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2030 Digital Compass: the European way for the Digital Decade

1. JOINING FORCES: DIGITAL TRANSFORMATION FOR EUROPE'S RESILIENCE

In just a year, the COVID-19 pandemic has radically changed the role and perception of digitalisation in our societies and economies, and accelerated its pace. Digital technologies are now imperative for working, learning, entertaining, socialising, shopping and accessing everything from health services to culture. It has also shown the decisive role that disruptive innovation can play[1]. The pandemic has also exposed the vulnerabilities of our digital space, its dependencies on non-European technologies, and the impact of disinformation on our democratic societies.

In the light of these challenges, our stated ambition is more relevant than ever: to pursue digital policies that empower people and businesses to seize a human centred, sustainable and more prosperous digital future.

Europe will have to build on its strengths – an open and competitive single market, strong rules embedding European values, being an assertive player in fair and rule-based international trade, its solid industrial base, highly-skilled citizens and a robust civil society.

At the same time, it needs to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions and will need to accelerate associated investment[2].

That is the way for Europe to be digitally sovereign in an interconnected world by building and deploying technological capabilities in a way that empowers people and businesses to seize the potential of the digital transformation, and helps build a healthier and greener society.[3]

In the State of the Union Address in September 2020, President von der Leyen announced that Europe should secure digital sovereignty with a common vision of the EU in 2030, based on clear goals and principles. The President put special emphasis on a European Cloud, leadership in ethical artificial intelligence, a secure digital identity for all, and vastly improved data, supercomputer and connectivity infrastructures. In response, the European Council invited the Commission to present a comprehensive Digital Compass by March 2021, setting out digital ambitions for 2030, establishing a monitoring system and outlining key milestones and the means of achieving these ambitions.

This political impetus calls for an intensification of the work begun in the past decade to accelerate Europe's digital transformation – building on progress towards a fully functioning

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1 The development of entirely new types of vaccines (e.g. Moderna, BioNTech) has highlighted to the wide public the benefits of disruptive innovation enabling to develop vaccines in less than a year, with efficiency and by following a method which was never implemented so far, as well as the importance of mastering these technologies.

2 Analysis made by Commission services for the recovery estimated at €125 billion per year the needs for ICT investment and skills to close the gap with leading competitors in the US and China. The European Investment Bank has flagged the risk that instead of increasing their investments, 45% of firms would reduce them after the COVID-19 crisis.

3 This Communication is part of a set of actions to strengthen the EU's open strategic autonomy and resilience. These include inter alia the Communication on fostering openness, strength and resilience of the European economic and financial system, the Trade Policy Review, and the upcoming updated industrial strategy for Europe and the 2021 Strategic Foresight Report.

Digital Single Market[4], and intensifying actions defined in the strategy for Shaping Europe's digital future[5]. The strategy set out a programme of policy reform[6], which have started already with the Data Governance Act, the Digital Services Act, the Digital Markets Act and the Cybersecurity Strategy. A number of Union budget instruments will support the investments necessary for the digital transition, including the Cohesion programmes, the Technical Support Instrument, and the Digital Europe Programme. The agreement by the co-legislators that a minimum of 20% of the Recovery and Resilience Facility should support the digital transition and will help underpin this reform agenda, with funding to build Europe's Digital Decade on solid foundations.

2. THE VISION FOR 2030: EMPOWERED CITIZENS AND BUSINESSES

The European way to a digitalised economy and society is about solidarity, prosperity, and sustainability, anchored in empowerment of its citizens and businesses, ensuring the security and resilience of its digital ecosystem and supply chains.

One of the key lessons of the pandemic is that digitalisation can bring people together independently of where they are physically located. Digital infrastructure and rapid connectivity bring people new opportunities. Digitalisation can become a decisive enabler of rights and freedoms, allowing people to reach out beyond specific territories, social positions or community groups, and opening new possibilities to learn, have fun, work, explore and fulfil one's ambitions. This will enable a society where geographical distance matters less, because people can work, learn, interact with public administrations, manage their finance and payments, make use of health care systems, automated transport systems, participate to democratic life, be entertained or meet and discuss with people anywhere in the EU, including in rural and remote areas.

However, the crisis also exposed the vulnerabilities of our digital space, its increased dependency on critical, often non-EU based, technologies, highlighted the reliance on a few big tech companies, saw a rise in an influx of counterfeit products and cyber theft, and magnified the impact of disinformation on our democratic societies. A new digital divide has also emerged, not only between well-connected urban areas and rural and remote territories, but also between those who can fully benefit from an enriched, accessible and secure digital space with a full range of services, and those who cannot. A similar divide emerged between those businesses already able to leverage the full potential of digital environment and those not yet fully digitalised. In this sense, the COVID-19 pandemic has exposed a new "digital poverty", making it imperative to ensure that all citizens and businesses in Europe can leverage the digital transformation for a better and more prosperous life. The European vision for 2030 is a digital society where no-one is left behind.

Digitally enabled health solutions

The COVID-19 pandemic has shown the potential and paved the way for generalised use of innovative telemedicine, remote care and robotics solutions for protecting medical staff and helping patients being remotely cared for at their home. Digital technologies can empower citizens to monitor their

[4] *A Digital Single Market Strategy for Europe*, 6 May 2015. Out of 30 legislative proposals, 28 were agreed by the co-legislature.

[5] *Shaping Europe's digital future*, 19 February 2020.

[6] Eight legislative and three non- legislative proposals including this Communication are scheduled to be adopted in 2021. See: European Commission Work Programme 2020.

health status, adapt their lifestyles, support independent living, prevent non-communicable diseases, and bring efficiency to health and care providers and health systems. Coupled with adequate digital skills, citizens will be using tools that help them to continue active professional life as they age, and health professionals and carers will be able to reap the full benefits of digitally enabled health solutions to monitor and treat their patients.

Digitalisation endows people with new sources of prosperity[7], allowing entrepreneurs to innovate, set up and grow their business wherever they live, opening markets and investments across Europe and globally, and creating new jobs at a time when an increasing number of Europeans feel threatened in their economic security or environment.

Digital technologies can significantly contribute to the achievement of the European Green Deal objectives. The uptake of digital solutions and the use of data will help in the transition to a climate neutral, circular and more resilient economy. The substitution of business travel by videoconferencing reduces emissions while digital technologies allow greener processes in agriculture, energy, buildings, industry or city planning and services, thus contributing to Europe's proposed goal to reduce greenhouse gas emissions by at least 55% by 2030 and a better protection of our environment. Digital infrastructures and technologies themselves will have to become more sustainable and energy and resource efficient. With innovation and ambitious eco-standards, businesses, in their digital transformation, will be able to adopt digital technologies with lower environmental footprint and higher energy and material efficiency.

Digitally enabled green solutions – Digital Product Passport

Transition to a sustainable economy requires smarter management of product-related data across the product lifecycle. Most of this information exists, but is not available to those that could use it best. Digital technologies provide the possibility to tag, trace, localise and share product related data along value chains, down to the level of the individual components and materials. Starting with batteries for electric vehicles and industrial applications, the European digital product passport (as part of the Sustainable Products Initiative) will improve information available to business, boost resource efficiency and empower consumers to make sustain able choices.

Resilient, secure and trustworthy infrastructures and technologies are indispensable to ensure the respect of European rules and values. A strong single market, fair competition and a functioning rules-based trade are critical assets for the EU's economic success and resilience.

