Digital Europe

Draft Orientations for the preparation of the work programme(s) 2021-2022

Executive Summary

The ongoing digital transformation touches every aspect of our lives. We need to embrace it, and to ensure that it has a positive effect on European growth, employment and well-being – while meeting our ambitious sustainability goals. But so far, Europe has not collectively invested enough in the latest technologies, and there is a growing mismatch between supply and demand. Businesses, public sector and academic community are increasingly having to look outside Europe to access the computing, data handling or cybersecurity capacities they need, while citizens often lack the skills to thrive in the new digital economy. In addition, not all sectors and geographical regions in the EU have benefited equally from digital innovation.

Digital Europe aims to trigger investments by the EU, Member States and industry in the key areas of artificial intelligence, advanced computing and data handling, cybersecurity, and the advanced digital skills necessary to deploy them. The programme has the potential to connect businesses, public administrations and citizens to the latest technologies and resources. It will also help Europe to remain globally competitive and strategically autonomous, and to have a say in how new technologies reflect our needs and values.

The purpose of these draft orientations is to reach a shared understanding of the Programme's scope for 2021-2022 and to guide the preparation of the work programmes for this period.

The programme proposes to fund activities which no Member State alone is able to implement: collective action at European level is needed. They will reinforce the positive impact of Digital Single Market's policy achievements. For example, they will aim at:

- Making Europe a top supercomputing region globally through the acquisition of at least one **exascale supercomputer** by the end of 2021, **upgrading existing supercomputers** and **extending the use of advanced computing to industry, including SMEs**;
- Setting up and making accessible Europe-wide **data spaces** and **testing and experimentation** facilities for **artificial intelligence** in the areas of **health, environment/climate, mobility, manufacturing and energy**;
- Enhancing cybersecurity by deploying a pan-European **quantum communication infrastructure** and supporting the set-up of a **certification scheme for cybersecurity products**;
- Addressing the shortages of digital experts in the EU through dedicated **Master's programmes for artificial intelligence, advanced computing and cybersecurity**;
- Providing SMEs and public administrations access to the latest digital technologies by setting

up a **network of Digital Innovation Hubs**;

- Ensuring a successful digital transformation of **health and care services** with the EU-wide deployment of innovative and cost-effective data-driven tools and services based on technologies like AI and data analytics;
- **Making ICT products and services sustainable**, by prioritising their energy efficiency as well as climate neutrality, reparability, lifespan and recycling;
- Deploying open, interoperable, trustworthy **urban digital platforms** tailored to **communities' needs**, offering easy standardised access to new datasets, and the large scale roll-out of AI-driven services in Smart Energy, Smart Mobility, waste and secondary resource management, industry and (re)manufacturing, healthcare and e-government.

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Introduction

The ongoing digital transformation touches every aspect of our lives. We need to embrace it, and to ensure that it has a positive effect on European productivity, growth, employment and well-being – while meeting our ambitious sustainability goals. But so far, Europe has not collectively invested enough in the latest technologies, and there is a growing mismatch between supply and demand. Researchers and industry are increasingly having to look outside Europe to access the resources they need, while citizens often lack the skills to thrive in the new digital economy: there are currently more than 350,000 vacancies for digital technology experts in the EU. In addition, not all sectors and geographical regions in the EU have benefited equally from digital innovation.

Digital Europe aims to trigger investments by the EU, Member States and industry in the key areas of artificial intelligence (AI), advanced computing and data handling, cybersecurity, and the advanced digital skills necessary to deploy them. The programme has the potential to connect businesses, public administrations and citizens to the latest technologies and resources. It will also help Europe to remain globally competitive and strategically autonomous, and to have a say in how new technologies reflect our needs and values.

All the areas of the programme are interdependent. AI relies on cybersecurity to ensure data is secure and trustworthy, cybersecurity requires high performance computing to process the vast amount of data obtained, digital services requires all three capacities to meet future standards, and deploying any one of these key technologies requires the appropriate skillset.

The Digital Europe programme cannot be conceived as a set of isolated parts. It will also complement the investments to be made in research and innovation in digital technologies and applications under Horizon Europe, and the support for connectivity under the Connecting Europe Facility (CEF).[1] Synergies between programmes, at regional, national and EU level, will allow for economies of scale, make investments more consistent, and provide better value for citizens and businesses.

The purpose of this document is to set out the orientations for the first two years of the programme (2021-2022), so as to reach a shared understanding of its scope and to guide the preparation of the work programmes for this period. The focus will be on **high-impact projects** that require EU-level action, whether for capacity building or for wider diffusion and uptake.

Why is the Digital Europe programme essential?

The Digital Europe programme will be key to making the achievements of the Digital Single Market a reality. Policy objectives announced by the Commission and supported by Member States and the European Parliament shaped the policy areas to which it will direct investment. These objectives include the 2018 European strategy for AI,[2] and the relevant Coordinated Action Plan,[3] the revised 2017 European cybersecurity strategy,[4] and the EuroHPC initiative.[5] They also take into account climate and environmental impact of digitising Europe.

The programme is also based on the Tallinn Digital Summit declaration of September 2017,[6] reflected in the October 2017 European Council conclusions.[7] It also takes into account the Digital

[1] COM(2018) 434 final, Proposal for a regulation of the European Parliament and of the Council establishing the Digital Europe programme for the period 2021-2027, 6 June 2018.

[2] COM(2018) 237 final, Communication from the Commission on Artificial Intelligence for Europe.

[3] COM(2018) 795 final, Communication from the Commission on a Coordinated Plan on Artificial Intelligence.

[4] COM/2017/0477 final, Proposal for a Regulation of the European Parliament and of the Council on ENISA, the "EU Cybersecurity Agency", and repealing Regulation (EU) 526/2013, and on Information and Communication Technology cybersecurity certification (''Cybersecurity Act''), 13 September 2017.

[5] Council Regulation (EU) 2018/1488 of 28 September 2018 establishing the European High Performance Computing Joint Undertaking. ST/10594/2018/INIT.

[6] Tallinn Digital Summit, Conclusions of the Prime Minister of Estonia, Juri Ratas.

Transformation of Health and Care initiative and the 2018 Data package, notably the Communication "Towards a Common European data space"[8], the European Cloud Initiative[9] and the Free Flow if Non-Personal Data Regulation[10]. It has been devised with the 2019 Ethics Guidelines for Trustworthy AI by the High-Level Group on Artificial Intelligence in mind.[11] The Council's recent conclusions on "Boosting digital and economic competitiveness across the Union and digital cohesion" will also help to direct investment efforts.[12]

The programme's priorities have also been shaped by broader policy discussions on the future of Europe, in particular environmental,[13] circular economy,[14] and climate policy[15] goals, as well as enhancing resource efficiency,[16] the future of food and farming,[17] justice,[18] security, defence, and combating disinformation.[19] These were further developed in the Commission's contribution to the informal EU27 leaders' meeting in Sibiu (Romania) on 9 May 2019.[20] The activities Digital Europe funds will take due account of the commitment made as part of the Multiannual Financial Framework proposals to comply with the goal for at least 25% of EU expenditure to contribute to climate objectives (in line with the Paris Agreement and the commitment to the United Nations Sustainable Development Goals). In order to comply with this commitment, the work programmes will specify in detail the criteria required to ensure that actions effectively contribute to these objectives.

Looking ahead

The orientations have been drafted at a time where the European Parliament and the Council have reached a provisional partial agreement on Digital Europe, confirming the overall objective, substance and architecture of the Commission's proposal. This is, however, still subject to agreement by the co-legislators on matters affecting the entire Multiannual Financial Framework, in particular budget allocations. In particular, the feasibility of the actions suggested will depend on the budget allocation.

The orientations set out below are based on the activities indicated in the Commission's programme proposal, and will be refined in light of continuing consultations, in particular the stakeholder consultation running between July and October 2019.

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7 https://www.consilium.europa.eu/en/press/press-releases/2017/10/20/euco-conclusions-final/

8 COM/2018/232 final, Communication from the Commission "Towards a common European data space".

9 COM(2016) 178 final, Communication from the Commission "European Cloud Initiative – Building a competitive data and knowledge economy in Europe".

10 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018R1807

11 High Level Group on Artificial Intelligence, set up by the European Commission, Ethics Guidelines for Trustworthy AI, document made public on 8 April 2019.

12 Council conclusion to be adopted on 7 June 2019, text reference 9577/19 in Coreper of 27 May.

13 European Parliament and Council Decision No. 1386/2013/EU: "General Union Environment Action Programme to 2020 'Living well, within the limits of our planet'" (7th Environmental Action Programme).

14 COM(2015) 614 final: "Closing the loop - An EU action plan for the circular economy" and more recently, SWD(2019) 91 final: "Sustainable Products in a Circular Economy".

15 COM(2018)773 final, Communication from the Commission on "A Clean Planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy".

