tunisia	1.13	3.31	9.65	2	23.9	3,500
64	Croatia	1.15	11.93	19.89	4	25.0	12,430
65	Montenegro	1.19	7.31	14.87	2	19.0	7,350
66	South Africa	1.24	5.62	11.94	1	14.0	5,430
67	Gabon	1.25	6.87	10.81	1	18.0	6,610
68	Saudi Arabia	1.25	21.00	40.71	10	5.0	20,080
69	Albania	1.28	4.62	9.87	1	20.0	4,320
70	Serbia	1.29	5.55	12.07	1	20.0	5,180
71	The Former Yugoslav Rep. of Macedonia	1.34	5.47	12.99	1	18.0	4,880
72	Turkey	1.35	12.34	28.05	8	23.0	10,930
73	Chile	1.36	15.40	21.95	5	19.0	13,610
74	Indonesia	1.39	4.11	11.03	1	10.0	3,540
75	Seychelles	1.40	16.49	26.06	1	15.0	14,180
76	Bhutan	1.42	3.21	9.38	1	5.0	2,720
77	Japan	1.47	47.18	49.39	2	8.0	38,550
78	Hungary	1.52	16.34	30.01	6	27.0	12,870
79	Bahrain	1.58	26.60	43.43	40	0.0	20,240
80	Barbados	1.62	21.00	17.12	2	17.5	15,540
81	Myanmar	1.63	1.62	6.46	1	5.0	1,190
82	Bosnia and Herzegovina	1.64	6.74	14.56	2	17.0	4,940
83	Maldives	1.72	13.71	17.68	2	6.0	9,570
84	Thailand	1.75	8.70	23.04	4	7.0	5,960
85	Mongolia	1.78	4.88	14.09	5	10.0	3,290
86	Panama	1.83	19.95	33.79	1	7.0	13,100
87	Nigeria	1.89	3.27	8.09	1	5.0	2,080
88	Philippines	1.94	5.93	15.15	4	12.0	3,660
89	Cambodia	1.95	2.00	4.93	2	10.0	1,230
90	Dominican Rep.	1.95	10.79	23.06	2	30.0	6,630
91	Libya	1.97	10.76		1	0.0	6,540

Table 4.4: Mobile-broadband basket, postpaid computer-based, 1 GB, 2017 (continued)

Rank	Economy	Mobile-broadband, postpaid computer-based (1 GB)			Monthly data allowance (GB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
92	Grenada	2.12	17.04	22.89	1	15.0	9,650
93	Armenia	2.18	7.25	17.78	15	20.0	4,000
94	Algeria	2.18	7.21	20.82	1	17.0	3,960
95	Botswana	2.19	12.47	24.62	1	12.0	6,820
96	Bangladesh	2.32	2.85	7.19	2	21.0	1,470
97	Malaysia	2.39	19.23	49.84	20	6.0	9,650
98	Suriname	2.40	12.02	27.71	3	8.0	6,020
99	Colombia	2.52	12.23	26.33	1	16.0	5,830
100	Lao P.D.R.	2.53	4.79	12.32	6	10.0	2,270
101	Morocco	2.55	6.09	14.03	7	20.0	2,863
102	Fiji	2.77	11.47	18.45	8	9.0	4,970
103	Bolivia (Plurinational State of)	2.77	7.24	14.56	1	13.0	3,130
104	Peru	2.77	13.80	25.94	1	18.0	5,970
105	Turkmenistan	2.84	15.71		1	15.0	6,650
106	Viet Nam	2.97	5.36	13.24	2	10.0	2,170
107	Lebanon	3.02	20.90	34.67	2	10.0	8,310
108	Iraq	3.19	12.67	24.78	1	0.0	4,770
109	Tonga	3.26	10.88	14.73	1	15.0	4,010
110	Paraguay	3.27	10.68	23.10	1	10.0	3,920
111	El Salvador	3.37	9.99	19.40	2	13.0	3,560
112	Belize	3.42	12.50	21.93	1	12.5	4,390
113	Ecuador	3.42	16.80	27.69	1	12.0	5,890
114	Moldova	3.57	6.49	17.52	10	16.7	2,180
115	Palestine	3.65	9.67	13.67	3	16.0	3,180
116	Ghana	3.70	4.60	14.25	1	17.5	1,490
117	Dominica	3.81	22.22	30.47	1	15.0	6,990
118	Namibia	3.82	14.65	30.95	2	0.0	4,600
119	Kenya	4.03	4.84	10.75	1	26.0	1,440
120	India	4.04	6.13	19.97	20	18.0	1,820
121	Kyrgyzstan	4.63	4.36	14.49	1	17.0	1,130
122	Honduras	4.66	8.74	17.46	1	15.0	2,250
123	Nauru	4.75	40.44		1	15.0	10,220
124	Brazil	4.82	34.46	50.14	8	40.2	8,580
125	Jordan	4.93	16.34	34.96	5	16.0	3,980
126	Tajikistan	4.96	4.09	15.01	1	23.0	990
127	Antigua and Barbuda	4.99	58.89	72.67	25	15.0	14,170
128	Jamaica	5.33	21.10	33.86	10	16.5	4,750
129	Tanzania	5.35	4.04	11.12	1	18.0	905
130	Senegal	5.43	4.29	10.63	1	23.0	950
131	Saint Vincent and the Grenadines	5.72	33.33	46.31	5	15.0	6,990
132	Samoa	5.79	19.77	26.91	2	15.0	4,100
133	Cameroon	6.06	6.87	16.75	2	19.3	1,360
134	Cabo Verde	6.52	16.26	34.79	6	15.0	2,990
135	Sudan	6.79	13.47		10	0.0	2,379
136	Mozambique	7.19	2.52	8.24	2	17.0	420
137	Pakistan	7.19	9.47	31.14	15	32.0	1,580

Table 4.4: Mobile-broadband basket, postpaid computer-based, 1 GB, 2017 (continued)

Rank	Economy	Mobile-broadband, postpaid computer-based (1 GB)			Monthly data allowance (GB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
138	Congo (Rep. of the)	7.43	8.42		1	18.0	1,360
139	Nicaragua	7.50	13.31	35.54	1	15.0	2,130
140	Guyana	7.58	28.15	44.32	4	14.0	4,460
141	Guatemala	8.00	27.08	45.77	4	12.0	4,060
142	Angola	8.14	22.60	28.85	1	10.0	3,330
143	Timor-Leste	8.38	12.50	19.15	1	0.0	1,790
144	Lesotho	8.79	9.37	26.75	1	5.0	1,280
145	Micronesia	10.03	30.00		2	0.0	3,590
146	Benin	10.31	6.87	17.90	1	18.0	800
147	Djibouti[1]	10.77	16.88	28.68		7.0	1,880
148	Afghanistan	10.83	5.15	16.84	2	0.0	570
149	Niger	11.45	3.44	9.06	1	19.0	360
150	Nepal (Republic of)	11.48	7.56	21.56	1	13.0	790
151	Guinea	11.83	8.09	18.50	3	20.0	820
152	Ethiopia	12.18	7.51	19.02	1	15.0	740
153	Zambia	12.61	13.66	34.71	1	33.5	1,300
154	Burundi	13.16	3.18	8.12	1	18.0	290
155	Burkina Faso	13.52	6.87	18.32	1	18.0	610
156	Papua New Guinea	15.46	31.05	37.85	2	10.0	2,410
157	Vanuatu	15.48	37.67	34.48	2	12.5	2,920
158	Yemen*	15.72	13.50		1		1,030
159	Gambia	15.73	5.90	20.27	1	21.3	450
160	Liberia	15.79	5.00	6.35	2	15.0	380
161	Uzbekistan	15.97	26.35		1	20.0	1,980
162	Uganda	16.61	8.31	24.86	1	18.0	600
163	Togo	16.90	8.59	21.38	2	18.0	610
164	Solomon Islands	17.43	27.89	28.06	3	10.0	1,920
165	Malawi	17.97	4.79	16.89	1	16.5	320
166	Comoros	18.99	12.03		1		760
167	Sao Tome and Principe	19.10	28.17	45.14	3	5.0	1,770
168	Mali	20.08	12.88	34.28	1	18.0	770
169	Côte d'Ivoire	20.68	26.54	65.70	15	18.0	1,540
170	Madagascar	21.66	7.22	25.05	1	20.0	400
171	South Sudan*	22.67	7.37	54.36	1	13.0	390
172	Guinea-Bissau	31.24	17.18	40.99	4	15.0	660
173	Kiribati	33.08	76.64		10		2,780
174	Mauritania	33.19	30.43	79.82	1	18.0	1,100
175	Rwanda	36.08	21.65	59.23	45	18.0	720
176	Sierra Leone	38.24	16.25	52.03	3	15.0	510
177	Chad	39.27	20.62		1	18.0	630
178	Haiti	43.88	27.79	63.53	10	10.0	760
179	Zimbabwe	46.15	35.00	68.95	1	20.0	910
180	Central African Rep.	52.86	17.18		3		390
181	Dem. Rep. of the Congo	53.33	20.00	50.07	1	13.0	450
	Syrian Arab Republic***		5.58		1	0.0	
	Somalia***		10.00		3		

Table 4.4: Mobile-broadband basket, postpaid computer-based, 1 GB, 2017 (continued)

Rank	Economy	Mobile-broadband, postpaid computer-based (1 GB)			Monthly data allowance (GB)	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$			
	San Marino***		11.27	12.97	1	0.0	
	Liechtenstein***		16.90		1	8.0	
	Monaco***		56.33		20	20.0	

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference. [1]Unlimited data allowance for 50 hours of use. *Data correspond to the GNI p.c. (Atlas method) in 2016. **Data correspond to the GNI p.c. in 2016, sourced from UNSD. ***Country not ranked because data on GNI p.c. are not available.
Source: ITU. GNI p.c. and PPP$ values are based on World Bank data.

the average prices paid per GB for computer-based plans were twice as high as in Europe and the CIS. In the case of the Americas, lower prices per GB for handset-based plans suggest that handset-based mobile-broadband plans offer more value for money to customers. In the case of Africa, the price per GB for handset-based plans is the highest of all regions, indicating that customers in the region pay the highest price per GB for both types of mobile-broadband baskets. Therefore, the challenge remains in Africa to extend the affordable offers based on low-denomination packages (Box 4.3) to plans including larger data allowances and longer validity periods.

Asia and the Pacific had the lowest average price per GB for handset-based mobile-broadband plans. The region is home to some of the lowest prices per GB worldwide, such as those offered by operator Dialog in Sri Lanka, Mobilink in Pakistan and Metfone in Cambodia.

The Arab States stand out for having much lower average prices per GB for computer-based plans than for handset-based plans. Such a difference is explained by the large data allowances included in computer-based mobile-broadband plans in Bahrain, Kuwait, Morocco, Saudi Arabia and Qatar, which allow operators in these countries to offer significant volume discounts to their customers. On the other hand, smaller data allowances coupled with relatively high prices for handset-based mobile-broadband plans drive the price per GB above PPP$ 40 in Djibouti, the United Arab Emirates and Saudi Arabia.

The following sections present a more detailed analysis of the differences in mobile-broadband prices within each region.

Africa

The price of the handset-based mobile-broadband basket corresponds to less than 2 per cent of GNI p.c. in Mauritius, Seychelles, Gabon, Cabo Verde, South Africa and Nigeria (Chart 4.16). Moreover, in 11 additional African countries, the basket represents less than 5 per cent of GNI p.c., including LDCs such as Angola, Namibia, Rwanda, Sao Tome and Principe, and Tanzania.

At the other end of the regional classification, the Central African Republic, the Democratic Republic of the Congo and Zimbabwe have prices representing more than 25 per cent of GNI p.c. and, consequently, the mobile-broadband baskets remain unaffordable to large segments of the population.

The postpaid computer-based mobile-broadband basket has a similar price to the prepaid handset-based basket in most African countries. In two countries, Botswana and Senegal, the postpaid computer-based basket is more affordable than the prepaid handset-based basket. In Botswana, the operator Mascom Wireless offers similar data bundles to both prepaid and postpaid customers, but postpaid prices are significantly lower, probably because they ensure a stable revenue flow to the operator. In Senegal, the lowest prepaid handset-based prices offered by Orange Senegal have a validity of a week or a day, whereas all computer-based mobile-broadband plans of the operator are valid for a month. As a result, computer-based mobile-broadband plans are more affordable to those customers requiring a monthly validity.

Gambia and Gabon are the two African countries that saw the largest price reductions in the mobile-broadband baskets in 2017 (Table 4.5). In Gambia, the change from a pay-per-use plan in

Box 4.3: Mobile-broadband in LDCs – different consumption patterns, different pricing schemes

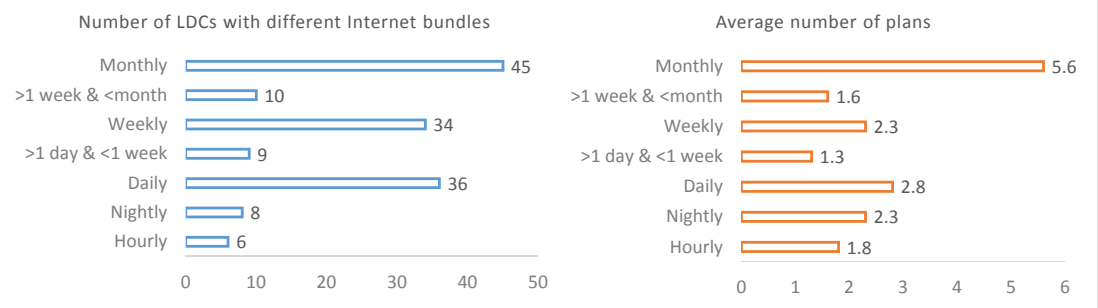
According to the Zambia Information and Communications Technology Authority (2015), 84 per cent of mobile users spent about USD 7.0 per month on mobile services in Zambia. However, the cost of the ITU handset-based mobile-broadband basket, which includes 500 MB, is USD 10.8 per month in the country. Moreover, small-scale agricultural households (which encompass 51 per cent of all Zambian households) only spend USD 1.5 per month on communications (Central Statistical Office Zambia, 2016).

Such a disparity between the expenditure on mobile communications and the cost of the ITU handset-based mobile-broadband basket is not unique to Zambia, but common to a number of LDCs. For instance, Mali has similar (or even lower) income levels as Zambia; household expenditure on ICT service is almost the same in the two countries, 3.4 per cent (see Chart 4.7 and Central Statistical Office Zambia, 2016); and the price of the ITU handset-based mobile-broadband basket is USD 8.1 per month in Mali.

In order to cater to those customers at the base of the income pyramid, operators in LDCs offer a variety of low denomination plans, ranging from hourly plans to weekly bundles offering unlimited access to popular social media and over-the-top applications, such as WhatsApp messaging. Indeed, mobile operators offer daily prepaid data plans in 80 per cent of LDCs, and weekly plans in 75 per cent of them (Chart Box 4.3). Moreover, in LDCs where these daily and weekly plans are offered, customers have the choice of more than two plans on average for each of these modalities.

In order to cover all different customer segments, some operators in LDCs are offering innovative metered packages targeting specific user groups. For instance, Smart in Cambodia offers a "night owl" package: between 1 a.m. and 5 a.m., users can get 1 GB for USD 10 cents.[13] In Rwanda, Airtel has a daily student bundle that includes over eight times as much data as a regular plan, as well as unlimited access to WhatsApp.[14]

Chart Box 4.3: Mobile data packages in LDCs, by type of validity period, 2017

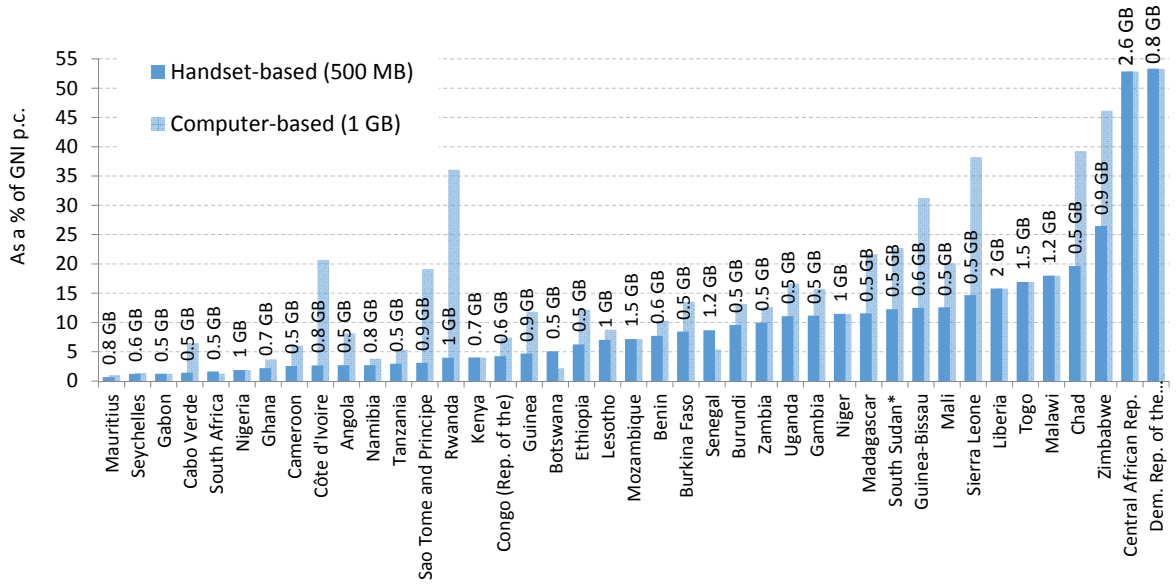


Note: Based on the largest mobile operator (by subscriptions) in the 45 LDCs where data were available. The left chart shows how many LDCs have a specific time bundle. For example, six LDCs offer hourly plans. The right chart shows the average number of plans per time bundle. For example, there are on average 1.8 different hourly plans in those LDCs that offer such type of plans.
Source: ITU (2018c).

Although not providing the convenience of monthly plans, packages with shorter validity periods allow lower-income users to access the Internet at an affordable cost through prepaid handset-based mobile-broadband. Indeed, evidence from LDCs suggests that cost is not the main barrier to using the Internet, but is rather a strong determinant of how much data is consumed.

Source: Adapted from ITU (2018c).

Chart 4.16: Mobile-broadband prices as a percentage of GNI p.c. and handset-based cap, Africa, 2017



Note: Only economies with available data for prepaid handset-based mobile-broadband prices in 2017 are shown in the chart. The caps indicated refer to the prepaid handset-based mobile-broadband basket.
Source: ITU. GNI p.c. values are based on World Bank data.

2016 to a package including 1 GB per month in 2017 dramatically improved the affordability of the computer-based mobile-broadband basket. In Gabon, operator Airtel revised the pricing of its monthly data packages for handset-based mobile-broadband plans. As a result, a package including 250 MB per month in 2017 had a lower price than the 100 MB package in 2016, thus significantly reducing the overall price of the 500 MB prepaid basket.

The Americas

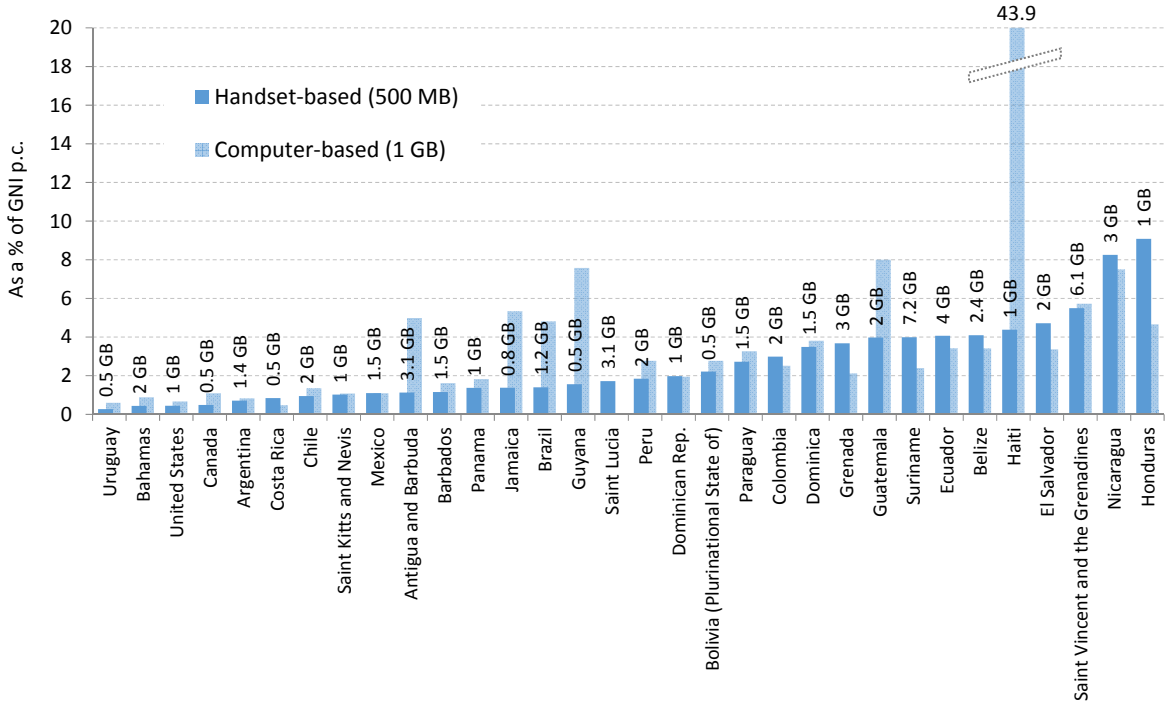
More than half of the countries in the Americas have handset-based mobile-broadband prices below the threshold of 2 per cent of GNI p.c. (Chart 4.17). Uruguay is at the forefront of the mobile-broadband affordability ranking in the region, thus being the country with both the most affordable mobile- and fixed-broadband services (see section 4.3). Bahamas, the country with the second most affordable mobile-broadband services in the region, also stood out for offering the most value for money in the handset-based mobile-broadband basket (Table 4.5).

The United States advanced to the third position in the 2017 regional ranking after recording the largest reduction in the region in the handset-based mobile-broadband basket (Table 4.5). Operator Verizon in 2017 offered a 1 GB prepaid plan with a 30-day validity for USD 20, whereas in 2016 its basic smartphone plan included 5 GB for USD 50. In the change of plans, there was a trade-off between higher price per GB and lower entry-level price, leading to a significant reduction in the base cost for prepaid handset-based mobile-broadband plans in the country.

Among the other top 10 countries with the most affordable mobile-broadband baskets in the region, Costa Rica and Mexico stand out for being the only non-high-income economies. Both countries are also among the regional top 10 when it comes to affordable mobile-cellular services (see section 4.1), thus confirming that mobile markets conducive to low mobile-cellular prices also tend to foster low handset-based mobile-broadband prices.

The computer-based mobile-broadband basket is more affordable than the handset-based basket in Colombia, Grenada, Suriname, El Salvador and Honduras. Unlike most other countries, the data allowances for the handset-based plans in these countries are equal to or higher than the data included in the computer-based plans. Many of the handset-based plans offered in these countries tend to have a daily or weekly validity, whereas monthly plans include only large data allowances. In this context, postpaid computer-based plans are

Chart 4.17: Mobile-broadband prices as a percentage of GNI p.c. and handset-based cap, the Americas, 2017



Note: Only economies with available data for prepaid handset-based mobile-broadband prices in 2017 are shown in the chart. The caps indicated refer to the prepaid handset-based mobile-broadband basket.
Source: ITU. GNI p.c. values are based on World Bank data.

more affordable given that they tend to be better suited for a monthly validity.

Commonwealth of Independent States

All CIS countries except Uzbekistan and Tajikistan had handset-based mobile-broadband prices corresponding to less than 2 per cent of GNI p.c. (Chart 4.18). Belarus had the most affordable handset-based mobile-broadband services in the region, closely followed by the Russian Federation. However, the data allowance in the Russian Federation was the highest in the region, thus offering the lowest price per GB in the CIS for handset-based services (Table 4.5). Belarus and the Russian Federation are the two CIS countries with the highest mobile-broadband penetration, confirming that affordable prices go hand in hand with high uptake.

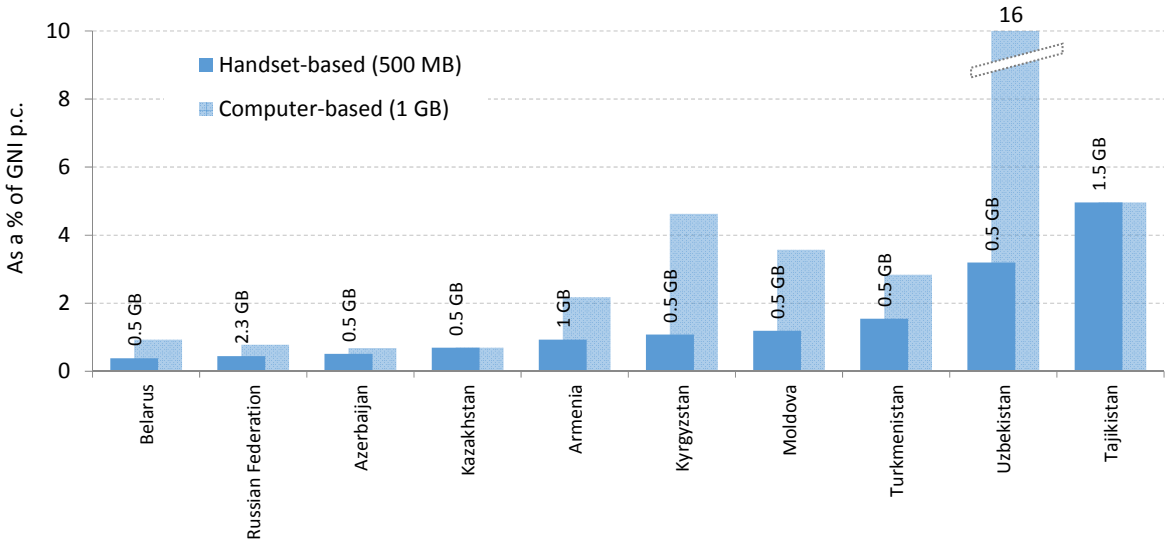
The computer-based mobile-broadband basket corresponded to less than 2 per cent of GNI p.c. in Belarus, the Russian Federation, Azerbaijan and Kazakhstan. In Armenia, although the price is slightly above that threshold, operator VivaCell-MTS offered 15 GB per month, the largest data allowance in the CIS by far. As a result, the value proposition in Armenia was high, with a price per GB of PPP$ 1.2, the lowest in the region (Table 4.5).

Armenia also stood out for having recorded the largest price reduction in the CIS in the handset-based mobile-broadband basket. In 2016, operator VivaCell-MTS offered either daily plans or a monthly plan with a 5 GB data allowance. In 2017, the operator started offering a bundle including 150 SMS, 1 500 minutes and 1 GB per month at LTE speeds for less than half the price of the 5 GB plan available in 2016.