At the same time, digital technologies are mostly developed outside the EU[8] and the convergence across Member States on digitalisation remains limited, hampering economies of scale[9]. The EU will be a stronger international partner thanks to reinforced internal strengths and capacities. A massive scale-up of investments, through all relevant EU funds and national spending, is necessary, including leveraging significant private investments, to allow the EU

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7 Driving the Digital Economy and Society Index (DESI) score to 90 by 2027, would result in a GDP increase per capita of 7,2% across the EU. Deloitte, February 2021, "Digitalisation: an opportunity for Europe".

8 The position of European players is far below the EU's global economic weight in key technology areas like processors, web platforms and cloud infrastructure, for example 90% of the EU's data are managed by US companies, less than 4% of the top online platforms are European, European made microchips represent less than 10 % of the European market.

9 DESI shows that the majority of EU countries, which are below the EU average in the level of digitisation, have not progressed much in the last five years. https://ec.europa.eu/digital-single-market/en/digital-economy-and-society-index-desi

to develop critical technologies in a way that fosters its productivity growth and economic development in full coherence with its societal values and objectives.

3. FOUR CARDINAL POINTS FOR MAPPING THE EU'S TRAJECTORY

The Commission proposes to set up a Digital Compass to translate the EU's digital ambitions for 2030 into concrete targets and to ensure that these objectives will be met. The Compass will be based on an enhanced monitoring system[10], to follow the EU's trajectory regarding the pace of a digital transformation, gaps in European strategic digital capacities as well as the implementation of digital principles. It will include the means to deliver the vision and set out key milestones along four cardinal points. The first two are focused on digital capacities in infrastructures and education & skills, and the two other are focused on digital transformation of business and public services.

3.1 A digitally skilled population and highly skilled digital professionals

In the world of tomorrow, if we want to be the master of our own destiny, confident in our means, value and choices, we must rely on **digitally empowered and capable citizens**, a digitally skilled workforce and way more digital experts than today. This should be fostered by the development of a high-performing digital education ecosystem, as well as by an effective policy to promote links with and attract talent from all over the globe.

Digital skills will be essential to reinforce our collective resilience as a society. Basic digital skills for all citizens and the opportunity to acquire new specialised digital skills for the workforce are a prerequisite to participate actively in the Digital Decade, as explained in the European Skills Agenda[11].

The European Pillar of Social Rights Action Plan projects the target for adults with at least basic digital skills to 80% in 2030.[12] To allow all Europeans to fully benefit from the welfare brought by an inclusive digital society, , and as proposed in the chapter on digital principles (Section 4), access to education allowing the acquisition of basic digital skills should be a right for all EU citizens and lifelong learning should become a reality.

Broad-based digital skills should also build a society which can trust digital products and online services, identify disinformation and fraud attempts, protect itself against cyberattacks, scams and fraud online, and in which children learn how to understand and navigate through the myriad of information they are exposed to online.

Advanced digital skills require more than mastering coding or having a basis of computing sciences. Digital training and education should support a workforce in which people can acquire specialised digital skills to get quality jobs and rewarding careers. As of 2019, there were 7.8 million ICT specialists with a prior annual growth rate of 4.2%. If this trend continues, the EU will be far below the projected need of 20 million experts e.g. for key areas, such as cybersecurity or data analysis. More than 70% of businesses report a lack of staff with adequate digital skills as an obstacle to investment. There is also a severe gender imbalance

[10] Based on DESI monitoring system set up by the Commission since 2014. The 2020 Strategic Foresight Report announces finalisation of resilience dashboards, including one for the digital dimension, which will provide complementary insights on EU's digital vulnerabilities and capacities.

[11] European Skills Agenda and Digital Education Action Plan.

[12] The European Pillar of Social Rights Action Plan COM (2021) 102. Adopted on 3 March 2021.

with only one in six ICT specialists and one in three STEM graduates being women[13]. This is compounded by a lack of capacity in terms of specialised education and training programs in areas such as Artificial Intelligence, quantum and cybersecurity and by a low integration of digital subjects and educational multimedia tools in other disciplines. Addressing this challenge requires massive investment to train future generations of workers and to up-skill and re-skill the workforce.

Actions at home should be complemented by support to enhance digital literacy globally, to achieve the UN Sustainable Development Goals (SDGs). The Erasmus+ programme will also provide opportunities for third country digital engineers and specialists and generally increase digital learning environments. In Africa, national **digital skills and jobs coalitions** could develop common digital skills curricula and support governments with expertise and projects to bring schools and education institutions to the digital age. Likewise, digital skills and literacy are becoming a central element in digital capacity building in our relations with the Latin American and Caribbean region.

Going towards 2030, the global competition for talent will be fierce, as expertise will remain scarce and be a critical factor of innovation, productivity growth and prosperity for all countries. The fostering of the EU's attractiveness as well as support schemes for digital talent will play a key role in EU's digital transformation.

It is our proposed level of ambition that ***by 2030:***

- ***In addition to the target on basic digital skills established in the European Pillar of Social Rights Action Plan, there are 20 million employed ICT specialists in the EU, with convergence between women and men.***

3.2 Secure and performant sustainable digital infrastructures

Europe will only achieve digital leadership by building it on a sustainable digital infrastructure regarding **connectivity, microelectronics and the ability to process vast data** as they act as enablers for other technological developments and support our industry's competitive edge. Significant investments need to be made in all of these areas that require coordination to achieve European scale.

Excellent and secure connectivity for everybody and everywhere in Europe is a prerequisite for a society in which every business and citizen can fully participate. Achieving gigabit connectivity by 2030 is key. Although this ambition can be reached with any technology mix, the focus should be on the more sustainable next generation fixed, mobile and satellite connectivity, with Very High Capacity Networks including 5G being rolled out, based on swift and efficient allocation of spectrum and respect of the 5G cybersecurity toolbox[14], and with 6G being developed in the years to come[15].

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13 See the Women in Digital Scoreboard 2020: https://ec.europa.eu/digital-single-market/en/news/women-digital-scoreboard-2020.

14 The Commission will ensure that participation in EU funding programmes in relevant technology domains will be conditional on compliance with security requirements specified in the respective EU programmes, including EU's external funding programmes and financial instruments, and is aligned with the approach in the EU toolbox on Cybersecurity for 5G networks. .

15 To contribute to this objective, the Commission adopted a proposal to launch a Joint Undertaking on Smart Networks and Services to coordinate research and innovation activities on 6G technology under

As the decade progresses, households will increase the take up of such network technologies reflecting their rising needs for very high capacity connectivity. By the end of this decade, new digital communications features and capabilities such as high-precision, holographic media, and digital-senses over the networks, are expected to provide a whole new perspective to a digitally enabled society underpinning the need for gigabit connectivity. Well before the end of the decade, businesses will need dedicated Gigabit connections and data infrastructures for cloud computing and data processing, in the same way as schools and hospitals will need this for eEducation and eHealth. High performance computing (HPC) will require terabit connections to allow real-time data processing.

It is our proposed level of ambition that ***by 2030***

All European households will be covered by a Gigabit network, with all populated areas covered by 5G[16].

Europe's digital leadership and global competitiveness depend on strong internal and external connectivity and should also inform our **international engagement,** in particular along the European time zones, and taking account the emergence of data gateways around EU periphery. The EU has a comprehensive program of engagement including Broadband rollout with partners in the Western Balkans and Eastern Partnership. Europe will be linked to its partners in the Neighborhood and Africa, including via terrestrial and submarine cables and a secure constellation of satellites. In addition, the EU will step up implementation of the EU-Asia Connectivity Strategy via new Connectivity Partnerships with India and ASEAN. Digital Partnership with Latin America & the Caribbean will complement the launch of connectivity component of the Digital Alliance with Latin America & the Caribbean, building on the BELLA Cable.

