



Brussels, 7.12.2018
COM(2018) 795 final

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to the

**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN
ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE
REGIONS**

Coordinated Plan on Artificial Intelligence

Coordinated Plan on the Development and Use of Artificial Intelligence Made in Europe – 2018

Artificial Intelligence (AI) can help us address some of the world's biggest challenges. It can enable doctors to improve diagnoses and develop therapies for diseases for which none exist yet; it can reduce energy consumption by optimising resources; it can contribute to a cleaner environment by lessening the need for pesticides; it can help improve weather prediction and anticipate disasters; and so on. The list is virtually endless. AI will be the main driver of economic and productivity growth and will contribute to the sustainability and viability of the industrial base in Europe¹. Like the steam engine or electricity in the past, AI is transforming the world.

The Union aims to develop trusted AI based on ethical and societal values building on its Charter of Fundamental Rights. People should not only trust AI, but also benefit from the use of AI for their personal and professional lives. Europe aims at creating an innovation friendly ecosystem for AI: an environment where economic players find the infrastructure, research facilities, testing environments, financial means, legal framework and adequate skills levels to invest in and deploy AI. **Overall, the ambition is for Europe to become the world-leading region for developing and deploying cutting-edge, ethical and secure AI, promoting a human-centric approach in the global context.**

AI has been high on the agenda of the Council of the EU since the Digital Summit organised by the Estonian Presidency in September 2017. The Communication “Artificial Intelligence for Europe” of 25 April 2018² proposes a European strategy in support of this goal. The Communication also proposes a coordinated plan on the development of AI in Europe³, to be drawn up with the Member States by the end of 2018. This was endorsed by the European Council⁴. The present document responds to this request. Only if Member States and the Commission work together will Europe be able to turn vision into reality.

The coordinated plan builds on a "declaration of cooperation" that was signed by all EU Member States and Norway in the context of the Digital Day 2018⁵, emphasising the

¹ The High Level Strategy Groupon Industrial Technologies has recommended including AI as one of the Key Enabling Technologies due to its cross cutting enabling potential crucial for European Industry. <https://publications.europa.eu/en/publication-detail/-/publication/28e1c485-476a-11e8-be1d-01aa75ed71a1/language-en>

² COM(2018) 237

³ As spelled out in the above-mentioned Communication of 25 April 2018, Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications). We are using AI on a daily basis, e.g. to translate languages, generate subtitles in videos or to block email spam. Many AI technologies require data to improve their performance. Once they perform well, they can help improve and automate decision making in the same domain. For example, an AI system will be trained and then used to spot cyberattacks on the basis of data from the concerned network or system.

⁴ <https://www.consilium.europa.eu/en/press/press-releases/2018/06/29/20180628-euco-conclusions-final/>

⁵ The Digital Day 2018, which took place on 10 April in Brussels, reached for joint commitments of Member States in relation to the digital future of Europe. The signing of the AI declaration takes place through a voluntary and participatory process.

willingness to cooperate more closely on AI. The Austrian Presidency of the EU also included AI as a priority in the context of the transformation of the industry⁶.

The main goals of the coordinated plan are to maximise the impact of investments at EU and national levels, encourage synergies and cooperation across the EU, including on ethics, foster the exchange of best practices and collectively define the way forward. By working together the Union can maximise its impact to compete globally.

The Member States' Group on Digitising European Industry and AI and the Commission discussed between June and November 2018 possible strands for cooperation. In order to accommodate the fast pace of the AI-induced change in societies and economies Member States, Norway and Switzerland agreed to put in place a rolling coordinated plan that is to be monitored and reviewed annually, so as to ensure it remains up to date. The present document is the first edition of this plan and mainly comprises activities for 2019 and 2020, with emphasis on planned EU-level activities under the current financial framework. The plan is expected to run into the next decade, possibly until 2027, in line with the next multi-annual financial framework.⁷

A need for coordinated action has been identified in the fields of investment, excellence in and diffusion of AI, data availability, societal challenges, ethics and the regulatory framework. Actions concern both private and public sectors with many synergies.

