

THE WAY TO DIGITAL MADE-IN-EUROPE

Promoting European values in the global digital arena



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SUMMARY

During the Covid-19 pandemic, digitisation has become the most important tool to ensure the continuity of economic and social relations, and one of the most important opportunities for rebooting Europe after the pandemic. Hence, the purpose of this analysis is to describe the level of European digital maturity and the main initiatives put in place by the European institutions to ensure the development of a digital-oriented ecosystem, based on trust, security and the protection of fundamental rights.

Chapter 1 describes the importance of digital for European competitiveness in the global context. Over the last decade, digitisation has become the last frontier in global economy competition. This means that a country’s technological progress is directly proportional to its economic growth. The latest data on patents issued by WIPO underlines that Japan, the USA and China play leading roles in world technological development, closely followed by Europe (EU27) and South Korea. In this scenario, the European Union appears to be in the last position among the geographical areas considered, with only 271,000 digital patents registered despite having recorded a slow but steady growth in the period under observation.

Looking at the number of patents registered by countries in the EU 27, we can see that Germany is the best performer with more than 82,000 licenses obtained (30.2% of the EU total). Analysing the data in relation to the population, the European country with the most patents per 100,000 inhabitants is Finland (373), followed by Sweden (367) and Luxembourg (285).

To test the level of digital readiness of each country, the American multinational Cisco has created an index regarding the social status of the population and the primary aspects that favour business development, especially for digital companies. Looking at the latest version of the study, it can be seen how Europe is divided into two. The Northern European countries register high values ranking them among the top 25 globally, while the Southern and Eastern European countries register medium-high values positioning them in the second bracket (between 25th and 72nd). In calculating the average for the EU countries, the score obtained (15.95) is considerably lower than that of the US (19.03), Korea (18.22) and Japan (17.69).

Industry is a driving force for EU Member States, representing more than 20% of the EU economy and employing around 35 million people, with millions of jobs involved both at home and abroad. It makes up 80% of exports and is one of the primary reasons behind the EU's position as the main global source and destination for direct foreign investment.

Since mid-2003, total industrial production has followed a relatively constant growth path. Production levels reached their highest in 2007 and then began falling continuously up to 2009, dropping 16.4 percentage points below the previous peak. However, production began steadily picking up again, and by 2018 had recovered over 96% of its pre-crisis value.

The restrictive measures adopted by the Member States to counter the spread of Covid-19 have had a strong impact on the production and demand for goods. In March 2020, industrial production in the now EU-27 decreased by 24% compared to February 2020, and by 28.7% compared to March 2019. EU industrial production decreased by 17.3% compared to March 2020 and by 27.2% compared to April 2019.

In March 2020, the Commission presented “**A New Industrial Strategy for Europe**” to help Europe's industry lead the twin transition towards climate neutrality and digital leadership. The strategy aims to drive Europe's competitiveness and its strategic autonomy at a time of moving geopolitical plates and increasing global competition. Considering that industry is central to Europe's future progress and prosperity and Europe's industry has a global competitive advantage on high value-added products and services, the strategy is focused on three drivers - make European industry greener, more circular and more digital.

On 11 March 2020, the Commission adopted a **New Circular Economy Action Plan** as part of the new industrial strategy to support the move to a more circular economy.

On 16 November 2020, the Council adopted a set of **conclusions** setting out how recovery from the COVID-19 crisis can be used as leverage for a more dynamic, resilient and competitive European industry. Then, on 25 November 2020, the European Parliament approved a report calling on the Commission to come up with a **revised industrial strategy** focused on two distinct phases - the first, on recovery, and the second, on reconstruction and building resilience.

Chapter 2 reviews the value of data economy in the European Union, the European debate on digital sovereignty and the Gaia-X launch and the regulatory framework.

With the growing focus on the Internet and the use of mobile devices, where objects communicate with each other using highly sophisticated technologies and a variety of sensors allowing us to measure and monitor virtually everything, we are witnessing the generation of an unprecedented amount of data. According to some estimates, in 2022, the **global consumer IP data** traffic is expected to reach 333 exabytes per month at a 27% CAGR in the period 2017-2022.

Data is the lifeblood of the economy and data-driven innovation is a key pillar in 21st century development. The smart use of data can create new opportunities for economic growth, especially for SMEs, leading to the development of AI applications, that can help us address various societal challenges, from medical care to the fight against climate change. Nowadays, most economic activity depends on the sharing and use of data and, in the future, this trend will continue to increase resulting in a huge economic impact.

According to the IDC European Data Market Monitoring Tool (2020), which measures the overall impact of the data market on the economy as a whole, the **value of the data economy** exceeded the threshold of € 300 billion in 2019 for the EU-27, with a growth of 7.7% over the previous year. Moreover, according to the estimates, in the Baseline scenario - that is considered the most likely -, the EU-27 data economy will grow faster in the next years, reaching a value of € 550 billion in 2025, at a 9.2% CAGR in the period 2019-2025 with a 4% impact on GDP.

The positive trend in the growth of the data economy is also confirmed by the data market value. This reached €58 billion in 2019 for the EU-27, up by 5% from 2018, and is expected to amount to approximately €80 billion in 2025 with a CAGR of 6% in the period 2019-2025.

Unfortunately, the **lack of adequate skills** risks becoming an important barrier to data industry development and the adoption of data-driven innovation. According to the latest estimates, the number of data professionals in the EU-27 amounted to 6 million in 2019, corresponding to 3.3% of the total workforce, with an increase of 6% over the previous year. However, the EDM Monitoring Tool continues to register an imbalance between the demand and the supply of data skills in Europe as the estimated gap showed approximately 399,000 unfilled positions in the EU-27, corresponding to 6.2% of total demand. This gap is expected to widen even more, reaching 759,000 units in 2025, 8.2% of total skill demand.

The growing **concern among EU countries on the importance of data** and on the risks that may emerge from an excessive dependence on foreign technology is spurring European states to work together to enforce or build-up internal infrastructures. With many European public bodies, enterprises and key players already adopting non-European service providers, there is apprehension within the EU institutions on the **risk of failing to take full advantage of the opportunities arising** from data management and storage. Specific attention has been placed on the numerous benefits that a common infrastructure would bring to the economic and technological development of Member States, strongly benefitting employment levels and investments. The Commission is also concerned about the issues regarding **data ownership** and

on the potential lack of privacy and absence of data protection for personal information collected by foreign providers. Therefore, the EU institutions and Member States are pushing forward the creation of a common **European Cloud Federation**, with 25 MSs adopting a joint declaration agreeing on working together towards a European cloud federation initiative. The market for cloud storage is forecasted to reach more than **\$50 billion in revenues by 2025**.

Together with some of their leading high-tech firms, France and Germany have promoted the creation of the **European “Gaia-X” cloud project**, a federated data infrastructure which would allow for the management, access and control of data belonging to EU citizens and businesses. The Commission is also planning to increase the fund availability on cloud development in order to provide trustworthy data processing infrastructures and services that public administrations, businesses and citizens require in Europe.

Data is one the most important elements to ensure European competitiveness. On 19 February 2020, the European Commission presented the Communication “*Shaping Europe’s digital future*”, and on the same date, “**A European strategy for data**” outlining a strategy for policy measures and investments to promote the data economy for the coming five years. This strategy is focused on four pillars and several key actions: 1) a cross-sectoral governance framework for data access and use; 2) **enablers, involving investments** in data and strengthening Europe’s capabilities and infrastructures for hosting, processing and using data, and interoperability; 3) **competences**; 4) **common European data spaces** in strategic sectors and domains of public interest. The European Strategy for Data had been open to **public consultation** until 31 May 2020. Member States then expressed their opinion on the Commission’s strategy in the conclusions adopted on 9 June 2020 by the Council, and on 2 October 2020 by the European Council.

On 15 October 2020, the 27 EU Member States signed a **Joint Declaration** on “*Building the next generation cloud for businesses and the public sector in the EU*”, agreeing to work together towards deploying resilient and competitive cloud infrastructures and services across Europe.

On **25 November 2020**, the Commission proposed a **regulation on European data governance** (Data Governance Act). This proposal is the first deliverable under the European strategy for data and aims to foster the availability of data for use by increasing trust in data intermediaries and by strengthening data-sharing mechanisms across the EU. The proposal, complementing the Directive n. 2019/1024 of 20 June 2019 on open data and the re-use of public sector information (Open Data Directive), includes measures to: 1) increase trust in data sharing, as the lack of trust is currently a major obstacle and results in high costs; 2) create new EU rules on neutrality to allow novel data

intermediaries to function as trustworthy organisers of data sharing; 3) facilitate the reuse of certain data held by the public sector; 4) give Europeans control on the use of the data they generate, by making it easier and safer for companies and individuals to voluntarily make their data available for the wider common good under clear conditions.

Chapter 3 focuses on **artificial intelligence**, especially analysing its role in Europe. Interest in artificial intelligence continues to grow and the positive impact in economic terms is considerable. According to a recent report of IDC (International Data Corporation), worldwide revenues for the AI market - including software, hardware and services -, are expected to total \$156.5 billion in 2020, an increase of 12.3% over 2019. While this year's growth is somewhat slower than previous years due to the economic impact of Covid-19, IDC analysts believes investment in AI will recover quickly, so much so that in 2024 global revenues are estimated to exceed \$300 billion, with a five-year CAGR of 17.1%.

The US and China continue to be the leaders in artificial intelligence, investing more resources than other countries. The European Union, on the other hand, is trying to keep up, but Brexit has certainly created a further problem for Europe's competitiveness.

The **gap in the overall amount of investments** appears to be the most startling reason for Europe lagging behind the US and China. In 2018, according to a Stanford University report, US companies invested \$18.7 billion in AI, compared to China's \$14.35 billion. The main 5 EU Member States (France, Germany, Sweden, Spain and Belgium) together slightly exceeded the level of UK investment (\$1.461 bn vs. \$1.27 bn), and only slightly surpassing the much less populated Israel (\$ 1.044 bn).

However, according to EU Commission data, the European Union is, immediately after the US and China, the main region globally to have a thriving **AI ecosystem**, populated by over 5,000 companies and 560 research institutes.

If we analyse the situation at single MS level, important differences are highlighted, with some countries keeping pace even at the international level, and others not being very inclined to a full AI adoption. In order to provide an idea of the degree of AI development in European countries, I-Com has developed a **synthetic index** that takes into account some variables relating to the industrial and research AI ecosystem in the various MSs, as well as the adoption level of some technologies closely linked to it and the analysis of Big Data.

At the top of the ranking we find Finland, the Netherlands and Belgium, with scores of 100, 94 and 89, respectively. These countries, despite being small in population - all together, their inhabitants slightly exceed 34 million, not even half of Germany’s population – have a good industrial ecosystem with a high number of AI companies - 119, 323 and 96, respectively. Furthermore, their companies, with a much higher percentage than the European average (20% vs. 12%) analyse Big Data. France (77) and Germany (68) follow at a distance, in seventh and eleventh position. The two largest EU countries, while numbering 633 and 711 AI companies, respectively, are far from the podium as, regarding size, their AI industrial and research ecosystems have not yet fully developed their potential. At the bottom of the ranking, we find the Eastern European countries, where both the industrial and research AI ecosystems see a lower number of active AI players and the level of adoption of AI-related technologies, such as robots and 3D printing, is very low. Therefore, to ensure inclusive and sustainable growth and to catch up with the current AI leaders, the US and China, the disparities in AI adoption in Europe must be tackled.

The **apparent gap in AI readiness in Europe** is quite evident, with Southern and Eastern European countries lagging greatly behind their Northern counterparts. This can be traced to a notably lower business digitalisation in the former. High levels of digitisation adoption and spread are prerequisites for taking up AI technologies and applications. Moreover, investment in AI development is substantially lower in Southern European firms compared to their Northern counterparts. This is also evident in the small share of R&D investment, but also in their clear backwardness in digital skills development and in connectivity.

To face these challenges, the European Commission has proposed several initiatives for successful AI adoption in Europe.

The EU began its pro-active AI strategy with the European Commission Communication “**AI for Europe**”, published on 25 April 2018. Since then, several initiatives have been developed in the field of AI (e.g. *Coordinated Plan on AI, Ethics Guidelines for Trustworthy AI, Policy and investment recommendations for trustworthy Artificial Intelligence*).

The first **Von der Leyen Commission digital proposals** were published on 19 February 2020, including two Communications (Shaping Europe’s digital future and A European Strategy for Data), a white paper (Artificial Intelligence: a European Approach to excellence and trust) and two reports (B2G Expert Group Report: Towards a European Strategy on business-to-government data sharing for the public interest and the Report on safety and liability implications of AI, the Internet of Things and Robotics).

The **AI White Paper** aims at setting a framework for trustworthy AI, based on excellence and trust. According to the adjusted Commission Work Programme 2020, the legislative proposal on the contents of the white paper, including security, responsibility, fundamental rights and data issues, is expected by the first quarter of 2021.

In the **European Parliament**, on 1 October, the Legal Affairs (JURI) Committee approved three **reports on AI**: the civil liability regime for artificial intelligence (rapporteur Axel Voss, EPP, Germany), 2020/2014(INL); the framework of ethical aspects of artificial intelligence, robotics and related technologies (rapporteur Ibán García del Blanco, S&D, Spain) 2020/2012(INL); and intellectual property rights for the development of artificial intelligence technologies (rapporteur Stéphane Séjourné, Renew, France), 2020/2015(INI). Other reports on AI are also expected to be approved, including a report from the Committee on Civil Liberties, Justice and Home Affairs (LIBE) on AI in criminal law and its use by the police and judicial authorities in criminal matters (2020/2016 (INI)), and a report from the Committee on Culture and Education (CULT) on AI in education, culture and the audio-visual sector (2020/2017(INI)).

After this series of “legislative initiatives” and own-initiative reports on AI in several standing committees, the European Parliament set up a **special Committee on Artificial Intelligence in the Digital Age (AIDA)** on 18 June 2020, mandating this committee to take a horizontal, long-term approach on the matter.

In its **conclusions** adopted on 2 October 2020, the European Council – supporting the Council Conclusions on Shaping Europe's Digital Future (9 June 2020) - highlighted that the EU needs to be a global leader in the development of secure, trustworthy and ethical AI. It invited the Commission to: «propose ways to increase European and national public and private investments in Artificial Intelligence research, innovation and deployment; ensure better coordination, and more networks and synergies between European research centres based on excellence» and «provide a clear, objective definition of high-risk Artificial Intelligence systems».

As stated in the position paper “Innovative and trustworthy AI: two sides of the same coin” signed by Denmark and another 13 EU countries, there is the **need to find a balance** within a framework of ethical values between privacy protection and the development of innovation tools capable of increasing efficiency, technology and well-being for all citizens.

Chapter 4 describes the usage of digital services by individuals and enterprises and the Covid-19 impact and the evolution of the European regulatory framework, leading to the DSA and DMA proposals.

The spread of the Internet and digital technologies has radically transformed the socio-economic context in which citizens and companies operate. According to the latest Eurostat surveys, the **main activities performed online** by individuals in the EU27 are the sending of emails (73%), followed by the search for information on goods and services (66%) and instant messaging (65%). One of the most important activities that individuals perform online is the **purchase of goods and services**. Whereas the retail sector, in general, is still facing difficult times, online shopping is continuing to grow. The European country whose citizens have the greatest tendency to shop online is Denmark, followed by Sweden and the Netherlands. Instead, at the bottom of the ranking we find Romania and Bulgaria, with 23% and 22%, respectively.

Another of the main activities performed by individuals online is **interacting with public authorities**. In this category, the difference between the various European countries is enormous. In countries such as Denmark, Finland and Sweden, almost all individuals interact with public authorities using the Internet. In other countries such as Romania and Italy, web interactions between public authorities and citizens are minimal.

The **use of ICT** has the potential to result in important changes in how enterprises are run. In 2019, more than three quarters (77%) of enterprises in the EU-27 had a website, with a much higher share for large enterprises (94%) compared to small enterprises (74%). This was 8 percentage points higher than in 2011, when 69% of enterprises had a website. The most popular use of enterprise websites regarded the description of goods and services and price lists, as well as links or references to the social media profiles of enterprises.

With digitisation spreading and new technologies emerging, enterprises need to invest in e-commerce development to survive in the competitive market. Eurostat data shows that 42% of large companies and 19% of SMEs in the EU27 sell online. The best performer here is Ireland (66% of large enterprises and 38% of SMEs), which is also an important hub for US-based digital companies operating in Europe.

The **Covid-19 pandemic has significantly accelerated business digital transactions**. Government restrictive measures to counter the spread of the pandemic have pushed both companies and individuals to use digital channels. To stay competitive in this new business and economic environment companies have had to adopt new strategies and practices. According to a new McKinsey Global Survey, companies have accelerated the digitisation of their customer and supply chain interactions and of their internal operations by seven years. The pandemic crisis has also sped up an expansion of e-commerce to new firms, customers and types of products. According

to the OECD, between January and May 2020, on average, e-commerce orders more than doubled year-on-year in North America and were up by 50% in Europe.

Online platforms are strong drivers of innovation and play an important role in Europe's digital society and economy. They have transformed the digital economy over the last two decades offering many benefits in digital society and attracting more scrutiny of their role in the market and their impact on users. Since the adoption of the DSM strategy (2015), the European Commission has focused on online platforms, conducting a series of analyses and studies on their role.

On 25 March 2016, the Commission adopted the Communication *“Online Platforms and the Digital Single Market Opportunities and Challenges for Europe”* introducing the following policy principles: 1) a level playing field for comparable digital services; 2) ensuring responsible behaviour of online platforms to protect core values; 3) fostering trust, transparency and ensuring fairness on online platforms; 4) keeping markets open and non-discriminatory to foster a data-driven economy.

The **Recommendation on measures to effectively tackle illegal content online**, published on 1 March 2018, defined general guidelines for online platforms and Member States to combat illegal online content.

To ensure the creation of an ecosystem based on transparency and fairness, on 20 June 2019, **Regulation n. 2019/1150** on online intermediation services was adopted (the new rules went into force on 12 July 2020). The purpose of the P2B Regulation is to contribute to the proper functioning of the internal market by laying down rules to ensure that business users of online intermediation services and corporate website users in relation to online search engines are granted appropriate transparency, fairness and effective redress possibilities.

As part of the European Digital Strategy, the European Commission has announced a **Digital Services Act** package to strengthen the Single Market for digital services and foster innovation and competitiveness of the European online environment. The DSA is focused on two main pillars: 1) clear rules framing the responsibilities of digital services to address the risks faced by their users and to protect their rights, able to ensure a modern system of cooperation for the supervision of platforms and guarantee effective enforcement; 2) ex ante rules covering large online platforms acting as gatekeepers.

The **Digital Markets Act**, instead, would prevent the largest platforms, the so-called “gatekeepers”, from undertaking anti-competitive behaviour.

Chapter 5 is focused on **digital networks and cybersecurity**. The ongoing digital transformation requires increasing network performance, as well as the growing data traffic generated by users and enterprises. For this reason, European institutions consider the spreading of high capacity networks as essential for economic development within the Union as it would allow access to new generation services such IoT, Big Data and AI. The topic is now central, both in investment plans and in the adoption of new legislation.

The Commission’s **strategy on Connectivity for a European Gigabit Society** aims at bringing Internet access with a capacity of at least 100 Mbps to all European households by 2025, as well as connecting, with performance up to 1 Gigabit, the main socio-economics drivers, covering all urban areas and major land transport routes with a 5G signal.

Broadband connection is widely available all over Europe, reaching 96% of European households, with only five countries registering less than 90% of household coverage, whereas in rural areas broadband coverage reached 90% of households in 2019.

Where download speed is concerned, data from 2019 shows that 86% of European households had access to at least 30 Mbps, even though full coverage should have been achieved by 2020 according to the European Digital Agenda’s previous targets. Instead, at least 50% of the population is covered by ultra-fast broadband Internet services above 100 Mbps, and almost 44% of European households are covered by **fixed VHCN**, including fibre to the home (FTTH), fibre to the building (FTTB) and cable connectivity (Cable Docsis 3.0).

Concerning the **availability of optical fibre**, that provides Internet connection of up to 1 Gbps, the percentage of households living in areas served by FTTP reached 33.5% in 2019, with only twelve EU countries revealing excellent performance with more than 50% of households connected. Another basic indicator is related to the effective take up of the Internet access service. Currently, 78% of European households have adopted a broadband connection service, while the adoption of ultra-fast broadband services reached 20.1% of European households.

As for mobile broadband, the infrastructures for high download capacity are already widely available, supplying **4G (LTE) capacity** to almost 96% of European households. In 2019, 73% of Europeans used a mobile phone (or smart phone) to access Internet in mobility, with smartphone

usage being more widely spread in Northern European countries, and Italy being the only country below the 50% threshold.

The **spread of 5G** is also recognised as an essential element for mobile networks due to its contribution to the development of the IoT and for the economic benefits resulting from its technical features. The EU institutions are now speeding up the upgrading to these networks, although the **spectrum allocation** is still far from being complete with only 17 Member States having assigned the 5G pioneer bands by the end of March 2020 (only 4 countries assigned at least 60% of the considered spectrum). Focusing on the 5G trials and experiments, almost 40% of the total (210 trials) are being carried out by the 5 largest countries, showing that the interest of both national bodies and private operators for the new mobile transmission standard in the larger EU economies is high. The development and the full exploitation of the benefits from 5G networks strongly depend on its deployment and on the amount of investments in the area. Auctions for 5G spectrum exceeded the €6 billion threshold in Italy and Germany, whilst values were much lower in other countries with a large part of the spectrum still to be assigned. The total amount spent in Europe is already close to €20 billion. Investments required for the implementation of the 5G networks have been estimated as more than €515 billion, while global 5G investments are expected to grow to over \$2.2 trillion between 2024 and 2034.

As for **5G service users**, I-Com’s analysis shows that South Korea registers the greatest spread in 5G services in relation to population (16,744 per 100,000 inhabitants), closely followed by China (12,790). The US and Europe are well behind, with only 2,313 and 779 users, respectively, of 5G services per 100,000 inhabitants, highlighting the **need for Europe to accelerate** in terms of infrastructures.

The Covid-19 crisis has once again underlined not only the importance of digital networks and new technologies in our societies, but also the need for these network services to be secure for users and businesses. The ongoing pandemic has been a driver for the adoption of new digital services and for the creation of networks, leading to an **exponential increase in data traffic**. Following this, the number of **cyberattacks** has also greatly increased, emphasising the vulnerability in the current IT infrastructures and the need for further, renewed, wide-spread digital protection systems. This has led to further apprehension amongst the EU institutions on the issue of cybersecurity, which has now been identified as one of the top priorities for future investments. The European Union is planning to provide a boost to its cyber-defences by committing to €8.2 billion in investments, underlining the importance of cybersecurity as a key component towards establishing a digitalised Single Market and **safeguarding the key infrastructures**, electronic communications networks,

services and terminal equipment. In order to access these resources, each Member State will have to define, by 30 April 2021, its **national plan for recovery and resilience** whereby the MS's reform and investment programme for the period 2021-2026 will be examined by the Commission and the Council.

Numerous interventions have also been undertaken on the **regulatory framework**. With the **EU Toolbox** and following Commission reports, the EU intends to stress the importance of uniform regulation across Europe in response to the intensifying transition of the most important economic activities to the mobile networks. Furthermore, **common standards for mobile network providers** need to be set. In order to foster the creation of a uniform and secure network, GSMA and 3GPP are implementing the **NESAS** (Network Equipment Security Assurance Scheme), a common scheme for 5G certification aimed at providing an **industry-wide security assurance framework** to facilitate improvements in security levels on mobile network infrastructure equipment.

The debate on common standards and regulations is also crucial for **geopolitical reasons**, with pressures coming from the US on NATO countries leading to a greater tightening up of several European countries regarding non-European vendors. In a globalised world, the EU is working to create and foster its own technological sovereignty without relinquishing the advantages of maintaining an open trade and innovation flow.

Work on a EU-wide **legislation on cybersecurity** capable of appropriately facing the challenges of digitalisation started in 2013 with the adoption of the **EU Cybersecurity Strategy of 2013**. This aimed at safeguarding the online environment providing security and freedom. A following milestone was set by the **Directive on Security of Network and Information System** (the **NIS Directive**), adopted by the European Parliament in 2016, which encouraged cooperation and information exchange among Member States by setting the EU Agency for Cybersecurity (**ENISA**). With **Regulation 2019/881**, known as the **Cybersecurity Act**, the EU also reached a political agreement to strengthen the ENISA and established a wide certification framework on digital products, services and processes. In addition, the Cybersecurity Act established the European Cybersecurity Certification Group (**ECCG**), made up of representatives from national cybersecurity certification authorities or other relevant national authorities, to assist the Commission in its work to ensure the implementation and application of the act.

On 26 March 2019, the Commission adopted **Recommendation 2019/534** on the cybersecurity of 5G networks, highlighting the risks for these networks and suggesting risk-analysis and management methods at the national level to be implemented within a coherent European

context. The Recommendation identifies a set of actions to support an appropriate risk assessment, both at national and European levels, and a package of measures to implement in case of need.

Thereafter, in January 2020, the Commission published the **Communication "Secure 5G deployment in the EU - Implementing the EU toolbox"** which took note of the absolute importance of 5G for many essential services and, therefore, the strategic need for the Union to ensure 5G network cybersecurity. On the same date, the NIS Cooperation Group put forward the EU's **package of instruments**, which aims at identifying a possible common set of measures to mitigate the main cybersecurity risks of 5G networks and providing guidance in selecting the measures to be taken so as to create a robust common framework.

On 24 July 2020, the NIS Cooperation Group published a **report on Member States' progress in implementing the 5G security toolbox**. At a general level, the report identifies **three main risks**: the incorrect configuration of networks, the lack of access control and state interference through the 5G supply chain and the lack of adequate existing measures.

In the meantime, on 25 June 2020, the Commission launched the **public consultation for the revision of Directive 2016/1148** on measures for a common level of network and information systems security in the Union ("NIS Directive"). The review, which must be done before the May 2021 deadline, pursues a threefold objective - to assess the possible improvement of cybersecurity in the EU, to identify existing and potentially emerging key security issues affecting the functioning of the directive and to identify and quantify the regulatory costs and benefits. To foster the development of networks, the **Implementing Regulation n. 2020/1070** was adopted on 20 July 2020. This specifies the characteristics of wireless access points of limited scope in accordance with Article 57(2) of the European Electronic Communications Code.

Together with these initiatives in the regulatory framework, the EU is developing a set of investments through the Recovery Fund **Next Generation EU**. This is based on three pillars: 1) instruments to support Member States' efforts to overcome the crisis and restart; 2) measures to stimulate private investment and support businesses in difficulty; 3) strengthening EU strategic programmes to learn the lessons of the crisis and make the Single Market stronger and more resilient and accelerate the dual green and digital transition.

The Next Generation EU identified cybersecurity as one of its top priorities and, in the Recovery Plan Communication *"Europe's moment: Repair and Prepare for the Next Generation"*, the

Commission also announced a new Cybersecurity Strategy to boost EU-level cooperation, knowledge and capacity. The objective is to help Europe strengthen its industrial capabilities and partnerships, and support SMEs in becoming established in the markets. On 17 September, the Commission also published the **guidelines for the preparation of the plans** and the consequent access to the RRF whilst, on the following day, it published **Recommendation n. 2020/1307** on a common EU toolbox to reduce the cost of deploying very high capacity networks and to accelerate the development of digital infrastructures.

Chapter 6, finally, analyses the importance of digital skills for European competitiveness and for the recovery from the Covid-19 crisis and the role of skills in reaping the benefits of the green transition.

On 1 July 2020, the European Commission adopted the **new Skills Agenda for Europe** which highlights the importance of skills to achieve sustainable competitiveness, social fairness and resilience for all. This is a strategy aimed at strengthening and renewing skills for all European citizens, which are of key importance, especially in the current situation, determined by the Covid-19 pandemic. The new Skills Agenda covers the following five steps: 1) calls for collective action, mobilising businesses, social partners and stakeholders, to commit to working together, overall within the EU’s industrial ecosystems; 2) defines a clear strategy to ensure that skills lead to jobs; 3) identifies the financial means to foster investment in skills; 4) helps people in building their skills throughout life in an environment where lifelong learning is the norm; 5) sets ambitious objectives for upskilling and reskilling to be achieved within the next 5 years, being divided into twelve actions to improve the importance of skills in the EU to strengthen sustainable competitiveness, ensure social fairness and build resilience.

To implement the actions promoted by the European Skills Agenda and achieve these objectives, a massive investment in skills will be required. The **Recovery Plan for Europe** proposed by the Commission in May 2020 includes unprecedented financial resources (Tab. 6.2) that support a sustainable recovery and investment in skills.

On **10 November 2020**, an agreement between the European Parliament and the Council was signed starting from the Commission’s May proposal. It ensures that the EU institutions cooperate even more effectively to ensure that the €1.8 trillion package goes to where the needs are, in a timely and transparent manner.

Making education and training fit for the digital age is the aim of the **Digital Education Action Plan** (2021-2027). It calls on Member States and stakeholders to work together to ensure a high-quality,

inclusive and accessible digital education in Europe. The Action Plan, specifically, sets two long-term strategic priorities: 1) fostering the development of a high-performing digital education ecosystem; 2) enhancing digital skills and competences for the digital transformation, encouraging the acquisition of basic digital skills and competences from an early age and advanced digital skills. On **10 November 2020**, the Commission launched the **Pact for Skills**, a central element of the European Skills Agenda and announced the first European skills partnerships in key industrial ecosystems – automotive, microelectronics, and aerospace and defence industries. The Pact for Skills is accompanied by a **Charter** outlining a shared vision from industry, social partners, vocational education and training (VET) providers, and national, regional and local authorities as regards quality training.

In attempting to contain the virus, worldwide, countries have established restrictions and lockdowns, which have disrupted the ordinary functioning of society and the economy. This disruption has transformed how communities, businesses and individuals operate, and communicate and transfer knowledge. For example, in the months of the Covid-19 health emergency, many companies have resorted to **remote working** to ensure the continuation of their activities and, at the same time, protect the health of their employees.

According to the research report “Living, working and COVID-19” by Eurofound, 34% of EU employees reported working exclusively from home in July 2020. Moreover, in education, governments and school administrations in all countries have adopted e-learning technologies for students forced to remain at home due to the closing of schools. Consequently, having a digitally skilled labour force and population is crucial to building resilience before economic and social shocks, such as those arising from the Covid-19 outbreak, where the acquisition of digital skills can also serve as a hedge against unemployment risks.

According to the EU Commission, **digital skills** are essential for the creation of a Digital Single Market in Europe and for receiving its benefits, for European competitiveness and for an inclusive digital society¹.

Throughout the last 4 years, the level of digital skills has continued to grow, though very slowly. In 2019, the percentage of people with at least basic digital skills reached 58% (up from 55% in 2015), while the percentage with above basic digital skills reached 33% (up from 28% in 2015). Therefore, a large part of the EU population still lacks basic digital skills, even though most jobs require such skills.

¹ <https://ec.europa.eu/digital-single-market/digital-skills-jobs-coalition> (last access: 17.08.2020)

Software skills are above all becoming a prerequisite for entry into many jobs. 61% of Europeans have at least basic software skills. Europe also lacks skilled **ICT specialists** to fill the growing number of job vacancies in all sectors of the economy. According to Eurostat data, during 2019, 9% of EU enterprises recruited or tried to recruit ICT specialists. More than half of these enterprises (58%) reported that they had problems filling vacancies requiring relevant ICT skills. 66% of large enterprises and 57% of SMEs that recruited ICT specialists during 2019 declared that vacancies for ICT specialists were hard to fill. Beyond the workforce, citizens, in general, also need to have at least the basic digital skills in order to live and participate in our modern society.

The European Commission is developing policies and investing in supporting **reskilling and upskilling** in Europe and tackling the **digital skills gap**. Different funds have been promoted to increase training in digital skills for the workforce and for consumers and to modernise education across the EU. These include the **Digital Europe Programme**, the **European Social Fund Plus**, the **European Global Adjustment Fund**, **Erasmus+** and **Horizon Europe**. Moreover, the **Digital Skills and Jobs Coalition**² - one of the central EU strategic development policies of the European Commission that brings together EU Member States, as well as companies, social partners, non-profit organisations and education providers – is tackling the gap in digital skills across Europe for citizens, professionals and the labour force. Moreover, the proposed European Social Fund+ will play an important role in helping Europe’s workforce to acquire the skills they need to transfer from declining sectors to growing sectors and to adapt to new processes³. Erasmus+, the EU’s education and training programme, is also boosting activities in this area.

² <https://ec.europa.eu/digital-single-market/digital-skills-jobs-coalition> (last access: 21.08.2020)

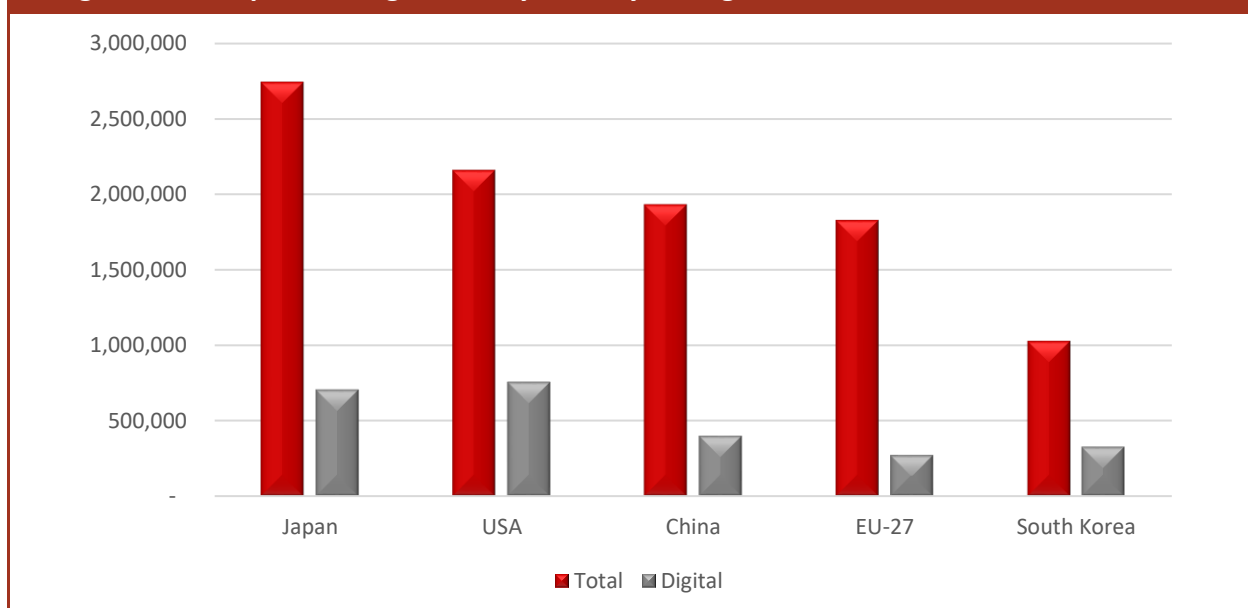
³ EU Commission, the European Green Deal, 2019

1. THE IMPORTANCE OF DIGITAL TRANSFORMATION IN THE GLOBAL AND EUROPEAN CONTEXT

1.1. The development of digital in Europe and comparison with the main areas of the world

Over the last decade, digitisation has become the last frontier in the competition between the main global economies. Digital platforms in recent years and, in particular, during the Covid-19 pandemic, have become the space where individuals carry out their work, social and play activities. This means that the **technological advancement** of a country is directly proportional to its economic growth. Observing the latest data on patents issued by WIPO (Fig.1.1), we can see how **Japan, the US and China play a leading role in world technological progress**, closely followed by Europe (EU-27) and South Korea.