If connectivity is a precondition for digital transformation, **microprocessors** are at the start of most of the key, strategic value chains such as connected cars, phones, Internet of Things, high performance computers, edge computers and Artificial Intelligence. While Europe designs and manufactures high-end chips, there are important gaps, notably in state-of-the-art fabrication technologies and in chip design, exposing Europe to a number of vulnerabilities.[17]

It is our proposed level of ambition that ***by 2030***

The production of cutting-edge and sustainable semiconductors in Europe including processors is at least 20% of world production in value *(meaning manufacturing capacities below 5nm nodes aiming at 2nm and 10 times more energy efficient than today)*[18].

Horizon Europe as well as 5G deployment initiatives under the Connecting Europe Facility Digital and other programs. https://ec.europa.eu/digital-single-market/en/news/europe-puts-forward-proposal-joint-undertaking-smart-networks-and-services-towards-6g

16 This ambition continues on the track proposed by the 2016 Commission Communication 'Connectivity for a Competitive Digital Single Market – Towards a European Gigabit society' and the 2025 targets set therein.

17 To contribute to this objective, the Commission adopted a proposal to launch a Joint Undertaking on Key Digital Technologies to coordinate research and innovation activities on semiconductor and processor technologies under Horizon Europe and has launched a European alliance on microprocessors.

18 The smaller the technology node means the smaller the feature size, producing smaller transistors which are faster and more efficient.

A digital infrastructure serving citizens, SMEs, the public sector and large companies require high performance computing and comprehensive data infrastructures. Today, data produced in Europe is generally stored and processed outside Europe, and its value is also extracted outside Europe[19]. While businesses generating and exploiting data should retain free choice in this regard, this can bring risks in terms of cybersecurity, supply vulnerabilities, switching possibilities as well as unlawful access to data by third countries.[20] EU-based cloud providers have only a small share of the cloud market, which leaves the EU exposed to such risks and limits the investment potential for the European digital industry in the data processing market. Also, given the impact of data centers and cloud infrastructures on energy consumption, the EU should take the lead in making these infrastructures climate neutral and energy efficient by 2030, while using their excess energy to help heating our homes, businesses and common public spaces. As part of the enhanced Digital Economy and Society Index (DESI), the Commission will introduce mechanisms to measure the energy efficiency of data centers and electronic communications networks used by European companies.

As highlighted in the European data strategy, the volume of data generated is greatly increasing and a growing proportion of data is expected to be processed at the edge, closer to the users and where data are generated. This shift will require the development and deployment of fundamentally new data processing technologies encompassing the edge, moving away from centralised cloud-based infrastructure models. To address these trends towards increasing distribution and decentralization of data processing capacities, and to overcome the gap of suitable cloud supply meeting the needs of European businesses and public administration, Europe needs to strengthen its own cloud infrastructure and capacities[21].

Intelligent edge computing - applications

- *To monitor dangerous intersections for an **autonomous vehicle** so that it can travel safely.*
- *In "**Smart Farming**" where the deployment of edge capacity connected to machinery in farms will allow to collect agriculture data in real time, provide advanced services to farmers like harvest prediction or farm management, and optimise food supply chains.*
- *In **Manufacturing-as-a-service** enabling manufacturing companies – notably SMEs – to have local access to cloud-based innovative industrial services platforms, and market places to boost the visibility of their production capacities.*
- ***Health data and health records:** this will allow to collect and aggregate health data at local level much more quickly (e.g. in context of pandemic).*
- *In **public sector modernization** where edge deployment will provide data processing capacity for local public administration.*

*It is our proposed level of ambition that **by 2030***

[19] According to Eurostat's data, while improved compared to 2018, only 36% of EU enterprises used cloud services in 2020, mostly for simple services such as e-mail and storage of files (only 19% of enterprises use advanced cloud services).

[20] The EU is acting to mitigate such concerns through mutually beneficial international cooperation, such as the proposed EU-U.S. Agreement to facilitate cross border access to electronic evidence, alleviating the risk of conflict of laws and establishing clear safeguards for the data of EU citizens and companies.

[21] The declaration on cloud federation and alliance will contribute to this objective.

- ***10,000 climate neutral highly secure edge nodes[22] are deployed in the EU, distributed in a way that will guarantee access to data services with low latency (few milliseconds) wherever businesses are located.***

Yet, the cloud and edge ecosystem will not bring their full benefits to European businesses and public administrations unless accompanied by state-of-art **computing capacity**. In this regard, the cooperation with the Member States through the already established European High Performance Computing Joint Undertaking will be accelerated to deploy a world leading, federated supercomputing and quantum computing data infrastructure.

At the same time, the EU must invest in new **quantum** technologies. The EU should be at the global cutting edge of developing quantum computers which are fully programmable and accessible from everywhere in Europe while being highly energy efficient and which will be able to solve in hours what is currently solved in hundreds of days, if not years.

The Quantum revolution in the next decade *will be a game changer in the emergence and use of digital technologies. Examples of possible applications include:*

- ***Health****: Quantum computers will enable faster and efficient development of medicines such as simulating a human body ("digital twin") to conduct virtual drug trials, develop personalised cancer treatments; much faster genome sequencing etc.*
- ***Increase security of communication and data transfers****: Quantum secured communication systems can safeguard sensitive communications, online voting systems, and financial transactions, ensure the long-term storage of sensitive health and national security-related data, and keep critical communication infrastructure safe.*
- ***Better monitoring of resources****: Quantum gravity sensors based on Earth or fitted to space-borne satellites, will measure gravitational fields, making it possible to detect obstacles, subsidence and water resources under the ground and monitor natural phenomena such as volcanic activity.*
- ***Business/environment****: Quantum computers will optimise the use of algorithms to solve highly complex logistical and scheduling problems, resulting in saving time and fuel or finding the cheapest combination of renewable sources to supply an energy grid.*

It is our proposed level of ambition that

By 2025, Europe will have its first computer with quantum acceleration paving the way for Europe to be at the cutting edge of quantum capabilities by 2030.

3.3 Digital transformation of businesses

During the COVID-19 pandemic embracing digital technologies has become essential for many businesses. By 2030, more than just enablers, digital technologies including 5G, the Internet of Things, edge computing, Artificial Intelligence, robotics and augmented reality will be at the core of new products, new manufacturing processes and new business models based on fair sharing of data in the data economy. In this context, the swift adoption and implementation of the Commission's proposals for the Digital Single Market and Shaping

[22] An edge node is a computer that acts as an end user portal (or "gateway") for communication with other nodes in cluster computing, where components of a software system are shared among multiple computers.

Europe's digital future strategies[23] will enhance the digital transformation of businesses and ensure a fair and competitive digital economy. It will also need to be matched with a level playing field abroad.

The transformation of businesses will depend on their ability to adopt new digital technologies rapidly and across the board, including in industrial and services ecosystems that are lagging behind. EU support, notably through the Single Market, Digital Europe and Cohesion programmes, will promote the deployment and use of digital capabilities including industrial data spaces, computing power, open standards, testing and experimentation facilities.

Businesses should be encouraged to adopt digital technologies and products with lower environmental footprint and higher energy and material efficiency. Digital technologies must be rapidly deployed to enable a more intensive and efficient resource use. In this way, boosting Europe's material productivity will both reduce manufacturing input costs and our vulnerability to supply shocks.

