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International Telecommunication Union

Digital trends in Europe 2021

ICT trends and developments in Europe, 2017-2020

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[1] When lists of countries in the text are not in alphabetical order, they refer to indexes shown in corresponding figures and images.

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Summary

This report provides an overview of trends and developments in ICT infrastructure, access and use in the Europe region, which includes 46 ITU Member States and is home to a population of 686 million people. The report highlights changes in ICT adoption since the last World Telecommunication Development Conference in 2017 (WTDC-17) and during the COVID-19 pandemic, tracks the evolution of regulation, and reviews progress and challenges of the ITU regional initiatives for Europe. Its objective is to serve the ITU membership as a reference for reviewing progress and identifying ICT development priorities in the Europe region.

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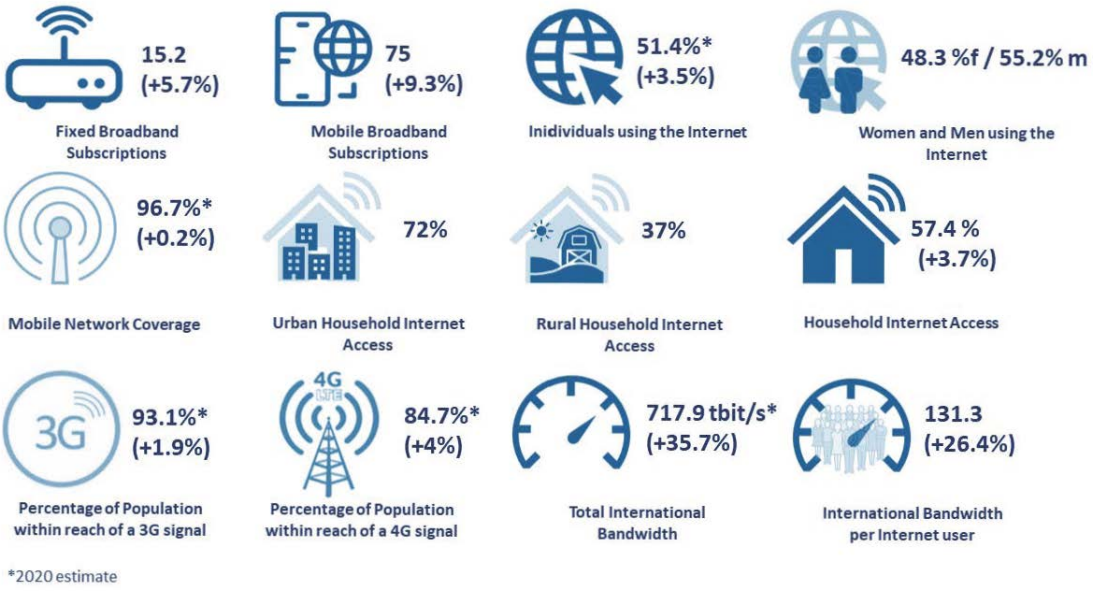
1. Overview

While COVID-19 has dominated the headlines throughout 2020, consistent development and deployment of ICT infrastructure and its concomitant services has meant a continued trend towards digital transformation for societies, businesses and governments alike. Since the last World Telecommunication Development Conference in 2017 (WTDC-17), information and communication technologies (ICTs) have continued to spread. ITU data show that in 2019 Internet use surpassed the 50 per cent mark (51.4 per cent globally by the end 2019), 75 per cent of the total world population had an active mobile broadband subscription, and fixed broadband subscription had grown to just over 15 per cent. Over 57 per cent of households today have Internet access at home. Moreover, given the increase in demand for data due to increasingly bandwidth-intensive services, international bandwidth has, on average, grown at a compound annual growth rate ("CAGR") of 36 per cent between 2017 and 2020, with a CAGR for international bandwidth per Internet user of 26 per cent between 2017 and 2019. Yet, the digital divide persists. While almost all urban areas in the world are covered by a mobile broadband network, many gaps persist in rural areas. The gender divide remains a reality, with still fewer women than men benefiting from Internet use (Figure 1).

Figure 1: Global ICT indicators 2019 and 2020 where available (per 100 inhabitants and per cent) and compound annual average growth rate (CAGR) for 2017-2019, 2017-2020 where available



Source: Based on ITU WTI Database from 2017, 2019, and 2020 where available

As most countries across the world grapple with the effects of the COVID-19 pandemic, the role of ICTs and services, and the digital infrastructure that they ride and scale on has become central to continued economic and societal activity and to lessening the pandemic's impact. An Economic Experts Roundtable organized by ITU and held in June 2020[1] concluded that countries with top connectivity infrastructure could mitigate up to half of the negative economic shock of the pandemic. Overall, the impact of the pandemic has been to accelerate digital

[1] The Economic Experts Roundtable was held on 26 June 2020 https://www.itu.int/en/ITU-D/Conferences/GSR/2020/Pages/default.aspx

transformation, as businesses move towards distributed models of employment and digital delivery of services and products. Individuals forego travel and socializing and turn towards digital entertainment and communication platforms but also, increasingly, to e-commerce. Schools move to online learning and digital classrooms, and governments increasingly rely on and need data on citizens, health, and economic indicators to establish policies.

While research on the contribution of digitization to soften the impact of pandemics is limited, emerging evidence is compelling about its accelerating effects across all areas of people's lives and sectors of the economy. For example, consumer and business surveys show that the COVID-19 pandemic has pushed consumers and businesses alike to adopt digital services and technologies, accelerating digital transformation in consumer behaviour and business activity by several years (Figure 2).

Figure 2: Accelerating impact of COVID-19 on digital transformation

Source: ITU, based on insights from 2020 McKinsey consumer and enterprise surveys at https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights[2]

Generally, the pandemic has forced a greater demand for digital reliance across the board, and this outcome is likely here to stay in the "new normal" as the utility of more abundant data and the lowering transaction costs of using that data impact how entrepreneurs, policy-makers and professionals make decisions. The pandemic, however, is just one driver of current trends. Climate responsibility, continued economic development, demographic shifts and social well-being are also other key drivers.

In the light of these global trends, policy development focused on inclusion, access, security, skills and sustainability in terms of emerging technologies and their benefits is poised to become one of the defining characteristics of the 2020s. This is mirrored in the ITU thematic priorities for Europe that remain highly relevant going forward.[3] Artificial intelligence, the Internet of Things, cloud computing, distributed ledger technology, precision medicine, digital trade, autonomous mobility, and many more evolving technological arenas will shape the future of the world, and Europe in it. Europe has the opportunity to set an example for the world in policy development

[2] https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/europes-digital-migration-during-covid-19-getting-past-the-broad-trends-and-averages, and https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/a-global-view-of-how-consumer-behavior-is-changing-amid-covid-19 and https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever

[3] https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Pages/ActivitiesandProjects.aspx

and implementation, given its top spot in many ICT indicator rankings and considering that it also leads other regions in the ITUG5 Benchmark for regulatory excellence[4]. For example, the increasing demand for digital transformation affects a broad range of stakeholders, and a collaborative regulatory response could set a responsible policy development approach not only for ICT regulation, but also for all emerging technologies that depend on the ICT infrastructure foundation.

Ultimately, at the heart of this historical transformation, ICT infrastructure is the predominant enabler, along with fit-for-purpose policy, of Europe's future competitiveness and global leadership. We cannot lose sight of the fact that improving ICT infrastructure is more than a goal for operators and consumers. It does much more than facilitate mobile and broadband connections. It facilitates the backbone for global supply chain integration, the innovative use of critical health information, the opportunity for citizens to improve their options in the workforce, the ability for students to gain skillsets previously unavailable to them, and many more positive externalities that are changing the course of history. Indeed, it will be history that looks back at this early era of technological development to see how policies and governance approaches reinforced the resilience and responsiveness of societies, all the while assessing for risks, protecting consumers and enabling positive outcomes for citizens.

2. Digital trends in Europe[5]

Over the last four years, the Europe region[6], which includes 46 Member States and has a population of 686 million, has seen continued growth in most areas of ICT infrastructure, access, and use. Europe's mobile cellular coverage, which refers to the percentage of the population that lives within reach of a mobile cellular signal, is estimated by ITU to be close to 100 per cent. Just over 98 per cent of the population is now within reach of a 3G signal and 97.2 per cent is within reach of an LTE mobile-broadband signal. The percentage of individuals using the Internet has increased from 77.4 per cent in 2017 to 82.5 per cent at the end of 2019, with households that have Internet access at home increasing from 80.9 per cent in 2017 to 85 per cent at the end of 2019. Both, fixed and mobile broadband markets have shown growth over the last four years, with active mobile broadband subscriptions outpacing fixed broadband subscriptions. A gender gap and a rural/urban divide persist: In 2019, there were 80.1 per cent of women and 85.1 per cent of men that used the Internet. Moreover, 77.9 per cent of rural households and 87.9 per cent of urban households had access to the Internet in 2019 (Figure 3). In the age group of 15- to 24-year-olds, 96.2 per cent used the Internet in 2019, well above the world average which stood at 69 per cent (Figure 3).[7]

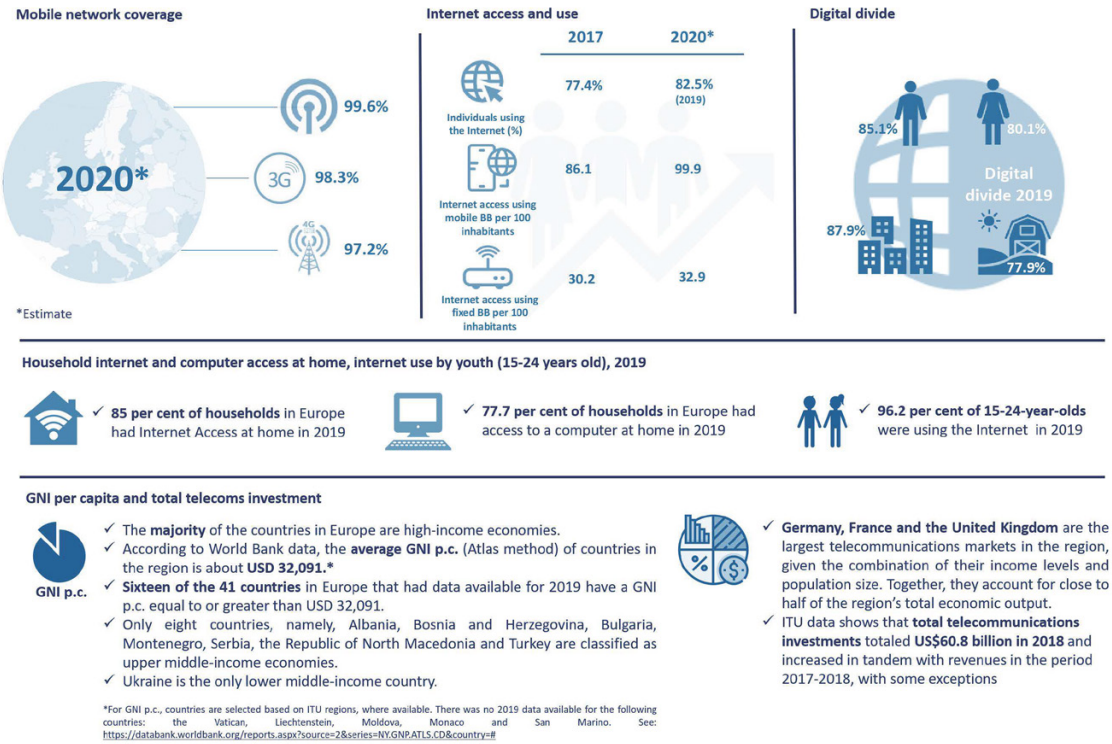
4 https://www.itu.int/en/ITU-D/Regulatory-Market/Pages/Policy-%26-Regulatory-Frameworks.aspx

5 Mostly 2019 data with some 2020 preliminary data/estimates. Disaggregated data will be reported when available and relevant (gender, age, rural/urban). Europe averages vs global will be reported when relevant.

6 This Report uses the ITU Europe region as defined under ITU country classifications, see: https://www.itu.int/en/ITU-D/Statistics/Pages/definitions/regions.aspx . Where data were only available for a subset of countries, this is indicated.

7 Measuring digital development, Facts and Figures 2020, https://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx

Figure 3: Key ICT statistics, ITU Europe region 2017-2020



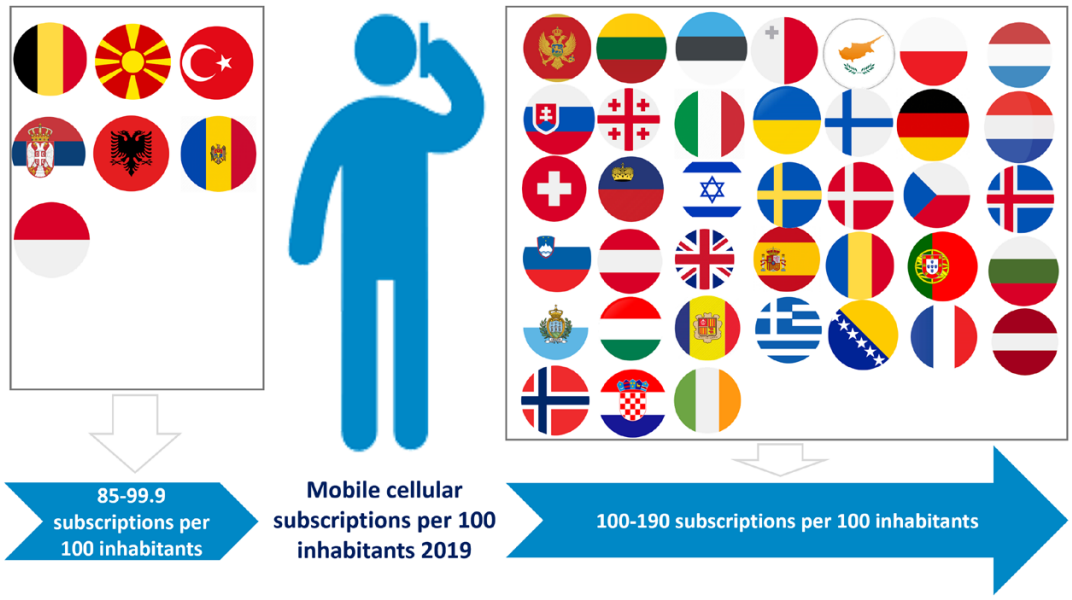
Source: ITU, WTI Database and World Bank data (for GNI data)

2.1 Mobile market developments

The European mobile market is very advanced, with mobile cellular subscriptions far in excess of 100 subscriptions per 100 inhabitants in 38 out of 45 countries. Only seven countries have subscription rates of less than 100 per 100 inhabitants, including Monaco, Moldova, Albania, Serbia, Turkey, North Macedonia and Belgium. For Europe region, the 2020 average subscription rate is estimated by ITU at 122.7 per 100 inhabitants, which is well above the world average of 105 subscriptions per 100 inhabitants (Figure 4).