Europe

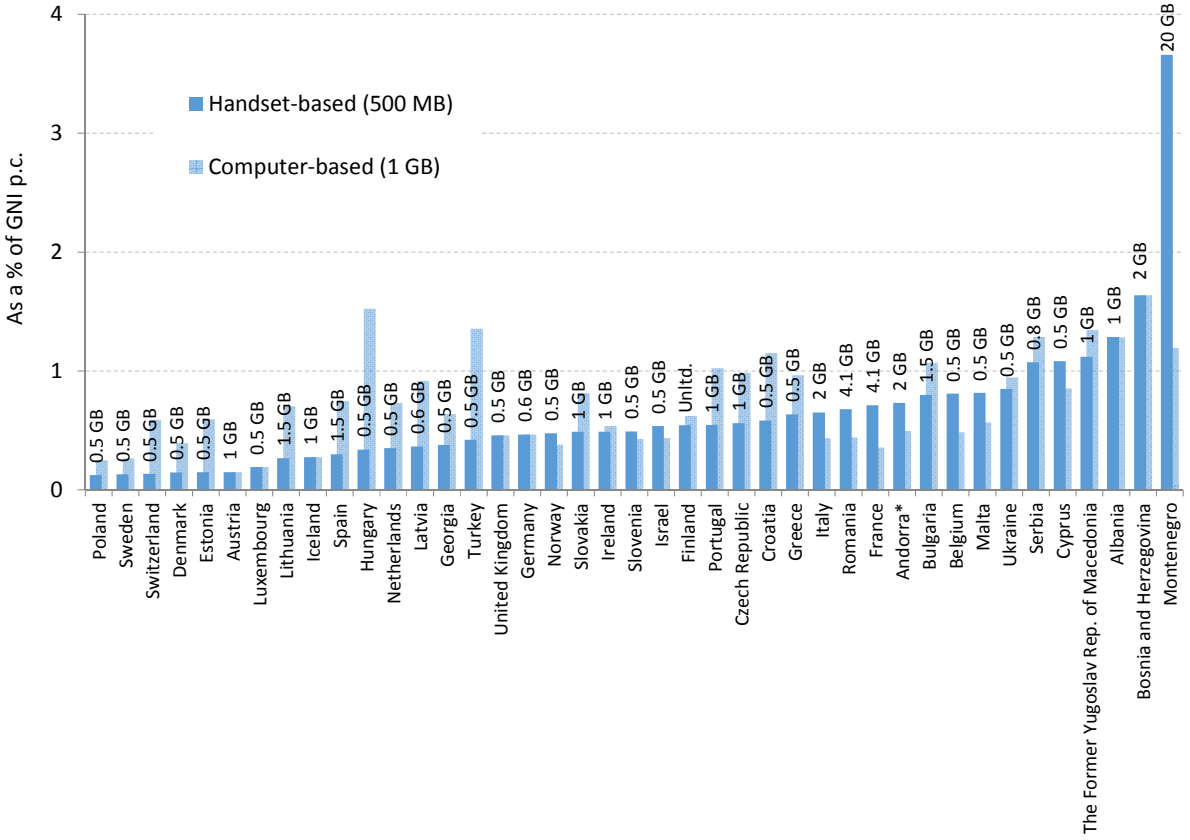
Europe stands out for having affordable mobile-broadband prices across the board, with all countries in the region having mobile-broadband prices for the two baskets corresponding to less than 2 per cent of GNI p.c., the only exception being handset-based services in Montenegro (Chart 4.19). High prepaid handset-based prices in Montenegro are explained by the high-end plan offered by operator Telenor Montenegro, which includes 10 GB per month at LTE speeds for

Chart 4.18: Mobile-broadband prices as a percentage of GNI p.c. and handset-based cap, CIS, 2017



Note: Only economies with available data for prepaid handset-based mobile-broadband prices in 2017 are shown in the chart. The caps indicated refer to the prepaid handset-based mobile-broadband basket.
Source: ITU. GNI p.c. values are based on World Bank data.

Chart 4.19: Mobile-broadband prices as a percentage of GNI p.c. and handset-based cap, Europe, 2017



Note: Only economies with available data for prepaid handset-based mobile-broadband prices in 2017 are shown in the chart. The caps indicated refer to the prepaid handset-based mobile-broadband basket. *The GNI p.c. data used to calculate the price as a percentage of GNI p.c. correspond to 2016, sourced from UNSD.
Source: ITU. GNI p.c. values are based on World Bank data.

PPP$ 45.6. Despite the high price, the high data allowance offered makes this plan the one with the lowest cost per GB in the region (PPP$ 2.3) apart from Finland, where operator Elisa offers unlimited data for only PPP$ 18.4 per month.

Affordable computer-based mobile-broadband plans were found in all European countries, with the most value for money being offered by operator Telia in Lithuania at PPP$ 0.3 per GB, one of the lowest prices per GB worldwide (Table 4.5).

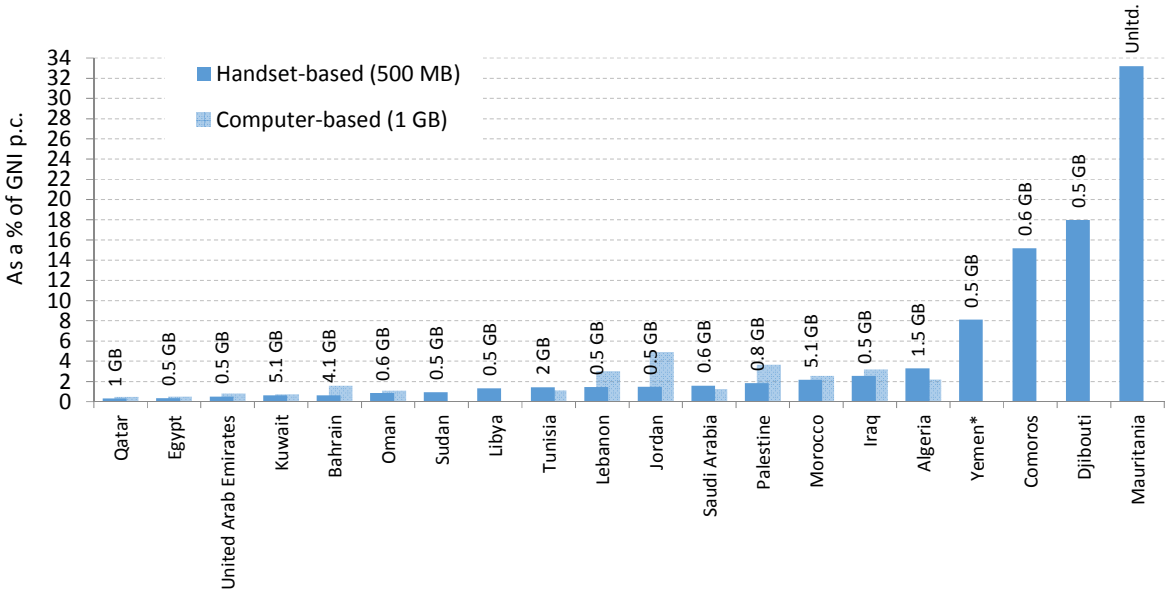
Bulgaria and Poland stood out in the regional comparison for having recorded the largest price reductions in the mobile-broadband baskets in 2017. It is noteworthy that Poland, after this drop in prices, had the lowest price in Europe for the computer-based mobile-broadband basket (PPP$ 5.3). Thanks to this, the country had the third most affordable computer-based mobile-broadband basket in the region. This is a remarkable achievement given that the only countries with a more affordable computer-based mobile-broadband basket were Austria and Luxembourg, which have income levels three and five times higher than that of Poland, respectively.

Arab States

Handset-based mobile-broadband prices were below the threshold of 2 per cent of GNI p.c. in most Arab States, and almost at that affordability level in Morocco, Iraq and Algeria (Chart 4.20). Egypt and Sudan stood out among the top countries in the regional affordability ranking because, despite being lower-middle-income countries, they have achieved mobile-broadband prices that are equal or more affordable than those in other Arab States with much higher incomes.

The only Arab States in which mobile-broadband services were well above the 2 per cent threshold and therefore remained unaffordable to some segments of the population were Yemen, Comoros, Djibouti and Mauritania. All these countries are LDCs and have the lowest incomes in the region. Comoros and Yemen offered handset-based mobile-broadband prices below the regional average, at USD 9.6 and USD 7.0 per month, respectively. Djibouti and Mauritania, on the other hand, had handset-based mobile-broadband prices above USD 25 per month. In the latter, the unlimited plan offered by operator Mauritel was a high-end plan when taken for a validity period of

Chart 4.20: Mobile-broadband prices as a percentage of GNI p.c. and handset-based cap, Arab States, 2017



Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference. Only economies with available data for prepaid handset-based mobile-broadband prices in 2017 are shown in the chart. The caps indicated refer to the prepaid handset-based mobile-broadband basket. *The GNI p.c. data used to calculate the price as a percentage of GNI p.c. correspond to 2016.
Source: ITU. GNI p.c. values are based on World Bank data.

one month, and therefore not within the reach of most customers in Mauritania.

Kuwait stood out in the regional and global comparison for offering the lowest price per GB of all computer-based mobile-broadband plans (Table 4.5). When it comes to handset-based mobile-broadband services, Morocco offered the most value for money in the Arab States (PPP$ 2.3 per GB). The data add-ons with a monthly validity proposed by operator Maroc Telecom started at 5 GB for USD 5.2, thus providing the largest data allowance for a handset-based plan in the Arab States (apart from the unlimited plan offered in Mauritania).

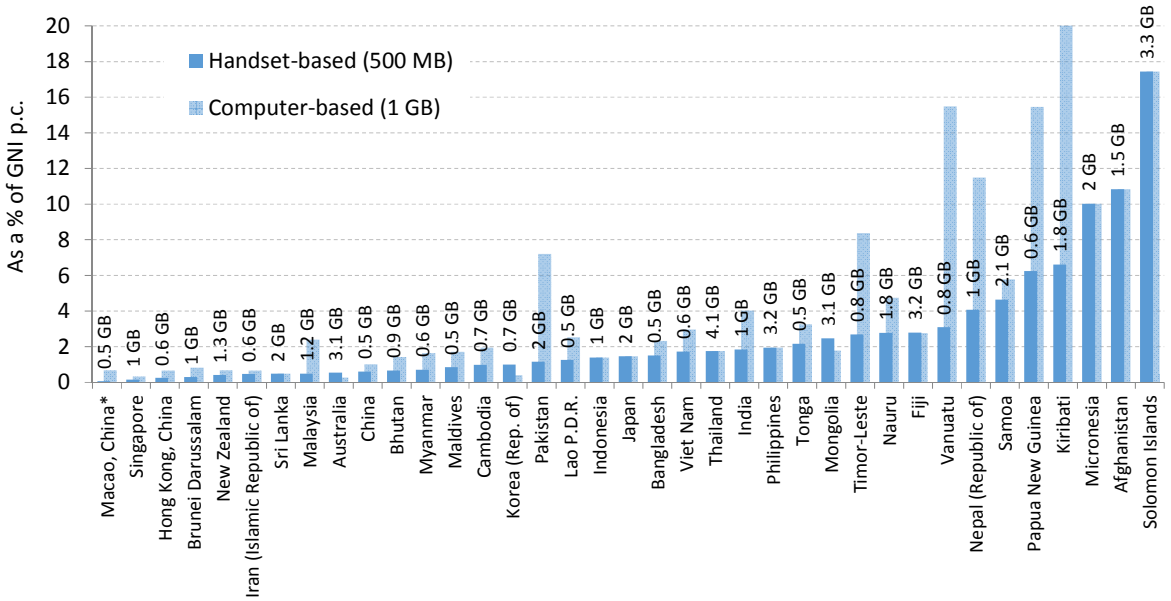
In the period 2016–2017, Algeria was the Arab State that recorded the largest price reduction in the mobile-broadband basket (Table 4.5). Operator Djezzy extended the validity of its entry-level computer-based mobile-broadband plan from 10 to 30 days, thus enabling large savings (PPP$ 41.6 per month) to those customers consuming 1 GB over a 30-day period. Thanks to this change in pricing schemes, the postpaid computer-based basket became more affordable than the prepaid computer-based mobile-broadband basket in Algeria in 2017.

Asia and the Pacific

Asia and the Pacific is home to some of the most affordable mobile-broadband services worldwide, having as many as 15 countries with handset-based prices that correspond to less than 2 per cent of GNI p.c. (Chart 4.21). The regional mobile-broadband affordability ranking was topped by high-income economies such as Macao (China), Singapore and Hong Kong (China), as well as countries with much lower incomes but extremely low handset-based mobile-broadband prices, such as Iran (Islamic Republic of), Sri Lanka, Bhutan and Myanmar, all of them offering prices below PPP$ 6 per month.

Moreover, the largest Asian countries (Bangladesh, China, India, Indonesia, Japan, Pakistan and the Philippines) also had handset-based mobile-broadband prices below the 2 per cent threshold, suggesting that 500 MB per month of mobile-broadband access is affordable to large segments of the population in these countries. Computer-based mobile-broadband plans including 1 GB per month were slightly above the 2 per cent threshold in some of these countries, such as Bangladesh, India and Pakistan. However, higher prices for postpaid computer-based plans came with substantially larger data allowances. This is

Chart 4.21: Mobile-broadband prices as a percentage of GNI p.c. and handset-based cap, Asia and the Pacific, 2017



Note: Only economies with available data for prepaid handset-based mobile-broadband prices in 2017 are shown in the chart. The caps indicated refer to the prepaid handset-based mobile-broadband basket. *The GNI p.c. data used to calculate the price as a percentage of GNI p.c. correspond to 2016.
Source: ITU. GNI p.c. values are based on World Bank data.

Table 4.5: Largest price reduction in mobile-broadband prices (2016–2017) and most value for money, by region, 2017

Region	Most value for money (PPP$ per GB)		Largest price reduction 2016-2017 (PPP$)	
	Handset-based (500 MB)	Computer-based (1 GB)	Handset-based (500 MB)	Computer-based (1 GB)
Africa	PPP$ 3.1 Liberia	PPP$ 1.3 Rwanda	PPP$-14.9 Gabon	PPP$-164 Gambia
Arab States	PPP$ 2.3 Morocco	PPP$ 0.1 Kuwait	PPP$-10.9 Palestine	PPP$-41.6 Algeria
Asia and the Pacific	PPP$ 2.3 Sri Lanka	PPP$ 1 India	PPP$-9.2 Timor-Leste	PPP$-13.6 Myanmar
CIS	PPP$ 3.6 Russian Federation	PPP$ 1.2 Armenia	PPP$-12.7 Armenia	
Europe	PPP$ 2.3 Montenegro	PPP$ 0.3 Lithuania	PPP$-27.7 Bulgaria	PPP$-10.6 Poland
The Americas	PPP$ 4.6 Bahamas	PPP$ 2.9 Antigua and Barbuda	PPP$-32.7 United States	PPP$-31.7 Honduras

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference. No CIS country recorded a decrease in the price of the computer-based mobile-broadband basket in the period 2016–2017.
Source: ITU.

the case for India, where operator Bharti Airtel offered a postpaid plan including 20 GB per month for PPP$ 6.1, the lowest price per GB in Asia and the Pacific (Table 4.5). In Pakistan, operator Jazz also offered high value for money to its computer-based mobile-broadband customers (PPP$ 2.1 per GB or USD 0.63 per GB), but at more sustainable levels than some of the prices recorded by PTA in its public consultation in 2016 (Box 4.2).

Timor-Leste and Myanmar were the countries that recorded the largest price reductions in mobile-broadband prices in Asia and the Pacific in 2017 (Table 4.5). In Myanmar, the new Cashback Data Packs offered by operator MPT made it possible to consume 1 GB over a 30-day period for one third of the price that it cost in 2016. Thanks to this price reduction, the computer-based mobile-broadband basket became much more affordable in Myanmar, from representing 5.6 of GNI p.c. in 2016 to 1.6 in 2017. In Timor-Leste, operator Timor-Telecom revised its pricing scheme for prepaid mobile Internet add-ons in 2017. The price of the packages was reduced and the validity extended, thus leading to a reduction of PPP$ 9.2 per month in the cost of consuming 500 MB over a 30-day period.

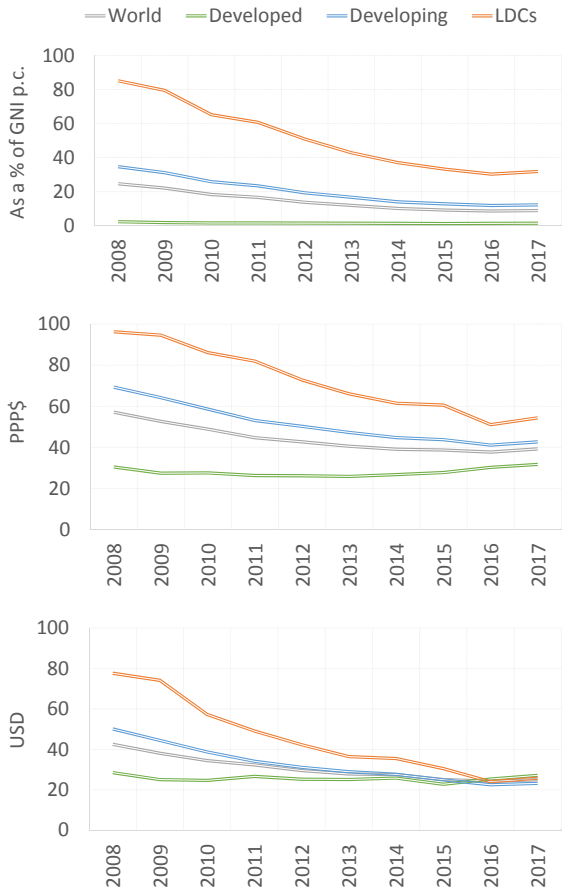
4.4 Fixed-broadband prices

The price of an entry-level fixed-broadband plan has significantly decreased worldwide in the last decade, from more than USD 40 per month on average in 2008 to USD 25 per month in 2017 (Chart 4.22).[18] Moreover, the gap in prices between developed and developing countries and LDCs has closed, and average prices across levels of development have converged to USD 25 per month. The most remarkable reduction in prices has been recorded in LDCs, where prices have been cut two-thirds since 2008.

However, USD 25 per month does not represent the same economic effort in developed, developing countries and LDCs, because the purchasing power of customers changes considerably across levels of development. This is reflected in prices in PPP$, which were 35 per cent more expensive in developing countries than in developed countries on average in 2017, and about 70 per cent more expensive in LDCs than in developed countries.

As a result of these differences in economic welfare, an entry level fixed-broadband plan remains unaffordable for large segments of the population in developing countries and, particularly, in LDCs. Indeed, the price of a monthly plan corresponds on average to 12 per cent of GNI p.c. in developing countries, whereas evidence from household surveys shows that household expenditure on ICT as a percentage of total household expenditure is below 8 per cent in all countries with data available. This suggests that the economic commitment that an average family in the developing world would need to face to connect to the Internet at home is larger than the average share of budget allocated to ICTs in most countries.

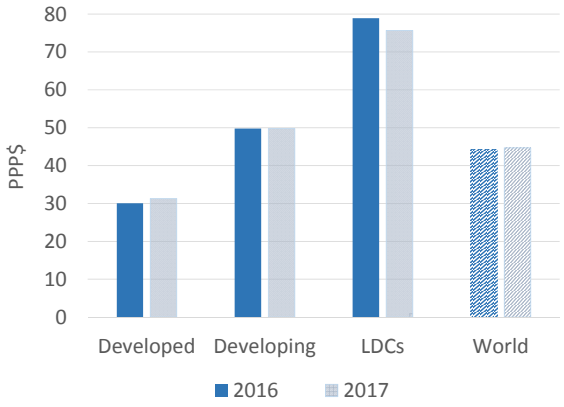
Chart 4.22: Fixed-broadband basket, as a percentage of GNI p.c. (top), in PPP$ (middle), and in USD (bottom), 2008–2017



Note: Simple averages. Based on the economies for which data on fixed-broadband prices were available for the years 2008–2017: 144 economies for data in USD, 142 for data in GNI p.c. terms, and 140 for data in PPP$. Prices have been capped at USD 100, PPP$ 100 and 100% of GNI p.c. in order to avoid an undue effect of outliers in the averages. A separate analysis of outliers is provided in this chapter.
Source: ITU.

A closer look at the evolution of fixed-broadband prices from 2016 to 2017 reveals that prices continued to decrease in LDCs, making the service more affordable, whereas in developed countries prices went slightly up (USD 2.2 and PPP$ 1.2 on average) in 2017 (Chart 4.23). Although this increase did not have a sizeable effect in the affordability of fixed-broadband services in developed countries, it is worth noting that entry-level fixed-broadband prices have stayed the same or even increased slightly in the developed world in the period 2008–2017. Improvements in affordability in developed countries have therefore been driven by increases in GNI p.c.

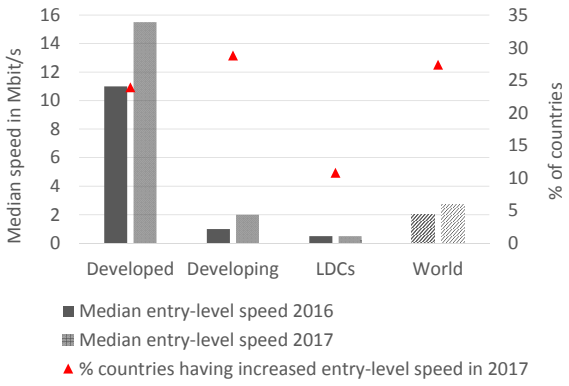
Chart 4.23: Fixed-broadband basket in PPP$, 2016–2017



Note: Simple averages. Based on 167 economies for which data on fixed-broadband prices in PPP$ were available for the years 2016 and 2017.
Source: ITU.

The increase in entry-level fixed-broadband prices in developed countries can partially be explained by the rise in speeds: almost 25 per cent of developed countries saw an increase in entry-level speeds, thus driving median speeds up from 10 Mbit/s in 2016 to 15 Mbit/s in 2017 (Chart 4.24). Likewise, almost 30 per cent of developing countries recorded an increase in fixed-broadband speeds, although more modest than in developed countries. Only about 10 per cent of LDCs saw a rise in entry-level fixed-broadband speeds in 2017, and the median speed in LDCs remained at 512 kbit/s, four times slower than the median in the whole of the developing world and 30 times slower than the median in developed countries.

Chart 4.24: Entry level fixed-broadband speeds, 2016 and 2017, by level of development



Note: Based on 179 economies for which data on entry-level fixed-broadband speeds were available for the years 2016 and 2017.
Source: ITU.

Benchmarking countries

The top 25 countries with the most affordable fixed-broadband services have prices that correspond to less than 1 per cent of their GNI p.c. (Table 4.6). The list includes high-income economies from Asia and the Pacific, Europe, the Arab States and the Americas, as well as upper-middle-income economies with outstanding low prices (i.e. below USD 8/month), such as the Russian Federation, Romania, Turkey and Kazakhstan.

The country with the most affordable entry-level fixed-broadband services is Uruguay. The government-owned operator Antel offers a basic fixed-broadband plan with 1 GB of data per month at a speed of 512 kbit/s at no extra cost if the customer has contracted a fixed-telephone line.[19] This plan is only one element of all initiatives undertaken by the Government of Uruguay to make ICT services affordable to all and promote their adoption (Box 4.4).

At the other end of the ranking, there are six countries in which entry-level fixed-broadband plans have a cost that represents more than 100 per cent of GNI p.c.: Togo, Rwanda, Niger, Haiti, Solomon Islands and Madagascar. These countries are LDCs and have entry-level fixed-broadband services that cost more than USD 40 per month, making them unaffordable for most of the population, given that these countries have some of the lowest incomes worldwide.

There are two main reasons why many LDCs – and some African non-LDCs as well – continue to have fixed-broadband services that are more expensive than in developed countries, despite having much lower incomes:

- Mobile-broadband is considered the Internet technology for residential customers in these countries, given that the legacy last-mile wired infrastructure (i.e. copper) has very limited reach. Recent roll-outs of fibre-optic access in LDCs are driven by the demand of large businesses and government users (ITU, 2018c). As a result, fixed-broadband packages are designed and priced as premium services. For example, this is the case in Madagascar and Rwanda, whose entry-level plans offer speeds of 8 and 10 Mbit/s, respectively, and cost more than USD 60.
- Fixed-broadband plans in some of these countries have a similar pricing scheme as low-cost mobile-broadband plans. That is, they follow pay-per-use schemes based on data consumption, which are affordable for small data usages but are very expensive on the basis of 1 GB per month. This is the case in Haiti, where the fixed operator Natcom prices data consumption at USD 0.04/MB. Under this scheme, the usage cost of 10 MB would only be USD 0.4, but 1GB would cost USD 44, to which the cost of the line rental would need to be added.

Note: Based on 144 economies for which data on fixed-broadband prices in USD were available for the years 2008–2017.
Source: ITU.

The underlying reasons for unaffordable fixed-broadband prices in many LDCs and some non-African LDCs are not immutable, and they are already changing as fibre-optic networks continue to be rolled out even in the poorest nations.[21] Some operators are seizing the opportunity to target mass markets with the new roll-outs, thus driving prices down. This is the case of the Bangladesh Telecommunication Company Limited, which has been upgrading its copper network to optical fibre through the Telecommunication Network Development Project, which began in 2009. The effect on entry-level prices in the country was immediate: they dropped from USD 50 in 2009 to USD 8.3 in 2010, and decreased further until reaching an outstanding low value of USD 4.3 in 2017.

Other countries apart from Bangladesh have followed this path (Chart 4.25) and more could achieve significant price reductions soon.