*The potential of **digital transformation** for five key ecosystems*[24]

- *Manufacturing: thanks to 5G connectivity, devices in factories will be even more connected and collect industrial data. Artificial Intelligence will instruct robots in real time, making them increasingly collaborative, improving workers' jobs, safety, productivity and wellbeing. Manufacturers will be able to enhance predictive maintenance and produce on demand, based on consumers' needs, with zero stocks, thanks to digital twins, new materials and 3D printing.*
- *Health: introducing more online interaction, paperless services, electronic transmission and access to data instead of paper records and automation could lead to benefits of up to € 120 billion per year in Europe.*
- *Construction: the lowest productivity development from all major sectors in the last 20 years. 70% of construction executives mentioned new production technologies and digitalisation as the drivers of change in the sector.*
- *Agriculture: Digital farming technologies can enable the agricultural sector to produce more tailored and efficiently, thus increasing the sector's sustainability performance and competitiveness. Agriculture has been identified as one key sector, where digital solutions can help to cut global GHG emissions and pesticide use.*
- *Mobility: digital solutions for connected and automated mobility have great potential for reducing traffic accidents, enhancing quality-of-life, and improving the efficiency of transportation systems, including concerning their environmental footprint.*

Specific attention should be given to **cutting-edge and disruptive innovation**. While Europe is creating already as many start-ups as the US, it needs to create more favourable conditions and a truly functioning Single Market for rapid growth and scale-up[25]. Europe has equipped itself with various tools[26], yet the investment gap for financing the growth of start-ups

[23] For instance the EU's Cybersecurity Strategy for the Digital Decade, Digital Services Act and Digital Markets Act, the European Digital Identity, the Media and Audiovisual Action Plan, the European Democracy Action Plan, the Digital Finance Strategy, the Data and AI strategies, Platform to Business Regulation and Geo-blocking Regulation .

[24] Source McKinsey report, *Shaping the digital transformation in Europe*, September 2020.

[25] Europe's next leaders: the Start-up and Scale-up Initiative, COM/2016/0733 final.

[26] A deepening of the EU's Capital Markets Union, a strengthening of the mobilisation of private finance as well as funding from Horizon Europe, the European Innovation Council and InvestEU will be important.

between the US and Europe and even between the EU and China is still considerable. The EU has already produced a number of unicorns, but there is scope for improvement. The development of a Startup Nations Standard of Excellence can contribute to facilitate growth across borders, including increasing access to finance for scaling-up[27].

SMEs have a central role in this transition, not only because they represent the bulk of the EU companies, but also because they are a critical source of innovation[28]. With the support of over 200 Digital Innovation Hubs and industrial clusters, by 2030, SMEs should have the opportunity to access digital technologies or data easily and on fair terms, ensured by appropriate regulation, and benefit from adequate support to digitalise. In this respect, more than 200 European Digital Innovation Hubs and industrial clusters across the EU should support digital transformation of both innovative and non-digital SMEs, and connect digital suppliers to local ecosystems The objective is to achieve a high level of digital intensity, leaving no-one behind. The Commission will update its Industrial Strategy, also with a view to accelerating the digital transformation of the industrial ecosystems in support of the 2030 targets.

It is our proposed level of ambition that ***by 2030:***

- ***75% of European enterprises have taken up cloud computing services, big data and Artificial Intelligence***
- ***More than 90% of European SMEs reach at least a basic level of digital intensity[29]***
- ***Europe will grow the pipeline of its innovative scale ups and improve their access to finance, leading to doubling the number of unicorns[30] in Europe.***

3.4 Digitalisation of public services

By 2030, the EU's objective is to ensure that democratic life and public services online will be fully accessible for everyone, including persons with disabilities, and benefit from a best–in-class digital environment providing for easy-to-use, efficient and personalised services and tools with high security and privacy standards. Secured e-voting would encourage greater public participation on democratic life. User-friendly services will allow citizens of all ages and businesses of all sizes to influence the direction and outcomes of government activities more efficiently and improve public services. Government as a Platform, as a new way of building digital public services, will provide a holistic and easy access to public services with a seamless interplay of advanced capabilities, such as data processing, AI and virtual reality. It will also contribute to stimulating productivity gains by European business, thanks to more

27 https://ec.europa.eu/digital-single-market/en/startup-europe

28 An SME Strategy for a sustainable and digital Europe, COM/2020/103 final.

29 The Digital Intensity Index (DII) measures the use of different digital technologies at enterprise level. The DII score (0-12) of an enterprise is determined by how many of the selected digital technologies it uses. A basic level of digital intensity corresponds to a situation where an enterprise scores 4 or more.

30 By unicorns we understand here both: 1) realised unicorn, i.e. companies founded after 1990 that have had an IPO or trade sale above $1 billion and 2) unrealised unicorn, i.e. companies that have been valued at or over $1 billion in their last private venture funding round (meaning the valuation has not been confirmed in a secondary transaction).

efficient services that are digital by default[31] as well as a role model incentivising businesses, in particular SMEs, towards greater digitalisation.

However, the gap to reach this vision is still significant. Despite the increasing use of public services online, services provided digitally are often basic e.g. filling in forms. Europe must harness digitalisation to drive a paradigm change in how citizens, public administrations and democratic institutions interact, ensuring interoperability across all levels of government and across public services[32].

Telemedicine

*During the pandemic **telemedicine consultations** grew more in one month than they did in 10 years, and this played a key role in keeping queues down at hospitals and maintaining patients in good health[33]. The ability for European citizens to access, and control access to, their electronic health records (EHR) across the EU should be greatly improved by 2030 based on common technical specifications for health data sharing, interoperability, developing the secure infrastructure, as well as taking actions to facilitate the public acceptability of sharing health information with the medical community.*

European digital identity: the Government in the palm of your hand

By 2030, the EU framework should have led to wide deployment of a trusted, user-controlled identity, allowing each citizen to control their own online interactions and presence. Users can make a full use of online services easily and throughout the EU while preserving their privacy.

EU communities are also developing smart data platforms integrating data across different sectors and cities that improve the quality of everyday life for their citizens. Today, most of the digital services these platforms offer are limited to basic services, such as smart parking, smart lighting or public transportation telematics. Digitalisation also plays a key role in the development of "Smart villages", i.e. communities in rural areas that use innovative solutions to improve their resilience, building on local strengths and opportunities.

Platforms in rural and urban communities will be powered by digital technologies and will offer services such as multi-modal intelligent transport systems, rapid emergency assistance in case of accidents, more targeted waste management solutions, traffic management, urban planning, smart energy and lighting solutions, resource optimisation, and more. Using Green Public Procurement criteria[34] can boost demand for a green digital transformation

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31 While public services will always be accessible in person, successful digital transformation will make digital the preferred way for people to access them.

32 Cf. in particular the Berlin Declaration on Digital Society and Value-based Digital Government, December 2020. The digitisation effort mandated by the EU Single Digital Gateway should be extended to other sectors so that citizens and businesses can interact digitally will all parts of national administrations.

33 In France, there were 10,000 teleconsultations per day in early March 2021 and this grew to 1 million per day by the end of March – according to Digital Health Partnership.

34 https://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm

The digital transformation should also enable modern and efficient justice systems[35], enforcement of consumer rights and an increased effectiveness of public action including law enforcement and investigation capacities[36] – what is illegal offline is also illegal online, and law enforcement must be best equipped to deal with more and more sophisticated digital crimes.