Fig. 1.1: WIPO patents registered by country of origin between 2010 and 2018



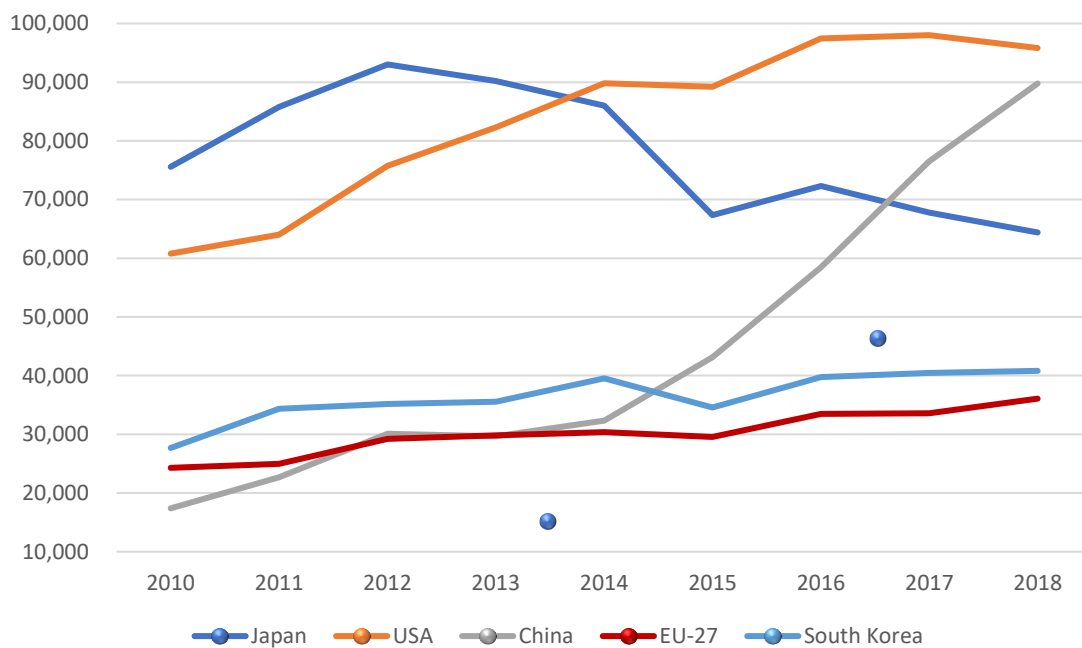
Source: WIPO

With more than 750,000 patents registered between 2010 and 2018, the US is the best performer in the digital area⁴. Observing the evolution of the number of patents registered, the **exponential growth of China** over the last decade is evident, increasing from about 17,000 patents in the digital

⁴ The patents in the digital area are obtained by adding the following areas: Audio-visual technology; Telecommunications; Digital communication; Computer technology; IT methods for management; Semiconductors; Micro-structural and nanotechnology

area in 2010 to about 90,000 in 2018 (Fig. 1.2). In this scenario, **the European Union appears to be the most behind of the geographical areas considered** with only 271,000 digital patents, despite having recorded a slow but steady growth during the same period.

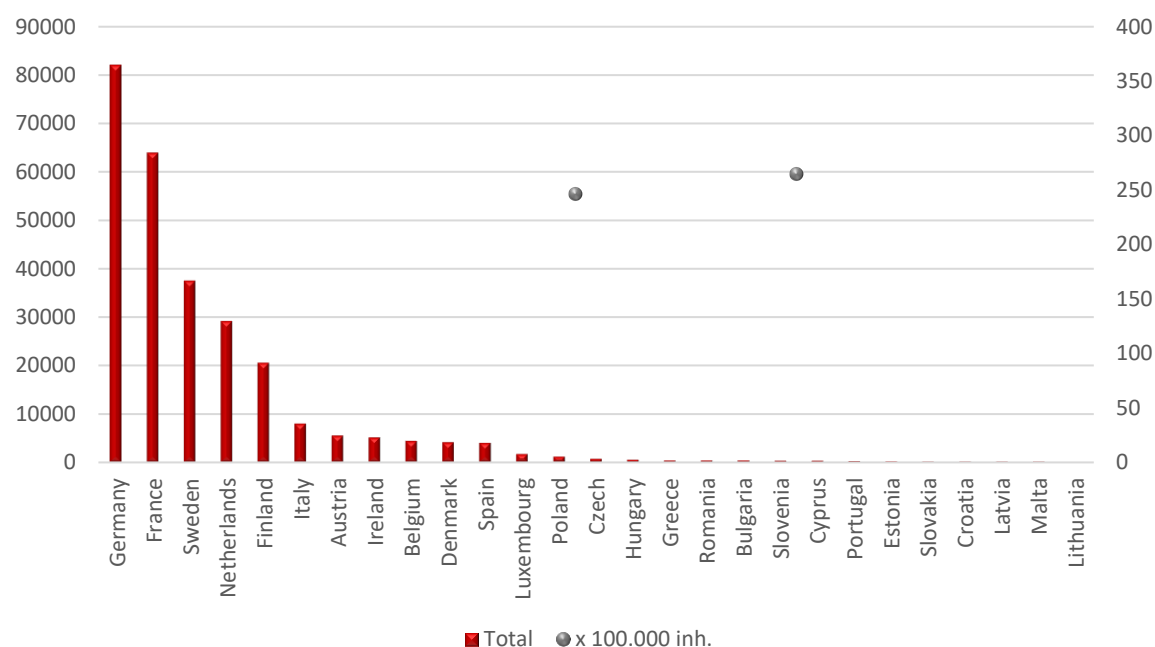
Fig. 1.2: Digital patents registered between 2010 and 2018



Source: WIPO

Looking at the number of patents registered by countries in the EU-27 (Fig.1.3), we notice that **Germany is the best performer with more than 82,000 licenses granted** (30.2% of the Union total). However, Finland is the European country with the most patents per 100,000 inhabitants (373), followed by Sweden (367) and Luxembourg (285). With only 2 patents per 100,000 inhabitants, Slovakia and Romania were the countries with the worst per capita performances.

Fig. 1.3: Digital patents registered by EU country of origin between 2010 and 2018

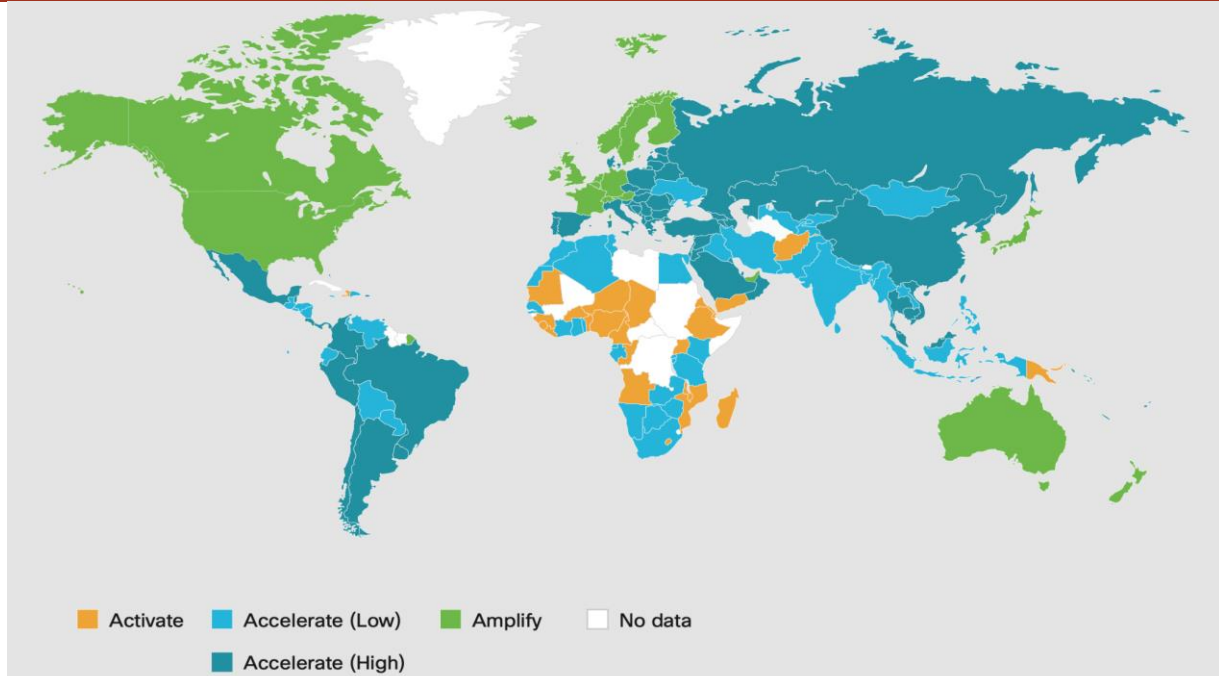


Source: WIPO

To test the level of **digital readiness of each country**, the American multinational Cisco has created an index based on 7 variables⁵ regarding the social status of the population and the basic aspects that favour business development, especially digital companies. Countries are assigned, according to the average score obtained, to one of the four quartiles that define their positioning on a global level. Looking at the latest version of the study (Fig. 1.4), it can be seen how Europe is divided into two. **Northern European countries display high values** ranking them among the top 25 globally, while Southern and Eastern European countries have medium to high values positioning them in the second bracket (between 25th and 72nd). Overall, the average score of EU countries (15.95) is considerably lower than that of the U<s (19.03), Korea (18.22) and Japan (17.69). At the level of individual countries, Singapore stands out (20.26) being ahead of Luxembourg (19.54) and the US. China, which in previous analyses was one of the most advanced countries, in this ranking occupies the 54th place (with a score of 13.22), held back by government restrictions on investments and the use of foreign technologies.

⁵ Variables: Basic needs of the population; public and private investments; ease of doing business; human capital; start-up ecosystem; level of technology adoption; technological infrastructures.

Fig. 1.4: Cisco Global Digital Readiness Index 2019



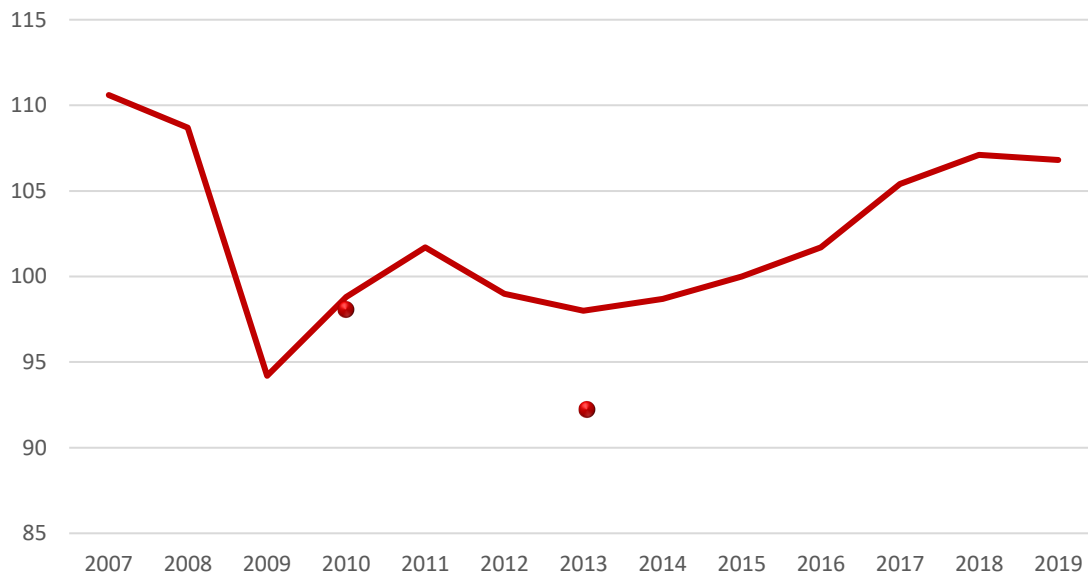
Source: CISCO

1.2. An overview on the European industry and the New Industrial Strategy for Europe

Industry is a driving force for EU Member States **representing more than 20% of the EU economy** and employing around 35 million people, with millions of jobs involved both at home and abroad. It makes up 80% of exports and is one of the primary reasons behind the EU's position as the main global source and destination for direct foreign investment. SMEs make up over 99% of all European enterprises and are an important economic and social backbone.

Since mid-2003, total industrial production has followed a relatively constant growth path. Production levels reached their highest in 2007 and then began falling continuously up to 2009, dropping 16.4 percentage points below its previous peak. However, production began to steadily pick up again, recovering over 96% of its pre-crisis value by 2018. In 2019, industrial production in the EU-28 stagnated, before the collapse due to the Covid-19 pandemic (Fig.1.5).

Fig. 1.5: Industrial production in the EU (2015=100)



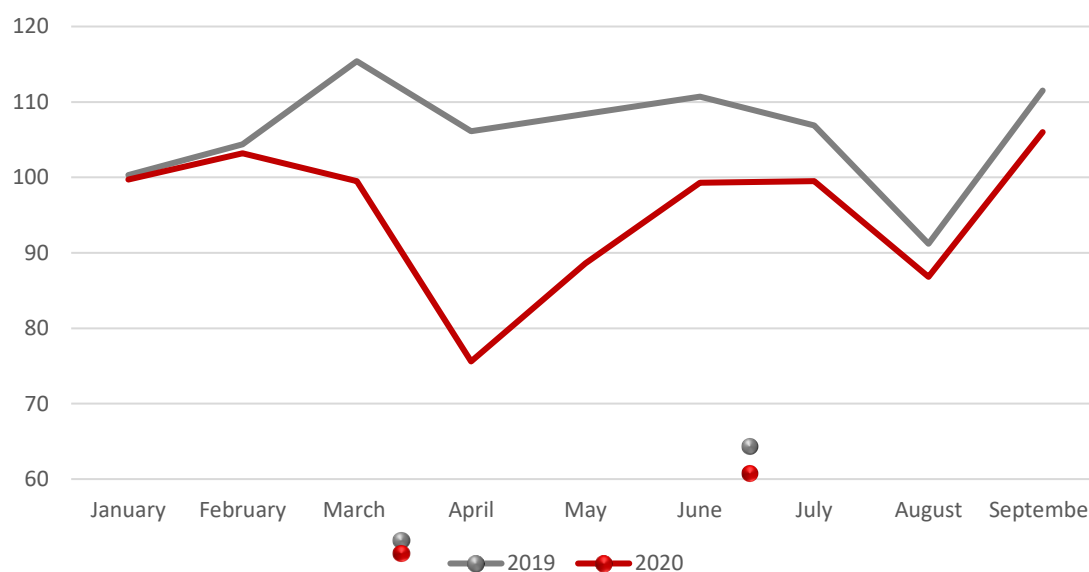
Source: Eurostat

The Covid-19 outbreak has pushed the EU economy into its most severe contraction since World War II. To hinder the spread of the pandemic, extremely strict containment measures have been adopted. In countries with the widest spread of the virus, all non-essential economic activities had been shut down and stringent limits had been imposed on people’s movements. These measures have impacted on important sectors of the European economy such as tourist and hospitality services, the entertainment industry and, to a certain extent, transport and energy. **The Commission’s Autumn forecasts estimate a contraction of the European Union economy by 7.4% in 2020** before recovering by 4.1% in 2021 and 3% in 2022, assuming there is no third pandemic wave in the winter. The collapse of the European economy has inevitably translated into a crisis in the labour market. According to the latest OECD forecasts (October 2020) in the Euro Area the employment rate decreased by 1.9% to 66.2% in the second quarter of 2020. Unfortunately, autumn marked an increase in the number of Covid-19 cases registered across most of the EU Member States, prompting European governments to resume stringent measures that will inevitably further impact on the European economy.

The restrictive measures adopted by the Member States have had a strong impact on the production and demand for goods. In March 2020, **industrial production** in the now EU-27 decreased by 24% compared to February 2020, and by 28.7% compared to March 2019 (Fig.1.6). In April 2020, EU industrial production decreased by 17.3% compared to March 2020 and by 27.2%

compared to April 2019. In the Eurozone, the decline was 17.1% during March 2020, and 28.0% over the previous year⁶.

Fig. 1.6: Industrial production in the EU (2015=100)



Source: Eurostat

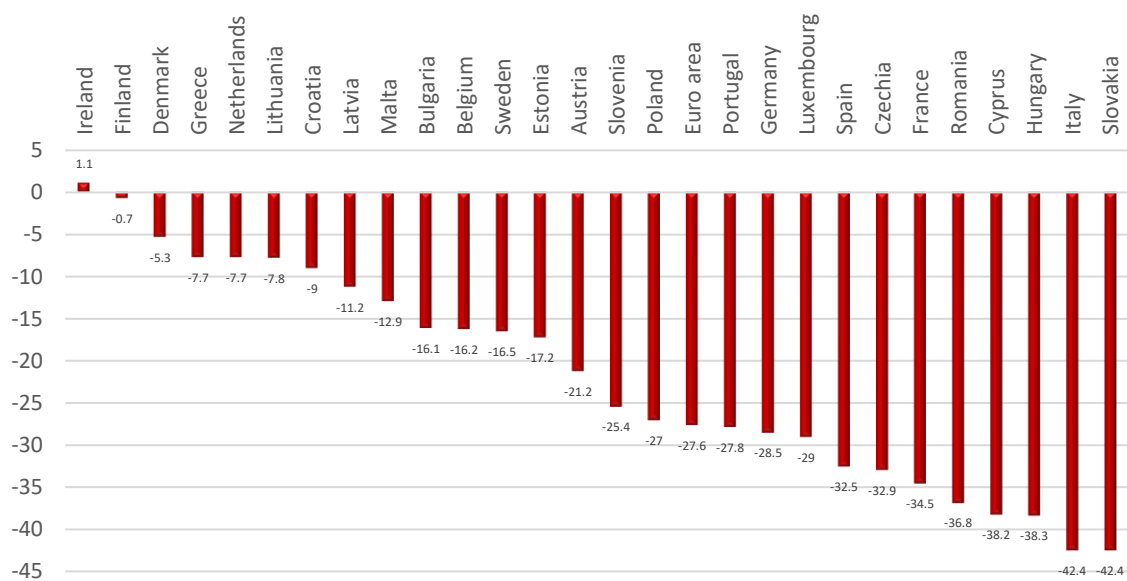
The drop in industrial production involved many industrial groupings, namely intermediate goods, capital goods, energy and durable and non-durable consumer goods. In the EU-27, industrial production of **durable consumer goods** showed the biggest reductions in March and April 2020 compared to the previous months (-25.3% and -27.8%). The drop in **capital goods** (-16.1% and -27.3%) was also quite pronounced. The production of **intermediate goods** decreased by 10.6% and 14.9%, while the production of **non-durable consumer goods** by only 1.2% in March, but by 10.7% in April. **Energy production** was slightly less affected by the crisis (-3.4% in March and -5% in April). Between February and April, the industries which suffered the most were the production of motor vehicles (-79.1%), leather goods (-76.3%), wearing apparel (-53.2%), furniture (-49.2%) and textiles (-35.5%). Pharmaceutical products (+3%) and tobacco products (+5.3%) were the only sectors that recorded positive growth rates.

On the other hand, looking at **individual countries**, between February and April, significant reductions were registered, ranging from a total drop in production of 42.4% in Italy and Slovakia

⁶ Eurostat, Impact of Covid-19 crisis on industrial production, June 2020

to an increase in Ireland (+1.1%). From February to April, the countries with the largest drops in industrial production were, together with Italy and Slovakia, Hungary (-38.3%), Cyprus (-38.2%), Romania (-36.8%) and France (-34.5%). The decrease in the Euro area and the EU-27 was 27.6% and 27%, respectively. Industrial production declined in 26 Member States from February to April (Fig.1.6).

Fig. 1.6: Industrial production growth rates for total industry - April on February 2020 (%)



Source: Eurostat

European industrial organisation has been undergoing deep transformations driven by digital and other new technologies, and new business models. Therefore, to ensure European industry competitiveness, it is essential to embrace technological change, integrate products and services, develop technologies that use less energy, reduce waste and avoid pollution and invest in a workforce with the right skills.

To ensure European industry's global competitiveness, reach climate-neutrality by 2050, and make Europe fit for the digital age, the European Commission is launching several actions that will help industry take advantage of the twin green and digital transformations.

In March 2020, the Commission presented “**A New Industrial Strategy for Europe**” to help Europe's industry lead the twin transition towards climate neutrality and digital leadership. The strategy aims to drive Europe's competitiveness and its strategic autonomy at a time of moving

geopolitical plates and increasing global competition. Considering that the industrial sector is pivotal to Europe’s future progress and prosperity and Europe’s industry has a global competitive advantage on high value-added products and services, the strategy is focused on three drivers - make European industry greener, more circular and more digital. To achieve these goals, the strategy underlines the importance to: 1) **encourage competition** at home and in the world being able to forge global high quality standards; 2) **invest in research, innovation, deployment and up-to-date infrastructures** to develop new production processes and create jobs in the process and create lead markets in clean technologies; 3) enhance European industrial capacity in **critical digital infrastructure** (specifically 5G and 6G). For the latter, the strategy emphasises that Europe’s digital transformation, security and future technological sovereignty depends on European strategic digital infrastructures and the necessity to support the development of key enabling technologies that are strategically important for Europe’s industrial future including robotics, microelectronics, high performance computing and data cloud infrastructure, blockchain, quantum technologies, photonics, industrial biotechnology, biomedicine, nanotechnologies, pharmaceuticals, advanced materials and technologies; 4) **provide skills for industry** by improving the quality and relevance of training and education, making skills more comparable, and easing the recognition of qualifications, also setting a new “Pact for Skills” to contribute to up- and reskilling and to unlock public and private investment in the workforce which will focus on sectors with high growth potential for Europe or those undergoing the most significant changes; 5) **promote entrepreneurship**, support workplace innovation and empower citizens and communities with social innovation; 6) encourage a **better balance between women and men** in industry.

On 11 March 2020, the Commission put forward a **new Circular Economy Action Plan** as part of the new industrial strategy to support the move to a more circular economy. The plan covers the cycle from production and consumption, to waste management and the market for secondary raw materials. In a circular economy, the value of products and materials is maintained for as long as possible and waste and resource use are minimised. This development can contribute to innovation, growth and job creation.

On 16 November 2020, the Council adopted a set of **conclusions** setting out how recovery from the Covid-19 crisis can be used as leverage for a more dynamic, resilient and competitive European industry. In these conclusions, the Council stresses the need for European solidarity and the importance, for European industry, of a green and digital transition, also reaffirming the need to achieve strategic autonomy while preserving an open economy in the most sensitive industrial ecosystems and specific areas, such as health, defence industry, space, digital, energy and key raw

materials. Conclusions also encourage the creation of a sustainable, attractive and competitive business environment, characterised by a fully functioning, deepened and strengthened Single Market, an effective level playing field for European businesses, a world-leading, safe, resilient and interoperable data infrastructure and communication networks, the up- and reskilling of workers, a well-functioning European standardisation system, EU technological leadership, smart specialisation, sustainability, strengthened European value chains and security of supply of raw materials in Europe. In order to monitor developments in the field, the Council invited the Commission to define key performance indicators for monitoring the industrial strategy and competitiveness by the end of March 2021 and to present an update of its New Industrial Strategy ahead of the European Council in March 2021.

On 25 November 2020, the **European Parliament** adopted a report calling on the Commission to come up with a revised industrial strategy focused on two distinct phases - the recovery and reconstruction and building resilience. The first, in particular, should aim to maintain the smooth functioning of the single market, mainly by recapitalising enterprises, saving jobs and adapting production to a post-Covid “new normal”. The second phase should aim to help reconstruct and transform European industry by pursuing the objectives of the twin transition and reinforcing the EU’s industrial sovereignty and its strategic autonomy, which require a competitive industrial base and massive investments in research and innovation. The strategy should help the EU achieve climate-neutrality, deliver on the European Green Deal, manage the twin green and digital transition and create high-quality jobs.

1.3. The digital strategy of the new Commission and the 2021 work plan

Considering that the global economy has been rapidly becoming digital and the importance of ensuring Europe’s position as a world leader in the digital economy, on 6 May 2015, the European Commission launched “A Digital Single Market Strategy for Europe” (DSM). The Digital Single Market Strategy aims to create a market in which the free movement of goods, persons, services and capital is ensured and where individuals and businesses can seamlessly access and exercise online activities under conditions of fair competition, and a high level of consumer and personal data protection, irrespective of their nationality or place of residence. The DSM Strategy is built on three pillars, including 16 specific initiatives: 1) better access for consumers and businesses to online goods and services across Europe; 2) creating the right conditions for digital networks and services to flourish; 3) maximising the growth potential of our European Digital Economy.

From the adoption of this strategy, several initiatives were launched by the Commission until the adoption, on **19 February 2020**, of the Communication “***Shaping Europe’s digital future***”. This

identifies as its macro-objectives: 1) **the implementation of technologies at the service of individuals**, underlining the importance of investing in digital competences for all Europeans, protecting citizens from cyber threats (hacking, ransomware, identity theft), ensuring that AI is developed respecting people’s rights and earning their trust, accelerating the roll-out of ultra-fast broadband for homes, schools and hospitals throughout the EU and expanding Europe’s super-computing capacity to develop innovative solutions for medicine, transport and the environment; 2) **the creation of a fair and competitive digital economy**, proposing a Digital Services Act to strengthen the responsibility of online platforms and clarify rules for online services, underlining the necessity to increase access to high-quality data (ensuring that personal and sensitive data is safeguarded), enabling a vibrant community of innovative and fast-growing start-ups and SMEs to access finance and to expand and ensure a fair competition in Europe; 3) **the realisation of an open, democratic and sustainable society**, highlighting the contribution of technology to help Europe become climate-neutral by 2050, of the importance to empower citizens with better control and protection of their data, creating a European health data space to foster targeted research, diagnosis and treatment and fight disinformation online and promote diverse and reliable media content.

On the same date, the European Commission published the **Data Strategy** and the **White Paper on Artificial Intelligence** which are the first pillars of the new digital strategy of the Commission. The Communication “**A European strategy for data**”, that will be thoroughly analysed in the following chapters, outlines a strategy for policy measures and investments to promote and establish the data economy for the coming five years and make the EU the most attractive, secure and dynamic data-agile economy in the world. It is focused on four pillars - a cross-sectoral governance framework for data access and use, enablers, competences and common European data spaces - and several key actions.

The White Paper on AI (“Artificial Intelligence: a European Approach to excellence and trust”) aims at setting a framework for **trustworthy AI, based on excellence and trust** and initiating a consultation with the participation of MSs, civil society, industry and academics on concrete proposals for setting a European regulatory framework. This will help prepare the ground for legislative proposals (also regarding safety, liability, fundamental rights and data) as a follow-up to the White Paper in Q1 2021, according to the adjusted Commission Work Programme 2020 presented in May 2020.

In her **State of the Union address** on **16 September 2020**, President of the European Commission Ursula von der Leyen presented her vision for a Europe that emerges stronger from the pandemic

and leads the way towards a new vitality. She underlined that NextGenerationEU represents the opportunity, for Europe, to make change happen by design. The goal is to create a green, digital and more resilient Europe with several initiatives, including those aimed at encouraging the digital transformation, particularly on data, technology and infrastructure.

On 19 October 2020, the European Commission adopted a **work programme** setting out its key initiatives for 2021. The document underlines that the pandemic has sharpened the need for Europe to lead the twin green and digital transition and make its societies and economies more resilient, also presenting an unparalleled opportunity to move out of the fragility of the crisis by creating a new vitality for the European Union. The 2021 work programme complements and builds on the updated and revised 2020 work plan that was revised in May 2020 due to the Covid-19 crisis and identifies six political priorities - a European Green Deal, a Europe fit for the digital age, an economy that works for people, a stronger Europe in the world, promoting our European way of life and a new push for European democracy.

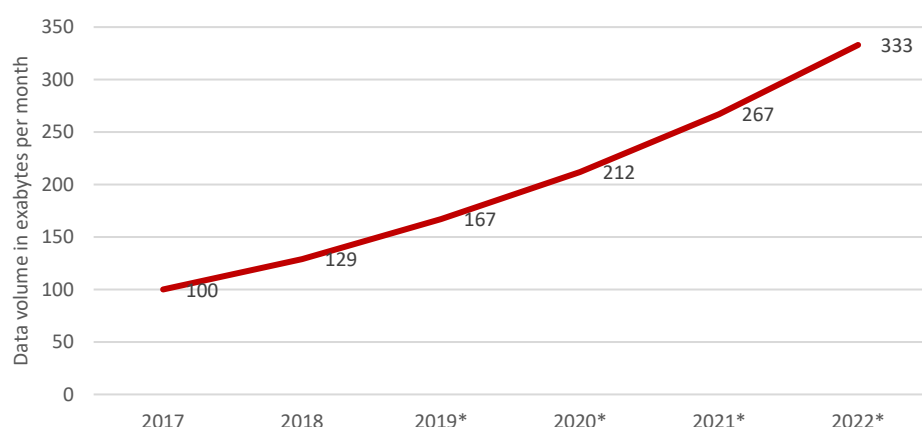
On **digital initiatives**, the programme proposes a **roadmap with clearly defined goals for 2030**, such as for connectivity, skills and digital public services, enforcing fundamental principles and values such as are the right to privacy and connectivity, freedom of speech, the free flow of data and cybersecurity. In these different areas, the document announces initiatives that include the adoption of a legislation covering the safety, liability, fundamental rights and data aspects of AI and a Data Act to set the right conditions for a better control and conditions for data sharing for citizens and businesses. It also underlines the intention to: a) propose a new European digital identity to encourage the development of services online across Europe and an increased citizen awareness of data sharing and usage; b) continue to work for an international agreement on a fair tax system that provides long-term sustainable revenues and, in case of failure, propose a digital levy and then a legal instrument to level the playing field as regards foreign subsidies; c) continue its ongoing review of competition rules to ensure compliance with the market environment, including the accelerating digitalisation of the economy also updating the industrial strategy for Europe; d) set a legislative proposal to improve the working conditions of those providing services through platforms to ensure fair working conditions and adequate social protection.

2. THE EUROPEAN WAY TO DATA ECONOMY

2.1. The data economy in the European Union

With the growing focus on the Internet and the use of mobile devices, where objects communicate with each other using highly sophisticated technologies and a variety of sensors allowing us to measure and monitor virtually everything, we are witnessing the generation of an unprecedented amount of data. According to some estimates, in 2022, the global consumer IP data traffic is expected to reach 333 exabytes per month at a 27% CAGR over 2017-2022 (Fig. 2.1).

Fig. 2.1: Data volume of global consumer IP traffic from 2017 to 2022



*Forecast

Source: Statista, 2020

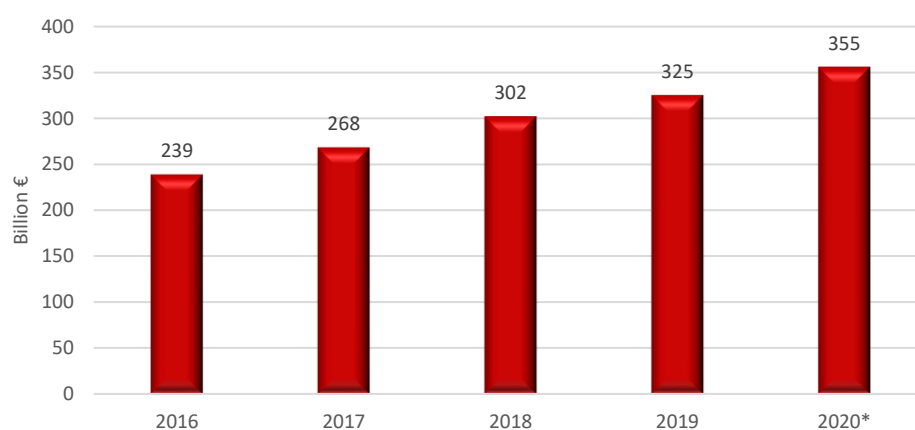
Data is the lifeblood of the economy and data-driven innovation is a key pillar in 21st century development. The **smart use of data** can create new opportunities for economic growth, especially for SMEs, enabling the development of AI applications that can help us address various societal challenges, from medical care to the fight against climate change.

The importance of data and information for economic development and wellbeing is clearly undeniable and **healthcare** is undoubtedly the sector in which this is becoming more evident. Although the Covid-19 experience has shown the resilience of the Union, it has also revealed the existing gaps and difficulties in collecting, analysing and sharing data in times of emergency. While the role played by data applications is clear, e.g. in matching existing molecules with genomic features of the virus, it is evident that a more effective and quick deployment of tools will be required in the near future. The Commission’s decision to prioritise the creation of the **Health Data Space** (Q4 2021) over other sectors will be considered in this light.

Moreover, data management undoubtedly plays a central role in supporting the decision-making process in cybersecurity issues. However, data should carry **high standards of quality and interoperability**. For this reason, it is important to develop a legislative framework based on the values of transparency, interoperability and accessibility. The importance of a network for mutual assistance and prevention of cyber-attacks and also the need for a **EU cybersecurity certification framework** has been emphasised. Consequently, the willingness to innovate the entire cybersecurity sector has been confirmed by the Commission that will put on the table in mid-December 2020 a new cybersecurity strategy and a proposal for the revision of the NIS Directive.

Nowadays, most economic activity depends on the sharing and use of data and, in the future, this trend will continue to increase with a huge economic impact. According to the IDC European Data Market Monitoring Tool (2020), the **value of the data economy** - which measures the overall impact of the data market on the economy as a whole - exceeded the threshold of € 300 billion in 2019 for the EU27 with a growth of 7.7% over the previous year and should reach nearly €355 billion in 2020, growing at 9.3% (Fig. 2.2). In relative terms, the impact of the data economy on the EU27 GDP was 2.6% in 2019.