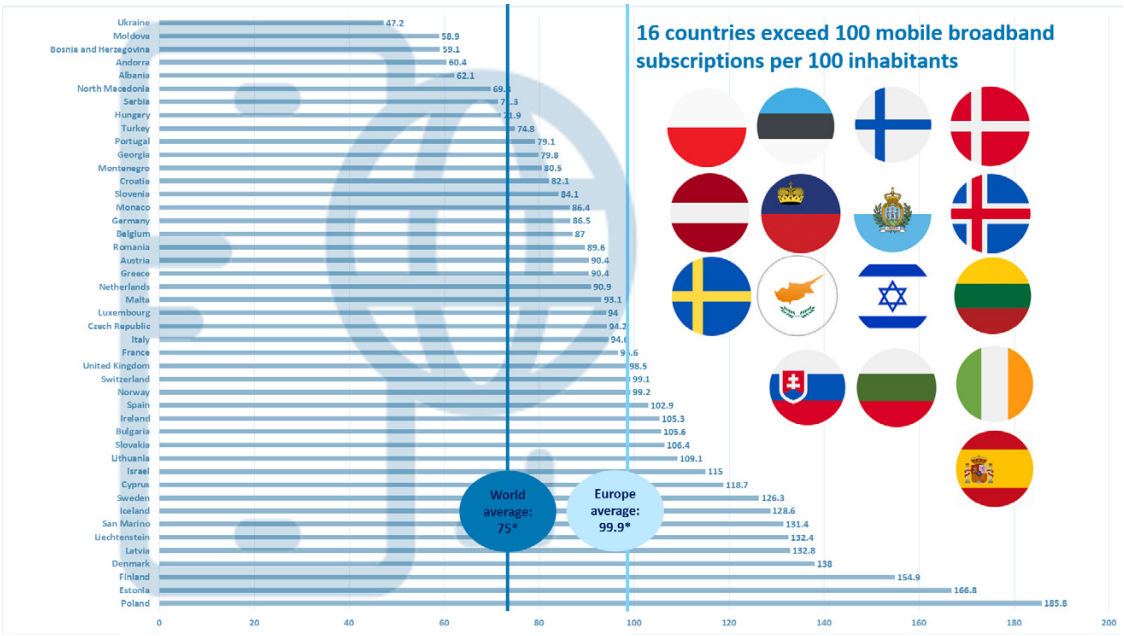
Active mobile broadband subscriptions per 100 inhabitants reached 99.9 per 100 inhabitants in 2019, outstripping the world average of 75 per 100 inhabitants by just under 25 per cent. One-third of countries in the Europe region, including Poland, Estonia, Finland, Denmark, Latvia, Liechtenstein, San Marino, Iceland, Sweden, Cyprus, Israel, Lithuania, Slovakia, Bulgaria, Ireland and Spain, have mobile broadband subscription rates in excess of 100 per 100 inhabitants, with Poland (185.8), Estonia (166.8) and Finland (154.6) being significant outliers (Fig. 4). Countries that lie below the world average include Turkey, Hungary, Serbia, North Macedonia, Albania, Andorra, Bosnia and Herzegovina, and Moldova. Ukraine is trailing behind, with a subscription rate of 47.2 per 100 inhabitants (Figure 5).

Figure 4: Mobile cellular subscriptions 2019, 45 European countries



Source: Based on ITU WTI Database, July 2020 edition

Figure 5: Active mobile broadband subscriptions per 100 inhabitants, 2019, 45 European countries

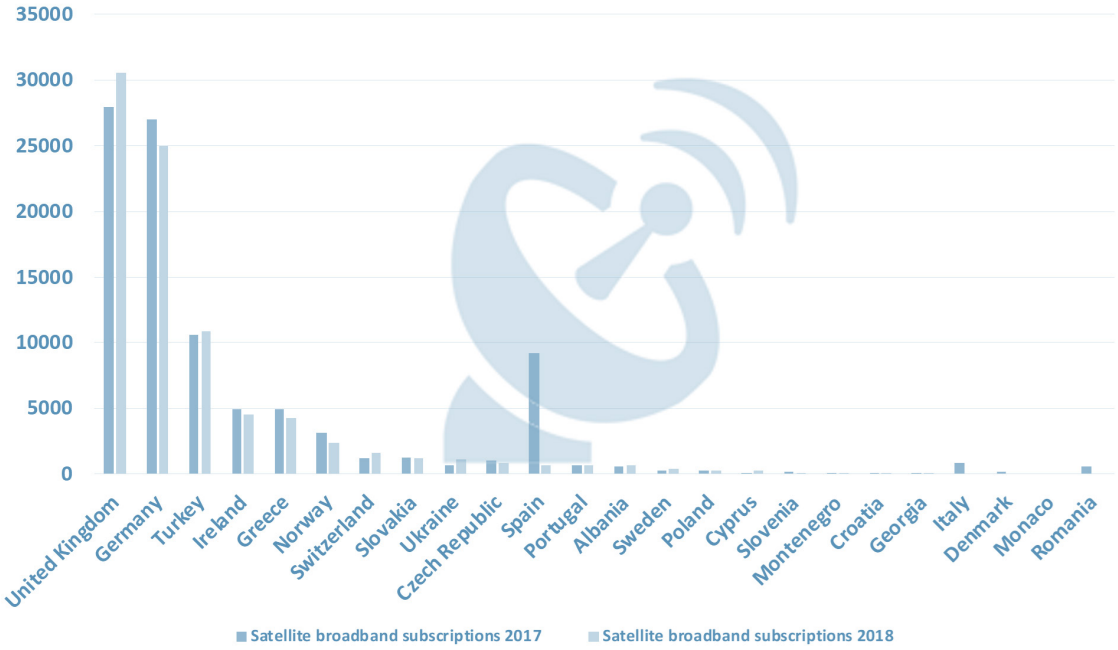


Source: Based on ITU WTI Database, *2020 estimate

2.2 Satellite broadband developments

Satellite broadband in Europe, as in other regions, offers an effective means to close the digital divide and address remaining connectivity gaps. Satellite broadband is available in all EU member states and some non-EU countries[8] ITU data for satellite broadband subscriptions[9] is only available for a subset of countries, with the biggest markets including the United Kingdom, Germany, Turkey, Greece and Ireland. Most of the markets show a small declining trend for the period 2017-2018 but several others, including the United Kingdom, Ukraine, Turkey, Switzerland, Sweden and Albania show increases in satellite subscriptions (Figure 6).

Figure 6: Satellite broadband subscriptions 2017-2018, Europe region



Source: ITU, based on ITU WTI Database

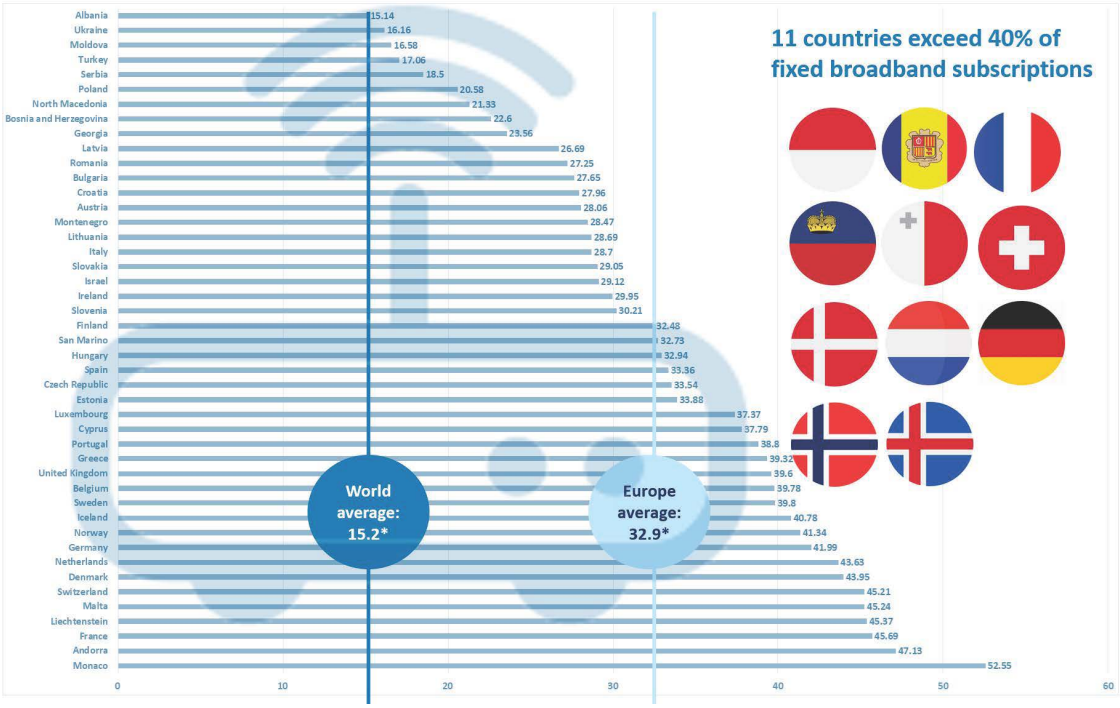
2.3 Fixed-broadband market

Compared with other regions, Europe has the highest fixed-broadband subscription rates. ITU estimates a fixed-broadband penetration level of 32.9 per cent for Europe as a whole in 2020, a figure more than twice as high as the global average of 15.2 per cent. Within the region, all countries, except Albania, have achieved a level of fixed-broadband penetration greater than the global average (Figure7). Eleven countries, including Monaco, Andorra, France, Liechtenstein, Malta, Switzerland, Denmark, the Netherlands, Germany, Norway and Iceland, have reached fixed broadband subscriptions rates of more than 40 per 100 inhabitants (Figure 7).

[8] https://ec.europa.eu/digital-single-market/en/broadband-all-satellite

[9] Satellite broadband subscriptions refers to the number of satellite Internet subscriptions with an advertised download speed of at least 256 kbit/s. It refers to the retail subscription technology and not the backbone

Figure 7: Fixed-broadband subscriptions per 100 inhabitants, 2019, Europe



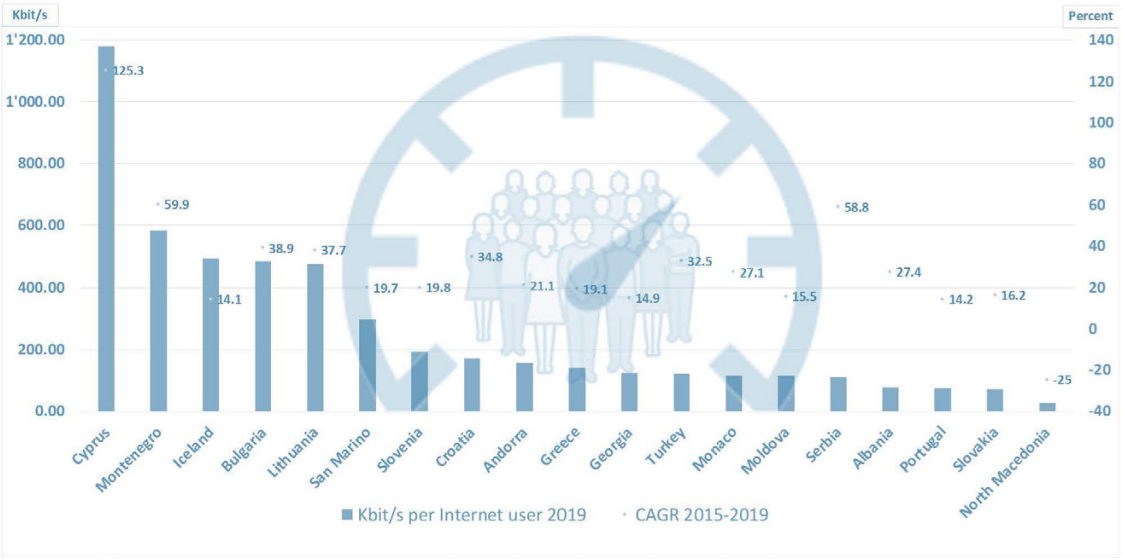
Source: ITU, based on ITU WTI Database, *2020 estimate

Between 2015 and 2019, Europe regionally achieved a CAGR of 3.3 per cent in fixed-broadband subscriptions per 100 inhabitants. Albania experienced the fastest growth of 15.9 per cent in fixed-broadband subscriptions per 100 inhabitants during this period. Other countries that have progressed significantly between 2015 and 2019 with a CAGR above 8 per cent include Montenegro at 12.3 per cent and Georgia with 10.5 per cent, Turkey with 9 per cent and Ukraine with 8.5 per cent. Serbia, Slovakia, Moldova, Greece, North Macedonia, Cyprus, Bulgaria and Bosnia and Herzegovina progressed at rates of between 5 per cent and 9 per cent. Overall, the fixed-broadband market in Europe still has some potential for expansion.

The availability of international bandwidth continues to be an important area for policy and investment, especially given the rising amount of data-intensive applications, cloud-based services and increasing numbers of Internet users desiring better international connectivity. Total international bandwidth has more than doubled over the last four years from 61.8 Tbit/s in 2017 to 153 Tbit/s in 2020. At the individual user level, kbit/s per Internet user in Europe amounted to 211.2 in 2019, as compared to 131.3 kbit/s per Internet user globally.

At the country level, kbit/s per Internet user have increased across all of the countries, where data were available for 2019, with the exception of North Macedonia. More than half of the countries shown in Figure 8 had CAGRs in excess of 20 per cent including Albania, Serbia, Monaco, Turkey, Andorra, Croatia, Lithuania, Bulgaria, Montenegro and Cyprus.

Figure 8: Kbit/s per Internet user, 2019 and CAGR 2015-2019 for selected countries in Europe



Source: ITU, based on ITU WTI Database

2.4 Internet access, use, skills, and gender

Europe is leading in Internet access at the global level, with 85 per cent of households estimated by ITU to have had Internet access in 2019, compared to 57.4 per cent globally. The proportion of individuals that was using the Internet in 2019 totalled 82.5 per cent in Europe and 51.4 per cent globally (Figure 9).