“AI made in Europe” meeting citizens’ aspirations, responding to societal needs, and boosting competitiveness

The coordinated plan will maximise the benefits of AI for all Europeans by fostering the development of trusted AI that corresponds to European ethical values, and citizens’ aspirations. Europe will progressively increase its effort in public interest areas such as healthcare, transport, security, education and energy as well as in other areas such as manufacturing and financial services (including through blockchain).

This plan brings together a set of concrete and complementary actions at EU, national and regional level⁸ in view of:

- Boosting investments and reinforcing excellence in AI technologies and applications which are trustworthy and “ethical and secure by design”. Investments shall take place in a stable regulatory context which enables experimentation and supports disruptive innovation across the EU, ensuring the widest and best use of AI by the European economy and society.
- Building on Europe’s strengths, to develop and implement in partnership with industry and Member States shared agendas for industry-academia collaborative Research and Development (R&D) and innovation.
- Adapting learning and skilling programmes and systems to prepare Europe’s society and its future generations for AI.
- Building up essential capacities in Europe underpinning AI such as data spaces and world-class reference sites for testing and experimentation.

⁶ See Presidency note 11972/18 of 14 September 2018.

⁷ All budget figures related to envisaged EU contributions from 2020 onwards are subject to the adoption of the underlying legal basis, work programmes and yearly budgets by the relevant authorities.

⁸ All of these actions must comply with the EU rules on competition law and state aid.

- Making public administrations in Europe frontrunners in the use of AI.
- Implementing, on the basis of expert work, clear ethics guidelines for the development and the use of AI in full respect of fundamental rights, with a view to set global ethical standards and be a world leader in ethical, trusted AI.
- Where needed, reviewing the existing national and European legal framework to better adapt them to specific challenges.

Key enablers

Progress in AI opens the door to new opportunities in areas such as personalised and precision healthcare, mobility (autonomous driving⁹), fintech, advanced manufacturing, space-based applications, smart power grids, sustainable circular and bio economy, improved detection and investigation of criminal activities (e.g. money laundering, tax fraud), media, etc.

This digital transformation requires in many cases a significant upgrading of the currently available infrastructure. The effective implementation of AI will require the completion of the Digital Single Market and its regulatory framework including the swift adoption of the Commission proposal for a European Cybersecurity Industrial, Technology and Research Competence Centre and the Network of National Coordination Centres¹⁰, reinforced connectivity through spectrum coordination, very fast 5G mobile networks and optical fibres, next generation clouds, as well as satellite technologies¹¹. High-performance computing and AI will increasingly intertwine as we transit to a future using new computing, storage and communication technologies. Furthermore, infrastructures should be both accessible and affordable to ensure an inclusive AI adoption across Europe, particularly by small and medium-sized enterprises (SMEs). Industry, and in particular small and young companies, will need to be in a position to be aware and able to integrate these technologies in new products, services and related production processes and technologies, including by upskilling and reskilling their workforce. Standardisation will also be essential for the development of AI in the Digital Single Market, helping notably to ensure interoperability.

A paradigm change is also required in cases where data needs to be processed locally (for example in connected automated driving that must be able to take swift decisions without waiting for an answer from a remote server). This trend drives demand for advanced, low-power semiconductor technologies. New paradigms beyond scaling are already emerging and new energy-efficient computing architectures (such as neuromorphic and quantum) will be needed to ensure sustainable use of energy. Ongoing partnerships between the Member States and the Union through joint undertakings such as ECSEL¹² (for electronic components and systems), EuroHPC (high-performing computing)¹³ as well as the quantum flagship under the Research and Innovation Programme Horizon 2020 (H2020) are key to processing big data and sustain further developments in AI.

Member States and the Commission will continuously support the deployment of the key enablers and will mainstream AI in the related initiatives.

⁹ The Communication on connected and automated mobility recognised for example the benefits stemming from the progress in the field of AI, which will serve to open up new areas for business development and pave the way for new mobility services making transport safer, more accessible and sustainable.

¹⁰ COM(2018) 630

¹¹ E.g. the EU-owned Global Satellite Navigation System Galileo.

¹² https://europa.eu/european-union/about-eu/agencies/ecsel_en

¹³ <https://ec.europa.eu/digital-single-market/en/blogposts/eurohpc-joint-undertaking-looking-ahead-2019-2020-and-beyond>

The coordinated plan links to the ongoing parallel strategies in these areas.