Fig. 2.2: Data economy value in the EU-27



*Estimate

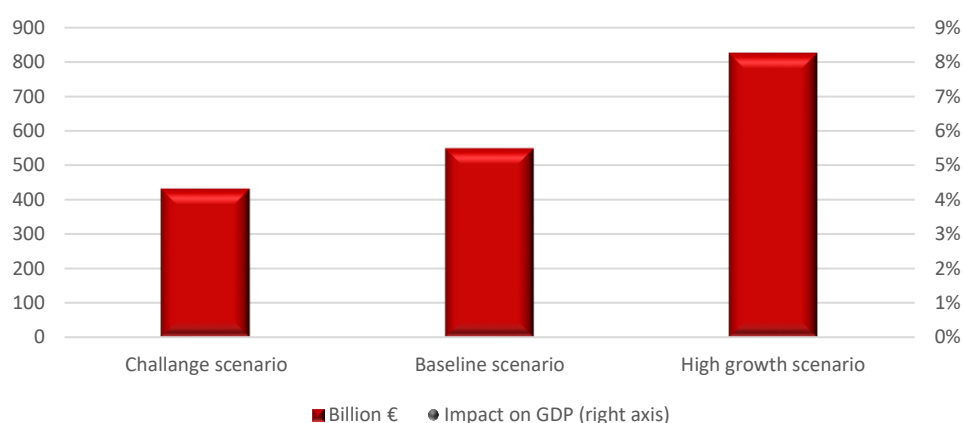
Source: IDC European Data Market Monitoring Tool, 2020

Moreover, according to the estimates, in the **Baseline scenario**⁷, that is considered the most likely, the EU27 data economy will grow faster in the next years, reaching a value of €550 billion in 2025

⁷ The Baseline scenario involves a healthy growth of data innovation, a moderate concentration of power by dominant data owners with a data governance model protecting personal data rights, and an uneven but rather wide distribution of data innovation benefits in society

at a 9.1% CAGR in the period 2020-2025 with a 4% impact on GDP. Instead, the CAGR over 2020-2025 in the EU27 for the **High Growth scenario**⁸ would be 18.4%, resulting in the data economy for the EU27 to surpass €827 billion, accounting for 5.9% of the GDP in 2025. In the **Challenge scenario**⁹, the CAGR over 2020-2025 for the EU-27 would be 4%, more than halved compared to the Baseline, with the data economy being just above €430 billion, and accounting for 3.3% of the GDP in 2025 (Fig. 2.3)

Fig. 2.3: Data economy forecast in 2025 and impacts on GDP according to the three scenarios



Source: IDC European Data Market Monitoring Tool, 2020

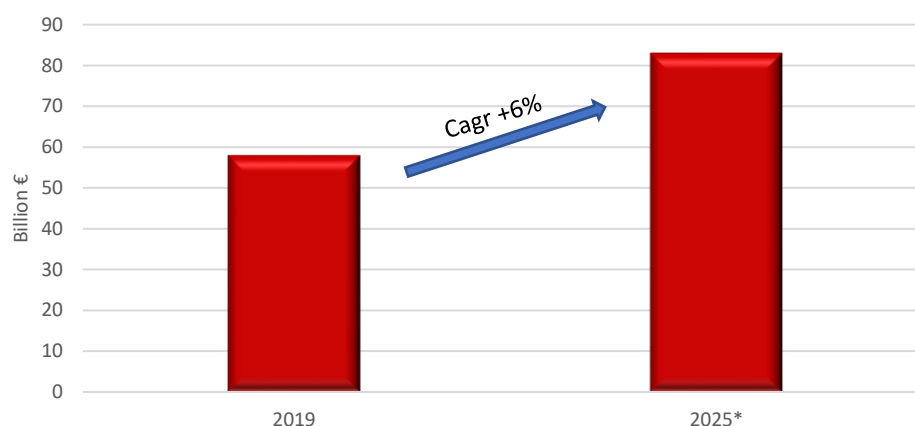
The positive trend in the growth of the data economy is also confirmed by the **data market**¹⁰ value that reached €58 billion in 2019 for the EU27, up by 5% from 2018, and is expected to amount to approximately €80 billion in 2025, with a CAGR of 6% in the period 2019-2025 (Fig. 2.4).

⁸ The High Growth scenario involves a high level of data innovation, low data power concentration, an open and transparent data governance model with high data sharing, and a wide distribution of the benefits of data innovation in society

⁹ The Challenge scenario involves a low level of data innovation, a moderate level of data power concentration due to digital markets fragmentation, and an uneven distribution of data innovation benefits in society.

¹⁰ The market where digital data is exchanged as products or services derived from raw data.

Fig. 2.4: Data market value in the EU27



*Baseline scenario

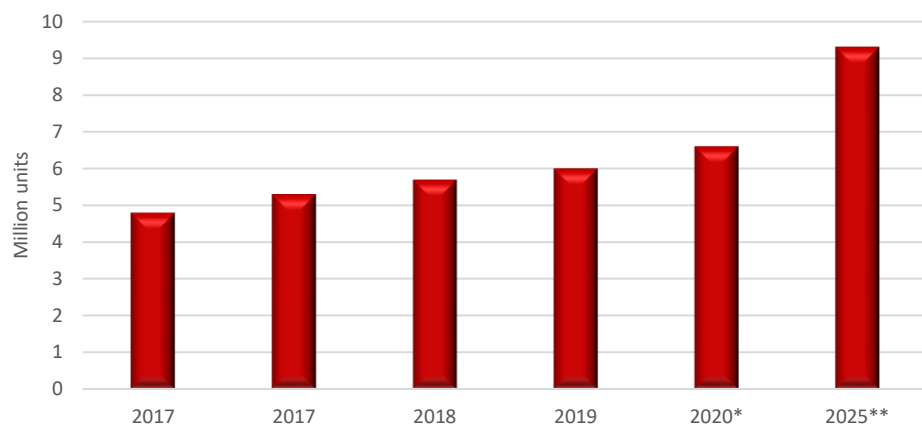
Source: IDC European Data Market Monitoring Tool, 2020

Unfortunately, the lack of adequate **skills** risks becoming an important barrier to development in the data industry and the adoption of data-driven innovation. According to the latest estimates, the number of **data professionals**¹¹ in the EU27 amounted to 6 million in 2019, corresponding to 3.3% of the total workforce, with an increase of 6% over the previous year. This number should reach 6.6 million units in 2020, and according to the Baseline scenario data professionals are expected to amount to 9.3 million in 2025 (Fig. 2.5).

However, the EDM Monitoring Tool continues to register an **imbalance between the demand and the supply of data skills** in Europe as the estimated gap showed approximately 399,000 unfilled positions in the EU27, corresponding to 6.2% of total demand. This **skills gap** is expected to widen even more, reaching 759,000 units in 2025, 8.2% of total skills demand (Fig. 2.6).

¹¹ Data professionals are workers who collect, store, manage, and/or analyse, interpret, and visualise data as their primary or as a relevant part of their activity. Data professionals must be proficient with the use of structured and unstructured data, should be able to work with a huge amount of data and be familiar with emerging database technologies.

Fig. 2.5: Data professionals in the EU27

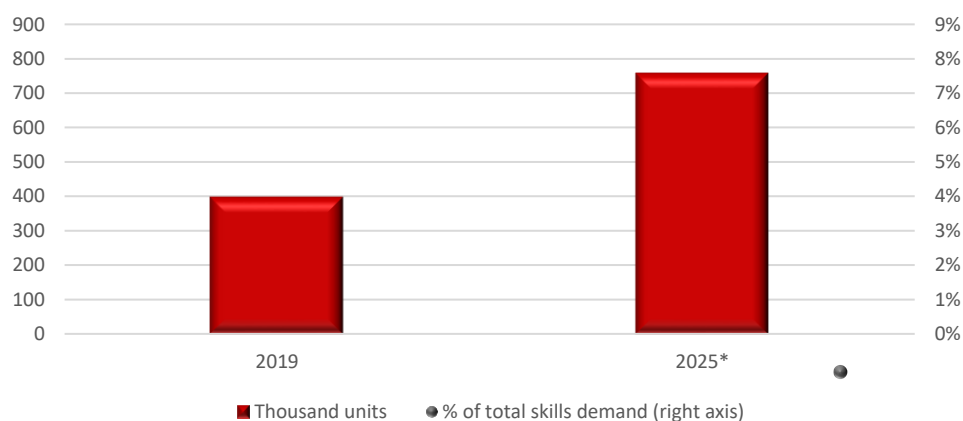


*Estimate

**Baseline scenario

Source: IDC European Data Market Monitoring Tool (2020)

Fig. 2.6: Skills gap for data professionals in the EU27



*Baseline scenario

Source: IDC European Data Market Monitoring Tool (2020)

2.2. The European debate on digital sovereignty and the Gaia-X launch

Since the end of 2019, the upsurge of nationalism and protectionism at the European political level has also spread to the digital environment. As shown by the approval of the GDPR, there is growing **concern among EU countries on the importance of data** and on the risks that may emerge from an excessive dependence on foreign technology. The many advantages brought about by cloud computing are now being exploited by several European public bodies and enterprises, but most of these have mainly **adopted non-European service providers**, meaning that data from key European players is stored in servers of private non-EU companies. The Commission is particularly concerned about the issues regarding **data ownership and management** within European MSs and on the potential **lack of privacy** and absence of data protection for personal information collected by foreign providers.

Therefore, the EU institutions and Member States are pushing forward on the creation of a common **European Cloud Federation**. On 15 October 2020, 25 out of the 27 MSs adopted a joint declaration agreeing on working together on a European cloud federation initiative. This is a project aimed at shaping a secure, efficient and interoperable cloud supply for Europe, needed to develop future data-driven innovation and emerging technologies, such as 5G/6G and AI. They also agreed to cooperate on creating the **EU Cloud Rulebook**, a set of common technical rules and norms on the EU Cloud initiative, as well as deploying interconnected cloud capacities across MSs, including common marketplaces. The implementation of this cloud federation will be facilitated by the Commission and then driven by the nascent **European Alliance for Industrial Data and Cloud**, which is expected to be launched by the end of the year. This alliance will allow interested Member States, industries and relevant experts to work together to design business, investment and implementation plans to deploy the next generation cloud capacities for the public and private sectors.

Control over personal data, and the **profit** from it, have made the provision of cloud services the main issue of the debate on “digital sovereignty”. Besides the concerns over cloud users’ ability to maintain control over strategic and sensitive personal and non-personal data, commercial practices and a **lack of interoperability** between cloud providers create risks of vendor lock-in, **undermining user trust and cloud uptake**. In the current situation, the benefits of the cloud have remained largely unexploited by EU businesses and the public sector, causing a significant loss in potential EU economic growth. In terms of money, the market for cloud storage has been in continuous expansion since 2015 and is forecasted to **produce more than \$50 billion in revenues by 2025**. Indicators highlight that the EU is lagging behind in the global race for new technologies,

digital services and AI, with the geographical distribution of major high-tech platforms showing a high concentration in the US and Asian (mainly Chinese) markets.

Therefore, EU policy-makers have begun developing digital autonomy strategies to counter the current trend whereby European businesses and public administrations are highly dependent on services imported from US or Chinese operators. Together with some of their leading high-tech firms, France and Germany, in response to this, have promoted the creation of the **European “Gaia-X” cloud project**, a federated data infrastructure which would allow for the management, access and control of data belonging to EU citizens and businesses.

The complex nature of these technologies and their continuous development have complicated this geo-political and technological debate, which also includes issues regarding the optimisation of data management, the redistribution of personal and non-personal information in several data centres, and the adoption of competition and regulatory tools ensuring transparency and trust. While the persisting gaps in European investments (R&D) and business development have guaranteed that the US providers have a better quality in services, speed, usability, as well as lower costs due to the global scale of their investments, the GAIA-X project plans to create a new pan-European platform pooling together different cloud service providers. However, it is not intended to compete against existing offers, but **focus on linking different elements through open interfaces and standards to create an innovative aggregation platform**.

On 15 September 2020, **22 firms from both France and Germany** officially registered a non-profit organisation name “GAIA-X AISBL”, *association internationale sans lucrative*. The project plans to create an environment in which EU Cloud Solution Providers (CSPs), High Performance Computing (HPC) and specific clouds in edge computing systems can share and store information **under European data protection standards**. The development of these services will follow the principles of the Security by Design, the Privacy by Design, as well as the two self-regulatory Codes of Conduct on data portability and cloud switching on ‘Infrastructure as a service’ and ‘Software as a service’ portability, to **allow smaller companies and new market entrants to compete**.

The platform will mainly operate in the areas concerning the **creation of trust mechanisms** that guarantee the identities of sources and recipients, access and usage rights, and an overall harmonisation of existing standards in order to allow for interoperability of infrastructures, applications and data. Furthermore, it will intervene in the provision of data through federal **catalogues** and in the establishment of **compulsory EU-wide certification** and standard schemes to support suppliers in offering safe and compatible services.

More than **300 firms** have been involved up to now, **including major US cloud providers and other extra-European players**, as non-European firms can also enter the scheme if they accept the

standards in line with EU values. This is to **promote a level playing field** open to all who accept the common principles, without encountering market barriers or protectionist issues. Therefore, the intent of the European founders of “Gaia X” is to establish general rules and frameworks for integration into the Gaia X ecosystem and, at the same time, to exploit the skills and the experience of non-European players.

The Commission also plans to integrate this platform with **investments in the rest of the cloud infrastructure** – from computing to software - to improve the European supply of “cloud and data infrastructure”. The Commission considers the cloud infrastructure essential to guaranteeing sovereignty for the future, as well as creating a more dynamic market for "data infrastructure provision", that includes Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

Therefore, the focus on a secure and competitive cloud offer is considered to be essential for **providing the trustworthy data processing infrastructure and services** that public administrations, businesses and citizens require in Europe. In order to reach this goal, the Commission is considering the possibility to pool funds from different resources. The **Recovery Fund** should allocate up to 20% (€130 billion) to digital innovation, an initial injection towards building a solid European data infrastructure, made up of cloud services, platform software and skills development. The Commission foresees **€2 billion** from the Digital Europe Programme, from Horizon Europe and the Connecting Europe Facility, specifically earmarked for common data spaces and cloud and data infrastructures. In addition, funds should also be destined through the European Green Deal for the development of eco-friendly efficient cloud services and energy efficient data centres.

The Commission also expects Member States to contribute to creating common networks, **combining funds from the private and public sectors**, with a total funding of €10 billion.

2.3. The European regulatory framework. The European Strategy for Data

Three main pieces of legislation currently provide the legislative framework for data - the General Data Protection Regulation (Reg. 2016/679), the Regulation on the free flow of non-personal data (Reg. 2018/1807) and the Open Data Directive (Directive 2019/1024). To ensure a coherent and comprehensive approach, a set of actions has already been established by the von der Leyen Commission, starting from the European Strategy for Data.

Specifically, on 19 February 2020, the European Commission presented the Communication **“Shaping Europe’s digital future”**, providing the background for the renewed European Digital Strategy. It identifies as its macro-objectives: 1) the implementation of technologies at the service of individuals, underlining the importance of investing in digital competences for all Europeans, protecting citizens from cyber-threats (hacking, ransomware, identity theft), ensuring that AI is developed respecting people’s rights and earning their trust, accelerating the roll-out of ultra-fast broadband for homes, schools and hospitals throughout the EU and expanding Europe’s super-computing capacity to develop innovative solutions for medicine, transport and the environment; 2) the creation of a fair and competitive digital economy, proposing a Digital Services Act to strengthen the responsibility of online platforms and clarify rules for online services, underlining the necessity to increase access to high-quality data (ensuring that personal and sensitive data is safeguarded), enabling a vibrant community of innovative and fast-growing start-ups and SMEs to access finance and to expand and ensure a fair competition in Europe; 3) the realisation of an open, democratic and sustainable society, highlighting the contribution of technology to help Europe become climate-neutral by 2050, of the importance to empower citizens with better control and protection of their data, creating a European health data space to foster targeted research, diagnosis and treatment and fight disinformation online and foster diverse and reliable media content.

On the same date, the European Commission published the Data Strategy and the White Paper on Artificial Intelligence which are the first pillars of the Commission’s new digital strategy. Considering that digital technologies have transformed the economy and society, affecting all sectors of activity and the daily lives of all Europeans and that data is at the centre of this transformation, the Communication **“A European strategy for data”** outlines a strategy for policy measures and investments to promote and establish the data economy for the coming five years. This Communication presents a European data strategy aimed at making the EU the most attractive, secure and dynamic data-agile economy in the world – empowering Europe with data to improve decisions and better the lives of all of its citizens.

The Commission is convinced that EU businesses and public sector can be empowered through the use of data to make better decisions, thus, creating a single European data space. This would be a genuine single market for data, open to data from across the world where personal as well as non-personal data, including sensitive business data, is secure and businesses also have easy access to an almost infinite amount of high-quality industrial data, boosting growth and creating value, while minimising the human carbon and environmental footprint.

To achieve this goal, several critical issues need to be overcome concerning: a) **the availability of data** - considering that the value of data lies in its use and re-use and currently there is not enough data available for innovative re-use, the strategy underlines the importance to guarantee government-to-business (G2B) data sharing (to ensure that data generated by the public sector, as well as the value created, should be available for the common good by ensuring, including through preferential access, that this data is used by researchers, other public institutions, SMEs or start-ups), business-to-business (B2B) data-sharing (removing the current lack of economic incentives, of trust between economic operators that the data will be used in line with contractual agreements, imbalances in negotiating power, the fear of misappropriation of the data by third parties, and a lack of legal clarity on who can do what with the data), business-to-government (B2G) data sharing (to improve evidence-driven policy-making and public services such as mobility management or enhancing the scope and timeliness of official statistics) and sharing of data between public authorities (to improve policy-making and public services, but also to reduce the administrative burden on companies operating in the Single Market); b) **imbalances in market power**, in the provision of cloud services and data infrastructures, but also in relation to access to and use of data; c) **data interoperability and quality**, encouraging the application of standard and shared compatible formats and protocols for gathering and processing data from different sources in a coherent and interoperable manner across sectors and vertical markets; d) **data governance**, to further reinforce the governance of data use in society and the economy; e) **data infrastructures and technologies**, underlining several critical issues on both the supply and demand side of cloud as EU-based cloud providers only have a small share of the cloud market with an insufficient visibility, and service providers operating in the EU may also be subject to legislation of third countries (with the risk that EU citizen and business data may be accessed by third country jurisdictions that are in contradiction with the EU’s data protection framework). As well, there is a low cloud uptake in Europe and European businesses often experience problems with multi-cloud interoperability (in particular, data portability); f) **empowering individuals to exercise their rights**, underlining that even if individuals value the high level of protection granted by the GDPR and ePrivacy legislation, they suffer from the absence of technical tools and standards that make the exercise of their rights simple and not overly burdensome; g) **skills and data literacy**, highlighting that general data literacy in the workforce and across the population is relatively low with gaps that need to be addressed to master the challenges of the data economy and society; h) **cybersecurity**.

Considering these issues, the Commission has outlined a strategy focused on **four pillars and several key actions**: 1) **a cross-sectoral governance framework for data access and use**. Key actions: a) cross-sectoral (or horizontal) measures for data access and use establishing a legislative

framework for the governance of common European data spaces (Q4 2020) to strengthen the governance mechanisms at EU and MS level relevant for cross-sector data use and for data use in the common sectoral data spaces, involving both private and public players, facilitating decisions on which data can be used, and how and by whom for scientific research purposes compliant with the GDPR and making it easier for individuals to allow the use of the data they generate for the public good, if they so wish ('data altruism'), in compliance with the GDPR; b) starting the procedure for the adoption of an implementing act on high-value data sets (Q1 2021) under the Open Data Directive, making these data sets available across the EU for free, in machine-readable format and through standardised Application Programming Interfaces (APIs); c) the adoption of a Data Act (2021); d) analysis of the importance of data in the digital economy (e.g. through the Observatory of the Online Platform Economy), and review of the existing policy framework under the Digital Services Act package (Q4 2020); 2) **enablers, involving investments** in data and strengthening Europe's capabilities and infrastructures for hosting, processing and using data, interoperability. Key actions: a) investing in a High Impact project on European data spaces; b) signing a Memoranda of Understanding with MSs on cloud federation (Q3 2020); c) launching a European cloud service marketplace, integrating the full stack of cloud service offering (Q4 2022); d) creating an EU (self-)regulatory cloud rulebook (Q2 2022); 3) **competences**, empowering individuals, investing in skills and in SMEs. Key action: exploring ways to enhance the portability right for individuals under Article 20 of the GDPR giving them more control over who can access and use machine-generated data (possibly as part of the Data Act in 2021); 4) **common European data spaces** in strategic sectors and domains of public interest. The Commission will promote the development of common European data spaces in strategic economic sectors - Industry (manufacturing), the Green Deal, Mobility, Health, Finance, Energy, Agriculture, Public Administrations and Skills. Key action: creating a framework to measure data flows and estimate their economic value within Europe, as well as between Europe and the rest of the world (Q4 2021).

The European Strategy for Data was subject to **public consultation** until 31 May 2020. This online consultation is part of a broader stakeholder consultation that will contribute to the preparation of several data initiatives including a legislative framework on the common European data spaces, expected in 2020, and an implementing act on a list of high-value datasets, expected in 2021. On 24 July 2020, the Commission published a **summary report** taking stock of the contributions and presenting the main trends. In total, 806 contributions were received - 338 from a company or business organisation/association, 201 from citizens (all EU citizens), 98 from academic/research institutions, and 57 from public authorities. Consumers were represented by 7 respondents and non-government organisations (including 2 environmental organisations) by 54 respondents.

The online consultation involved general questions on the data strategy (section 1), specific questions on data governance (section 2.1) - including standardisation, secondary use of data, data donation and data intermediaries -, specific questions on high-value datasets (section 2.2), and specific questions on the (self-/co-) regulatory context of cloud computing (section 2.3).

For the **general questions**, there is consensus on the need to increase data availability, make it easier for individuals to grant access to their existing data, in line with the GDPR, remove difficulties in using data from other companies, and make major investments in technologies and infrastructures that enhance data access and use, while giving individuals, as well as public and private organisations, full control over the data they generate.

Where **governance** is concerned, there is a general consensus that standardisation is necessary to improve interoperability and ultimately data re-use across sectors. As for making a broader range of sensitive data available for R&I purposes for public interest, the report highlights the importance that public authorities place on the anonymity of specific data for concrete use-cases and the clarification of the legal rules. For “data altruism”, instead, the lack of sufficient tools and mechanisms to ‘donate’ their data was underlined. Regarding the specific questions on **high-value datasets**, the respondents consider the establishment of a list of high-value datasets, to be made available free of charge, without restrictions and via Application Programme Interfaces (APIs). This is seen a good way to ensure that public sector data has a positive impact on the EU’s economy and society, as well as providing funding to enhance the availability and re-use of high-value datasets across Europe, especially those to improve the quality (e.g. machine-readability) and interoperability of the data/metadata and, to a lesser extent, funding for engaging with re-users. As for the regulatory context of **cloud computing**, the stakeholders answered that the cloud market currently offers the technological solutions that businesses need to grow and innovate, even if a significant percentage of respondents underlined the existence of problems in cloud market functioning, of barriers (security, technical and economic/cost barriers), and the idea that security concerns represent the most prominent risk for the future.

To set up the regulation on data spaces, on 2 July 2020, the European Commission published an **Inception Impact Assessment** to inform citizens and stakeholders about the Commission's plans so as to allow them to provide feedback. This document defines objectives and policy options and identifies likely economic, social and environmental impacts, and also likely impacts on

fundamental rights and simplification and/or administrative burdens. The adoption of the initiative is expected in Q4 2020.

Member States expressed their opinion on the Commission’s strategy in the conclusions adopted on 9 June 2020 by the Council and on 2 October 2020 by the European Council. The **conclusions adopted on 9 June by the Council** underline the need to develop a human-centred European data economy in accordance with common EU values, human rights and fundamental freedoms, founded on the interests of European citizens and businesses, and in compliance with privacy and data protection rights, competition law and intellectual property rights. They also stress that individuals, employees and companies in Europe should retain control over their data, based on secure data infrastructures and resilient, trustable value chains, while preserving the EU principle of openness vis à vis third countries and the importance to ensure the availability of adequate infrastructures. This should strengthen Europe’s autonomy and place Europe as the best place in the world for sharing, protecting, storing and using data.

The Council has specifically encouraged the Commission to: 1) facilitate the emergence of **new data-driven ecosystems**; 2) present concrete proposals on **data governance** and to encourage the development of **common European data spaces for strategic sectors** of the industry and domains of public interest (including health, environment, public administration, manufacturing, agriculture, energy, mobility, financial services and skills) based on a joint effort between the public and the private sector to deliver high quality data by all parties involved; 3) initiate discussions on the modalities of ensuring **fair access to and use of privately held data**, including promoting data sharing arrangements based on fair, transparent, reasonable, proportionate and non-discriminatory conditions; 4) ensure **trustable, safe and secure European cloud services and high performance computation capacity** usable by the MSs on a voluntary basis; 5) guarantee **high capacity connectivity infrastructures**, including submarine cables, connecting mainland Europe, islands and outermost regions, to effectively and efficiently build up such a federation; 6) ensure, where necessary through new proposals, that cloud services provided in Europe comply with key **interoperability, portability and security requirements**, inter alia, to guarantee that there is no vendor lock-in and balanced, fair and transparent contractual conditions for the access of all market players to cloud infrastructure and cloud services; 7) speed up the delivery of a coherent framework around the **applicable rules and self-regulation for cloud services**, in the form of a ‘cloud rulebook’, to increase clarity and to facilitate compliance.

The **conclusions adopted by the European Council** on 2 October 2020, instead, reaffirm the appreciation of the Council for the European Strategy for Data, which supports the EU’s global digital ambitions to build a true European competitive data economy, while ensuring European

values and a high level of data security, data protection and privacy, and stress the need to make high-quality data more readily available and to promote and enable better sharing and pooling of data, as well as interoperability. The European Council welcomes the creation of common European data spaces in strategic sectors, underlining the importance of prioritising the **health data space**, which should be set up by the end of 2021. The European Council also highlights the importance of establishing trustable, safe and secure European cloud services in order to ensure that European data can be stored and processed in Europe, in compliance with European rules and standards, and welcomes the concept of an EU federated cloud infrastructure inviting the Commission to take this work forward swiftly.

On 15 October 2020, the 27 EU Member States signed a **Joint Declaration** on “*Building the next generation cloud for businesses and the public sector in the EU*”, agreeing to work together towards deploying resilient and competitive cloud infrastructures and services across Europe. Member States recognised the need for additional investments, enhanced synergies across national initiatives and a coordinated strategy to lead the cloud uptake in the private and public sectors across Europe. In particular, as agreed in the Declaration, the Member States’ joint actions will focus on: 1) combining private, national and EU investments in deploying competitive, green and secure cloud infrastructures and services. This will mean pursuing the next steps together with industry and experts to shape the *European Alliance on Industrial Data and Cloud*, to be launched by the end of the year; 2) defining a common European approach on federating cloud capacities, by working towards one set of joint technical solutions and policy norms in order to foster pan-European interoperable EU cloud services; 3) driving the take-up of more secure, interoperable and energy-efficient data centres and cloud services, especially for SMEs, start-ups and the public sector.

On **25 November 2020**, the Commission proposed a **regulation on European data governance** (Data Governance Act). This proposal is the first deliverable under the European strategy for data and aims to foster the availability of data for use by increasing trust in data intermediaries and by strengthening data-sharing mechanisms across the EU. The proposal, complementing the Directive n. 2019/1024 of 20 June 2019 on open data and the re-use of public sector information (Open Data Directive), includes measures to: 1) increase **trust** in data sharing, as the lack of trust is currently a major obstacle and results in high costs; 2) create new EU rules on **neutrality** to allow novel data intermediaries to function as trustworthy organisers of data sharing; 3) facilitate the **reuse** of certain data held by the public sector; 4) give Europeans **control** over the use of the data they generate, by making it easier and safer for companies and individuals to voluntarily make their data available for the wider common good under clear conditions.

The regulation lays down: **1) conditions for the re-use**, within the Union, of certain categories of data held by public sector bodies, specifically, data held by public sector bodies which are protected on grounds of commercial confidentiality, statistical confidentiality, protection of intellectual property rights of third parties and protection of personal data. The proposal: a) prohibits agreements or other practices pertaining to the re-use of data held by public sector bodies containing these categories of data which grant exclusive rights or which have as their object or effect to grant such exclusive rights or to restrict the availability of data for re-use, except for the case of provision of a service or a product in the general interest (the award of an exclusive right shall be transparent and be made publicly available online regardless of a possible publication of an award of a public procurement and concessions contract); b) provides a **period of exclusivity of the right to re-use data** not exceeding three years; c) sets the conditions for re-use prescribing that they shall be **non-discriminatory, proportionate and objectively justified** with regard to categories of data and purposes of re-use and the nature of the data for which re-use is allowed. These conditions will also not be used to restrict competition; d) **attributes public sector bodies the possibility to impose obligations** to (i) access and re-use the data within a secure processing environment provided and controlled by the public sector ; (ii) access and re-use the data within the physical premises in which the secure processing environment is located, if remote access cannot be allowed without jeopardising the rights and interests of third parties; e) **gives the public sector the power to verify any results of processing of data undertaken by the re-user** and reserve the right to prohibit the use of results that contain information jeopardising the rights and interests of third parties; f) prescribes that **fees** for allowing the re-use shall be non-discriminatory, proportionate and objectively justified, will not restrict competition, be derived from the costs related to the processing of requests for re-use (providing the publication by the public sector body of a description of the main categories of costs and the rules used for the allocation of costs) and be paid online through widely available cross-border payment services (without discrimination based on the place of establishment of the payment service provider, the place of issue of the payment instrument or the location of the payment account within the Union); **2) requirements applicable to data sharing services**. The regulation identifies specific data sharing services¹²

¹²¹² (a) intermediation services between data holders which are legal persons and potential data users, including making available the technical or other means to enable such services; those services may include bilateral or multilateral exchanges of data or the creation of platforms or databases enabling the exchange or joint exploitation of data, as well as the establishment of a specific infrastructure for the interconnection of data holders and data users; (b) intermediation services between data subjects that seek to make their personal data available and potential data users, including making available the technical or other means to enable such services, in the exercise of the rights provided in Regulation (EU) 2016/679; (c) services of data cooperatives, that is to say, services supporting data subjects or one-person companies or micro, small and medium-sized enterprises, who are members of the cooperative or who confer the power to the cooperative

subject to notification procedure to the competent authority (which may charge fees) and identifies the information to be included. It also prescribes that a provider of data sharing services that is not established in the Union, but offers the services referred to in art. 9 within the Union, shall appoint a legal representative in one of the Member States in which those services are offered. The proposal sets the conditions of data sharing services foreseeing that fair, transparent and non-discriminatory procedures for access to the service for both data holders and data users, the provision by the provider of procedures to prevent fraudulent or abusive practices in relation to access to data and adequate technical, legal and organisational measures to prevent transfer or access to non-personal data that is unlawful under Union law and ensure a high level of security for the storage and transmission of non-personal data. The same rules allow providers to convert the data into specific formats only to enhance interoperability within and across sectors or if requested by the data user or where mandated by Union law or to ensure harmonisation with international or European data standards and prescribes the specification of the jurisdiction in which the data use is intended to take place when a provider provides tools for obtaining consent from data subjects or permission to process data made available by legal persons; **3) data altruism.** The proposal sets general requirements for registration of data altruism organisations and identifies information to be contained in application for registration. It also prescribes the transparency requirements that any entity entered in the national register of recognised data altruism organisations shall observe setting an obligation to communicate an annual activity report to the competent national authority containing information on the activities of the entity, a list of all natural and legal persons that are allowed to use data it holds, a summary of the results of the data uses allowed by the entity and information on sources of revenue of the entity. In order to facilitate the collection of data based on data altruism, the proposal delegates to the Commission the adoption of implementing acts developing a European data altruism consent form; **4) competent authorities and procedural provisions.** Chapter V identifies requirements relating to competent authorities and sets the right to an effective judicial remedy; **5) European Data Innovation Board.** The proposal allows the Commission to establish a European Data Innovation Board in the form of an Expert Group, made up of representatives from competent authorities of all the Member States, the European Data Protection Board, the Commission, relevant data spaces and other representatives of competent authorities in specific sectors and identifies the tasks.

More dedicated proposals on data spaces are expected to follow in 2021, complemented by a Data Act to foster data sharing among businesses, and between business and governments.

to negotiate terms and conditions for data processing before they consent, in making informed choices before consenting to data processing, and allowing for mechanisms to exchange views on data processing purposes and conditions that would best represent the interests of data subjects or legal persons.

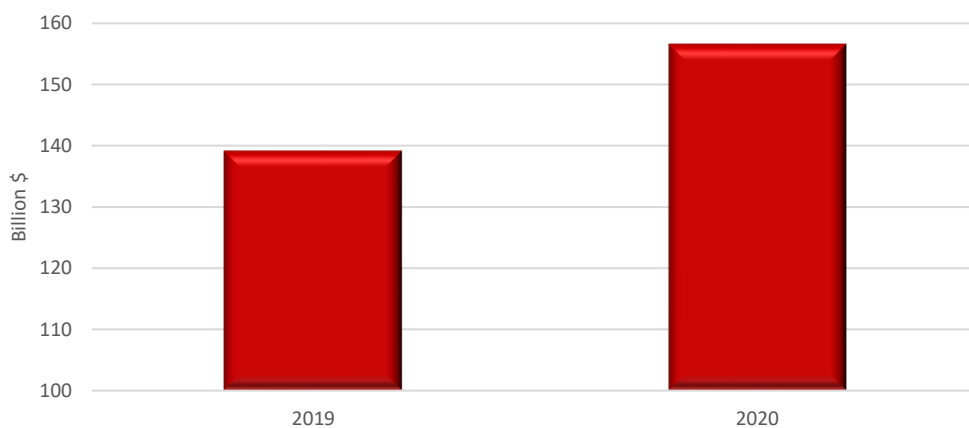
3. ARTIFICIAL INTELLIGENCE FOR EUROPE

3.1. The global artificial intelligence market

AI is markedly changing all aspects of our daily life and it is very difficult to imagine a segment of society that will not be transformed in the years to come by these new technologies. Thanks to the intense research activity in the field of AI, nowadays, several intelligent technologies, such as computer vision, natural language understanding, decision support systems, machine learning and robotics, are reaching levels of maturity so as to be able to be applied in different sectors and business contexts and to increasingly consolidate the interest of companies in them.