16 Draft Council conclusions on "An EU Industrial Policy Strategy: A Vision for 2030", 2.5.2019, Doc 8870/19.

17 COM(2017) 713 final, Communication from the Commission on The Future of Food and Farming.

18 Council 2019-2023 Strategy on e-Justice, OJ 2019/C 96/04.

19 European Council meeting (13 and 14 December 2018) – Conclusions.PDF document (ST 17 2018 INIT, 14-12-2018).

20 https://ec.europa.eu/commission/sites/beta-political/files/comm_sibiu_06-05_en.pdf

		Deployment and best use of digital capacities											
		Aiming for high impact deployments									Widening the best use of digital technologies		
		For climate and environment			For modern public services				In technological areas				
		Clean Planet	Smart Communities and Mobility	Agri-food	Health and Care	Citizen-centric digital public services	Justice	Security	Cultural Heritage	Blockchain	Cloud Federation	Building Trust	Language Technologies	Learning and Education
Capacity building	High Performance Computing	x	x	x	x			x					x	
	Artificial Intelligence	x	x	x	x	x	x	x	x	x	x		x	
	Cyber-security		x	x	x	x		x		x		x		
	Advanced Digital Skills	x		x	x					x				
	European Digital Innovation Hubs													

Proposed activities in 2021-22

The Digital Europe programme is structured around two main types of activities: A) **Building essential digital capacities** for the three key digital technology areas identified (HPC, AI and cybersecurity) as well as the advanced digital skills needed to "operate" them, and B) **accelerating the adoption and best use of digital technologies**, including the latest digital capacities, across the economy and society.

A) BUILDING ESSENTIAL DIGITAL CAPACITIES

Europe is facing harsh global competition. As outlined in the Commission's contribution to the Sibiu meeting,[21] Europe needs to invest in key European digital capacities, so that it can become a world leader in digital transformation with a view to solving our societal and global challenges. In particular, Europe will only become a leader in developing and deploying cutting-edge, ethical, lawful, robust, environmentally-friendly, safe and secure AI if the necessary efforts are made to build European world-class supercomputers and cybersecurity strategic capacities.

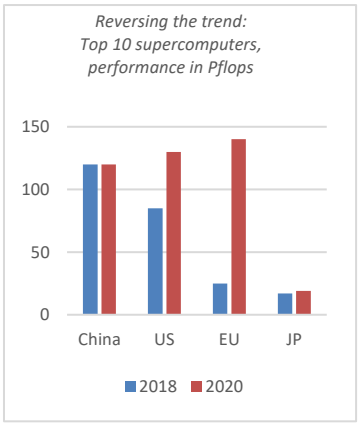
By concentrating from the start on funding capacity-building in these key areas and building the case for Member States and industry to co-invest, we will enable Europe to seize the opportunities and take up the challenges brought by the digital transformation of its societies and economies. Moreover this can boost innovation and improve Europe's competitiveness in the global digital economy, in a fair and sustainable way. The actions proposed for building essential capacities will be achieved by co-investing with Member States in new high-end infrastructures, and by upgrading and consolidating available capacities at EU and national level.

[21] https://ec.europa.eu/commission/sites/beta-political/files/comm_sibiu_06-05_en.pdf

World leading computing and data handling capacities

Advances in computing technology are continuing at a steady pace. Experts predict that, in less than a decade, quantum computing will be accessible to everyone, bringing a gigantic leap in computing power and immense benefits in areas ranging from medical research and development of new treatments to innovative and resource-efficient production processes.

By pooling together EU and MSs efforts, Europe will have the means to be a world- leading[22] region in the next five years, allowing it not only to acquire and make the best use of latest computing systems but also in designing and producing them. The EuroHPC Joint Undertaking will ensure that European supercomputing capacities be made available satisfying demand for highly demanding and essential applications in Artificial Intelligence, software development, climate change modelling, precision agriculture and planning for renewable energy availability. Further areas that will require supercomputing are in biodiversity, security, space, healthcare, environment, energy and climate. In 2019, EuroHPC announced the support to 8 High Performance Computing systems in the EU through a collective effort involving 18 Member States[23]. This co-investment between MSs and EU will ensure that computing capacity will support development of an EU-wide ecosystems of applying and using HPC and that Europe has at least three Super Computers in the top 10 highest performing computers in the world. Today's swiftest computers can cost up to €250 million to design and assemble, and several million euros more per year to run.



The overarching strategic objective for HPC is therefore to develop, deploy, support access to and maintain in the EU an integrated world-class exascale and post–exascale supercomputing and data infrastructure, including the integration of quantum computing technologies, and to develop and support a highly competitive and innovative HPC ecosystem. It will prioritise systems with the highest computing performance, the lowest power consumption and highest resource efficiency, an area where Europe has clear strengths. Building HPC capacity will also boost demand for state-of-the-art electronic components, thus nourishing a strategically important industry in Europe.

The successful launch of the EuroHPC initiative[24] shows the great interest of Member States, industry and the academic community in pooling their efforts in this field. The Digital Europe programme will build on the momentum and stakeholder mobilisation around an EU-wide common agenda for next generation computing.

The HPC priorities for the first two years of Digital Europe will focus on three areas.

1. To build capacities towards exascale supercomputing, the programme will fund the acquisition and deployment of new supercomputing capabilities, notably one exascale EuroHPC supercomputer and several petascale EuroHPC supercomputers.
2. Secondly, by federating national and European HPC and data resources into a common platform and providing horizontal HPC-based services for industry, academia and public sector, the programme aims to ensure the widest access to HPC infrastructure.
3. Finally, the ecosystem for user communities (scientific, industrial and public sector) will be further developed and supported to achieve excellence by developing, preparing and

[24] Council Regulation (EU) 2018/1488 of 28 September 2018 establishing the European High Performance Computing Joint Undertaking.

optimising HPC codes and applications for future exascale and post-exascale systems, using co-design processes. In addition, the networking of the HPC Competence Centres between participating states will be also reinforced. These actions will be complemented by training and education-related activities to provide the scientific and industrial community with the skills they require to use HPC systems.

Pending the outcome of the relevant legislative procedure, participating States may use ERDF funds to partly support the acquisition and capacity-building activities, supporting the digitalisation of SMEs. This may include cooperation with Digital Innovation Hubs (AI) and Cybersecurity Competence Centre, provided this is in line with the relevant smart specialisation strategies, future CEF Digital – to ensure a hyper-connected network of Europe's supercomputing centres which will include activities for ensuring a terabit connectivity (provided this is in line with the relevant national or regional broadband plan), and InvestEU.

Close synergies with other programmes, notably Horizon Europe and other research and development activities,[25] will be established and will feed directly into the development and capacity-building activities, including the reduction of HPC's energy and resources footprint.

Priority actions for the first two years:

Towards exascale supercomputing:

- Acquisition of one exascale supercomputing machine
- Acquisition of new petascale machines and upgrading of existing supercomputers

Ensuring the widest access to HPC infrastructure :

- Provide services for European access to HPC resources
- Federate of national and European HPC and data resources into a common platform
- Provide horizontal HPC-based services (i.e. HPDA) for industry, academia and public sector

Building capabilities: widening the use of HPC and applying it across sectors

- Launching and deployment of service platforms on the industrialisation and deployment of Industrial HPC codes and industrial software
- Adaptation and deployment of industrial/sectorial HPC tools and software environments (Deployment Demonstrators)
- Supporting the capacity aspects of HPC Centres of Excellence (CoEs) in HPC applications (e.g. climate, health, engineering, energy, etc) that promote and prepare the use of exascale and extreme performance computing capabilities
- Supporting/networking of National HPC Centres of Competence (CoCs) (actions to strengthen the wide application of HPC and increasing the innovation potential of SMEs using HPC services)
- Dedicated dissemination, outreach to Industry (if not part of CoCs)/widening use and outreach actions (2021)
- Training and skills development in the area of HPC and related subjects

The EuroHPC Joint Undertaking will be the main vehicle for implementing the above activities. HPC education/skills (curriculum development), short term training courses and traineeships will be supported under advanced digital skills.

[25] Including the LIFE Programme where relevant.

ARTIFICIAL INTELLIGENCE – Exploiting the potential of data and putting AI to work

Latest developments in AI show how we can build on the large amounts of available data today to better understand and treat common diseases, to anticipate, prevent and manage natural disasters, to make our roads safer, and to significantly improve the quality of work for many citizens. In its different forms, from robotics and autonomous systems to predictive analytics, and decision-support systems, AI is shaping up as the key driver for the digital transformation of the economy and society, underlying the competitiveness of many industrial and business sectors and the drive towards sustainability.

The European AI market is underdeveloped compared to the US, where the capacities available, notably in data, provide supportive conditions for innovation at scale.

The Digital Europe programme aim is to develop capacity in AI in Europe, in line with the Communication on AI for Europe and the Coordinated Plan on AI.[26] To this end, the first two years of the programme will focus on developing an infrastructure which offers businesses and the public sector access to AI tools and components and data resources, as well as reference testing and experimentation facilities in some prioritised application sectors. Particular attention will be paid to ensuring that fundamental rights and ethics requirements, such as privacy, diversity, non-discrimination, accessibility,[27] societal and environmental wellbeing, are met when developing and deploying AI technology. Moreover, transparent implementation of AI should ensure that basic legal safeguards for citizens such as due process and good administration are maintained.

Data spaces include:

i) IT systems (digital industrial and personal data platforms);

ii) domain-specific data governance frameworks as articulations of the overall technical governance framework;

iii) standards, including semantic standards and interoperability protocols – both domain-specific and cross-cutting;

iv) competitive and seamless access and use of cloud infrastructures based on the rollout of cross-border cloud federations.

Actions will focus on three main aspects:

- establishing EU-wide common, interoperable data spaces providing access to data for AI. Common European data spaces are a means of organising access and use of data from both the public and private sector in a market-conforming, lawful,[28] ethical and trusted manner;
- developing world-class large-scale reference Testing and Experimentation Facilities (TEF) for AI hardware, software, components, systems and solutions, and underlying resources (data, computing, cloud) in a number of sectors;
- and scaling up the Common European AI platform, building on the existing AI-on-demand platform.