A. Strategic actions and coordination

The Commission put forward its approach to AI in the Communication “Artificial Intelligence for Europe” published in April 2018, resting on three pillars:

- Boosting the EU's technological and industrial capacity and AI uptake across the economy, both by the private and public sectors;
- Preparing for socio-economic changes brought about by AI;
- Ensuring an appropriate ethical and legal framework, based on the Union's values and in line with the Charter of Fundamental Rights of the European Union.

As announced in the April Communication, the Commission has tasked a High-level Expert Group on AI to draft AI ethics guidelines. The High-Level Expert Group will also propose policy recommendations on investments and the regulatory framework.

The Commission has also tasked the Expert Group on Liability and New Technologies to assist the Commission in drawing up guidance on the implementation of the Product Liability Directive and in developing EU-wide principles which can serve as guidelines for possible adaptations of applicable laws at EU and national level.

The Commission's Expert Group for the Observatory of the Online Platform Economy will additionally explore policy issues in AI-related regulatory areas, such as data access¹⁴, online advertising and the role of algorithms in the digital platform economy.

Moreover, the Commission also established a High-Level Expert Group on the impact of digital transformation on EU labour markets which will deliver a report addressing strategies to deal with employment disruption in spring 2019¹⁵.

Investment levels for AI in the Union are low and fragmented, relative to other parts of the world such as the US and China. To remedy this shortcoming, the April Communication sets an ambitious objective, aiming to increase investment and reach a total (public and private sectors combined) of at least EUR 20 billion in the period 2018-2020, and to increase investments progressively to EUR 20 billion per year in the course of the next decade.

The Commission is increasing investments in AI under the research and innovation framework programme Horizon 2020 to EUR 1.5 billion in the period 2018-2020, constituting a 70% increase compared to 2014-2017. Under the next multi-annual financial framework, the Commission has proposed to dedicate at least EUR 1 billion per year from Horizon Europe¹⁶ and the Digital Europe Programme¹⁷ to AI. Options to mobilise resources from the European Fund for Strategic Investments and the European structural and investment funds are being

¹⁴ Duch-Brown et al (2017), The economics of ownership, access and trade in digital data. Joint Research Centre Digital Economy Working Paper 2017-01. <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/economics-ownership-access-and-trade-digital-data>

¹⁵ <https://ec.europa.eu/digital-single-market/en/news/appointment-members-high-level-expert-group-impact-digital-transformation-eu-labour-markets>

¹⁶ COM(2018) 435 and COM(2018) 436

¹⁷ COM(2018) 434

explored. For example the European Regional Development Fund is expected to invest in AI based on the next generation of Smart Specialisation Strategies.

As of today, France, Finland, Sweden, the UK and Germany have targeted AI strategies in place. Some countries like Denmark, Luxembourg, the Netherlands, Ireland and Norway include AI related actions in a broader digitalisation strategy. Moreover, Austria, Belgium, Czech Republic, Denmark, Estonia, Germany, Italy, Latvia, Poland, Portugal, Slovenia, Slovakia and Spain are in the process of developing strategies.¹⁸ In order to maximise investments, pool important resources such as data, provide a seamless regulatory environment, all Member States need to put in place national AI strategies, in line with their intentions expressed in the Digital Day Declaration of Cooperation on AI, including support measures.

Member States and the Commission will monitor progress of the implementation of the plan on annual basis.¹⁹

- ✓ **By mid-2019 all Member States are encouraged to put in place - and share with other Member States and the Commission - national AI strategies or programmes or add AI dimensions in other relevant strategies and programmes²⁰ outlining investment levels and implementation measures**, taking into account this coordinated plan. The exact form, contents and governance of the national AI strategies will be up to each Member State to decide based on national characteristics²¹.
- ✓ Discussions between Member States and the Commission will be steered by the **Member States' Group on Digitising European Industry and Artificial Intelligence** (MS Group on DEI and AI), assisted on technical matters by a Sherpa Group²². The group will meet at least biannually. It will ensure coordination across different national Ministries and other stakeholders, for example from industry, academia and civil society. Dedicated Member States' groups²³ will provide the necessary input in the different areas covered by the plan. The Member States and the Commission will also organise topical workshops.
- ✓ To assess impacts, in **2019 Member States and the Commission will identify relevant investment parameters** and comparable benchmarks for uptake so as to achieve common targets. Progress will be monitored annually.