This is a growing interest which is confirmed by the exponential growth registered by the **AI market** in recent years. According to the recent report of IDC (International Data Corporation)¹³, worldwide revenues for the AI market, including software, hardware and services, are expected to total \$156.5 billion in 2020, an increase of 12.3% over 2019 (Fig. 3.1). While this year's growth is somewhat slower than previous years due to the economic impact of Covid-19, IDC analysts believes investment in AI will recover quickly, so much so that, in 2024 ,global revenues are estimated to exceed \$ 300 billion, with a five-year CAGR of 17.1%.

Fig. 3.1: Worldwide revenues for AI



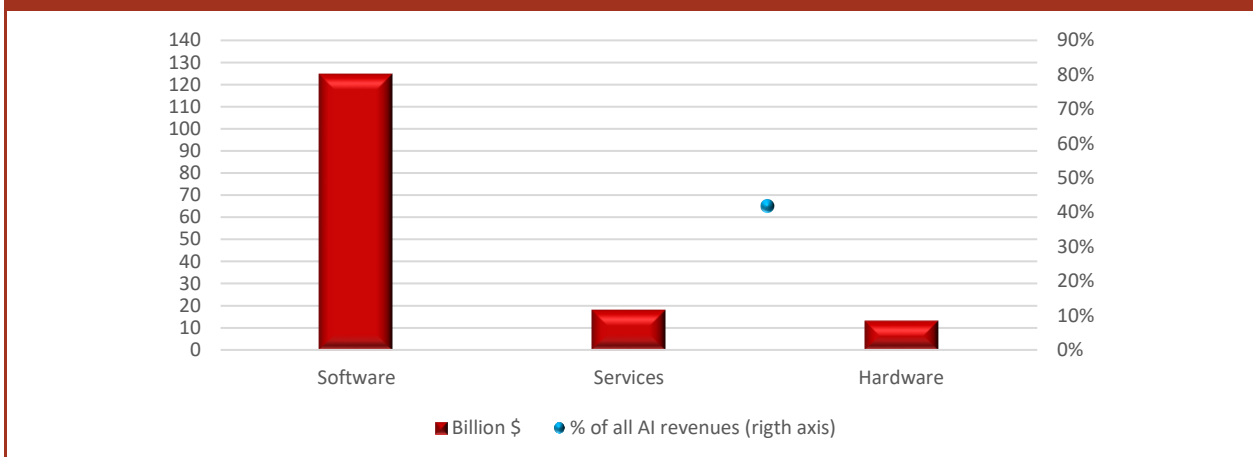
Source: IDC, 2020

Software is the largest AI segment delivering roughly 80% of all AI revenue. Most of the software revenue comes from AI applications (\$120.4 bn in 2020) with AI software platforms (\$4.3 bn)

¹³ <https://www.idc.com/getdoc.jsp?containerId=prUS46757920> (Last access: 23.11.20))

making up the remainder. The second largest AI category is services, which IDC forecasts will reach \$18.4 billion in 2020, an increase of 13% year over year. Finally, IDC expects AI hardware (server and storage combined) revenues to reach \$13.4 billion in 2020, representing 10.3% year-over-year growth, which is a marked drop from the prior year when it grew 33.4% (Fig. 3.2).

Fig. 3.2: Worldwide revenues for AI, by segment



Source: IDC, 2020

3.2. The AI global race: EU vs. US and China

China, the US and the EU have shown different approaches to the development, implementation and regulation of AI, outlined in their respective strategies (New Generation of AI Development Plan, American AI initiative, and White Paper on AI). **China** designed a plan based on three sequential goals: (1) to reach a globally advanced level in terms of AI by 2020; (2) to use AI as the main driver for upgrading its economic and industrial capabilities by 2025; and (3) to become the main innovation hub in the world by 2030. This strategy is mainly focused on the role of the state, which protects and invests in those businesses that have made it to the top after an initial phase of fierce domestic competition.

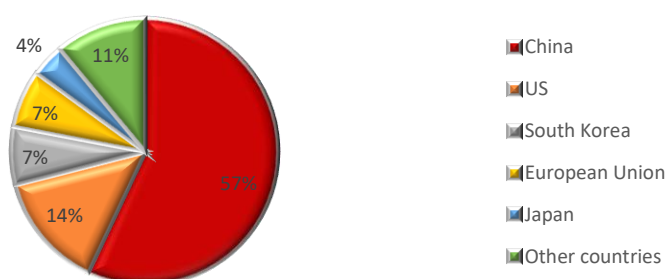
On the other hand, the **US** gives a much more prominent role to the market and the investments made by big corporations, maximising space for innovation through lighter public regulation. The US strategy relies, to a greater extent, on voluntary self-regulation and the protection of values that they consider as “core”, such as freedom, human rights or the rule of law. Finally, the **EU** is trying to develop legislation that paves a third way, promoting what is dubbed as “ethical and trustworthy AI”. Its strategy aims at fostering cooperation between the public and private sector,

as well as ensuring a set of values that are considered to be key (e.g., transparency, accuracy, robustness and non-discrimination)¹⁴.

However, comparing the EU to other world regions, especially China and US, a pattern of a clear competitive disadvantage seems to emerge.

In terms of **patents**, China appears in a very strong leading position. Almost 60% of all AI patenting firms are from China, versus 14% from the US and 7% from South Korea and the EU (Fig. 3.3)¹⁵.

Fig. 3.3: AI firms with at least one patent application in AI (2009-2018)



Source: European Commission, 2020

It should be pointed out that the situation is different if we exclusively consider players with publications on AI related key areas. The EU28 is the leading area, with 34% of the total AI players worldwide. The US follows closely, whereas China holds only 9.32% (Fig. 3.4).

Moreover, out of 41 AI unicorns in March 2019, 18 were based in the US, 17 in China and only 1 in the EU¹⁶.

In 2018, a wider look at the start-up environment allowed Roland Berger and Asgard to survey 769 EU start-ups specialised in AI, much less than in the US (1,393), but significantly more than in China (383). However, close to one-third of the EU start-ups were based in the UK, now no longer a EU Member State. Moreover, in a world ranking of hosting cities, the first EU hub (Paris) is only in 10th position, due to extreme fragmentation in Europe.

Fragmentation is definitely one factor at play, reducing EU chances to become an AI world leader, frustrating the high potential to be found in the number of top EU scientists (by far the highest in the world, according to a recent study by Tsinghua University).

¹⁴ [PromethEUs, THE N\(EU\) WAY TO ARTIFICIAL INTELLIGENCE \(2020\)](#)

¹⁵ [jrc120106_jrc120106_tes_analysis_ai_worldwide_ecosystem_1.pdf\(europa.eu\)](#)

¹⁶ Global Artificial Intelligence Industry Data Report, China Academy of Information and Communications Technology

Fig. 3.4: AI frontier research players by country (2009-2018)

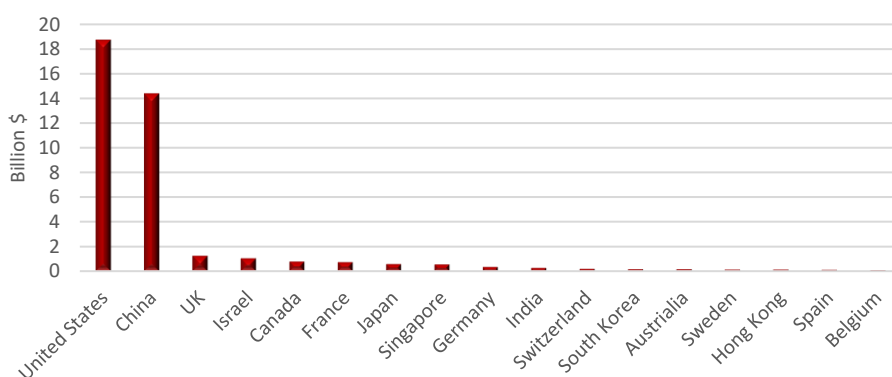


Source: European Commission, 2020

However, the gap in the overall amount of **investments** appears to be the most startling reason for Europe lagging behind the US and China.

In 2018, according to Stanford University estimates, US companies invested \$18.7 billion in AI, compared to China's \$14.35 billion. The main 5 EU Member States (France, Germany, Sweden, Spain and Belgium) together slightly exceeded the level of UK investment (\$1.461 bn vs. \$1.27 bn), and only slightly surpassing the much less populated Israel (\$1.044 bn) (Fig. 3.5). However, also in terms of public investments, the US is allocating large resources, projected to amount to approximately \$5 billion (\$ 4bn from the Department of Defense).

Fig. 3.5: Private Investment in AI (2018)

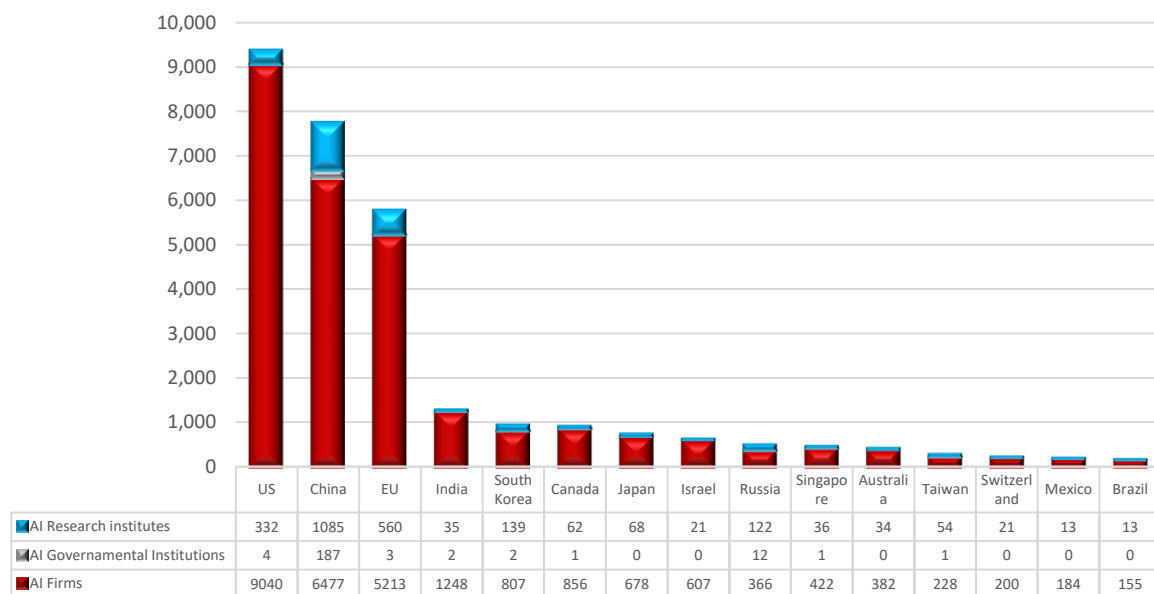


Source: Artificial Intelligence Index Report 2019, Stanford University

3.3. I-Com 2020 Index on AI development in European countries

According to EU Commission data, the European Union is, immediately after the US and China, the main region globally to have a thriving **AI ecosystem**, populated by over 5,000 companies and 560 research institutes (Fig. 3.6).

Fig. 3.6: Number of AI players active globally (2009-2018)



Source: EU Commission, 2020

However, if we analyse the situation at the level of single Member States, substantial differences are highlighted, with some countries keeping pace even at the international level, and other countries not being very inclined to full AI adoption.

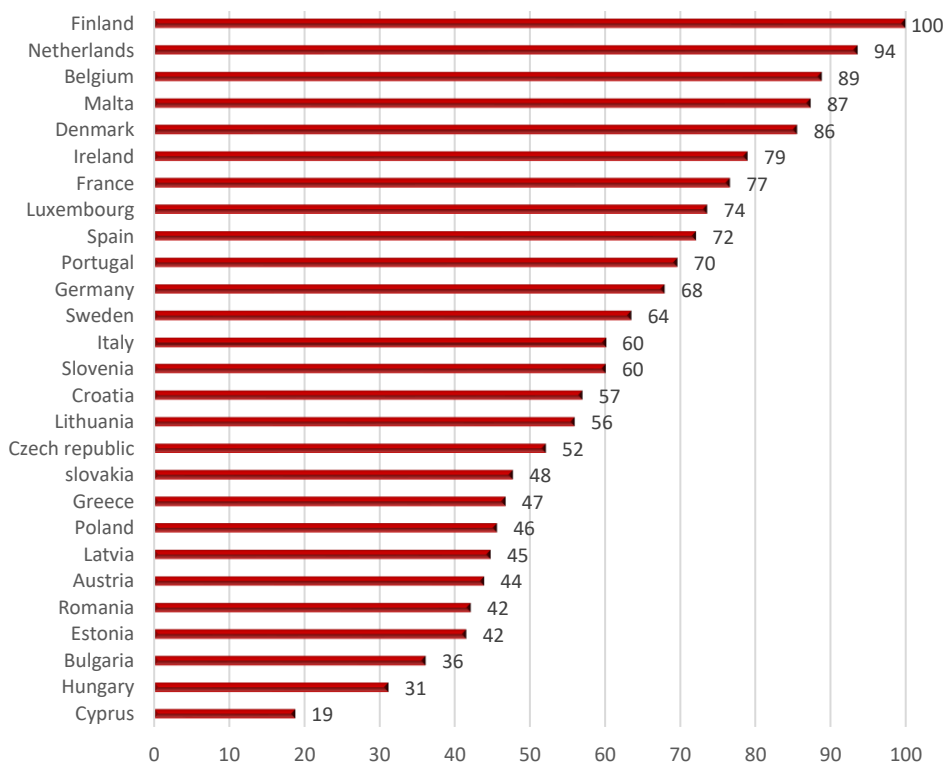
In order to provide an idea of the degree of **AI development** in EU countries, I-Com has developed a **synthetic index** (Fig. 3.7) that takes into account some variables relating to the industrial and research AI ecosystem in the various Member States, as well as the level of the adoption of some technologies closely linked to it and the analysis of Big Data:

- Number of AI firms (per capita value)
- Number of AI research institutes (per capita value)
- Number of AI companies that have filed patent applications for AI applications (in % of AI companies)
- Companies that use 3D printing (in % of total companies)
- Companies using robots (in % of total companies)

- Companies that analyse Big Data from any source (in % of total companies).

Each listed variable was appropriately weighted and an average of the variables was calculated for each country. The values obtained were normalised compared to the country “best performer”, in order to establish a ranking from 0 to 100.

Fig. 3.7: I-Com 2020 Index on AI development in EU countries



Source: I-Com elaboration

At the **top of the ranking** are Finland, the Netherlands and Belgium with a score of 100, 94 and 89, respectively. These countries, despite having lower populations compared to the others - together slightly exceeding 34 million inhabitants, not even half of Germany's population of around 83 million inhabitants - they have a good industrial ecosystem with a number of AI companies, equal to 119, 323 and 96, respectively. Furthermore, they have a much higher percentage than the European average (12%) of companies that analyse Big Data, which is around 20%. France (77) and Germany (68) follow at a distance in seventh and eleventh position. The two main EU countries, while numbering 633 and 711 AI companies, respectively, are far from the podium as, compared to their size, their industrial and AI research ecosystem has not yet been fully developed.

At the **bottom of the ranking**, we mainly find the Eastern Europe countries, where both the industrial and research AI ecosystem sees a lower number of active AI players and where the level of adoption of technologies, such as robots and 3D printing, is very low.

3.4. European challenges for successful AI adoption

It is safe to say that Europe should make more effort into catching up with the current AI leaders, the US and China, since it is lagging well behind. On the other hand, to ensure inclusive and sustainable growth, the **geographical disparities in AI adoption** in Europe have to be confronted. An apparent gap in AI readiness across Europe is quite evident, with Southern and Eastern Europe being greatly behind the Northern states. This can be traced to the notably lower business digitalisation in the southern part of Europe compared to the north where it is much more developed. A high level of digitisation adoption and spread are prerequisites for adopting AI technologies and applications. Smaller firms predominate the entrepreneurial landscape of Southern Europe. SME digitisation is more lacklustre in comparison with larger companies. The limited financial resources, the inability to attract senior professionals, the lack of digital awareness and the absence of an enabling general entrepreneurial framework could serve as the main reasons, amongst other factors, for the low digitisation levels.

As well, **investment in AI development** is much lower in the southern firms compared to their northern counterparts. This is also evident in the small share of R&D investment, where current statistics point out a high concentration in the four largest economies in the EU. Furthermore, it is vital to promote collaboration among research institutions and encourage synergies with the private sector.

Connectivity is also essential for ensuring a viable AI. The Northern EU countries enjoy a comparative advantage to the South, where connection quality is on average inferior.

Human skills are imperative for AI adoption since both high technological capabilities and emotional intelligence abilities, which cannot be easily developed by machines, are equally important. Human capital skills are already in short supply where AI applications are concerned, with evident regional differences existing. Southern EU Member States register a severe insufficiency in digital skills progress and there is a considerable risk of a potential digital exclusion. For instance, in Portugal and Greece, approximately half of the citizens do not possess at least the necessary digital skills. A wide disparity among EU states is present as regards the share of the labour force that has no digital skills. What is more, **ICT specialists** are not equally shared among EU Member States, with the South experiencing a much lower share in proportion to total

employment. Slightly more encouraging is the landscape pertaining to the ratio of ICT graduates to the total number of graduates, but still, there is potential to improve.

Simplifying regulations for SMEs to cluster with other firms or with research institutes could pave their way to AI adoption. Creating a facilitating environment that minimises bureaucratic procedures, motivates participants, focuses on the targets of a cycling economy, open innovation and the AI technologies as a core strategy of such collaborations could serve a double purpose. Firms could transform their business model having at their core AI applications, sharing the risk mitigated by investing in new technologies and greatly increasing their productivity. At the same time, universities could be able to commercialise their research increasing added value in production and leading to an overall more sustainable growth model.

Cultural barriers should also not be neglected. Southern countries may need to nurture a technologically-friendly environment that would encourage firms, and particularly new ventures, to produce, adopt and spread innovation. AI should be included in the strategic planning of firms. Smart specialisation focused on technological advance could benefit the scope of AI adoption. The **involvement of SMEs** in the value chain could particularly boost the adoption of AI. In the same vein, the absence of regional specialisation in the South of Europe limits the potential to exploit technological innovation spillovers that could enhance the transition to an AI ecosystem. Such spillovers could also favour SMEs boosting to a large extent their production efforts.

On another note, the **scarcity of prominent technology companies** in Europe affects the development of novel firms. A new entrepreneur would be more willing to undertake AI investments if larger firms that could buy or invest in his/her venture were available. This possibility mitigates the undertaken risk substantially, encouraging SME growth. Furthermore, start-ups and SMEs might be in an adverse position compared to larger firms regarding their ability to absorb public funding, since the bureaucratic and technical procedures are not negligible.

3.5. Analysis of European AI initiatives: From the 2018 AI Strategy to the 2019 AI HLEG Documents

The EU began its pro-active AI strategy with the European Commission Communication “*AI for Europe*” published on 25 April 2018.

Prior to this, on **16 February 2017**, the **European Parliament** had adopted a resolution with **recommendations to the Commission on Civil Law Rules on Robotics**, describing the benefits related to the increasing use of AI in terms, for example, of safeguarding workers in the more difficult or dangerous professions, but also, in general, the impact on the job market and the worker skills required.

In **May 2017**, the Commission published its **mid-term review of the Digital Single Market Strategy** underlining the importance of building on Europe's scientific and industrial strengths, as well as on its innovative start-ups, to be in a leading position in the development of AI technologies, platforms and applications.

The **April 2018 Communication** presented a European approach to AI based on **three pillars**: 1) being at the cutting-edge of technological developments and encouraging uptake by the public and private sectors with the Commission increasing its annual investments in AI by 70% under the Horizon 2020 Research and Innovation Programme, reaching €1.5 billion for the period 2018-2020, to connect and strengthen AI research centres across Europe and support the development of AI applications in key sectors and an "AI-on-demand platform" that will provide access to relevant AI resources in the EU for all users; 2) preparing for socio-economic changes brought about by AI, supporting business-education partnerships to attract and keep more AI talent in Europe and training and retraining schemes for professionals, also encouraging the modernisation of Member State education and training systems and foreseeing changes in the labour market and skills mismatching; and 3) ensuring an appropriate ethical and legal framework.

The European Commission has also tried to strike a balance between the investment and the ethical and regulatory priority in subsequent documents.

For instance, the **Coordinated Plan on AI**, published on **7 December 2018**, required Member States to adopt AI strategies, including budget figures, to be possibly and significantly increased in the following years.

At the same time, the plan identified developing ethics guidelines with a global perspective and ensuring an innovation-friendly legal framework, amongst its several goals and actions.

On **9 April 2019**, the High-Level Expert Group on AI presented the **Ethics Guidelines for Trustworthy AI**, following the publication of the guidelines' first draft in December 2018, on which more than 500 comments were received through an open consultation. The document sets out a framework for achieving trustworthy AI aiming to offer guidance to all stakeholders identifying a list of ethical principles, by providing guidance on how such principles can be operationalised in socio-technical systems. Guidance is provided in three layers of abstraction, from the most abstract in Chapter I to the most concrete in Chapter III, closing with examples of opportunities and critical concerns raised by AI systems.

It underlines that trustworthy AI should be: 1) lawful, complying with all applicable laws and regulations; 2) ethical, ensuring adherence to ethical principles and values; and 3) robust, both

from a technical and social perspective, since, even with good intentions, AI systems can cause unintentional harm.

On **26 June 2019**, the High-Level Expert Group on AI (AI HLEG) presented its second deliverable, the report **Policy and investment recommendations for trustworthy Artificial Intelligence**.

It underlines the importance of encouraging investments and research and development on the impact of AI on individuals and society.

Regarding the private sector, the document highlights the need for: 1) boosting the uptake of AI technology and services across sectors in Europe, allocating, for instance, significant resources in the InvestEU programme to support the transformation of European enterprises to AI-enabled solutions; 2) fostering and scaling AI solutions by enabling innovation and promoting technology transfer; 3) setting up public-private partnerships to foster sectoral AI ecosystems.

Concerning research and academia, the document underlines the necessity to develop and maintain a European strategic research roadmap for AI, focusing on areas of strategic value and opportunities, ensuring AI solutions that meet the Trustworthy AI principles and requirements. This involves providing dedicated, significant and long-term research funding, creating incentives and support for inter-disciplinary and multi-stakeholder research, simplifying and streamlining the structure of research funding tools, creating the conditions for talented professionals to find Europe attractive as a research environment, creating, strengthening and supporting additional Centres of Excellence (CoEs) that address strategic research topics and become a European level multiplier for a specific AI topic and, finally, encouraging cooperation at all levels.

3.6. The Von der Leyen Commission’s digital proposals and the White Paper on AI

The first Von der Leyen Commission digital proposals were published on **19 February 2020**, including two Communications (Shaping Europe’s digital future & A European Strategy for data), a white paper (Artificial Intelligence: a European Approach to excellence and trust) and two reports (B2G Expert Group Report: Towards a European Strategy on business-to-government data sharing for the public interest and the Commission Report on Safety and liability implications of AI, the Internet of Things and Robotics).

The **AI White Paper** aims at setting a framework for trustworthy Artificial Intelligence, based on excellence and trust.

In the so-called **ecosystem of excellence**, among several planned actions, the Commission plans to propose a revision of the 2018 Coordination Plan, facilitating the creation of excellence and testing centres that can combine European, national and private investments. This involves working with MSs to ensure that at least one digital innovation hub per MS has a high degree of

specialisation in AI, setting up a new public-private partnership in AI, data and robotics in the context of the Horizon Europe Programme.

Therefore, for a competitive economy, the EU regulatory framework should encourage the vast majority of companies to adopt AI easily and at a cost to be competitive.

For the **ecosystem of trust**, the Commission assesses the main risks associated with AI in order to ensure a European regulatory framework for a trustworthy AI.

The risk-based approach allows for a proportionate regulatory intervention, heavier for high-risk AI applications than for other lower-risk applications.

According to the white paper, an AI application should be considered **high-risk** when it meets the following two cumulative criteria: 1) it is employed in a sector where, given the characteristics of the activities typically undertaken, significant risks can be expected to occur (for instance, healthcare, transport, energy and parts of the public sector); and 2) the AI application in the sensitive sector is used in such a manner that significant risks are likely to arise (based on the kind of impact on presumably affected parties). Moreover, the use of AI applications for employment processes, biometric identification and other intrusive surveillance purposes would always be considered as high-risk.

Mandatory requirements for high-risk applications would cover the following areas: 1) training data; 2) data and record-keeping; 3) information to be provided 4) robustness and accuracy; 5) human oversight; 6) specific requirements for certain specific applications, such as biometric identification.

These requirements would be at least in part verified under prior conformity assessments, in line with already existing mechanisms for a large number of products being placed on the EU’s internal market. Of course, ex post controls could still be enforced by competent national authorities.

For **non-high risk applications**, the Commission envisages a voluntary labelling scheme, allowing the economic operators to signal the trustworthiness of their products or services.

The European Commission ran a **public consultation on the AI White Paper** between February and June 2020. Over 1,250 replies were received via the procedures foreseen in the consultation, including survey submissions and stand-alone position papers¹⁷. Participants represented all interested stakeholders from the public and private sectors, including governments, local

¹⁷ White Paper on Artificial Intelligence: Public consultation towards a European approach for excellence and trust: <https://ec.europa.eu/digital-single-market/en/news/white-paper-artificial-intelligence-public-consultation-towards-european-approach-excellence>

authorities, commercial and non-commercial organisations, experts, academics and citizens. Contributions arrived from all over the world, including the EU’s 27 Member States and countries such as India, China, Japan, Syria, Iraq, Brazil, Mexico, Canada, the US and the UK.

The survey showed that the Commission's actions to build an ecosystem of excellence capable of supporting the development and adoption of AI in the EU were considered important or very important by the majority of respondents. Specifically, 90% of respondents found actions on skills and networking between major universities to be very important. The support of the research and innovation communities and coordination with the Member States (with the revision of the coordinated plan on AI) were considered fundamental actions by 88% and 87% of respondents respectively. 72% of respondents believe that public private partnerships (PPPs) and the public sector are (very) important for the wider uptake of AI in Europe, while 69% said that special attention should be placed on SMEs.

Regarding the section on the regulatory framework for AI, the main concerns relate to the possibility of violation of fundamental rights and discriminatory actions resulting from the use of AI. 90% and 87% of respondents, respectively, considered these concerns important or very important.

The possibility that AI endangers safety or takes actions that cannot be explained was considered a relevant concern by 82% and 78% of respondents, respectively. This is followed by the possible lack of accuracy of AI (70%) and lack of compensation following harm caused by AI (68%).

To address such concerns, 42% of respondents request the introduction of new AI legislation, another 33% asked for changes to current legislation to fill identified gaps.

Finally, regarding the third section on the safety and liability implications of AI, IoT and robotics, 60.7% of respondents supported a revision of the existing Product Liability Directive to cover particular risks engendered by certain AI applications. 47% of respondents supported national liability rules should also be adapted to all AI applications and 16% only for specific AI applications in order to ensure adequate compensation in the event of damage and fair attribution of liability. According to the **adjusted Commission Work Programme 2020**¹⁸, the legislative proposal on the contents of the White Paper, including on security, responsibility, fundamental rights and data, is expected for the first quarter of 2021.

In the **European Parliament**, on 1 October, the Legal Affairs (JURI) Committee approved three reports on AI: the *Civil liability regime for artificial intelligence* (rapporteur Axel Voss, EPP,

¹⁸ [cwp-2020-adjusted-factsheet_en.pdf \(europa.eu\)](#)

Germany), 2020/2014(INL), the *Framework of ethical aspects of artificial intelligence, robotics and related technologies* (rapporteur Ibán García del Blanco, S&D, Spain) 2020/2012(INL) and *Intellectual property rights for the development of artificial intelligence technologies* (rapporteur Stéphane Séjourné, Renew, France), 2020/2015(INI)¹⁹. Other reports on AI are also expected to be approved, including a report from the Committee on Civil Liberties, Justice and Home Affairs (LIBE) on *Artificial intelligence in criminal law and its use by the police and judicial authorities in criminal matters* (2020/2016 (INI)) and a report from the Committee on Culture and Education (CULT) on *Artificial intelligence in education, culture and the audio-visual sector* (2020/2017(INI)).

After this series of “legislative initiatives” and own-initiative reports on AI in several standing committees, the European Parliament set up a special **Committee on Artificial Intelligence in the Digital Age (AIDA)** on 18 June 2020, mandating this committee to take a horizontal, long-term approach on the matter. The new Special Committee on Artificial Intelligence in a Digital Age (AIDA) is made up of 33 members, and will initially last 12 months from the date of the constitutive meeting. Its mandate is to analyse the future impact of AI in the digital age on the EU economy, especially on skills, employment, fintech, education, health, transport, tourism, agriculture, the environment, defence, industry, energy and e-government. The constitutive meeting of the AIDA Committee took place on 23 September 2020.

In its conclusions adopted on 2 October 2020, the **European Council** – supporting the Council Conclusions on Shaping Europe's Digital Future (9 June 2020) - highlighted that the EU needs to be a global leader in the development of secure, trustworthy and ethical AI. It invited the Commission to: «propose ways to increase European and national public and private investments in Artificial Intelligence research, innovation and deployment; ensure better coordination, and more networks and synergies between European research centres based on excellence» and «provide a clear, objective definition of high-risk Artificial Intelligence systems»²⁰.

¹⁹ Making Artificial Intelligence ethical, safe and innovative: <https://www.europarl.europa.eu/news/en/press-room/20200925IPR87932/making-artificial-intelligence-ethical-safe-and-innovative>

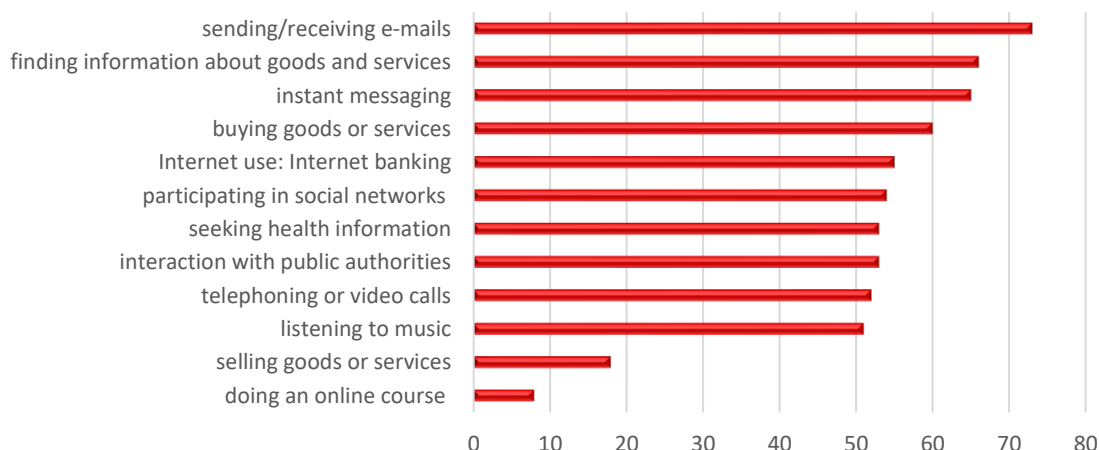
²⁰ Special meeting of the European Council (1/2 October 2020) – Conclusions: <https://www.consilium.europa.eu/media/45910/021020-euco-final-conclusions.pdf>

4. THE IMPORTANCE OF DIGITAL TRANSFORMATION IN THE GLOBAL AND EUROPEAN CONTEXT

4.1. The usage of digital services by individuals and enterprises and the Covid-19 impact

The spread of Internet and digital technologies has radically transformed the socio-economic context in which citizens and companies operate. The network has become the epicentre of our life. Nowadays, we use the web to communicate, find information, buy and sell goods or services, interact with public administrations and many other activities that before we had done through traditional channels. According to the latest Eurostat surveys (Fig.4.1), the **main activity performed online** by individuals in the EU 27 is the sending of emails (73%), followed by the search for information on goods and services (66%) and instant messaging (65%).

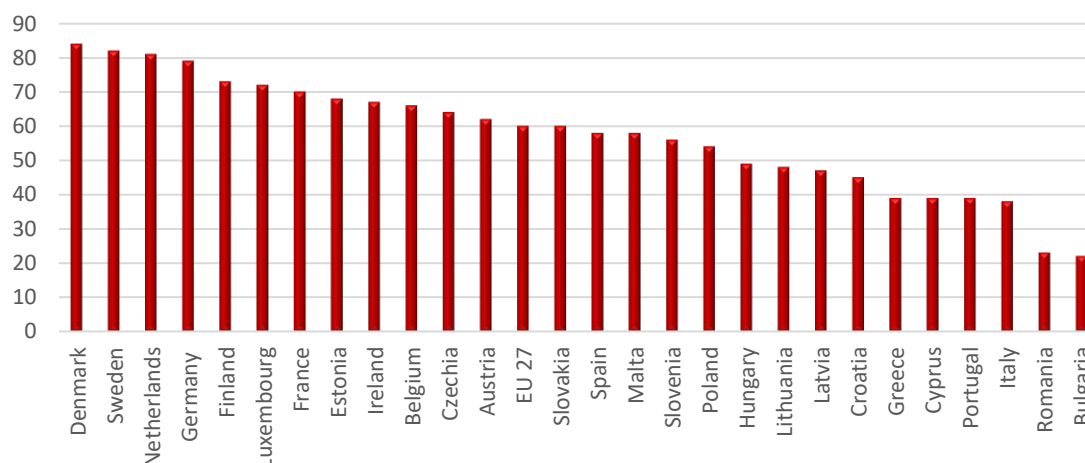
Fig. 4.1: Main internet activities by individuals in the EU (% , 2019)



Source: Eurostat

One of the most important activities that individuals perform online is the **purchase of goods and services**. Whereas the retail sector, in general, is still facing difficult times, online shopping is continuing to grow. The European country whose citizens have the greatest tendency to shop online is Denmark, followed by Sweden and the Netherlands. Instead, the worst data is recorded by Romania and Bulgaria, 23% and 22%, respectively (Fig. 4.2).