It is our proposed level of ambition that ***by 2030:***

- ***100% online provision of key public services available for European citizens and businesses***
- ***100% of European citizens have access to medical records (e-records)***
- ***80% of citizens will use a digital ID solution.***

4. DIGITAL CITIZENSHIP

Deploying digital infrastructures, skills and capacities and digitising businesses and public services alone is not sufficient to define the EU's approach to its digital future; it is also necessary to enable all Europeans to make full use of digital opportunities and technologies. In the digital space, we need to make sure that the same rights that apply offline can be fully exercised online.

To be fully empowered, people should first have access to affordable, secure and high quality connectivity, be able to learn basic digital skills –which should become a right for all- and be equipped with other means which together allow them to fully participate in economic and societal activities of today and the future. They also need to have easy access to digital public services, on the basis of a universal digital identity, as well as access to digital health services. People should benefit from non-discriminatory access to online services and as well from the realisation of principles, such as secure and trusted digital spaces, work-life balance in a remote working environment, protection of minors, and ethical algorithmic decision-making.

In addition, the digital technologies and services people use must be compliant with the applicable legal framework and respect the rights and values intrinsic to the "European way". Furthermore, the human-centred, secure and open digital environment should comply with the law, but also further enable people to enforce their rights, such as the rights to privacy and data protection, freedom of expression, the rights of the child and consumer rights.

The digital principles are rooted in primary EU law, notably the Treaty on European Union (TEU), the Treaty on the Functioning of the European Union (TFEU), the Charter of Fundamental Rights and the case-law of the Court of Justice of the European Union, as well as in secondary legislation[37].

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35 Communication from the Commission on the Digitalisation of justice in the European Union A toolbox of opportunities, COM(2020) 710 final.

36 85% of criminal investigations rely on electronic evidence.

37 This is the case of existing legislation, e.g. the Consumer Sales and Guarantees Directive, the European Accessibility Act, the European Electronic Communication Code, the Audiovisual Media Service Directive, the Single Digital Gateway Regulation or the Cybersecurity Act, as well as legislation that has been proposed and should be rapidly adopted by the EU co-legislators and ratified by national Parliaments such as the Digital Services Act and the Digital Markets Act.

This European way for the digital society should also underpin and support open democracy initiatives by contributing to inclusive policy-making, enabling wide-ranging engagement with people and stimulating grass-roots action for developing local initiatives as enabler factors to improve social acceptability and public support for democratic decisions.

This European way for the digital society is also based on ensuring full respect of EU fundamental rights:

- Freedom of expression, including access to diverse, trustworthy and transparent information,
- Freedom to set up and conduct a business online,
- Protection of personal data and privacy, and right to be forgotten,
- Protection of the intellectual creation of individuals in the online space.

It is equally important to set up a comprehensive set of digital principles that will allow to inform users and guide policy makers and digital operators such as:

- Universal Access to internet services
- A secure and trusted online environment
- Universal digital education and skills for people to take an active part in society and in democratic processes
- Access to digital systems and devices that respect the environment
- Accessible and human-centric digital public services and administration
- Ethical principles for human centric algorithms
- Protecting and empowering children in the online space
- Access to digital health services.

The Commission will propose to include such a set of digital principles and rights in an inter-institutional solemn declaration between the European Commission, the European Parliament and the Council, based on a proposal from the European Commission and building on and complementing the experience of the European Pillar of Social Rights.

The Commission intends to carry out an annual Eurobarometer exercise specifically dedicated to monitoring the perception of Europeans regarding the respect of their rights and values, and to what extent they feel that the digitisation of our society is serving them.

5. A COMPASS TO REACH THE 2030 TARGETS AND OBJECTIVES

To deliver the renewed EU ambition for digitalisation a robust framework is necessary. It should encompass our vision based on the four cardinal points, digital principles and addressing critical capacity gaps.

Digital COMPASS

Governance structure with annual reporting and follow up

Achieving the concrete objectives under the four cardinal points[38]	**Shaping and launching Multi-country projects**[39]	**Monitoring Digital Principles**
Monitored by quantitative KPIs, reporting on actions undertaken and followed up with recommendations	Monitoring of infrastructure and critical capacity gap. Building consensus / fostering agreement on common projects and facilitating their implementation	Reporting and scoreboards Annual Eurobarometer

5.1 Governance

Operationally, the Commission intends to propose a Digital Compass in the form of a digital policy programme[40] to be adopted by co-decision of European Parliament and Council, setting the focus on delivery and constant commitment towards the common digital goals. The programme would feature the following aspects:

- A set of concrete objectives for each of the four cardinal points as proposed in Section 3.
- A monitoring system measuring the progress of the EU against the key targets for 2030 (Section 3 and Annex) and digital principles (Section 4), also assessing the areas with insufficient development at the level of Member States, including for instance lack of action or incomplete implementation of key regulatory proposals.[41] The underlying indicators for monitoring the targets at EU level and the digitalisation trends at national level will be part of an enhanced DESI reporting in order align with and harness existing processes and methodologies[42]. The European Commission will be responsible for the analysis and overall reporting on progress at the European level. Such reporting will provide an overview and analysis of the situation and show the remaining distance towards the digital decade targets (see as an example a graph below). The final purpose is to identify in which areas progress lags behind and how the identified gaps can be addressed through measures and recommendations at European and/or at national level.

  How far are we from the 2030 Targets which enable an inclusive and sustainable digital society?

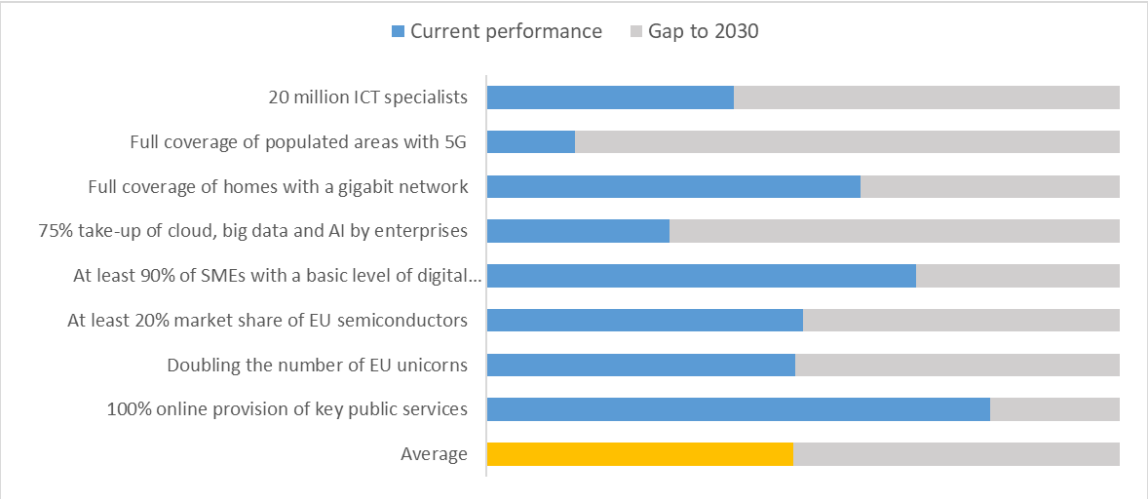
38 See below paragraph 5.1

39 See below paragraph 5.2.

40 Possibly similar to the Radio Spectrum Policy Programme (RSPP) approved on 14 March 2012 by the European Parliament and Council. This Decision created a comprehensive roadmap, set general principles and called for concrete actions to meet the objectives of EU policies for radio spectrum use.