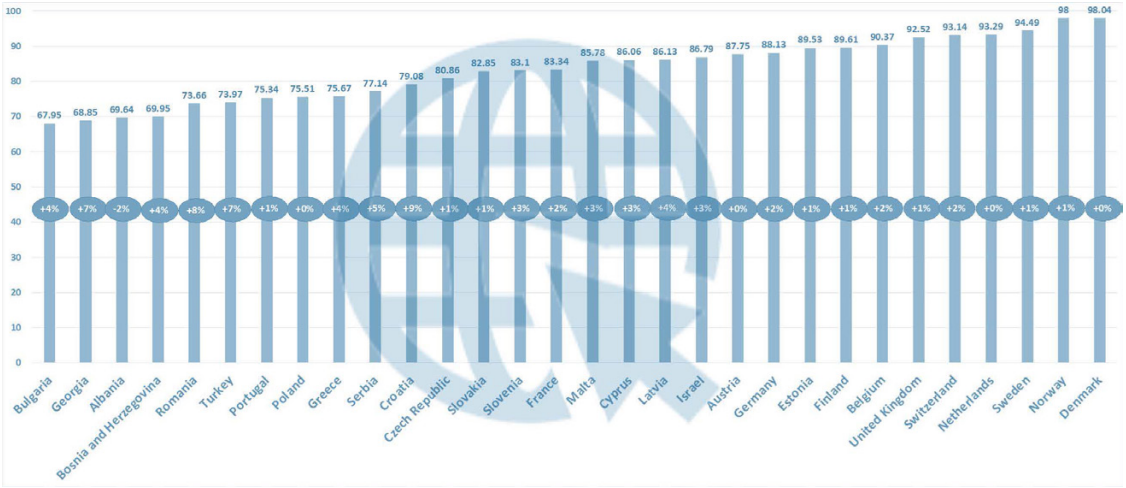
Figure 9: Household access, individuals using the Internet, total and by gender, 2019, Europe and world

2019	Internet Access at home	Individuals using the Internet	Women	Men
	85%	**82.5%**	80.1%	85.1%
	57.4%	**51.4%**	48.3%	55.2%

Source: Based on ITU WTI Database, *2020 estimate

The percentage of individuals using the Internet has increased in almost every European country over the period 2017-2019 (Figure 10). In eight countries, namely Denmark, Norway, Sweden, the Netherlands, Switzerland, the United Kingdom and Belgium, more than 90 per cent of individuals were using the Internet in 2019. In 40 per cent of the countries, percentages of individual Internet users were between 80 per cent and 90 per cent (Figure 10).

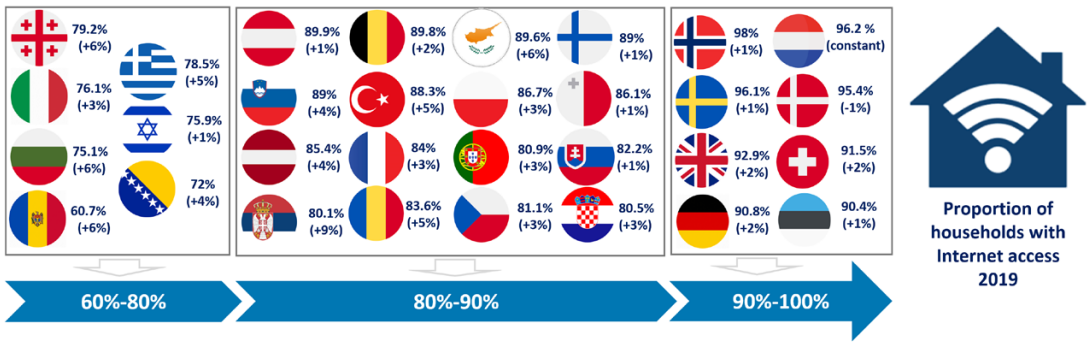
Figure 10: Percentage of individuals using the Internet 2019 and CAGR 2017-2019



Source: ITU, based on ITU WTI Database for 2017 and 2019

In terms of households with Internet access, Europe leads other regions and the world average, with an average penetration rate of 85 per cent. Taking a closer look at the individual country level, more than half of the countries have a proportion of households with Internet access between 80 per cent and 90 per cent; eight countries, Norway, the Netherlands, Sweden, Denmark, the United Kingdom, Switzerland, Germany and Estonia, are nearing 100 per cent and, five countries are trailing at rates between 70 per cent and 80 per cent, with only Moldova at 60.8 per cent (Figure 11).

Figure 11: Proportion of households with Internet access, 2019 and CAGR 2017-2019 in brackets



Source: ITU, based on ITU WTI Database for 2017 and 2019

In terms of the digital divide, a gender gap remains in Europe, albeit decreasing, and less pronounced than compared to the world average. While on average 80.1 per cent of women and 85.1 per cent of men used the Internet in Europe in 2019, globally 48.3 per cent of women and 55.2 per cent of men used the Internet that year. Data also show that in Europe, more men than women were using the Internet in 33 out of 39 countries in 2019 (Figure 12). The digital

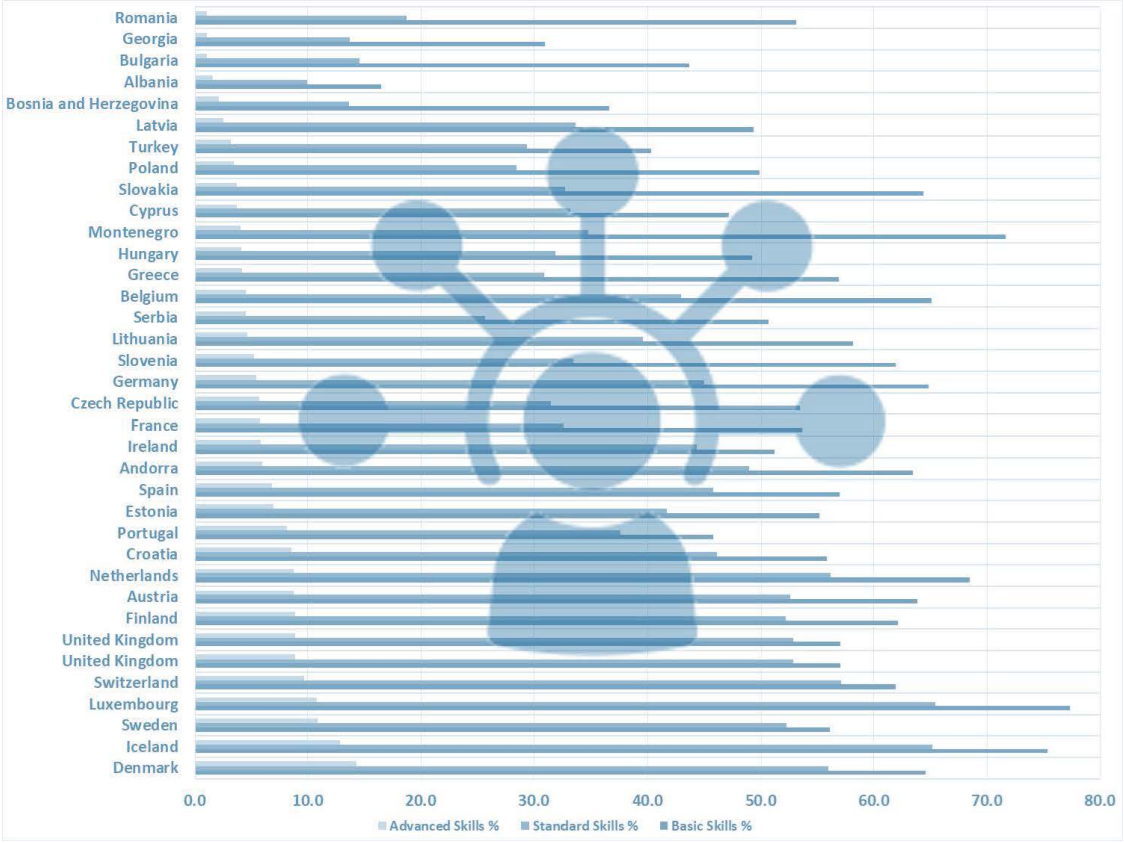
divide is most pronounced in Ukraine, Albania, Moldova, Bosnia and Herzegovina, Turkey, Italy, Croatia, North Macedonia, the Czech Republic, Serbia, Austria and Germany, where differences in usage surpass or equal five percentage points. Countries that are almost at parity (equal to or less than one percentage point difference) include Iceland, Denmark, Luxembourg, Sweden, Malta, Estonia and Cyprus. Spain is the only country where men and women are using the Internet at equal rates.

Figure 12: Individuals using the Internet by gender, European countries, 2019*

Source: Based on ITU WTI Database 2019, *figures for Ukraine, North Macedonia, Luxembourg, Italy, Ireland and Iceland are for 2018

The levels reached in basic, standard and advanced ICT skills over the last three year vary significantly across Europe, with Denmark, Iceland, Sweden and Luxembourg leading in advanced skills with levels between 10 per cent and 15 per cent. Levels of standard and basic skills are well above 50 per cent (see Box 1 for definitions of skill levels). Thirteen countries have attained levels of basic skills above 60 per cent, including Denmark, Iceland, Luxembourg, Switzerland, Finland, Austria, the Netherlands, Andorra, Germany, Slovenia, Belgium, Montenegro and Slovakia. In relation to standard skills, 10 countries have achieved levels above 50 per cent, including Denmark, Iceland, Sweden, Luxembourg, Switzerland, the United Kingdom, Finland, Austria and the Netherlands, and seven countries including Croatia, Estonia, Spain, Andorra, Ireland, Germany and Belgium, have achieved levels of between 40 per cent and 50 per cent. Only five countries, namely Bosnia and Herzegovina, Bulgaria, Georgia, Romania and Albania have standard skills levels of below 20 per cent (Figure 13).

Figure 13: Basic, standard and advanced ICT Skills, 2017-2019, European countries



Source: Based on ITU WTI Database

Box 1: ITU definition of different ICT skills levels

For each economy, the value for **basic skills** is the average value of the available recent data for 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 average value of the available recent data for 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.

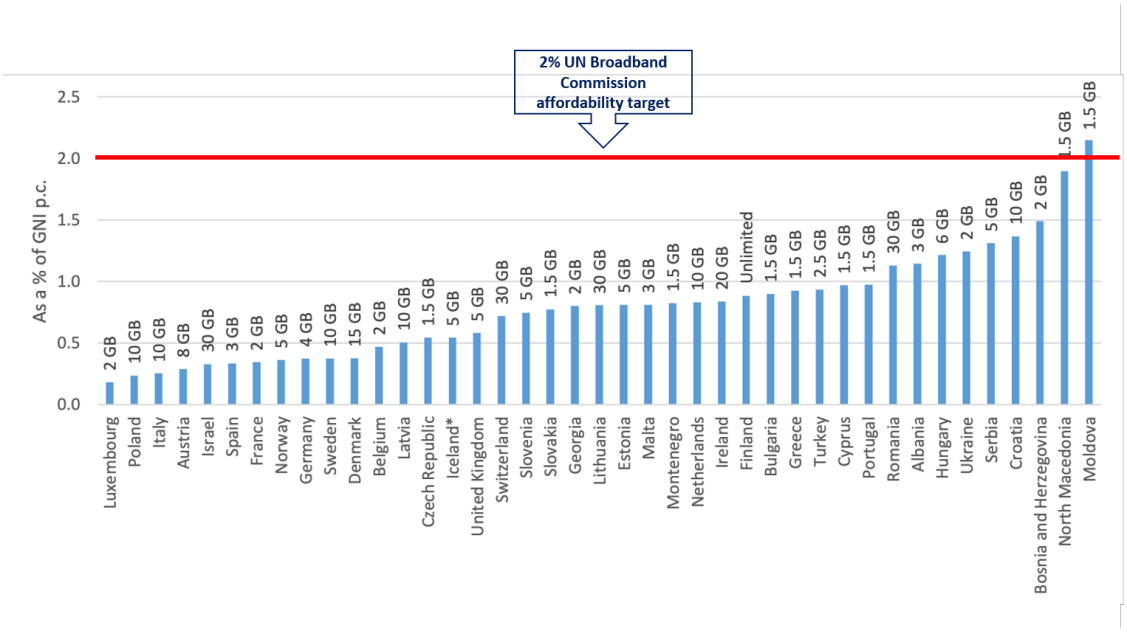
The value for **advanced skills** is the value for writing a computer program using a specialized programming language.

2.5 ICT prices

ITU data show that telecommunication and ICT services are becoming more affordable and prices have generally followed a downward trend over the last four years across the world, including for mobile-voice, mobile-data and fixed-broadband. At the regional level, Europe has the most affordable prices, closely followed by the Commonwealth of Independent States (CIS) region. The ITU report "Measuring Digital Development: ICT Price Trends 2019"[10] provides a detailed examination and discussion of ICT price trends.

Europe is the region with the most affordable mobile-data baskets relative to income[11], with 32 countries having a basket costing less than 1 per cent of gross national income per capita (GNI p.c.) and all countries below 2.1 per cent of GNI p.c. Only Moldova is borderline with regard to the Broadband Commission target, which stipulates that ICT services should not cost more than 2 per cent of GNI p.c. Monthly data allowances included in the relevant plans in the region are high, at least 5 GB in more than half of the countries (Figure 14). Finland is a global leader with no data limit applied. Israel, Lithuania, Romania and Switzerland are also worth mentioning, all offering a 30 GB data cap.