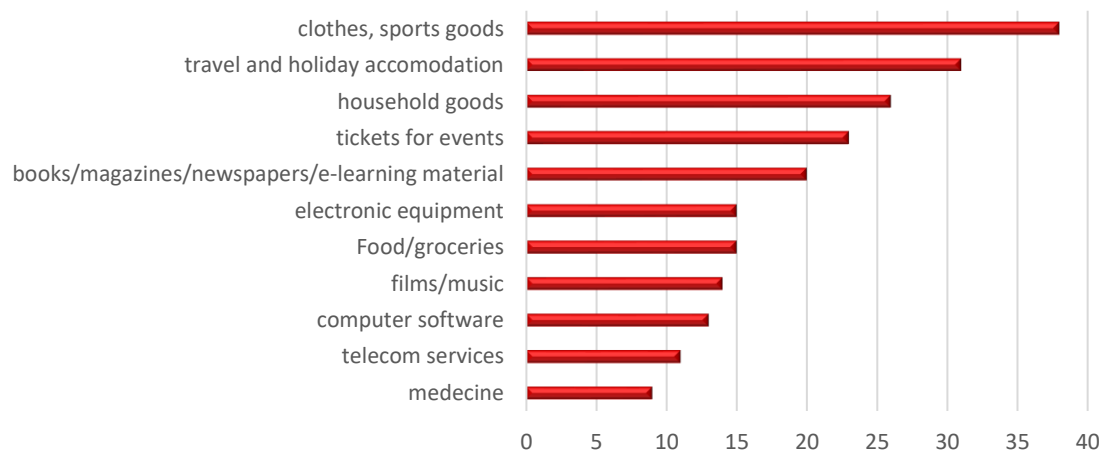
Fig. 4.2: Internet purchases by individuals in the EU (% , 2019)



Source: Eurostat

The **most popular type of goods and services purchased online** in 2019 in the EU (Fig. 4.3) were clothes and sports goods (38 % of e-buyers), followed by travel and holiday accommodation (31 %). E-shoppers aged 16-24 were the top age group when it came to clothes and sports goods purchases (73 %), those aged 25-54 for travel and holidays (57 %) and the older age group (55-74) in buying books, magazines and newspapers, together with those aged 25-54 (35 % both).

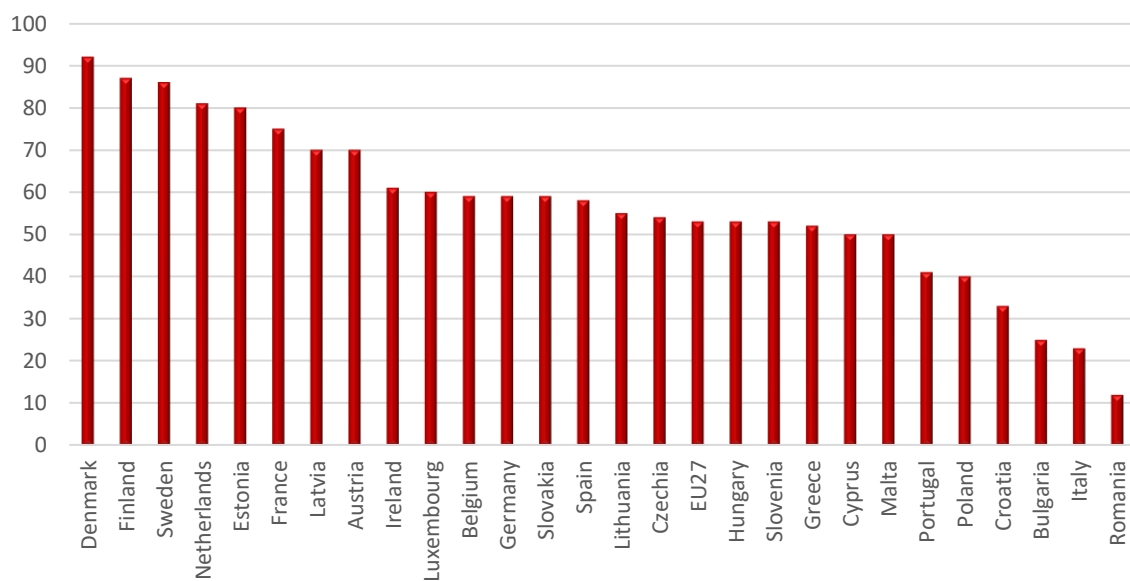
Fig. 4.3: Types of goods purchased online in the EU (% , 2019)



Source: Eurostat

Another of the main activities performed by individuals online is interacting with public authorities. In this category, the difference between the various European countries is enormous (Fig.4.4). In countries such as Denmark, Finland and Sweden almost all individuals interact with public authorities using the Internet. In other countries, such as Romania and Italy, web interactions between public authorities and citizens are minimal.

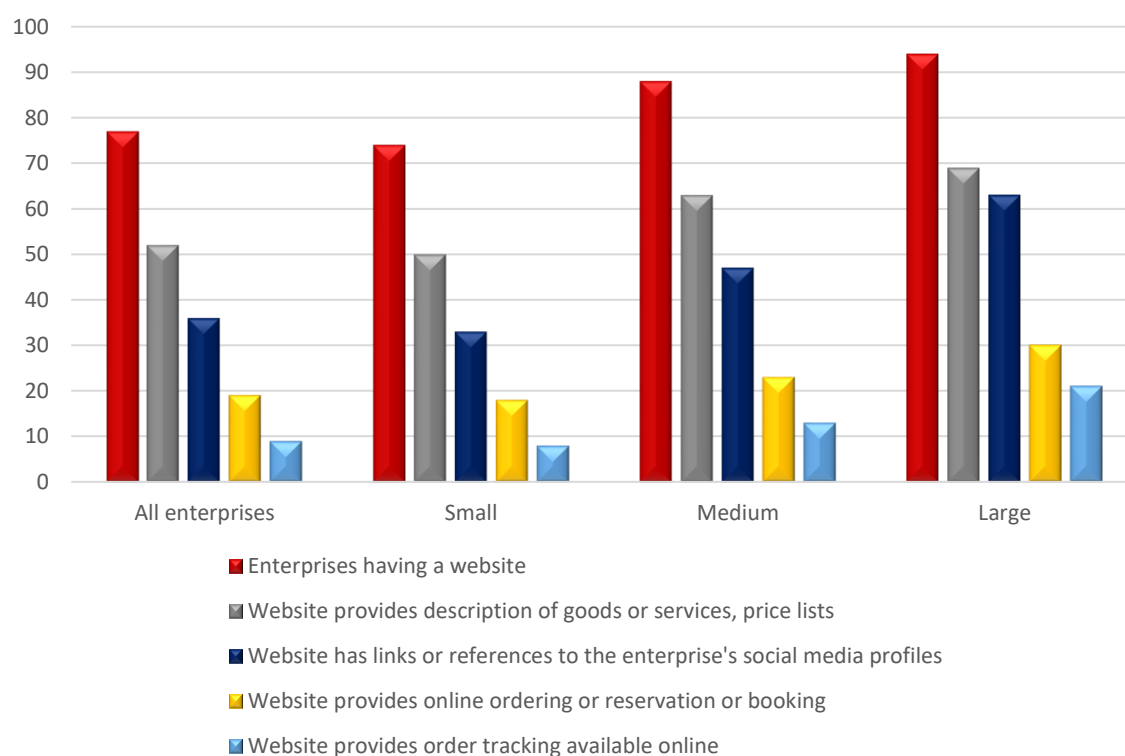
Fig. 4.4: Interaction with public authorities on Internet in the EU27 (% of individuals, 2019)



Source: Eurostat

The use of ICT has the potential to make significant changes to how enterprises are run. The adoption of ICT-based solutions for businesses is often referred to using the generic term of ‘e-business’. Figure 4.5 presents information on one of the most basic types of e-business that is used by enterprises, namely **having a website**. In 2019, more than three quarters (77%) of enterprises in the EU27 had a website, with a much higher share for large enterprises (94%) compared to small enterprises (74%). This share was 8 percentage points higher than in 2011, when 69% of enterprises had a website. The most popular use provided by enterprise websites regarded the description of goods and services and price lists, as well as links or references to the social media profiles of enterprises.

Fig. 4.5: Enterprises having a website in the EU, by functionality and size class (% , 2019)



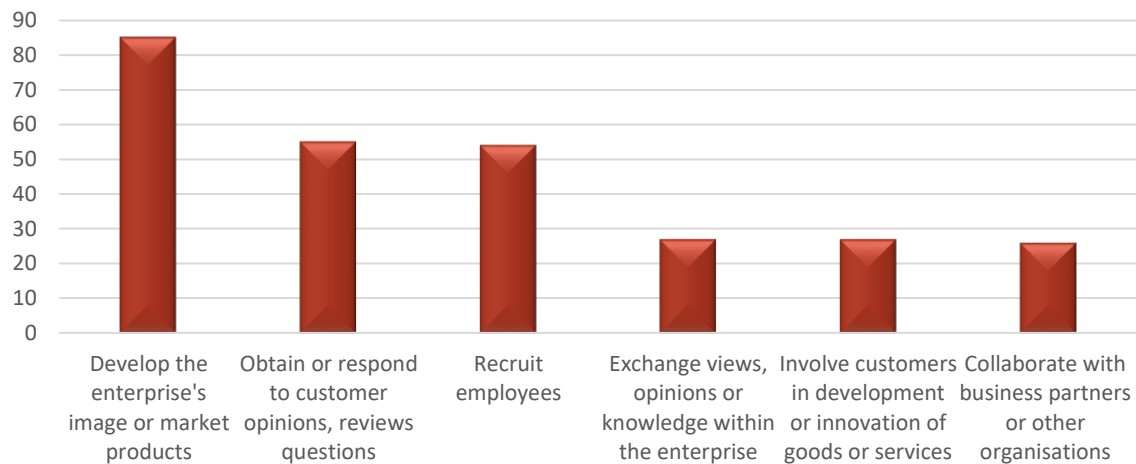
Source: Eurostat

Enterprises use the social media for image building or for marketing purposes, for gaining insights from customers or communicating within or outside the enterprise or for recruiting. The four most widely known categories of **social media** include social networks (Facebook, LinkedIn), corporate blogs or microblogs such as Twitter, multi-media content-sharing websites (YouTube, Instagram) and wiki-based knowledge-sharing tools.

According to Eurostat statistics, 85% of EU **enterprises that used the social media in 2019** had the purpose of building their image or marketing their products (Fig.4.6). Furthermore, 55% of firms reported using social media to obtain customer opinions or reviews, or to answer their questions, implying an effort to improve customer service. At the same time, 54% of enterprises used the social media to recruit employees. Recruiting was especially important for large companies using social media, with 79% reporting to use the social media for that purpose. In addition, for 27% of the firms using the social media, the purpose was to exchange views and opinions within the enterprise. The same share of companies (27%) used the social media to involve customers in

product development or innovation. The collaboration with other organisations was the reason for 26% of enterprises to use social media.

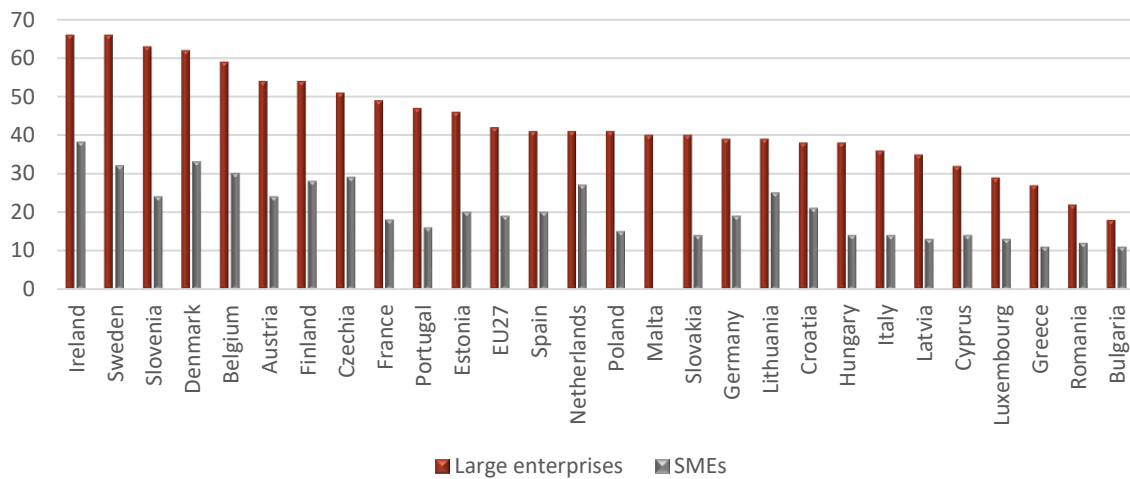
Fig. 4.6: Enterprises using social media in the EU (% , 2019)



Source: Eurostat

With digitisation spreading and new technologies emerging, enterprises need to invest in **e-commerce** development to survive in the competitive market. Eurostat data shows that 42% of large companies and 19% of SMEs in the EU27 sell online (Fig.4.7). The best performer country is Ireland (66% of large enterprises and 38% of SME's), which is also the headquarters of the main foreign digital companies in Europe. In general, looking at the data, it can be seen that large companies use this channel the most in all Member States.

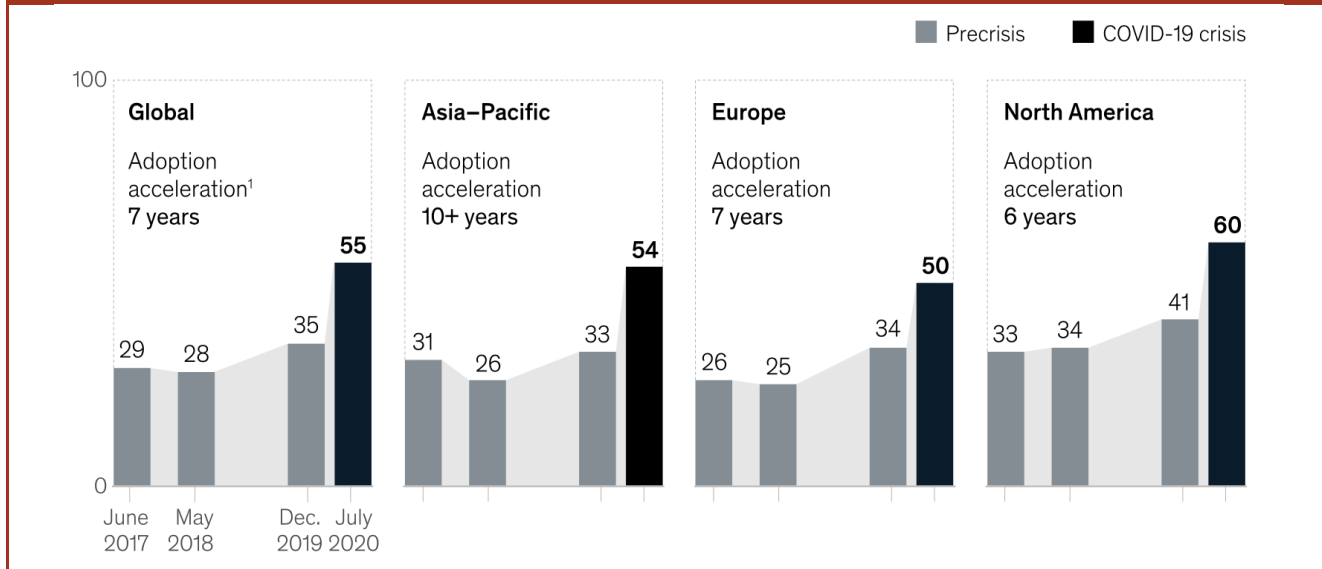
Fig. 4.7: Enterprises with e-commerce sales in the EU (% , 2019)



Source: Eurostat

The **Covid-19 pandemic** has greatly accelerated the digital transaction of businesses. Government restrictive measures to counter the spread of the pandemic have pushed both companies and individuals to use digital channels. To stay competitive in this new business and economic environment companies have had to adopt new strategies and practices. According to a new McKinsey Global Survey, companies have sped up the digitisation of their customer and supply-chain interactions and of their internal operations by seven years (Fig.4.8). Nearly all respondents say that their companies have adopted at least temporary solutions to meet many of the new demands on them, and much more quickly than they had thought possible before the crisis. Furthermore, respondents expect most of these changes to be long lasting and are already making the kinds of investments that all but ensure they will stick.

Fig. 4.8: Average share of products and/or services that are partially or fully digitalised after Covid-19 (%)



Source: McKinsey

The Covid-19 crisis has also accelerated an **e-commerce expansion** for new firms, customers and types of products. It has provided customers with access to a greater variety of products from the convenience and safety of their homes and has enabled firms to continue operations in spite of contact restrictions and other confinement measures. Despite persistent cross-country differences, the Covid-19 crisis has enhanced dynamism in the e-commerce landscape across countries and has expanded the scope of e-commerce, including through new firms, consumer segments (e.g., the elderly) and products (e.g., groceries). Meanwhile, e-commerce transactions in many countries have partly shifted from luxury goods and services towards everyday necessities, relevant to a large number of individuals. Some of these changes in the e-commerce landscape will likely be of a long-term nature, in light of the possibility of new waves of the epidemic, the convenience of the new purchasing habits, learning costs and the incentive for firms to capitalise on investments in new sales channels. According the OECD, between January and May 2020, on average, orders through e-commerce more than doubled year-on-year in North America and were up by 50% in Europe (Fig.4.9). The only region in counter-trend is Asia (where online orders had already increased by 70% between the end of 2019 and the beginning of 2020) given the arrival of the pandemic earlier than in the rest of the world and the different course of the infection over time.

Fig. 4.9: Growth in goods orders through e-commerce, selected regions (January-May 2020)



Source: OECD, 2020

4.2. The European regulatory framework: from the GDPR to the DSA and DMA new rules

Online platforms and intermediaries are strong drivers of innovation and play an important role in Europe's digital society and economy. They have transformed the digital economy over the last two decades offering many benefits in digital society and imposing the analysis of their role in the market and their impact on users. They cover a wide range of activities including online marketplaces, social media, creative content outlets, app stores, price comparison websites, platforms for the collaborative economy, as well as search engines, sharing key characteristics, such as the use of information and communication technologies to facilitate interactions between users, collection and use of data about such interactions, and network effects.

Since the adoption of the DSM strategy (2015), the European Commission has focused on online platforms conducting a series of workshops and studies on their role.

On 25 March 2016, the Commission adopted the Communication “**Online Platforms and the Digital Single Market Opportunities and Challenges for Europe**” introducing the following policy principles: 1) a level playing field for comparable digital services; 2) ensuring responsible behaviour of online platforms to protect core values; 3) fostering trust, transparency and ensuring fairness on online platforms; 4) keeping markets open and non-discriminatory to foster a data-driven economy.

The **Recommendation of 1.3.2018 on measures to effectively tackle illegal content online** defined general guidelines for online platforms and Member States to combat illegal online content.

To ensure the creation of an ecosystem based on transparency and fairness, on 20 June 2019, the **Regulation n. 2019/1150** on online intermediation services (**“P2B Regulation”**) was adopted (the new rules came into force on 12 July 2020). The regulation on online platform-to-business relationships establishes a harmonised framework for minimum transparency and redress rights and protects companies that depend on online platforms for reaching consumers, while safeguarding the innovation potential of platforms.

The purpose of the P2B Regulation is to contribute to the proper functioning of the internal market by laying down rules to ensure that business users of online intermediation services and corporate website users are granted appropriate transparency, fairness and effective redress possibilities. It applies to providers of online services who facilitate direct transactions between businesses/traders and EU consumers, i.e., e-commerce websites, price comparison websites, app stores and online search engines. Considering that the P2B Regulation applies to online platforms irrespective of their establishment or residence, there is an extra territorial effect which means the P2B Regulation will have a significant effect on the online regulatory landscape.

Analysing the main provisions set by the regulation, there are several new points on different aspects, specifically: 1) **Terms and Conditions (T&Cs)**. The Regulation should apply where the terms and conditions of a contractual relationship, regardless of their name or form, are unilaterally determined by the provider of online intermediation services and prescribes (art. 3) that they: a) are drafted in plain and intelligible language; b) are easily available to business users at all stages of their commercial relationship with the provider of online intermediation services, including in the pre-contractual stage; c) set out the grounds for decisions to suspend or terminate or impose any other kind of restriction upon, in whole or in part, the provision of their online intermediation services to business users; d) include information on any additional distribution channels and potential affiliate programmes through which providers of online intermediation services might market goods and services offered by business users; e) include general information regarding the effects of the terms and conditions on the ownership and control of intellectual property rights of business users. The Regulation also imposes communication obligations on the provider of online intermediation about proposed changes fixing as a notice period at least 15 days from the date on which the provider of online intermediation services notifies the business users concerned about the proposed changes and attributing the business the right to terminate the contract with the provider of online intermediation services before the expiry of the notice period;

2) Restriction, suspension and termination (art. 4). When an OIP wishes to restrict, suspend or terminate the services, it must comply with certain information requirements, including the provision of a statement of reasons to the business user; **3) Ranking** (art. 5). The OIPs and providers of online search engines must set out in their terms and conditions the main parameters determining ranking and the reasons for the relative importance of those main parameters as opposed to other parameters, including the possibility to influence ranking against any direct or indirect remuneration paid by business users or corporate website users to the respective provider (describing those possibilities and the effects of remuneration on ranking). Where a provider of an online search engine has altered the ranking order in a specific case or delisted a particular website following a third-party notification, the provider must offer the possibility for the corporate website user to inspect the contents of the notification. The regulation provides for the adoption of guidelines by the Commission setting out the transparency requirements; **4) Differentiated treatment**. Providers must include in their terms and conditions a description of any differentiated treatment which they give, or might give, in relation to goods or services offered to consumers. Where, in the provision of their services, providers of online intermediation services restrict the ability of business users to offer the same goods and services to consumers under different conditions through other means than through those services, they must include the grounds for that restriction in their terms and conditions and make those grounds easily available to the public. Those grounds shall include the main economic, commercial or legal considerations for those restrictions. **5) Access to Data**. Providers of online intermediation services must include in their terms and conditions a description of the technical and contractual access, or absence thereof, of business users to any personal data or other data, or both, which business users or consumers provide for the use of the online intermediation services concerned or which are generated through the provision of those services. **6) Mediation**. The Regulation prescribes the identification of two or more mediators - with specific requirements set by art. 12 - for the solution of any disputes between the provider and the business user and encourages the setting up of one or more organisations providing mediation services. **7) Codes of conduct**. The regulation encourages the drawing up of codes of conduct by providers of online intermediation services and by organisations and associations representing them, together with business users, including SMEs and their representative organisations, that are intended to contribute to the proper application of the regulation, taking account of the specific features of the various sectors in which online intermediation services are provided, as well as of the specific characteristics of SMEs.

The Observatory on the online platform economy, made up of a group of 15 independent experts and a team of Commission officials, accompanies the new rules monitoring and analysing the latest trends and issues in the online platform economy.

Considering that new services, technologies and business models have resulted in many opportunities in the daily life of European citizens, but also created new risks for citizens and society at large, exposing them to a new range of illegal goods, activities or content, in her political guidelines²¹, the President of the European Commission, Ursula von der Leyen, , has committed to upgrading the Union's liability and safety rules for digital platforms, services and products, with a new Digital Services Act Package.

As part of the European Digital Strategy, the European Commission has announced a **Digital Services Act Package** to strengthen the Single Market for digital services and foster innovation and competitiveness of the European online environment.

The new Digital Services Act Package should modernise the current legal framework for digital services ensuring that online platforms behave fairly and can be challenged by new entrants and existing competitors, so that consumers have the widest choice and the Single Market remains competitive and open to innovation. The legal framework for digital services has remained relatively unchanged since the adoption of the e-Commerce Directive in 2000, which harmonised the basic principles allowing for the cross-border provision of services and has been a cornerstone for EU regulating digital services. The **Digital Markets Act**, instead, will list the prohibited behaviour for gatekeeper platforms and will put forward new competition rules fit for the digital age.

The DSA is focused on two main pillars: 1) clear rules framing the responsibilities of digital services to address the risks faced by their users and to protect their rights, able to ensure a modern system of cooperation for the supervision of platforms and guarantee effective enforcement; and 2) ex ante rules covering large online platforms acting as gatekeepers.

On 2 June, the Commission launched a **public consultation on the DSA**²², in order to gather views, evidence and data from people, businesses, online platforms, academics, civil society and all interested parties «to help in shaping the future rulebook for digital services». The consultation covered the two work strands announced by the Commission as part of the DSA package:

²¹ https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission_en.pdf

²² Press Release: Commission launches consultation to seek views on Digital Services Act Package: https://ec.europa.eu/commission/presscorner/detail/en/ip_20_962

- **the first set of rules would relate to the fundamentals of the E-commerce Directive**, specifically, the freedom to provide digital services across the EU Single Market in accordance with the rules of the place of establishment and a broad limitation of liability for content created by users. Building on these principles, the EU government aims to establish clearer and modern rules concerning the role and obligations of online intermediaries, including non-EU ones active in the EU, as well as a more effective governance system to ensure that such rules are correctly enforced across the EU Single Market while guaranteeing respect for fundamental rights.
- **the second measure would address the issue of the level playing field in European digital markets**, where currently only a few large online platforms act as gatekeepers. Rules will be explored to address these market imbalances, to ensure that consumers have the widest choice and that the EU Single Market for digital services remains competitive and open to innovation. This could be through additional general rules for all platforms of a certain scale, such as rules on self-preferencing, and/or through tailored regulatory obligations for specific gatekeepers, such as non-personal data access obligations, specific requirements regarding personal data portability, or interoperability requirements.

In its conclusions on Shaping Europe's Digital Future (9 June 2020), the **Council**, inter alia, emphasised «the need for clear and harmonised evidence-based rules on responsibilities and accountability for digital services that would guarantee internet intermediaries an appropriate level of legal certainty» and stressed « the need for effective and proportionate action against illegal activities and content online, including the distribution of illegal, counterfeited and dangerous goods, whilst ensuring the protection of fundamental rights, in particular the freedom of expression, in an open, free and secure Internet»²³.

In the **European Parliament**, the Committee on the Internal Market and Consumer Protection (IMCO), the Committee on Civil Liberties, Justice and Home Affairs (LIBE) and the Legal Affairs Committee (JURI) approved their respective reports in Committees in September and October 2020: *Digital Services Act: Improving the functioning of the Single Market*, rapporteur Alex Agius Saliba, S&D, Malta) (2020/2018(INL); *Digital Services Act and fundamental rights issues posed*, 2020/2022(INI) and *Digital Services Act: adapting commercial and civil law rules for commercial entities operating online*, 2020/2019(INL). Voting took place during the 19-22 October plenary

²³ Shaping Europe's Digital Future - Council Conclusions (9 June 2020): <https://data.consilium.europa.eu/doc/document/ST-8711-2020-INIT/en/pdf>

session. These “legislative initiative” reports are then sent to the Commission to feed into its Digital Services Act Package.

In the “legislative initiative” report approved in the Internal Market and Consumer Protection Committee, MEPs requested that the Commission addresses and tackles current shortcomings in the online environment in its DSA package²⁴. The IMCO Committee’s report states that the principle of “what is illegal offline is also illegal online”, as well as the principles of consumer protection and user safety, should become “guiding principles” of the future DSA. The Committee recommendations touch upon a wide range of issues, including obligations related to transparency and information for online marketplaces, product safety online, effective enforcement and supervision measures, including fines, the spread of illegal content online, artificial intelligence, and ex-ante regulation to prevent (instead of merely remedy) market failures caused by the big platforms.

Even if online platforms are revolutionising markets, leading to a rethinking of the current regulatory framework, the adoption of DSA package is part of a regulatory framework that has seen the introduction of important innovations, e.g. in the field of privacy.

In this context, the **GDPR Regulation (Reg. n. 2016/679)** is the main regulatory instrument of European origin on data protection and is an important turning point for European action in this field. The regulatory framework has defined the controller and processor, has provided for consent as one of the conditions for the processing to be lawful and legitimate, requiring that it be a free, specific, informed and unequivocal manifestation of will, has defined the purposes of the processing and guaranteed many rights including the right to portability and has affirmed the principles of privacy by design and privacy by default setting several obligations also on platforms.

With the General Data Protection Regulation, the EU has put in place a solid and trusted legal framework for the protection of personal data and a standard for the world, requiring careful evaluation of further measures to be taken with the DSA package to ensure a regulatory framework that does not hinder innovation and is clear, streamlined and future-oriented.

²⁴ MEPs spell out their priorities for the Digital Services Act: <https://www.europarl.europa.eu/news/en/press-room/20200925IPR87924/meps-spell-out-their-priorities-for-the-digital-services-act>

5. DIGITAL NETWORKS

5.1. The spreading of digital infrastructures in Europe

As well as the digital transformation requiring increasing network performance, the growing data traffic generated by users and enterprises needs a continuous development of data capacity management. Moreover, the spreading of **high capacity networks** can lead to an increased adoption of cloud computing by SMEs, allowing them to access new generation services such IoT, Big Data and AI. The importance of high capacity digital networks, both wired and wireless, are well known at the European level, since their availability and take-up have enabled the widespread use of products, services and applications in the Digital Single Market.

For these reasons, digital networks are among the issues receiving the widest attention from the European institutions in their legislation and monitoring. For the former, the **Commission’s strategy on Connectivity for a European Gigabit Society**, adopted in September 2016, increased the targets decided on by the previous broadband objectives for 2020, which forecasted to supply every European with access to at least 30 Mbps Internet connectivity, and to provide half of European households with connectivity bandwidth of 100 Mbps (see 5.3). The more recent targets focus on bringing Internet access with a capacity of at least 100 Mbps to all European households, as well as connecting, up to 1 Gigabit, the main socio-economics drivers (such as schools, hospitals and other PA entities), covering all urban areas and major land transport routes with a 5G signal. Here, an opportunity is presented by means of the Recovery Fund, which should allocate up to 20% (€130 bn) to the digital sector. Digital platforms, including connectivity infrastructures, as well as platforms such as cloud computing, are key to enabling the access to the advanced services like AI, Big Data and IoT, and to the benefits from the digitisation of firms and services.

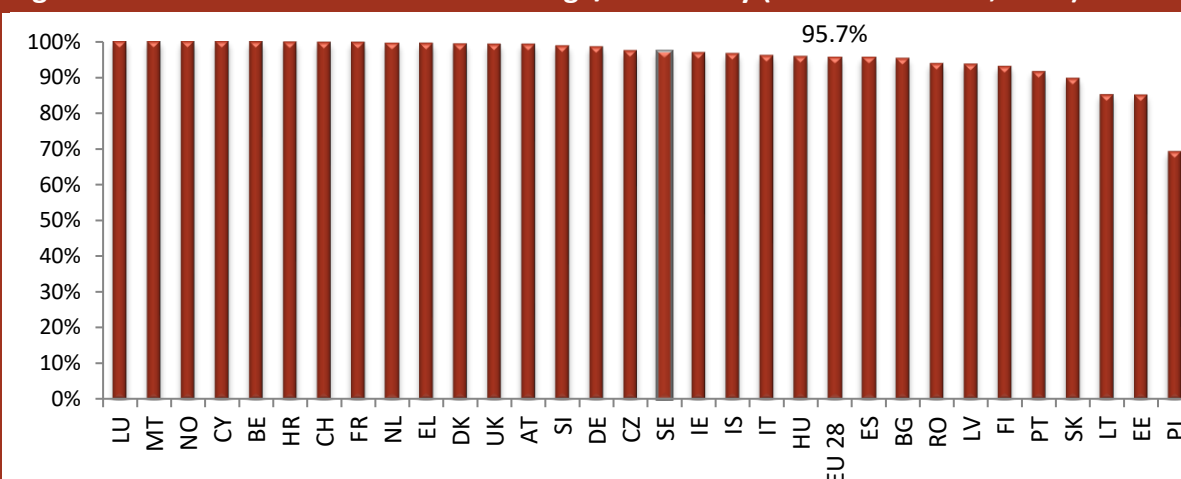
Concerning the **monitoring of the progress in digital network availability**, starting in 2014, the European Commission published the Digital Economy and Society Index (DESI), a composite index updated every year which measures the progress of EU countries towards a digital economy and society²⁵.

Broadband connection is widely available all over Europe, as shown in Fig. 5.1. On average, **broadband coverage reached 96% of European households in 2019**, while the only countries

²⁵ The DESI Index does not focus on digital networks only, but is made up of approximately 30 indicators related to Europe’s digital performance and tracks the evolution of EU Member States, across five main components - Connectivity, Human Capital, Use of Internet, Integration of Digital Technology, Digital Public Services.

registering less than 90% of household coverage, though above 80%, are Slovakia, Lithuania and Estonia. Poland is the only country below the 70% threshold.

Fig. 5.1: Standard fixed broadband coverage/availability (% of households, 2019)

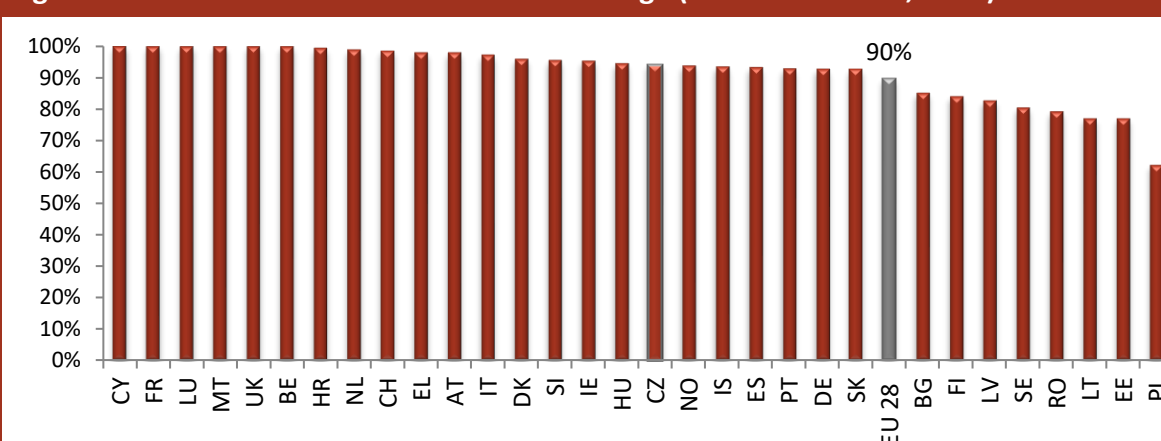


Note: connections with a capacity of at least 2Mbps

Source: European Commission, Digital Scoreboard

In 2019, **broadband coverage of rural areas** reached 90% of households (Fig.5.2). This classification, also revealing the lower penetration in highly digitalised countries such as Norway, Sweden and Estonia, shows how these values are linked to the morphology of the different national areas.