Chart 4.25: Number of countries with entry-level fixed-broadband plans costing more than USD 70 per month, 2008–2017, by level of development

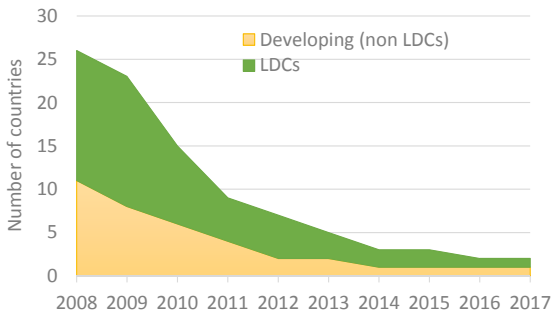


Table 4.6: Fixed-broadband basket, 2017

Rank	Economy	Fixed-broadband basket			Speed in Mbit/s	Cap per month in GB	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$				
1	Uruguay[1]	0.00	0.00	0.00	0.5	1.0	22	15,250
2	Macao, China*	0.14	7.85	9.68	3.0	Unlimited	0	65,130
3	Kuwait	0.36	9.33	14.39	1.0	Unlimited	0	31,430
4	Russian Federation	0.45	3.43	8.04	30.0	Unlimited	18	9,232
5	Hong Kong, China	0.46	17.71	21.39	100.0	Unlimited	0	46,310
6	Andorra**	0.57	17.67		0.5	2.0	5	36,987
7	United Arab Emirates	0.58	18.79	24.59	0.25	Unlimited	0	39,130
8	Switzerland	0.68	45.70	31.83	5.0	Unlimited	8	80,560
9	Norway	0.69	43.40	34.18	6.0	Unlimited	25	75,990
10	Canada	0.73	26.08	24.97	3.0	20.0	13	42,870
11	Brunei Darussalam	0.73	18.10	31.55	10.0	45.0	0	29,600
12	Luxembourg	0.79	46.20	40.72	20.0	Unlimited	17	70,260
13	Singapore	0.80	36.14	42.49	500.0	Unlimited	7	54,530
14	Denmark	0.82	37.71	29.56	25.0	Unlimited	25	55,220
15	Romania	0.83	6.91	14.77	100.0	Unlimited	19	9,970
16	Austria	0.84	31.72	32.99	20.0	Unlimited	20	45,440
17	Turkey	0.84	7.68	17.46	1.0	1.0	23	10,930
18	Iceland	0.85	43.06	28.48	50.0	50.0	24	60,830
19	Finland	0.88	32.57	29.67	10.0	Unlimited	24	44,580
20	Israel	0.89	27.50	22.41	15.0	Unlimited	17	37,270
21	Belgium	0.89	30.99	31.34	50.0	100.0	21	41,790
22	France	0.89	28.16	28.78	15.0	Unlimited	20	37,970
23	Kazakhstan	0.90	5.92	16.95	1.0	10.0	12	7,890
24	Cyprus	0.91	18.08	22.81	5.0	Unlimited	19	23,719
25	Sweden	0.98	43.16	38.51	100.0	Unlimited	25	52,590
26	Japan	0.99	31.68	33.16	1.0	Unlimited	8	38,550
27	Iran (Islamic Republic of)	1.02	4.59	12.77	1.0	4.0	9	5,400
28	Belarus	1.02	4.50	17.93		10.0	25	5,280
29	Netherlands	1.02	39.44	39.19	20.0	Unlimited	21	46,180
30	Lithuania	1.03	13.03	22.50	100.0	Unlimited	21	15,200
31	United Kingdom	1.03	34.75	33.66		12.0	20	40,530
32	United States	1.03	49.99	49.99	100.0	Unlimited	9	58,270
33	Germany	1.09	39.38	42.05	16.0	Unlimited	19	43,490
34	Ireland	1.10	50.71	45.21	24.0	30.0	23	55,290
35	Malaysia	1.16	9.37	24.28	1.0	1.0	6	9,650
36	Estonia	1.19	18.03	26.41	10.0	Unlimited	20	18,190
37	Spain	1.20	27.14	32.70	1.0	5.0	21	27,180
38	Slovakia	1.22	16.90	27.42	4.0	300.0	20	16,610
39	Sri Lanka	1.22	3.92	11.80	4.0	4.0	20	3,840
40	Bahamas	1.23	29.99	26.27	1.0	Unlimited		29,170
41	Seychelles	1.25	14.75	23.31	1.0	4.0	15	14,180
42	Australia	1.25	53.65	43.65	15.0	100.0	10	51,360
43	Saudi Arabia	1.27	21.33	41.35	2.0	20.0	0	20,080
44	Egypt	1.28	3.21	20.80	1.0	10.0	14	3,010
45	Qatar	1.35	68.68	88.55	10.0	Unlimited	0	61,070
46	Bosnia and Herzegovina	1.39	5.70	12.32	2.0	2.0	17	4,940
47	Greece	1.39	20.95	27.49	4.0	Unlimited	30	18,090
48	Czech Republic	1.41	21.35	34.94	20.0	Unlimited	21	18,160
49	Croatia	1.48	15.31	25.53	4.0	1.0	25	12,430
50	Korea (Rep. of)	1.48	35.03	39.45	100.0	Unlimited	10	28,380
51	Tunisia	1.49	4.34	12.67	4.0	Unlimited	23	3,500
52	Ukraine	1.51	3.01	13.53		Unlimited	20	2,388
53	Viet Nam	1.51	2.74	6.75	2.5	1.0	10	2,170
54	Portugal	1.57	25.91	34.02	12.0	Unlimited	23	19,820
55	Bahrain	1.58	26.60	43.43	10.0	70.0	0	20,240
56	Trinidad and Tobago	1.58	20.20	24.14	3.0	Unlimited	13	15,350
57	Latvia	1.61	19.72	30.41	10.0	Unlimited	21	14,740
58	Albania	1.63	5.88	12.56	1.0	Unlimited	20	4,320
59	Malta	1.70	33.81	45.89	70.0	Unlimited	18	23,810
60	Azerbaijan	1.71	5.81	26.39	1.0	Unlimited	18	4,080
61	Mauritius	1.71	14.47	25.65	10.0	15.0	15	10,140
62	Italy	1.74	44.96	49.36	7.0	Unlimited	22	31,020
63	Poland	1.75	18.52	37.18	80.0	Unlimited	23	12,710
64	Bulgaria	1.76	11.41	26.67	30.0	Unlimited	20	7,760
65	New Zealand	1.86	60.39	51.85	24.0	120.0	15	38,970
66	Costa Rica	1.88	17.27	26.26	1.0	Unlimited	13	11,040
67	Slovenia	1.90	34.88	45.90	10.0	Unlimited	22	22,000
68	Montenegro	1.94	11.90	24.20	1.0	1.0	21	7,350
69	Panama	1.96	21.35	36.16	4.0	Unlimited	7	13,100
70	Hungary	2.02	21.70	39.87	50.0	Unlimited	18	12,870

Table 4.6: Fixed-broadband basket, 2017 (continued)

Rank	Economy	Fixed-broadband basket			Speed in Mbit/s	Cap per month in GB	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$				
71	Mongolia	2.14	5.86	16.93	1.0	Unlimited	10	3,290
72	China	2.17	15.68	27.55	100.0	Unlimited	0	8,690
73	Fiji	2.21	9.17	14.76	10.0	5.0	9	4,970
74	Lebanon	2.30	15.92	26.41	4.0	40.0	10	8,310
75	Brazil	2.41	17.20	25.02	0.5	Unlimited	40	8,580
76	Maldives	2.51	19.98	25.76	4.0	Unlimited	6	9,570
77	Uzbekistan	2.53	4.17		1.0	2.4	20	1,980
78	Mexico	2.57	18.44	34.51	10.0	Unlimited	16	8,610
79	South Africa	2.73	12.37	26.27	2.0	1.0	14	5,430
80	Saint Kitts and Nevis	2.74	36.67	47.98	6.0	Unlimited		16,030
81	Chile	2.85	32.35	46.12	30.0	Unlimited	19	13,610
82	Barbados	2.90	37.50	30.57	35.0	Unlimited	18	15,540
83	Peru	3.02	15.03	28.24	2.0	Unlimited	18	5,970
84	Armenia	3.11	10.36	25.40	4.0	Unlimited	20	4,000
85	Oman	3.24	39.01	75.25	4.0	20.0	0	14,440
86	Georgia	3.28	10.36	30.54	10.0	Unlimited	18	3,790
87	Serbia	3.33	14.37	31.27	10.0	Unlimited	20	5,180
88	Bangladesh	3.50	4.29	10.83	0.25	Unlimited	15	1,470
89	Bhutan	3.55	8.05	23.52	2.0	8.0	5	2,720
90	The Former Yugoslav Rep. of Macedonia	3.59	14.62	34.72	4.0	30.0	18	4,880
91	Antigua and Barbuda	3.61	42.59	52.56	10.0	Unlimited	15	14,170
92	Argentina	3.61	39.24		3.0	Unlimited	21	13,040
93	Turkmenistan	3.63	20.14		2.0	1.0	15	6,650
94	Thailand	3.80	18.88	50.00	30.0	Unlimited	7	5,960
95	Libya	3.95	21.52		0.5	20.0	0	6,540
96	Colombia	4.04	19.62	42.22	5.0	Unlimited	0	5,830
97	Cabo Verde	4.06	10.12	21.66	12.0	5.0	15	2,990
98	Dominican Rep.	4.20	23.22	49.63	2.0	Unlimited	30	6,630
99	Morocco	4.28	10.21	23.55	4.0	Unlimited	20	2,863
100	Nepal (Republic of)	4.36	2.87	8.19	1.0	15.0	13	790
101	Gabon	4.37	24.05	37.83	0.5	Unlimited	0	6,610
102	Algeria	4.37	14.42	41.65	1.0	Unlimited	0	3,960
103	India	4.48	6.79	22.15	2.0	1.5	18	1,820
104	Saint Lucia	4.51	32.97	42.28	2.0	Unlimited	15	8,780
105	Papua New Guinea	4.53	9.09	11.09	24.0	1.0	10	2,410
106	Grenada	4.56	36.67	49.27	15.0	Unlimited	15	9,650
107	Ecuador	4.77	23.41	38.59	5.0	Unlimited	12	5,890
108	Botswana	4.93	28.03	55.36	0.5	Unlimited	12	6,820
109	Iraq	5.31	21.11	41.30	0.25	Unlimited	0	4,770
110	Belize	5.33	19.50	34.22	0.5	Unlimited	0	4,390
111	Dominica	5.53	32.20	44.15	2.0	Unlimited	15	6,990
112	Samoa	5.67	19.38	26.37		3.1	15	4,100
113	Saint Vincent and the Grenadines	5.83	33.94	47.16	2.0	Unlimited	16	6,990
114	Pakistan	5.94	7.82	25.71	1.0	10.0	32	1,580
115	Moldova	5.95	10.81	29.20	100.0	Unlimited	20	2,180
116	Guatemala	5.99	20.28	34.27	2.0	Unlimited	12	4,060
117	Suriname	6.04	30.29	69.83	3.0	Unlimited	8	6,020
118	Philippines	6.50	19.82	50.60	1.0	Unlimited	12	3,660
119	Paraguay	7.08	23.14	50.04	3.0	Unlimited	10	3,920
120	El Salvador	7.45	22.09	42.89	3.0	Unlimited	18	3,560
121	Sudan	7.55	14.96		0.5	15.0	35	2,379
122	Guyana	7.82	29.05	45.73	1.5	Unlimited	14	4,460
123	Indonesia	7.94	23.43	62.88	10.0	Unlimited	10	3,540
124	Jordan	8.45	28.03	59.97	4.0	Unlimited		3,980
125	Tajikistan	8.51	7.02	25.73	2.0	15.0	18	990
126	Yemen*	8.54	7.33		0.25	4.0	5	1,030
127	Micronesia	8.69	26.00		0.5	Unlimited	0	3,590
128	Jamaica	8.74	34.59	55.50	20.0	Unlimited	17	4,750
129	Kyrgyzstan	8.88	8.36	27.82	0.5	Unlimited	12	1,130
130	Lao P.D.R.	9.11	17.24	44.36	0.5	Unlimited	10	2,270
131	Tonga	9.20	30.76	41.66		5.0	15	4,010
132	Bolivia (Plurinational State of)	9.71	25.33	50.98	2.5	Unlimited	13	3,130
133	Namibia	9.78	37.48	79.20	0.5	Unlimited	0	4,600
134	Djibouti	9.88	15.47	26.29	1.0	30.0	10	1,880
135	Lesotho	10.48	11.17	31.88	16.0	5.0	5	1,280
136	Uganda	11.08	5.54	16.57	0.5	1.0	18	600
137	Cambodia	11.71	12.00	29.58	4.0	Unlimited	10	1,230
138	Guinea	11.83	8.09	18.50		3.0	18	820

Table 4.6: Fixed-broadband basket, 2017 (continued)

Rank	Economy	Fixed-broadband basket			Speed in Mbit/s	Cap per month in GB	Tax rate included (%)	GNI p.c., USD, 2017
		as % of GNI p.c.	USD	PPP$				
139	Marshall Islands	12.49	50.00		0.25	Unlimited	0	4,800
140	Myanmar	13.23	13.12	52.44	0.5	Unlimited	5	1,190
141	Palestine	13.45	35.65	50.41	8.0	75.0	16	3,180
142	Honduras	14.40	27.00	53.95	2.0	Unlimited	12	2,250
143	Angola	14.77	40.98	52.31	4.0	15.0	5	3,330
144	Nigeria	14.90	25.83	63.90	20.0	20.0	10	2,080
145	Nicaragua	15.41	27.36	73.05	1.0	Unlimited	15	2,130
146	Ethiopia	18.45	11.38	28.82	0.5	2.0	15	740
147	Ghana	18.51	22.99	71.23	16.0	20.0	24	1,490
148	Equatorial Guinea	18.98	111.67	188.03	0.5	Unlimited		7,060
149	Eswatini	19.06	47.02	120.04	0.25	6.0	14	2,960
150	Sao Tome and Principe	19.10	28.17	45.14	1.0	12.0	5	1,770
151	Zimbabwe	19.78	15.00	29.55	2.0	8.0	25	910
152	Cameroon	22.59	25.60	62.39	2.0	Unlimited	19	1,360
153	Vanuatu	23.03	56.04	51.29	0.5	Unlimited	13	2,920
154	Zambia	24.24	26.26	66.74	2.0	10.0	34	1,300
155	Afghanistan	24.76	11.76	38.50	0.25	Unlimited	0	570
156	Tanzania	24.98	18.84	51.90	1.0	Unlimited	33	905
157	Côte d'Ivoire	25.43	32.64	80.80	1.0	Unlimited	18	1,540
158	Malawi	25.68	6.85	24.13	10.0	2.0	17	320
159	Mali	26.51	17.01	45.25	0.25	Unlimited	18	770
160	Mozambique	29.21	10.22	33.48	1.0	Unlimited	17	420
161	Mauritania	32.16	29.48	77.35	2.0	Unlimited	14	1,100
162	Senegal	32.33	25.60	63.33	0.5	Unlimited	23	950
163	Timor-Leste	32.85	49.00	75.05	2.0	6.0		1,790
164	Kenya	37.88	45.46	101.07	30.0	Unlimited	26	1,440
165	Sierra Leone	38.24	16.25	52.03	1.0	5.0	15	510
166	Benin	38.65	25.77	67.13	0.5	Unlimited	18	800
167	Burkina Faso	42.24	21.47	57.24	0.25	Unlimited	18	610
168	Congo (Rep. of the)	53.05	60.13		0.5	Unlimited	16	1,360
169	Comoros	54.25	34.36		0.5	Unlimited		760
170	Kiribati	82.71	191.61		0.25	Unlimited	0	2,780
171	Togo	114.90	58.41	145.41	1.0	Unlimited	18	610
172	Rwanda	140.30	84.18	230.33	10.0	Unlimited	18	720
173	Niger	143.16	42.95	113.21	0.25	Unlimited	19	360
174	Haiti	154.82	98.05	224.16	1.0	1.0	10	760
175	Solomon Islands	172.61	276.18	277.83	0.25	6.0	10	1,920
176	Madagascar	191.59	63.86	221.57	8.0	Unlimited	20	400
177	Burundi	311.11	75.19	191.86	0.25	Unlimited	18	290
	Syrian Arab Republic***		1.62		0.25	Unlimited		
	Somalia***		15.00		0.5	10.0	10	
	San Marino***		18.76	21.59	20.0	Unlimited	0	
	Venezuela***		27.27		1.0	Unlimited	12	
	Monaco***		56.23		200.0	Unlimited	20	
	Liechtenstein***		67.61		40.0	Unlimited	8	
	Cuba***		180.00		0.25	Unlimited	0	

Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference. Basic fixed-broadband plan at no extra cost if the customer has contracted a fixed-telephone line. See Box 4.4 for more information. *Data correspond to the GNI p.c. (Atlas method) in 2016. **Data correspond to the GNI p.c. in 2016, sourced from UNSD. ***Country not ranked because data on GNI p.c. are not available.
Source: ITU. GNI p.c. and PPP$ values are based on World Bank data.

For instance, Rwanda, where Liquid Telecom purchased the assets of Rwanda Telecom and is spending USD 35 million to bring optical fibre to the Rwandese mass market (ITU, 2018c).

Apart from bottom and top performers, data show that a majority of countries offer fixed-broadband services meeting the 2015 target set by the Broadband Commission (i.e. prices representing less than 5 per cent of GNI p.c.) (Chart 4.26). This is particularly true for developed countries, most of which already meet the 2025 target set by the Broadband Commission (i.e. 2 per cent of GNI p.c.).

On the other hand, most LDCs have fixed-broadband prices that represent more than 20 per cent of their GNI p.c., thus being far from the Broadband Commission target for 2015. There are three remarkable exceptions among LDCs – Bangladesh, Bhutan and Nepal (Republic of) – all of them below the 5 per cent threshold thanks to fixed-broadband prices equal or below USD 8 per month. Current price trends suggest that most of the remaining LDCs will have to rely on mobile-broadband services to meet the Broadband Commission targets on the affordability of broadband services.

Box 4.4: Affordable ICTs for all – Effective public policies in Uruguay

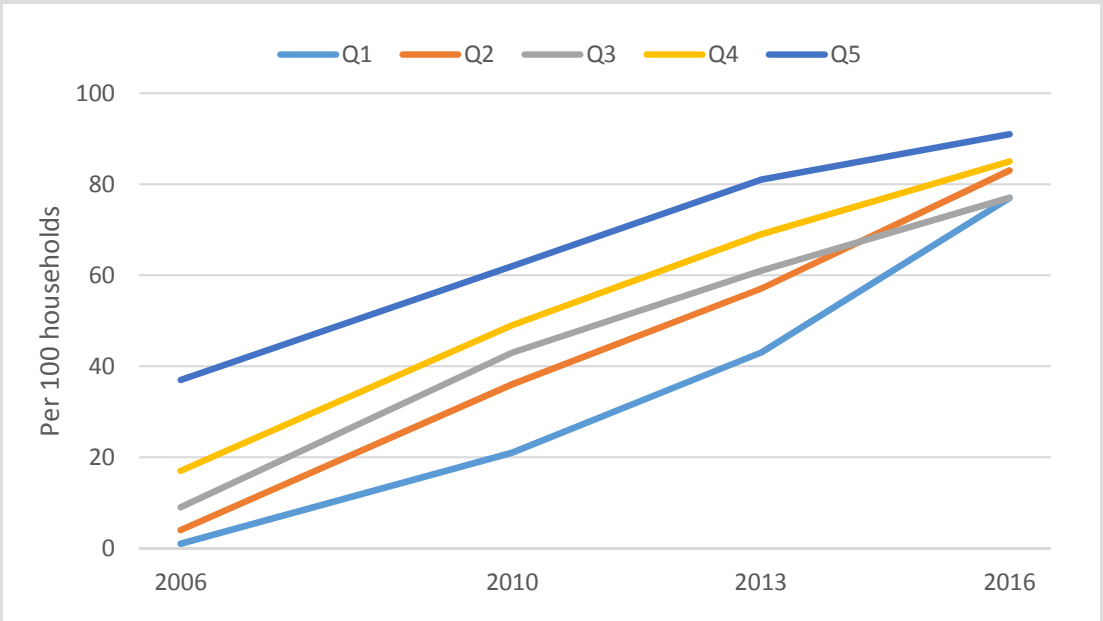
Uruguay has been implementing a very ambitious set of public policies in the area of digital inclusion since its adoption of the first Digital Agenda in 2007. Since then, initiatives in this area have been regularly updated based on evidence-based feedback, concretized in new digital agendas covering rolling periods of several years.

For instance, the initiative called Plan Ceibal aimed in its inception to ensure that each child in Uruguay had a computer. This led to a sharp increase in households with a PC, since the computer given to the child was also used at the household level. The same data that revealed the success of Plan Ceibal in increasing the number of households with a PC also showed that household Internet access remained low, particularly among low-income segments of the population.

In order to address this issue, the third Digital Agenda (2011–2015) included a new objective to promote "Internet for all". Among the goals designed to achieve this objective, one that stood out was the Universal Internet Household Service to support basic broadband connectivity, the roll-out of optical fibre to 300,000 households and the deployment of optical fibre to all primary and secondary schools in towns larger than 10,000 inhabitants (Agesic, 2011). In addition, Plan Ceibal was reformulated to ensure that no child would need to move more than 300 meters to connect to the Internet (Plan Ceibal, 2017).

The implementation of these initiatives bore its fruits as demonstrated by the upturn from 2013 in the percentage of low-income households with Internet (Chart Box 4.4). The gap in Internet access between low-income and high-income households was significantly reduced: 77 per cent of households in the lowest quintile had Internet in 2016, against 91 per cent for the highest quintile – this difference of 14 percentage points compares with a gap of 41 percentage points in 2010.

Chart Box 4.4: Households with access to the Internet, per income quintile, Uruguay



Source: AGESIC.

Box 4.4: Affordable ICTs for all – Effective public policies in Uruguay (continued)

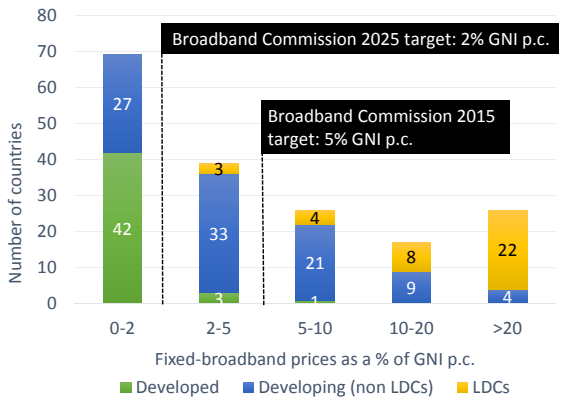
Despite the progress achieved in household Internet adoption, data collected from ICT household surveys made it possible to identify that the elders were not benefitting from ICTs as much as the rest of the population. This prompted the creation of the Plan Ibirapitá in 2015,[20] which aims to ensure digital inclusion of all retired people with low income by providing them with tablets connected to the Internet and training on how to use them (Agesic, 2017). Some of the benefits of this plan are already apparent, as the percentage of individuals above 64 years old using the Internet increased from 21 per cent in 2013 to 40 per cent in 2016.

Today, Uruguay is on its fourth Digital Agenda, and the objectives set forth in it go well beyond basic connectivity, including commitments on fibre-to-the-home (FTTH) deployment, Long-Term Evolution (LTE) and the construction of international telecommunication links.

The largest telecommunication operator in Uruguay, Antel, is publicly owned and implements some of the Government's policies concerning digital inclusion as defined in the digital agendas. Plan Universal Hogares is part of these initiatives and allows any household in Uruguay with a fixed line to contract 1 GB of data per month at 512 kbit/s with no extra cost.

Source: ITU.

Chart 4.26: Number of countries having achieved the Broadband Commission targets with fixed-broadband services, 2017



Source: ITU.

Regional analysis of fixed-broadband prices

A regional analysis of fixed-broadband prices across regions reveals that the CIS has the lowest average and median prices in USD and PPP$, whereas the Americas has the highest average and median prices in USD terms, and Africa in PPP$.

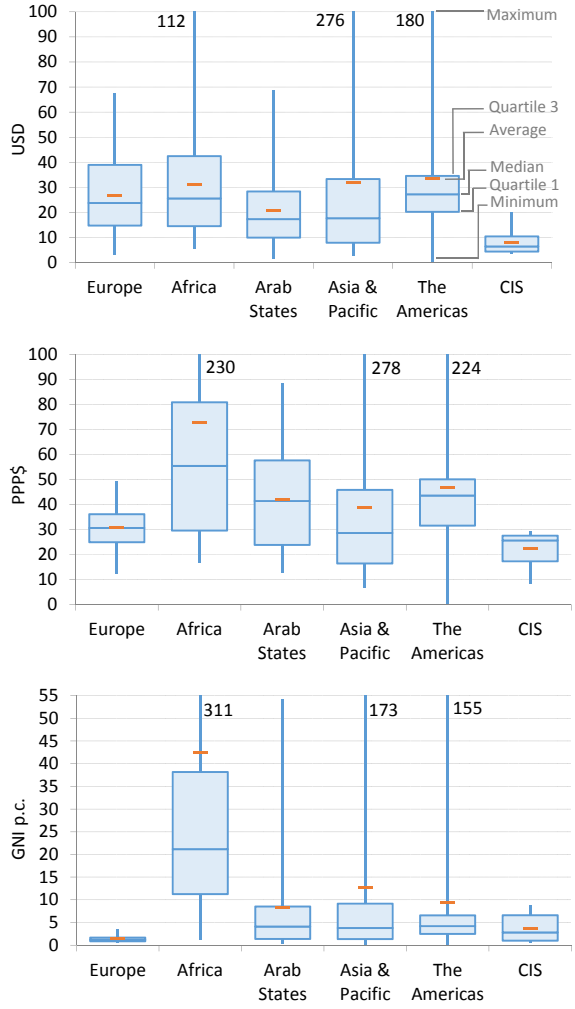
Considering only the interquartile values (i.e. excluding the top and bottom countries in each region), price ranges do not differ that much between regions. For instance, prices range between USD 10 and USD 20 in the Arab States, a little more in Asia and the Pacific (USD 10–30) and similarly in the Americas, but from a higher starting point (USD 20–35).

Europe and Africa have similar interquartile ranges in USD terms (USD 15–40). However, given the different purchasing power of customers in these two regions, the average in PPP terms is more than twice as high in Africa as in Europe. It is worth noting that outliers with very high fixed-broadband prices influence the averages in Africa, Asia and the Pacific, and the Americas. For instance, half of the countries in Asia and the Pacific have prices below PPP$ 30 and a quarter below PPP$ 17, but the average remains at about PPP$ 40 because of high prices in a few countries in the region. This illustrates the diversity within these three regions, which are home to both the most and least expensive fixed-broadband services worldwide.

In terms of GNI p.c., Europe, CIS and the Americas have median prices that represent less than the 5 per cent threshold set by the Broadband Commission for 2015, meaning that more than half of the countries in these regions achieved this target for fixed-broadband prices. In addition, more than one in four countries in the CIS, Asia and the Pacific, and the Arab States have

already achieved the 2 per cent target set by the Broadband Commission for 2025. In Europe, three out of four countries have entry-level fixed-broadband prices that represent less than 2 per cent of GNI p.c. This is in line with the high fixed-broadband penetration in the region: more than 30 fixed-broadband subscriptions per 100 inhabitants, compared with fewer than 20 subscriptions per 100 inhabitants in all other regions.

Chart 4.27: Fixed-broadband basket in USD (top), in PPP$ (middle) and as a percentage of GNI p.c. (bottom), by region, 2017



Source: ITU.

Fixed-broadband prices are the least affordable in Africa, although countries such as Seychelles, Mauritius, South Africa, Cabo Verde, Gabon and Botswana have achieved prices below the 5 per cent threshold.

The analysis of outliers shows that a number of countries in Africa, Asia and the Pacific, and the Americas have fixed-broadband services that remain unaffordable for almost all residential customers. In these countries, households need to resort to mobile-broadband services to connect to the Internet.

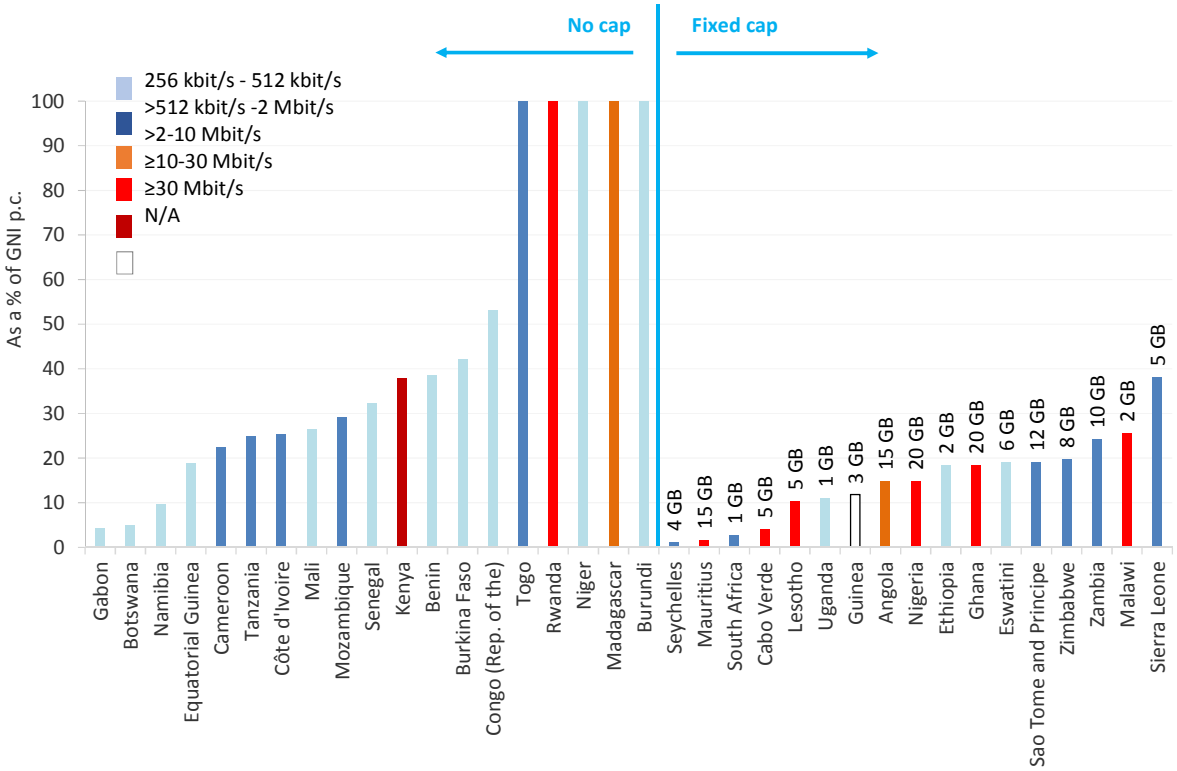
Africa

Fixed-broadband prices in Africa range from a cost representing less than 2 per cent of GNI p.c. in Seychelles and Mauritius to more than 100 per cent of GNI p.c. in Togo, Rwanda, Niger, Madagascar and Burundi (Chart 4.28). Only six African countries have achieved fixed-broadband prices below the 5 per cent threshold set by the Broadband Commission for 2015. These include Botswana, Cabo Verde, Gabon and South Africa, as well as the two countries having already achieved in 2017 the 2025 Target of 2 per cent of GNI p.c. The unaffordability of fixed-broadband plans in other countries in the region indicates that most customers have to rely on mobile-broadband services to access the Internet.