¹⁸ Five regions have AI related priorities in their Smart Specialisation Strategies and AI may play a role in the context of the digital industrial transition dimensions of the national or regional Smart Specialisation Strategies in view of the post-2020 ERDF programmes: Lower Saxony [DE], Pohjois-Savo [FI], Łódzkie [PL], North-West [RO] and North-East [RO]. See: <http://s3platform.jrc.ec.europa.eu/map> . There are also other regions in Europe, for example in Belgium, with AI strategies.

¹⁹ AI Watch developed by the Joint Research Centre will contribute to monitoring AI-related development and will provide a number of analyses necessary to support the implementation of the European AI initiative. Among others it will develop AI indexes addressing all dimensions relevant for policy making. Such information will be made available at the AI Watch portal https://ec.europa.eu/knowledge4policy/ai-watch_en

²⁰ Including in the field of social inclusion and employment, eGovernment, eHealth, Key Enabling Technologies, skills, industrial transition / smart specialisation, etc.

²¹ Member States and regions are encouraged to analyse digital – including AI - dimensions in the process for reviewing the Smart Specialisation Strategies in view of the future European Regional Development Fund investments.

²² Representatives nominated by the Member States' Group on Digitising European Industry and Artificial Intelligence.

²³ Building on existing groups and respecting the specific governance of the different EU instruments involved.

B. Maximising investments through partnerships

To facilitate and reinforce investment in AI, and to maximise its impact in both the public and the private sectors, joint efforts between the Commission, Member States and the private sector are necessary. Only if both the Commission and Member States direct their investments in the same direction through joint programming and leverage significant private investments, will Europe as a whole have an impact and establish its strategic autonomy in AI.

- **Paving the way to a new partnership on AI:** AI is addressed today in different Public-Private Partnerships (PPP) under Horizon 2020, notably the Robotics and the Big Data PPPs with separate Research & Innovation agendas. The academic research community is also organised in networks such as EurAI, the European association for AI. The Commission, with support from the Member States, will work together with industry and academia on a common Research and Innovation Agenda in AI. Building on Europe's strengths, it will aim at the development of a dynamic EU-wide AI innovation ecosystem, fostering close cooperation between industry and academia, and reinforcing competitiveness across the whole AI value chain. For that, it will facilitate discussions with initially stakeholders from the robotics and big data PPP, but later expanding to representatives of all relevant stakeholders from industry and research institutes to develop a common strategic research and innovation agenda for AI. The Commission is planning to set up a Leaders' Group.
- **Teaming up for investment in AI:** It is key for Europe to identify and invest in the next generation of AI and to roll it out widely. One important element is making available sufficient investment for start-ups in their early stage as well as for companies in their scale-up phase. To this end, the Commission aims at making available resources for start-ups and innovators in AI and blockchain in their early stage as well as for companies in their scale-up phase, using existing instruments such as the European Fund for Strategic Investments, Horizon 2020 and the European Investment Fund. EUR 100 million should be initially mobilised in 2020. As certain early applications of blockchain utilising mining (Bitcoin) consume high amounts of energy, in the investment selection criteria for such a financial programme, the Commission will give preference to supporting newer energy efficient blockchain infrastructures and applications. Activities could focus on (i) financing a portfolio of innovative AI/blockchain companies; (ii) developing a dynamic EU-wide investors community focusing on AI; (iii) multiplying investments at the national level by involving the national promotional banks (NPBs) that are willing to participate; (iv) incentivising private sector investments and (v) making Europe become more attractive for start-ups to stay and grow. In the following years, AI and blockchain could be further supported through the InvestEU Programme.
- As a follow-up of the European Council conclusions of June 2018²⁴, the European Commission is preparing an enhanced pilot for a European Innovation Council (EIC) to support the scale-up of innovative companies (start-ups and SMEs) carrying out breakthrough market creating innovation, as well as breakthrough science and key enabling technologies that could lead to disruptive innovation.