41 While the key targets for the four cardinal points will be defined in the digital policy programme, the digital principles will be laid down in the inter-institutional solemn declaration mentioned above.

42 Member States are currently already providing relevant information for the DESI index, therefore there will not be a significant increment of the reporting requests, while at the same time DESI will become an official and concerted instrument. Member States will have a key role in defining the relevant target and indicators, as well as in the enforcing mechanism.



- On the basis of the analysis, the Commission will publish annually the **European State of the Digital Decade Report** for the Council and the European Parliament, to report on the progress towards the 2030 vision and corresponding cardinal points, targets and principles, as well as on the more general state of compliance with these objectives, through a score of 'traffic lights'. The report will raise awareness on deviations towards the common 2030 EU goals and digital principles and identified investment gaps. The annual State of the Digital Decade Report, as a sole report on the progress in digital, will feed also into the European Semester exercise, and will be aligned with the recovery and resilience facility process.
- The Report will trigger a collaborative analysis between the Commission and Member States to identify solutions addressing weaknesses and to propose targeted actions for effective remedies. The Commission will be empowered, in collaboration with Member States, to undertake an operational follow-up and to provide recommendations. This could include recommendations as regards regulatory implementation[43] or the need for public intervention to foster additional investments in digital technologies and capacities, e.g. through the development of Multi-Country Projects.

The policy programme will set up a mechanism to enable the Commission to engage with Member States through close cooperation and coordination with the objective of taking joint commitments as well as possible measures at EU and national level, also taking into account the implementation of other digital policies and initiatives. In addition, the policy programme will allow the Commission to engage with Member States to launch and shape Multi-Country Projects, as described below.

While the focus would be on the cooperation and coordination with Member States, for the governance to be effective, all economic and societal actors need to have well-founded trust in delivery. Since this is a key condition of success for the acceleration of EU's digitalisation, the Compass will subject to targeted consultations with relevant stakeholders.

5.2 Multi-Country Projects

To deliver the European vision for the Digital Decade, digital capacities are needed in the four areas of the Digital Compass, which can only be delivered if Member States and the EU pool

[43] This could encompass, for instance, a further harmonization of spectrum policies.

resources. For the large technological projects that are necessary for Europe's digital transition, a European approach to building digital capacities is indispensable. Cutting-edge European capacities require critical mass of funding and alignment of all the actors.

The European Council has called for further strengthening synergies between the use of EU and national funds as regards such key technological projects. The Recovery and Resilience Facility (RRF) Regulation and the Technical Support Instrument recognise the opportunity of developing Multi-Country Projects combining investments from several national recovery and resilience plans. Moreover, action should be prepared for the longer term, seeking to ensure the mobilisation of investments from the EU budget, Member States and the industry.

Possible directions for Multi-Country Projects have already been discussed with Member States as part of the preparation of the national recovery and resilience plans, under the flagships Connect, Scale Up, Modernise and Reskill and Upskill. The Commission has offered operational support and encouraged Member States to use funding from their national recovery and resilience plans to join forces and support such Multi-Country Projects.

Multi-country digital projects discussed so far with the Member States under the RRF[44]*:*

- *Building a common and multi-**purpose pan-European interconnected data processing infrastructure**, to be used in full compliance with fundamental rights developing real-time (very low latency) **edge capacities** to serve end-users' needs close to where data are generated (i.e. at the edge of telecom networks), designing secure, low power and interoperable middleware platforms for sectoral uses, and enabling easy exchange and sharing of data, notably for Common European Data Spaces;*
- *Endow the EU with capabilities in electronics **design and deployment of the next generation of low power trusted processors and other electronic components** needed to power its critical digital infrastructure, AI systems and communication networks;*
- *Pan-European deployment of **5G corridors** for advanced digital rail operations and Connected and Automated Mobility contributing to road safety and green deal objectives;*
- *Acquiring **supercomputers and quantum computers**, connected with the EuroHPC extreme-bandwidth communication network, investing and cooperating in large-scale application platforms requiring supercomputing (e.g. in health, disaster prediction), as well as in HPC national competence centres and HPC & Quantum skills;*
- *Developing and deploying an **ultra-secure quantum communication infrastructure** spanning the whole EU, to significantly increase the security of communication and storage of sensitive data assets all over the EU, including of critical infrastructures;*
- *Deploying a network of **Security Operations Centres**, powered by artificial intelligence, able to detect signs of a cyberattack early enough, and to enable proactive action, for enhanced joint risk preparedness and response at national and EU level;*
- ***Connected Public Administration**: build in complementarity and synergy with the eIDAS framework and offer on a voluntary basis European Digital Identity, to access and use digital services online from the public and private sectors in a privacy-enhancingway and in full compliance with existing data protection laws;; Build a Once-Only system allowing public administrations at the local, regional and national levels to exchange data and evidence across borders, in full compliance with legal requirements and fundamental rights;*

[44] The list of multi-country projects provided is indicative. Eligibility for funding from the Recovery and Resilience Facility of any of these projects depends on full compliance with Regulation (EU) 2021/241 of the European Parliament and of the Council.

- ***European Blockchain Services Infrastructure:*** *develop, deploy and operate a pan-European blockchain-based infrastructure that is green, secure, in full compliance with EU values and the EU legal framework, making cross-border and national/local public service provision more efficient and reliable and promoting new business models;*
- ***European Digital Innovation Hubs****: support the digitisation of European Industry through completing an EU-wide network of "European Digital Innovation Hubs" (EDIHs), which are "one-stop-shops" to provide to SMEs technical expertise, opportunities to "test before invest", financing advice, training and more;*
- ***High tech partnerships for digital skills through Pact for Skills****: there are growing gaps of ICT specialists in all industrial ecosystems, regions and Member States. To fill this gap, a large-scale multi-stakeholder skills partnership could be set up to build a bridge between demand and supply, foster greater private and public investment increase the quantity and the quality of the offer of specialised education and training and to boost excellence in higher education and VET institutions, making them more attractive and responsive to the needs of the labour market in terms of digital.*

The Commission is committed to support the development and implementation of Multi-Country Projects, including under the RRF, and in enhanced dialogue with Member States, including through a flexible governance framework.

Until now a variety of mechanisms[45] has been used for different projects and investments., which have revealed a gap in the Commission's toolbox to combine funding from Member States, the EU budget and private investment for the purposes of deploying and operating infrastructures and services of common interest, outside the research area.

In particular, a number of combined features are necessary for an efficient mechanism for deploying and operating digital multi-country projects (and possibly also projects in other fields):

- the possibility to be set up swiftly and flexibly, while making sure it remains open to all interested Member States;
- standard arrangements governing common issues such as ownership and management of data, including the role of the Commission to ensure openness, alignment with agreed EU priorities and regulations, including competition and State aid rules, and coordination with EU programmes and policies
- facilitate the pooling of EU and national funding and the complementarity and combination of the various sources of funding, while creating incentives to crowd in private investments;
- legal capacity to procure and operate multi-country infrastructures and pan-European services of public interest, going beyond research, while facilitating vendor neutrality.

To offer an efficient solution and incentivise Member States to work together in Multi-Country Projects, building on lessons learnt, including from the implementation of such projects under the RRF, the Commission is assessing options, such as the feasibility and

[45] E.g. Joint Undertakings, European Research Infrastructure Consortia, Non-profit associations, Important Projects of Common European Interest.

features of a specific instrument for Multi-Country Projects, as part of the future proposal for the Digital Policy Programme.