To mobilise the community, both providers and users of the technologies, and ensure the commitment from the private sector and the take up of the state of the latest research results, the proposed new partnership on AI, data and robotics[29] will be involved in the process. This infrastructure will be used to deploy the research and innovation results and complement the research and innovation actions on AI carried out under Horizon Europe.

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[26] COM(2018) 795 final, Coordinated Plan on Artificial Intelligence.

[27] Including for people with disabilities.

[28] Common data spaces need to be developed in full compliance with the GDPR.

[29] https://ec.europa.eu/research/pdf/horizon-europe/ec_rtd_orientations-towards-the-strategic-planning.pdf

Where possible, we will aim for synergies and cross-cutting activities with the other strategic objectives of the programme, notably with HPC, cybersecurity and advanced digital skills. The infrastructure to be deployed will provide AI capacity and resources to be exploited for the high impact deployments indicated in following sections. In particular data for AI, tools and resources made available by the Common European AI platform, as well as solutions, and prototypes fully tested in TEF. Other EU-funded projects could use the data in the common data spaces in order to develop and use AI applications for e.g. health, environment, industrial transition or mobility.

Priority actions for the first two years:

Establish EU-wide common data spaces

The EU-wide common, interoperable data spaces will build on public and private sector datasets. Actions will focus on:

(i) Data spaces in key industrial and societal sectors: Pooling and sharing of data in sectors identified as priorities (including, but not limited to, health, climate, environmental, manufacturing, agriculture, energy, financial and mobility data). The large-scale actions may include the creation of data platforms enabling secure and compliant sharing and re-use of sensitive, confidential, proprietary and personal data, as well as large-scale experimentation based on AI. Where relevant, the latter will take place in connection with the large testing and experimentation facilities mentioned below.

(ii) High-value datasets from the public sector: Pooling, preparing and making available high-value datasets in the categories identified in the Open Data Directive and reuse of Public Sector Information Directive,[30] including space data and the geospatial data themes identified in the Annexes of the INSPIRE Directive,[31] as a horizontal layer for use in different sectors. The actions will lead to the availability of free and easy to use EU-wide datasets in areas such as geospatial and earth observation/environment, and will include large-scale experimentation and AI use cases.

(iii) Developing incubators for aggregating demand for data assets and to bring together data providers, integrators, brokers, data users and service providers, especially SMEs. These will operate in coordination with the Digital Innovation Hubs network.

Developing Large Testing and Experimentation Facilities to provide a common, highly specialised resource to be shared at European level and foster the deployment of trustworthy AI in the following areas: 1) a common European platform to design and manufacture edge intelligence components and systems based on neuromorphic and quantum technologies; 2) reference sites for applications in essential sectors such as health, agri-food, manufacturing, smart cities and smart mobility (including environment and climate perspective).

Scaling up the European AI platform to provide a single access point to high quality tested AI resources (e.g. AI algorithms which are safe, robust and transparent; new generation hardware computing; smart robots), and, where needed, bring such resources to industrial standard, and to provide corresponding support for users, to integrate AI into solutions, products and services. The platform will provide access to key AI technologies, including AI, perception, interaction software, big data analytics, language processing, IoT, neuromorphic, robotics, cyberphysical systems and their integration.

[30] Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information.

[31] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

CYBERSECURITY AND TRUST – Creating a cyber shield for Europe

The Digital Single Market needs trust to function. Europe has recently witnessed a large number of increasingly complex cyberattacks with the potential to undermine the functioning of our communication networks, critical infrastructure, services and ultimately our society itself. Cyberattacks also undermine public confidence in the integrity of digital systems and data, and the decisions made using them.

Digital Europe aims to implement the EU's cybersecurity strategy and policies. It will support the implementation of existing and future EU regulations. The implementation of the NIS Directive and the Cybersecurity Act[32] are key steps towards a safer digital EU.

Actions addressing cybersecurity aim to reinforce European strategic autonomy in this area by strengthening the cyber-resilience of critical services, such as energy infrastructures and grids and logistics services in the Digital Single Market, and by creating a strong, autonomous European industry. Manufacturers need to recognise the importance of including cybersecurity features in connected products at the design stage.

The programme will be used to start building a European Cybersecurity Shield based on a terrestrial and satellite-based pan-European quantum communication infrastructure (EuroQCI). The EuroQCI will become the core infrastructure for ultra-high security communication in Europe. The satellite-based segment will be covered by the space-related programme for 2021-2027[33]. In addition a network of cyber ranges will start being deployed. The cyber ranges will become the platform for training, testing of equipment and services, but also repository of shared data needed to ensure cyber security.

Additionally, the programme will also consolidate and strengthen actions launched under the current Connecting Europe Facility in support of the NIS Directive[34] deploying the competence centre network[35] with Member States, contributing to the implementation of the "EU Cybersecurity Act" Regulation, notably by supporting enabling infrastructure for security certification. To strengthen EU industrial capacity in the field, the programme will support widening the deployment of cybersecurity tools inter alia by supporting faster validation and take-up of new research/innovations, and supporting EU supply chain providers from critical sectors.

Cybersecurity both underpins the security of AI tools and HPC infrastructures supported under other parts of the programme, and relies on them for the development of its own solutions (e.g. by testing against attacks run on HPC). A key activity will also be to ensure that professionals have the specific skillsets they need, in coordination with activities under the Advanced Digital Skills pillar of the programme. The proposed European Cybersecurity Industrial, Technology and Research Competence Centre will act as the implementation body for various EU programmes supporting cybersecurity (notably Digital Europe and Horizon Europe) and enhance coherence and synergies between them.

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[32] Regulation (EU) 2019/881 of the European Parliament and of the Council of 17 April 2019 on ENISA (the European Union Agency for Cybersecurity) and on information and communications technology cybersecurity certification and repealing Regulation (EU) No 526/2013 (Cybersecurity Act).

[33] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A447%3AFIN

[34] Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union.

[35] COM(2018) 630 final, Proposal for a Regulation of the European Parliament and of the Council establishing the European Cybersecurity Industrial, Technology and Research Competence Centre and the Network of National Coordination Centres, 12 September 2018.

Priority actions for the first two years:

Deploying the competence centre network with Member States;

Key capacity building: the cybersecurity shield

- Deploying a quantum-secured public communication infrastructure (terrestrial segment) with the aim at deploying Quantum Key Distribution (QKD) in various large-scale networks;
- Deploying through cyber ranges, with Member States and industry, the European cyber threat information network;

Certification scheme(s)

- Complete a certification scheme for 5G;
- Start extending schemes for IoT tools providers, SMEs and hospitals;
- Provide certification testbed;

Widening the deployment of cybersecurity tools

- Support for faster validation and market take-up of innovative cyber security solutions by businesses and public buyers;

Supporting the NIS Directive implementation

- Strengthening the activities started under the current CEF Telecom programme through capacity building and the enhancement of cross-border cooperation on cybersecurity at technical, operational and strategic levels among Member State bodies and among industry stakeholders, including Information Sharing and Analysis Centres (ISACs).

Cybersecurity related activities under this programme will be implemented primarily through the European Cybersecurity Industrial, Technology and Research Competence Centre.

ADVANCED DIGITAL SKILLS – Equipping ourselves for tomorrow's challenges

Europe cannot make good use of its new capacities if the shortage of digital experts needed to "operate" them is not addressed. As highlighted in the mid-term review on the implementation of the Digital Single Market Strategy,[36] over the past 10 years, employment of ICT specialists in the EU has grown by around 2 million, but in 2018 53% of companies trying to recruit ICT specialists reported difficulties in filling vacancies.[37] Actions under this objective aim at addressing the shortages of digital experts in the EU, in particular in the fields of AI, HPC and cybersecurity.

Over the first two years, the programme will fund, in cooperation with the HPC and cybersecurity competence centres and AI centres, the design and set up of specialised Master's programmes, and will provide financing for short-term training courses and job placements in these key technology areas. In addition, support will be provided for the set-up of specialised modules and courses in advanced digital technologies to train highly skilled professionals in non-tech sectors and foster inter-disciplinarity.

To this end, the programme will, in the first two years, focus on (1) the setting up of highly specialised Master's programmes or modules, as well as the reinforcement of existing ones through the establishment of consortia of higher education institutions working alongside excellence centres and industry participants; (2) the design and delivery of short-term training courses in advanced

[36] COM(2017) 228 final, Communication from the Commission on the Mid-Term Review on the implementation of the Digital Single Market Strategy – A Connected Digital Single Market for All, 10 May 2017.

[37] Digital Economy and Society Index Report 2019 – Human capital

technologies for both people already in employment and jobseekers, including targeted trainings to develop digital skills in key professions handling sensitive data, such as health and care professionals and managers; and (3) the provision of job placements in companies or research centres, in particular for students and graduates, to acquire the necessary advanced digital skills needed for the deployment of the above advanced technologies. All three actions will be designed and delivered in cooperation with the HPC and cybersecurity competence centres and AI centres, to ensure that the learning content is relevant and up to date with the latest technological developments in every field addressed. In particular, for the first two years activities will focus:

- In the field of HPC, on curriculum development in HPC and computational science and short-term trainings. This could include training integrated with university courses (e.g. HPC-based biomedical modelling for medical students), specialised Master's degrees and training programmes (e.g. traineeships, upskilling/on-the-job training) as well as dedicated spring/summer schools.
- In the field of cybersecurity, to enhance the cybersecurity skills of cybersecurity practitioners and cyber fighters (e.g. CSIRT/CERT operators, penetration testers, conformity assessors, security administrators (of organisations/SMEs, HPC and AI platforms) and create aligned practitioners' cybersecurity operational certifications
- In the field of AI, to create a pool of top-level talents (e.g. AI engineers, integrators) to develop and deploy AI-based solution, products and services; and to equip professionals with the technology-specific skills, as well as linked ones (such as law and ethics), to be able to use and deploy AI technology in their specific sectors and make the best of the digital transformation in their jobs; this may include AI modules in multi-disciplinary Master's programmes (e.g. in e-health, fintech, e-government, climate/environment related disciplines) and in adult training programmes with the focus on people with higher education or work experience.