Figure 14: Mobile-data prices as a percentage of GNI p.c. and monthly data allowance, Europe, 2019



Source: ITU, adapted from "Measuring Digital Development, ICT Price Trends 2019"

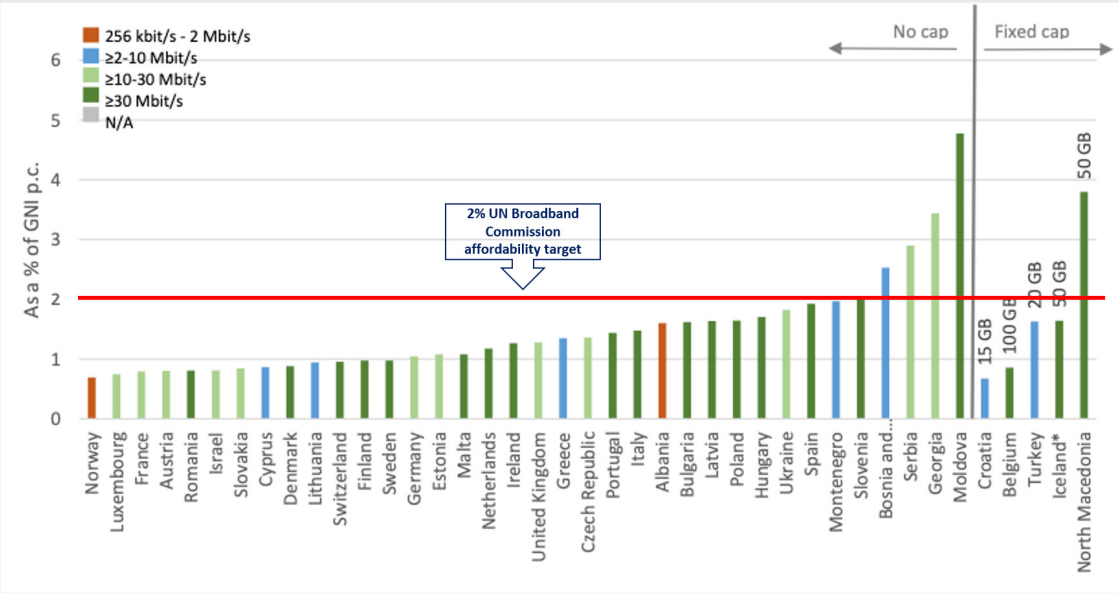
As regards affordability of fixed services, Europe is the region with the lowest fixed-broadband basket price as a percentage of GNI p.c. (1.5 per cent). The only six countries, where the fixed-broadband basket costs more than the Broadband Commission target of 2 per cent of GNI p.c. are Slovenia, Bosnia and Herzegovina, Serbia, Georgia, North Macedonia and Moldova (Figure 15). In almost all countries, the advertised download speed is 10 Mbit/s or more. In

[10] https://www.itu.int/en/mediacentre/Pages/pr08-2020-Measuring-Digital-Development-ICT-Price-Trends-2019.aspx

[11] Data-only plans are not be very common in developed countries, as most people have a data-and-voice bundle.

five countries, namely Croatia, Belgium, Turkey, Iceland and North Macedonia, monthly data allowances are capped.

Figure 15: Fixed-broadband prices as a percentage of GNI p.c., speeds and caps, Europe, 2019



Source: ITU, adapted from "Measuring Digital Development, ICT Price Trends 2019"

Box 2: Measuring ICT prices at ITU

The International Telecommunication Union (ITU), its partners and stakeholders devote considerable time and effort to developing and refining price methodologies, in particular through the Expert Group on Telecommunication/ICT Indicators (EGTI). ITU maintains a set of different price baskets to reflect different usage patterns and behaviour. In 2017, ITU updated and adjusted its price baskets to reflect current developments in the fixed and mobile broadband markets. The price baskets cover three different technologies: mobile- voice, mobile-data and fixed-broadband.

In addition, the 2017 revision introduced combined data-and-voice baskets, as a first attempt to monitor the prices of bundled services, which is now a very common commercial practice.

The ITU mobile-data-and-voice baskets include voice, text messages and data for two different consumption levels. The low-consumption mobile-data-and-voice basket includes 70 voice minutes, 20 SMSs and 500 MB of broadband data while the high-consumption mobile-data-and-voice basket includes 140 voice minutes, 70 SMSs and 1.5 GB of broadband data.

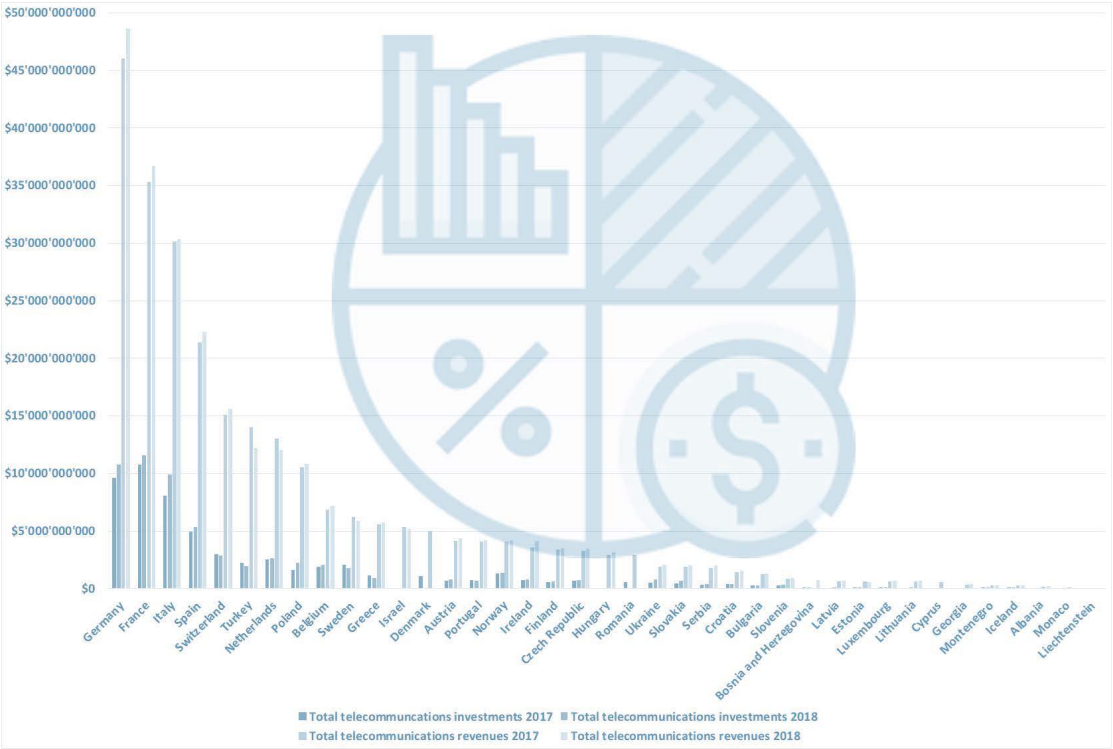
Source: From ITU, "Measuring Digital Development, ICT Price Trends, 2019"

2.6 Telecommunication revenues and investment

In Europe, ITU estimates that total telecommunication investments amounted to USD 60.8 billion, or 24.8 per cent of total European telecommunication revenues in 2018. Total telecommunication revenues and investments increased from 2017 to 2018 in 22 of the countries, where data were available. Both in Turkey and Sweden, revenues and investments declined over the period 2017-2018, whereas in the Netherlands, Estonia and Iceland, investments increased despite

falling revenues over the same period. In Portugal and Luxembourg, investments declined while revenues increased (Figure 16).

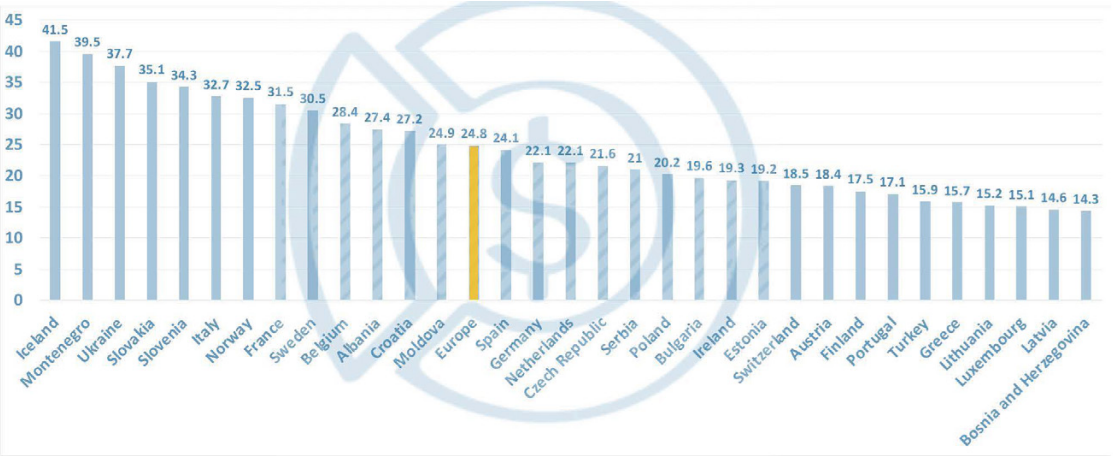
Figure 16: Total telecommunication investments and revenues by European country where available, 2017-2018



Source: Based on ITU WTI Database

The percentage share of investments in revenues was highest in Iceland with 41.5 per cent, followed by Montenegro, Ukraine, Slovakia, Slovenia, Italy, Norway, France and Sweden, all of which had shares above 30 per cent. Lowest levels of investments as a share of revenue were committed in Bosnia and Herzegovina and in Latvia, with 14.3 per cent and 14.6 per cent, respectively (Figure 17).

Figure 17: Percentage share of telecommunication investments in telecommunication revenues, European countries, 2018



Source: Based on ITU WTI Database

Box 3: Investment efforts to mitigate the impact of COVID-19

Despite the global economic recession expected to follow the COVID-19 crisis, and confirming the importance of connectivity in time of pandemics, telecommunication operators are reporting increased efforts to invest in additional capacity and deploying new network infrastructure and technologies. For example, Turkcell reported an increase of 10 per cent in expected investments for 2020, including plans to uphold the 5G launch and to deploy new fibre-to-the-home connections.[1]

Source: ITU News 03

[1] https://www.itu.int/en/myitu/Publications/2020/09/09/13/13/ITU-News-Magazine-No3-2020

2.7 Developments regarding cybersecurity

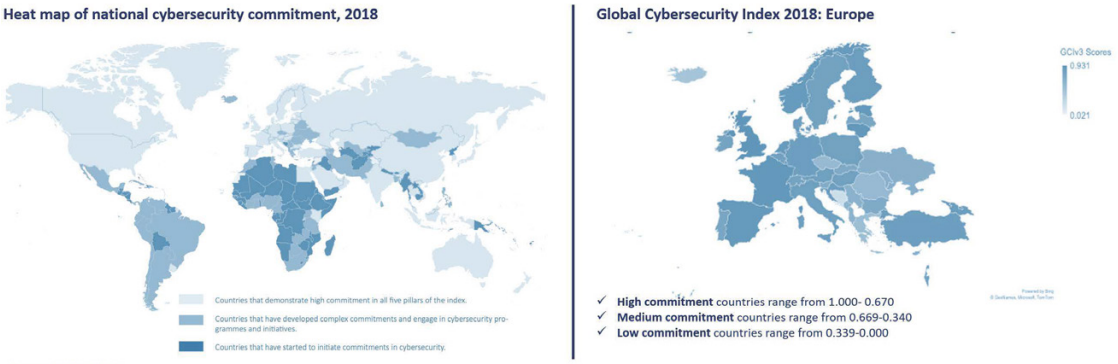
Cybersecurity is key to trusted and sustainable digital transformation. This is particularly evident during situations of crisis such as the COVID-19 pandemic, where many of an organization's activities and communication move online and where cyberdefences might be lowered due to the shift of focus to the health crisis. Based on an Interpol assessment of the global landscape on COVID-19 cyberthreats[12], there were significant increases across all cybercrime domains, including online scams and phishing, data-harvesting malware, disruptive malware/ransomware, as well as exploitation of vulnerabilities of systems, networks and applications used by businesses, governments and schools to support staff who are now working remotely.

ITU estimates that at the end of 2019, the cost of cybercrime totalled USD 2 trillion globally.[13] Therefore, fit-for-purpose cybercrime legislation, strategies and frameworks, as well as computer emergency response teams, capabilities, awareness and capacities are key to progressing sustainable economic and socio-economic development.

Since 2015 ITU publishes the Global Cybersecurity Index (GCI) to measure the commitment of each ITU Member State to cybersecurity across five pillars (see Box 4 for a description of these pillars). GCI is an initiative of ITU involving experts from different backgrounds and organizations. Europe region is well advanced in its commitment to ensuring that the use of ICTs is safe and secure and outpaces all other regions with regard to cybercrime preparedness and commitment across all GCI cybercrime pillars. GCI 2018 shows that all European countries have cybercriminal legislation and cybersecurity regulation in place. Moreover, more than two-thirds of Europe region countries fall into the highest category of commitment (Figure 18). Only 10 countries, namely Moldova, Ukraine, Cyprus, Serbia, Montenegro, Albania, Liechtenstein, Greece, Malta and Iceland fall into the medium commitment category. The United Kingdom, France and Lithuania have obtained the top three scores in the Europe region across all five GCI pillars (Figure 18).[14]

[12] https://www.interpol.int/en/content/download/15217/file/Global%20landscape%20on%20COVID-19%20cyberthreat.pdf
[13] https://www.itu.int/en/ITU-D/Cybersecurity/Pages/global-cybersecurity-index.aspx
[14] https://www.itu.int/en/ITU-D/Cybersecurity/Pages/global-cybersecurity-index.aspx, see GCI Report 2018 p. 30

Figure 18: Heatmap of national cybersecurity commitment and GCI scores Europe, ITU GCI 2018

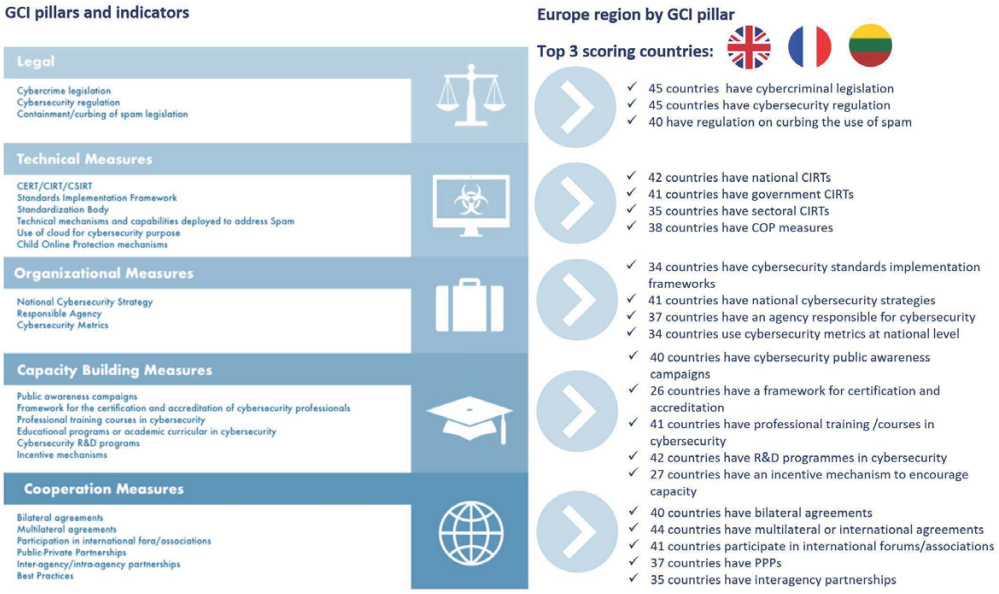


Source: ITU GCI 2018

Box 4: ITU Global Cybersecurity Index: Europe Region – A closer look

It is the **objective of the GCI** to measure each ITU Member States' level of cybersecurity commitment in five main areas, including **Legal, Technical, Organizational, Capacity Building and Cooperation**. The GCI can help countries identify areas for improvement, motivate action to improve relative GCI rankings, raise the level of cybersecurity worldwide, help identify and promote best practice and foster a global culture of cybersecurity.