Almost half of the countries in the region offer entry-level fixed-broadband plans with capped monthly data allowances. Capped plans allow operators to offer fixed-broadband services at a reduced cost: on average, capped plans cost PPP$ 42.2 per month, compared with PPP$ 101.4 per month for unlimited plans. This price reduction makes capped plans better suited for the pockets of many customers in African countries, thus being a good commercial option to achieve affordable fixed-broadband prices for residential customers. An outstanding example of this is Uganda, where Uganda Telecom offers a “starter pack” with 1 GB per month and a speed of 512 kbit/s at PPP$ 16.6/ month, the lowest price in Africa (Table 4.7).

There is a disparity in entry-level fixed-broadband speeds in Africa: from 256 kbit/s in Burundi, Burkina Faso, Eswatini, Mali and Niger to 30 Mbit/s in Kenya. The countries with the highest entry-level fixed-broadband speeds are not necessarily the ones with the least affordable services. On the contrary, when looking at prices in terms of value for money, Kenya stands out for offering the lowest price per Mbit/s in Africa (Table 4.7).

Chart 4.28: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Africa, 2017



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

Table 4.7: Lowest fixed-broadband prices, largest price reduction (2016–2017) and most value for money, Africa, 2017

	Value	Country
Lowest price	PPP$ 16.6	Uganda
Most value for money (unlimited plans)	PPP$ 3.4 per Mbit/s	Kenya
Most value for money (capped plans)	PPP$ 1.7 per GB	Mauritius
Largest price reduction 2016-2017 (PPP$)	PPP$-43.5	Burkina Faso

Source: ITU.

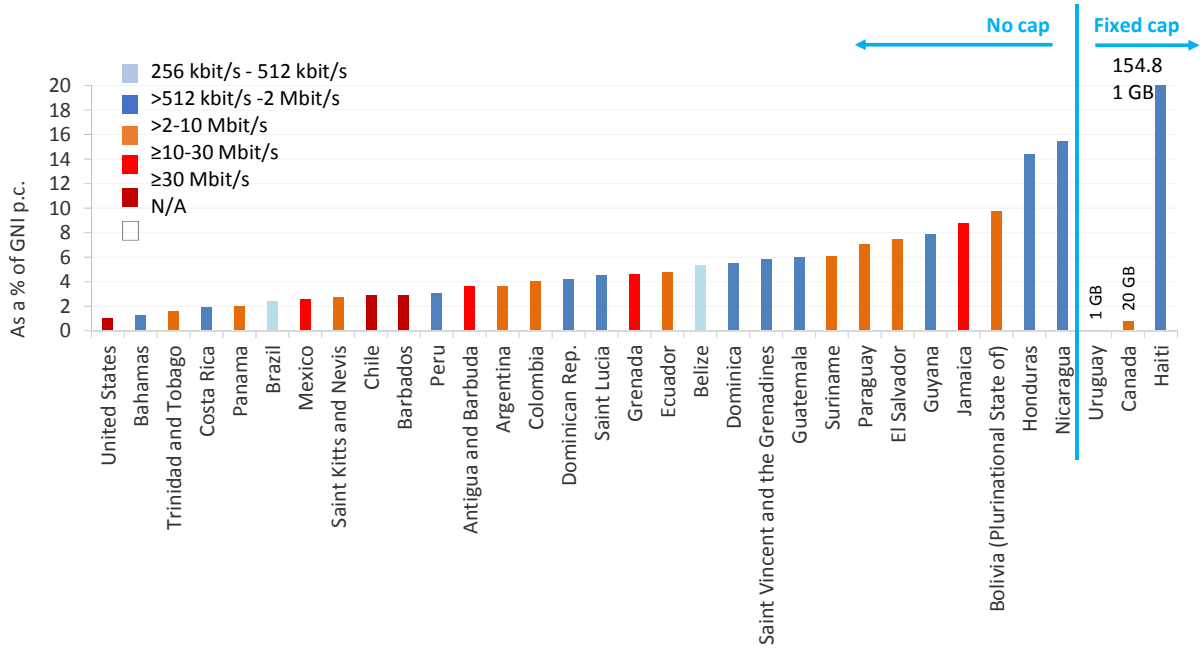
Burkina Faso saw the largest price reduction in the region in 2017. The main fixed operator in the country, Onatel, shifted the speeds of fixed-broadband plans upward. As a result, the plan targeting residential customers, which was limited to 128 kbit/s in the past, was upgraded to 256 kbit/s, thus meeting the minimum requirements for a plan to be considered broadband. This led to a saving of PPP$ 43.5 per month to those customers subscribing to a fixed-broadband plan at 256 kbit/s.

Americas

Fixed-broadband prices in the Americas correspond to less than 2 per cent of GNI p.c. in all high-income economies in the region, except Barbados and Antigua and Barbuda (Chart 4.29). Costa Rica stands out as the only country with upper-middle income having achieved the Broadband Commission's 2 per cent target for 2025 by 2017. This comes as no surprise given the successful liberalization of the telecommunication sector undertaken by the country since 2008, which has led to lower entry-level fixed-broadband prices and higher speeds.[22]

The Americas is the region with the most countries offering unlimited data for entry-level fixed-broadband plans. Despite this, fixed-broadband prices are relatively affordable in most countries in the region, except in lower-middle-income economies such as Bolivia (Plurinational State of), Honduras and Nicaragua. In Haiti, the extremely high prices for 1 GB of data usage per month testify that most Internet users rely on mobile-broadband services.

Chart 4.29: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, the Americas, 2017



Note: 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.

A majority of countries in the Americas offer entry-level fixed-broadband speeds at 1 Mbit/s or above. However, countries such as Uruguay and Brazil show that lower-speed entry-level offers may be an effective way to ensure that fixed-broadband services are affordable for almost the entire population. Similarly, in Canada, the launch of a lower-end plan by the operator Bell led to the largest price reduction in the Americas (Table 4.8).[23]

At the other end, in the United States, the operator Spectrum offers an entry-level fixed-broadband plan at 100 Mbit/s and unlimited data for PPP$ 50 per month, thus providing the lowest price per Mbit/s in the region (Table 4.8).

Table 4.8: Lowest fixed-broadband prices, largest price reduction (2016–2017) and most value for money, the Americas, 2017

	Value	Country
Lowest price	PPP$ 0	Uruguay
Most value for money (unlimited plans)	PPP$ 0.5 per Mbit/s	United States
Most value for money (capped plans)	PPP$ 0 per 1 GB	Uruguay
Largest price reduction 2016–2017 (PPP$)	PPP$-29.2	Canada

Source: ITU.

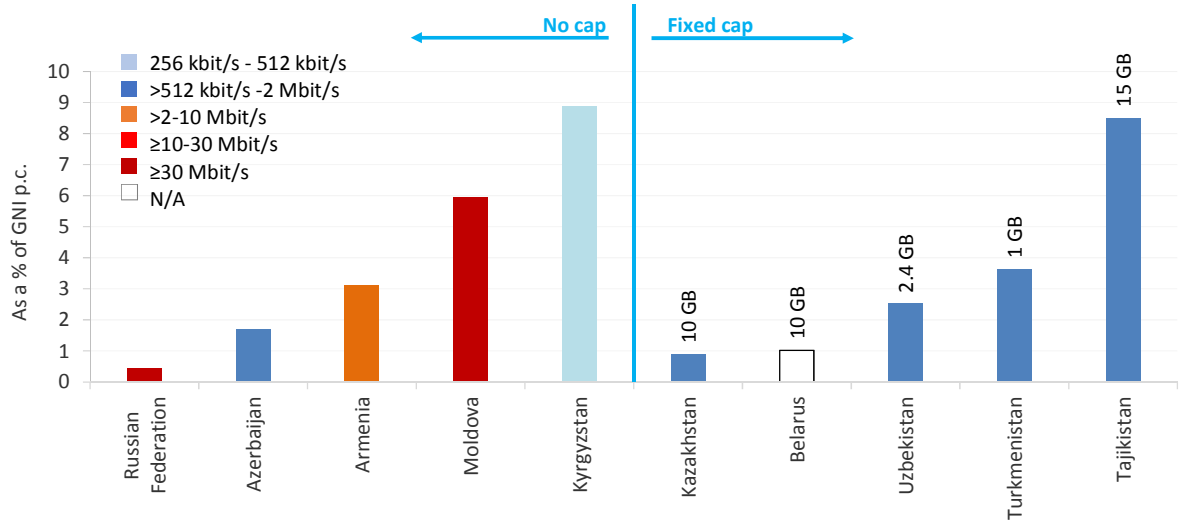
Commonwealth of Independent States

Fixed-broadband prices correspond to less than 2 per cent of GNI p.c. in the Russian Federation, Kazakhstan, Belarus and Azerbaijan (Chart 4.30). These are the CIS countries with the highest fixed-broadband penetration, together with Moldova, where entry-level fixed-broadband services are less affordable but offer the highest speed in the whole region (100 Mbit/s).

Uzbekistan and Armenia, despite prices representing slightly more than 2 per cent of GNI p.c., have entry-level fixed-broadband services that are remarkably affordable, and are on the way to achieving the 2 per cent target set by the Broadband Commission for 2025. Kyrgyzstan and Tajikistan, on the other hand, are far from that target and entry-level fixed-broadband prices in these countries suggest that most Internet users rely on mobile-broadband services.

The Russian Federation stands out in the region for having both the lowest price and offering the most value for money, as well as for having recorded the largest price drop in 2017 (Table 4.9). Indeed, the main fixed-broadband operator, Rostelecom, cut prices in half in 2017 for its FTTH plan "Onlime 30". Despite this reduction in prices, speeds were maintained at 30 Mbit/s, thus increasing the value

Chart 4.30: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, CIS, 2017



Note: 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.

for money obtained by the customers of this plan. Kazakhstan, on the other hand, offers the lowest price per GB of all CIS countries with capped entry-level fixed-broadband plans.

Table 4.9: Lowest fixed-broadband prices, largest price reduction (2016–2017) and most value for money, CIS, 2017

	Value	Country
Lowest price	PPP$ 8.0	Russian Federation
Most value for money (unlimited plans)	PPP$ 0.3 per Mbit/s	Russian Federation
Most value for money (capped plans)	PPP$ 1.7 per GB	Kazakhstan
Largest price reduction 2016–2017 (PPP$)	PPP$-8.0	Russian Federation

Source: ITU.

Europe

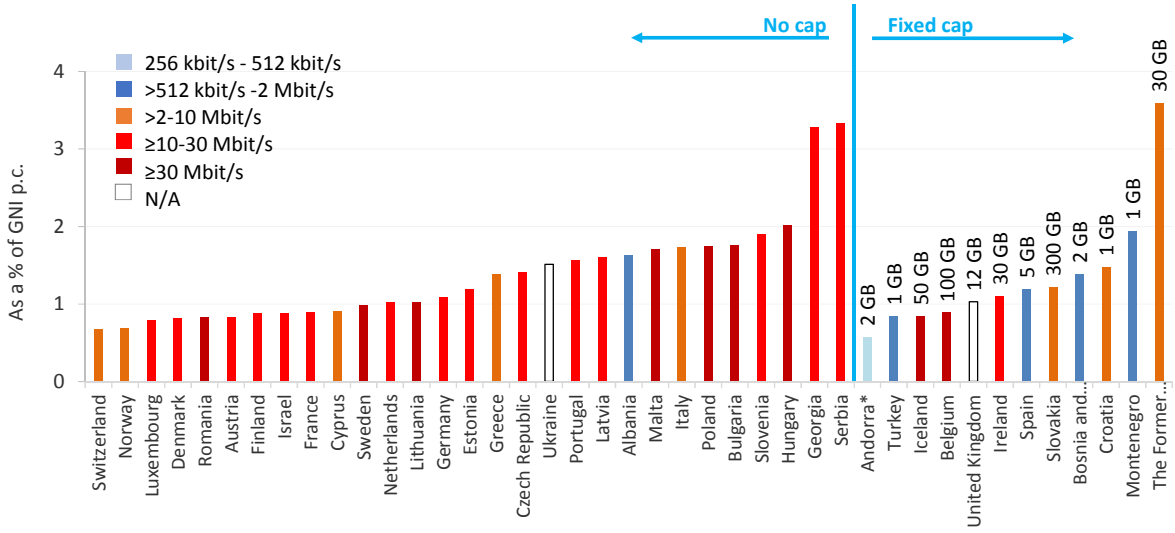
Fixed-broadband services are very affordable in the majority of European countries: all but three countries had already achieved in 2017 the affordability target set by the Broadband Commission for 2025 (Chart 4.31). This goes hand in hand with the high level of fixed-broadband adoption in Europe, the highest of all regions by far.

Entry-level fixed-broadband speeds are equal to or above 10 Mbit/s in a majority of countries in the region, and most entry-level fixed-broadband plans include unlimited data allowances. This highlights that affordable fixed-broadband services are possible to achieve in the region, even based on plans with higher-end features.

A good example of this is Romania: cable operator RCS-RDS offers an entry-level plan at 100 Mbit/s including unlimited data, thus bringing the price per Mbit/s down to PPP$ 0.1, the lowest in the region (Table 4.10). BH Telecom follows the opposite approach in Bosnia and Herzegovina: it offers a lower-end entry-level plan including 2 GB per month at a speed of 2 Mbit/s, thus achieving the lowest fixed-broadband prices in Europe (PPP$ 12.3). Such different approaches make it possible to respond to different market contexts: GNI p.c. in Bosnia and Herzegovina is half that of Romania and, as a result, low-cost plans with lower-end features are a sensible approach to ensure that fixed-broadband services are affordable for most of the population.

Another country that stands out in the regional comparison is Albania, which recorded the largest price reduction in 2017 (Table 4.10). The Albanian telecommunication market has seen in the past few years an increase in bundled offers, particularly in the mobile-cellular market, but also in the fixed-line segment. Coupled with a downward trend in prices, this has led to a significant increase in the value for money obtained by Albanian customers. For instance, operator Albtelecom offered in 2017 a "standard package" of bundled fixed-telephone and fixed-

Chart 4.31: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Europe, 2017



Note: Speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription. *The GNI p.c. data used to calculate the price as a percentage of GNI p.c. correspond to 2016, sourced from UNSD.
Source: ITU. GNI p.c. values are based on World Bank data.

broadband services for a 40 per cent price reduction from the basic entry-level plan offered in 2016.

Table 4.10: Lowest fixed-broadband prices, largest price reduction (2016–2017) and most value for money, Europe, 2017

	Value	Country
Lowest price	PPP$ 12.3	Bosnia and Herzegovina
Most value for money (unlimited plans)	PPP$ 0.1 per Mbit/s	Romania
Most value for money (capped plans)	PPP$ 0.1 per GB	Slovakia
Largest price reduction 2016–2017 (PPP$)	PPP$-9.2	Albania

Source: ITU.

Arab States

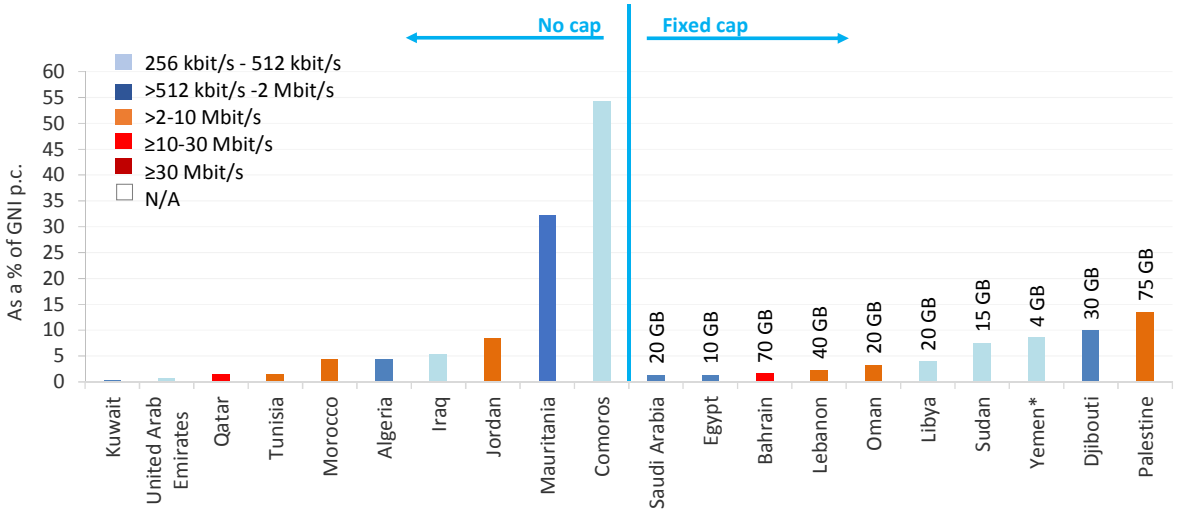
Fixed-broadband prices represent less than 2 per cent of GNI p.c. in all high-income Gulf Cooperation Council countries, except Oman, as well as in Egypt and Tunisia (Chart 4.32). Other Arab States with relatively affordable fixed-broadband services include Algeria, Lebanon, Libya and Morocco, all of them having prices that correspond to a range from 2 to 5 per cent of GNI p.c. At the other end, Comoros and Mauritania have the least affordable prices in the region and are also the Arab States with the lowest fixed-broadband penetration, together with Sudan.

Half of the Arab States offer uncapped entry-level plans. In the other half, data allowances are relatively high, at 10 GB per month or more in all countries except Yemen. There is also a diversity in entry-level fixed-broadband speeds: 30 per cent of countries in the region offer minimum entry-level speeds of 512 or 256 kbit/s, whereas the top 45 per cent offer speeds above 2 Mbit/s.

Higher entry-level speeds may not always be beneficial for customers, particularly for those with the lowest incomes. For instance, in Mauritania, operator Mauritel upgraded the entry-level plan from 512 kbit/s in 2016 to 2 Mbit/s in 2017. This fourfold increase in the speed was accompanied by a threefold increase in the price of the plan and, as a result, although value for money increased, entry-level fixed-broadband services became less affordable in the country.

Tunisia stands out in the regional comparison for having both the lowest prices and offering the most value for money (Table 4.11). These positive results reflect the competitive environment in the country, where three facilities-based operators compete in the fixed-broadband market (Tunisie Telecom, Ooredoo and Orange Tunisie), all of them rolling FTTH infrastructure (see Volume 2 for more details). Indeed, the entry of the second and third operators drove fixed-broadband prices down in 2012, and sustained competitive pressure has kept entry-level prices stable since then, despite the successive upgrades in entry-level speeds.

Chart 4.32: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Arab States, 2017



Note: Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference. Speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription.
*The GNI p.c. data used to calculate the price as a percentage of GNI p.c. correspond to 2016.
Source: ITU. GNI p.c. values are based on World Bank data.

Table 4.11: Lowest fixed-broadband prices, largest price reduction (2016–2017) and most value for money, Arab States, 2017

	Value	Country
Lowest price	PPP$ 12.7	Tunisia
Most value for money (unlimited plans)	PPP$ 3.2 per Mbit/s	Tunisia
Most value for money (capped plans)	PPP$ 0.6 per GB	Bahrain
Largest price reduction 2016–2017 (PPP$)	PPP$-68.4	Djibouti

Source: ITU.

Another Arab State that stands out is Djibouti, which recorded the largest price reduction in entry-level fixed-broadband services in the region (Table 4.11). Indeed, operator Djibouti Telecom cut the price of the entry-level plan by 70 per cent at the expense of reducing the cap (from 50 to 30 GB per month) and the speed (from 3 to 1 Mbit/s). Thanks to this new commercial offer, the affordability of fixed-broadband services in Djibouti has been significantly improved.

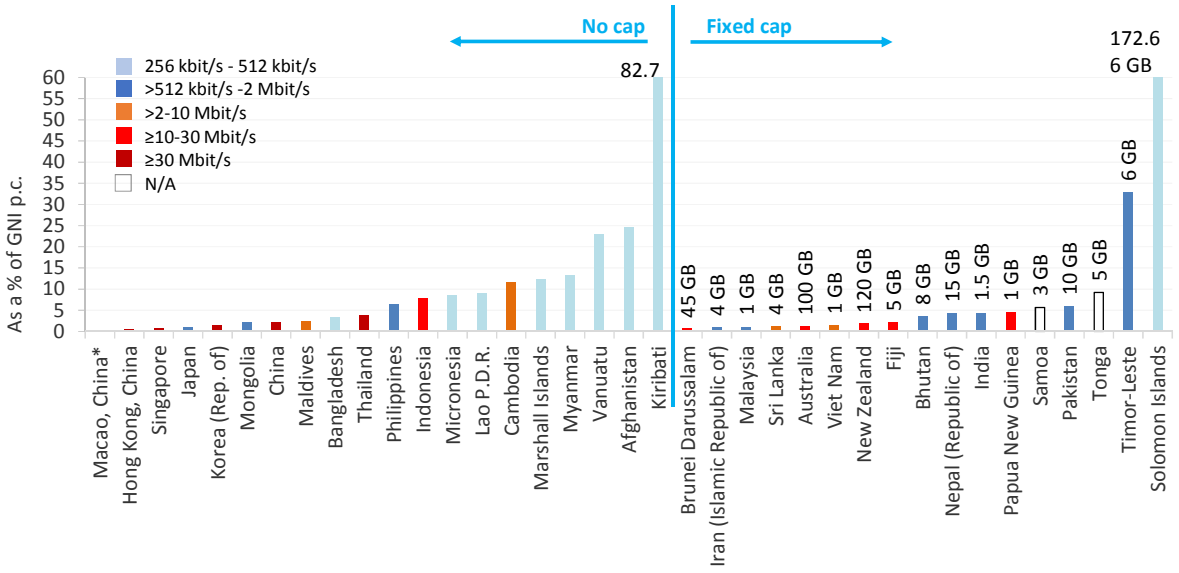
Asia and the Pacific

Asia and the Pacific is home to some of the most affordable entry-level fixed-broadband services worldwide. All high-income economies in the region have prices that correspond to less than 2 per cent of GNI p.c., with Macao (China) at the forefront of the regional and global ranking (Chart 4.33). In addition, countries with much lower income levels – such as Bangladesh, Iran (Islamic Republic of), Nepal (Republic of), Sri Lanka and Viet Nam – have achieved rather affordable fixed-broadband services thanks to entry-level offers below USD 5 per month. This is probably the current lowest price level possible for entry-level fixed-broadband plans in the absence of direct government intervention.

At the other end of the regional ranking, LDCs such as Afghanistan, Kiribati, Solomon Islands, Timor-Leste and Vanuatu have fixed-broadband prices unaffordable for the majority of the population in these countries. All of these countries except Afghanistan are also Small Island Developing States, and all of them share a difficult geography for the deployment of fixed-broadband networks. As a result, residential customers have to rely on mobile-broadband services to connect to the Internet.

Large data caps in countries such as Australia, Brunei Darussalam and New Zealand make their entry-level fixed-broadband plans comparable to unlimited data plans, given that even unlimited data allowances tend to integrate a fair-usage policy that de facto limits the amount of data per subscription. In the other countries in the region with lower data caps (40 per cent of total countries in Asia and the Pacific), limited data offers have

Chart 4.33: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Asia and the Pacific, 2017



Note: Speeds and caps/month refer to the advertised speeds and the amount of data included in the entry-level fixed-broadband subscription. *The GNI p.c. data used to calculate the price as a percentage of GNI p.c. correspond to 2016.
Source: ITU. GNI p.c. values are based on World Bank data.

enabled lower prices for entry-level fixed-broadband services.

Asia and the Pacific is home to some of the operators offering most value for money to their customers for entry-level fixed-broadband plans. Singtel in Singapore offers the lowest price per Mbit/s worldwide, and other operators – such as HKT (Hong Kong, China), China Unicom (China) and KT (the Republic of Korea) – offer prices per Mbit/s below PPP$ 0.4. When comparing the value for money of capped offers, the operator Spark in New Zealand offers the lowest price per GB (Table 4.12).

Although the largest price reduction in Asia and the Pacific in 2017 was recorded in the Solomon Islands, fixed-broadband services remain a premium service beyond the pockets of most residential customers in this Small Island Developing State.[24] At the other end, Viet Nam is home to the least expensive fixed-broadband prices in the region (Table 4.12).

Table 4.12: Lowest fixed-broadband prices, largest price reduction (2016–2017) and most value for money, Asia and the Pacific, 2017

	Value	Country
Lowest price	PPP$ 6.8	Viet Nam
Most value for money (unlimited plans)	PPP$ 0.1 per Mbit/s	Singapore
Most value for money (capped plans)	PPP$ 0.4 per GB	New Zealand
Largest price reduction 2016–2017 (PPP$)	PPP$-104.8	Solomon Islands

Source: ITU.

Endnotes

1 Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference.

2 Data on household expenditure on ICT can be separated into two categories: (a) expenditure on ICT services and (b) expenditure on ICT equipment and repair. The first category represents more than 60 per cent of total household expenditure in all countries for which data are available.

3 For more information on the Broadband Commission's Targets for 2015, see https://www.itu.int/net/pressoffice/press_releases/2011/42.aspx.

4 For more information on the Broadband Commission's 2025 Targets, see https://www.broadbandcommission.org/Documents/publications/wef2018.pdf.

5 The Alliance for Affordable Internet includes among its members private sector stakeholders such as Cisco, Google, GSMA and Microsoft, public sector stakeholders such as the United States Department of State and the Department for International Development of the United Kingdom, and international organizations such as UN Women and the World Bank Group. For more information on the alliance for affordable Internet, see https://a4ai.org.

6 For example, if country A and country B have the same price in USD for any given ICT service, but in country A prices of other products are in general cheaper (in USD), then applying PPP exchange rates to the price of the ICT service in country A will make this service more expensive. That is so because, compared with country B, in country A the same amount of USD (exchanged into national currency at market exchange rates) can buy more products or services. Therefore, the ICT service in country A is more expensive in terms of what could be bought with that amount in each country. The International Comparison Program is the major global initiative to produce internationally comparable price levels. For more information on the PPP methodology and data, see http://icp.worldbank.org.

7 GNI takes into account all production in the domestic economy (i.e. gross domestic product) plus the net flows of factor income (such as rents, profits and labour income) from abroad. The Atlas method smooths exchange-rate fluctuations by using a three-year moving average, price-adjusted conversion factor. See http://data.worldbank.org/indicator/NY.GNP.PCAP.CD.

8 References to income groups are based on the World Bank classification by income group, available at https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

9 Source: Telecommunications Regulatory Commission of Sri Lanka, Determination of Floor Rates – 2016. Available at http://www.trc.gov.lk/images/pdf/Floor_Rates_2016.pdf.

10 For more information about Digicel Jamaica's "One Rate Plan", see https://www.digicelgroup.com/jm/en/mobile/plans-services/prepaid-plans/legacy-plans.html.

11 For more information, see MTS Russia's "Super MTS" plan at https://moskva.mts.ru/personal/mobilnaya-svyaz/tarifi/vse-tarifi/supermts.

12 For more information about Mauritel's "Comfort PASS" packages, see http://www.mauritel.mr/particulier/Mobile/OffresPr%C3%A9pay%C3%A9es/PassConfort.aspx.

13 For more information on Smart's "LateNightOwl" plan, see https://www.smart.com.kh/services/add-services/latenightowl.

14 For more information on Airtel Rwanda's plans for students, see http://africa.airtel.com/wps/wcm/connect/africarevamp/rwanda.

15 In 2016, Kuwait had 61 data-only mobile-broadband subscriptions per 100 inhabitants, the third highest penetration for this type of broadband subscriptions after Finland and the United Arab Emirates.