Training activities will be delivered in key capacity areas, in particular AI, HPC and cybersecurity, but also others such as distributed ledger technologies/blockchain and quantum. The EuroHPC Joint Undertaking and the cybersecurity competence centre will elaborate a strategic paper outlining the skills and training priorities in their fields so as to ensure the relevance of the learning content of the Master's programmes and short-term training courses.

In line with the Rome Declaration of March 2017, when EU Member States stressed their commitment to fighting unemployment and providing young people with the 'best education and training', as well as the Council Conclusions of October 2017 where Member States stressed the need for Europe to go digital and to invest in digital skills, the programme will continue to support the Digital Skills and Jobs Platform initiative currently financed under the CEF Telecom programme.

Activities under this pillar will be complementary to the European Social Fund Plus, which can support education and training in the area of basic and medium skills, and the European Globalisation Adjustment Fund, which will offer IT training to dismissed workers.[38] Synergies and complementarities will be ensured also with the Erasmus programme, which contributes to the development and acquisition of all types of skills for students and teaching staff through learning mobility and cooperation in the area of education, training, youth and sport.

[38] For the European Globalisation Adjustment Fund, the Commission proposed, as a mandatory horizontal element post-2020, including digital skills training in the package of personalised services of every European Globalisation Adjustment Fund case, adapted to the needs and qualifications of the respective participant.

Priority actions for the first two years:

Developing Master's programmes or modules in key capacity areas or specific modules to be included in other educational programmes to train professionals for the use of advanced digital technologies.

Developing short term training courses in key capacity areas to increase the number of digital specialists, but also to equip professionals in non-tech sectors with the skills needed to deploy advanced digital technologies.

Job placements in key capacity areas to give the opportunity to both people already in employment and job-seekers to acquire advanced digital skills on the job, in companies or organisations deploying cutting-edge technologies.

Maintaining and populating the platform for Skills and Jobs - mapping of training/traineeship offer, certifications and a repository of best practices and training resources in the domains of AI, cyber security, HPC, quantum technologies and blockchain

B) ACCELERATING THE BEST USE OF TECHNOLOGIES

There is high added value in engaging collectively in the deployment of digital solutions, notably in areas where scale and cross border access are essential success factors. Support for take-up by SMEs and public administrations is necessary to achieve widespread adoption.

The emphasis in the first two years will be on setting up an initial network of European Digital Innovation Hubs, which will offer access to technology testing, financing advice, market intelligence and networking opportunities, to help the digital transformation of SMEs and public sector organisations.

Moreover, deployment of technologies will be based on projects with high transformative impact in key areas of public and societal interest. Finally, building on the investment made in Digital Service Infrastructures (DSIs) under the current CEF Telecom programme, Digital Europe aims to rapidly scale up pan-European investments in interoperable and interconnected digital services and ensure that the benefits of new technologies (e.g. AI, data analytics and advanced computing) are taken up in key services of public interest and by industry across the EU economy and society.

EUROPEAN DIGITAL INNOVATION HUBS

A European Digital Innovation Hub (DIH) is a single entity or a coordinated group of entities with complementary expertise and a not-for-profit objective to support the digital transformation of companies (especially SMEs and mid-caps) and/or public sector organisations on a large scale. This support includes access to services such as technology-testing, financing advice, and market intelligence. They could work in collaboration with partners whose expertise lies in business development/public sector innovation or training, as well as with partners that can help in networking and engagement in the regional innovation ecosystem.

Existing hubs, funded to run experiments under Horizon 2020, or with a different background (for example, as a local technology transfer institution), could qualify to become European DIHs, provided they pass all steps of the competitive selection procedures, both at national and European level.

The Digital Europe programme will co-invest, together with Member States, in capacity building for a selected number of 'European DIHs'. While Member States' investments in European DIHs –

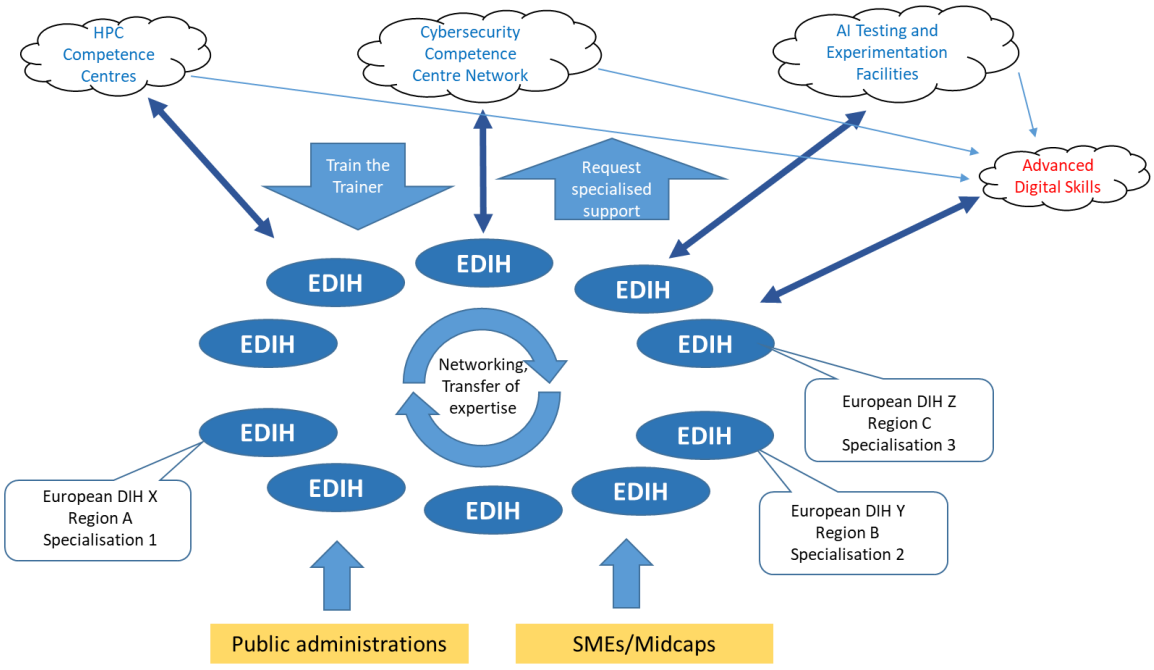
supported through national, regional or European Regional Development Funds – would focus on a hub's national, regional, or local activities, Digital Europe will focus on European added value, for example to enhance hubs' capacity to serve more than one country and to export excellence.

The first two years of the programme will see the setting up of an initial network of European DIHs and the early stages of the network's expansion. The objective is to have at least one European DIH per Member State at the start of the network, with the aim of ultimately reaching one hub per NUTS2 region, including the outermost regions, in subsequent years. Each DIH will have a focus/expertise, which could be strengthened over time and which should ensure the future strengths of the region's industry and public sector, e.g. precision agriculture, smart manufacturing, smart government, a combination of AI, HPC or cybersecurity, and promising application areas. Most smart specialisation strategies will require the take-up of advanced digital technologies to implement their priorities. Each European DIH should have experimentation facilities related to its specialisation to be used by companies and the public sector to test these technologies, including their environmental impact where relevant, before further investing in it.

The balanced network of European DIHs will broaden the use of applications, technologies and services benefitting from AI, HPC and cybersecurity. The selection process will also take into account national or regional smart specialisation priorities and presence of relevant users of the hub services. Some DIHs may focus on health and care, smart and sustainable cities and communities, citizen-centric public services, clean planet, agri-food or blockchain (see the section below on high-impact deployments). Digital Europe will also support the networking of the European Digital Innovation Hubs amongst themselves to transfer expertise between regions and to be able to help SMEs and the public sector with expertise not locally available.

The European DIHs will liaise, as appropriate, with the existing cybersecurity competence centres and the centres of excellence for AI to access the knowledge needed to provide the services in their remit to their customers. 'Train-the-trainer' events will be organised where the specialised centres will brief DIHs on the latest developments, while the latter provide user feedback.

Furthermore, investments in each of the priorities of Digital Europe will lead to new products and services available for SMEs and the public sector. DIHs will be the means to spread these capacities across the European economy and society widely.



European DIHs will also develop synergies with hubs funded by Horizon Europe or other research and innovation programmes, as well as with the European Institute for Innovation and Technology and other networks, for example the European Enterprise Network, the cluster networks and the EU Invest hubs, and the network of Agri-DIHs, for instance by good practice exchange, learning, skills development and community building.

Priority actions for the first two years:

Set up of the initial network (first year) – 80 European DIHs set up and networked

First network enlargement (second year) – additional 80 European DIHs, also taking into account sufficient coverage of key digital capacities

Tasks of the European DIH will be to offer:

(i) access to technology-testing (including awareness raising, digital maturity assessment, knowledge and technology transfer, etc.)
(ii) financing advice (including supporting the preparation of business models, access to financial institutions and investors, etc.)
(iii) information about advanced digital skills training and education opportunities
(iv) networking opportunities (including technology scouting, brokering between end-users and potential suppliers of technological solutions, etc.)