The Digital Compass: a new tool to pilot the Digital Decade

*The Commission will propose a **Digital Compass in the form of a policy programme** to be adopted by co-decision of European Parliament and Council. This Digital Compass will include:*

(i) concrete targets to reach our vision along four cardinal points measured at EU and national level with key performance indicators based on an enhanced DESI,

(ii) a governance structure - including annual reporting by the Commission to the European Parliament and Council on the progress towards the Digital Decade which could include specific recommendations to limit deviations with the achievement of goals

(iii) monitoring of digital principles endorsed in the inter-institutional declaration, and

(iv) a mechanism to organise with Member States those Multi-Country Projects that are necessary for building Europe's digital transition in critical areas.

6. INTERNATIONAL PARTNERSHIPS FOR THE DIGITAL DECADE

The degree of digitalisation of an economy or society has been shown not only to be a critical underpinning of economic and societal resilience, but also a factor in **global influence**. As the pandemic has highlighted the extent to which digital policy is never value-neutral, with competing models on offer the EU now has an opportunity to promote its positive and human-centric vision of the digital economy and society.

For Europe's Digital Decade to be successful, we will build strong **international digital partnerships** matching the four pillars of our Compass: skills, infrastructures, transformation of business and of public services. These will strengthen the EU's capacity to assert its own interests and deliver global solutions while fighting against unfair and abusive practices and ensuring the security and resilience of EU digital supply chains.

The EU's starting point is an open digital economy based on the flow of investment and innovation as an engine for prosperity. At the same time, the EU will strongly promote our core interests and values, through three overarching principles: **a level playing field in digital markets, a secure cyberspace and upholding fundamental rights online**.

Trade policy and agreements will play a vital role in this regard by setting the global and bilateral rules for digital trade in an open but assertive manner, based on European values.

As a central part of the renewed transatlantic relationship, the EU has proposed to establish a new EU-US Trade and Technology Council, to deepen our trade and investment partnership, strengthen our joint technological and industrial leadership, develop compatible standards, deepen research collaboration, promote fair competition and ensure the security of critical supply chains.

The EU is a key player in multilateral fora and a promoter of **inclusive multilateralism** where governments, civil society, the private sector, academia and other stakeholders work together. Such fora can improve the functioning of the digital economy globally, as in the case

of negotiations on new e-commerce rules in the World Trade Organisation. The EU will work actively and assertively to promote its human-centric vision of digitisation within international organisations, in cooperation with its Member States and like-minded partners. This coordinated approach should especially defend a use of technology that is fully adherent to the United Nations Charter and the Universal Declaration on Human Rights.

The EU's international digital partnerships will be underpinned by a **toolbox,** drawing on a combination of regulatory cooperation, addressing capacity building and skills, investment in international cooperation and research partnerships. A growing programme of bilateral dialogues will be used for that purpose:

- The EU's international digital partnerships will promote alignment or convergence with EU **regulatory norms and standards** on issues such as data protection, privacy and data flows, the ethical use of AI, cybersecurity and trust, tackling disinformation and illegal content online, ensuring internet governance, and supporting development of digital finance and e-government. The EU will also contribute to common solutions such as the ongoing work at the G20 and the OECD with respect to a global consensus-based solution to address the **taxation of the digital economy**.
- To underpin its digital partnerships with developing and emerging countries, the Commission will design and propose **digital economy packages** that draw on the toolbox. They will be financed through **Team Europe Initiatives** (TEIs) that combine resources of the EU[46] and its Member States, working with world leading European companies, including via the development and networking of digital innovation hubs. These packages will be designed so that the cardinal points remain linked and addressed comprehensively, guaranteeing the promotion of a human-centric model of digital development. Fostering digital connectivity in order to bridge the digital divide requires important investments and hence comprehensive financial cooperation, including with like-minded partners and International Financial Institutions. Team Europe will address this digital gap in partner countries, with particular attention to Africa, promoting at the same time EU technology and values. This could be supported by the creation of a **Digital Connectivity Fund** in a Team Europe approach. The Commission will explore its feasibility, together with our partners, in the coming months.
- Digital Partnerships will offer the opportunity to carry out joint **research activities, including under Joint Undertakings on industrial issues,** which will support EU leadership in evolving technologies such as 6G, Quantum or the use of digital technology in the fight against climate change and environmental challenges.

Building on a renewed transatlantic relationship as a strong pillar of our digital international engagement, the EU should lead the way towards a **wider coalition of like-minded partners,** open to and developed together with all those who share its vision of a human-centric digital transformation. Together we will defend the open, decentralised internet, based on a single world wide web, and a use of technology that respects individual freedoms and promote a digital level playing field Such a coalition should work together to boost competitiveness and

[46] Notably through the Neighbourhood, Development and International Cooperation Instrument, but also through its Connecting Europe Facility.

innovation, set standards in multilateral fora – such as on the ethical use of artificial intelligence – promote digital trade flows through mutually interdependent and resilient supply chains, and secure cyberspace. The Commission and the High Representative will work with EU Member States to develop a **comprehensive and coordinated approach to digital coalition-building and diplomatic outreach** including through the network of EU delegations.

By 2030 **international digital partnerships** should result in greater opportunities for European companies, increased digital trade via secure networks, respect of European standards and values, and a more supportive environment internationally for the kind of human-centric digital transformation we and other partners want to see.

7. CONCLUSION: THE WAY FORWARD

The Digital Compass Communication maps out a clear path towards a common vision and actions for Europe to succeed in the Digital Decade, at home and in the world.

The involvement and commitment of the public and of all stakeholders is crucial to achieve a successful digital transformation. In this context, the Commission, shortly after this Communication, will start a wide consultation process on the digital principles. It will engage with the Member States, the European Parliament, regional and economic and social partners, businesses and citizens, on specific elements of the Communication during 2021, including the compass framework with specific targets and governance. The Commission will set up a stakeholder forum, which would be associated to some aspects of the Digital Compass 2030 work.

The Commission will build on these concertation steps with a view to proposing the Digital Policy Programme to the co-legislators by the third quarter of 2021, and hopes to achieve decisive progress with the other institutions on a Declaration of Digital Principles by the end of 2021.

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COM(2021) 118 final

ANNEX

ANNEX

to the

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions

2030 Digital Compass: the European way for the Digital Decade

Proposal of common Targets to mobilise public and private actors

When selecting **targets,** the Commission looked at existing **Key Performance Indicators (KPIs)**, having in mind that targets need to be measurable in order to be monitored. For each target we present the baseline and source of data. The choice of lead KPIs hereafter was made based partly on existing KPIs which are monitored e.g. in the Digital Economy and Society Index (DESI) monitoring system set up by the Commission since 2014. There are, however, also potential KPIs where studies (ongoing or future) or other sources would be needed, methodologies would still need to be developed or relevant data would still need to be acquired. Moreover, it is to be recalled that even if a particular KPI is not mentioned in the below list of lead KPIs, this does not mean it is not monitored. Many other KPIs will continue to be monitored and reported via an enhanced DESI[1].