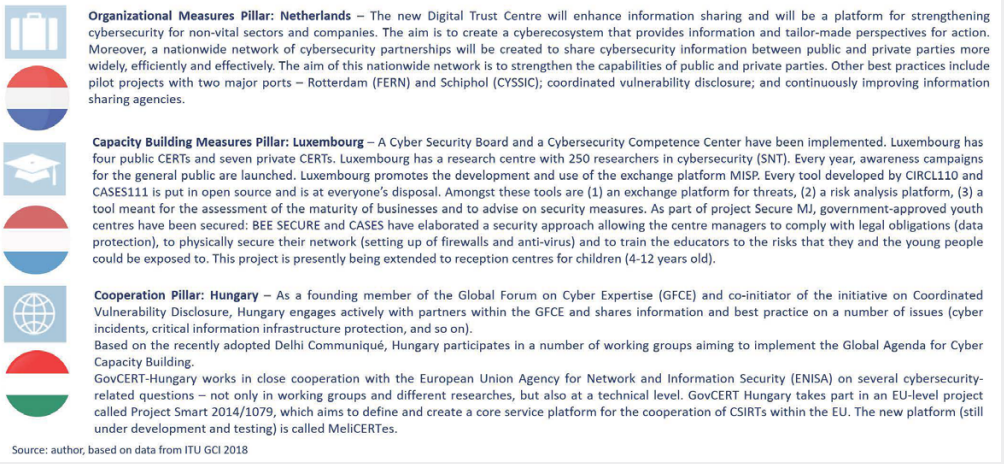
Europe is at the forefront of the GCI across all five pillars. This is shown in the below figure.



Selected country case studies by GCI pillar:

Legal Measures Pillar: United Kingdom - Agency (NCA) continues to lead and coordinate the United Kingdom fight against cybercrime, working closely with a range of domestic and international cybersecurity partners. Recent successful activity, as a result of close collaboration between NCA, police and judiciary partners both domestically and abroad, includes: Criminals offering Webstresser tools often look to exploit grey areas arising from the ability of such tools to be used for both legitimate networking stress testing activity and illegal activity such as DDOS attacks. However, on 24 April 2018, NCA and the Dutch National Police, in collaboration with international law-enforcement partners, successfully led an international operation that shut down a website linked to 4 million DDoS attacks globally, including against the biggest banks in the United Kingdom linked to the "Webstresser" service. A major criminal website was shut down, and the sophisticated crime group behind it stopped. In June 2017, NCA and United Kingdom Police partners successfully led another activity, as part of a coordinated international law-enforcement operation targeting people suspected of using cybertools to get around anti-virus computer protection. At the heart of the investigation was a platform used by malware developers before they launch cyberattacks to test samples for their ability to evade popular off-the-shelf anti-virus software. Data sharing between the United Kingdom and its partners in the Europol European Cybercrime Centre (EC3) and the Joint Cybercrime Action Taskforce (J-CAT) triggered and enabled these arrests to take place.

Technical Measures Pillar: Georgia started a cyber research project in 2018, a portal of online cyberexercises. CyberLab is an online resource created by Computer Emergency Response Team (CERT.GOV.GE) and Georgian Research and Educational Networking Association (GRENA) with the support of EU-funded "EaPConnect" project. The portal helps IT students from educational institutions interested in cybersecurity to deepen their practical skills, so they can better discover and respond to cyberincidents. The portal will also help IT personnel from both the public and private sectors, where readiness is critically important to defend against attacks, ensure cybersustainability and improve skills. Exercises available on the portal are diverse and cover: cryptography, malware code analyses of real incidents, log file analysis of cyberincidents that occurred on real servers, reverse engineering, network flaw analyses, cyberanalytics, and so on.



Organizational Measures Pillar: Netherlands – The new Digital Trust Centre will enhance information sharing and will be a platform for strengthening cybersecurity for non-vital sectors and companies. The aim is to create a cyberecosystem that provides information and tailor-made perspectives for action. Moreover, a nationwide network of cybersecurity partnerships will be created to share cybersecurity information between public and private parties more widely, efficiently and effectively. The aim of this nationwide network is to strengthen the capabilities of public and private parties. Other best practices include pilot projects with two major ports – Rotterdam (FERN) and Schiphol (CYSSIC); coordinated vulnerability disclosure; and continuously improving information sharing agencies.

Capacity Building Measures Pillar: Luxembourg – A Cyber Security Board and a Cybersecurity Competence Center have been implemented. Luxembourg has four public CERTs and seven private CERTs. Luxembourg has a research centre with 250 researchers in cybersecurity (SNT). Every year, awareness campaigns for the general public are launched. Luxembourg promotes the development and use of the exchange platform MISP. Every tool developed by CIRCL110 and CASES111 is put in open source and is at everyone's disposal. Amongst these tools are (1) an exchange platform for threats, (2) a risk analysis platform, (3) a tool meant for the assessment of the maturity of businesses and to advise on security measures. As part of project Secure MJ, government-approved youth centres have been secured: BEE SECURE and CASES have elaborated a security approach allowing the centre managers to comply with legal obligations (data protection), to physically secure their network (setting up of firewalls and anti-virus) and to train the educators to the risks that they and the young people could be exposed to. This project is presently being extended to reception centres for children (4-12 years old).

Cooperation Pillar: Hungary – As a founding member of the Global Forum on Cyber Expertise (GFCE) and co-initiator of the initiative on Coordinated Vulnerability Disclosure, Hungary engages actively with partners within the GFCE and shares information and best practice on a number of issues (cyber incidents, critical information infrastructure protection, and so on).
Based on the recently adopted Delhi Communiqué, Hungary participates in a number of working groups aiming to implement the Global Agenda for Cyber Capacity Building.
GovCERT-Hungary works in close cooperation with the European Union Agency for Network and Information Security (ENISA) on several cybersecurity-related questions – not only in working groups and different researches, but also at a technical level. GovCERT Hungary takes part in an EU-level project called Project Smart 2014/1079, which aims to define and create a core service platform for the cooperation of CSIRTs within the EU. The new platform (still under development and testing) is called MeliCERTes.

Source: author, based on data from ITU GCI 2018

2.8 ICT infrastructure developments and integrated technologies

While ITU does not collect data for indicators on emerging technologies such as the application of AI, the status of the IoT (except for M2M SIM cards) or developments in relation to cloud technologies at this point in time, it is an increasingly important area of ICT development that thrives through the work of all the three ITU Bureaux. As the infrastructure evolves globally, it is likely to do so in a way that accommodates co-dependent hardware and software. Figure 19 provides an overview of the AI, IoT and cloud technologies landscape in Europe region.

Figure 19: Europe region AI, IoT and cloud technologies landscape

AI landscape

- ✓ In the area of AI, in comparison to other regions, Europe trails far behind the United States and China in the AI competitive landscape.
- ✓ A report by BCG Henderson Institute finds that while Europe has a number of aspirant AI leaders, including France, Germany and the United Kingdom with significant innovation capabilities given their large domestic industries and a market for AI deployment, there is too much fragmentation to achieve sufficient scale.
- ✓ The scale issue also concerns countries such as Denmark, Finland, Ireland, the Netherlands and Israel. While in these countries, innovation capacity is in place, there is a limited domestic demand that could benefit from the available capacities, creating a dependence on partnerships with companies and countries outside Europe.
- ✓ For Southern and Eastern EU economies, the report finds that sufficient innovation capabilities and capacities are not yet available.

https://www.bcg.com/en-ch/publications/2020/europe-can-catch-up-in-ai-but-must-act-today

IOT landscape

- ✓ As regards the status of IoT, the market is well-established and growing, with countries such as Germany, the United Kingdom, France, Italy, Spain and the Netherlands at the forefront of adoption.
- ✓ Nordic and Eastern European countries are not far behind, but significant challenges could hamper their development, deployment and resulting economic benefits. For example, interoperability issues are a key hurdle, recognized and addressed by the European Commission's BIG IoT Horizon 2020 project.
- ✓ Regulatory alignment and collaboration are also needed in order to facilitate interoperability, not only for IoT technologies, but also for the use of data across borders and/or in ways that reveal personal information.
- ✓ Data privacy concerns are deeply important industry and governance challenges for realizing the potential of IoT as well as AI.
- ✓ European countries may have an advantage over larger players, in that they can implement at a smaller and cheaper scale. A fragmented policy environment, however, could mitigate this advantage and leadership opportunity.

https://cordis.europa.eu/project/id/688038

Cloud computing technologies

- ✓ Cloud computing technology is the quintessential example of integrated application and infrastructure development.
- ✓ With the goal of a single EU digital market (and therefore a data market), the steps Europe takes towards cloud computing could be the foundation for innovation in areas such as Big (and distributed) Data, IoT, mobility, eCommerce and open data for digital government services and scientific collaboration.
- ✓ The European Cloud Initiative recognizes that cloud computing technologies will redefine how societies interact, share and benefit from the data generated on, and by, ICT infrastructure.
- ✓ Estimates from the European Commission's Digital Policy and Development Unit suggest that the digital transformation of the market, which will be highly reliant on cloud computing technologies, could be worth EUR 2.2 trillion.
- ✓ Comparatively, the EU trails the United States, but has massive troves of data and leads the world in initiatives on digital governance and policy development.
- ✓ The expectation is that with greater investment, the EU would be far more competitive and also hold a place as a global leader in responsible regulation.

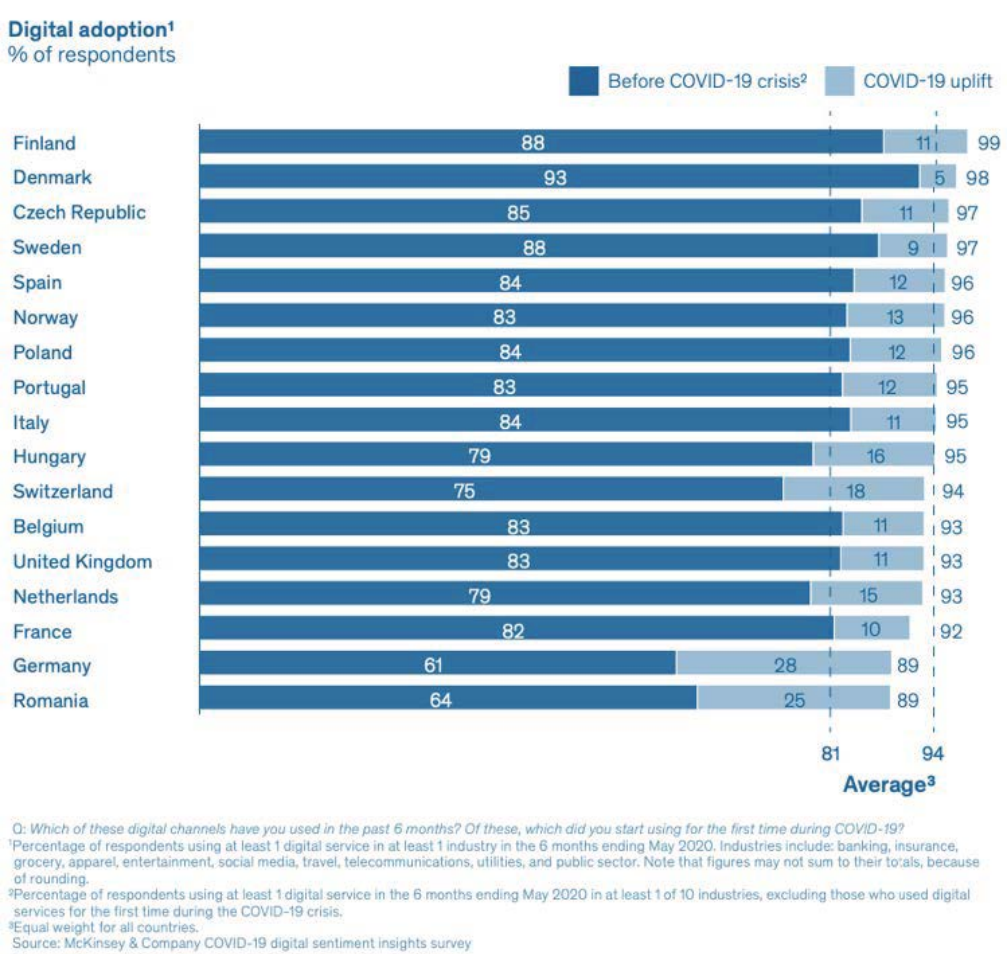
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016DC0178&from=EN
https://ec.europa.eu/digital-single-market/en/news/shaping-digital-transformation-europe-working-paper-economic-potential

Box 5: COVID-19 impact on digital development in Europe

The COVID-19 Pandemic has had an accelerating impact on digital development. While research on the contribution of digitization to mitigate the impact of pandemics is limited, emerging evidence is compelling about its positive effects. For example, anecdotal evidence published by ITU in "Facts and Figures 2020" shows an impact on activities undertaken online by individuals using the Internet in Austria, Ireland and Norway, and an impact on daily data traffic on fixed networks in Italy.

To better understand and explore whether COVID-19 has accelerated digitalization and how consumers and businesses concretely responded to the pandemic, McKinsey conducted a number of surveys during 2020. A survey of 20 000 European consumers on "Europe's digital migration during COVID-19"[1] finds that digital adoption among European consumers jumped from 81 per cent to 95 per cent as a result of the COVID-19 crisis. McKinsey surveyed which digital services and channels were used by respondents for the first time during COVID-19 across a number of industries, including banking, insurance, grocery, apparel, entertainment, social media, travel, telecommunications, utilities, and the public sector. The findings highlight differences in the magnitude of the impact across the countries surveyed, driven by the severity of restrictions imposed in different markets on people's movement and business operations and by the digital maturity of those markets. They also show a discernable uplift in digital adoption across all markets, narrowing the digital gap that existed between European countries.