AIMING FOR HIGH-IMPACT DEPLOYMENTS

The 'Tallinn Declaration'[39] calls for actions for efficient and inclusive digital public services to all citizens and businesses. The programme should ensure support for the 'User-Centricity principles' across all public services, while ensuring the respect of fundamental rights. It should be used to facilitate the deployment of simpler, more transparent, effective and interoperable administrative procedures across Europe. DSIs developed under the current CEF Telecom programme will continue to be deployed.

Digital technologies have great potential to transform health and care systems, improve quality of life in urban and rural environments, and contribute to sustainable climate-neutral economies while protecting our environment and changing the way public services are supplied and used. The transformative effect will have an impact on society, and there is clear support for action at EU level. In particular, this is the case in the areas of health, [40] smart cities and mobility, security, public administration,[41] justice, smart agri-food,[42] climate,[43] and environmental protection.[44] In the area of culture, digital technologies make it possible to preserve and provide access to Europe's rich cultural

[39] http://ec.europa.eu/newsroom/document.cfm?doc_id=47559.
[40] COM(2018) 233 final, Communication from the Commission on enabling the digital transformation of health and care in the Digital Single Market; empowering citizens and building a healthier society, 25 April 2018.
[41] https://ec.europa.eu/digital-single-market/en/news/communication-eu-egovernment-action-plan-2016-2020-acceleratingdigital-transformation.
[42] COM(2017) 713 final, Communication from the Commission on The future of Food and Farming, 29 November 2017.
[43] COM(2018)773 final, Communication from the Commission on "A Clean Planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy".
[44] European Parliament and Council Decision No. 1386/2013/EU: "General Union Environment Action Programme to 2020 'Living well, within the limits of our planet'" (7th Environmental Action Programme).

heritage.[45] The programme should further enhance these developments by making use of recent technological possibilities, such as 3D.

The initial list of actions for the first two years stems directly from the priorities set in Annex I to the DEP Regulation and are grouped in three main themes: i) deployments addressing climate and environment, ii) modernisation of public services and iii) deployment of technologies underpinning digital services.

A number of actions will build on the Digital Service Infrastructures deployed under the current CEF Telecom programme.

Deployments addressing climate and environment

Digital for a Clean Planet

Actions will focus on high-impact deployments in the ICT sector aiming to use environmental and other data for creating solutions and applications to achieve environmental and climate goals. It will also aim to 'green' ICT products and services, improving their energy efficiency and climate neutrality, reparability, lifespan and recycling (circularity) of ICT products and services. We must minimise the unwanted side effects of digitalisation and contribute positively overall to environmental goals, in particular to climate and the circular economy.

Some digital technologies and applications that support environmental policy, waste management and climate adaptation and mitigation actions are described in this section, but most of the digitally enabled solutions for sustainability goals in sectors such as agriculture, health, manufacturing, mobility and smart cities, are addressed in other sections of Digital Europe.

Close synergies with other programmes, notably LIFE and Copernicus, will help achieve our environmental and climate goals, e.g. to reach carbon neutrality and circularity of our economy. Deployments under this action will support the transition to a circular economy by enabling future actions of Circular Economy Action Plan, complementing research and development under the Horizon Europe programme.

Priority actions for the first two years

Common and open environment data space (with the support of cloud federation of services,[46] supercomputing capacity and AI algorithms):

- Develop a first version of an integrated and interoperable environmental data space linking international and national environmental monitoring data, by making the best use of the EU wide common data spaces[47] effort and in cooperation with the LIFE programme. Data to be considered should also include citizen monitoring data and should be enriched with sensor-based data, for example linking environmental and health data such air quality and noise exposures, in particular for epidemiological analysis.

[45] COM(2018) 267 final, Communication from the Commission on A New European Agenda for Culture, 22 May 2018.

[46] The 'digital for Clean Planet' action will leverage the 'Cloud Federation as a Service' action for instance to support the interconnection of data repositories and the deployment of analytical capabilities to support EU implementation laws.

[47] The EU wide common data spaces effort includes pooling, preparing and making available high-value datasets in the categories identified in the Open Data Directive, the Public Sector Information Directive, including space data and the geospatial data themes identified in the Annexes of the INSPIRE Directive.

- Deploy algorithms and analytical services to support the enforcement of EU environmental laws and the implementation of climate change objectives exploiting the developed data space, AI algorithms and modelling capabilities. Exploit new testing facilities provided for AI to merge with other available facilities for processing large amounts of physical, climate-related data and getting benefit of digital models in order to improve our capacity to mitigate climate change.

Energy efficient ICT

- Energy efficient ICT systems, focussing on the greatest energy users such as data centres, block chain system, servers etc., to optimise efficiency and ensure measurable energy savings. Prioritise the deployment of cost-effective technology which improves efficiency and maintains necessary levels of availability but is integrated with carbon neutral energy sources.

Carbon Neutral ICT

- Carbon neutral ICT systems, focussing on the development of both software and hardware which are carbon neutral designed and aim to support near zero-emission targets at all life phases (production, use, re-use, end-of life). Prioritise the deployment of those with proven overall minimum footprint.

Industrial pilots

- to test full reverse-flow industrial systems, from the finished products to modules, components and raw materials in the area of ICT goods, such as smart automated waste treatments and smart disassembly factories for electronic products.

Building trust for green digital products and services (including standards and applications)

- Establish and deploy robust methodology for assessing and monitoring the environmental and carbon footprint of ICT devices, networks and data centres. This will require integration and deployment of existing standards and methods for measurement of footprint to be applied to the ICT sector.
- Develop a data 'factsheet' for digital product and services, providing information on energy, resource use, chemical content, carbon footprint as well as reparability and other features (linked, where appropriate, to Product Environmental Footprint and Extended Producer Responsibility)[48] and pilot it in some product categories.
- Provide clarity and visibility for European best practices in green ICT.

Clean, sustainable and smart Communities and Mobility

The objectives of this initiative are twofold. First, to bring to European citizens and businesses the benefits of fully interoperable, scalable and decentralised smart city and smart rural area ecosystems capable of supporting cross-sector digital services; second, to deploy Mobility as a Service (MaaS)[49] integrating different transport modes and allowing for alternative business models.

During the first two years, the programme will focus on achieving a recognised European ecosystem of open, interoperable, trustworthy urban digital platforms tailored to communities. This will enable

[48] Linking with the Product Environmental Footprint and Extended Producer Responsibility.

[49] Mobility-as-a-Service (MaaS) is an AI-driven service (including cross-border and last mile) for package delivery solutions, for fleet management and for citizens, that combines in an efficient way different public and/or private connected transportation modes through an open-data unified platform.

easy standardised access to new datasets and large-scale roll-out of AI-driven services that go beyond individual interventions, for example in Smart Energy, Smart Mobility, waste and secondary resource management, industry and (re)manufacturing, healthcare, e-government, and more.

For Smart Mobility, the programme aims to deliver and complement an open MaaS ecosystem for package delivery solutions, for fleet management and for citizens, covering the different transport modes (public/private). The aim is to allow for interoperable, transparent, secure, privacy-aware and cross-border solutions deployed at a large scale to a large number of cities, including last-mile delivery (e.g. via drones). These solutions will also focus on improving the quality of life (e.g. reducing air or noise pollution), building on the health and clean planet data.

To achieve these results will necessitate the deployment of open cross-sectorial urban green digital platforms and services and cross-border MaaS. Testing and experimentation facilities for smart cities and mobility will enable stakeholders to work with real data in controlled spaces and access adequate computing resources for the uptake of smart city and MaaS solutions, and support innovators to develop service based on new digital technologies (in particular AI applications).

Smart Communities and Smart Mobility will serve as application areas for other areas in Digital Europe such as AI, HPC and cybersecurity, which are essential elements for this initiative. The Digital Innovation Hubs will also be used as essential instruments of the implementation. These actions would be particularly suitable for developing synergies with the European Regional Development Fund, in particular by fostering interactions between the DIHs and pertinent integrated sustainable urban development strategies that will be prepared under the ERDF/CF Regulation and that will provide the policy frameworks for substantial public procurement for digital solutions to address urban issues.

These actions complement the activities supported by the future CEF Digital (digital operational platforms) and Horizon Europe, where the Commission aims to support research, development and deployment of smart cities and smart mobility solutions including a proposed mission area on smart cities and a partnership on Connected and Automated Mobility. In addition, the Urban Agenda for the EU[50] will support through its partnership on digital transition better public services to citizens (including via smart mobility), support European cities in exploiting the possibilities of digitalisation and help business develop and test innovation in view of opportunities in the global market.

Priority actions for the first two years:

Deployment of Open Cross-sectorial Urban Digital Platforms and Cross-border Mobility as a Service solutions

Deployment of innovative smart city and smart mobility applications by SMEs and start-ups including the exploration of new business models

Establish world-reference **testing and experimentation facilities (TEF)** for smart cities and smart mobility (including AI, cybersecurity, advanced computing power), with a focus on large-scale use cases within experimentation sandboxes.

[50] https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/urban-agenda-eu_en.

Agri-food

Digital technologies have the potential to increase farm efficiency and to make farming systems more sustainable. Data-driven insight can improve decision-making and practices and help to increase environmental performance, thus contributing to fighting climate change. Increased use of digital technologies can also have a positive impact on the quality of life of farmers and the rural population, and may attract a younger generation to farming and rural business start-ups.