16 In 2017, Kuwait recorded an average consumption of 13 GB per mobile-broadband subscription per month.

17 In the Americas, the average data allowance for the handset-based mobile-broadband basket was about 2 GB per month, compared with 3.6 GB per month for the computer-based mobile-broadband basket. In Asia and the Pacific, average data allowances were 1.4 GB and 3.4 GB. These compare with 1.5 GB and 5 GB per month in Europe, and 1 GB and 5 GB in the CIS. Because in Europe and CIS operators offered larger data allowances for the postpaid computer-based plans, volume discounts were larger.

18 Fixed-broadband prices presented in this chapter correspond to what could be considered an entry-level fixed-broadband plan in most countries, i.e. based on a minimum speed of 256 kbit/s and 1 GB of data consumption per month. For more information on the composition of the ITU fixed-broadband basket, see Annex 1.

19 The rental of a fixed-telephone line cost USD 6.0 per month in Uruguay in 2017.

20 For more information on Plan Ibirapitá, see https://ibirapita.org.uy.

21 According to data from the ITU Interactive Transmission Map, 44.9 per cent of the population in Africa lived within 25 km of a fibre-optic node at the end of 2017, and 45.8 per cent in Asia and the Pacific.

[22] Although the former incumbent *Instituto Costarricense de Electricidad* (ICE) remains the dominant fixed-broadband provider in the country, the liberalization of the market has had an evident impact on ICE's tariffs. Indeed, the introduction of competition in the Costa Rican market was followed by a sharp drop in entry-level fixed-broadband prices (from USD 21.5 per month in 2008 to less than USD 10 per month in 2009). Subsequently, entry-level fixed-broadband prices have stabilized at around USD 17 per month and entry-level speeds have increased from 256 kbit/s in 2008 to 1 Mbit/s in 2017. For more information on the Costa Rican market, see Volume 2 of this report.

[23] The plan Essential Plus offers 20 GB per month at a speed of 3 Mbit/s for PPP$ 25 per month. Previously, the entry-level plan of Bell Canada included 75 GB per month at 15 Mbit/s for PPP$ 54 per month.

[24] In 2017, a fixed-broadband service including 6 GB per month at an entry-level speed of 256 kbit/s cost more than USD 200 per month in the Solomon Islands.

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Annex 1. ICT Price Data Methodology

Price data collection and sources

The price data presented in this report were collected in the fourth quarter of 2017. With the exception of the data on mobile-broadband prices, which were collected by ITU directly from operators' websites[1], all data were collected through the ITU ICT Price Basket Questionnaire, which was sent to the administrations and statistics contacts of all 193 ITU Member States in October 2017.[2] Through the questionnaire, contacts were requested to provide 2017 data for fixed-telephone, mobile-cellular and fixed-broadband prices; the 2015 and 2016 prices were included for reference, where available. For those countries that did not reply to the ITU ICT Price Basket Questionnaire and for mobile-broadband services, price data were collected directly from operators' websites and/or through direct correspondence. Price data were collected from the operator with the largest market share, as measured by the number of subscriptions. Insofar as, for many countries, it is not clear which Internet service provider (ISP) has the dominant market share, preference was given to prices offered by the (former) incumbent telecommunication operator. In some cases, especially where prices were not clearly advertised or were indicated only in the local language, and where operators did not respond to queries, alternative operators were chosen. All prices were converted into United States dollars using IMF's average annual rate of exchange for 2017, and into PPP$ using World Bank conversion factors for 2017 (as published in July 2018). Prices are also presented as a percentage of countries' monthly gross national income per capita (GNI p.c.) using GNI p.c. values from the World Bank (Atlas method) for 2017 (as published in July 2018). Price data for 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015and 2016, which are also shown and used in this chapter, were collected in previous years (always during the second half of the respective year), in national currencies, and converted using the average annual rates of exchange.

The mobile-cellular sub-basket

The mobile-cellular sub-basket refers to the price of a standard basket of mobile monthly usage for 30 outgoing calls per month (on-net/off-net to a fixed line and for peak and off-peak times) in predetermined ratios, plus 100 SMS messages[3]. It is calculated as a percentage of a country's average monthly GNI p.c. and is also presented in USD and PPP$. The mobile-cellular sub-basket is based on prepaid prices, although postpaid prices are used for countries where prepaid subscriptions make up less than two per cent of all mobile-cellular subscriptions.

The mobile-cellular sub-basket is largely based on, but does not entirely follow, the 2009 methodology of the OECD low-user basket, which is the entry-level basket with the smallest number of calls included (OECD, 2010). Unlike the 2009 OECD methodology, which is based on the prices of the two largest mobile operators, the ITU mobile sub-basket uses only the largest mobile operator's prices. Nor does the ITU mobile-cellular sub-basket take account of calls to voicemail (which in the OECD basket represent four per cent of all calls) or non-recurring charges, such as the one-time charge for a SIM card. The basket gives the price of a standard basket of mobile monthly usage in USD determined by OECD for 30 outgoing calls per month in predetermined ratios, plus 100 SMS messages.[4] The cost of national SMS is the charge to the consumer for sending a single SMS text message. Both on-net and off-net SMS prices are taken into account. The basket considers on-net and off-net calls as well as calls to a fixed telephone[5] and, since the price of a call often depends on the time of day or week it is made, peak, off-peak and weekend periods are also taken into consideration. The call distribution is outlined in Annex Table 1.1.

Prepaid prices were chosen because they are often the only payment method available to low-income users, who might not have a regular income and will thus not qualify for a postpaid subscription. Rather than reflecting the cheapest option available, the mobile-cellular sub-basket therefore corresponds to a basic, representative (low-usage)

Annex Table 1.1: OECD mobile-cellular low-user call distribution (2009 methodology)

	To fixed	On-net	Off-net	TOTAL	Call distribution by time of day (%)
Call distribution (%)	17.0	56.0	26.0	100.0	100.0
Calls	**5.2**	**16.9**	**7.9**	**30.0**	
Peak	2.4	7.8	3.6	13.8	46.0
Off-peak	1.5	4.9	2.3	8.7	29.0
Weekend	1.3	4.2	2.0	7.5	25.0
Duration (minutes per call)	**2.0**	**1.6**	**1.7**		
Duration (total minutes of calls)	10.4	27.0	13.4	50.9	N/A
Peak	4.8	12.4	6.2	23.4	46.0
Off-peak	3.0	7.8	3.9	14.8	29.0
Weekend	2.6	6.8	3.4	12.7	25.0
Calls	**30 calls per month**				
SMS	100 SMSs per month (50 on-net, 50 off-net)				

Source: ITU, based on OECD (2010).

package available to all customers. In countries where no prepaid offers are available, the monthly fixed cost (minus the free minutes of calls included, if applicable) of a postpaid subscription is added to the basket. To make prices comparable, a number of rules are applied (see Annex Box 1.1).

Annex Box 1.1: Rules applied in collecting mobile-cellular prices

1. The prices of the operator with the largest market share (measured by the number of subscriptions) are used. If prices vary between different regions of the country, prices refer to those applied in the largest city (in terms of population) or in the capital city.

2. Price data should be collected in the currency in which the prices are advertised, including taxes. If prices are not advertised in local currency, a note should be added specifying the currency.

3. Prices refer to prepaid plans. Where the operator offers different packages with a certain number of calls and/or SMS messages included, the cheapest one on the basis of 30 calls and 100 SMSs should be selected. If, instead of a pay-per-use plan, a package is selected for the whole basket (e.g. a bundle including 100 SMSs, 60 minutes and 100MB) or for some of its elements (e.g. a package including 100 SMSs), this should be indicated in the notes. In countries where prepaid subscriptions account for less than 2 per cent of the total subscription base, postpaid prices may be used. In this case, the monthly subscription fee, plus any free minutes, will be taken into consideration for the calculation of the mobile-cellular sub-basket.

4. If per-minute prices are only advertised in internal units rather than in national currency, the price of the top-up/refill charge is used to convert internal units into national currency. If there are different refill prices, then the "cheapest/smallest" refill card is used. If different refill charges exist depending on the validity period, the 30-day validity period (or that closest to 30 days) is used.

5. Prices refer to a regular (non-promotional) plan and exclude special or promotional offers, limited discounts or options such as special prices to certain numbers or restricted to new customers, or plans where calls can only be made during a limited number of (or on specific) days during the month.

6. If subscribers can chose "favourite" numbers (for family, friends, etc.) with a special price, this special price will not be taken into consideration, irrespective of the quantity of numbers involved.

7. Prices refer to outgoing local calls. If different rates apply for local and national calls, then the local rate is used. If different charges apply depending on the mobile operator called, the price of calls to the operator with the second largest market share (measured by the number of subscriptions) should be used, indicating in the notes the rates for calling to other mobile operators. If charges apply to incoming calls, these are not taken into consideration.

8. If prices vary between minutes (1st minute = price A, 2nd minute = price B, 3rd minute = price C), the sum of the different prices is divided by the number of different prices (e.g. price per minute = (A+B+C)/3).

9. If prices vary beyond three minutes, the average price per minute is calculated based on the first three minutes.

10. If there is a connection cost per call, then this is taken into consideration in the formula for the mobile-cellular sub-basket, based on 30 calls.

11. If there are different off-peak prices, then the one that is the cheapest before midnight is used. If the only off-peak period is after midnight, then this is not used. Instead, the peak price is used.

12. If there are different peak prices, the most expensive one during the daytime is used.

13. If there are different weekend prices, the price that applies to Sundays during the daytime is used (or the equivalent day in countries where weekends are not on Sundays).

14. If there is no weekend price, the average peak and off-peak price that is valid during the week is used.

15. If peak and off-peak SMS prices exist, the average of both is used for on-net and off-net SMSs.

16. If calls are charged by call or by hour (and not by the minute), the mobile-cellular sub-basket formula will be calculated on the basis of 30 calls or 50.9 minutes. Similarly, if calls are charged by call or by number of minutes for a specific network/time of the day, this will be taken into account for that particular network/time of the day.

17. If monthly, recurring charges exist, they are added to the sub-basket.

Source: ITU.

The fixed-broadband sub-basket

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

Where several offers are available, preference is given to the cheapest available connection that offers a speed of at least 256 kbit/s and 1 GB of data volume. Where providers set a limit of less than 1 GB on the amount of data that can be transferred within a month, then the price per additional byte is added to the monthly price in order to calculate the cost of 1 GB of data per month. Preference is given to the most widely used fixed (wired)-broadband technology (DSL, fibre, cable, etc.). The sub-basket does not include the installation charges, modem prices or telephone-line rentals that are often required for a DSL service. The price represents the broadband entry plan in terms of the minimum speed of 256 kbit/s, but does not take into account special offers that are limited in time or to specific geographical areas. The plan does not necessarily represent the fastest or most cost-effective connection since the price for a higher-speed plan is often cheaper in relative terms (i.e. in terms of the price per Mbit/s) (see Annex Box 1.2).

Annex Box 1.2: Rules applied in collecting fixed-broadband Internet price data

1. The prices of the operator with the largest market share (measured by the number of fixed-broadband subscriptions) should be used.

2. Price data should be collected in the currency in which the prices are advertised, including taxes. If prices are not advertised in local currency, a note should be added specifying the currency.

3. Only residential, single-user price data should be collected. If prices vary between different regions of the country, prices applying to the largest city (in terms of population) should be provided. If that information is not available, prices applying to the capital city should be reported. The selected city should be mentioned in a note in the monthly subscription indicator.

4. From all fixed-broadband plans meeting the above-mentioned criteria, the cheapest plan on the basis of a 1 GB monthly usage and an advertised download speed of at least 256 kbit/s should be selected. If there is a price distinction between residential and business tariffs, the residential tariff should be used.

5. If the plan selected places no limit on the monthly data usage, the cap should be set at 0 and a note added to that indicator specifying "unlimited".

6. If operators propose different commitment periods, the 12-month plan (or the one closest to this commitment period) should be used. If the plan selected requires a longer commitment (i.e. over 12 months), it should be indicated in the note regarding the monthly subscription. Furthermore, if different prices apply (e.g. a discount price for the first year, and a higher price as of the 13th month), then the price after the discount period should be selected (e.g. the price as of the 13th month). The discount price charged during the initial period should be indicated in a note regarding the monthly subscription charge. This is because the initial price paid is considered a limited/discount price, whereas the price subsequently charged is the regular price.

7. Price data should be collected for the fixed (wired)-broadband technology with the greatest number of subscriptions in the country (DSL, cable, etc.).

8. The same price plan should be used for collecting all the data specified. For example, if Plan A is selected for the fixed-broadband service, according to the criteria mentioned above, the elements in Plan A shall be taken into account in regard to the monthly subscription, the excess-charge price, the volume of data that can be downloaded, etc.

9. Price data should be collected for regular (non-promotional) plans and should not include promotional offers or limited or restricted discounts (e.g. for students only, for existing customers, etc.).

10. With convergence, operators are increasingly providing multiple (bundled) services such as voice telephony, Internet access and television reception over their networks. They often bundle these offers into a single subscription. This can present a challenge for price data collection, since it may not be possible to isolate the prices for one service. It is preferable to use prices for a specific service (i.e. unbundled); if this is not possible, then the additional services that are included in the price plan should be specified in a note.

The cost of a fixed-telephone line should be excluded if it can be used for other services as well. If a monthly rental for the physical line is not required (e.g. naked DSL), this should be mentioned in a note. If a monthly rental of a fixed-telephone line is required, this should also be explained in a note.

Source: ITU.

Mobile-broadband prices

ITU has been collecting mobile-broadband price data through its annual ICT Price Basket Questionnaire since 2012. The collection of mobile-broadband price data from ITU Member States was agreed upon by the Expert Group on Telecommunication/ICT Indicators (EGTI)[6] in 2012, and revised by EGTI in 2013 in the light of the lessons learned from the first data collection exercise. The revised methodology was endorsed by the eleventh World Telecommunication/ICT Indicators Symposium held in December 2013 in Mexico City, and was applied in the 2014 data collection.

To capture the prices of different data packages, covering both prepaid and postpaid services and support by different devices (handset and computer), mobile-broadband price data were collected for two different data thresholds, based on a set of rules (see Annex Box 1.3).

For plans that were limited in terms of validity (less than 30 days), the price of the additional days was calculated and added to the base package in order to obtain the final price. Two possibilities exist, depending on the operator, for extending a plan that is limited in terms of data allowance (or validity). The customer either (i) continues to use the service and pays an excess usage charge for additional data,[7] or (ii) purchases an additional (add-on) package. Thus, for some countries, prices presented in this chapter reflect the price of the base package plus an excess-usage charge (e.g. a base package including 400 MB plus the price for 100 MB of excess usage for a monthly usage of 500 MB), or a multiplication of the base package price (e.g. twice the price of a 250 MB plan for a monthly usage of 500 MB).

The plans selected represent the least expensive offers that include the minimum amount of data for each respective mobile-broadband plan. The guiding principle is to base each plan on what customers could and would purchase given the data allowance and validity of each plan.

Annex Box 1.3: Rules applied in collecting mobile-broadband prices[8]

1. Price data should be collected based on one of the following technologies: UMTS, HSDPA+/ HSDPA, CDMA2000 and IEEE 802.16e. Prices applying to WiFi or hotspots should be excluded.

2. Price data should be collected in the currency in which they are advertised, including taxes. If prices are not advertised in local currency, a note should be added specifying the currency.

3. Only residential, single-user prices should be collected. If prices vary between different regions of the country, prices applying to the largest city (in terms of population) or to the capital city should be provided.

4. Price data should be collected for both: a) handset-based mobile-broadband subscriptions and b) computer-based mobile-broadband subscriptions.

5. Mobile-broadband price data should be collected from the operator with the largest market share measured by the number of mobile-broadband subscriptions. If this information is not available, mobile-broadband price data should be collected from the mobile-cellular operator with the largest market share (measured by the number of mobile-cellular subscriptions) in the country.

6. Different operators can be chosen for different mobile-broadband services if: a) there are different market leaders for specific segments (postpaid, prepaid, computer-based, handset-based); b) there is no offer available for a specific sub-basket.

7. Price data should be collected for prepaid and postpaid services, for both handset and computer-based plans. If there are several plans, the plan satisfying the indicated data volume requirement should be used.

8. Where operators propose different commitment periods for postpaid mobile-broadband plans, the 12-month plan (or the plan closest to this commitment period) should be selected. A note should be added if only longer commitment periods are offered.

9. Price data should be collected for the cheapest plan, with a data volume allowance of a minimum of:

    i. 1GB for USB/dongle (computer-based) subscription

    ii. 500MB for the handset-based subscription

    The selected plan should not necessarily be the one with the cap closest to 500 MB or 1 GB, but include a minimum of 500 MB/1 GB. This means, for example, that if an operator offers a 300 MB and an 800 MB plan, the 800 MB plan or twice the 300 MB plan (if the package can be purchased twice for a monthly capacity of 600 MB) should be selected for the 500 MB sub-sub-basket. The cheapest option should be selected.

    Data volumes should refer to both upload and download data volumes. If prices are linked to "hours of use" and not to data volumes, this information should be added in a separate note (ITU will not be able to include these cases in a comparison).

10. The validity period considered for the basket is 30 days or four weeks. If a plan with a validity of 15 days is selected, it will be taken into consideration twice to cover the whole period. Likewise, if a plan with a validity of a day or a week is selected, it will be taken into consideration as many times as necessary to cover a period of four weeks. The cheapest plan on the basis of a validity period of 30 days or four weeks should be selected.

11. Preference should be given to packages (including a certain data volume). Pay-as-you-go offers should be used when they are the cheapest option for a given basket or the only option available. If operators charge different pay-as-you-go rates depending on the time of the day (peak/off-peak), then the average of both should be recorded. Night-time data allowances will not be considered.

12. Even if the plan is advertised as "unlimited", the fine print should be read carefully since the data volumes are usually limited, either by throttling (limiting the speed) or by cutting off the service.

13. Data on non-recurrent fees, such as installation/set-up fees, are not collected.

14. Preference should be given to the cheapest available package even if this is bundled with other services (e.g. with voice services). If the plan chosen includes other services besides mobile-broadband access, these should be specified in a note.

15. Prices refer to a regular (non-promotional) plan and exclude promotional offers and limited discounts or special user groups (e.g. existing clients). Special prices applying to a certain type of phone (iPhone/Blackberry, iPad) should be excluded. Night-time allowances are not included.

Source: ITU.

Endnotes

1 Price data for mobile-broadband services were collected by ITU, in collaboration with Consultants.

2 Data for fixed-telephone, mobile-cellular and fixed-broadband have been collected since 2008 through the ITU ICT Price Basket Questionnaire, which is sent out annually to all ITU Member States/national statistics contacts.

3 On-net refers to a call made to the same mobile network, while off-net and fixed-line refer to calls made to other (competing) mobile networks and to a fixed-telephone line, respectively.

4 See OECD (2010).

5 See footnote 3.

6 EGTI was created in May 2009 with the mandate to revise the list of ITU supply-side indicators (i.e. data collected from operators), as well as to discuss outstanding methodological issues and new indicators. EGTI is open to all ITU members and experts in the field of ICT statistics and data collection. It works through an online discussion forum (http://www.itu.int/ITU-D/ict/ExpertGroup/default.asp) and face-to-face meetings. EGTI reports to the World Telecommunication/ICT Indicators Symposium (WTIS).

7 Some operators throttle speeds after the data allowance included in the base package has been reached. Customers can then pay an excess-usage charge in order to continue to have full-speed connections. In some cases, even throttled speeds are still considered to be broadband (i.e. equal to or greater than 256 kbit/s, according to ITU's definition).

Annex 2. ICT Prices

Annex Table 2.1: Fixed-broadband prices 2017

	Economy	Notes	Residential monthly subscription		Speed, in Mbit/s	Cap (GB)	ISP
			USD	PPP$			
1	Afghanistan		11.8	38.5	0.25	Unlimited	Afghan Telecom
2	Albania	1	5.9	12.6	1	Unlimited	Albtelecom
3	Algeria	2	14.4	41.6	1	Unlimited	Algérie Telecom
4	Andorra		17.7	N/A	0.5	2.0	STA
5	Angola		41.0	52.3	4	15.0	Angola Telecom
6	Antigua and Barbuda	3	42.6	52.6	10	Unlimited	APUA Inet
7	Argentina	4	39.2	N/A	3	Unlimited	Telefónica de Argentina- Speedy
8	Armenia		10.4	25.4	4	Unlimited	ArmenTel Beeline
9	Australia	5	53.6	43.7	15	100.0	Telstra
10	Austria	6	31.7	33.0	20	Unlimited	A1 Telekom Austria AG
11	Azerbaijan		5.8	26.4	1	Unlimited	Aztelekom
12	Bahamas		30.0	26.3	1	Unlimited	Batelnet
13	Bahrain		26.6	43.4	10	70.0	Batelco
14	Bangladesh		4.3	10.8	0.25	Unlimited	Bangladesh Telecommunications Company Limited
15	Barbados		37.5	30.6	35	Unlimited	Flow
16	Belarus		4.5	17.9		10.0	ByFly. RUE Beltelecom
17	Belgium		31.0	31.3	50	100.0	Proximus
18	Belize		19.5	34.2	0.5	Unlimited	BTL
19	Benin		25.8	67.1	0.5	Unlimited	Benin Telecoms
20	Bhutan		8.0	23.5	2	8.0	Bhutan Telecom Ltd.
21	Bolivia (Plurinational State of)	7	25.3	51.0	2.5	Unlimited	Cotas Net
22	Bosnia and Herzegovina		5.7	12.3	2	2.0	BH Telecom
23	Botswana		28.0	55.4	0.5	Unlimited	BTC
24	Brazil	8	17.2	25.0	0.5	Unlimited	Vivo
25	Brunei Darussalam		18.1	31.6	10	45.0	Telekom Brunei Berhad
26	Bulgaria	9	11.4	26.7	30	Unlimited	Bulgarian Telecommunication Company EAD
27	Burkina Faso		21.5	57.2	0.25	Unlimited	ONATEL
28	Burundi		75.2	191.9	0.26	Unlimited	ONATEL
29	Cabo Verde		10.1	21.7	12	5.0	Cabo Verde Telecom (CVMultimedia)
30	Cambodia		12.0	29.6	4	Unlimited	Metfone
31	Cameroon		25.6	62.4	2	Unlimited	Camtel
32	Canada		26.1	25.0	3	20.0	Bell Canada
33	Chile		32.4	46.1	30	Unlimited	VTR
34	China	10	15.7	27.6	100	Unlimited	China Unicom
35	Colombia	11	19.6	42.2	5	Unlimited	Telmex Colombia S.A. (CLARO)
36	Comoros		34.4	N/A	0.5	Unlimited	Comores Telecom
37	Congo (Rep. of the)		60.1	N/A	0.5	Unlimited	Congo Telecom
38	Costa Rica		17.3	26.3	1	Unlimited	ICE
39	Côte d'Ivoire		32.6	80.8	1	Unlimited	Orange Côte d'Ivoire
40	Croatia	12	15.3	25.5	4	1.0	T-Com
41	Cuba	13	180.0	N/A	0.26	Unlimited	ETECSA
42	Cyprus		18.1	22.8	5	Unlimited	CYTA
43	Czech Republic	14	21.3	34.9	20	Unlimited	O2 Czech Republic a.s.
44	Denmark		37.7	29.6	25	Unlimited	YouSee
45	Djibouti		15.5	26.3	1	30.0	Djibouti Telecom

Annex Table 2.1: Fixed-broadband prices 2017 (continued)

	Economy	Notes	Residential monthly subscription		Speed, in Mbit/s	Cap (GB)	ISP
			USD	PPP$			
46	Dominica		32.2	44.1	2	Unlimited	Flow
47	Dominican Rep.		23.2	49.6	2	Unlimited	Claro
48	Ecuador		23.4	38.6	5	Unlimited	CNT EP
49	Egypt	15	3.2	20.8	1	10.0	TE Data
50	El Salvador	16	22.1	42.9	3	Unlimited	Claro
51	Equatorial Guinea		111.7	188.0	0.5	Unlimited	Getesa
52	Estonia		18.0	26.4	10	Unlimited	Telia Eesti AS
53	Eswatini		47.0	120.0	0.25	6.0	SPTC
54	Ethiopia		11.4	28.8	0.5	2.0	Ethio Telecom
55	Fiji		9.2	14.8	10	5.0	Connect Fiji Ltd
56	Finland		32.6	29.7	10	Unlimited	Elisa
57	France	17	28.2	28.8	15	Unlimited	Orange
58	Gabon		24.1	37.8	0.5	Unlimited	Gabon Telecom
59	Georgia		10.4	30.5	10	Unlimited	Silknet
60	Germany	18	39.4	42.1	16	Unlimited	Telekom Deutschland GmbH
61	Ghana	19	23.0	71.2	16	20.0	Vodafone Ghana
62	Greece		20.9	27.5	4	Unlimited	OTE
63	Grenada		36.7	49.3	15	Unlimited	Flow
64	Guatemala	20	20.3	34.3	2	Unlimited	Claro
65	Guinea	21	8.1	18.5		3.0	Orange Guinea
66	Guyana		29.1	45.7	1.5	Unlimited	GT&T
67	Haiti	22	53.8	123.0	1	1.0	Natcom
68	Honduras		27.0	54.0	2	Unlimited	Millicom (TIGO-HOME)
69	Hong Kong, China	23	17.7	21.4	100	Unlimited	PCCW-HKT Telephone Ltd. and Hong Kong Telecommunications (HKT) Ltd.
70	Hungary		21.7	39.9	50	Unlimited	Magyar Telekom
71	Iceland	24	43.1	28.5	50	50.0	Síminn
72	India		6.8	22.1	2	1.5	Bharat Sanchar Nigam Limited (BSNL)
73	Indonesia	25	23.4	62.9	10	Unlimited	PT. Telekomunikasi Indonesia, Tbk.
74	Iran (Islamic Republic of)		4.6	12.8	1	4.0	TCI
75	Iraq		21.1	41.3	0.25	Unlimited	State Company for Internet Services (SCIS)
76	Ireland	26	50.7	45.2	24	30.0	Eir
77	Israel	27	27.5	22.4	15	Unlimited	Bezeq
78	Italy	28	45.0	49.4	7	Unlimited	Tim
79	Jamaica		34.6	55.5	20	Unlimited	FLOW
80	Japan		31.7	33.2	1	Unlimited	Open Computer Network
81	Jordan		28.0	60.0	4	Unlimited	Orange Internet
82	Kazakhstan		5.9	17.0	1	10.0	Kazakhtelecom JSC
83	Kenya		45.5	101.1	30	Unlimited	Wananchi Group
84	Kiribati		191.6	N/A	0.25	Unlimited	Telecom Services Kiribati Limited
85	Korea (Rep. of)	29	35.0	39.5	100	Unlimited	KT
86	Kuwait	30	9.3	14.4	1	Unlimited	Quality net
87	Kyrgyzstan		8.4	27.8	0.5	Unlimited	Kyrgyz Telekom/JET
88	Lao P.D.R.		17.2	44.4	0.5	Unlimited	Unitel
89	Latvia		19.7	30.4	10	Unlimited	Lattelecom
90	Lebanon		15.9	26.4	4	40.0	Ogero Telecom

Annex Table 2.1: Fixed-broadband prices 2017 (continued)