[1] https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/europes-digital-migration-during-covid-19-getting-past-the-broad-trends-and-averages



Countries with relatively low digital adoption rates before COVID-19 showed the highest uplifts (e.g., Germany and Romania), with Finland and Denmark topping the chart. The survey also provides insights into the industries that were accessed the most by users (some of them for first time) during COVID-19. Banking, entertainment and social media had the highest scores. And on the question of the digital actions that were performed the most while online, *looking for information* was the most frequent answer, highlighting that increased traffic did not translate automatically into increased e-commerce and sales.

A second survey published by McKinsey in October 2020 explored the extent to which companies had reached the technology tipping point and found that responses to COVID-19 have accelerated the adoption of digital technologies by several years, in particular as regards interaction with consumers and their supply-chains through online channels and internal operations.

Source: McKinsey 2020 "How COVID-19 has pushed companies over the technology tipping point – and transformed business forever"[1]

ITU finds in its GSR-20 Discussion Paper "Economic Impact of COVID-19 on Digital Infrastructure"[2] that in the medium term (e.g., 2021), countries with top connectivity infrastructure could mitigate up to half of the negative economic impact of the COVID-19 pandemic. However, there are also factors that limit the capacity of digitization to improve social and economic resilience. These include the digital divide where it still persists, and demand-side barriers, such as limited affordability and digital illiteracy. Furthermore, the paper emphasizes that the benefits of digital infrastructure for dealing with the pandemic is limited to those industries that are well on their way to digital transformation, such as logistics. To address these barriers and increase the mitigation value of digitization, the paper makes a number of recommendations, stressing that the digital infrastructure sector needs to re-examine some of the digital sector basic fundamental premises that were held before COVID-19. These premises include:

- **Concrete, actionable measures** in the telecommunication sector to enable the private operators to provide universal access to quality digital infrastructure networks for all and support the development of a digital economy.
- **Adoption of a much broader, holistic view by governments** of investment in high-speed broadband networks, considering the economic, social and environment/climate benefits and costs of investment.
- **Possible adjustment of regulatory frameworks** to stimulate investment whilst maintaining a sensible level of competition, shifting from a purist to a pragmatic viewpoint on State-aid regulations.
- **Harnessing the opportunity to use COVID-19 as a catalyst** for the adoption of digitization in sectors where it had not occurred before, especially in more business-oriented applications.

ITU has called into life various COVID-19 initiatives, activities and partnerships to help understand the impact of the crisis better and develop guidance for countries, including "Connect2Recover", the Global Network Resiliency Platform "REG4COVID", the WSIS ICT Case Repository, and CYB4COVID. Partnerships include the Ad hoc Group on digital technologies for COVID health emergency "AI for Health", the UN Broadband Commission's Agenda for Action and others. For more information see https://www.itu.int/en/Pages/covid-19.aspx.

1 https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever

2 https://www.itu.int/en/ITU-D/Conferences/GSR/2020/Pages/default.aspx

3. Regulatory trends in Europe

The right regulatory framework is key to successful digital transformation that is inclusive and sustainable, and minimizes the emergence and manifestation of unwanted consequences for market structures and consumers. As the COVID-19 crisis has laid bare, inequalities are increasing within and between countries, not least because current governance and regulatory frameworks and their implementing mechanisms are failing to deliver more equitable outcomes. As the pace of digital transformation accelerates, formulating an effective regulatory approach therefore becomes a defining moment. Through complementary ITU regulatory metrics, the now established ICT Regulatory Tracker and the new Benchmark of Fifth Generation Collaborative Regulation (G5 Benchmark (ITU, 2019))[15], ITU has identified the broad tracks for regulatory reform and has pinpointed how countries can accelerate progress towards the next regulatory generation. "

3.1 New collaborative regulatory paradigm

A new regulatory paradigm has emerged – the "gold standard" for collaboration among regulators and policy-makers [16] – that seeks to fast forward digital transformation for all. This new paradigm is embodied in collaborative regulation (see Box 6 for a definition of the general concept), which must engage a broad and diverse range of stakeholders in informed, evidence-based rulemaking and decision making, with both social and economic impact in mind – and with priority granted to the latter. Collaborative regulation applies readily to multiple areas of regulatory work; infrastructure sharing, and co-deployment are no exception and can substantially benefit from the introduction and effective use of collaborative governance and data-driven regulatory instruments.

ITU forged the concept of "collaborative regulation" in 2016 and has since tested it annually at every Global Symposium for Regulators (GSR). While the concept continues to evolve, it can best be cast in 2020 as a framework to discuss the evolution of regulatory pattern and policy while charting the way ahead for industry and regulators as one constituency, towards digital transformation.

[15] Note that the term "G5" used in relation to the Benchmark should not be confused with "5G" which refers to wireless technology.

[16] https://www.itu.int/en/mediacentre/Pages/PR06-2020-Global-ICT-Regulatory-Outlook-G5-Benchmark.aspx

Box 6: Collaborative regulation - a forward-looking concept

What is collaborative regulation?

Collaborative regulation or 5th generation regulation (G5) is a broad notion that ITU has defined based on the concept of generations of ICT regulation. It marks a fundamental shift in the way regulation is executed, its holistic policy ground and the stakeholders that it brings together – from policy-makers, single-sector and cross-sector regulators to market players of any size. It also shifts regulatory focus on behaviours and impact on markets and development.

Collaborative regulation puts a new emphasis on consumer benefits and protection and leverages the resources of government institutions and industry to deliver them, through organic consultation, collaboration and conciliation. Collaborative regulation is driven by leadership, incentive and evidence rather than by command-and-control schemes. The concept also refers to the set of new tools used by regulators to tackle the issues related to digital transformation and the data economy.

Why do we need collaborative regulation?

All roads now point to more collaboration, better channels and more bandwidth. But while the case for collaboration is irrefutable, progress has been stalled by power battles, lack of resources and misconceptions. Good progress towards inclusive, collaborative regulation is needed for the good of all users of digital services, now and into the future – a need borne out by four fundamentals:

• Digital transformation is a game changer – especially in "the new normal" amid the current global pandemic

ICTs have become the foundation for every economic sector and a *sine qua non* of business performance, national growth and more recently –resilience. Regulators need to ensure that regulation achieves its objectives in the most effective and efficient manner, in particular network resilience and enhancing both the capacity and coverage of networks without imposing disproportionate, redundant or overlapping burden on the market.

• The new digital world needs a new take on regulation

ICTs can dramatically transform education, health care, environmental management, agriculture, trade and entrepreneurship, the provision of government services – and so much more. For this to happen, enabling frameworks of policy and regulation, and the right networks and services need to be put in place.

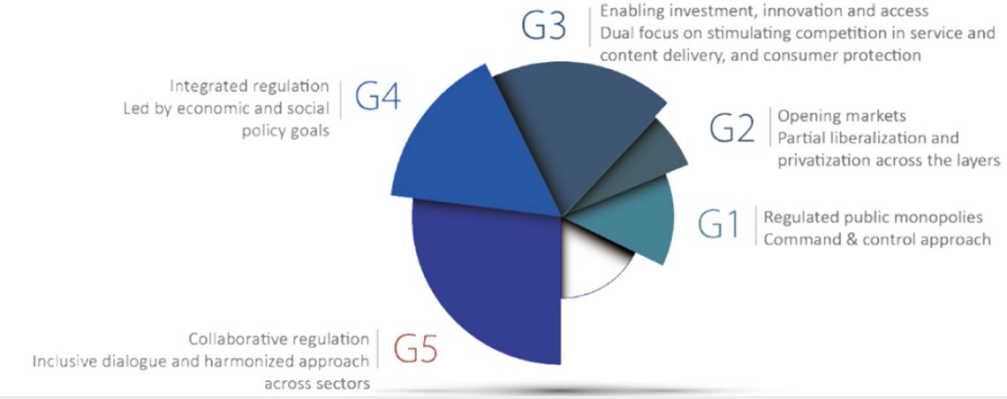
• Holistic and harmonized approach can deliver greater impact

Silo-style ICT sector regulation is not viable in the digital world. Collaborative regulation will mirror the interplay between digital infrastructure, services and content across industries and national borders. It will also harmonize rules and ensure consistent implementation of policy and regulatory frameworks that have evolved independently in many sectors over the years.

• Development and inclusion have become a primary focus of regulation

Collaborative regulation is people-centred regulation – it looks at sustainability and long-term gains as opposed to industry profit maximization and exclusive economic growth. Collaborative regulation champions are also engaged in connecting marginalized individuals, persons with disabilities, low-income communities, communities challenged by educational impoverishment, and remote or isolated populations which may also lack basic infrastructure such as electricity – so there is a need to be much more innovative and collaborative in the approach to policy-making.

The 5 Generations of ICT Regulation – conceptual framework



Source: ITU, 2020

3.2 The G5 Benchmark for regulatory excellence

To afford perspectives on the regulatory road already travelled as well as on the pathways into the future, ITU developed the G5 Benchmark for regulatory excellence, which is based on GSR Best Practice Guidelines[17] and ITU research and analysis. First conceptualized in 2019 to set out new goals for regulatory excellence, the Benchmark is built around an extensive and varied set of indicators and will soon cover all of the ITU Member States[18]. The indicators are clustered into three tracks, including collaborative governance, policy design principles and the G5 toolbox. The cross-sector regulatory frameworks captured through the various indicators

[17] See in particular GSR Best Practice Guidelines 2019 "Fast forward digital connectivity for all", and 2020 "The gold standard for digital regulation", which set out key principles and recommendations regarding regulatory thought leadership for digital transformation.

[18] The G5 Benchmark will be expanded to cover all ITU Member States leveraging the new refined methodological framework and a new edition will be released ahead of the World Telecommunication Development Conference 2021 (WTDC-21).

are pivotal in creating a digital marketplace that is inclusive, sustainable and pro-development and a cornerstone of digital transformation. Box 7 sets out the ITU G5 Benchmark in a nutshell. More in-depth information on the G5 Benchmark can be obtained in the "Global Regulatory Outlook 2020" report (GIRO 2020).[19]

Box 7: ITU G5 Benchmark in a nutshell

What is it?

The G5 Benchmark is a new tool for policy-makers and regulators. It fast tracks collaborative, cross- sector regulation – the best and quickest means to leverage digital transformation for the benefit of everyone. It uses a brand-new three-lens approach which focuses in on collaborative regulation – and offers insights that are both surprising and of high-value. The G5 Benchmark is the new gold standard for collaboration amongst regulators.

What does the G5 Benchmark do?

It is a powerful, straightforward tool that makes sense of shifts in regulatory frameworks as policy- makers and regulators navigate a complex digital landscape. It delivers on additional aspects of high-value for policy-makers and regulators:

- Sets out new goals for regulatory excellence.
- Highlights shortcomings in the pursuit of SDGs and proposes solutions.
- Dives deep into policy trends.
- Enriches global policy debate.

Why is the G5 Benchmark different?

First, it uses a brand-new three-lens approach, which focuses in laser-sharp on collaborative regulation.

Second, three features combined make it especially powerful:

1. *Scope:* Most of ITU Member States, all regions, 2018-2019 data.
2. *Ease-of-use:* straightforward methodology, three regulatory tracks and easy-to-measure indicators. Policy-makers can check and update country data, compare with others and run "what-if" projections. Easy interplay with ICT Regulatory Tracker. Easy assessment of cross- sector regulatory frameworks and quick identification of "win" opportunities.
3. *Objectivity*: built on latest data, factual evidence.

[19] https://itu.foleon.com/itu/global-ict-regulatory-outlook-2020/home/

What is the three-track approach and why is that important?

The G5 Benchmark is built with simplicity to cut through complexity. It uses three regulatory tracks, or lenses, which together focus in on the DNA of G5 collaborative regulation:

1. *Collaboration* – the very watermark of G5 regulation. Focuses on breadth and depth of cross-sector collaboration between the ICT regulators and their peers.
2. *High-level principles*: focuses on use of policy principles (increasingly replacing rules in policy design).
3. *G5 regulatory toolbox*: focuses on use of reimagined, innovative policy instruments that "switch on" the digital economy. "

Why is the G5 Benchmark especially important at this time?

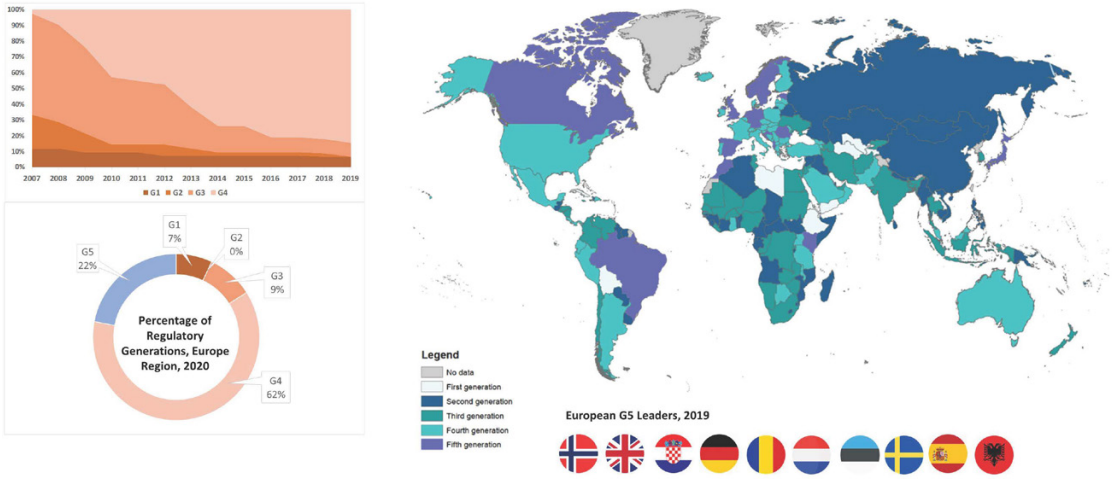
1. *Regulation is changing as digital markets mature.* Economies in the course of digital transformation in this decade follow a very different path from those followed previously.
2. *Existing metrics do not tell the whole story.* The Benchmark's three clear regulatory tracks present new perspectives and new insights, previously not apparent.
3. *High-level policy design principles are fully taken on board.* Regulation is multi-layered and complex in our digital age – and rules are increasingly giving way to principles.
4. *Collaboration among sector/multi-sector regulators.* Collaboration, the very watermark of G5 regulation, is essential for relevance, coherence and impact.
5. *A benchmark is worth a thousand words***.** Policy-makers need a tool that simply and quickly evaluates and models regulatory set-up and tools – comparing apples with apples.