The Digital Europe programme will be used to build the capacity and facilitate the deployment of secure digital technologies in agriculture and rural areas which will improve efficiency and contribute towards reduced climate impacts. This will be achieved by strengthening the capacity of Europe-wide technology infrastructure for a smart agri-food sector.

In its first two years, the Digital Europe programme will focus on two of the priorities identified in the declaration on "A smart and sustainable digital future for European agriculture and rural areas", signed on 9 April 2019 by Member States.[51] These priorities are: i) set up infrastructure for digital innovation in agriculture; ii) set up a network of dedicated agri-food digital innovation hubs.

The infrastructures to be set up are a number of large-scale reference experimentation and testing facilities, allowing technology providers to test their technologies in real environments. These testing facilities may include regulatory sandboxes[52] and cyber ranges, and may integrate dedicated agri-food AI-platforms and common data spaces for use and further development.

Support will be provided to link the existing network of agri-food digital innovation hubs currently funded under the H2020 project SmartAgriHubs with the new network of Digital Europe DIHs in order to exploit synergies. Support will also be provided through the programme for the development of advanced digital skills in the farming sector and in other activities in rural areas, linking up with efforts undertaken under other relevant policies and instruments, including the CAP and its Agriculture Knowledge and Innovation System.

All activities planned under this action will be carried out in cooperation with DG AGRI and where possible the European Agricultural Fund for Rural Development (EAFRD) and the European Regional Development Funds (ERDF) could include synergetic actions (e.g. to co-fund the agri-food digital innovation hubs). Further opportunities for synergies with Horizon Europe, in particular with the Global Challenges Cluster on "Food, Bioeconomy Natural Resources, Agriculture and Environment", will also be sought.

Priority actions for the first two years:

Develop/scale up large-scale reference experimentation and testing facilities
Prepare and help to establish at least five large-scale reference experimentation and testing facilities across Europe to serve as common resource for all stakeholders (users and solution providers). Collect data on efficiency, environment and climate impacts. Integrate with agri specific AI platforms and common data spaces.

Ensure the link/collaboration between the network of specific agri-food hubs and the network of European DIH

[51] https://ec.europa.eu/digital-single-market/en/news/eu-member-states-join-forces-digitalisation-european-agriculture-and-rural-areas.
[52] Areas where regulation is limited or favourable to testing new products and services.

Deployment of modern public services

Digital Transformation for better and sustainable Health and Care

The increasing volume of health data (e.g. from health care records, disease and patient registries, and genomic banks), combined with new digital technologies, will play a key role in transforming health and care systems. We must optimise overall system governance, workflows and decision making and transform the science and practice of disease prevention, diagnosis, self-care, treatment and cure (personalised approaches). Actions in the area of health aim to improve the efficiency and quality of health and care systems and support their regulatory processes by accelerating and scaling-up the integration of new, cost-effective digital solutions. A key goal will be the development of a European health data space underpinning the uptake and use of digital solutions, which benefits practitioners, scientists, policy makers and citizens whilst ensuring privacy and security.

Building a European health data space will require boosting existing actions on cross-border interoperability of electronic health records (EHR) and other relevant datasets, through setting up the infrastructure, fostering consensus on common standards and building on initiatives in Member States and regions. It will also entail fostering a European approach to accessing health data sets that will enable the development, testing and deployment of innovative and cost-effective data-driven tools and services (based on technologies like AI and data analytics), taking advantage of advanced computing (e.g. HPC) and of federated cloud services (e.g. for faster data processing). Blockchain/Distributed Ledger Technologies can help in the creation of this European health data space and in data processing, in particular to ensure data integrity and immutable record for all consent transactions.

For activities driving digital transformation in this domain, synergies with the European Regional Development Fund (ERDF) and the European Social Fund (ESF+) should be sought to support the country-specific deployment of the solutions that are developed.

In the first two years, activities will focus on setting up the infrastructure (started under the current CEF Telecom programme), the establishment of testing and experimentation facilities and the promotion of the acquisition of the necessary advanced digital skills.

Priority actions for the first two years:

Connecting health data (infrastructure, interoperability)

- **Interconnect repositories of different kinds of health and care data** (including genomics, clinical records, laboratory information systems, patient registries and health images) to support secure access to data across Europe, in secure and privacy-aware environments, including federated cloud services[53] and interoperability mechanisms.
- **Deploy and expand eHealth Digital Service Infrastructure (eHDSI) and the European EHR exchange format** to improve the interoperability of health data and information systems and their capacity to exchange health data through the eHDSI. Support eHDSI to expand its ability to exchange current and new information domains of the EHR[54] (e.g. lab tests, medical images, hospital discharge reports), engage additional Member States and strengthen interoperability with other IT systems.
- **Maintain and expand the European Reference Network on rare, low prevalence and complex diseases (ERNs):** support eHDSI activities related to the goals of the European

[53] Federated cloud services for European services of general interest will be deployed by the "Cloud Federation as a Service" DEP project.
[54] In line with the EC Recommendation on a European EHR exchange format, 6/02/2019, C(2019) 800 final.

Reference Network on rare, low prevalence and complex diseases.

Building Trust and innovation for digital health and care

- Establish testing and experimentation platforms and reference centres for health and care, to enable stakeholders to work with real-world health data in controlled spaces and access adequate computing power/resources, enable the uptake of cybersecurity solutions, and support innovators to develop new digital technologies for health and care (in particular AI applications, including for smart hospitals).
- Identify Digital Innovation Hubs specialised in health and care to facilitate the large-scale uptake of digital solutions and encouraging activities to ensure their networking.

Advanced Digital Skills for Health and Care professionals

Promote advanced digital skills, via short-term trainings, aimed at clinical staff and managers of the health and care sector, including on cybersecurity to enable the health and care workforce to make full use of these digital solutions.

Citizen-centric digital public services

This action targets the digital transformation of public services – increasing the efficiency of service delivery, the convenience of services for European businesses and citizens and the accessibility of public data – by providing:

- a Digital Transformation Platform Ecosystem for interoperability of data and services across borders and domains,
- technical specifications and infrastructure to support cross-border once-only principle,
- an interoperability incubator fostering the creation of innovative gov-tech services.

A wealth of infrastructure, tools and datasets were created with resources made available by the 2014-2020 Multiannual Financial Framework, through the CEF Telecom programme (Building Blocks and the European Open Data Portal) and the 'Interoperability solutions for public administrations, businesses and citizens' programme (ISA^2). In March 2019, CEF was supporting eight building blocks that were being re-used in at least 118 projects across Europe. In 2019, 54 ISA^2 Actions will support initiatives in at least 12 Commission Directorates-General and numerous other public bodies at all levels of government. The European Open Data Portal, a CEF Digital Service Infrastructure, provides access to over 800 000 datasets from European public administrations, including over 13 000 datasets from over 70 EU institutions and agencies. These actions have together shaped an ecosystem of interdependent offerings supporting European digital government. This ecosystem – together with sector-specific legislation such as the eIDAS Regulation, Single Digital Gateway Regulation and INSPIRE Directive – lays a foundation – a "digital *acquis*" – for European public and private parties to build on and valorise sector-specific applications. Many stakeholders depend on this foundation and rely on its evolution under the Digital Europe Programme to ensure their investments in it.

Selected CEF Building Blocks , selected ISA^2 actions and the Open Data Portal will be consolidated in a *Digital Transformation Platform Ecosystem* supporting in particular the public sector, but open to take-up by the private sector as well. The ecosystem can expand to integrate other digital offerings from the Commission – such as the EU INSPIRE Geoportal – into a cohesive ecosystem.

The public Digital Transformation Platform Ecosystem will be distributed and will depend on the participation of European public authorities for its deployment. Rather than a single, all-encompassing, centrally deployed software system, the ecosystem will consist of a cohesive set of tools and guidelines with a common governance.

Roll-out of the ecosystem will be integrated with other European programmes managed at the national, regional and local levels, such as the Structural Reform Support Service and the European Regional Development Fund. The Digital Innovation Hubs will also be a key channel for enlarging the take up of the platform at all levels and in all domains.

The Digital Transformation Platform will lay a foundation for the implementation of other actions targeting public services and in particular the cross-border implementation of the 'once-only principle', initially under the Single Digital Gateway.

The EU Student eCard Initiative, the digital portability of Know-Your-Customer from banking (based on notified eID under eIDAS Regulation), and public procurement are examples of how sectoral systems can build on the Digital Transformation Platform ecosystem, and in particular make use of the technical infrastructure implementing the once-only principle in the Single Digital Gateway.

Take-up of emerging, innovative technologies in digital government services will be supported by an interoperability incubator to pilot new interoperable gov-tech services.

Priority actions for the first two years:

Deployment of the Digital Transformation platform supporting the full integration of:

- selected existing CEF Telecom programme Building Blocks, selected ISA[2] actions and the European Data Portal unified in the Digital Transformation Platform ecosystem ensuring continuity. This ecosystem will complete the roll-out of the eIDAS Regulation cross-border and cross-sector, thus enabling the provision of trusted assertions and entitlements, as well as the implementation of other relevant policy initiatives;
- open data platform services developed under the current CEF Telecom programme and tools and technologies for accessing real-time data held by the public sector, including supporting further take up of the Big Data Test Infrastructure by public administrations.