²⁴ EUCO 9/18 – 28 June 2018.

Maximising investment:

- ✓ In 2019, **the Commission** will bring together the stakeholders initially including the robotics and big data PPPs but later expanding to other involved parties, in order to develop a **common strategic research and innovation agenda for AI**, to be supported starting in 2020. For that, it will set up a Leaders' Group representing the stakeholders at CEO level from industry and research institutes to develop the agenda and ensure commitment at the highest level in its implementation, paving the way to a new partnership in AI (first meeting early 2019).
- ✓ The Commission aims at making available resources for start-ups and innovators in AI and blockchain in their early stage as well as for companies in their scale-up phase, using existing instruments such as the European Fund for Strategic Investments, Horizon 2020 and the European Investment Fund. EUR 100 million should be initially mobilised in 2020. The Commission will also launch an investment support programme to facilitate portfolio development, co-investment with Member States and private investors, and in order to raise the awareness of start-ups and other companies, including both traditional and innovative SMEs, facilitating engagement in otherwise risky projects. This will help prepare for strengthening access to finance for AI under the InvestEU programme.
- ✓ Member States can actively support the process **through the participation of national promotional banks**, and taking part in awareness raising support programmes.
- ✓ The **European Innovation Council** will support disruptive innovation through the enhanced European Innovation Council pilot which will in particular support cutting-edge, high reward research and innovation projects that aim to demonstrate a new technological paradigm in fields such as for example **Human centric AI**, through a fund totalling EUR 100 million in 2019-2020.
- ✓ **Member States are encouraged to** explore the implementation of innovation vouchers, small grants and loans targeting SMEs in their digital transformation, including notably the integration of AI in products, process and business models.

C. From the lab to the market: (i) building up research excellence, (ii) establishing world-reference testing facilities and (iii) accelerating AI take-up through Digital Innovation Hubs.

The Commission and the Member States acknowledge the importance of continuing to strengthen their science base²⁵ and support research and innovation in order to ensure competitiveness in technology, address innovation challenges, as well as facilitate the transfer of research results to industry.

The Commission will reinforce its investment in research and innovation throughout Horizon 2020, and mainstream AI in all the topics where its benefit can be developed or exploited. For example, it will be necessary that substantial funding is allocated to AI for security purposes, namely, on the one hand to prevent the malicious use of AI technologies utilized by malevolent actors for

²⁵ As an example, the European Research Council has funded over 150 cutting edge AI projects by Europe's leading researchers in areas such as deep learning, neural networks, prediction, machine translation, natural language processing, computer vision, robotics, artificial agents and medical imaging as well as governance and standards.

criminal activities or terrorism, and on the other hand to deploy AI tools and solutions in support of law enforcement agencies to better prevent, detect and investigate criminal activities and terrorism.²⁶

*For **AI made in Europe** one key principle will be “**ethics by design**” whereby ethical and legal principles, on the basis of the General Data Protection Regulation, competition law compliance, absence of data bias are implemented since the beginning of the design process. When defining the operational requirements, it is also important to take into account the interactions between humans and AI systems. The Commission will explore how to introduce an “ethics by design” principle in relevant calls for proposals under the research programme.*

*Another key principle will be “**security by design**”, whereby cybersecurity, the protection of victims and the facilitation of law enforcement activities should be taken into account from the beginning of the design process.*

In addition, the Commission will work towards reinforcing European AI excellence centres, establishing world reference testing facilities and accelerating the uptake of AI through Digital Innovation Hubs, making sure that Europe benefits from the results of the research activities.

The Commission will maintain a geographical balance on its efforts to reinforce Digital Innovation Hubs and will encourage geographical coverage in the networks of excellence centres and testing facilities and will encourage complementarities with Cohesion Policy investments. While Europe has undeniable strengths with its many leading research centres, joining forces is essential in order to be competitive at the global level. Europe will scale up national research capacities and reach a critical mass through tighter **networks of European AI research excellence centres**²⁷. The objective is to foster cooperation among the best research teams in Europe, joining forces to tackle more efficiently major scientific and technological challenges in AI and mobilise industry to be integrated in and find synergies with the research teams.