Source: ITU 2020

3.3 Maturity of ICT regulatory frameworks in Europe region

Europe is at the forefront of the new regulatory paradigm and leads other regions by far with 28 fourth generation and 10 fifth generation regulators (Figure 20). Norway topped both European and world rankings in 2019, followed by the United Kingdom. Europe was the first region to produce a G4 regulator, Belgium, the first (and only) country in the world to have attained this status in 2007. Albania, while in the G3 category with regard to inward ICT sector regulation, leaped forward to G5, benefiting from its preparedness to move forward with digital transformation. The annual average scores of Europe have consistently been the highest since 2007.

Figure 20: Evolution of the generations of ICT regulation, Europe, 2007-2019



Source: Based on ITU data, 2019 and 2020

At the global level, ITU analysis shows that while digital has been gaining ground and shaping regulatory response, too few countries have to date achieved the maturity needed to trigger its multiplier effect on development and digital transformation – with nine of every 10 countries still regulating ICTs as a separate economic sector. However, a vanguard of 8 per cent of countries now have holistic, forward-looking regulatory frameworks in place, enabling digital transformation across their economies. It should also be noted that the gap between European annual average scores and world averages has halved from 45 per cent in 2007 to 21 per cent in 2018. More information and a deep dive into country analysis can be found in the ICT Regulatory Tracker and the Global ICT Regulatory Outlook Report 2020.

Box 8: Voices from the region - France on the journey towards collaborative regulation

In an effort to better understand how regulators are mastering the journey towards collaborative regulation, ITU undertook primary research based on five questions that were sent to regulators. This box highlights how the French regulator ARCEP experienced the journey:

• What is the single most difficult challenge in moving towards collaborative regulation?

Kick off a strategic review to identify new challenges and rethink regulatory priorities, with the aim of adapting regulation to new technological and market realities.

• Who are your key counterparts/interlocutors?

Specialized government agencies, cross-sector regulators, local authorities, operators, new digital players, manufacturers and consumers.

• What are the top three most important actions a regulator can undertake?

1. Monitor and collect information on the entire digital ecosystem, beyond the regulated operators.
2. Promote innovation.
3. Promote data-driven regulation, empowering consumers and leveraging their experience to improve service provision.

• What is the single most important lesson learned moving forward with a collaborative regulatory approach?

Enabling independent regulators to observe markets, and collect data on new topics will help the definition of future rational policies.

• What piece of advice can you give to regulators engaging on a journey towards digital regulation?

What matters most in moving towards a more open, collaborative and agile regulation is to bring external as well internal partners and various stakeholders on board.

Source: ARCEP, France

Box 9: Digital Regulation Handbook and Platform

ITU collects significant information across various domains, including regulatory governance, competition, access for all, consumer affairs, spectrum management, trust and safety, emerging technologies, emergency communications and technical regulation. To provide an easy-to-access gateway to this wealth of information, ITU together with the World Bank launched the Digital Regulation Handbook and Platform in 2020, which provides a repository of practical guidance and best practice for policy-makers and regulators across the globe concerned with harnessing the benefits of the digital economy and society for their citizens and firms. The content provides an update on the basics of ICT regulation in the light of the digital transformation sweeping across sectors and also includes new regulatory aspects and tools for ICT regulators to consider when making regulatory decisions.

There have been various developments throughout the Europe region across a number of areas. In the area of competition policy for example, German competition law and the German merger control regime are proposed to be changed to enable them to better address a number of complexities arising from digital markets, including:

- the modernization of the rules on abusive conduct by companies who possess outstanding market power;
- addressing the increasing importance of data in the assessment of the market power of a company;
- introducing the concept of "intermediation power" as a factor for determining a dominant market position in multisided markets;
- expanding the "essential facilities doctrine" to include access to data; and,
- lowering the financial threshold for review of mergers and acquisitions and giving some discretion to competition authorities in the case of digital platforms.[1]

Similar issues have been picked up in the UK Furman Report[2] and the European Commission's Special Advisers' Report.[3]

Source: ITU-World Bank Digital Regulation Platform, www.digitalregulation.org

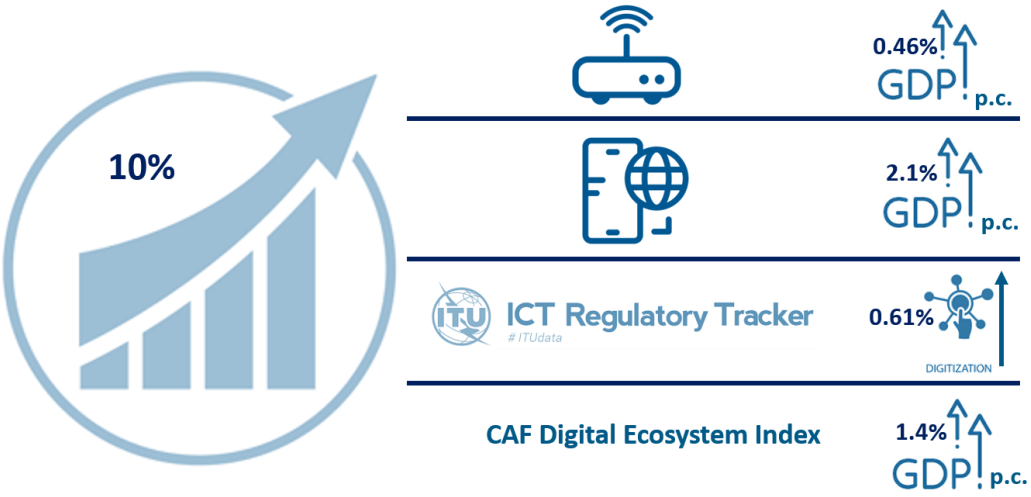
1 https://digitalregulation.org/amending-german-competition-law-for-digital-regulation/
2 https://www.gov.uk/government/publications/unlocking-digital-competition-report-of-the-digital-competition-expert-panel
3 https://ec.europa.eu/competition/information/digitisation_2018/report_en.html

3.4 Economic contribution of broadband, digitization and ICT regulation in Europe

It is without doubt that broadband, digitization and ICT regulation contribute to economic and socio-economic development across the Europe region. To this effect, ITU has undertaken a recent study "The economic contribution of broadband, digitization and ICT regulation: Econometric modelling for the ITU Europe region" that measures the impact of fixed and mobile broadband and digital transformation on the economy as a whole in the region, as well as in how far institutional and regulatory variables contribute to the development of the digital ecosystem.

The results of the study, as summarized in Figure 21, reveal that a 10 per cent increase in mobile and fixed broadband penetration in the Europe region would yield an increase of 2.1 per cent and 0.46 per cent, respectively, in GDP per capita. Moreover, the report also validated the positive impact of the policy and regulatory component in the region, suggesting that an increase of 10 per cent in the ITU ICT Regulatory Tracker yields a positive increase in the CAF[20] Digital Ecosystem Development Index of 0.61 per cent.

Figure 21: Economic impact of fixed and mobile broadband and digitization, 2019



Source: Adapted from the ITU study: "The economic contribution of broadband, digitization and ICT regulation: Econometric modelling for the ITU Europe region", 2019

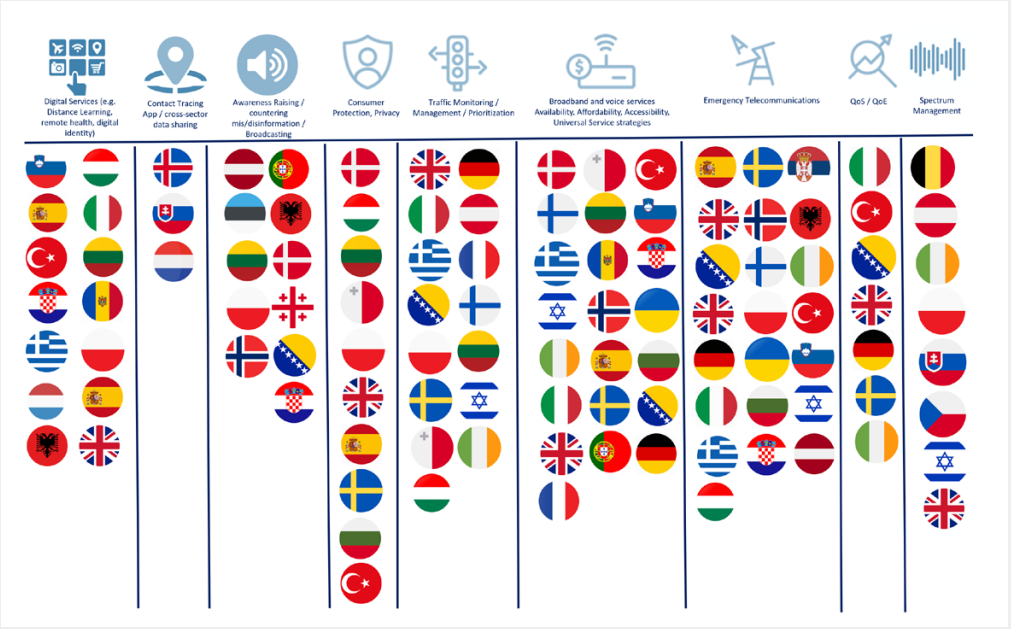
[20] CAF stands for Corporación Andina de Fomento/ Development Bank for Latin America.

Box 10: COVID-19 Regulatory framework initiatives for Europe region

The COVID-19 outbreak has led to significant disruptions in economic activity, which has impacted all industries, albeit at differing levels. To mitigate the impact of the pandemic, different ICT stakeholders have undertaken a number of emergency steps and initiatives in the areas of consumer protection, traffic management and prioritization of traffic, broadband availability, affordability and accessibility, emergency telecommunications, universal service strategies and QoS and QoE, and so on. These responses include increasing broadband capacity and speeds, providing free services to customers, providing information services on COVID-19, network management, allowing more flexible IMT spectrum use, free access to online learning sources, generally easing regulatory requirements on licensees, new fixed wireless access (FWA) networks, addressing misinformation in relation to COVID-19, contact tracing development and government subsidized broadband services.

To provide easy access to this information, ITU has created the Global Network Resiliency Platform (#REG4COVID), where ICT regulators, policy-makers and other interested stakeholders can **share** information, **view** what initiatives and measures have been introduced around the world designed to help ensure communities remain connected, during the COVID-19 crisis. The map below provides an overview of the number of submissions made to the platform by different countries.

In the Europe region, the majority of European countries have made submissions to the platform, with the United Kingdom, Poland, Lithuania, Italy and Spain having submitted more than two initiatives across seven or more different areas. This is shown in the figure below.



Source: Adapted, based on data from ITU https://reg4covid.itu.int/

Industry has been very active in the implementation of emergency responses to mitigate the impact of the COVID-19 pandemic. A recent GSR Discussion Paper "Pandemic in the Internet Age: communications industry responses," published by ITU in June 2020, explores and summarizes the types of responses by industry stakeholders.[1] The tables below, taken from this report, show selected responses by operators and content and online service providers.

Common Short-term Initiatives by Operators

Initiative	Description
Additional Data Allowances	Many fixed operators, MNOs and wholesale providers have offered to provide their customers with additional data allowances as businesses and schools across the world transition to working remotely, due to the spread of the COVID-19 virus.
Increasing Broadband Speeds	Operators have upgraded Internet speeds – including transmission and backhaul capacity - to better accommodate the unprecedented number of people working and learning from home.
Relaxing of payment terms	Operators have relaxed the payment terms including downgrade plans/vouchers, payment of monthly invoices, and prepaid voucher validities dates etc.
Providing free services	MNOs have also commenced a variety of other initiatives for their customers, many at no extra cost. These include free access to networks and waiving overcharge fees.
Free access to online learning/education resources	In order to support distance learning and home-schooling during school closures, access to remote leaning opportunities and educational platforms has been made available at no cost by a number of operators.
Free access to health/government information	Operators are providing free access to information contained in government and social welfare sites, as well as to websites containing health information relevant to coronavirus crisis.
Facilitating mobile money transactions	Telecommunications companies (and banks) are encouraging consumers to avoid cash payment in favour of digital transactions to avoid the spread of the coronavirus.
Going digital in terms of recharges etc.	MNOs have facilitated prepaid mobile recharges being made online rather through physical scratch cards etc. to improve connectivity during any lockdowns

Source: ITU REG4COVID database and selected industry sources, 2020

Selected COVID-19 related initiatives by Content and Online Service Providers

Initiative	Description
Lifting time limits in video calls	**Zoom** has lifted time limits on its video calls for the free versions in China, as well as for schools in Japan, Italy, and the US, by request.[11]
Reducing network demands	**Netflix** and **Youtube (Google)** reduced the resolution of their video content to assist in reducing the peak network demands on fixed and mobile networks experiencing additional COVID-19 demand.
Developing new technology	**Apple** and **Google** announced its partnership to develop a contact tracing technology to reduce the spread of COVID-19. The two companies have launched a comprehensive solution that includes application programming interfaces (APIs) and operating system-level technology to assist in enabling contact tracing. Given the urgent need, this solution is being implemented in two steps while maintaining strong protections around user privacy.
Range of free services including but not limited to:	**Microsoft** is offering anyone its premium version of Teams for free for six months and has lifted existing user limits on its free version. The premium Teams product was already available for no extra cost to those who pay for the Office Suite, and Teams had already been free for many schools.[12]
	Google announced that it would offer its enterprise videoconferencing features — for example, larger meetings of up to 250 people and the ability to record — for free to G Suite and G Suite for Education customers through July 1, 2020
	LogMeIn is making "Emergency Remote Work Kits" available for free for three months. Those kits are designed for nonprofits, schools, and health care organizations that aren't already customers. The kits include GoToMeeting, GoToWebinar--where users can host presentations for up to 3,000 users--and LogMeIn, which provides remote desktop access from numerous devices.[13]
	Cisco is offering the free version of its Webex service with no time restrictions. In addition, it will allow up to 100 meeting participants and has added toll-free dial-in features with a 90-day license for businesses that are not already customers.[14]
	Slack already offers a free tier, but the company is offering live Q&A and webinars to get the influx of new users up to speed.[15]

Source: ITU REG4COVID database and selected industry sources, 2020

[1] https://www.itu.int/en/ITU-D/Conferences/GSR/2020/Pages/default.aspx

4. Opportunity and challenges of digital transformation

To harness opportunities and meet the challenges of digital transformation, the Telecommunication Development Bureau (BDT) fosters international cooperation and solidarity in the delivery of technical assistance and in the creation, development and improvement of telecommunication and ICT equipment and networks in developing countries. ITU-D/BDT ten areas of action (also referred to as "thematic priorities") guide and shape the BDT work and contribute to achieving its objectives. The areas of action include capacity development, cybersecurity, digital inclusion, digital innovation ecosystems, digital services and applications, emergency telecommunications, environment, network and digital infrastructure, policy and regulation, and statistics. Across these areas, many initiatives, projects and programmes are conducted that take the shape of direct technical assistance to Member States or capacity building initiatives such as events or workshops, often in collaboration with other stakeholders such as Sector Members, Academia or other international organizations.