	Economy	Notes	Residential monthly subscription		Speed, in Mbit/s	Cap (GB)	ISP
			USD	PPP$			
91	Lesotho		11.2	31.9	16	5.0	Econet Telecom Lesotho
92	Libya		21.5	N/A	0.5	20.0	Libya Telecom & Technology (LTT)
93	Liechtenstein		67.6	N/A	40	Unlimited	Telecom Liechtenstein AG
94	Lithuania		13.0	22.5	100	Unlimited	Telia Lietuva, AB
95	Luxembourg		46.2	40.7	20	Unlimited	Post Luxembourg (Post Telecom)
96	Macao, China		7.8	9.7	3	Unlimited	Companhia de Telecomunicações de Macau S.A.R.L. (CTM)
97	Madagascar		63.9	221.6	8	Unlimited	Telma Global Net (Groupe Telma)
98	Malawi		6.8	24.1	10	2.0	Malawi Telecommunication Limited
99	Malaysia		9.4	24.3	1	1.0	Telekom Malaysia Berhad (TM)
100	Maldives		20.0	25.8	4	Unlimited	Dhiraagu
101	Mali		17.0	45.3	0.25	Unlimited	SOTELMA
102	Malta	31	33.8	45.9	70	Unlimited	Go plc
103	Marshall Islands		50.0	N/A	0.25	Unlimited	National Telecommunications Authority Marshall Is. (NTAMAR)
104	Mauritania		29.5	77.3	12	Unlimited	Mauritel
105	Mauritius		14.5	25.6	10	15.0	Mauritius Telecom Ltd
106	Mexico		18.4	34.5	10	Unlimited	Telmex
107	Micronesia		26.0	N/A	0.5	Unlimited	FSM Telecommunications Corporation
108	Moldova		10.8	29.2	100	Unlimited	Moldtelecom
109	Monaco	32	56.2	N/A	200	Unlimited	Monaco Telecom
110	Mongolia		5.9	16.9	1	Unlimited	Micom
111	Montenegro		11.9	24.2	1	1.0	Crnogorski Telekom
112	Morocco		10.2	23.5	4	Unlimited	Maroc Telecom
113	Mozambique		10.2	33.5	1	Unlimited	TDM
114	Myanmar		13.1	52.4	0.5	Unlimited	MPT
115	Namibia		37.5	79.2	0.5	Unlimited	Telecom Namibia
116	Nepal (Republic of)		2.9	8.2	1	15.0	Nepal Doorsanchar Company Limited
117	Netherlands		39.4	39.2	20	Unlimited	KPN
118	New Zealand		60.4	51.9	24	120.0	Spark New Zealand Limited
119	Nicaragua	33	27.4	73.0	1	Unlimited	Claro
120	Niger		42.9	113.2	0.25	Unlimited	Sonitel
121	Nigeria		25.8	63.9	20	20.0	ipNX Nigeria
122	Norway	34	43.4	34.2	6	Unlimited	Telenor
123	Oman		39.0	75.3	4	20.0	Oman Telecommunications Company (Omantel)
124	Pakistan		7.8	25.7	1	10.0	Pakistan Telecommunication Company Limited (PTCL)
125	Palestine*	35	35.6	50.4	8	75.0	Paltel (access) + Hadara (Internet)
126	Panama		21.4	36.2	4	Unlimited	Cable & Wireless Panama
127	Papua New Guinea		9.1	11.1	24	1.0	Telikom PNG
128	Paraguay		23.1	50.0	3	Unlimited	Tigo
129	Peru		15.0	28.2	2	Unlimited	Movistar
130	Philippines		19.8	50.6	1	Unlimited	Philippine Long Distance Telephone Company (PLDT)
131	Poland	36	18.5	37.2	80	Unlimited	Orange Polska S.A
132	Portugal	37	25.9	34.0	12	Unlimited	MEO

Annex Table 2.1: Fixed-broadband prices 2017 (continued)

	Economy	Notes	Residential monthly subscription		Speed, in Mbit/s	Cap (GB)	ISP
			USD	PPP$			
133	Qatar	38	68.7	88.6	10	Unlimited	Ooredoo
134	Romania	39	6.9	14.8	100	Unlimited	S.C. RCS & RDS S.A.
135	Russian Federation		3.4	8.0	30	Unlimited	Rostelecom
136	Rwanda	40	84.2	230.3	10	Unlimited	Liquid Telecom (former Rwandatel)
137	Saint Kitts and Nevis		36.7	48.0	6	Unlimited	FLOW
138	Saint Lucia		33.0	42.3	2	Unlimited	Flow
139	Saint Vincent and the Grenadines	41	33.9	47.2	2	Unlimited	Flow
140	Samoa		19.4	26.4		3.1	Bluesky Samoa
141	San Marino		18.8	21.6	20	Unlimited	Telecom Italia San Marino
142	Sao Tome and Principe		28.2	45.1	1	12.0	CST-Companhia Santomense de Telecomunicações
143	Saudi Arabia		21.3	41.4	2	20.0	STC
144	Senegal		25.6	63.3	0.5	Unlimited	Orange Senegal
145	Serbia	42	14.4	31.3	10	Unlimited	Telekom Srbija
146	Seychelles		14.7	23.3	1	4.0	Cable and Wireless (Seychelles) Limited
147	Sierra Leone		16.3	52.0	1	5.0	Sierratel
148	Singapore	43	36.1	42.5	500	Unlimited	Singtel
149	Slovakia	44	16.9	27.4	4	300.0	Slovak Telekom, a.s.
150	Slovenia	45	34.9	45.9	10	Unlimited	Telekom Slovenije, d.d.
151	Solomon Islands		276.2	277.8	0.25	6.0	Solomon Telekom
152	Somalia		15.0	N/A	0.5	10.0	Hormuud Telecom
153	South Africa		12.4	26.3	2	1.0	Telkom
154	Spain		27.1	32.7	1	5.0	Movistar
155	Sri Lanka		3.9	11.8	4	4.0	Sri Lanka Telecom
156	Sudan		15.0	N/A	0.5	15.0	Sudatel
157	Suriname		30.3	69.8	3	Unlimited	Telesur
158	Sweden	46	43.2	38.5	100	Unlimited	Telenor
159	Switzerland		45.7	31.8	5	Unlimited	Swisscom
160	Syrian Arab Republic		1.6	N/A	0.25	Unlimited	Tarassul
161	Tajikistan		7.0	25.7	2	15.0	Tajik Telecom
162	Tanzania		18.8	51.9	1	Unlimited	TTCL
163	Thailand	47	18.9	50.0	30	Unlimited	TrueOnline
164	The Former Yugoslav Rep. of Macedonia	48	14.6	34.7	4	30.0	Makedonski telekom (T-Home)
165	Timor-Leste		49.0	75.0	2	6.0	Timor Telecom
166	Togo		58.4	145.4	1	Unlimited	Togo Telecom
167	Tonga		30.8	41.7		5.0	Tonga Communications Corporation
168	Trinidad and Tobago		20.2	24.1	3	Unlimited	Flow Tinidad Limited
169	Tunisia		4.3	12.7	4	Unlimited	Topnet
170	Turkey		7.7	17.5	1	1.0	TTNET AS
171	Turkmenistan		17.1	N/A	2	1.0	Turkmen Telecom
172	Uganda		5.5	16.6	0.5	1.0	Uganda Telecom Ltd (UTL)
173	Ukraine	49	3.0	13.5	0	Unlimited	Ukrtelecom
174	United Arab Emirates	50	18.8	24.6	0.26	Unlimited	Etisalat
175	United Kingdom		34.7	33.7		12.0	BT
176	United States	51	50.0	50.0	100	Unlimited	Spectrum

Annex Table 2.1: Fixed-broadband prices 2017 (continued)

	Economy	Notes	Residential monthly subscription		Speed, in Mbit/s	Cap (GB)	ISP
			USD	PPP$			
177	Uruguay	52	0.0	0.0	0.5	1.0	Antel
178	Uzbekistan		4.2	N/A	1	2.4	Uzbektelecom
179	Vanuatu	53	56.0	51.3	0.5	Unlimited	Telecom Vanuatu Limited
180	Venezuela		27.3	N/A	1	Unlimited	Cantv
181	Viet Nam	54	0.9	2.2	2.5	1.0	Vietnam Posts and Telecommunications Group (VNPT)
182	Yemen		7.3	N/A	0.25	4.0	YemenNet
183	Zambia	55	26.3	66.7	2	10.0	Zamtel
184	Zimbabwe	56	15.0	29.6	2	8.0	TelOne

Note: *Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference.
Source: ITU.

Annex Table 2.2: Mobile-cellular prices 2017 (on-net)

	Economy	Notes	Call connection charge		Per minute local call, on-net					
					Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
1	Afghanistan				0.04	0.12	0.04	0.12	0.04	0.12
2	Albania	1			0.33	0.70	0.33	0.70	0.33	0.70
3	Algeria				0.07	0.21	0.07	0.21	0.07	0.21
4	Andorra		0.14	N/A	0.37	N/A	0.17	N/A	0.17	N/A
5	Angola				0.18	0.23	0.12	0.15	0.12	0.15
6	Antigua and Barbuda				0.35	0.43	0.35	0.43	0.35	0.43
7	Argentina		0.14	N/A	0.29	N/A	0.29	N/A	0.29	N/A
8	Armenia				0.01	0.03	0.01	0.03	0.01	0.03
9	Australia	2			0.00	0.00	0.00	0.00	0.00	0.00
10	Austria				0.04	0.05	0.04	0.05	0.04	0.05
11	Azerbaijan				0.02	0.11	0.02	0.11	0.02	0.11
12	Bahamas				0.35	0.31	0.16	0.14	0.22	0.19
13	Bahrain				0.04	0.07	0.04	0.07	0.04	0.07
14	Bangladesh	3			0.02	0.05	0.02	0.05	0.02	0.05
15	Barbados				0.30	0.24	0.30	0.24	0.30	0.24
16	Belarus	4			0.04	0.16	0.04	0.16	0.04	0.16
17	Belgium				0.34	0.34	0.34	0.34	0.34	0.34
18	Belize				0.26	0.46	0.26	0.46	0.26	0.46
19	Benin				0.10	0.27	0.10	0.27	0.10	0.27
20	Bhutan	5			0.03	0.09	0.02	0.07	0.03	0.08
21	Bolivia (Plurinational State of)				0.17	0.35	0.08	0.16	0.17	0.35
22	Bosnia and Herzegovina	6			0.12	0.25	0.12	0.25	0.12	0.25
23	Botswana		0.06	0.11	0.12	0.23	0.06	0.11	0.06	0.11
24	Brazil	7			0.00	0.00	0.00	0.00	0.00	0.00
25	Brunei Darussalam				0.14	0.25	0.07	0.13	0.07	0.13
26	Bulgaria	8			0.22	0.53	0.22	0.53	0.22	0.53
27	Burkina Faso				0.15	0.41	0.15	0.41	0.15	0.41
28	Burundi				0.10	0.25	0.10	0.25	0.10	0.25
29	Cabo Verde		0.05	0.11	0.28	0.59	0.28	0.59	0.28	0.59
30	Cambodia				0.08	0.18	0.05	0.14	0.06	0.16
31	Cameroon				0.11	0.26	0.11	0.26	0.11	0.26
32	Canada				0.26	0.25	0.26	0.25	0.26	0.25
33	Central African Rep.				0.10	N/A	0.10	N/A	0.10	N/A
34	Chad				0.15	N/A	0.15	N/A	0.15	N/A
35	Chile				0.18	0.26	0.18	0.26	0.18	0.26
36	China				0.03	0.05	0.03	0.05	0.03	0.05
37	Colombia				0.12	0.25	0.12	0.25	0.12	0.25
38	Comoros	9			0.14	N/A	0.14	N/A	0.14	N/A
39	Costa Rica				0.07	0.11	0.07	0.11	0.07	0.11
40	Côte d'Ivoire				0.14	0.35	0.14	0.35	0.14	0.35
41	Croatia	10	0.04	0.07	0.15	0.25	0.15	0.25	0.15	0.25
42	Cuba	11			0.35	N/A	0.10	N/A	0.22	N/A

Annex Table 2.2: Mobile-cellular prices 2017 (on-net) (continued)

	Economy	Notes	Call connection charge		Per minute local call, on-net					
					Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
43	Cyprus				0.09	0.11	0.09	0.11	0.09	0.11
44	Czech Republic				0.17	0.27	0.17	0.27	0.17	0.27
45	Dem. Rep. of the Congo				0.10	0.25	0.10	0.25	0.10	0.25
46	Denmark		0.15	0.12	0.39	0.31	0.39	0.31	0.39	0.31
47	Djibouti		0.17	0.29	0.17	0.29	0.11	0.19	0.11	0.19
48	Dominica				0.26	0.36	0.26	0.36	0.26	0.36
49	Dominican Rep.				0.16	0.35	0.16	0.35	0.16	0.35
50	Ecuador	12			0.11	0.18	0.11	0.18	0.11	0.18
51	Egypt	13			0.01	0.07	0.01	0.07	0.01	0.07
52	El Salvador				0.12	0.24	0.12	0.24	0.12	0.24
53	Estonia	14			0.03	0.05	0.03	0.05	0.03	0.05
54	Ethiopia				0.04	0.10	0.02	0.04	0.02	0.04
55	Fiji				0.19	0.31	0.16	0.26	0.16	0.26
56	Finland				0.07	0.07	0.07	0.07	0.07	0.07
57	France				0.45	0.46	0.45	0.46	0.45	0.46
58	Gabon				0.21	0.32	0.21	0.32	0.21	0.32
59	Georgia		0.04	0.12	0.00	0.00	0.00	0.00	0.00	0.00
60	Germany	15			0.10	0.11	0.10	0.11	0.10	0.11
61	Ghana				0.02	0.07	0.02	0.07	0.02	0.07
62	Greece	16			0.93	1.23	0.93	1.23	0.93	1.23
63	Grenada				0.29	0.39	0.29	0.39	0.29	0.39
64	Guatemala				0.35	0.60	0.35	0.60	0.35	0.60
65	Guinea				0.05	0.12	0.05	0.12	0.05	0.12
66	Guinea-Bissau				0.11	0.27	0.11	0.27	0.11	0.27
67	Guyana	17			0.15	0.24	0.15	0.24	0.15	0.24
68	Haiti				0.04	0.08	0.04	0.08	0.04	0.08
69	Honduras	18			0.17	0.34	0.17	0.34	0.17	0.34
70	Hong Kong, China				0.02	0.02	0.01	0.01	0.01	0.01
71	Hungary				0.09	0.17	0.09	0.17	0.09	0.17
72	Iceland	19	0.11	0.07	0.00	0.00	0.00	0.00	0.00	0.00
73	India	20			0.002	0.01	0.002	0.01	0.002	0.01
74	Indonesia	21			0.05	0.13	0.04	0.12	0.05	0.13
75	Iran (Islamic Republic of)				0.02	0.06	0.02	0.06	0.02	0.06
76	Iraq				0.10	0.20	0.03	0.06	0.07	0.13
77	Ireland		0.10	0.09	0.39	0.35	0.39	0.35	0.39	0.35
78	Israel				0.32	0.26	0.32	0.26	0.32	0.26
79	Italy	22	0.23	0.25	0.21	0.24	0.21	0.24	0.21	0.24
80	Jamaica	23			0.06	0.10	0.06	0.10	0.06	0.10
81	Japan	24			0.00	0.00	0.00	0.00	0.00	0.00
82	Jordan				0.04	0.09	0.04	0.09	0.04	0.09
83	Kazakhstan				0.03	0.08	0.03	0.08	0.03	0.08
84	Kenya				0.04	0.09	0.02	0.04	0.03	0.06
85	Kiribati				0.20	N/A	0.14	N/A	0.14	N/A
86	Korea (Rep. of)	25			0.00	0.00	0.00	0.00	0.00	0.00

Annex Table 2.2: Mobile-cellular prices 2017 (on-net) (continued)

	Economy	Notes	Call connection charge		Per minute local call, on-net					
					Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
87	Kuwait				0.15	0.23	0.15	0.23	0.15	0.23
88	Kyrgyzstan				0.02	0.05	0.02	0.05	0.02	0.05
89	Lao P.D.R.				0.10	0.25	0.10	0.25	0.10	0.25
90	Latvia	26			0.19	0.30	0.19	0.30	0.19	0.30
91	Lebanon				0.28	0.46	0.17	0.27	0.22	0.36
92	Lesotho				0.09	0.26	0.09	0.26	0.09	0.26
93	Liberia				0.22	0.28	0.22	0.28	0.22	0.28
94	Libya				0.04	N/A	0.04	N/A	0.04	N/A
95	Liechtenstein	27			0.00	N/A	0.00	N/A	0.00	N/A
96	Lithuania	28			0.07	0.12	0.07	0.12	0.07	0.12
97	Luxembourg				0.18	0.16	0.18	0.16	0.18	0.16
98	Macao, China				0.05	0.06	0.05	0.06	0.05	0.06
99	Madagascar				0.02	0.07	0.02	0.07	0.02	0.07
100	Malawi				0.10	0.35	0.05	0.17	0.07	0.26
101	Malaysia				0.06	0.14	0.06	0.14	0.06	0.14
102	Maldives				0.07	0.09	0.07	0.09	0.07	0.09
103	Mali				0.19	0.49	0.08	0.22	0.13	0.36
104	Malta	29			0.11	0.15	0.11	0.15	0.11	0.15
105	Marshall Islands				0.50	N/A	0.25	N/A	0.38	N/A
106	Mauritania				0.27	0.72	0.27	0.72	0.27	0.72
107	Mauritius				0.03	0.06	0.03	0.06	0.03	0.06
108	Mexico				0.04	0.07	0.04	0.07	0.04	0.07
109	Micronesia				0.15	N/A	0.15	N/A	0.15	N/A
110	Moldova				0.08	0.22	0.08	0.22	0.08	0.22
111	Monaco	30			N/A	N/A	N/A	N/A	N/A	N/A
112	Mongolia				0.03	0.08	0.03	0.08	0.03	0.08
113	Montenegro				0.14	0.28	0.14	0.28	0.14	0.28
114	Morocco				0.03	0.07	0.03	0.07	0.03	0.07
115	Mozambique				0.002	0.01	0.002	0.01	0.002	0.01
116	Myanmar	31			0.02	0.07	0.02	0.07	0.02	0.07
117	Namibia				0.04	0.08	0.04	0.08	0.04	0.08
118	Nauru				0.23	N/A	0.19	N/A	0.21	N/A
119	Nepal (Republic of)				0.02	0.07	0.02	0.07	0.02	0.07
120	Netherlands				0.34	0.34	0.34	0.34	0.34	0.34
121	New Zealand				0.21	0.18	0.21	0.18	0.21	0.18
122	Nicaragua				0.34	0.91	0.34	0.91	0.34	0.91
123	Niger				0.19	0.49	0.19	0.49	0.19	0.49
124	Nigeria		0.09	0.22	0.09	0.22	0.09	0.22	0.09	0.22
125	Norway		0.11	0.08	0.12	0.09	0.12	0.09	0.12	0.09
126	Oman				0.14	0.28	0.10	0.20	0.12	0.24
127	Pakistan	32			0.02	0.07	0.02	0.07	0.02	0.07
128	Palestine*				0.14	0.20	0.14	0.20	0.14	0.20
129	Panama				0.10	0.17	0.10	0.17	0.10	0.17
130	Papua New Guinea				0.25	0.31	0.19	0.23	0.22	0.27
131	Paraguay				0.04	0.09	0.04	0.09	0.04	0.09

Annex Table 2.2: Mobile-cellular prices 2017 (on-net) (continued)

	Economy	Notes	Call connection charge		Per minute local call, on-net					
					Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
132	Peru				0.15	0.28	0.15	0.28	0.15	0.28
133	Philippines				0.13	0.33	0.13	0.33	0.13	0.33
134	Poland				0.08	0.15	0.08	0.15	0.08	0.15
135	Portugal				0.11	0.15	0.11	0.15	0.11	0.15
136	Qatar	33			0.15	0.19	0.15	0.19	0.15	0.19
137	Romania	34			0.00	0.00	0.00	0.00	0.00	0.00
138	Russian Federation				0.00	0.00	0.00	0.00	0.00	0.00
139	Rwanda	35			0.05	0.15	0.00	0.00	0.05	0.15
140	Saint Kitts and Nevis				0.33	0.43	0.33	0.43	0.33	0.43
141	Saint Lucia				0.35	0.45	0.35	0.45	0.35	0.45
142	Saint Vincent and the Grenadines				0.37	0.51	0.37	0.51	0.37	0.51
143	Samoa				0.07	0.10	0.07	0.10	0.07	0.10
144	San Marino				0.07	0.08	0.07	0.08	0.07	0.08
145	Sao Tome and Principe	36	0.06	0.09	0.12	0.19	0.12	0.19	0.12	0.19
146	Saudi Arabia				0.15	0.28	0.15	0.28	0.15	0.28
147	Senegal				0.21	0.51	0.13	0.33	0.17	0.42
148	Serbia		0.11	0.24	0.11	0.24	0.11	0.24	0.11	0.24
149	Seychelles				0.21	0.32	0.09	0.14	0.15	0.23
150	Sierra Leone	37			0.09	0.28	0.09	0.28	0.09	0.28
151	Singapore				0.12	0.14	0.06	0.07	0.06	0.07
152	Slovakia	38			0.14	0.22	0.14	0.22	0.14	0.22
153	Slovenia	39			0.21	0.27	0.21	0.27	0.21	0.27
154	Solomon Islands				0.13	0.13	0.13	0.13	0.13	0.13
155	Somalia				0.05	N/A	0.05	N/A	0.05	N/A
156	South Africa				0.09	0.19	0.09	0.19	0.09	0.19
157	South Sudan				0.01	0.04	0.01	0.04	0.01	0.04
158	Spain	40	0.23	0.27	0.00	0.00	0.00	0.00	0.00	0.00
159	Sri Lanka				0.01	0.04	0.01	0.04	0.01	0.04
160	Sudan	41	0.01	N/A	0.02	N/A	0.02	N/A	0.02	N/A
161	Suriname				0.18	0.41	0.18	0.41	0.18	0.41
162	Sweden	42	0.12	0.10	0.08	0.07	0.08	0.07	0.08	0.07
163	Switzerland				0.29	0.21	0.29	0.21	0.29	0.21
164	Syrian Arab Republic				0.03	N/A	0.03	N/A	0.02	N/A
165	Tajikistan				0.02	0.09	0.01	0.04	0.02	0.06
166	Tanzania				0.16	0.44	0.16	0.44	0.16	0.44
167	Thailand	43			0.03	0.08	0.03	0.08	0.03	0.08
168	The Former Yugoslav Rep. of Macedonia				0.03	0.08	0.03	0.08	0.03	0.08
169	Timor-Leste				0.12	0.18	0.12	0.18	0.12	0.18
170	Togo				0.14	0.34	0.07	0.17	0.10	0.26
171	Tonga				0.08	0.10	0.08	0.10	0.08	0.10

Annex Table 2.2: Mobile-cellular prices 2017 (on-net) (continued)

	Economy	Notes	Call connection charge		Per minute local call, on-net					
					Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
172	Trinidad and Tobago				0.19	0.23	0.19	0.23	0.19	0.23
173	Tunisia				0.01	0.04	0.01	0.04	0.01	0.04
174	Turkey		0.17	0.39	0.03	0.07	0.03	0.07	0.03	0.07
175	Turkmenistan				0.04	N/A	0.04	N/A	0.04	N/A
176	Uganda				0.05	0.15	0.05	0.15	0.05	0.15
177	Ukraine				0.00	0.00	0.00	0.00	0.00	0.00
178	United Arab Emirates	44			0.04	0.05	0.04	0.05	0.04	0.05
179	United Kingdom	45			0.45	0.44	0.45	0.44	0.45	0.44
180	United States	46			0.00	0.00	0.00	0.00	0.00	0.00
181	Uruguay				0.28	0.34	0.28	0.34	0.28	0.34
182	Uzbekistan				0.01	N/A	0.01	N/A	0.01	N/A
183	Vanuatu				0.25	0.23	0.25	0.23	0.25	0.23
184	Viet Nam				0.07	0.17	0.07	0.17	0.07	0.17
185	Yemen				0.07	N/A	0.02	N/A	0.05	N/A
186	Zambia				0.11	0.29	0.06	0.14	0.06	0.14
187	Zimbabwe				0.16	0.32	0.16	0.32	0.16	0.32

Note: *Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference.
Source: ITU.

Annex Table 2.3: Mobile-cellular prices 2017 (off-net)

	Economy	Notes	Per minute local call, off-net					
			Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$
1	Afghanistan		0.05	0.17	0.05	0.17	0.05	0.17
2	Albania	1	0.24	0.52	0.24	0.52	0.24	0.52
3	Algeria		0.07	0.21	0.07	0.21	0.07	0.21
4	Andorra		0.37	N/A	0.17	N/A	0.17	N/A
5	Angola	2	0.22	0.28	0.16	0.21	0.19	0.24
6	Antigua and Barbuda		0.35	0.43	0.35	0.43	0.35	0.43
7	Argentina		0.29	N/A	0.29	N/A	0.29	N/A
8	Armenia		0.07	0.18	0.07	0.18	0.07	0.18
9	Australia	3	0.00	0.00	0.00	0.00	0.00	0.00
10	Austria		0.04	0.05	0.04	0.05	0.04	0.05
11	Azerbaijan		0.03	0.16	0.03	0.16	0.03	0.16
12	Bahamas		0.35	0.31	0.16	0.14	0.22	0.19
13	Bahrain		0.04	0.07	0.04	0.07	0.04	0.07
14	Bangladesh	4	0.02	0.05	0.02	0.05	0.02	0.05
15	Barbados		0.40	0.33	0.40	0.33	0.40	0.33
16	Belarus	5	0.08	0.31	0.08	0.31	0.08	0.31
17	Belgium		0.34	0.34	0.34	0.34	0.34	0.34
18	Belize		0.28	0.49	0.28	0.49	0.28	0.49
19	Benin		0.10	0.27	0.10	0.27	0.10	0.27
20	Bhutan	6	0.03	0.09	0.02	0.07	0.03	0.08
21	Bolivia (Plurinational State of)		0.17	0.35	0.08	0.16	0.17	0.35
22	Bosnia and Herzegovina	7	0.12	0.25	0.12	0.25	0.12	0.25
23	Botswana		0.14	0.27	0.07	0.13	0.07	0.13
24	Brazil	8	0.16	0.23	0.16	0.23	0.16	0.23
25	Brunei Darussalam		0.14	0.25	0.07	0.13	0.07	0.13
26	Bulgaria		0.22	0.53	0.22	0.53	0.22	0.53
27	Burkina Faso		0.15	0.41	0.15	0.41	0.15	0.41
28	Burundi		0.12	0.31	0.12	0.31	0.12	0.31
29	Cabo Verde		0.28	0.59	0.28	0.59	0.28	0.59
30	Cambodia		0.09	0.22	0.08	0.20	0.09	0.21
31	Cameroon		0.16	0.38	0.16	0.38	0.16	0.38
32	Canada		0.26	0.25	0.26	0.25	0.26	0.25
33	Central African Rep.		0.14	N/A	0.14	N/A	0.14	N/A
34	Chad		0.36	N/A	0.36	N/A	0.36	N/A
35	Chile		0.18	0.26	0.18	0.26	0.18	0.26
36	China		0.03	0.05	0.03	0.05	0.03	0.05
37	Colombia		0.12	0.25	0.12	0.25	0.12	0.25
38	Comoros	9	0.14	N/A	0.14	N/A	0.14	N/A
39	Costa Rica		0.07	0.11	0.07	0.11	0.07	0.11
40	Côte d'Ivoire		0.14	0.35	0.14	0.35	0.14	0.35
41	Croatia	10	0.15	0.25	0.15	0.25	0.15	0.25
42	Cuba	11	0.35	N/A	0.10	N/A	0.22	N/A
43	Cyprus	12	0.10	0.13	0.10	0.13	0.10	0.13
44	Czech Republic		0.17	0.27	0.17	0.27	0.17	0.27
45	Dem. Rep. of the Congo		0.10	0.25	0.10	0.25	0.10	0.25
46	Denmark		0.39	0.31	0.39	0.31	0.39	0.31

Annex Table 2.3: Mobile-cellular prices 2017 (off-net) (continued)