Roll out of the once-only principle (OOP) infrastructure

- Implementation of 'once-only' tools and the 'once-only' technical system under the **Single Digital Gateway Regulation** at local and regional level.
- Implementation of the **eCard for Students** and **digital Know-Your-Customer for banking** as a concrete examples of the once-only principle.

Implementation of the interoperability incubator for testing innovative gov-tech services.

Justice

Effective justice systems contribute significantly to building an investment-friendly environment, establishing mutual trust and maintaining sustainable growth. Digitisation of the justice system enhances its quality and improves its efficiency. This policy requires the establishment of national digital capacities and the development and implementation of seamless and secure electronic communication within the judiciary, and between the judiciary and other competent bodies in the area of civil, administrative and criminal justice.

Activities in this area will contribute to the implementation of the European e-Justice Strategy and Action Plan for 2019-2023[55] with the objective of improving access to justice and electronic communication in a pan-European context.

[55] 2019-2023 Strategy on e-Justice (2019/C 96/04) and 2019-2023 Action Plan European e-Justice (2019/C 96/05), 13 March 2019.

The current CEF Telecom programme supports several DSIs related to justice: the eJustice portal, the Online Dispute Resolution system and the Business Registers Interconnection System. Activities under Digital Europe will be based on systems already deployed, and will expand them both in term of use and functionalities. For example, the interoperable interconnections to national databases and registers will be based on the existing Business Registers Interconnection System and will include new functions like the interconnection of beneficial ownership registers and the Interconnection of Insolvency Registers. New/more advanced registers which have not been feasible so far and interconnections amongst them may also be created. The out-of-court dispute resolution online will be facilitated by continuing the support to the European Online Dispute Resolution Platform.

The use of innovative technologies, based on the key digital technologies supported by Digital Europe, such as artificial intelligence or blockchain, will be promoted to courts, prosecutor offices, national administrations (e.g. Financial Intelligence Units and consumer authorities) and legal professionals in general.

Enforcement authorities will also benefit from the solutions deployed with the support of this programme, to guarantee effective enforcement in the area of fundamental rights, consumers and data protection.

New systems will also be considered for deployment, like the establishment of interoperable case management systems for courts, Eurojust, the European Public Prosecutor's Office (EPPO), the European Criminal Records Information System – Third Country Nationals and the European Judicial Network in Civil and Commercial matters.

Priority actions for the first two years:

- Continue and expand the support to already established digital service infrastructures: the Online Dispute Resolution system, the Business Registers Interconnection Systems, and the eJustice portal.
- Innovative solutions in the field of justice will be piloted in the framework of the interoperability incubator.
- Applications in the justice field may also serve as use cases for innovative technologies, such as AI and blockchain.

Security

Constantly growing digitalisation in all sectors, and the rapidly changing technological landscape, provide vast opportunities for criminals and terrorists. Security authorities (law enforcement, border and coast guards, customs, first responders) often lack the necessary technical and financial means as well as digital skills when preventing, detecting, investigating or prosecuting criminal and terrorist activities supported by advanced technologies. Therefore, in order to ensure a high level of security for citizens, it is necessary to focus on opportunities offered by technologies, to invest more in new and emerging technologies, and to provide digital tools to support EU security practitioners in their activities. Various security aspects and law enforcement activities would benefit from enhanced technological and digital tools, for example countering cybercrime (cyberattacks or crime perpetrated via the internet, such as child sexual abuse online and non-cash payment fraud), protection of public spaces, countering terrorism and radicalisation online, investigations of the dark web, securing communication channels for the exchange of electronic evidence, and securing borders. It is also necessary to prevent the malicious use of these tools. As such, the security dimension has by definition a crosscutting nature since it would be impacted by most if not all the identified strands: HPC, AI, cybersecurity and development of advanced digital skills.

Within the scope of Horizon 2020 and Horizon Europe, significant research efforts are and will continue to be invested in exploring means of improving the capabilities of security practitioners in dealing with exponentially growing amounts of data as well as in the research of digital tools to prevent and counter various security threats, which may result in building prototypes. The Digital Europe programme and the Internal Security Fund (ISF) are complementary instruments that will allow appropriate uptake of the output of security research in the digitised domain so that research results can be used to provide tools for security practitioners. As a consequence, in the first two years, the focus under the Digital Europe programme would be, for example, on the use of AI for the analysis of large amount of structured and unstructured data for law enforcement purposes in identifying criminal links and patterns, and on the creation of a common platform and data space for training, testing, as well as increased analytics.

Given the sensitivity of the security domain and the need to ensure the societal acceptance of the digital tools, potential ethical and legal implications have to be adequately addressed so that the developed solutions comply with the Charter of Fundamental Rights, the existing European and national legislation as well as that they are embedded in ethical frameworks and governance.

Priority actions for the first two years:

Security data space and platform for training and testing

- Set-up of training and testing data spaces and of a common platform for security stakeholders (practitioners and solution providers)

Industrial pilots

- First pilots of innovative digital forensic and investigation tools for law enforcement purposes

Digital Culture Heritage

Europe's cultural institutions, such as libraries, archives, museums and audio-visual archives, have vast and rich collections, of which most items are locked in vaults. Moreover, Europe's rich cultural heritage faces increasing threats due to earthquakes, fires, floods, pollution, mass tourism, not to mention vandalism, theft, terrorism and deterioration over time. The unfortunate fire at Notre-Dame in April 2019 confirmed the urgency to act in the domain. At the Digital Day 2019, Member States signed a declaration of cooperation on advancing digitisation of cultural heritage.[56]

The digitisation of cultural heritage is key for the conservation, renovation, study and promotion of European cultural assets. There is thus an urgent need to make the most of digital technologies to record, document, preserve, and make Europe's cultural heritage accessible online. Currently, approximately only 10% of Europe's cultural heritage has been digitised, and digitised resources still lack visibility, especially across national borders.

To address this gap, over its first two years Digital Europe will support the digital transformation of cultural heritage institutions by deploying innovative and emerging technologies in advanced digitisation technologies, in particular 3D, to guarantee preservation, re-use of content and facilitate further applications of content. It should include access to expertise, standardisation, exchange of good practices and showcases. Furthermore, in line with the vision set in the Commission report on the evaluation of Europeana and the way forward,[57] the current Europeana platform will be strengthened to broaden access to, and preservation of, cultural content.

[56] https://ec.europa.eu/digital-single-market/en/news/eu-member-states-sign-cooperate-digitising-cultural-heritage.
[57] COM(2018)612.

These actions will be underpinned by supporting a network of competence centres for advanced digitisation of cultural heritage to assist cultural heritage institutions in adopting and making innovative use of digital technologies in the cultural heritage domain but also in helping them to upskill. The cultural heritage sector requires very specific skills (in terms of technique of digitisation as each object is unique and processes are semi-automated at best) and knowledge (for instance in terms of respect of copyright).

Priority actions for the first two years

Europeana, the EU digital platform for cultural heritage
Continuation of existing platform and activities, which are supported by the current CEF Telecom programme.

Supporting Digital Transformation of Cultural Heritage Institutions – advanced digitisation – 3D and emerging technologies, uptake and promotion of good practices and cutting-edged technologies / technical advice/ showcase of technologies / technology transfer / financial support via vouchers to CH institutions for challenging cases / knowledge building / legal, publishing and funding advices.

Technologies supporting deployment of digital services

Blockchain

Blockchain and distributed ledger technologies (DLT) should be seen as a crosscutting enabling technology that can support the validation of transactions, the development of data spaces and empowerment of citizens, public services and businesses to control and share access to data in a trusted, distributed, secure, transparent and verifiable way. Enriched blockchain based solutions for management of and access to distributed data (including data from distributed sources like sensors and machines) can be applied to different sectors of public and private interest, encouraging the deployment of more decentralised, flexible, resilient and responsive systems. Specific attention should be paid to less energy-intensive solutions now proposed by blockchain developers (fixing energy consumption issues linked to the first generation of blockchain technologies).

A trusted European Blockchain Services Infrastructure built on interoperability and robust data protection, privacy and cybersecurity standards, is critical to supporting enhanced cross-border digital public services and EU regulatory compliance, as well as cross-border sectoral applications in areas such as health, environment, transport and agri-food.

Actions planned will build on the results of research and innovation projects and pilots currently supported in Horizon 2020: solutions are expected to be mature for deployment under Digital Europe. They will build as well on priorities identified in the context of the European Blockchain Partnership and on initiatives concerning blockchain as a means to serve EU policies.

In the first two years, the programme will support the deployment of the European Blockchain Services Infrastructure (EBSI) which has been started under CEF Telecom in 2019-2020. It will enhance EBSI capacities and will integrate new cross-border digital public services.

Support will go also to deployment of cross-border sectoral blockchain based services and applications in areas of public interest. Those actions will be supported in the context of the European Blockchain Partnership as well as other public private initiatives. For instance, the cross border deployment of Anti Money laundering/Know Your Customer (KYC) blockchain-based solutions; actions for significant enhancement of certification schemes and product traceability all

across of Europe; enforcement of consumer/data subject/user rights enshrined in EU legislation, emissions monitoring verification and/or trading systems or fighting against fraud like the VAT carousel, counterfeiting, and more.

Beyond that, it is expected that other Digital Europe actions use blockchain to deploy solutions in their respective areas. Such blockchain solutions could contribute to high-impact projects in areas such as climate, health, environment, and agri-food, to decentralised AI applications, to the provision of AI software and tools, and more significantly to the creation of data spaces relying on the empowerment of EU citizens to exert control over the use of personal data, as well as use of IoT-based data through smart contracts. Blockchain/DLT can also be considered when deploying Cybersecurity solutions and could be proposed to facilitate the access to HPC capacities, in particular to help SMEs and start-ups to use those advance computing capacities. DIHs will also be a key channel for enlarging the take up of blockchain /DLT, helping in particular SMEs to participate in new value chains and promoting skills acquisition.