4.1 Developments under the regional initiatives for Europe

A number of initiatives have been undertaken across the Europe region under the chapeau of ITU-D thematic priorities. These initiatives are fully aligned with, and implemented under, the ITU Regional Initiatives for Europe. As illustrated in Box 11 below, there are five regional initiatives for Europe: broadband infrastructure, e-government services, digital inclusion and accessibility, cybersecurity and trust in ICTs and innovation.

Box 11: Europe Regional Initiatives – Definition and Objectives

Source: ITU Office for Europe Report on 2018-2020 Actions Across Europe

Figure 22 provides an overview of initiatives, projects and activities undertaken in the period 2018-2020, some of which are discussed below. A detailed description of all initiatives undertaken by the ITU Office for Europe can be accessed on the ITU Regional Presence, Europe website.

Figure 22: Overview on Europe Regional Initiatives, thematic priorities and country examples 2018-2020

Source: ITU Office for Europe Report on 2018-2020 Actions Across Europe

Furthermore, significant efforts have been dedicated to generating large-scale projects for Europe that would create substantial impact, for example the following projects and partnerships launched recently:

- Investment Opportunity Mapping Systems in South Eastern Europe;
- mHealth Knowledge and Innovation Hub for Europe;
- Digitalization of government services for the achievement of Sustainable Development Goals;

- Accessible Europe: ICT for ALL;
- Technical assistance in the development of national strategies on COP, e-agriculture, digital skills, and broadband.

4.2 Regional initiatives: Areas of progress

While implementing the activities listed above, Europe region has progressed significantly in all areas covered by the ITU Regional Initiatives for Europe and beyond. Notable improvements are listed in Figure 23.

Figure 23: Regional initiatives - Areas of progress

EUR 1 - Infrastructure

- Harmonization and alignment of spectrum policy in line with WRC-19 outcomes and CEPT recommendations already took place in most of the countries and is taking place in all the rest.
- Spectrum planning for 5G development has gained substantial pace, also due to the push forward of the European Union and most countries have adopted specific strategies or plans to make spectrum available for 5G mobile communications.
- Significant progress on digital broadcasting deployment in all 46 countries and many insights in new trends have been developed through the work of ITU.
- The European Union has made significant progress in collaborative regulation for infrastructure sharing and co-deployment of telecommunication infrastructure together with other sectors such as utilities. Europe region leads globally on the G5 Benchmark for collaborative regulation.
- In terms of ubiquitous connectivity Europe region offers a broad variety of technology solutions for broadband, spanning fixed, mobile and satellite services. This maximizes the region's capabilities towards reaching ubiquitous connectivity.
- Mapping broadband infrastructure and services has become a regular practice for many NRAs in the region to support efficient allocation of public resources and to foster co-deployment and infrastructure sharing, resulting in concrete benefits for Member States.
- The digitalization of energy services has also been a notable trend in the region. An ITU Europe-wide report on this topic was published in 2019.

EUR 2 – E-government and digital applications

- The digitalization of government services has been improving in Europe region. In particular, the European Union has been fostering a digitally-driven approach to public administration and also non-EU countries have been following suit, adopting open government approaches.
- Recently, some EU countries have partnered to develop a platform to accelerate digitalization of governmental services for the achievement of the Sustainable Development Goals (SDG). This project will likely have a strong impact in non-EU countries of Europe region and beyond.
- Regarding health in particular, ITU has concurred to the establishment of the mHealth Knowledge and Innovation Hub for Europe together with WHO and the European Commission. The platform will support countries in implementing large-scale use and integration of mHealth in the healthcare services impacting several Member States.
- Emergency telecommunications for disaster relief is another area where Member States have been joining ITU in its global effort.
- Another area where significant progress has been made is digital agriculture, where government strategies have been elaborated by countries with the assistance of ITU and FAO. e-agriculture strategies help rationalize financial and human resources, address (holistically) ICT opportunities and challenges of the agricultural sector, generate new revenue streams and improve the lives of people in rural communities.
- Regarding the security of e-government services, Europe benefits from a robust regulatory framework for data protection which is increasingly extended to the public domain.

EUR 3 - Digital inclusion and accessibility

- Europe leads the way globally in digital inclusion when it comes to gender, youth and persons with disabilities. Significant progress and innovation have been particularly notable in the continent in the past three years, with all countries taking concrete actions in this field.
- With regard to women and ICTs, almost all countries have achieved an approach that proactively seeks to facilitate women STEM education and professional careers.
- Gaps in women studying and working in ICT are closing as more women are attracted to the prospect of higher salaries, in secure yet flexible companies. Economic instability brought about by COVID-19 will only increase the attractiveness of the ICT industry overall.
- As policy impacts are greater when targeted at youth, Europe region has made progress through many countries adopting digital skills strategies. Beyond impacting young adults, these strategies also had a positive impact on the entire education systems ensuring youth can take advantage of the many career opportunities offered by the ICT sector.
- Finally, Europe region has made a significant leap forward in the field of ICT accessibility, thanks to the regulatory measures undertaken at the level of the European Union, including, notably, the European Accessibility Act or the Web Accessibility Directive, the latter entering into force in 2020, just to mention two important milestones.
- Digitally accessible audiovisual media services as well as government services are considered two important achievements reached in many countries in Europe region, also in several non-EU countries.

EUR 4 – Cybersecurity and trust in ICTs

- According to the ITU Global Cybersecurity Index, countries of Europe region are leading when it comes to cybersecurity resilience in legal, technical, organizational, capacity building, and cooperation terms.
- Notably, all countries have cybercriminal legislation and cybersecurity regulation in place, while most countries have national and sectoral computer incident response teams (CIRTs), cybersecurity standards in place, cybersecurity strategies, cybersecurity agencies, cybersecurity metrics, as well as R&D programmes.
- Europe region has also increased capacity in response to cyberattacks and many countries conduct simulation exercises regularly such as Cyber Drills at national and regional levels in cooperation with ITU and regional organizations.
- With regard to trust in the use of ICTs, many countries in Europe have stepped up their efforts in Child Online Protection (COP), as the challenges of protecting children from harm increasingly move to the digital sphere. In this regard, many global best practices can be identified in countries of Europe region.
- Europe region is also the first region to have launched the ITU COP guidelines for industry, educators, and policy-makers, with relevant material for children and parents. Notably, the guidelines have been developed by experts from Europe region. ITU is now engaging with more than 18 countries to ensure implementation of the COP guidelines at the national level.

EUR 5 – ICT-centric innovation

- Over the past three years, all countries have come to recognize the importance of digital transformation and accelerated the implementation of policies to tackle persistent challenges. These include country-wide digital agendas, industry 4.0 strategies, investments in infrastructure, dedicated digital skills and innovation programmes, and facilitating more favourable environment for start-ups, researchers and innovators, among others.
- ICT-centric innovation ecosystems have become a point of reference for all other innovation happening in the region, even for non-ICT sectors. Europe has in fact been characterized by a strong digitalization of all other sectors of the economy over the past three years.

Source: ITU Office for Europe

4.3 Regional initiatives: Areas of challenge

Although there has been much progress in the region, some longstanding challenges remain and new challenges have emerged over the past three years. In the context of each regional initiative the main challenges encountered, based on ITU experiences and research, are outlined in Figure 24.

Figure 24: Regional initiatives - Areas of challenges

EUR 1 - Infrastructure

- 5G deployment is already occurring in many EU countries while non-EU countries risk delaying implementation. There is a real risk of widening the gap between EU and non-EU countries which should be addressed.
- Freeing up the second digital dividend from broadcasting services towards mobile communications is still a challenge in many countries in the region, and will remain so for some beyond 2023. This presents opportunities for action leveraging expertise of those who have already completed the process.
- Despite the regulatory progress on infrastructure sharing and co-deployment at the EU level, many countries are still in the transition from G4 standards of regulation to G5 standards of "collaborative regulation", according to the ITU framework. There is a clear scope to improve regulatory practices and strengthen the Europe region leadership position globally.
- Despite the many technical solutions available, rural-urban connectivity remains a considerable challenge in some areas of Europe region. According to ITU research, USD 33 billion are needed to connect everyone in the region by 2030. This suggests the need to find new ways and business models to unlock additional investment in broadband.
- Broadband mapping of infrastructure and services has instilled a data-driven approach to regulation in many NRAs, but remains a challenge in non-EU countries of Europe region, mainly due to financing and human capacity development.
- With the deployment of 5G and with the advent of the COVID-19 pandemic, concern and misinformation on electromagnetic fields (EMF) has risen in all countries, suggesting the need for concrete actions at the international level.
- As the COVID-19 pandemic struck, network resiliency suffered in the region, drawing the attention of NRAs to map backbone capacity in line with the ITU Interactive Transmission Maps project. Development of reliable indicators by avoiding duplication of efforts with national and regional organizations will be important.

EUR 2 – E-government and digital applications

- e-government is often country-specific due to the many bureaucratic and cultural factors at play. Therefore, it would be beneficial to find new ways of gathering and sharing best practice and solutions that can be implemented readily in other countries.
- One of the key challenges in digital agriculture is that ecosystems differ from country to country and are also fragmented across the regions and within individual countries. Additional harmonization of approaches and cross-border cooperation are envisaged to harness the substantial innovations in this area.
- In terms of e-health applications, cross-border fragmentation is again a substantial challenge that requires greater harmonization in Europe. In this context, and especially considering the situation created by COVID-19, additional impetus should be given to initiatives such as mHealth Knowledge and Innovation Hub which leverages expertise from various stakeholders to deliver large-scale benefits.

EUR 3 - Digital inclusion and accessibility

- Women in STEM education and work remain a challenge in the Europe Region. In particular, ITU research finds that there is a "leaky pipeline" between the numbers of women STEM graduates and the even much lower numbers of women working in ICT. This trend is also perpetuated in the career progression. On aggregate, women also still lag in terms of advanced digital skills compared to men.
- Another challenge is that, contrary to the majority of EU countries, in most non-EU countries companies have no gender equality targets and are not keeping track of the composition of their workforce. This shortage of women working in ICT also has important implications for technology products and services.
- With regard to digital skills policy, the challenge is that there is no one-size-fits-all method. Policy-makers should take advantage of ITU research and develop tailored plans to engage with partners in the private sector, non-governmental organizations and academia to craft the assessment approach that matches a country's needs and goals.
- Another important issue relating to digital skills, and to education in general, is that often the best STEM-educated individuals leave the country of origin as more attractive opportunities are found abroad, with the risk of jeopardizing developing countries' efforts towards building human capacity in the field.
- With regard to ICT accessibility, despite the significant progress made in the fields of audiovisual media services and public procurement of government services, challenges still remain in the field of web accessibility and the accessibility of products and services in the market.

EUR 4 - Cybersecurity and trust in ICTs

- One principal challenge in Europe region, with regard to cybersecurity, is to bring all countries to adopt a national cybersecurity strategy and CERTs which follow international standards and best practice. This is increasingly important as the dependency of economies on digital infrastructure increased because of COVID-19.
- With regard to keeping children and young people safe online, the lack of national strategies is a challenge which requires additional capacity building and assistance at the country level.
- In all areas related to security and trust in ICTs, additional international cooperation through events, expert meetings and workshops is envisaged, believing that it is only by sharing best practice and experiences that challenges in this field can be overcome in a consistent manner. A useful model is that of the Cyber Drills.

EUR 5 – ICT-centric innovation

- According to ITU research on innovation, there is a digital innovation divide between European countries. The non-Western European economies still underperform in some or in all three engines of growth: entrepreneurship, innovation and technology. Adoption of comprehensive national strategies for innovation may be a solution to tackle the issue in a systematic way.
- Despite recent efforts, existing ecosystems in countries that lag behind are not yet successful in mobilizing entrepreneurs, entrepreneurial support organizations, academics, public and private sector stakeholders and investors to a degree that is sufficient to foster digital transformation in society, suggesting that more should be done in terms of ecosystem development at the national level.
- There is a need in the region to develop an enabling environment that fosters innovation and entrepreneurship, and sustainably connects Europe to other regional and global innovation ecosystems.

Source: ITU Office for Europe

5. Conclusion

Europe region has seen continued growth in most areas of ICT infrastructure, access, and use and leads globally across all ICT indicators. Mobile network coverage is just shy of 100 per cent, Internet use by individuals is above 80 per cent, Internet access at home is nearing 90 per cent and almost 100 per cent of 15- to 24-year-olds are using the Internet. In addition, Europe has the most affordable ICT prices, ahead of the CIS region. While a digital divide persists, rural Internet access by household has increased to 78 per cent and the gender gap has decreased, with a five-percentage-point difference remaining between women's and men's Internet use. Most European countries have achieved levels of basic ICT skills above 40 per cent, but great variation remains in relation to standard and advanced skills. Total telecommunication investments amounted to USD 60.8 billion in 2018 and increased in tandem with total telecommunication revenues over the period 2017-2018 across the majority of European countries. Europe has progressed significantly in the area of cybersecurity, with all countries having cybercriminal legislation and cybersecurity regulation in place. In terms of ICT infrastructure developments and integrated technologies, there is still ample room with regard to AI capability and capacity development that can be fostered through advancing standardization to achieve the necessary scale. While in the area of IoT, Europe is well-positioned and at the forefront of adoption across a number of countries, a fragmented policy environment stands in the way of accelerated progress. On the other hand, Europe is leading the way in cloud technology governance and policy development, a key enabler of IoT and other ICTs. The COVID-19 pandemic has had a profound impact on Europe and has pushed consumers and businesses alike in the adoption of digital services and technologies, accelerating digital transformation of some areas of business by several years. Most network operators were able to cope with the increased demand on their networks, providing a good stress test for the future and highlighting areas that require increased attention. The positive ICT developments and trends have been underpinned and accompanied by state-of-the-art G5 regulatory frameworks that are based on a new regulatory paradigm of collaborative regulation. Europe is at the forefront of this new regulatory paradigm and leads other regions by far with 28 fourth generation and 10 fifth generation regulators. Many projects, programmes and initiatives have been undertaken jointly by ITU-D and Member States across all of the ITU Office for Europe's five thematic priorities, including broadband infrastructure, e-government services, digital inclusion and accessibility, cybersecurity and trust in ICTs and innovation. The outlook for the European ICT market is positive and the Europe region together with the ITU Office for Europe stand ready to build on the progress achieved and to address challenges where these persist.

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