Targets of cardinal point 1: A digitally skilled population and highly skilled digital professionals

EU's objective for 2030: " A tech savvy continent where all are digitally empowered"		
Dimension	**2030 EU Target vs baseline**	**Source**
ICT specialists[2]	**20 million** employed ICT specialists, with convergence between women and men[3] (2019 baseline: 7.8 million)	DESI, ESTAT

[1] DESI is a composite index that summarises dozens of relevant indicators on Europe's digital performance and tracks the evolution of EU Member States, across five main dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services. DESI has been in continuous evolution since its first publication in 2014. It is the main analytical tool developed by the European Commission services to provide evidence-based input for the assessment of digital development in the EU as a whole as well as in Member States. The data included in DESI is mostly collected from the Member States through the European Commission services Eurostat and DG Connect and by ad-hoc studies launched by the Commission services. DESI is a dynamic index. Its constituent indicators are extended and change to reflect new priorities and changing trends. The indicator list is reviewed and improved every year to keep up with latest technologies and policy priorities.

[2] In addition to the target on basic digital skills established in the European Pillar of Social Rights Action Plan that 80% of citizens aged 16-79 have at least basic digital skills (2020 baseline: 58,3%).

[3] DESI indicator "2b1". Currently the share of women among the employed ICT specialist is merely 18%.

Target of cardinal point 2: Secure and performant sustainable digital infrastructures

EU's objective for 2030: "Top-notch trustworthy and secure Digital Infrastructures"		
Dimension	**2030 EU target vs baseline**	**Source**
Connectivity	**All European households** will be covered by **a Gigabit network**, with **all populated areas** covered by **5G**[4] Baseline: - Gigabit Coverage (2020 baseline[5]: 59%) - 5G coverage in populated areas[6] (2021 baseline: 14%)	DESI Study on Broadband coverage in Europe by Omdia
Semiconductors	The production of cutting-edge and sustainable semiconductors in Europe including processors is **at least 20% of world production** in value[7] (2020 baseline: 10%)	Data source to be confirmed in the digital policy programme
Edge/cloud	**10,000 climate neutral highly secure edge nodes** are deployed in the EU, distributed in a way that will guarantee access to data services with low latency (few milliseconds) wherever businesses are located[8] (2020 baseline: 0)	Annual study on edge deployment under CEF2 (as of 2022)
Quantum computing	**By 2025**, Europe will have **its first computer with quantum** acceleration paving the way for Europe to be at the cutting edge of quantum capabilities by 2030. (2020 baseline: 0)	Data source to be confirmed in the digital policy programme

4 Continuation and extension of the Gigabit society targets for 2025, which are that all European households, urban or rural, will have access to internet connectivity of at least 100 Mbps upgradable to Gigabit' and 'Gigabit connectivity for all main socio-economic drivers (…) as well as digitally intensive enterprises'. All urban areas and major terrestrial transport paths to have uninterrupted 5G coverage by 2025.

5 Please note that current DESI measurement is via DESI indicator "1b2" (Coverage of households covered by any fixed Very High Capacity Networks (VHCN)). The technologies, at the current state of development, considered for VHCNs are "Fiber to the Home" (FTTH), Fiber to the building ("FTTB") and Cable "Docsis 3.1", as all of those technologies are able to deliver 1Gbps downlink. Space-based assets can be an important contributor towards the 100% target by covering the remote and/or sparsely populated areas hard to reach otherwise. For a legal definition of VHCN, see Art. 2(2) of Dir (EU) 2018/1972: 'very high capacity network' means either an electronic communications network which consists wholly of optical fibre elements at least up to the distribution point at the serving location, or an electronic communications network which is capable of delivering, under usual peak-time conditions, similar network performance in terms of available downlink and uplink bandwidth, resilience, error-related parameters, and latency and its variation; network performance can be considered similar regardless of whether the end-user experience varies due to the inherently different characteristics of the medium by which the network ultimately connects with the network termination point.

6 Percentage of populated areas (i.e. percentage of all places where households are located, including remote areas) with coverage by 5G - measured as the total coverage of telecom operators in each country.

7 Meaning manufacturing capacities below 5nm nodes aiming at 2nm and 10 times more energy efficient than today. The smaller the technology node means the smaller the feature size, producing smaller transistors which are faster and more efficient.

8 The target is to materialise the vision set out in the data strategy that is to have 80% of data processing done at the edge by 2025. Many of the future data services and 5G applications, such as Connected Automated Driving, smart farming, intelligent management of energy grids, smart manufacturing require a latency of a few milliseconds. To achieve such a latency in return requires an edge node in every 100km. 8-10,000 edge nodes correspond to this deployment of a mesh with a node every 100km. This density of edge nodes will conversely stimulate the demand from European user industry for novel and innovative digital services based on local data processing, and allow these users to be more in control of their data. The current baseline is 0 as the technology is just emerging and there has just been a few pilots (an IDATE study of 2019 identified 62 implementations in Europe).

Target of cardinal point 3: Digital transformation of business

EU's objective for 2030: "The continent with a high share of digitalised businesses"		
Dimension	**2030 EU Target vs baseline**	**Source**
Take up of digital technologies	**75% of European enterprises** have taken up: - Cloud computing services (2020 baseline: 26%) - Big data (2020 baseline: 14%) - Artificial Intelligence (AI) (2020 baseline 25%)	ESTAT, IPSOS
Digital "late adopters"	**More than 90% of European SMEs** reach at least a basic level of digital intensity[9] (2019 baseline : 60.6%)	DII, ESTAT
Innovative businesses/scale-ups	Europe will grow the pipeline of its innovative scale ups and improve their access to finance, leading to **doubling the number of unicorns**[10] (2021 baseline: 122)	Dealroom (used by Atomico in its state of European tech)

[9] The Digital Intensity Index (DII) is a micro-based index that measures the availability at firm level of 12 different digital technologies: internet for at least 50% of employed persons, recourse to ICT specialists, fast broadband (30 Mbps or above), mobile internet devices for at least 20% of employed persons, a website, a website with sophisticated functions, social media, paying for advertising on the internet; the purchase of advanced cloud computing services; sending eInvoices, eCommerce turnover accounting for over 1% of total turnover and business-to-consumer (B2C) web sales of over 10% of total web sales. The value for the index therefore ranges from 0 to 12. The list of the aforesaid 12 indicators is reviewed and improved every year to keep up with latest technologies and policy priorities.

[10] By unicorns we understand here both: 1) realised unicorn, i.e. companies founded after 1990 that have had an IPO or trade sale above $1 billion and 2) unrealised unicorn, i.e. companies that have been valued at or over $1 billion in their last private venture funding round (meaning the valuation has not been confirmed in a secondary transaction). In 2019 there were 703 unicorns in the US and 206 in China (https://blog.dealroom.co/uk-unicorn-tech-update-for-london-tech-week/).

Targets of cardinal point 4: Digitalisation of public services

EU's objective for 2030: "Modernised public services responding to society's needs"		
Dimension	**2030 EU Target vs baseline**	**Source**
Government as a platform	-100% online provision of key public services[11] available for European citizens and businesses -100% of European citizens have access to medical records (e-records) -80% of citizens will use a digital ID solution 2020 baselines: -key digital public services: 75/100 (citizens), 84/100 (businesses) -citizens with access to medical records: N/A[12] -digital ID: currently no baseline for take-up of digital ID[13]	Online service completion indicator, e-Government Benchmark[14]

11 "key public services" are services related to the following "life events": Regular Business Operations, Moving, Owning and Driving a Car, Starting a Small Claims Procedure, Business StartUp, Family life, Losing and Finding a Job and Studying. (source: e-Government Benchmark).

12 Can be developed through e-Government Benchmark or administrative sources.

13 As regards availability, the current baseline for the percentage of key services that are e-ID enabled is 58% (services accessible domestically) and 9% (services accessible cross-border).

14 Revised Online service completion indicator.