Priority actions for the first two years:

Deployment and enhancement of European Blockchain Services Infrastructure

- Upgraded infrastructure elements of EBSI: protocols, new functions, improved capacities, improved energy efficiency and sustainable solutions meeting the highest EU standards in full compliance with EU regulations.
- New and upgraded EBSI nodes in European Blockchain Partnership countries, and the related operations, maintenance and training services.
- Set-up of experimentation sandboxes providing controlled environments to allow for smoother development and testing of innovative applications based on EBSI.

Deployment of services of public interest (and their possible integration in EBSI).

Cloud Federation as a Service

The need to efficiently implement the principle of the free movement of data across the EU is of strategic importance to foster EU competitiveness and for a well-functioning single market for data. The aim of this targeted action is to build a federation of pan-European cloud services that enables the provision of strategic services of general interest across the EU both of *public* interest nature such as public services, healthcare, social services, education, public safety, environment, sustainability and of *economic nature* such as transport, energy, utilities and communication.

In the two first years, the programme will start by a two-fold deployment:

- a federation of cloud services to support the delivery of two specific services of general interest of *public nature*: (a) public services provisioned by public administrations and (b) health services by hospitals;
- the deployment of the federation of cloud services in at least one of the three specific services of general interest of *economic nature*: (a) [transport], (b) [energy] or (c) [environment] provided by small and medium enterprises that use AI, HPC, cloud or blockchain to deliver the above services.

This will be done in close synergy with the 'health', 'clean planet'[58] and 'smart cities' actions proposed under the Digital Europe programme.[59] Further synergies with other parts of the

[58] The 'Cloud Federation as a Service' could be used to support some of the specific objectives of the 'Digital for Clean Planet' action, e.g. supporting the interconnection of data repositories and the deployment of analytical capabilities to support EU implementation laws.

programme will also be explored. For instance, federated cloud services such as data analytics services and storage of data repositories could enable AI services, while data storage and processing services could facilitate the use of digital ledger technologies solutions and the set-up of common EU-wide data spaces. This action will be the opportunity to deploy at large scale the results of Horizon 2020 projects that successfully piloted federation of cloud services, while complementing it with the financing of pan-European cross-border interconnections of energy-efficient cloud infrastructures under the future CEF Digital programme.

Priority action for the first two years:

Deployment of a federation of pan-European cloud services (including data storage, data exchange and data optimisation services) to enable the provision of services of general interests of ***public nature*** focussing on public services and health services in the first two years.

Deployment of a federation of pan-European cloud services (including data storage, data exchange and data optimisation services) among SMEs from several Member States to enable the provision of services of general interests of ***economic nature*** focussing on [transport], [energy] and [climate] services in the first two years.

WIDENING THE BEST USE OF DIGITAL TECHNOLOGIES

It is crucial to ensure that citizens of all ages feel secure in the digital world. We need to work on enhancing security and trust. Actions in this area will build on current activities, such as our focus on a safer internet for children,[60] and initiatives to combat disinformation and other forms of online manipulation. Schools will not be left behind and support for the digital transformation of education[61] will be provided. The programme also aims to lower the language barriers for citizens and SMEs impeding access to the Digital Single Market.

Building trust for the digital transformation

Increasing connectivity and digitisation are transforming the economy and society at an unprecedented pace, just as AI, augmented and virtual reality and other emerging technologies are changing the way citizens engage in society, politics, and government. Online digital platforms bring about radical changes in the way we socialise, access and share information, engage in democratic debate, work, create value in the economy, and compete for profits. While offering new forms of commerce and sharing, and unprecedented opportunities in social interaction, education, and entertainment, the internet also gives rise to risks such as disinformation, unfair commercial practices, privacy concerns, hacking, cyberbullying, violence, incitement to hatred, the spread of child sexual abuse material or online sales of illegal goods such as dangerous products.

Children are particularly vulnerable. A Europe-wide network of Safer Internet Centres will coordinate their activities and share common resources through a central platform to raise awareness, offer helpline counselling for children and hotlines for reporting online child sexual abuse content. They will protect and empower minors to become resilient digital citizens and contribute to preparing them for the digital economy.

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[59] Federated cloud services may encourage public administrations to start using services enabled by emerging technologies such as AI, HPC and blockchain.

[60] https://ec.europa.eu/digital-single-market/en/content/creating-better-internet-kids-0.

[61] COM(2018) 22 final, Communication from the Commission on the Digital Education Action Plan, 17 January 2018.

As more and more citizens get and share news and information online, online disinformation proliferates, and there is a need for measures aimed at detecting and combatting intentional disinformation spread. Online disinformation should not only be tackled by the use of new technologies for checking veracity and source of information on the internet, but also by an infrastructure that supports and connects together stakeholders tackling the issue in the Member States in order to better study the phenomenon of disinformation and develop adequate responses that involve the whole media ecosystem including social networks. Furthermore, incentivising Member States to embed digital literacy, cybersecurity awareness and online safety from an early age will also increase societal resilience against disinformation.

Priority actions for the first two years:

Safer internet for kids

Safer Internet Centres in Member States empower and protect children online through awareness activities and resources, helpline counselling on online risks, and hotlines facilitating the swift removal of child sexual abuse material. Activities supporting the Safer Internet Centres, are already supported by the current CEF Telecom programme.

Platform for combating disinformation

Increasing the capacity of the platform in terms of tools, services and datasets made available for detection and analysis of disinformation campaigns. Support the creation of national multidisciplinary communities tackling information. These activities have started under the current CEF Telecom programme.

Language Technologies

The objective of this action is to lower the language barriers for citizens and European SMEs to access the Digital Single Market and to promote the development of language processing services (e.g. voice-based services, translation, semantics and text analytics) by deploying language technologies, which will provide better access to information, products and services for European citizens and SMEs. Activities will foster the creation of an efficient ecosystem of technology providers, the localisation and uptake of language technologies, and access to the necessary data sets and computing power.

In line with this, the focus for the first two years of the programme will be on: (1) fostering the uptake of language technologies by offering support for standardisation, localisation, testing, and piloting local and cross border deployment of these technologies notably by European SMEs. More specifically, AI resources made available under Specific Objective 2 (e.g. through the data spaces and the Common European AI platform) and relevant to the language technologies will be adapted to the local language requirements. Cross-border specifications and standardisation efforts will be established in order to lower the cost of such local adaptations. Finally, the deployment and take-up of these solutions by European SMEs will be supported through dedicated grants. (2) providing automatic aggregation of the existing relevant data sets from the data space and access to HPC capabilities to support the processing, development and deployment of localised language technologies; and (3) mobilising the community through a network of local anchor points, gathering technological expertise in their language to ensure that all Member States can identify, analyse and adapt to digital trends, establish the needs and priorities of the public and private sectors, share best practice, and contribute to common specifications and standards.

Activities on language technologies rely on, and feed into, other parts of the Digital Europe Programme: for example, the Digital Transformation Platform will provide baseline multilingual services before further localisation to dedicated application domains and services. The AI platform

and data spaces will provide the resources required to train localised language technology models. Moreover, use of HPC will facilitate training and take-up of language tools and services by private and public users.

The deployment activities under Digital Europe build on technology developments under both Horizon 2020 and Horizon Europe.

Priority actions for the first two years:

Set standards and provide the language technology industry with access to relevant datasets and high performance computing.

Support the EU language technology industry in developing and deploying latest artificial intelligence-based technologies in all EU languages.

Digital Transformation of Learning and Education

In the Rome Declaration of March 2017, EU Member States stressed their commitment to fighting unemployment, providing young people with the 'best education and training'. In the Council Conclusions of October 2017, Member States stressed the need for Europe to go digital and to invest in digital skills, to empower and enable all Europeans and develop labour markets, training and education systems fit for the digital age. Ahead of the EU leaders' meeting in Gothenburg on 17 November 2017, the Commission set out its position on the way towards a European Education Area by emphasising the need for a high level of education and training better suited to today's labour market.[62]

In order to ensure that labour markets and education and training systems are fit for the digital age, Digital Europe will also support the digital transformation of schools, targeting primary, secondary and vocational schools. Digital education has a great potential to significantly improve learning outcomes, enhance equality and improve efficiency, as well as raising awareness on climate and environmental consequences. This initiative aims for the large-scale deployment of digital capabilities at schools and will work in synergy with the future CEF Digital programme providing connectivity to socio-economic drivers, including schools. Priority activities for the years 2021-2022 target educational institutions for wide scale take-up of effective digital content and platforms including personalised learning solutions (e.g. based on AI and data analytics) also in view of developing pedagogical approaches, learning environments and organisational developments, while ensuring the respect for fundamental rights, and notably the rights to privacy, data protection and the Rights of the Child. The support may involve co-funding of some innovative equipment/devices (such as VR glasses, 3D printers) to facilitate the effective use of digital content.

Priority actions for the first two years

Supporting the digital transformation of schools – large scale pilots – scaling up good practices/whole-school approach taking into account different dimensions (from teaching staff to students to wider community)/ use of ICT in pedagogies /demonstration of personalised and inclusive learning, inquiry-based teaching.

[62] https://ec.europa.eu/commission/news/towards-european-education-area-2025-2017-nov-14_en.