	Economy	Notes	Per minute local call, off-net					
			Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$
47	Djibouti	13	0.17	0.29	0.11	0.19	0.11	0.19
48	Dominica		0.37	0.51	0.37	0.51	0.37	0.51
49	Dominican Rep.		0.21	0.46	0.21	0.46	0.21	0.46
50	Ecuador	14	0.22	0.37	0.22	0.37	0.22	0.37
51	Egypt	15	0.01	0.07	0.01	0.07	0.01	0.07
52	El Salvador		0.15	0.29	0.15	0.29	0.15	0.29
53	Estonia	16	0.03	0.05	0.03	0.05	0.03	0.05
54	Ethiopia		0.04	0.10	0.02	0.04	0.02	0.04
55	Fiji		0.23	0.37	0.20	0.33	0.20	0.33
56	Finland		0.07	0.07	0.07	0.07	0.07	0.07
57	France		0.45	0.46	0.45	0.46	0.45	0.46
58	Gabon		0.21	0.32	0.21	0.32	0.21	0.32
59	Georgia		0.03	0.08	0.03	0.08	0.03	0.08
60	Germany	17	0.10	0.11	0.10	0.11	0.10	0.11
61	Ghana		0.03	0.09	0.03	0.09	0.03	0.09
62	Greece	18	0.93	1.23	0.93	1.23	0.93	1.23
63	Grenada		0.29	0.39	0.29	0.39	0.29	0.39
64	Guatemala		0.35	0.60	0.35	0.60	0.35	0.60
65	Guinea		0.07	0.17	0.07	0.17	0.07	0.17
66	Guinea-Bissau		0.27	0.66	0.27	0.66	0.27	0.66
67	Guyana		0.15	0.24	0.15	0.24	0.15	0.24
68	Haiti		0.08	0.18	0.08	0.18	0.08	0.18
69	Honduras	19	0.17	0.34	0.17	0.34	0.17	0.34
70	Hong Kong, China		0.02	0.02	0.01	0.01	0.01	0.01
71	Hungary		0.09	0.17	0.09	0.17	0.09	0.17
72	Iceland		0.22	0.15	0.22	0.15	0.22	0.15
73	India	20	0.005	0.02	0.005	0.02	0.005	0.02
74	Indonesia	21	0.10	0.27	0.09	0.24	0.09	0.25
75	Iran (Islamic Republic of)		0.03	0.08	0.03	0.08	0.03	0.08
76	Iraq		0.20	0.39	0.20	0.39	0.20	0.39
77	Ireland		0.39	0.35	0.39	0.35	0.39	0.35
78	Israel		0.33	0.27	0.33	0.27	0.33	0.27
79	Italy	22	0.21	0.24	0.21	0.24	0.21	0.24
80	Jamaica	23	0.06	0.10	0.06	0.10	0.06	0.10
81	Japan	24	0.00	0.00	0.00	0.00	0.00	0.00
82	Jordan		0.11	0.24	0.11	0.24	0.11	0.24
83	Kazakhstan		0.04	0.11	0.04	0.11	0.04	0.11
84	Kenya		0.04	0.09	0.02	0.04	0.03	0.06
85	Kiribati		0.20	N/A	0.14	N/A	0.14	N/A
86	Korea (Rep. of)	25	0.00	0.00	0.00	0.00	0.00	0.00
87	Kuwait	26	0.15	0.23	0.15	0.23	0.15	0.23
88	Kyrgyzstan		0.04	0.14	0.04	0.14	0.04	0.14
89	Lao P.D.R.		0.10	0.25	0.10	0.25	0.10	0.25
90	Latvia	27	0.19	0.30	0.19	0.30	0.19	0.30
91	Lebanon		0.28	0.46	0.17	0.27	0.22	0.36
92	Lesotho		0.09	0.26	0.09	0.26	0.09	0.26
93	Liberia		0.25	0.32	0.25	0.32	0.25	0.32

Annex Table 2.3: Mobile-cellular prices 2017 (off-net) (continued)

	Economy	Notes	Per minute local call, off-net					
			Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$
94	Libya		0.06	N/A	0.06	N/A	0.06	N/A
95	Liechtenstein	28	0.26	N/A	0.26	N/A	0.26	N/A
96	Lithuania	29	0.16	0.27	0.16	0.27	0.16	0.27
97	Luxembourg		0.18	0.16	0.18	0.16	0.18	0.16
98	Macao, China		0.05	0.06	0.05	0.06	0.05	0.06
99	Madagascar	30	0.06	0.20	0.06	0.20	0.06	0.20
100	Malawi		0.13	0.45	0.08	0.27	0.10	0.36
101	Malaysia		0.06	0.14	0.06	0.14	0.06	0.14
102	Maldives		0.10	0.13	0.10	0.13	0.10	0.13
103	Mali		0.19	0.49	0.19	0.49	0.19	0.49
104	Malta	31	0.11	0.15	0.11	0.15	0.11	0.15
105	Marshall Islands		0.50	N/A	0.25	N/A	0.38	N/A
106	Mauritania		0.27	0.72	0.27	0.72	0.27	0.72
107	Mauritius		0.10	0.19	0.10	0.19	0.10	0.19
108	Mexico		0.04	0.07	0.04	0.07	0.04	0.07
109	Micronesia		0.15	N/A	0.15	N/A	0.15	N/A
110	Moldova		0.08	0.22	0.08	0.22	0.08	0.22
111	Monaco	32	N/A	N/A	N/A	N/A	N/A	N/A
112	Mongolia		0.03	0.09	0.03	0.09	0.03	0.09
113	Montenegro		0.14	0.28	0.14	0.28	0.14	0.28
114	Morocco		0.03	0.07	0.03	0.07	0.03	0.07
115	Mozambique		0.002	0.01	0.002	0.01	0.002	0.01
116	Myanmar	33	0.02	0.07	0.02	0.07	0.02	0.07
117	Namibia		0.04	0.08	0.04	0.08	0.04	0.08
118	Nauru		0.23	N/A	0.19	N/A	0.21	N/A
119	Nepal (Republic of)		0.02	0.07	0.02	0.07	0.02	0.07
120	Netherlands		0.34	0.34	0.34	0.34	0.34	0.34
121	New Zealand		0.21	0.18	0.21	0.18	0.21	0.18
122	Nicaragua		0.46	1.23	0.46	1.23	0.46	1.23
123	Niger		0.21	0.54	0.21	0.54	0.21	0.54
124	Nigeria		0.09	0.22	0.09	0.22	0.09	0.22
125	Norway		0.12	0.09	0.12	0.09	0.12	0.09
126	Oman		0.14	0.28	0.10	0.20	0.12	0.24
127	Pakistan	34	0.02	0.07	0.02	0.07	0.02	0.07
128	Palestine		0.17	0.24	0.17	0.24	0.17	0.24
129	Panama		0.10	0.17	0.10	0.17	0.10	0.17
130	Papua New Guinea		0.31	0.38	0.31	0.38	0.31	0.38
131	Paraguay		0.04	0.09	0.04	0.09	0.04	0.09
132	Peru		0.15	0.28	0.15	0.28	0.15	0.28
133	Philippines		0.15	0.38	0.15	0.38	0.15	0.38
134	Poland		0.08	0.15	0.08	0.15	0.08	0.15
135	Portugal		0.11	0.15	0.11	0.15	0.11	0.15
136	Qatar	35	0.15	0.19	0.15	0.19	0.15	0.19
137	Romania	36	0.24	0.51	0.24	0.51	0.24	0.51
138	Russian Federation		0.04	0.10	0.04	0.10	0.04	0.10
139	Rwanda		0.05	0.15	0.05	0.15	0.05	0.15
140	Saint Kitts and Nevis		0.33	0.43	0.33	0.43	0.33	0.43

Annex Table 2.3: Mobile-cellular prices 2017 (off-net) (continued)

	Economy	Notes	Per minute local call, off-net					
			Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$
141	Saint Lucia		0.35	0.45	0.35	0.45	0.35	0.45
142	Saint Vincent and the Grenadines		0.37	0.51	0.37	0.51	0.37	0.51
143	Samoa		0.07	0.10	0.07	0.10	0.07	0.10
144	San Marino		0.11	0.13	0.11	0.13	0.11	0.13
145	Sao Tome and Principe	37	0.12	0.19	0.12	0.19	0.12	0.19
146	Saudi Arabia		0.15	0.28	0.15	0.28	0.15	0.28
147	Senegal		0.21	0.51	0.13	0.33	0.17	0.42
148	Serbia		0.11	0.24	0.11	0.24	0.11	0.24
149	Seychelles		0.29	0.46	0.16	0.25	0.23	0.36
150	Sierra Leone	38	0.09	0.30	0.09	0.30	0.09	0.30
151	Singapore		0.12	0.14	0.06	0.07	0.06	0.07
152	Slovakia	39	0.14	0.22	0.14	0.22	0.14	0.22
153	Slovenia	40	0.21	0.27	0.21	0.27	0.21	0.27
154	Solomon Islands		0.19	0.19	0.19	0.19	0.19	0.19
155	Somalia		0.05	N/A	0.05	N/A	0.05	N/A
156	South Africa		0.09	0.19	0.09	0.19	0.09	0.19
157	South Sudan		0.01	0.07	0.01	0.07	0.01	0.07
158	Spain	41	0.00	0.00	0.00	0.00	0.00	0.00
159	Sri Lanka		0.01	0.04	0.01	0.04	0.01	0.04
160	Sudan		0.03	N/A	0.03	N/A	0.03	N/A
161	Suriname		0.18	0.41	0.18	0.41	0.18	0.41
162	Sweden	42	0.08	0.07	0.08	0.07	0.08	0.07
163	Switzerland		0.29	0.21	0.29	0.21	0.29	0.21
164	Syrian Arab Republic		0.03	N/A	0.03	N/A	0.02	N/A
165	Tajikistan		0.04	0.13	0.02	0.09	0.03	0.11
166	Tanzania		0.20	0.54	0.20	0.54	0.20	0.54
167	Thailand		0.03	0.08	0.03	0.08	0.03	0.08
168	The Former Yugoslav Rep. of Macedonia		0.03	0.08	0.03	0.08	0.03	0.08
169	Timor-Leste		0.19	0.29	0.19	0.29	0.19	0.29
170	Togo		0.14	0.34	0.10	0.26	0.12	0.30
171	Tonga		0.11	0.15	0.11	0.15	0.11	0.15
172	Trinidad and Tobago		0.19	0.23	0.19	0.23	0.19	0.23
173	Tunisia		0.01	0.04	0.01	0.04	0.01	0.04
174	Turkey		0.03	0.07	0.03	0.07	0.03	0.07
175	Turkmenistan		0.04	N/A	0.04	N/A	0.04	N/A
176	Uganda		0.05	0.15	0.05	0.15	0.05	0.15
177	Ukraine	43	0.02	0.10	0.02	0.10	0.02	0.10
178	United Arab Emirates	44	0.04	0.05	0.04	0.05	0.04	0.05
179	United Kingdom	45	0.45	0.44	0.45	0.44	0.45	0.44
180	United States	46	0.00	0.00	0.00	0.00	0.00	0.00
181	Uruguay		0.28	0.34	0.28	0.34	0.28	0.34
182	Uzbekistan		0.03	N/A	0.03	N/A	0.03	N/A
183	Vanuatu		0.25	0.23	0.25	0.23	0.25	0.23
184	Viet Nam		0.08	0.19	0.08	0.19	0.08	0.19
185	Yemen		0.10	N/A	0.10	N/A	0.10	N/A

Annex Table 2.3: Mobile-cellular prices 2017 (off-net) (continued)

	Economy	Notes	Per minute local call, off-net					
			Peak		Off-peak		Weekend/evening	
			USD	PPP$	USD	PPP$	USD	PPP$
186	Zambia		0.14	0.35	0.09	0.22	0.09	0.22
187	Zimbabwe		0.16	0.32	0.16	0.32	0.16	0.32

Note: *Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference.
Source: ITU.

Annex Table 2.4: Mobile-cellular prices 2017 (to fixed telephone; SMS)

	Economy	Notes	Per minute local call, to fixed-telephone						Local SMS			
			Peak		Off-peak		Weekend/evening		On-net		Off-net	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
1	Afghanistan		0.05	0.17	0.05	0.17	0.05	0.17	0.01	0.05	0.04	0.12
2	Albania	1	0.24	0.52	0.24	0.52	0.24	0.52	0.11	0.23	0.11	0.23
3	Algeria		0.07	0.21	0.07	0.21	0.07	0.21	0.05	0.13	0.05	0.13
4	Andorra	2	0.37	N/A	0.17	N/A	0.17	N/A	0.14	N/A	0.14	N/A
5	Angola	3	0.22	0.28	0.16	0.21	0.19	0.24	0.08	0.10	0.08	0.10
6	Antigua and Barbuda		0.35	0.43	0.35	0.43	0.35	0.43	0.12	0.15	0.12	0.15
7	Argentina		0.29	N/A	0.29	N/A	0.29	N/A	0.07	N/A	0.07	N/A
8	Armenia		0.07	0.18	0.07	0.18	0.07	0.18	0.01	0.03	0.01	0.03
9	Australia	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Austria		0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.05
11	Azerbaijan		0.03	0.16	0.03	0.16	0.03	0.16	0.02	0.08	0.02	0.08
12	Bahamas		0.35	0.31	0.16	0.14	0.22	0.19	0.05	0.05	0.05	0.05
13	Bahrain		0.04	0.07	0.04	0.07	0.04	0.07	0.08	0.13	0.08	0.13
14	Bangladesh	5	0.02	0.05	0.02	0.05	0.02	0.05	0.01	0.02	0.01	0.02
15	Barbados		0.40	0.33	0.40	0.33	0.40	0.33	0.17	0.13	0.17	0.13
16	Belarus	6	0.08	0.31	0.08	0.31	0.08	0.31	0.01	0.04	0.01	0.04
17	Belgium		0.34	0.34	0.34	0.34	0.34	0.34	0.14	0.14	0.14	0.14
18	Belize		0.26	0.46	0.26	0.46	0.26	0.46	0.14	0.25	0.14	0.25
19	Benin		0.10	0.27	0.10	0.27	0.10	0.27	0.02	0.04	0.04	0.11
20	Bhutan	7	0.03	0.09	0.03	0.09	0.03	0.09	0.01	0.02	0.01	0.02
21	Bolivia (Plurinational State of)		0.17	0.35	0.08	0.16	0.17	0.35	0.03	0.06	0.03	0.06
22	Bosnia and Herzegovina	8	0.12	0.25	0.12	0.25	0.12	0.25	0.06	0.12	0.06	0.12
23	Botswana		0.12	0.23	0.06	0.11	0.06	0.11	0.02	0.04	0.04	0.08
24	Brazil	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	Brunei Darussalam		0.14	0.25	0.07	0.13	0.07	0.13	0.04	0.06	0.04	0.06
26	Bulgaria		0.22	0.53	0.22	0.53	0.22	0.53	0.14	0.34	0.14	0.34
27	Burkina Faso		0.10	0.27	0.10	0.27	0.10	0.27	0.02	0.05	0.03	0.09
28	Burundi		0.12	0.31	0.12	0.31	0.12	0.31	0.01	0.04	0.02	0.05
29	Cabo Verde		0.28	0.59	0.28	0.59	0.28	0.59	0.10	0.22	0.10	0.22
30	Cambodia		0.09	0.22	0.08	0.20	0.09	0.21	0.02	0.05	0.04	0.10
31	Cameroon		0.16	0.38	0.16	0.38	0.16	0.38	0.05	0.13	0.09	0.21
32	Canada		0.26	0.25	0.26	0.25	0.26	0.25	0.00	0.00	0.00	0.00
33	Central African Rep.		0.14	N/A	0.14	N/A	0.14	N/A	0.04	N/A	0.09	N/A
34	Chad		0.36	N/A	0.36	N/A	0.36	N/A	0.02	N/A	0.10	N/A
35	Chile	10	0.18	0.26	0.18	0.26	0.18	0.26	0.03	0.04	0.03	0.04
36	China		0.03	0.05	0.03	0.05	0.03	0.05	0.01	0.03	0.01	0.03
37	Colombia		0.12	0.25	0.12	0.25	0.12	0.25	0.05	0.10	0.10	0.21
38	Comoros		0.14	N/A	0.14	N/A	0.14	N/A	0.03	N/A	0.03	N/A
39	Costa Rica		0.07	0.11	0.07	0.11	0.07	0.11	0.01	0.01	0.01	0.01
40	Côte d'Ivoire		0.14	0.35	0.14	0.35	0.14	0.35	0.07	0.18	0.07	0.18
41	Croatia	11	0.15	0.25	0.15	0.25	0.15	0.25	0.06	0.10	0.06	0.10
42	Cuba	12	0.35	N/A	0.10	N/A	0.22	N/A	0.09	N/A	0.09	N/A

Annex Table 2.4: Mobile-cellular prices 2017 (to fixed telephone; SMS) (continued)

	Economy	Notes	Per minute local call, to fixed-telephone						Local SMS			
			Peak		Off-peak		Weekend/evening		On-net		Off-net	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
43	Cyprus		0.09	0.11	0.09	0.11	0.09	0.11	0.02	0.03	0.02	0.03
44	Czech Republic		0.17	0.27	0.17	0.27	0.17	0.27	0.08	0.13	0.08	0.13
45	Dem. Rep. of the Congo		0.10	0.25	0.10	0.25	0.10	0.25	0.04	0.11	0.04	0.11
46	Denmark		0.39	0.31	0.39	0.31	0.39	0.31	0.11	0.09	0.11	0.09
47	Djibouti	13	0.17	0.29	0.11	0.19	0.11	0.19	0.06	0.10	0.06	0.10
48	Dominica		0.37	0.51	0.37	0.51	0.37	0.51	0.07	0.10	0.07	0.10
49	Dominican Rep.		0.21	0.46	0.21	0.46	0.21	0.46	0.03	0.06	0.05	0.10
50	Ecuador	14	0.22	0.37	0.22	0.37	0.22	0.37	0.07	0.11	0.07	0.11
51	Egypt	15	0.01	0.07	0.01	0.07	0.01	0.07	0.01	0.07	0.01	0.07
52	El Salvador		0.10	0.20	0.10	0.20	0.10	0.20	0.10	0.20	0.08	0.16
53	Estonia	16	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05
54	Ethiopia		0.04	0.10	0.02	0.04	0.02	0.04	0.02	0.04	0.02	0.04
55	Fiji		0.22	0.36	0.19	0.31	0.19	0.31	0.07	0.11	0.09	0.14
56	Finland		0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
57	France		0.45	0.46	0.45	0.46	0.45	0.46	0.11	0.12	0.11	0.12
58	Gabon		0.21	0.32	0.21	0.32	0.21	0.32	0.04	0.07	0.09	0.14
59	Georgia		0.03	0.08	0.03	0.08	0.03	0.08	0.02	0.07	0.02	0.07
60	Germany	17	0.10	0.11	0.10	0.11	0.10	0.11	0.10	0.11	0.10	0.11
61	Ghana		0.03	0.09	0.03	0.09	0.03	0.09	0.01	0.03	0.01	0.04
62	Greece	18	0.93	1.23	0.93	1.23	0.93	1.23	0.30	0.40	0.30	0.40
63	Grenada		0.29	0.39	0.29	0.39	0.29	0.39	0.09	0.12	0.09	0.12
64	Guatemala		0.35	0.60	0.35	0.60	0.35	0.60	0.14	0.23	0.14	0.23
65	Guinea		0.07	0.17	0.07	0.17	0.07	0.17	0.01	0.03	0.02	0.04
66	Guinea-Bissau		0.27	0.66	0.27	0.66	0.27	0.66	0.05	0.12	0.10	0.25
67	Guyana		0.15	0.24	0.15	0.24	0.15	0.24	0.06	0.09	0.06	0.09
68	Haiti		0.08	0.18	0.08	0.18	0.08	0.18	0.05	0.11	0.02	0.04
69	Honduras	19	0.13	0.25	0.13	0.25	0.13	0.25	0.06	0.11	0.06	0.11
70	Hong Kong, China		0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.09	0.11
71	Hungary		0.09	0.17	0.09	0.17	0.09	0.17	0.09	0.17	0.09	0.17
72	Iceland	20	0.22	0.15	0.22	0.15	0.22	0.15	0.00	0.00	0.14	0.09
73	India	21	0.02	0.08	0.02	0.08	0.02	0.08	0.02	0.05	0.02	0.05
74	Indonesia	22	0.10	0.27	0.09	0.24	0.09	0.25	0.02	0.07	0.02	0.07
75	Iran (Islamic Republic of)		0.02	0.06	0.02	0.06	0.02	0.06	0.00	0.01	0.00	0.01
76	Iraq		0.20	0.39	0.20	0.39	0.20	0.39	0.04	0.08	0.05	0.10
77	Ireland		0.39	0.35	0.39	0.35	0.39	0.35	0.17	0.15	0.17	0.15
78	Israel		0.33	0.27	0.33	0.27	0.33	0.27	0.19	0.15	0.19	0.15
79	Italy	23	0.21	0.24	0.21	0.24	0.21	0.24	0.18	0.20	0.18	0.20
80	Jamaica	24	0.06	0.10	0.06	0.10	0.06	0.10	0.03	0.05	0.03	0.05
81	Japan	25	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03
82	Jordan		0.11	0.24	0.11	0.24	0.11	0.24	0.00	0.00	0.00	0.00
83	Kazakhstan		0.05	0.13	0.05	0.13	0.05	0.13	0.02	0.06	0.04	0.11
84	Kenya		0.04	0.09	0.02	0.04	0.03	0.06	0.01	0.02	0.01	0.02
85	Kiribati		0.20	N/A	0.14	N/A	0.14	N/A	0.08	N/A	0.08	N/A
86	Korea (Rep. of)	26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87	Kuwait	27	0.15	0.23	0.15	0.23	0.15	0.23	0.07	0.10	0.07	0.10

Annex Table 2.4: Mobile-cellular prices 2017 (to fixed telephone; SMS) (continued)

	Economy	Notes	Per minute local call, to fixed-telephone						Local SMS			
			Peak		Off-peak		Weekend/evening		On-net		Off-net	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
88	Kyrgyzstan		0.07	0.23	0.07	0.23	0.07	0.23	0.02	0.08	0.02	0.08
89	Lao P.D.R.		0.10	0.25	0.10	0.25	0.10	0.25	0.01	0.03	0.02	0.06
90	Latvia	28	0.19	0.30	0.19	0.30	0.19	0.30	0.15	0.23	0.15	0.23
91	Lebanon		0.28	0.46	0.17	0.27	0.22	0.36	0.04	0.07	0.04	0.07
92	Lesotho		0.09	0.26	0.09	0.26	0.09	0.26	0.04	0.11	0.04	0.11
93	Liberia		0.25	0.32	0.25	0.32	0.25	0.32	0.05	0.06	0.08	0.10
94	Libya		0.06	N/A	0.06	N/A	0.06	N/A	0.04	N/A	0.04	N/A
95	Liechtenstein	29	0.26	N/A	0.26	N/A	0.26	N/A	0.00	N/A	0.00	N/A
96	Lithuania	30	0.16	0.27	0.16	0.27	0.16	0.27	0.03	0.06	0.03	0.06
97	Luxembourg		0.28	0.25	0.18	0.16	0.18	0.16	0.14	0.12	0.14	0.12
98	Macao, China		0.05	0.06	0.05	0.06	0.05	0.06	0.03	0.04	0.03	0.04
99	Madagascar		0.06	0.20	0.06	0.20	0.06	0.20	0.03	0.09	0.04	0.13
100	Malawi		0.13	0.45	0.08	0.27	0.10	0.36	0.02	0.07	0.03	0.12
101	Malaysia		0.06	0.14	0.06	0.14	0.06	0.14	0.03	0.07	0.03	0.07
102	Maldives		0.07	0.09	0.07	0.09	0.07	0.09	0.01	0.02	0.02	0.03
103	Mali		0.19	0.49	0.19	0.49	0.19	0.49	0.03	0.09	0.05	0.14
104	Malta	31	0.11	0.15	0.11	0.15	0.11	0.15	0.11	0.15	0.11	0.15
105	Marshall Islands		0.50	N/A	0.25	N/A	0.38	N/A	0.02	N/A	0.02	N/A
106	Mauritania		0.27	0.72	0.27	0.72	0.27	0.72	0.04	0.09	0.04	0.09
107	Mauritius		0.10	0.18	0.10	0.18	0.10	0.18	0.02	0.03	0.02	0.03
108	Mexico		0.04	0.07	0.04	0.07	0.04	0.07	0.04	0.08	0.04	0.08
109	Micronesia		0.15	N/A	0.15	N/A	0.15	N/A	0.10	N/A	0.10	N/A
110	Moldova		0.08	0.22	0.08	0.22	0.08	0.22	0.03	0.09	0.03	0.09
111	Monaco	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
112	Mongolia		0.03	0.09	0.03	0.09	0.03	0.09	0.01	0.02	0.01	0.02
113	Montenegro		0.14	0.28	0.14	0.28	0.14	0.28	0.03	0.06	0.03	0.06
114	Morocco		0.03	0.07	0.03	0.07	0.03	0.07	0.10	0.23	0.10	0.23
115	Mozambique		0.002	0.01	0.002	0.01	0.002	0.01	0.03	0.09	0.03	0.09
116	Myanmar	33	0.02	0.07	0.02	0.07	0.02	0.07	0.01	0.03	0.01	0.03
117	Namibia	34	0.04	0.08	0.04	0.08	0.04	0.08	0.03	0.06	0.03	0.06
118	Nauru		0.23	N/A	0.19	N/A	0.21	N/A	0.10	N/A	0.10	N/A
119	Nepal (Republic of)		0.02	0.07	0.02	0.07	0.02	0.07	0.01	0.03	0.02	0.04
120	Netherlands		0.34	0.34	0.34	0.34	0.34	0.34	0.11	0.11	0.11	0.11
121	New Zealand		0.21	0.18	0.21	0.18	0.21	0.18	0.07	0.06	0.07	0.06
122	Nicaragua		0.46	1.23	0.46	1.23	0.46	1.23	0.08	0.22	0.08	0.22
123	Niger		0.21	0.54	0.21	0.54	0.21	0.54	0.01	0.03	0.01	0.03
124	Nigeria		0.09	0.22	0.09	0.22	0.09	0.22	0.01	0.03	0.01	0.03
125	Norway		0.12	0.09	0.12	0.09	0.12	0.09	0.08	0.07	0.08	0.07
126	Oman		0.14	0.28	0.10	0.20	0.12	0.24	0.03	0.05	0.03	0.05
127	Pakistan	35	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.06	0.02	0.06
128	Palestine*		0.17	0.24	0.14	0.20	0.14	0.20	0.06	0.09	0.10	0.14
129	Panama		0.10	0.17	0.10	0.17	0.10	0.17	0.07	0.12	0.10	0.17
130	Papua New Guinea		0.31	0.38	0.31	0.38	0.31	0.38	0.08	0.10	0.08	0.10
131	Paraguay		0.04	0.09	0.04	0.09	0.04	0.09	0.03	0.06	0.05	0.10
132	Peru		0.15	0.28	0.15	0.28	0.15	0.28	0.03	0.06	0.03	0.06

Annex Table 2.4: Mobile-cellular prices 2017 (to fixed telephone; SMS) (continued)