Fig. 5.2: Rural standard fixed broadband coverage (% of households, 2019)

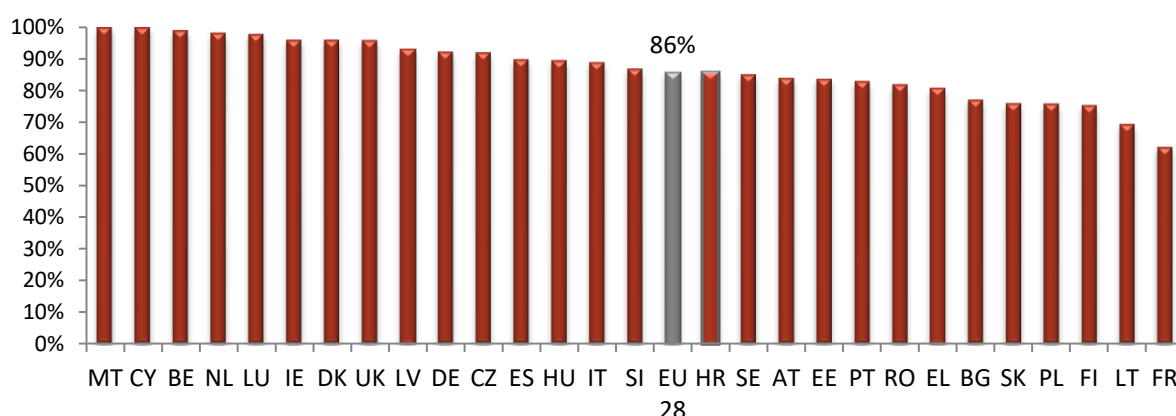


Note: Rural areas are defined as those with less than 100 people per km².

Source: European Commission, Digital Scoreboard

Looking at the progress made by EU countries in providing **connections capable of a download speed of at least 30 Mbps** to all of their households, a record average coverage of 86% was reached in 2019. On the one hand, the spread of connectivity around Europe appears to have achieved a very good result. On the other, the full coverage target by 2020, as previously established by the European Digital Agenda, is still relatively far away.

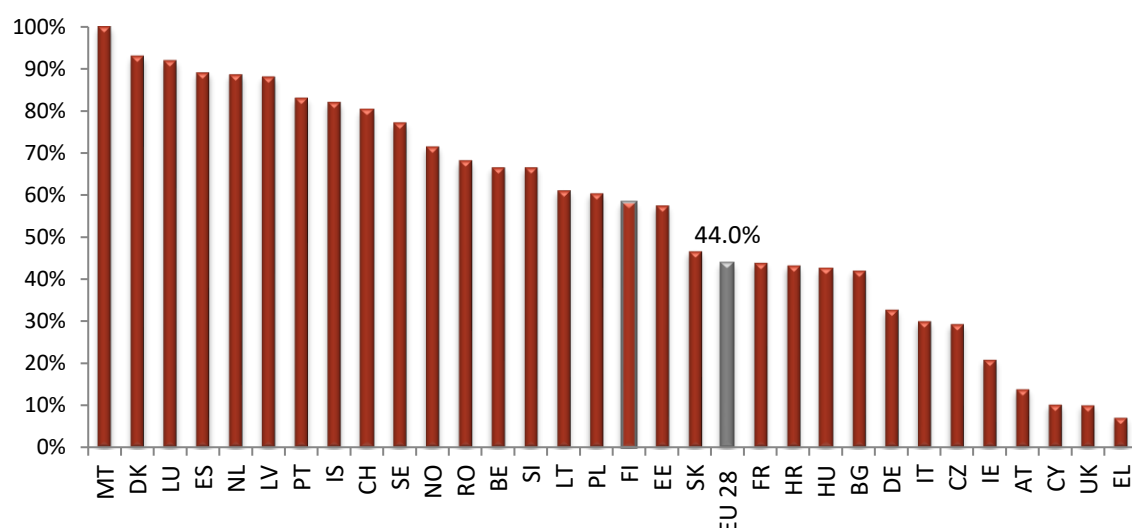
Fig. 5.3: NGA broadband coverage/availability (% of households, 2019)



Note: Fast broadband is a connection with download speeds of at least 30 Mbps.

Source: European Commission, Digital Scoreboard

Fig. 5.4: Very High Capacity Network (VHCN) broadband coverage (% of households, 2019)



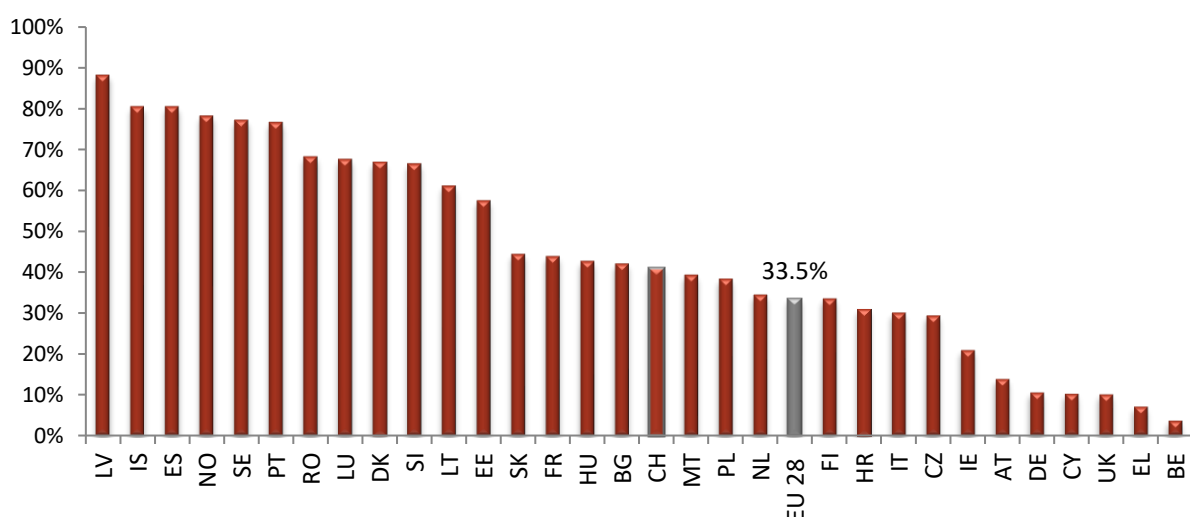
Note: Fixed Very High Capacity Network (VHCN) coverage includes FTTP and DOCSIS 3.1 coverage

Source: European Commission, Digital Scoreboard

Very High Capacity Networks is a new definition established by Berec which took the place of the former *ultra-fast networks*, including also the Fixed Wireless Access (FWA) coverage by BTS connected in fibre or with capacities of at least 150 Mbps in downlink.

The threshold reached by EU infrastructures related to this parameter is close to the objectives set in 2010 for the second pillar of the European Digital Agenda. At least 50% of the population is covered by **ultra-fast broadband Internet services above 100 Mbps**. In 2019, almost 44% of European households were covered by **fixed VHCN**, including fibre to the home (FTTH), fibre to the building (FTTB) and cable connectivity (Cable Docsis 3.0).

Fig. 5.5: Fibre to the premises coverage/availability (% of households, 2019)

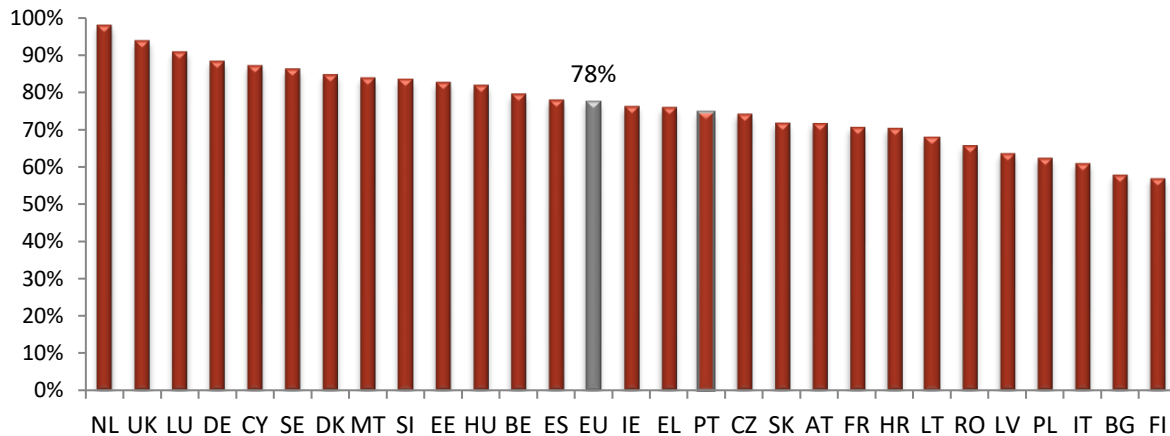


Note: Coverage is a supply indicator defined as the percentage of households living in areas served by FTTP
Source: Broadband coverage in Europe, studies for the EC by Point Topic (2011-2012 figures, SMART 2011/0027 and 2012/0035) and IHS and Valdani, Vicari & Associati (2013 figures, SMART 2013/0054) in European Commission, Digital Scoreboard

Another interesting indicator is related to the availability of optical fibre, that shows the capability of providing Internet connection of up to 1 Gbps. Fig. 5.5 shows the **coverage percentage of households living in areas served by FTTP**, reaching almost 33.5% in 2019. Differently from 100 Mbps speed, which can be achieved through different technologies, the up-to-1Gbps connections require the spread of optical fibre to premises (buildings or homes). Twelve EU countries reveal excellent performance, with more than 50% of households connected. On the other hand, many other countries, such Austria, Germany and the UK, which can count on digital cable connectivity,

reveal a lower fibre distribution, being a disadvantage in the long term and in reaching the goals for achieving the Gigabit Society.

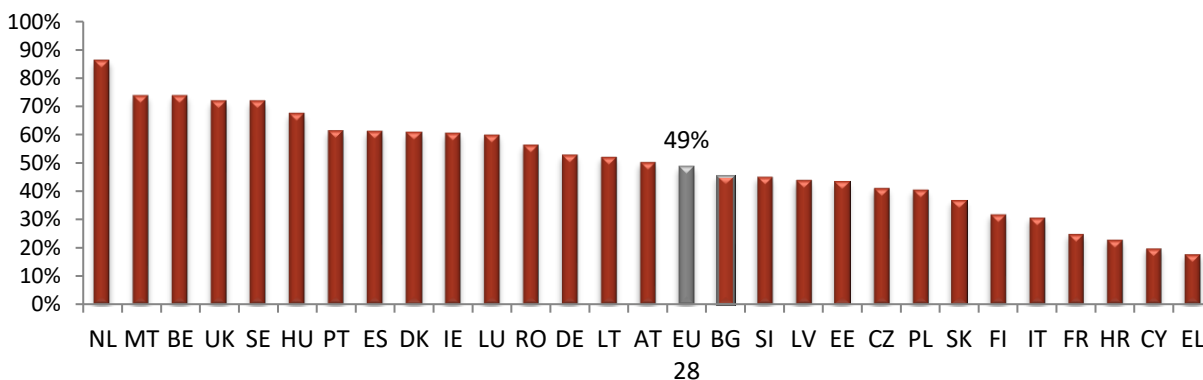
Fig. 5.6: Households with fixed broadband connections (% , 2019)



Source: European Commission, Digital Scoreboard

If the availability and coverage of households appear extremely important, another fundamental indicator is related to the effective take up of the Internet access service. **Currently, 78% of European households have adopted a broadband connection service**, up from 75% of 2018 (Fig. 5.6). Only two countries show figures lower than 60%.

Fig. 5.7: Fixed Fast Broadband take-up (% of households, 2019)

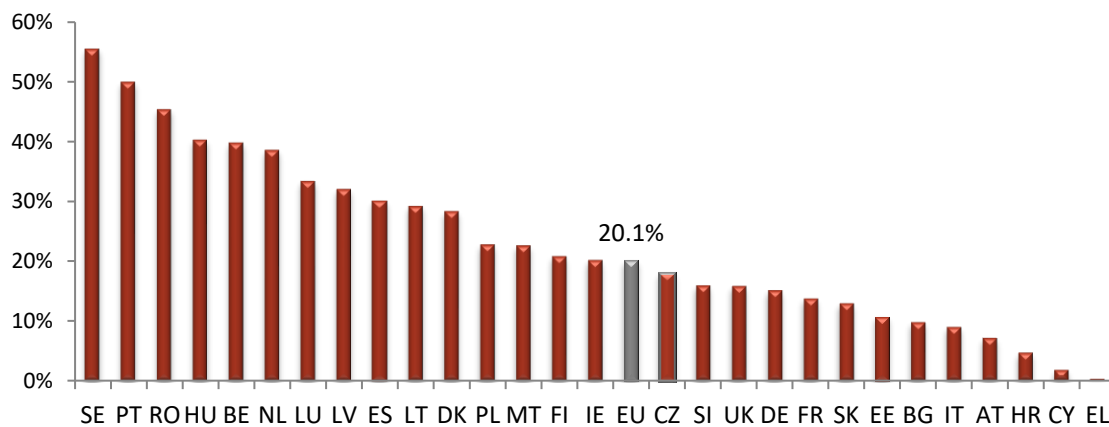


Note: Percentage of households subscribing to broadband of at least 30 Mbps

Source: European Commission, Digital Scoreboard

At the same time, **the adoption of fixed fast broadband services reached almost 49% of European households** (Fig. 5.7). Northern countries appear to have the highest adoption percentage (especially the Netherlands, Belgium, Luxembourg, Ireland, Denmark and the UK), as well as Malta, Portugal and Spain, while those with the lowest rates are France, Croatia, Cyprus and Greece. For at least 100 Mbps connection adoption, considering the target of 50% of EU households, the current average is just above 20%. Only 1 country reached the 50% adoption threshold, while 5 countries did not even reach 10% (Fig. 5.8).

Fig. 5.8: Households with an ultra-fast broadband subscription (% , 2019)



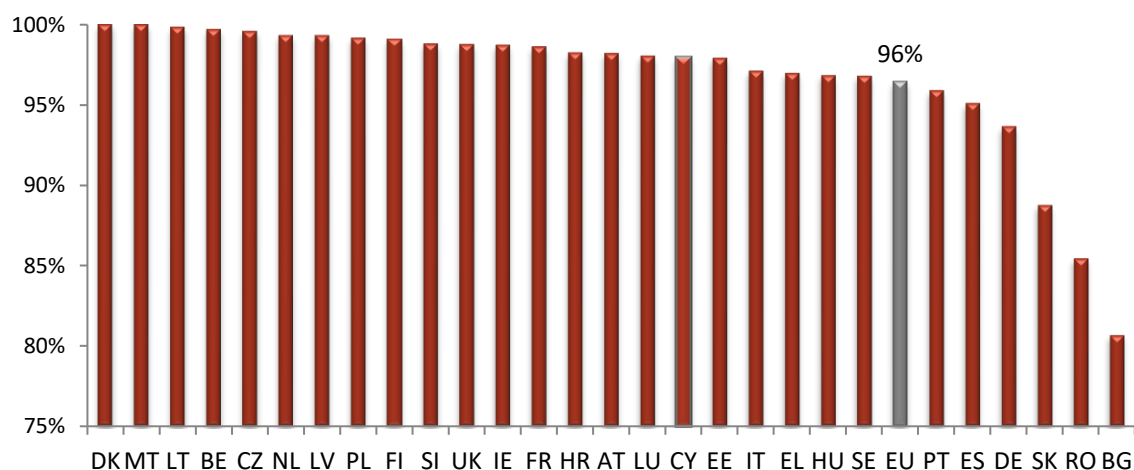
Note: Households with a broadband connection of at least 100 Mbps

Source: European Commission, Digital Scoreboard

5.2. Mobile connections and 5G developments

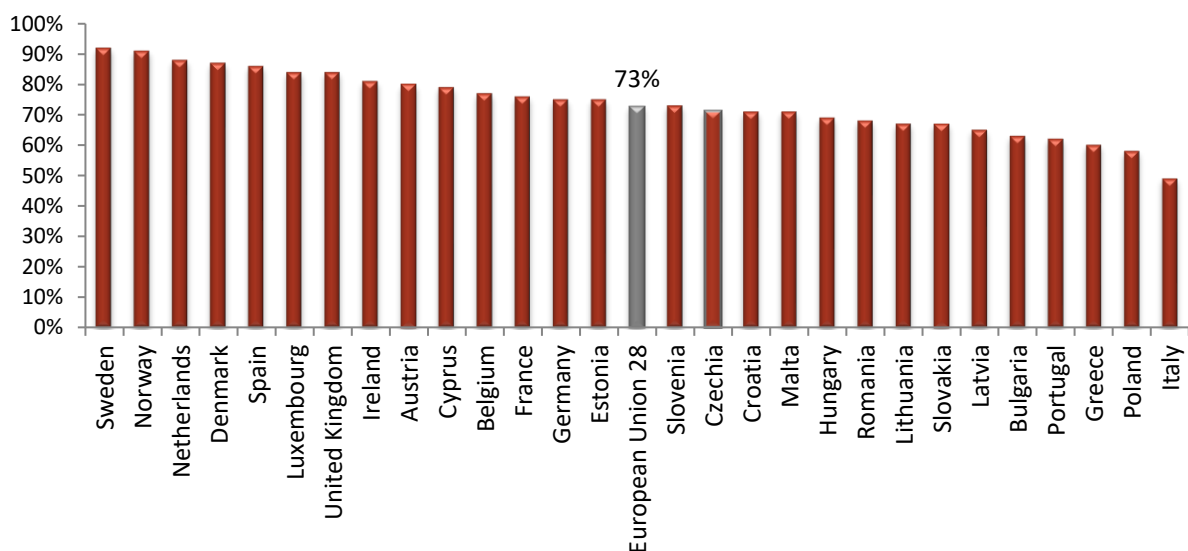
If fast and ultra-fast wired broadband systems are being currently developed, mobile broadband infrastructure with high download capacity has already become widely available. According to the data provided by the operators and the EU Commission, the mobile networks supply **4G (LTE) broadband capacity to almost 96% of European households**. Moreover, even in the three countries with the lowest levels (Cyprus, Romania and Ireland), the coverage is above 80% of households (Fig. 5.9).

Fig. 5.9: 4G mobile broadband (LTE) coverage (% of households, 2019)



Source: European Commission, Digital Scoreboard

Fig. 5.10: Individuals using a mobile phone (or smartphone) to access the Internet (% , 2019)



Note: data for Finland is missing

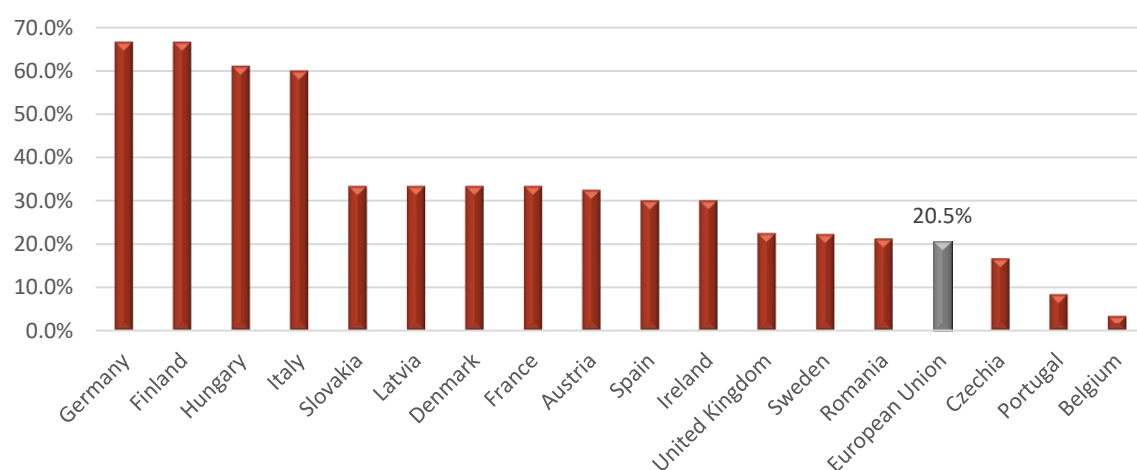
Source: Eurostat

Mobile networks have become such good performers that, in 2018, about 10% of European households used only mobile to connect to the Internet. As **for internet access in mobility**, in 2019, 73% of Europeans used a mobile phone (or smartphone) for this purpose. Northern European countries, together with Spain, register a more widespread smartphone usage, whereas Greece and Poland show a penetration of about 60%. Italy is the only country below the 50% threshold.

As far as mobile networks are concerned, a fundamental element is linked to the spread of 5G. This is due to the contribution it can provide in spreading the Internet of Things and, as well, the economic benefits resulting from its technical features. For these reasons, it is extremely important for the EU institutions to speed up the upgrading to 5G networks and the construction of new infrastructures supporting the new mobile standard.

Fig. 5.11 shows how **spectrum allocation** is very far from being complete, with only 17 Member States having assigned spectrum in the 5G pioneer bands by the end of March 2020. 5G readiness is calculated based on the portion of spectrum assigned in each 5G pioneer band in comparison to the maximum feasible amounts²⁶.

Fig. 5.11: 5G Readiness in European countries



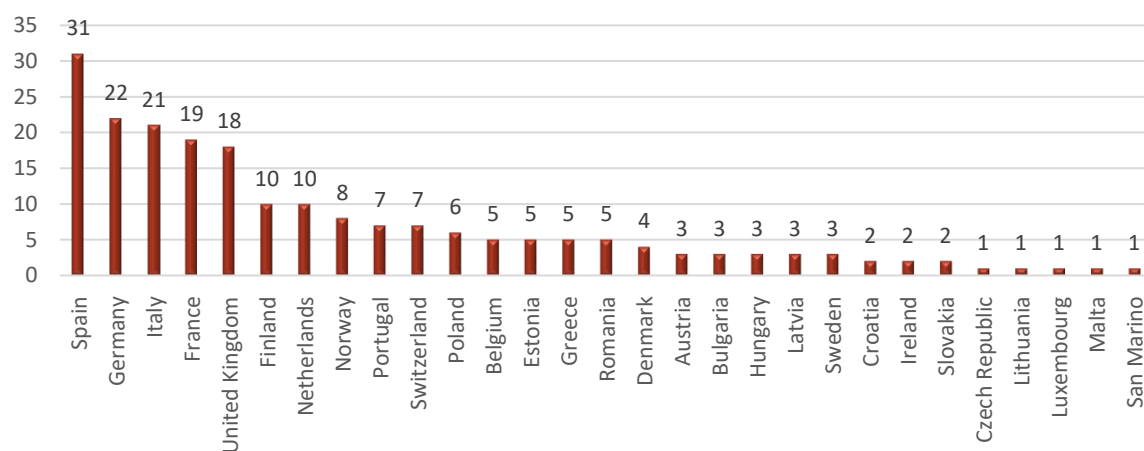
Source: 5G Observatory, 2019

²⁶ The maximum limit is considered as follows:

- 60 MHz in the 700 MHz band
- 400 MHz in 3.6 GHz band
- 1000 MHz within the 26 GHz band

At the same date, only 4 countries - Germany, Finland, Hungary and Italy)- had assigned at least 60% of the considered spectrum, while 11 MSs - Bulgaria, Croatia, Cyprus, Estonia, Greece, Lithuania, Luxembourg, Malta, the Netherlands, Poland and Slovenia- had still not assigned anything (according to the quoted conditions) -.

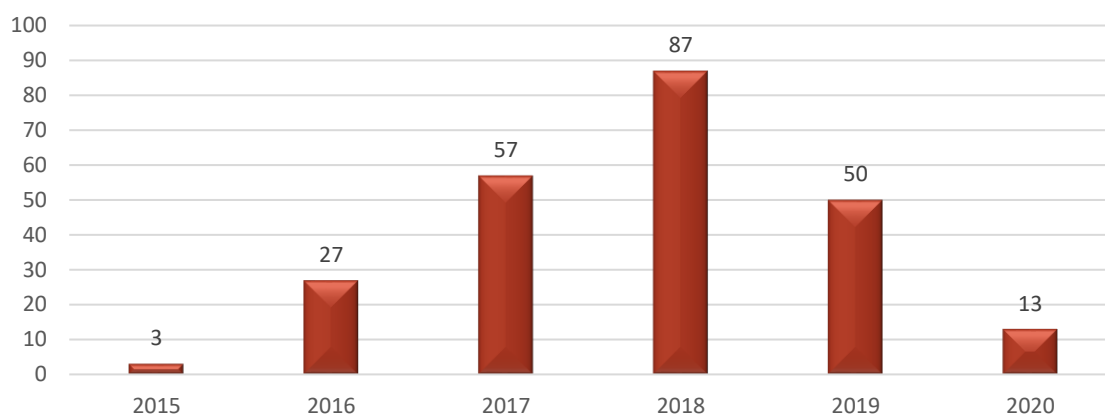
Fig. 5.12: 5G Trials in Europe by country (2015-2020)



Note: Calculated according to public announcements. The perimeter includes EU27 + UK

Source: 5G Observatory 2020

Fig. 5.13: Yearly evolution of the 5G trial announcements in Europe (yearly n. of trials, 2015-2020)



Note: Calculated according to public announcements. The perimeter includes EU27 + UK
Source: 5G Observatory 2020

Focusing on 5G trials (Fig. 5.12), it emerges that the **5 main countries are conducting a wider number of experiments**, accounting for almost 40% of the total (210 trials), showing that the interest of both national bodies and private operators for the new mobile transmission standard in the larger EU economies is high. Spain is currently the leader with 31 trials, followed by Germany (22), Italy (21), France (19) and the UK (18). At the same time, looking at the number of trials per year since 2015, is clear that this momentum is slowing down (Fig. 5.13).

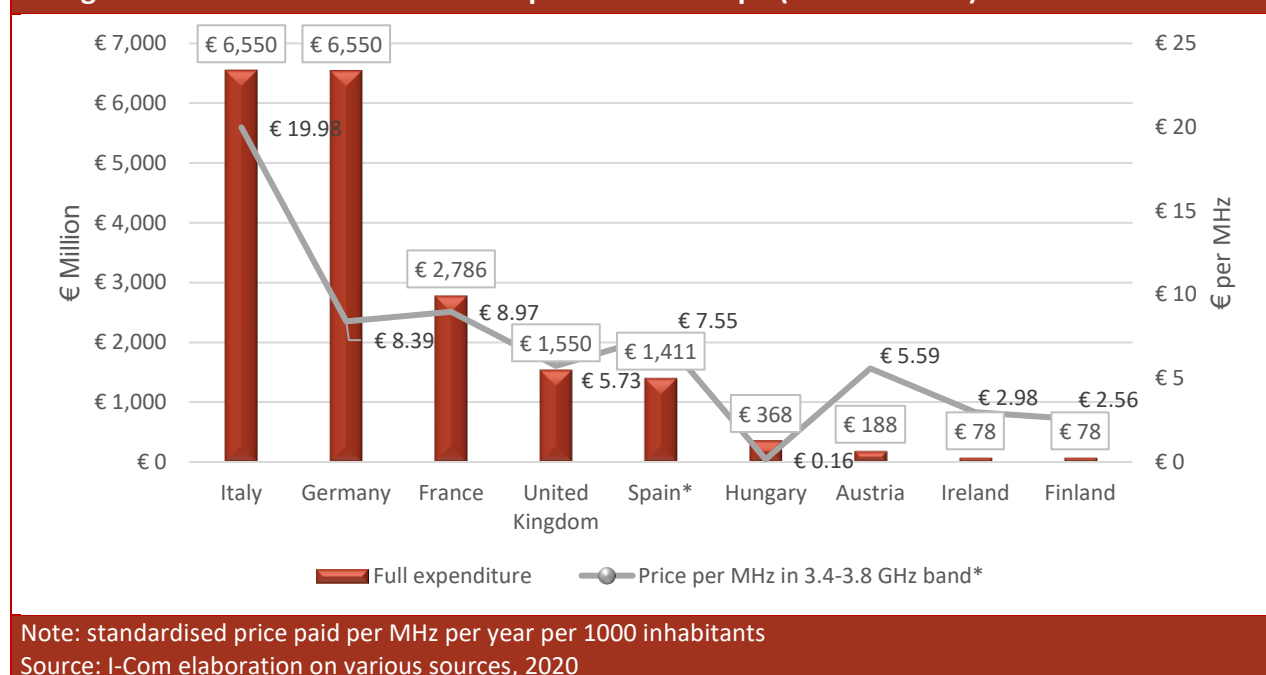
For this reason, along with the possible economic and social benefits, operator investments and the racing ahead of foreign countries such as South Korea and the economic super powers of China and the US to implement the new standards, a start to study **measures that could accelerate the spread of 5G within Europe** could be a sensible move.

Where the economic advantages are concerned, the study commissioned by the European Commission to a consortium made up of Trinity College, Tech4i2, Real Wireless and InterDigital (2016), found that 5G could produce benefits of up to €113 billion per year in 2025, coming from automotive (€42 bn), transport (€8 bn), smart workplaces (€30 bn), smart cities (€8 bn) and suburban areas (€10 bn).

While benefits are consistent, the same can also be said for the **investments required to implement the new 5G technical environment**. First of all, in countries such as Italy and Germany, the spectrum auction price overtook the €6 billion threshold. Currently, the amount spent in

Europe is already close €20 billion, and there are still many more spectrums to assign. Comparing the pioneer band for 5G (3.4-3.8 GHz), the price per MHz paid in Italy is by far the highest, taking into account the licence length and the number of inhabitants (Fig. 2.14).

Fig. 5.14: Auction results for 5G frequencies in Europe (October 2020)

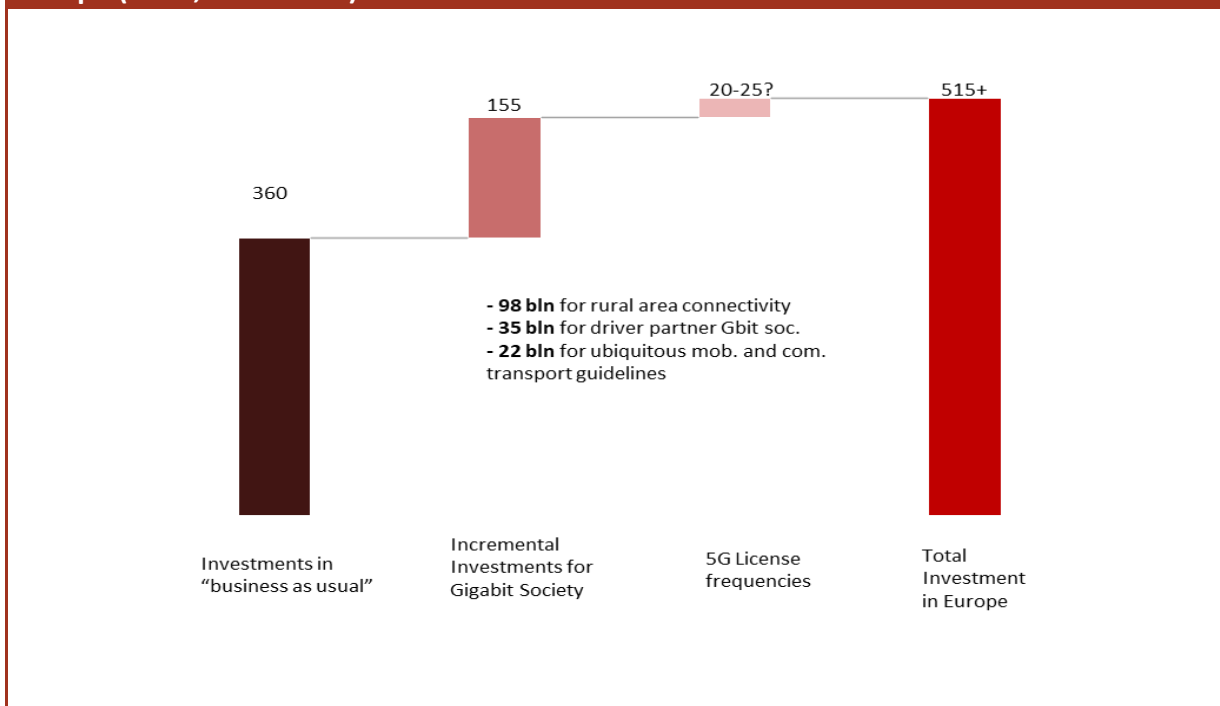


Generally speaking, **investments required for the implementation of the 5G networks** have been estimated as more than €515 billion, coming from the so-called “business as usual” segments (about €360 bn), as well as from the incremental investment for the Gigabit Society (€98 bn for rural area connectivity), while €35 billion are required for socio-economic driver connectivity and €22 billion for ubiquitous mobility and connection of transport routes.

Overall, the large amount of investments in 5G networks could lead to a consistent contribution to the EU economy. GSMA estimated the **global impact of 5G investments on the world economy**, finding resulting growth up to over \$ 2.2 trillion between 2024 and 2034, driven by utilities, manufacturing, professional services and financial services (over \$1400 bn). To these, can be added another \$350 billion from public services, \$300 billion from ICT and trade, in addition to \$140 billion from agriculture and mining. At the level of geographical areas, estimates indicate the greatest growth in the US (over \$650 bn), followed by Europe (\$480 bn) and China (\$460 bn). At the sectoral level, China will receive many more benefits from manufacturing and utilities (up to \$270 bn), while the US and Europe will see revenues from professional and financial services grow to \$250 and \$170 billion, respectively. In terms of public services, Europe could generate benefits

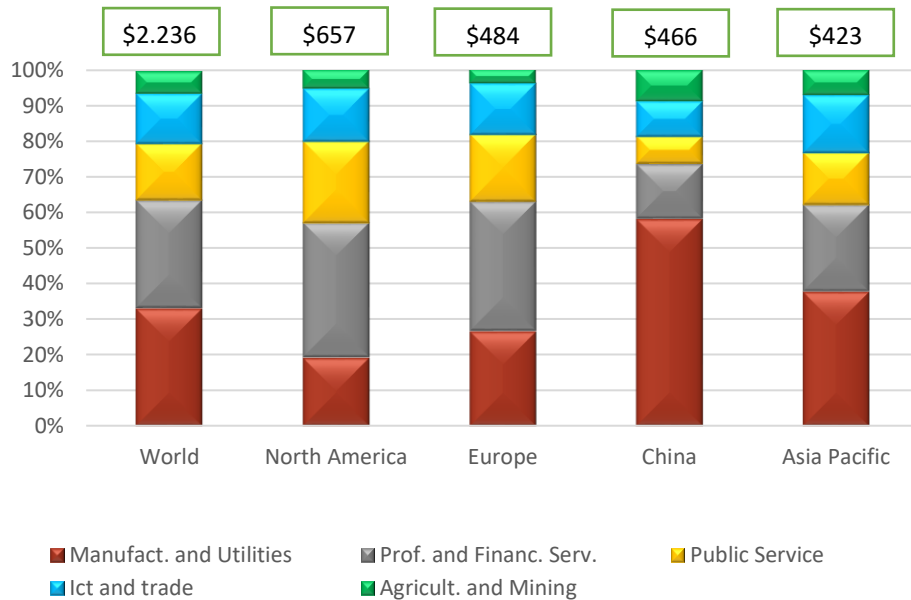
up to 3 times higher than those of China (\$90 bn vs \$30 bn), but still significantly lower than the US (about \$150 bn).

Fig. 5.15: Estimated investments needed for the implementation of the 5G network in Europe (€ bln, 2017-2025)



Source: European Commission Connectivity for a Competitive Digital Single Market (2016)

Fig. 5.16. 5G contribution to global economic growth (in \$ bn, 2024-2034)

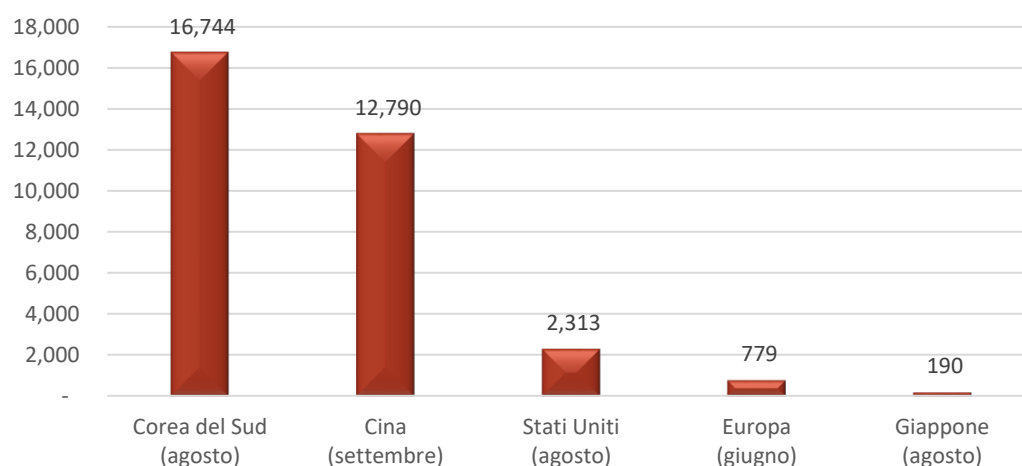


Source: GSMA, Mobile Economy 2020

As for the 5G services users, although it is difficult to provide an exact number considering the recent implementation of the services and the scarcity of data provided by operators, I-Com has estimated the number of active users per 100,000 inhabitants taking into account data from multiple primary sources (Fig.5.17). The analysis shows that South Korea shows the highest spread **in 5G services in relation to the population** (16,744 per 100,000 inhabitants), followed closely by China (12,790). The US and Europe are significantly lagging behind the first two countries examined, with just 2,313 and 779, respectively, of 5G services users per 100,000 inhabitants. Japan (190 users per 10,000 inhabitants) is in the last position among the considered areas, even if it must be taken into account that it is the last Asian country to have launched commercial 5G services and that, among Japanese mobile operators, only one has provided official data.

Hence, data shows the **need for Europe to accelerate in terms of infrastructures and offer of attractive services for users**, by increasing and encouraging investments in networks and also by means of policies that facilitate the activities for sector operators.

Fig.5.17: 5G users per geographical area (per 100,000 inhabitants, 2020)



Note: Some operators (Unicom – China, KDDI – Japan, SoftBank – Japan) did not provide 5G user data. Data for the USA is related to the number of 5G mobiles sold by the network operators.

Source: I-Com on South Korean Ministry of Science and ICT, China Mobile, China Telecom, M-Science, DOCOMO, Ericsson, World Bank

5.3. Cybersecurity issues between technical assessment and geographical discrimination

The Covid-19 crisis has once again highlighted the **importance of digital networks and new technologies in our societies**. These have seen a continuous expansion in usage and coverage in recent years and are now of paramount importance in many spheres of social and economic activities within the European Union. Not only are they essential for economic development and for telecommunications, but, as well, during the Covid-19 pandemic, they have played a **vital role** in allowing for the continuation of services, production, public administration, transport, office jobs and education.

While reducing actual human physical intervention, the ongoing pandemic has been an **accelerator for the adoption of new digital services and infrastructures**, and for the **creation of networks** containing data, private and public information, as well as economic transactions. Most of these now affect our daily life and are becoming part of all citizens' habits, contributing to narrowing the generational digital-divide that used to be quite considerable in Europe.

In parallel, the emergency resulting from Covid-19 and the forced permanence of citizens in their homes during lockdown periods, has had significant effects on telecommunication systems, resulting in an **exponential increase in data traffic**. This has been due to the increased use of video

content, streaming, gaming platforms and other data-intensive products, as well as the massive use of companies adopting smart-working and educational institutions e-learning for students. Furthermore, the pandemic has also increased the use of online shopping services and e-commerce that, together with video-calls and messaging, have contributed to increasing the amount of **personal information and details available online**.

Following the increase in data traffic and available online content, the number of **cyber-attacks also has also greatly grown**. The fast and sudden adoption of new technologies and more efficient telecommunication systems, such as the 5G networks, has increased the possible scope for these illegal crimes, and European institutions are now working to strengthen the security issues arising from the digitisation boom of the recent months. The dramatic changes in European lifestyles and interaction have become key to EU policies that are being planned and implemented in order to lead to the post-Covid recovery. The Next Generation EU investment scheme has allocated 20% of expenditure to the digitisation sector and has identified **cybersecurity** as one of its top priorities. This was linked to the increased number of cyber-attacks occurring during the lockdown, emphasising the vulnerability of the current IT infrastructures and the need for further, renewed, widespread digital protection systems.

Over the last months, there has been an **extraordinary increase in cyber-attacks** from multiple sources, attempting to exploit the abrupt digital disruption caused by the pandemic and the lack of knowledge of millions of digitally unskilled people who were suddenly forced to carry out activities on the Internet, being exposed to threats. Furthermore, the crisis has also shown the need for a stronger industrial and technological presence in strategic areas of the digital supply chain, as well as for **stronger synergies between network providers and regulatory institutions** as the security of technology is emerging as a critical and central key- -topic.

As a part of the Recovery Plan Communication “Europe's moment: Repair and Prepare for the Next Generation”, the Commission has announced a new Cybersecurity Strategy, which could look at how to boost EU-level cooperation, knowledge and capacity on the issue. The aim is to help European countries to strengthen their industrial capabilities and partnerships, specifically focusing on supporting SMEs in becoming established in new digital markets. According to the Recovery Plan Communication, this will accompany the review of the Directive on the Security of Network and Information Systems (**NIS Directive**) and a proposal for additional measures on Critical Infrastructure Protection. In addition, the EU Council also underlined the importance of cybersecurity as a key component towards the establishment of a **digitalised Single Market**. The Council highlighted the need for trust in digital technology and recognised that the increase in

connectivity and in amounts of data can result in citizens, companies and governments, being exposed to cyber threats and crimes that are increasing in number and sophistication. For these reasons, the Council emphasised the importance of **safeguarding critical infrastructures**, electronic communications networks, services, and terminal equipment by boosting the Union’s cyber defences with an €8.2 billion investment in the Digital Europe Programme.

An important role is also to be played by the GSMA Association and 3GPP in implementing a common framework to support vendors to meet all the requirements published in the **EU Toolbox** and following Commission reports. With the latter, the EU intends to stress the importance of uniform regulations at European level in response to the intensifying transition of the most important economic activities to mobile networks due to growing data traffic and the massive spread of IoT, Big Data analysis, as well as services such as cloud storage. Furthermore, these are needed to **set common standards for mobile network providers** who play a key role in the construction of the infrastructures needed for the network deployment.

In order to foster the creation of a uniform and secure network, the GSMA is implementing the **NESAS** (Network Equipment Security Assurance Scheme), a common scheme for 5G certification defined together with 3GPP. The latter group establishes the predefined standardised security tests and the Security Assurance Specifications (SCAS), while GSMA provides the requirements and the methodology for vendor process assessment and the procedures for the test lab accreditation.

The NESAS provides an **industry-wide security assurance framework** to facilitate improvements in security levels on mobile network infrastructure equipment with the goal of making a common set of security requirements available. Independently from national standards, this introduces a security baseline for all products and is based on voluntary participation. Vendors are free to decide if to follow the scheme or not, and the network is made up of operators and regulators. Thanks to the **interaction among all stakeholders** and the continuous feedback, the standard is designed to evolve over time and to extend requirements if the possibility of improvements in particular areas is shown. The NESAS is, therefore, tailored to industry needs, and also includes fast processes for the release of new products and for the updating of pre-existing ones.

The debate on common standards and regulations at European level is also of crucial importance for political and geographical reasons. Within the globalised world, the EU is working to create and foster its own technological sovereignty without relinquishing the advantages of maintaining an open trade and innovation flow. This is also important to avoid divergent national approaches in an area with strong **geopolitical consequences**. As for the concern on cybersecurity enforcement,

the European Commission aims at guiding the European countries towards the provision of services from strategically important corporates with a specific focus on firms established and operating in the EU.

Two principles, were generally taken into account by the major European countries **regarding the security of telecommunications networks and 5G**. Firstly, the need to not compromise the feasibility and the potential of projects considered essential for the development of new technologies and, secondly, the protection of economic and commercial principles adopted in a market society.

Interest in the subject has become even greater due to pressures exerted by the USA on the NATO alliance countries. These have recently become more explicit, leading to a **stronger tightening up** of several European countries regarding **non-European vendors**. For example, the UK formalised the decision to exclude Huawei from supplies for the country's new 5G network from 31 December 2020. An important response in this direction was also given by 41 MEPs, belonging to five different groups, who sent a letter to Commissioners Breton, Vestager and Dombrovskis, stating that suppliers from non-European providers represent **"a danger to the safety"** of EU networks.

Nevertheless, market trends observed in many countries show an inclination of the network operators towards the **renewal of agreements with previous equipment suppliers** (the so-called **legacy effect**), in order to speed up and smoothen the upgrading processes from 4G to 5G networks. In fact, within the limits of the availability of frequencies and the new standards, the upgrade to 5G is now considered as a must-have, being crucial for economic development, telecommunications and job creation. Moreover, **vendor diversification** in an already concentrated market is an increasing priority, both for economic and security reasons.

5.4. The European initiatives to encourage development and ensure the security of digital infrastructures

The digital transformation of society and the economy has led to the rise of new security issues. Since 2013, the EU has worked on a wide legislation on cybersecurity to appropriately face the challenges of digitalisation.

The **EU Cybersecurity Strategy of 2013** was adopted to safeguard the online environment providing security and freedom. It outlines the EU's vision and proposes actions aimed at pursuing cyber resilience, reducing cybercrime, developing an EU Cyber Defence Policy and fostering the industrial and technological resources required to benefit from the Digital Single Market.

Nevertheless, a significant step forward in the EU legislation on cybersecurity was represented by the **Directive on Security of Network and Information System** (the **NIS Directive**), adopted by the European Parliament on 6 July 2016, entering into force in August 2016. Member States had to transpose the directive into national law by May 2018, following Art. 7 of the directive itself, that explicitly identifies the leading principle for national strategies. Moreover, the directive encourages cooperation and the exchange of information among MSs by setting up a cooperation group made up of MS representatives, the European Commission and the EU Agency for Cybersecurity (ENISA). The group is involved in the planning, guidance, signaling and sharing of the strategies. In addition, the directive creates a network of agents active on security issues and identifies the security and notification requirements needed by digital service providers.

With **Regulation 2019/881**, known as the **Cybersecurity Act**, the EU reached a political agreement to strengthen the EU Agency for Cybersecurity (**ENISA**) and established a wide certification framework on digital products, services and processes. The first part of the regulation, specifically the first 45 articles, disciplines the mandate, resources and new tasks of the ENISA, while from article 46 on, it describes the certification framework for cybersecurity with the aim of building up a Single Digital Market. The ENISA must propose implementation acts that the Commission can adopt, and it must also evaluate each certification system every 5 years.

The regulation identifies a set of security requirements for the European certification systems, dividing them into three groups – basic, substantial and high - and basing the evaluation on the expected risk level associated with the use of the product, service or process in terms of impact and probability of the occurrence of product inconvenience and liability. It specifies the evaluation activities and the remedies for each category. Furthermore, it prescribes at the organisational level the identification of a national authority in each Member State.

In addition, the Cybersecurity Act establishes the **European Cybersecurity Certification Group** (ECCG), made up of representatives from national cybersecurity certification authorities or other relevant national authorities, to assist the Commission in its work to ensure the implementation and application of the act, being an advisor in the relations between the Commission and the ENISA.

By 28 June 2024, and then every 5 years, the Commission will have to evaluate the impact and effectiveness of the ENISA and its work, with the possibility to modify its mandate and subsequent financial implications.

The continually evolving digital environment requires the European system to be able to define and implement effective security standards in order to make the development of 5G networks possible. This is a core target as these networks are a key element for the internal market to evolve, especially for the effective management of core economic and social services, such as energy, transport, financial services, health systems and industrial controls.

On 26 March 2019, the Commission adopted **Recommendation 2019/534** on the cybersecurity of 5G networks, highlighting the risks for these networks and suggesting risk-analysis and management methods at the national level to be implemented within a coherent European context.

It is important to not only consider the technical factors, but also to evaluate the risks under a broader approach involving legal requirements, or other aspects concerning technological providers or the governance model adopted in the MSs.

The recommendation identifies a set of actions to support an appropriate risk assessment, both at national and European levels, and a package of measures to implement in case of need. For 5G networks, it identifies a clear roadmap that the MSs must follow to evaluate risks, updating the requirements for firms that provide public communication networks or public communication services.

In order to achieve an effective prevention of and fight against threats, the document points out the importance of a **European coordination of the evaluation systems** and encourages **information sharing between MSs and the European institutions**, in order to reach a common awareness of the cybersecurity risks connected to 5G networks. Moreover, each Member State should have communicated its national evaluations to the ENISA by 15 July 2019, in order to complete a specific map of the 5G environment in Europe.

Finally, the recommendation encouraged MSs to cooperate with the Commission in evaluating the effects of the document itself by 10 October 2020. Hence, consistent with the recommendation, the **NIS Cooperation Group** has published a **EU-wide coordinated risk assessment of 5G network security**. This is a report that, starting from the respective MS's evaluations, identifies the most important threats and most dangerous agents, the sensitive resources, the main vulnerabilities and the different strategic dangers. The report also focuses on the innovations brought about by these networks and, as well, the role of providers in setting up and using 5G networks, and the degree of dependence from the single provider. It also stresses the importance of the implementation of a new security paradigm through the analysis of the current strategic

framework. Moreover, in its conclusion of the 3 December 2019, the Council sustained the remarks of the Cooperation Group, once again underlining the importance of a coherent approach to avoid market fragmentation.

Finally, on 29 January 2020, the Commission published the **Communication "Secure 5G deployment in the EU - Implementing the EU toolbox"** which took note of the absolute importance of 5G for many essential services and, therefore, the strategic need for the Union to ensure 5G network cybersecurity at a time when cyber-attacks are both on the rise, more sophisticated and affecting a wide range of stakeholders. Under the NIS cooperation and following the completion of MSs' 5g network infrastructure risk assessment procedures, the NIS Cooperation Group published a EU-wide report on the coordinated cybersecurity risk assessment of these networks, identifying the most important threats and their main perpetrators, the most sensitive resources and major vulnerabilities (technical and other) affecting 5G networks.

On the same date, the NIS Cooperation Group published the EU's **package of instruments**, including risk mitigation measures. It deals with all the risks identified in the coordinated risk assessment report, identifying and describing a range of strategic and technical measures, as well as corresponding support actions aimed at strengthening their effectiveness, which can be implemented to mitigate the identified risks. The document, in highlighting how Europe is one of the most advanced regions in the world regarding the commercial launch of 5G services (by the end of 2020, the first 5G services should be available in 138 European cities), takes stock of some of the areas where 5G will operate as an enabling factor for a number of important applications and, more specifically, in e-health, intelligent energy networks, future factories, media and entertainment and mobility.

The document's objective is to identify a possible common set of measures to **mitigate the main cybersecurity risks of 5G networks** (as identified in the EU-coordinated risk assessment report) and to provide **guidance in selecting the measures to be taken** so as to create a robust framework ensuring an adequate level of cybersecurity in the 5G networks across the EU and a coordinated MS approach.

The package's measures will contribute to achieving a number of important **safety objectives** necessary to address the risks identified in the risk assessment report and to protect the confidentiality, integrity and availability of 5G networks. These objectives are based on: a) strengthening security in the design, implementation and operation of networks; b) raising **basic safety standards** for product and service safety; c) minimising **exposure to the risks** arising from the risk profile of individual suppliers; d) avoiding or limiting the **main dependencies on a single**

provider in 5G networks; and e) promoting a **diverse, competitive and sustainable market for 5G equipment**. After briefly recalling the regulatory tools already in use (NIS Directive, Cybersecurity Act, Reg. 452/2019 which has established a framework for controlling foreign direct investment in the Union, the GDPR, and e-Privacy Directive, etc.), the document highlights the centrality of mobile network operators and their suppliers, responsible for providing the software and hardware needed for network operations.

Where the measures are concerned, the **package** identifies: 1) **8 strategic measures**, including strengthening the regulatory powers of the authorities for the examination of the network supply and deployment, specific measures to address risks related to non-technical vulnerabilities (e.g. risk of interference by a third country or risks of dependence), as well as possible initiatives to promote a sustainable and diversified 5G supply chain and value, in order to avoid systemic long-term dependency risks; 2) **11 technical measures**, including measures to strengthen the security of 5G networks and equipment and, in particular, the security of technologies, software, processes, people and physical factors. These measures are to be supported by a **number of actions** based on reviewing or developing network security guidelines and best practices, strengthening the testing and control capabilities at a national and European level, supporting standardisation, exchanging best practices on the implementation of strategic measures (especially, national disciplines for assessing the risk profile of suppliers), ensuring that public-funded 5G implementation projects take into account cybersecurity risks and ensuring the application of standard technical and organisational security measures through a specific European Certification Scheme.

The most complex section of the document is paragraph 4.2 where for each of the nine risk areas identified in the EU-wide coordinated risk assessment report, the package identifies **risk mitigation plans**. These involve a combination of strategic and/or technical measures (along with appropriate support actions) that are classified into four levels, based on an assessment that considers risks to be faced and the persistent risks occurring after the application of the same measure. In conclusion, the toolbox calls on MSs to implement measures and obtain the necessary powers to mitigate risks, by strengthening security requirements for mobile network operators, assessing the risk profile of suppliers, and applying appropriate restrictions on suppliers considered to be high risk. The latter includes the necessary exclusions for critical assets, ensuring that each operator has an adequate multi-supplier strategy to avoid or limit any heavy dependence on a single supplier and avoid dependence on suppliers. The Commission expressed its willingness to continue to provide full support and take all relevant actions within its powers in order to support MS implementation of the package of instruments and to strengthen its impact. It called

on MSs to outline, by 30 April 2020, firm and measurable actions to implement the set of key measures recommended in the conclusions of the EU's toolkit package and, as well, for the NIS Cooperation Group to prepare a report on the state of implementation in each MS of these key measures by 30 June 2020. This was to be on the basis of the reports already submitted and the monitoring carried out periodically, particularly within the NIS Cooperation Group, with the support of the Commission and ENISA.

On 24 July 2020, the NIS Cooperation Group, with the support of the Commission and ENISA, published a **report on MSs' progress in implementing the 5G security toolbox**. This is a very interesting document which takes stock of the level of maturity reached by the various countries in the implementation of the measures contained in the toolbox and shows how, although all MSs have started to revise and strengthen their security measures in view of 5G, in some countries this work is still ongoing and, therefore, no final measures have yet been taken. At a general level, the report highlights that the three main risks identified are the incorrect configuration of networks, the lack of access control and state interference through the 5G supply chain. Regarding the latter, it highlights the belief, widespread among states, in the lack of adequate existing measures. Where the dependence on individual suppliers is concerned, the report highlights the need to understand the involvement of different suppliers in the individual elements of the network, the technical and operational difficulty of applying a multi-vendor strategy at certain points of the network, the limited number of 5G suppliers, the major critical issues for smaller countries, the possible effects on operators resulting from the formulation of diversified requests to suppliers and the need to identify specific regulatory bases that allow for imposing certain obligations on suppliers. Also interesting, are the considerations related to the implementation of measures to ensure the security of 5G networks. On this specific point, the document, after having defined the medium-low level of maturity reached in the implementation of such measures, describes a rather diversified panorama where, however, the request emerges from many MSs for a coordinated approach to EU standards. The deadline for MSs, in cooperation with the Commission, to determine whether further action is needed, expired on 1 October 2020.

In the meantime, on 25 June 2020, the Commission launched the **public consultation for the revision of Directive 2016/1148** on measures for an EU common level of network and information systems security ("NIS Directive"). The launch of the public consultation (closed on 2 October) was in line with the periodic review of the NIS Directive, provided for in Article 23, to verify its functioning and application in the individual MSs. The review will have to take place, as announced by the Commission and in line with the political objective of making "Europe fit for the digital age", by the end of 2020 prior to the May 2021 deadline set by the afore-mentioned article. The review pursues a threefold objective: to assess the possible improvement of cybersecurity in the EU, to

identify existing and potentially emerging key security issues affecting the functioning of the directive and to identify and quantify the regulatory costs and benefits.

To foster the development of networks, on 20 July 2020, **Implementing Regulation n. 2020/1070**, which specifies the characteristics of wireless access points of limited scope in accordance with Article 57(2) of the European Electronic Communications Code, was adopted.

The **Code**, adopted in 2018, and being transposed in the various EU countries just this year (by 21 December), has introduced a number of important innovations regarding the scope of the regulatory framework, access regulation, radio spectrum management, universal service and consumer protection. The code, specifically, in addition to regulating the powers of the regulatory authorities: sets the contents of the authorisations; regulates spectrum assignment procedures; prescribes, in art.22, the national regulatory authorities to proceed, by 21 December 2023 (and then every three years), with the geographical mapping of electronic communications networks capable of providing broadband with the possibility to include also forward-looking assessments; sets out, in art.40/41, a series of requirements aimed at ensuring the security of networks and services. In view of the launch and spread of 5G, the new code contains provisions aimed at accelerating and coordinating spectrum assignment procedures for electronic communications services and networks. In particular, it is foreseen that the radio spectrum for 5G will be allocated by the end of 2020. The new rules also aim at harmonising certain key aspects of licensing models and authorisation regimes, including the minimum duration of individual rights of use licences (at least 15 years), addressing problems arising from harmful (national or cross-border) interference, and facilitating, whenever possible, the shared use, transfer and lease of spectrum on the basis of the "use it or lose it" principle.

Within this set of initiatives, there is also the adoption of the Recovery Fund, a powerful instrument to combat the economic crisis caused by the health emergency and a bulwark of EU economic recovery. The **Next Generation EU** will have an extraordinary impact being placed next to and in combination with a strengthened Multi-annual Financial Framework (MFF), allowing the Commission to contract, on behalf of the Union, loans on the capital markets up to €750 billion at 2018 prices with the EU commitment to use the loans contracted on the capital markets for the sole purpose of dealing with the consequences of the Covid-19. Next Generation EU is based on **three pillars**: 1) instruments to support MS efforts to overcome the crisis and restart; 2) measures to stimulate private investment and support businesses in difficulty; 3) a strengthening of EU strategic programmes to learn the lessons of the crisis and make the Single Market stronger and more resilient and accelerate the dual green and digital transition.

The Next Generation EU identified **cybersecurity as one of its top priorities**, also due to the Covid-19 crisis. This was especially linked to the increased cyber-attacks occurring during the lockdown, showing the vulnerability in the current IT system. Over the last weeks, there has been an extraordinary increase in malicious attacks from multiple sources, attempting to capitalise on the sudden digital disruption caused by the pandemic (millions of digitally unskilled people were obliged to carry out activities on the Internet, being exposed to threats). Furthermore, the crisis has also shown the need for a stronger industrial and technological presence in strategic parts of the digital supply chain, since the security of technology is emerging as a critical and central key-topic.

As a part of the Recovery Plan Communication “*Europe's moment: Repair and Prepare for the Next Generation*”, the Commission has announced a **new Cybersecurity Strategy**, which could look at how to boost EU-level cooperation, knowledge and capacity. The aim is to help Europe strengthen its industrial capabilities and partnerships, and support SMEs in becoming established in the markets. According to the Recovery Plan Communication, this will accompany the review of the Directive on the Security of Network and Information Systems (NIS Directive) and a proposal for additional measures on Critical Infrastructure Protection.

In addition, on **9 June 2020**, the **EU Council** also underlined the importance of cybersecurity as a key component for a digitalised Single Market. The Council highlighted the need for trust in digital technology and recognised that increased connectivity, while empowering digital services, can result in citizens, companies and governments being exposed to cyber threats and crimes that are increasing in number and sophistication. For these reasons, the Council emphasised the importance of safeguarding critical infrastructures, electronic communications networks, services and terminal equipment.

As well as the reinforcements financed under Next Generation EU, other programmes are focusing on making the Union more resilient and addressing challenges that have been heightened by the pandemic and its consequences. These include boosting the Union's cyber-defences and supporting the digital transition by equipping the **Digital Europe Programme** with a total budget of €8.2 billion.

In order to access these resources, each Member State will have to define - by 30 April 2021 at the latest - its national plan for recovery and resilience in which the reform and investment programme of the MS concerned for the period 2021-2026 is defined and will be examined by the Commission and the Council.

On 17 September, the Commission, launching the Annual Strategy for Sustainable Growth 2021, published the **guidelines for the preparation of the plans** and the consequent access to the RRF, in which digital and, in particular, the development of networks, play a leading role. The guidelines, on the one hand, identify the fight against the climate and environmental crisis as the main challenge of our time, highlighting the opportunity to sustainably revitalise our economies and, on the other, it recognises the digital transition as a key tool for strengthening the social and economic resilience of the EU and its MSs, and their potential for sustainable growth and job creation.

On the resources to be allocated to the different priorities, the guidelines prescribe that each recovery and resilience plan should include **at least 37% of climate spending and at least 20% to promote the digital transformation of all economic or social sectors**, including public services. It identifies seven flagship projects, with the Commission strongly encouraging their inclusion in national plans, one of which specifically concerns connectivity. Where networks are concerned, in line with the approach adopted in **Connecting Europe Facility (CEF2)** to support and catalyse investments in digital connectivity infrastructures of common interest during the period 2021-2027, the Commission encourages MSs to focus on reforms and investments that improve connectivity by promoting the large-scale deployment of very high capacity networks, including 5G and Gigabit connectivity between households in urban and rural areas and major transport corridors. This is in line with the EU's objectives for 5G and Gigabit connectivity by 2025.

To accelerate the development of digital infrastructures, on 18 September, the Commission published **Recommendation n.2020/1307** on a common EU toolbox to reduce the cost of deploying very high capacity networks and ensure timely and investment-friendly access to 5G radio spectrum to promote connectivity in support of European economic recovery from the Covid-19 crisis. It is an important document which, starting from the recognition of the need to ensure high performance networks and to develop a common Union approach, pursues the objective of fostering the timely deployment of very high capacity networks, including fibre optic networks and next generation wireless networks. It focuses on three objectives: 1) reducing the cost and accelerating the procedures for the deployment of electronic communications networks, by streamlining permitting procedures, increasing transparency and improving the work of the Points of Single Contact set up under the Broadband Cost Reduction Directive, extending access rights to existing physical infrastructure controlled by public authorities and identifying measures that would help to reduce the environmental impact of networks; b) providing timely access to 5G radio spectrum through incentives for investment in the use of spectrum, as well as timely spectrum assignment procedures for 5G pioneer bands; c) defining a more robust coordination

process for spectrum assignment that also facilitates the cross-border provision of innovative 5G services.

With regard to timing, Member States should identify and share best practices among themselves and with the Commission by 20 December 2020 and reach agreement on the package of instruments by 30 March 2021. At the same time, the Commission sets 30 April 2021 as the deadline for each MS to submit a roadmap for the implementation of the package of instruments, and 30 April 2022 as the deadline for the same states to report on the implementation of the package of instruments.

6. A NEW SKILLS AGENDA FOR EUROPE

6.1. Introduction to the European Skills Agenda and the initiatives to encourage skills acquisition

The EU’s transition to a green and digital economy and the wide deployment of artificial intelligence and robotics require an unparalleled shift in skill sets due to new jobs being created and other jobs changing or even disappearing. Therefore, it is essential that European citizens improve their existing skills and undertake training in new skills. Moreover, a **skills revolution** is fundamental to helping in the Covid-19 pandemic recovery. The current health crisis has clearly shown that digital skills are not just an asset for career progress, but also essential for work, study, accessing goods and services, keeping in touch with others and the latest information, and having a say and supporting each other²⁷.

Based on the above, after four years from the first Skills Agenda, the European Commission adopted the **new Skills Agenda for Europe on 1 July 2020**²⁸, which highlights the importance of skills to achieve sustainable competitiveness, social fairness and resilience for all²⁹. This is a strategy aimed at strengthening and renewing skills for all European citizens, which are of key importance, especially in the current situation, determined by the Covid-19 pandemic.

The Commission wishes to ensure the right to quality and inclusive education, training and life-long learning, enshrined in the European Pillar of Social Rights, for everybody and everywhere in the EU, from cities to remote and rural areas.

The new Skills Agenda covers the following **five steps**:

1. Calls for collective action, mobilising business, social partners and stakeholders, to commit to working together, overall within the EU’s industrial ecosystems;
2. Defines a clear strategy to ensure that skills lead to jobs;
3. Identifies the financial means to foster investment in skills;
4. Helps people in building their skills throughout life in an environment where lifelong learning is the norm;
5. Sets ambitious objectives for upskilling and reskilling to be achieved within the next 5 years.

²⁷ <https://ec.europa.eu/social/main.jsp?catId=1223&langId=en> (Last access: 11.08.2020)

²⁸ https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1196 (Last access: 20.11.2020)

²⁹ [file:///C:/Users/utente/Downloads/Communication_30June_v2%20\(4\).pdf](file:///C:/Users/utente/Downloads/Communication_30June_v2%20(4).pdf) (Last access: 20.11.2020)

Specifically, the European Skills Agenda builds on twelve actions to improve the importance of skills in the EU to strengthen sustainable competitiveness, ensure social fairness and build resilience³⁰:

1. **Pact for Skills.** Mobilising all partners for more and better opportunities for people to train, and to unlock public and private investments across industrial and skills ecosystems;
2. **Strengthening skills intelligence.** Using big data analysis of job vacancies and making it widely available so it will be possible to acquire online information "in real time" on the demand for skills;
3. **EU support for strategic national upskilling action.** Working with MSs on modern and comprehensive national skills strategies and joining forces with national public employment agencies to achieve this;
4. **Future-proof vocational education and training (VET).** Taking a fresh approach to make vocational education and training more modern, attractive for all learners, and flexible and fit for the digital age and green transition;
5. **Rolling out the European Universities Initiative and up-skilling scientists.** Building long-term transnational alliances between higher education institutions throughout Europe and developing a core set of skills for researchers;
6. **Skills to support the green and digital transitions.** Developing a set of core green skills, statistical monitoring of the greening of our workplaces, boosting digital skills through a Digital Education Action Plan and ICT jump-start training courses;
7. **Increasing STEM graduates, fostering entrepreneurial and transversal skills.** Encouraging young people, especially women, into science, technology, engineering and mathematics. The EU's Skills Agenda also aims to strengthen support for entrepreneurs and the acquisition of transversal skills such as cooperation and critical thinking;
8. **Skills for life.** Supporting young people and adult learning on issues such as media literacy, civic competences, and financial, environmental and health literacy;
9. **Initiative on individual learning accounts.** Exploring if and how portable and quality-checked training entitlements could help stimulate lifelong learning for all;
10. **A European approach to micro-credentials.** Training courses are becoming shorter and more targeted and are often online. Creating European standards that should help recognise the results of such training;
11. **New Europass platform.** Revamping of the Europass platform, offering online tools and guidance on CV-writing, suggesting tailored jobs and learning opportunities, providing information for job seekers, and available in 29 languages;

³⁰Factsheet – European Skills Agenda: skills for job (2020) - <https://ec.europa.eu/social/main.jsp?catId=1223&langId=en> (last access: 11.08.2020)

12. Improving the enabling framework to unlock investment. A key element of the Skills Agenda is the much-boosted EU budget to push MSs and private actors to invest in skills. The EU will work on improving transparency around skills investment and explore novel financing mechanisms.

Moreover, the strategy sets ambitious and quantitative objectives for upskilling (improving existing skills) and reskilling (training in new skills) to be achieved within the next 5 years (Tab. 6.1), placing an emphasis on the need to invest in skills as a key priority to foster the EU’s recovery and prepare European workers and citizens for the green transition and the digital transformation.

Tab. 6.1: European Skills Agenda objectives

Indicators	Objectives for 2025	Current level (latest year available)	Percentage increase
Participation of adults aged 25-64 in learning during the last 12 months (%)	50%	38% (2016)	+32%
Participation of low-qualified adults 25-64 in learning during the last 12 months (%)	30%	18% (2016)	+67%
Share of unemployed adults aged 25-64 with a recent learning experience (%)	20%	11% (2019)	+82%
Share of adults aged 16-74 having at least basic digital skills (%)	70%	56% (2019)	+25%

Source: EU Commission, 2020

This means that Europe should see, over the next five years, €540 million in training activities for adults, including €60 million for low-qualified adults and €40 million for unemployed people. The number of adults with basic digital skills should increase to €230 million³¹.

To implement the actions promoted by the European Skills Agenda and achieve these objectives will require **massive investments in skills**. The Recovery Plan for Europe proposed by the Commission in May 2020 includes unprecedented financial resources (Tab. 6.2) that support a sustainable recovery and investment in skills. Throughout the 2021-2027 period, EU tools such as the **European Social Fund Plus, Erasmus and InvestEU’s Social Investment** can all be mobilised to help people gain better or new skills. The new **Digital Europe Programme** will invest in advanced digital skills development to master technologies. Moreover, the Recovery and Resilience Facility

³¹ https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1196 (Last access: 11.08.2020)

provides Member States with ample opportunity to fund upskilling and reskilling initiatives, with the appropriate reforms in place³².

Finally, the Council has also adopted conclusions on **reskilling and upskilling** as a basis for increasing sustainability and employability, in the context of supporting economic recovery and social cohesion. The conclusions highlight the importance of promoting better use of EU financial tools, namely the European Social Fund Plus, Erasmus and InvestEU³³.