	Economy	Notes	Per minute local call, to fixed-telephone						Local SMS			
			Peak		Off-peak		Weekend/evening		On-net		Off-net	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
133	Philippines		0.15	0.38	0.15	0.38	0.15	0.38	0.02	0.05	0.02	0.05
134	Poland		0.08	0.15	0.08	0.15	0.08	0.15	0.05	0.11	0.05	0.11
135	Portugal		0.11	0.15	0.11	0.15	0.11	0.15	0.11	0.15	0.11	0.15
136	Qatar	36	0.15	0.19	0.15	0.19	0.15	0.19	0.11	0.14	0.11	0.14
137	Romania	37	0.24	0.51	0.24	0.51	0.24	0.51	0.00	0.00	0.07	0.14
138	Russian Federation		0.04	0.10	0.04	0.10	0.04	0.10	0.03	0.08	0.03	0.08
139	Rwanda		0.05	0.15	0.05	0.15	0.05	0.15	0.01	0.04	0.03	0.09
140	Saint Kitts and Nevis	38	0.33	0.43	0.33	0.43	0.33	0.43	0.08	0.11	0.08	0.11
141	Saint Lucia		0.35	0.45	0.35	0.45	0.35	0.45	0.09	0.11	0.11	0.14
142	Saint Vincent and the Grenadines		0.37	0.51	0.37	0.51	0.37	0.51	0.07	0.09	0.11	0.15
143	Samoa		0.07	0.10	0.07	0.10	0.07	0.10	0.07	0.10	0.07	0.10
144	San Marino		0.09	0.10	0.09	0.10	0.09	0.10	0.10	0.12	0.10	0.12
145	Sao Tome and Principe	39	0.12	0.19	0.12	0.19	0.12	0.19	0.05	0.08	0.05	0.08
146	Saudi Arabia		0.15	0.28	0.15	0.28	0.15	0.28	0.07	0.13	0.07	0.13
147	Senegal		0.21	0.51	0.13	0.33	0.17	0.42	0.03	0.09	0.03	0.09
148	Serbia		0.11	0.24	0.11	0.24	0.11	0.24	0.05	0.12	0.05	0.12
149	Seychelles		0.29	0.46	0.16	0.25	0.23	0.36	0.03	0.05	0.03	0.05
150	Sierra Leone		0.12	0.39	0.12	0.39	0.12	0.39	0.01	0.04	0.02	0.06
151	Singapore		0.12	0.14	0.06	0.07	0.06	0.07	0.04	0.04	0.04	0.04
152	Slovakia	40	0.14	0.22	0.14	0.22	0.14	0.22	0.07	0.11	0.07	0.11
153	Slovenia	41	0.21	0.27	0.21	0.27	0.21	0.27	0.14	0.18	0.14	0.18
154	Solomon Islands		0.19	0.19	0.19	0.19	0.19	0.19	0.06	0.06	0.06	0.06
155	Somalia		0.05	N/A	0.05	N/A	0.05	N/A	0.01	N/A	0.01	N/A
156	South Africa		0.09	0.19	0.09	0.19	0.09	0.19	0.04	0.08	0.04	0.08
157	South Sudan		0.01	0.07	0.01	0.07	0.01	0.07	0.00	0.02	0.00	0.02
158	Spain	42	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.13	0.11	0.13
159	Sri Lanka		0.01	0.04	0.01	0.04	0.01	0.04	0.00	0.01	0.00	0.01
160	Sudan		0.03	N/A	0.03	N/A	0.03	N/A	0.01	N/A	0.01	N/A
161	Suriname		0.18	0.41	0.18	0.41	0.18	0.41	0.04	0.09	0.04	0.09
162	Sweden	43	0.08	0.07	0.08	0.07	0.08	0.07	0.08	0.07	0.08	0.07
163	Switzerland		0.29	0.21	0.29	0.21	0.29	0.21	0.15	0.11	0.15	0.11
164	Syrian Arab Republic		0.03	N/A	0.03	N/A	0.03	N/A	0.01	N/A	0.01	N/A
165	Tajikistan		0.04	0.13	0.02	0.09	0.03	0.11	0.01	0.04	0.02	0.09
166	Tanzania		0.20	0.54	0.20	0.54	0.20	0.54	0.03	0.08	0.03	0.08
167	Thailand		0.03	0.08	0.03	0.08	0.03	0.08	0.06	0.17	0.06	0.17
168	The Former Yugoslav Rep. of Macedonia		0.03	0.08	0.03	0.08	0.03	0.08	0.09	0.21	0.09	0.21
169	Timor-Leste		0.12	0.18	0.12	0.18	0.12	0.18	0.06	0.09	0.08	0.12
170	Togo		0.14	0.34	0.07	0.17	0.10	0.26	0.04	0.10	0.05	0.13
171	Tonga		0.08	0.10	0.08	0.10	0.08	0.10	0.05	0.06	0.05	0.07
172	Trinidad and Tobago		0.19	0.23	0.19	0.23	0.19	0.23	0.05	0.07	0.08	0.10
173	Tunisia		0.01	0.04	0.01	0.04	0.01	0.04	0.02	0.06	0.02	0.06

Annex Table 2.4: Mobile-cellular prices 2017 (to fixed telephone; SMS) (continued)

	Economy	Notes	Per minute local call, to fixed-telephone						Local SMS			
			Peak		Off-peak		Weekend/evening		On-net		Off-net	
			USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$	USD	PPP$
174	Turkey		0.03	0.07	0.03	0.07	0.03	0.07	0.16	0.37	0.16	0.37
175	Turkmenistan		0.04	N/A	0.04	N/A	0.04	N/A	0.03	N/A	0.03	N/A
176	Uganda		0.05	0.15	0.05	0.15	0.05	0.15	0.02	0.07	0.04	0.11
177	Ukraine	44	0.06	0.25	0.06	0.25	0.06	0.25	0.04	0.17	0.04	0.17
178	United Arab Emirates	45	0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.06	0.04	0.06
179	United Kingdom	46	0.45	0.44	0.45	0.44	0.45	0.44	0.15	0.15	0.15	0.15
180	United States	47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
181	Uruguay		0.28	0.34	0.28	0.34	0.28	0.34	0.03	0.04	0.03	0.04
182	Uzbekistan		0.03	N/A	0.03	N/A	0.03	N/A	0.01	N/A	0.01	N/A
183	Vanuatu		0.25	0.23	0.25	0.23	0.25	0.23	0.09	0.09	0.09	0.09
184	Viet Nam		0.07	0.17	0.07	0.17	0.07	0.17	0.01	0.02	0.01	0.03
185	Yemen		0.10	N/A	0.10	N/A	0.10	N/A	0.02	N/A	0.02	N/A
186	Zambia		0.14	0.35	0.09	0.22	0.09	0.22	0.02	0.06	0.03	0.08
187	Zimbabwe		0.16	0.32	0.16	0.32	0.16	0.32	0.05	0.10	0.05	0.10

Note: *Palestine is not an ITU Member State; the status of Palestine in ITU is the subject of Resolution 99 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference.
Source: ITU.

Notes

The notes are presented here as submitted by countries to ITU.

Fixed-broadband prices:

The tariff plan reported is a bundle (telephony and broadband Internet) and the monthly fee includes: 60 international minutes, all calls towards ALBtelecom Mobile and fixed, starting from 20:00 to 08:00, ADSL Internet of 1 Mbps speed, and FREE Internet service installation. 2) This speed is for ADSL connection but for LTE fixe broadband it can reach 150Mbit/s. 3) 24 Months Contract Period. 4) First 12 months $325. Months 12-15: $488. After month 15: $650. Increase of 30% between 2016 and 2017. A little higher than the country's inflation's rate in the same period. 5) 41% of the fixed-line broadband market as at June 2016. Includes fixed voice connection. Cheapest standalone fixed voice service from Telstra priced at 27.95 per month. Speed varies based on technology. In other products, Telstra advertises maximum download speeds of 20Mbps on ADSL2+ and 8Mbps on ADSL.6) Includes the monthly share of the annual 15 Euros fee. 7) Price corresponding to Santa Cruz. 8) Using São Paulo as reference. 9) Standard monthly subscription charge for a 12-month contract. The subscription charge for a 24-month contract is 17.80.10) 1480 Yuan for 14 months. 11) Price of monthly broadband subscriptions for population with the lowest income (Estrato 1). 12) 80.94 HRK (up to 4Mbit/s) and 20.49 HRK for 1GB traffic. Requires fixed-telephone line of 155.94 HRK for standalone service. 13) Price in CUC. Only available for commercial clients. 14) Price 499.00 CZK with a 24-month commitment (649.00 CZK without commitment). 15) This includes a 14% VAT tax starting in 8th September 2017. 16) Fixed line: 100 fixed-to-fixed minutes. Unlimited on-net calls to fixed and to mobile in Claro's network in Central America. $0.08/min USA and Canada. 17) 17.96 € per month are to be paid in addition for a fixed-telephone connection +3€ per month for renting a modem (also purchasable for 79€). 18) 19.95 for the first 12 months. 19) Postpaid. 20) Claro does not set a limit about the maximum amount of internet data that can be transferred within a month. 21) 73 800F for 3GB, 108 960F for 5 GB; 186 960F for GB, 354 240F for 20 GB. 22) Advertised as USD 55.23) 24-month contract. 24) 12 for ADSL, 50 for VDSL, 100 for VDSL with vectoring, 100 for GPON. Same monthly price for each access network. 25) Inclusive of free monthly telephone subscription. 26) 12 months contract. 27) 75 ILS for the first 12 months. 28) Online promotional price of € 24.54 per month. 29) If users contract the fixed broadband internet plan for more than 3 years, a discount is applied (39,600KRW→28,050KRW). 30) Quality net delivers the theoretical download speed to the end user exactly the same. 30) Quality net delivers the theoretical download speed to the end user exactly the same. 31) 24 months commitment. 32) Including unlimited calls to fixed and mobile phones in Monaco and France. 33) Advertised as USD 23.79 + VAT. 34) 299 NOK for the first three months. 35) Superfast Net Service (Paltel) 77 NIS + VAT + Internet (Hadara) 39 NIS. 36) 39.99 for the first 12 months. 37) 14.99 Euro for the first three months. 38) https://www.ooredoo.qa/portal/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadername2=MDT-Type&blobheadervalue1=inline%3B+filename%3DC05-02+Consumer+Fibre+Broadband+service+010.pdf&blobheadervalue2=abinary%3B+charset%3DUTF-8&blobkey=id&blobtable=MungoBlobs&blobwhere=1451277994204&ssbinary=true . 39) In localities not covered with fibre link, a cable link connection is offered for the same price but with lower download speed (usually 20 Mbit/s). 40) MTN sells fixed broadband in terms of capacity (Mbps) and not in volume. 41) There is no maximum.42) 24-month commitment. Without commitment, 1749 RSD per month. 43) 24-month contract. 44) Magio Internet M: 4 Mbit/s (ADSL technology) 8 Mbit/s (VDSL technology) 15 Mbit/s (fibre technology). 45) 19.95 Euro for the first 12 months. Internet speeds of up to 10/2 var Mbit/s on standard and 10/2 Mbit/s on optical connections. 46) Discounted price (SEK 249) for the first 6 months. 47) (Baht) Charges are for unlimited usage and depending on download/upload speed, exclusive of tax 7%. Most plans have unlimited data cap, but speed varies according to monthly Charge 599 baht (Download 30 Mbps/ Upload 10 Mbps) and exclusive of tax 7%. 48) For 12 months contract, download 4 Mbps and upload 768 Kbps. 49) Monthly fee for multi-apartment houses in big cities. Unlimited without limitation (max. fixed-broadband speed depends on the technical ability of the line). 50) Fixed-broadband speed of 0.256 Mbits/s. 51) There are no data caps. 52) Requires fixed-line rental (UYU 171/month). Speed depends on the infrastructure of each household. For fixed wireless, 512 kbit/s; copper, 10 Mbit/s; fibre, 30 Mbit/s. 53) At 512 kbps download speed unlimited Fiber or 256/512kbps at 5950/9950 vt per month. 54) 400M 460K/512K.55) Minimum permissible ADSL package. Minimum package offered for ADSL internet. Minimum capacity on offer for broadband. 56) TelOne's fixed monthly charge for residential fibre is now $5.00.

Mobile-cellular prices (on-net):

1) Vodafone Club Basic prepaid plan costs 800 Albanian Lek, and includes 200 National Minutes (to all mobile and fixed networks), 200 National SMS, 500 MB Internet 3G/4G and 1GB Internet 4G for a validity period of 28 days. 2) Monthly access fee of $30. Includes unlimited calls and SMS to standard Australian numbers. 3) BDT 0.21 per 10 seconds (BDT 1.26 per minute) Tax: 21% (15% VAT, 5% SD, 1% SC). 4) 0.076 rubles for the first 3 minutes per day, 0.026 rubles per minutes thereafter. 5) Call facility is activated during the registration Nu. 0.5 for 15 seconds. Nu. 0.40 for 15 seconds. 6) Per per unit price refers to "Ultra". For the calculation of the basket, Ekstra Paket, which includes 100 minutes and 100 SMS to all networks in Bosnia and Herzegovina, as well as 1 GB (download / upload) of data is used.

7) Plan requires R$ 35.99 upfront payment per month and includes unlimited SMS, on-net and to-fixed minutes, as well as 25 minutes off-net and 1GB per month. Using the city of São Paulo as the reference.8) "Prima Universal" prepaid plans may include numbers within "Friends and Family" group and 1 "Mtel VIP number". 9) The customer is either charged per minute (50 KMF per minute) or per second (1 KMF per second). 10) It also applies to calls included in the bundle. Price after the combination of 500 minutes, SMS or MB included in the option Mjesečna zmajčić (35 HRK monthly charge). 11) In CUC. No weekend tariffs: average of peak and off-peak price is used. 12) The value of the tax was added. 13) Tax inclusive.14) Price after min incl. in package.15) Refers to price per unit once the 200 sms/minutes included in Smart 1 GB are finished. 16) Basic charge after the package allowance. Minimum call charge of 1 min. 17) Prices advertised in USD. 18) USD 0.15 + ISV tax. 19) 12 kr. for off-net calls, 0 kr. for on-net calls. Unlimited minutes without setup fee for on-net calls. 20) Many offers in the form of bundled tariff are available where call rated are zero. 21) Simpati prepaid plan, prices for Jakarta region. 22) Refers to price per unit for Tim Base. For the calculation of the basket, Tim Special Voce (9.90 Euro/ per 4 weeks) + Opzione 500 SMS (3 Euro/ 4 weeks) is used. 23) 6.5*1.25 (VAT) = 8.125. 24) NTT DOCOMO provides postpaid "Kake-hodai Plan" for basic monthly charge of JPY 2,700 (for Smart phones) with domestic calling free for 24 hours. 25) Postpaid plan includes unlimited voice + SMS + 300 MB data for 32,890 won per month. 26) The ZZVisi plan includes unlimited calls and SMS to the most popular Latvian networks (Tele2, LMT, Amigo, Bite, Lattelecom) for 4.99 Euro per month. 0.17 Euro for minute of call to networks other than Tele2, ZZ, LMT, Amigo, Bite and Lattelcom. 27) Charge for postpaid tariff "FLY! XS" of Telecom Liechtenstein AG (missing prepaid offers in Liechtenstein). 28) No connection charge is applied. Per unit price refers to the plan "Pildyk". For the calcuation of the basket "Planas Visiems" is used which includes 190 minutes and 10 000 SMS. 29) Price per additional unit. 30) Including unlimited calls and SMS. No commitment period. 31) Off-net Connection Charge- 20 Kyats per minute (Peak hour). 15 Kyats per minute (Off-peak hour) 23 kyats per minute. 32) Including Tax. This is per minute on net price for JAZZ Champion (Prepaid) (Including Tax). 33) https://www.ooredoo.qa/portal/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadername2=MDT-Type&blobheadervalue1=inline%3B+filename%3DC11-01-Prepaid-MobileServices07021sep.pdf&blobheadervalue2=abinary%3B+charset%3DUTF8&blobkey=id&blobtable=MungoBlobs&blobwhere=1451327589515&ssbinary=true 34) Unlimited on-net calls. 35) These are normal tariffs, however in most cases you find that they are not applied as these operators offer many promotions and different calling packs. 36) Price is in Dobras for every 30 seconds. 37) Africell does not have peak and off-peak prices. The company charges at a flat rate of Le 650/min for on-net calls. 38) Šikovná Prima tier tariffing 0.12 – 0.11- 0.10 – 0.09 EUR/min (0-15-30-45 min). 39) Per minute prices refer to out-of-bundle rates. For the calculation of the basket Mobi 200 is used which includes 200 units (SMS or minutes) for 3.95 Euro over a period of 30 days. 40) Tarifa Tuenti costs 6 Euro per month and incl. 1,5GB and free calls from the Tuenti app. Regular voice calls free the first 30 min of each call (then 0.06 EUR /min) with a call setup charge of 0.2 EUR. For the calculation of the basket, added voice add-on incl. 50 min for 3€, call setup charge incl. 41) 35% VAT included. 42) Per minute price refers to Ladda Enkel Refill. For the calculation of the basket Ladda Fastpris is used (kr 99 for 100 min, unlimited SMS and 0.5GB). 43) Mao Mao JA THO : Call to all network 1 Baht/Min (http://www.ais.co.th/one-2-call/addon/call_only.html). Call rates 0.014 baht/Second (First minute 0.99 baht. For all network 24 hours. (Baht/min) example rate, actual rate varies depending on promotion. 44) Call Connection fee is not applicable. All Day (24 x 7). 45) Out-of-bundle rate. 46) The plan has unlimited minutes and text messages. The other prepaid plans offered increase the amount of data included with the plan, but all come with unlimited talk and text.

Mobile-cellular prices (off-net):

1) Vodafone Club Basic plan costs 800 Albanian Lek, and includes 200 National Minutes (to all mobile and fixed networks), 200 National SMS, 500 MB Internet 3G/4G and 1GB Internet 4G for a validity period of 28 days. The per-minute prices reported refer to the prices charged after the use of the inclusive (200) national minutes. 2) Average of peak (0.15 Euro) and off-peak (0.10 Euro) SMS. 3) 1 UTT =10 KZ. 4) Monthly access fee of $30. Includes unlimited calls and SMS to standard Australian numbers. 5) Tariff: BDT 0.21 per 10 seconds (BDT 1.26 per Minute] Tax: 21% [VAT = 15%, Supplementary Duty = 5%, Service Charge=1%]. 6) 0.01525 rubles per minute. 7) Nu 0.75 per 15 seconds. Nu 0.75 per 15 seconds. There is no separate weekend offer as such. 8) Per unit price refers to "Ultra". For the calculation of the basket, Ekstra Paket, which includes 100 minutes and 100 SMS to all networks in Bosnia and Herzegovina, as well as 1 GB (download / upload) of data is used. 9) Plan requires R$ 35.99 upfront payment per month and includes unlimited SMS, on-net and to-fixed minutes, as well as 25 minutes off-net and 1GB per month. 10) "Bolsa de Mensajes 100 SMS": CLP 1990. 11) Price after the combination of 500 minutes, SMS or MB included in the option Mjesečna zmajčić (35 HRK monthly charge). 12) In CUC. No weekend tariffs. Average peak and off-peak. There are no off-net SMS, given that there is only one mobile operator in Cuba. 13) No competing network. 14) Multi-destination. The value of the tax was added. 15) Tax inclusive. 16) Price after min included in package. Price after SMS included in package. 17) Refers to price per unit once the 200 SMS/minutes included in Smart 1 GB are finished. 18) Basic charge after the package allowance. Minimum call charge of 1 minute. Basic charge after the package allowance. 19) USD 0.11 + ISV tax. USD 0.05 + ISV tax. 20) Unlimited SMS for on-net messaging. 21) Many offers in the form of bundled tariff are available where call rated are zero. 22) Prices refer to Jakarta region. 23) Refers to price per unit for Tim Base. For the calculation of the basket, Tim Special Voce (9.90 Euro/ per 4 weeks) + Opzione 500 SMS (3 Euro/ 4 weeks) is used. 24) 6.5*1.25 (VAT)=8.125. 25) NTT DOCOMO provides postpaid "Kake-hodai Plan" for basic monthly charge of JPY 2,700 (for Smart phones) with domestic calling free for 24 hours. This is the price of SMS on the postpaid "Kake-hodai Plan" provided by NTT DOCOMO. 26) Postpaid plan includes unlimited voice + SMS + 300 MB data for 32,890 won per month. 27) It is 0.045 fills. 28) The ZZVisi plan includes unlimited calls and SMS to the most popular Latvian networks (Tele2, LMT, Amigo,

Bite, Lattelecom) for 4.99 Euro per month.. 0.17 Euro for minute of call to networks other than Tele2, ZZ, LMT, Amigo, Bite and Lattelcom. 29) Price of a one-minute local call to fixed, for postpaid tariff "FLY! XS" of Telecom Liechtenstein. Price of SMS, for postpaid tariff "FLY! XS" of Telecom Liechtenstein.30) Per unit price refers to the plan "Pildyk". For the calculation of the basket "Planas Visiems" is used which includes 190 minutes and 10 000 SMS. 31) Price per additional unit. 32) Including unlimited calls and SMS. No commitment period. 33) 25 Kyats per minute. 10 Kyats per SMS. 34) SMSs charged to national numbers after free units are depleted. 35) JAZZ Champion including Tax. 36) https://www.ooredoo.qa/portal/Satellite ?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadername2=MDT-Type &blobheadervalue1=inline%3B+filename%3DC11-01-Prepaid-Mobile-Services-070-21sep.pdf&blobheadervalue2=abinary %3B+charset%3DUTF-8&blobkey=id&blobtable=MungoBlobs&blobwhere=1451327589515&ssbinary=true 37) Tariff is in EURO like in operator's commercial offer. 0.18 EUR/min (VAT excluded) is the off-net standard tariff and it applies after the included minutes allowance is finished. Package incl. 1000 minutes or SMS which can be used in any combination of national calls (i.e. both to mobiles and to landlines, on-net and off-net), to international calls to fixed and national SMS. Unlimited on-net SMS. Tariff is in EURO like in operator's commercial offer. 0.05 EUR/SMS (VAT excluded) is the off-net standard tariff and it applies after the included SMS allowance is finished. Package incl. 1000 minutes or SMS which can be used in any combination of national calls (i.e. both to mobiles and to landlines, on-net and off-net), to international calls to fixed and national SMS. 38) Mean between peak (0.20) and off peak (0.25) rate. 39) Price is in Dobras for every 30 seconds. 40) Šikovná Prima tier tariffing 0.12 – 0.11- 0.10 – 0.09 EUR/min (0-15-30-45 min). 41) Per minute prices refer to out-of-bundle rates. For the calculation of the basket Mobi 200 is used which includes 200 units (SMS or minutes) for 3.95 Euro over a period of 30 days. 42) Tarifa Tuenti costs 6 Euro per month and incl. 1,5GB and free calls from the Tuenti app. Regular voice calls free the first 30 min of each call (then 0.06 EUR /min) with a call setup charge of 0.2 EUR. For the calculation of the basket, added voice add-on incl. 50 min for 3 EUR, call setup charge included. 43) Per minute price refers to Ladda Enkel Refill. For the calculation of the basket Ladda Fastpris is used (kr 99 for 100 min, unlimited SMS and 0.5GB). 44) Price SMS is more over including 100 SMS in package/2UAH and more over 90 package/2UAH per day. 45) All Day (24 x 7). 46) Out-of-bundle rate. 47) The plan has unlimited minutes and text messages. The other prepaid plans offered increase the amount of data included with the plan, but all come with unlimited talk and text.

Mobile-cellular prices (to fixed telephone; SMS):

1) Vodafone Club Basic plan costs 800 Albanian Lek, and includes 200 National Minutes (to all mobile and fixed networks), 200 National SMS, 500 MB Internet 3G/4G and 1GB Internet 4G for a validity period of 28 days. The per-minute prices reported refer to the prices charged after the use of the inclusive (200) national minutes. 2) Average of peak (0.15 Euro) and off-peak (0.10 Euro) SMS. 3) 1 UTT =10 KZ. 4) Monthly access fee of $30. Includes unlimited calls and SMS to standard Australian numbers. 5) Tariff: BDT 0.21 per 10 seconds (BDT 1.26 per Minute] Tax: 21% [VAT = 15%, Supplementary Duty = 5%, Service Charge=1%]. 6) 0.01525 rubles per minute. 7) Nu 0.75 per 15 seconds. Nu 0.75 per 15 seconds. There is no separate weekend offer as such. 8) Per unit price refers to "Ultra". For the calculation of the basket, Ekstra Paket, which includes 100 minutes and 100 SMS to all networks in Bosnia and Herzegovina, as well as 1 GB (download / upload) of data is used. 9) Plan requires R$ 35.99 upfront payment per month and includes unlimited SMS, on-net and to-fixed minutes, as well as 25 minutes off-net and 1GB per month. 10) "Bolsa de Mensajes 100 SMS": CLP 1990. 11) Price after the combination of 500 minutes, SMS or MB included in the option Mjesečna zmajčić (35 HRK monthly charge). 12) In CUC. No weekend tariffs. Average peak and off-peak. There are no off-net SMS, given that there is only one mobile operator in Cuba. 13) No competing network. 14) Multi-destination. The value of the tax was added. 15) Tax inclusive. 16) Price after min included in package. Price after SMS included in package. 17) Refers to price per unit once the 200 SMS/minutes included in Smart 1 GB are finished. 18) Basic charge after the package allowance. Minimum call charge of 1 minute. Basic charge after the package allowance. 19) USD 0.11 + ISV tax. USD 0.05 + ISV tax. 20) Unlimited SMS for on-net messaging. 21) Many offers in the form of bundled tariff are available where call rated are zero. 22) Prices refer to Jakarta region. 23) Refers to price per unit for Tim Base. For the calculation of the basket, Tim Special Voce (9.90 Euro/ per 4 weeks)+ Opzione 500 SMS (3 Euro/ 4 weeks) is used. 24) 6.5*1.25 (VAT)=8.125. 25) NTT DOCOMO provides postpaid "Kake-hodai Plan" for basic monthly charge of JPY 2,700 (for Smart phones) with domestic calling free for 24 hours. This is the price of SMS on the postpaid "Kake-hodai Plan" provided by NTT DOCOMO. 26) Postpaid plan includes unlimited voice + SMS + 300 MB data for 32,890 won per month. 27) It is 0.045 fills. 28) The ZZVisi plan includes unlimited calls and SMS to the most popular Latvian networks (Tele2, LMT, Amigo, Bite, Lattelecom) for 4.99 Euro per month.. 0.17 Euro for minute of call to networks other than Tele2, ZZ, LMT, Amigo, Bite and Lattelcom. 29) Price of a one-minute local call to fixed, for postpaid tariff "FLY! XS" of Telecom Liechtenstein. Price of SMS, for postpaid tariff "FLY! XS" of Telecom Liechtenstein.30) Per unit price refers to the plan "Pildyk". For the calculation of the basket "Planas Visiems" is used which includes 190 minutes and 10 000 SMS. 31) Price per additional unit. 32) Including unlimited calls and SMS. No commitment period. 33) 25 Kyats per minute. 10 Kyats per SMS. 34) SMSs charged to national numbers after free units are depleted. 35) JAZZ Champion including Tax. 36) https://www.ooredoo.qa/portal/Satellite ?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadername2=MDT-Type &blobheadervalue1=inline%3B+filename%3DC11-01-Prepaid-Mobile-Services-070-21sep.pdf&blobheadervalue2=abinary %3B+charset%3DUTF-8&blobkey=id&blobtable=MungoBlobs&blobwhere=1451327589515&ssbinary=true 37) Tariff is in EURO like in operator's commercial offer. 0.18 EUR/min (VAT excluded) is the off-net standard tariff and it applies after the included minutes allowance is finished. Package incl. 1000 minutes or SMS which can be used in any combination of national calls (i.e. both to mobiles and to landlines, on-net and off-net), to international calls to fixed and national SMS. Unlimited

on-net SMS. Tariff is in EURO like in operator's commercial offer. 0.05 EUR/SMS (VAT excluded) is the off-net standard tariff and it applies after the included SMS allowance is finished. Package incl. 1000 minutes or SMS which can be used in any combination of national calls (i.e. both to mobiles and to landlines, on-net and off-net), to international calls to fixed and national SMS. 38) Mean between peak (0.20) and off peak (0.25) rate. 39) Price is in Dobras for every 30 seconds. 40) Šikovná Prima tier tariffing 0.12 – 0.11- 0.10 – 0.09 EUR/min (0-15-30-45 min). 41) Per minute prices refer to out-of-bundle rates. For the calculation of the basket Mobi 200 is used which includes 200 units (SMS or minutes) for 3.95 Euro over a period of 30 days. 42) Tarifa Tuenti costs 6 Euro per month and incl. 1,5GB and free calls from the Tuenti app. Regular voice calls free the first 30 min of each call (then 0.06 EUR /min) with a call setup charge of 0.2 EUR. For the calculation of the basket, added voice add-on incl. 50 min for 3 EUR, call setup charge included. 43) Per minute price refers to Ladda Enkel Refill. For the calculation of the basket Ladda Fastpris is used (kr 99 for 100 min, unlimited SMS and 0.5GB). 44) Price SMS is more over including 100 SMS in package/2UAH and more over 90 package/2UAH per day. 45) All Day (24 x 7). 46) Out-of-bundle rate. 47) The plan has unlimited minutes and text messages. The other prepaid plans offered increase the amount of data included with the plan, but all come with unlimited talk and text.

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