Tab. 6.2: EU investment in skills

Programme	Investment (in billions €)
European Social Fund Plus (ESF+)	61.5
Erasmus	16.2
InvestEU	4.9
European Globalisation Adjustment Fund	1.1
European Solidarity Corps	0.8
Digital Europe	0.5

Source: EU Commission (2020) - <https://ec.europa.eu/social/main.jsp?catId=1223&langId=en#funding> (last access 13.08.2020)

On **10 November**, an agreement between the European Parliament and the Council was signed arising from the Commission’s proposal from 27 May 2020. It ensures that the EU institutions cooperate even more effectively to make sure that the €1.8 trillion package goes to where the needs are, in a timely and transparent manner. Specifically, the agreement foresees that this €15 billion top-up is allocated to a number of priority areas:

- Horizon Europe: €4 billion (to €79.9 bn in 2018 prices)
- Erasmus+: €2.2 billion (to €23.4 bn in 2018 prices)
- EU4Health: €3.4 billion (to €5.07 bn in 2018 prices)
- Integrated Border Management Fund: €1 billion (to €6.5 bn in 2018 prices)
- European Border and Coast Guard Agency (Frontex): €0.5 billion (to €5.6 bn in 2018 prices)
- Rights and Values: €0.8 billion (to €1.6 bn in 2018 prices)
- Creative Europe: €0.6 billion (to €2.2 bn in 2018 prices)
- InvestEU Fund: €1 billion (to €3.8 billion in 2018 prices);
- Neighbourhood, Development and International Cooperation Instrument (NDICI): €1 billion (to €71.8 bn in 2018 prices)

³² ibidem

³³ <https://www.consilium.europa.eu/media/44351/st08682-en20.pdf> (last access: 11.08.2020)

- Humanitarian Aid: €0.5 billion (to €10.26 bn in 2018 prices)³⁴.

The new Skills Agenda delivers on the European Pillar of Social Rights and, notably, its first principle spelling out the right to quality and inclusive education, training and lifelong learning. It is also firmly anchored in the European Green Deal, New Digital Strategy and the new Industrial and SME Strategies, as skills are key to their success. Moreover, it also supports the proposal for a Council Recommendation on a “Bridge to Jobs – reinforcing the Youth Guarantee” which the Commission has adopted and takes into account the findings of the recent Report on the Impact of Demographic Change. The New Circular Economy Action Plan and the EU Biodiversity Strategy for 2030 also underline the key role of skills in the transition to a green economy³⁵.

Making education and training fit for the digital age is the aim of the **Digital Education Action Plan** (2021-2027). It calls on MSs and stakeholders to work together to ensure a high-quality, inclusive and accessible digital education in Europe. The Action Plan, specifically, sets **two long-term strategic priorities**: 1) **fostering the development of a high-performing digital education ecosystem**. To achieve this goal, the plan underlines the importance to ensure infrastructure, connectivity and digital equipment, effective digital capacity planning and development, including up-to-date organisational capabilities, digitally competent and confident teachers and education and training staff, high-quality learning content, user-friendly tools and secure platforms which respect privacy and ethical standards. To this end, the Commission defines several initiatives and, in particular, the launch of a strategic dialogue with EU Member States to prepare a proposal for a Council Recommendation on the enabling factors for successful digital education by 2022, a proposal of a Council Recommendation on online and distance learning for primary and secondary education, the development of a European Digital Education Content Framework and the launch of a feasibility study on a possible European exchange platform to share certified online resources and connect with existing education platforms, the support the Gigabit connectivity of schools, as well as connectivity in schools and digital transformation plans at all levels of education and training through Erasmus cooperation projects and the development of ethical guidelines on artificial intelligence and data usage in teaching and learning; 2) **enhancing digital skills and competences for the digital transformation**, encouraging the acquisition of basic digital skills and competences from an early age and advanced digital skills. To achieve these goals, the Commission proposes the development of common guidelines for teachers and educational staff to foster digital literacy and tackle disinformation through education and training, the update of the

³⁴ https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_2088

³⁵ EU Commission Communication: EUROPEAN SKILLS AGENDA FOR SUSTAINABLE COMPETITIVENESS, SOCIAL FAIRNESS AND RESILIENCE (2020)

European Digital Competence Framework, the creation of a European Digital Skills Certificate (EDSC), a Council recommendation on improving the provision of digital skills in education and training, the support to women’s participation in STEM, the provision of an EU target for student digital competence of under 15% by 2030 for 13-14 year old students who underperform in computer and information literacy and the extension of the Digital Opportunity traineeships to VET learners and apprentices, and offer professional development opportunities for teachers, trainers and other educational staff.

On **10 November 2020**, the Commission launched the **Pact for Skills**, a central element of the European Skills Agenda and announced the first European skills partnerships in key industrial ecosystems – automotive, micro-electronics, and aerospace and defence industries. The pact for Skills, in particular, promotes joint action to maximise the impact of investing in improving existing skills (upskilling) and training in new skills (reskilling), calling on industry, employers, social partners, chambers of commerce, public authorities, education and training providers and employment agencies to work together and make a clear commitment to invest in training for all working age people across the Union. The Pact for Skills is accompanied by a **Charter** outlining a shared vision from industry, social partners, vocational education and training (VET) providers, national, regional and local authorities as regards quality training. By joining the Pact, stakeholders will gain access to networking, knowledge and resource hubs. The Commission will also offer information and guidance on EU funding and programmes for skills development by offering a single-entry point at EU level.

6.2. The importance of digital skills for European competitiveness and for recovery from the Covid-19 crisis

The Covid-19 global pandemic has highlighted the important role of information technologies and digital assets as a lever for economic productivity and growth, and it has shown how basic and advanced digital skills sustain our economies and societies³⁶. In attempting to contain the virus, worldwide, countries have established restrictions and lockdowns, which have disrupted the ordinary functioning of society and the economy. This disruption has transformed how communities, businesses and individuals operate, communicate and transfer knowledge. For example, in these months of the health emergency caused by the spread of Covid-19, many companies have resorted to smart working to ensure the continuation of their activities and, at the same time, protect the health of their employees.

³⁶ EU Commission, Digital Economy and Society Index (DESI) 2020 - Human capital (<https://ec.europa.eu/digital-single-market/en/human-capital>, last access 17.08.2020)

According to the research report “Living, working and COVID-19” by Eurofound, 34% of EU employees reported working exclusively from home in July 2020, while 52% of EU employees claimed to have worked on the employer’s premises or other locations outside home only (Fig. 6.1).

Fig. 6.1: Proportion of employees, by location of paid work during COVID pandemic (EU-27, July 2020)



Source: Eurofound, 2020

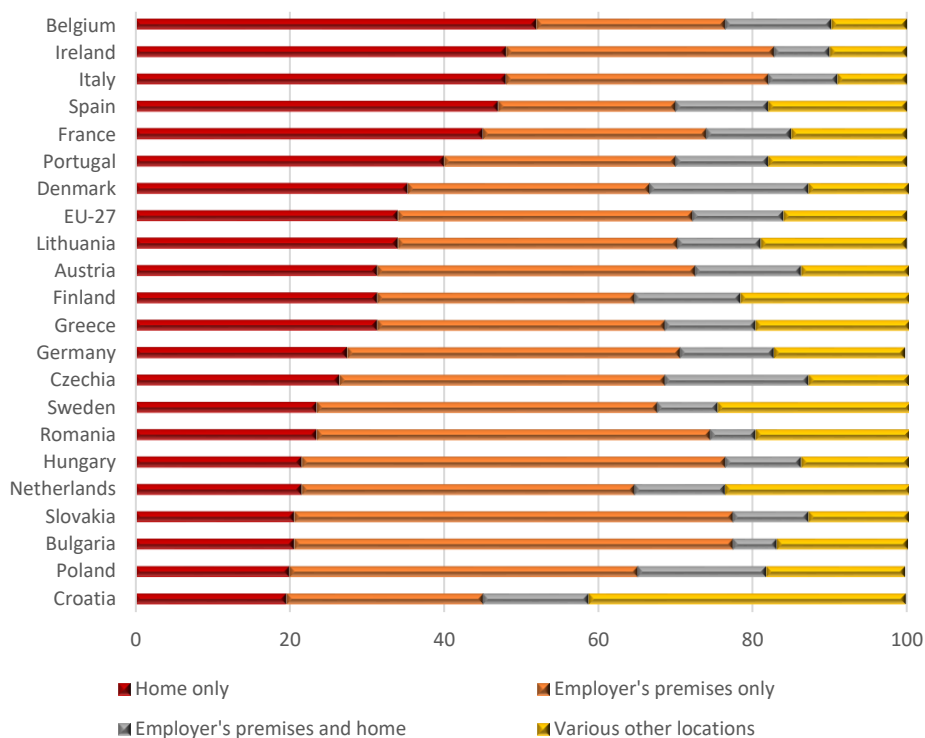
Three-quarters of employees with tertiary qualifications (74%) worked from home, compared to 34% of those with secondary qualifications and 14% of those with primary education only. There was also an important divide in homeworking incidence by sector, with a higher incidence in most service sectors (notably education, financial services and public administration) and a lower incidence in ‘frontline’ sectors such as health, transport and agriculture, as well as in sectors with a large share of place-dependent employment that were subject to specific lockdown restrictions such as commerce and hospitality³⁷.

The proportion of EU employees reporting they were working exclusively from home varies significantly across MSs, from around one-fifth in Croatia, Poland, Slovakia, Bulgaria and Hungary to more than 40% in France, Spain, Italy, Ireland and more than 50% in Belgium (Fig. 6.2). Similarly, the proportion of employees working from their employer’s premises varies greatly, from less than a quarter in Belgium and Spain, to more than half of the participating employees in Romania, Hungary, Bulgaria and Slovakia³⁸.

³⁷ <https://www.eurofound.europa.eu/publications/report/2020/living-working-and-covid-19> (last access: 20.11.2020)

³⁸ ibidem

Fig. 6.2: Employees’ place of work during the pandemic, by country (% , July 2020)



Source: Eurofound, 2020

Moreover, in education, governments and school administrations in all countries have adopted **e-learning** technologies for students forced to remain at home due to the closing of schools.

Consequently, having a digitally skilled labour force and population is crucial to building resilience to economic and social shocks such as those presented by the Covid-19 outbreak, where the acquisition of digital skills can also serve as a hedge against unemployment risks. The Covid-19 outbreak is not only intensifying the need for the digitisation of a wide range of services, but it is also making digital skills a prerequisite for employees to successfully work from home.

Moreover, according to the EU Commission, digital skills are essential for the creation of a Digital Single Market in Europe and for receiving its benefits, for European competitiveness and an inclusive digital society³⁹.

Having sufficient levels of **basic digital skills** is crucial for young people to easily access the labour market and for adults to retain employment in high quality and stable jobs. However, large

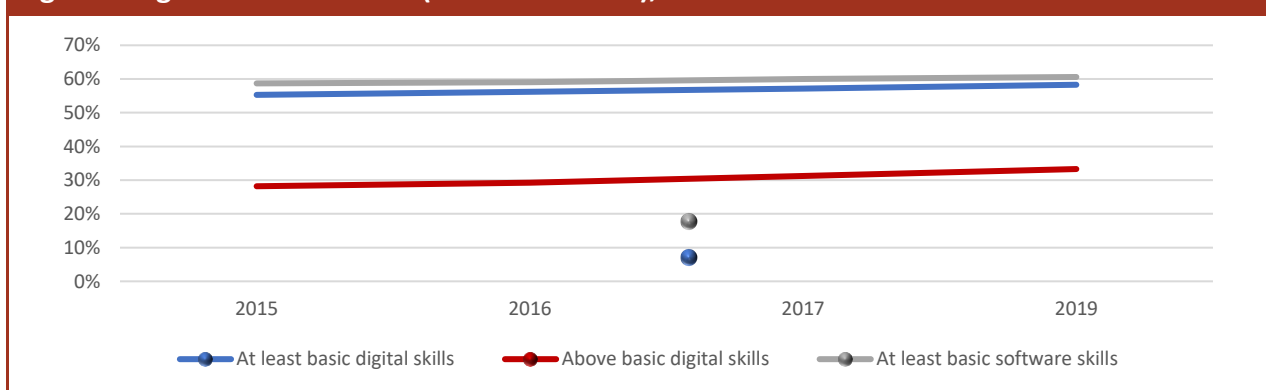
³⁹ <https://ec.europa.eu/digital-single-market/digital-skills-jobs-coalition> (last access: 17.08.2020)

proportions of both young people and working-age adults are lacking in these basic digital skills, hindering their ability to find stable employment and participate in economic and social life in general.

Throughout the last 4 years, the level of digital skills has continued to grow slowly (Fig. 6.3). In 2019, the percentage of people with at least basic digital skills reached 58% (up from 55% in 2015), while the percentage of individuals with above average basic digital skills reached 33% (up from 28% in 2015). The skills indicators are strongly influenced by socio-demographic aspects. For example, 82% of young individuals (16-24), 85% of those with higher formal education, 68% of employed or self-employed people and 87% of students have at least basic digital skills. By contrast, only 35% of those aged 55-74 and 30% of the retired and the inactive possess basic digital skills.

Software skills are above all becoming a prerequisite for entry into many jobs. 61% of Europeans have at least basic software skills. In Member States such as the Netherlands, Finland and the UK, three out of four individuals have at least basic software skills (80%, 77% and 75%, respectively). In contrast, only 31% of Bulgarians and 35% of Romanians have at least basic software skills. This indicator is also strongly affected by socio-demographic factors. For example, 85% of young individuals (16-24), 87% of those with higher formal education, 70% of employed or self-employed people and 91% of students display at least basic software skills. Nevertheless, only 38% of those aged 55-74 and 32% of the retired and the inactive possess basic skills in this domain⁴⁰.

Fig. 6.3: Digital skills in the EU (% of individuals), 2015–2019



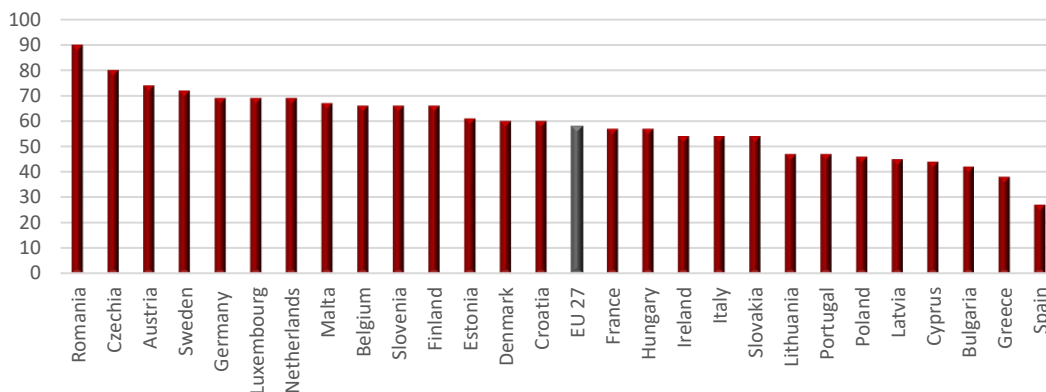
Source: EU Commission, DESI 2020

⁴⁰ EU Commission, Digital Economy and Society Index (DESI) 2020 - Human capital (<https://ec.europa.eu/digital-single-market/en/human-capital>, last access 17.08.2020)

Europe also **lacks skilled ICT specialists to fill the growing number of job vacancies** in all sectors of the economy. According to Eurostat data, during 2019, 9% of EU⁴¹ enterprises recruited or tried to recruit ICT specialists. More than half of these enterprises (58%) reported that they had problems filling vacancies requiring relevant ICT skills. 66% of large enterprises and 57% of SMEs that recruited ICT specialists during 2019 reported that vacancies for ICT specialists are hard to fill. The problem is even more widespread in Romania and the Czech Republic, where at least 80% of enterprises that recruited or tried to recruit ICT specialists reported such difficulties. Instead, the proportion of businesses finding it difficult to recruit ICT specialists was below 40% only in Spain (27%) and Greece (38%) (Fig. 6.4).

Therefore, the spread of digital is having a huge impact on the labour market and the type of skills needed to work successfully. The advent of new digital technologies (such as AI, machine learning, IoT) is changing the structure of employment, leading to the automation of "routine" tasks and to the creation of new and different types of jobs. Moreover, it is leading to the need for more skilled ICT professionals in all sectors of the economy.

Fig. 6.4: Enterprises with hard-to-fill vacancies for ICT specialist (% , 2019)



Note: Financial sector is not included in the survey

Source: Eurostat, 2020

Beyond the workforce, citizens, in general, also need to have at least the basic digital skills in order to live and participate in our modern society. Here, the European Commission is developing policies and investing in supporting reskilling and upskilling in Europe and tackling the digital skills gap. Different funds have been promoted to increase training in digital skills for the workforce and for consumers and to modernise education across the EU⁴²:

⁴¹ The European Union (EU) includes 27 EU Member States. The UK left the European Union on 31 January 2020

⁴² <https://ec.europa.eu/digital-single-market/en/policies/digital-skills> (last access 21.08.2020)

- The new **Digital Europe Programme**, with a budget of €600 million for advanced digital skills, will expand the digital talent pool with around 256,000 people who will be able to deploy the latest technology in businesses throughout Europe. It will focus on three types of actions:
 1. Master's programmes in cutting-edge digital technologies developed together with EU excellence centres in AI, cyber and high-performance computing. The aim is to offer 160 new master programmes training 80,000 digital specialists;
 2. Short-term specialised training courses in advanced digital technologies for around 150,000 job seekers and employed people, especially in SMEs. The aim is to equip them with the competences that will enable the deployment of digital technologies across all sectors of the economy;
 3. 35,000 job placements in companies or research centres where advanced digital technologies are developed or used. The aim is to give people the opportunity to learn specialists' skills working with the latest available technologies.
- The **European Social Fund Plus** will support EU Member States to improve the quality, effectiveness and labour market relevance of national education and training systems to support the acquisition of key competences, including digital skills. It will also promote upskilling and reskilling opportunities for all, placing a particular emphasis on digital skills.
- The **European Global Adjustment Fund** will support training, which will all have a digital skills component, to help laid-off workers find another job or set up their own business.
- **Erasmus+** will support digital learning from early childhood to vocational and university education. It will also continue to support the acquisition of digital skills through cross-border experiences.
- **Horizon Europe** will finance grants for Master, PhD and post-graduate research activities in all fields including digital through Marie Skłodowska-Curie actions as well as the European Institute of Innovation & Technology.

Moreover, the **Digital Skills and Jobs Coalition**⁴³ - one of the central EU strategic development policies of the European Commission that brings together EU Member States, as well as companies, social partners, non-profit organisations and education providers – is tackling the gap in digital skills across Europe for the following beneficiaries:

- **digital skills for all** – developing digital skills to enable all citizens to be active in our digital society;
- **digital skills for the labour force** – developing digital skills for the digital economy, e.g. upskilling and reskilling workers, jobseekers, and actions on career advice and guidance;

⁴³ <https://ec.europa.eu/digital-single-market/digital-skills-jobs-coalition> (last access: 21.08.2020)

- **digital skills for ICT professionals** – developing high level digital skills for ICT professionals in all industry sectors;
- **digital skills in education** – transforming teaching and learning of digital skills in a lifelong learning perspective, including the training of teachers.

All EU Member States participating in the Coalition have put in place some initiatives and good practices in meeting the growing demand for digital skills and for addressing the challenges of the Covid-19 crisis⁴⁴.

⁴⁴ <https://ec.europa.eu/digital-single-market/en/news/digital-skills-and-jobs-coalition-compiles-digital-skills-resources-and-best-practices> (last access: 21.08.2020)

CONCLUSIONS AND POLICY RECOMMENDATIONS

DIGITAL IN EUROPE

The still ongoing pandemic is revealing, beyond any possible doubt, how essential it is to ensure the wide availability and accessibility of **digital networks and services** for citizens, businesses and public administrations. In one year, 2020, marked by lock-down and social distancing measures determined by the need to stem contagions and reduce the negative impact of the health crisis on the economy, the digital channel has been the most effective response to the need to ensure the continuity of socio-economic activities and reduce risks to the health of individuals.

Digitisation is a fundamental requirement for competing on global markets. However, in digital innovation, **the European Union lags behind the other major global economies**. Therefore, the EU must look to investing in innovation and facilitating investments by private companies if it is to maintain a leading role on the international stage. Digital innovation is also essential to achieving technological sovereignty which is nowadays one of the main objectives of the European Commission. Here, the **differences in digital readiness among Member States** must be addressed. In fact, the Northern European countries rank among the first for innovation on a global level, whilst the Southern and Eastern European countries, instead, must begin bridging the gap their better performing northern counterparts.

Industry is one of the main components of the Union's economy and provides jobs for millions of European citizens. Following the economic crisis, some European states struggled to recover the lost levels of previous industrial production. The Covid-19 pandemic has now further aggravated this situation, pushing European industry into a new crisis. Therefore, to be able to overcome this situation, a deep transformation driven by digital and other new technologies and new business models must take place. To ensure European **industry competitiveness**, it is essential to embrace technological change, integrate products and services, develop technologies that use less energy, reduce waste and avoid pollution and invest in a workforce with the right skills.

At a European level, the focus on digital transformation is high, as shown last year in the Digital Strategy launched in February, and the wide range of initiatives put in place to promote the creation of an ecosystem based on trust, security and respect for fundamental rights. As well, in the Next Generation EU plan, digital, together with the green transition, assumes a role of primary importance as a fundamental tool for rebooting Europe.

In the logic of curbing the very strong competition from the USA and the Far East, especially China, the European effort, catalysed by the enormous financial crisis resulting from the spread

of the pandemic, is aimed at providing the Union with all the regulatory, economic and factual tools necessary to play a leading role at global level in the field of digital.

DATA

To achieve a successful digital transformation for the economy and society, Europe must seize on the opportunity to capture, store and take advantage of available data. This means developing new technologies and infrastructures, with a clear legal framework and the supply of the right skills, and the final goal of ensuring that all Europeans may profit from the potential that data may provide for our economies and societies.

We have identified **4 main points as key aspects** to be considered while assessing the current EU data scenarios: 1) **interoperability**, as a powerful tool to fight fragmentation, both within EU MSs and at the EU level; 2) **co-opetition**, i.e. the need to strike a balance between competition and cooperation when it comes to data sharing and governance; 3) the importance of encouraging the development of a **new set of skills** for workers, technicians and young people entering the labour market; 4) the need to develop a **framework** in which **European Digital Sovereignty** could be effectively delivered, both in terms of infrastructures and new technologies, taking into account the importance of investments and international competition.

Data management undoubtedly plays a key role in supporting the decision-making process. Indeed, data should have high standards of quality and interoperability. Moreover, a framework enabling the safe and effective sharing and reusing of data is missing in Europe, therefore, the European Commission’s adoption of a **Data Governance Act** is very important. It is the first deliverable under the European strategy for data and aims to foster the availability of data for use by increasing trust in data intermediaries and by strengthening data-sharing mechanisms across the EU.

It is necessary to speed up the creation of a legislative framework based on the values of transparency, interoperability and accessibility and a network for mutual assistance. Another key topic here regards the prevention of cyber-attacks based on a **EU-wide cybersecurity certification framework**. Consequently, the willingness to innovate the entire cybersecurity sector has been confirmed by the Commission, that will put on the table in mid-December 2020 a new cybersecurity strategy and a proposal for the revision of the NIS Directive.

Moreover, in considering the importance of **increasing clarity over terms of use and reuse**, and authorised actors and authorities in charge of enforcement and monitoring compliance, the Commission plans that this be included within the framework of the Data Act. Conditions for donation of data will be specified as well, whether they are provided by companies, associations

or the public sector. Rules to be applied to intermediaries in facilitating the sharing, mainly between private actors, should be clearly determined in order to create a secure and clear legal framework. A framework for the exploitation of data concerning competition rules, market fairness and asymmetries in the exploitation and use of data will also be taken into account. This will mainly be done through the DSA package and also partially by the Data Act.

The debate on a common approach and regulations is also crucial for security issues regarding the Commission’s concern over **data ownership** and on the potential lack of privacy and absence of data protection for personal information collected by foreign providers. The EU is, therefore, working to create and foster its own technological sovereignty without relinquishing the advantages of maintaining an open trade and innovation flow. There is a commonly recognised **need to find a balance** between privacy protection and the development of innovation tools within a framework of ethical values.

Here, federating European cloud service providers can work if extra European providers are not left out. Indeed, the gap in **R&D investments** is still too wide to be bridged immediately and also required major investments – DG Connect found that that EU should invest €9 billion per year in order to catch up with the main North-American providers. Moreover, as already stated, **competition dynamics** should be preserved within the **Single Market** in order to deploy all their potential in the field of innovation.

ARTIFICIAL INTELLIGENCE FOR EUROPE

The US and China are clearly the two superpowers which, understanding the enormous potential of artificial intelligence, have long been investing more resources than other countries. The EU is trying to keep up, setting itself ambitious goals such as attracting over €20 billion in total annual investments for AI by 2030, in order to strengthen its position in research and in innovation and to enable its industrial ecosystem to become an AI technology developer as well as a user. However, the EU's objectives of increasing R&D and manufacturing excellence should not jeopardise the possibility for EU citizens and businesses to have **access to the best available AI technologies at a competitive price**.

Indeed, the main goal is to build a **fair and inclusive framework** to develop digital technologies and strengthen the internal market, where European citizens could feel comfortable as individual users, and where EU companies wishing to become involved in the digital market can grow and compete.

Furthermore, in virtue of what the European Commission hopes for in the White Paper on AI, namely the creation of a European ecosystem of excellence, a greater effort by all of Europe and greater coordination is required, with an effective exchange of best practices between countries. This involves both a greater impetus for the creation and growth of start-ups in the AI field, especially in the leading sectors of the European economy and improving assets and skills, essential accompanying factors of the digital transformation of businesses.

The **training of enterprises** should be a key activity of digital innovation centres, which must support, in particular **SMEs**, in their digital transformation. Here, it is important to create networks between the different Digital Innovation Hubs, to promote access to skills not available locally and to overcome geographical barriers.

Investments certainly play a key role in a sector undergoing major changes. Compared to the well-known competitors on the global stage, the level of investment in Europe still remains modest. More investments are undoubtedly needed, though the preliminary requirement is to allocate resources in a more targeted and strategic way (i.e. to first identify existing gaps).

This issue will certainly be addressed throughout the MFF negotiations. Where this is concerned, efforts on the EU budgetary level, that are currently being made to identify instruments and solutions to combat the current crisis, should also be considered. Furthermore, it is important to link up different sources of investment, resources and capabilities. National investments are also key to providing an extra boost to research and innovation locally.

On the ecosystem of trust, a **EU-wide regulatory approach** is preferable in order to avoid major risks of internal market fragmentation. Therefore, Member States should refrain from unilateral moves and look for agreements and alliances at EU level. Although some new legislation is certainly required and a EU-wide regulatory framework is surely preferable to a national one, current legislation should apply whenever possible in order to avoid excessive market fragmentation and uncertainty and increase compliance costs for companies, especially SMEs⁴⁵.

Therefore, Europe must commit to defining an adequate legislation that is able to favour the further development and adoption of AI by citizens and to strengthen Europe's industrial base in the field of AI, avoiding risks of market fragmentation and uncertainty.

⁴⁵ PromethEUs, A NEW FRAMEWORK FOR EUROPE’S DIGITAL RULES, Policy brief October 2020

As stated in the position paper *“Innovative and trustworthy AI: two sides of the same coin”*, signed by Denmark and another 13 Member States, there is the **need to find a balance** - within a framework of ethical values - between privacy protection and the development of innovation tools capable of increasing efficiency, technology and well-being for all citizens.

DIGITAL SERVICES IN THE EUROPEAN UNION

Digital technologies have radically transformed the socio-economic context in which citizens and companies operate. The Covid-19 pandemic is helping to accelerate this process by forcing millions of individuals to use digital channels to work and socialise. Here, it is essential that the European institutions work to eliminate the existing differences between the various Member States. Many companies, especially small ones, still remain extraneous to the technological transformation. It is also important to help businesses access digital commerce which can be a key development factor, especially for SMEs.

Digital channels are determining the affirmation of **new business models** that see platforms excelling. The latter, in particular, are tools through which individuals and companies carry out their socio-economic activities, inform and communicate with each other.

The **new role of platforms and intermediaries** is determining the need to rethink the current regulatory framework through the adoption, expected in December, of the **Digital Services Act** (and the **Digital Markets Act**). This is an initiative of paramount importance that needs to take into account the need to modernise the existing regulatory framework also by introducing new forms of responsibility for the platforms but respecting the need not to hinder innovation and to provide for proportionate obligations. Even if online platforms are revolutionising markets, leading to a rethinking of the current regulatory framework, the adoption of the DSA package is part of a regulatory framework that has seen the introduction of important innovations (e.g. in the field of privacy). However, it is necessary **to avoid contradictions and the creation of a regulatory framework so complex as to hinder innovation**.

The priority should be ensuring an **adequate protection of fundamental rights through a clear, streamlined and future-oriented regulatory framework**.

INFRASTRUCTURES AND CYBERSECURITY

The lockdown and the Covid-19 emergency have made it clear that digital transformation is not only of interest to large corporations and key players, but is now also a fundamental part of the lives of all Europeans. The **deployment of high capacity networks** is widely recognised as

essential for economic development within the Union, allowing for access to a new generation of services such as IoT, Big Data and AI that would foster economic development and allow Europe to regain the lost ground in technological advances. For these reasons, the EU recognises these issues are central to the Union’s agenda of the next years, working both on the regulatory and the economic aspects to guarantee a homogeneous development across the MSs.

The European Commission has placed great attention on the issues regarding digitalisation, setting guidelines and requirements for the spreading of networks throughout the continent. These regard the expanding of high-speed connections, the coverage quality, and the availability of **new generation networks such as 5G**.

At the same time, when looking at the targets that were set in the European Digital Agenda, and comparing them with the actual results observed in 2019 (also taking into account that those targets are mainly established to push countries and governments to speed up with procedures and operations), it is clear that a substantial push is still needed both in terms of demand and supply. For the former, the **adoption of ultrafast broadband services** is still around 20% (versus the 50% threshold established for the year 2020), while the latter is lagging behind especially for the 5G Roadmap. Indeed, a large part of the **spectrum** (almost 80%) in the pioneer bands is still unassigned, and also the number of trials has been progressively declining. As a consequence, the analysis of the 5G active users sees Europe quite far from the other advanced economies (especially South Korea, China and the US). For these reasons, it seems crucial to **relaunch a proper 5G roll-out all over Europe**, even if the required investments in infrastructure are still huge. For this, the Recovery Fund could be a unique opportunity, also considering the 20% quota dedicated to the digital sector.

Recently, there has been a focus on the need for a common European action with regards to infrastructure standards and security issues, which are now been identified as some of the top priorities for future investments. The ongoing pandemic has indeed been an accelerator for the adoption of new digital services, leading to an exponential increase in data traffic and of available private information. Following this, the number of **cyber-attacks** has also increased significantly, emphasising the vulnerability in the current IT infrastructures and the need for further, renewed, wide-spread common digital protection systems. Thus, enforcing a common security approach should be pursued, especially regarding the application of the **EU toolbox** for all European countries. Similarly, a common approach should be taken concerning the relationship between Member States and non-European providers, in order allow operators competing in the Single Market to avoid the different regulations in different countries belonging to the same political macro-entity.

The Covid-19 crisis has clearly highlighted the importance of connectivity for the global digital economy, at the same time, raising awareness of the **vulnerability of critical infrastructures**.

The **Recovery Plan** proposed by the Commission moves in the right direction in terms of ambitions. The Commission’s proposal to focus **Next Generation EU** on investments and reforms, especially on the green and digital transition, is an important step to enforcing the spread of advanced digital services, and supporting European economic recovery. It is significant that recovery investments aim to be channelled towards strategic digital capacities and capabilities, including artificial intelligence, cybersecurity, secured communication, data and cloud infrastructure, 5G and 6G networks, supercomputers, quantum and blockchain.

The guidelines of September 17 for the preparation of the **National Plans** prescribe, on the one hand, that at least 20% should be devoted to the promotion of the digital transformation of all economic or social sectors, including public services. On the other, they identify seven flagship projects, of which the Commission strongly encourages the inclusion within the National Plans, one of which specifically concerns connectivity.

In order to ensure the competitiveness of the Union in the development of 5G, aboveall, it is important not only that individual Member States **observe the roadmap outlined in 2016 with the Action Plan** by making available the frequencies identified through the completion of all the procedures for their allocation, but also, more generally, Europe pursues **harmonisation objectives**. These should especially concern standards and certification, and be as ambitious as possible, ensuring the simplification and clarity necessary to create an ecosystem-friendly investment and, thus, facilitate the work of companies operating in different Member States.

SKILLS

Geographical divides and social fragmentation characterise the **EU skills landscape**. Therefore, summing up, improving digital literacy, capacity and skills at all levels of education is key to strengthening the European economy and societies across the digital ecosystem.

Consequently, increasing public and private investments in new training opportunities and reducing social barriers are some of the key actions required to reduce the EU skills divide. The employability of young and unemployed people is a fundamental concept in a period of social and economic crisis, when access to the labour market is becoming increasingly difficult for these segments of society.

Inclusiveness, access and opportunity to skilling, upskilling and reskilling are keywords to emphasise when addressing the issue of divide and fragmentation, highlighting that the Skills Agenda targets will become a reference for all Europeans, regardless of the region of origin and social reality.

The **portability of skills** within the EU is as another key goal to achieve by means of mutual recognition and mobility. However, more work is needed here, although the European Qualification Framework (EQF) already represents a good starting point. The coordination between EU institutions and Member States is pivotal to reducing the skills regional divide and, for this reason, the future national recovery plans are an important tool to address the skills shortages at national level.

The coordination between EU institutions and MSs is key to reducing the skills regional divide and, here, the future national recovery plans are an important tool to address the skills shortages at national level.

The **National Recovery Plans will need to effectively address the skills dimension**, following the EU digital and green priorities. Even if this specific area is essentially a competence of Member States, a more coordinated approach is needed. For instance, it will be important to introduce an EU-level framework to align education systems with Research & Innovation objectives, involving both the public sectors and business actors, reinforcing the role of the private sector in education, also looking at tendencies and the performance of other regions.

Consequently, the launch of a **Pact for Skills**, the first building block to foster cooperation between stakeholders and to provide incentives to take action, by mobilising all partners for more and better opportunities for people to train, and to unlock public and private investments across industrial and skills ecosystems, is very important.