Establishing world-reference testing facilities²⁸: An important step in bringing technology to market relates to experimenting and testing state-of-the art technology in real-world environments. To optimise investment and avoid duplication or competing efforts, a limited number of AI specialised large-scale reference sites should be developed and be opened to all actors across Europe.

Examples of such testing facilities include the cross-border testing of connected and autonomous driving, test sites for autonomous shipping and the creation of data spaces. The Commission and the Member States will identify the need for new large-scale testing facilities for the latest AI technologies in key areas such as mobility, healthcare, manufacturing, agro-food or security. These testing facilities may include regulatory sandboxes (i.e. areas where

²⁶ This would also enable businesses to enhance their security capacity. The Commission will discuss with the Secure Societies Programme Committee the inclusion of relevant actions in the Horizon 2020 Work Programme for 2020.

²⁷ An AI Excellence Centre is a research centre with a strong expertise in AI. The main purpose of such centres is to advance progress in specific fields of science and technology.

²⁸ A Reference Testing and Experimentation Facility is a technology infrastructure that has specific expertise and experience of testing mature technology in a given sector, under real or close to real conditions (smart hospital, clean rooms, smart city, experimental farm, corridor for connected and automated driving, etc.).

regulation is limited or favourable to testing new products and services) in selected areas where the law provides regulatory authorities with sufficient leeway, relaxing specific legal and regulatory requirements for the duration of the sandbox.

Accelerating AI take-up through Digital Innovation Hubs: Equally important will be fostering the uptake of AI in the wider economy, in particular by SMEs. This includes transmitting knowledge and scientific advances generated in European AI research excellence centres as well as technologies validated in the testing facilities above. **Digital Innovation Hubs (DIH)** can help ensure that every company, small or large, high-tech or not, as well as the public sector, can grasp the digital opportunities. With technical universities or research organisations at the core, DIHs act as one-stop-shops where companies and the public sector can get access to technology, testing and technical support, financing advice, market intelligence and networking opportunities. More specifically, in the area of AI, DIH can help SMEs and public administrations identify necessary datasets, develop algorithms, train AI and they can link to computing facilities building on the “AI-on on-demand” platform. They can help training professionals from the SMEs in the use of AI solutions and advise on existing financial support. They link both to the research excellence centres and to available testing facilities.

Similarly, the current eleven nodes of the Digital Knowledge and Innovation Communities of the European Institute of Technology & Innovation bring together prominent actors of the digital sectors in targeted regions.

i) Strengthening research excellence through networks of European AI research excellence centres:

- ✓ **In 2019, Member States will map national AI research excellence centres** and their competences and further support their EU-wide cooperation and networking through national programmes.
- ✓ **The Commission plans to fund networks of AI research excellence centres** with EUR 50 million in 2020 through Horizon 2020, supporting collaborative research addressing industrial and scientific challenges identified by such networks in joint research agendas.
- ✓ **Member States** are encouraged to mobilise their industry to be integrated in or develop synergies with the **networks of AI research excellence centres**.

(ii) Establishing world-reference testing facilities

- ✓ **2018-20, Member States and the Commission will:**
 - ✓ Building on a first set of 5G cross-border corridors for connected and autonomous driving²⁹, **support additional testing corridors** with up to EUR 30 million in 2020 through Horizon 2020.
 - ✓ Work on the development of **platforms and large-scale pilots** integrating AI elements in areas such as energy, healthcare, manufacturing, geo-information and agriculture. For 2019-20, the Commission will make available EUR 160 million from

²⁹ <https://ec.europa.eu/digital-single-market/en/news/new-5g-cross-border-corridors-connected-and-automated-mobility-baltics-will-allow-testing>

Horizon 2020.

- ✓ In 2019 and 2020, under the **ECSEL Joint Undertaking³⁰**, AI and data analytics will be integrated in lighthouse initiatives in manufacturing, mobility and personalized medicine, with a total budget of around EUR 200 million, from components up to full systems.

In total, the Commission will make available around EUR 390 million in developing platforms and large-scale pilots in the period 2019-20; it is expected that this investment will be matched with close to EUR 200 million from Member States and EUR 550 million from the private sector.

Beyond 2020,

- ✓ **Under the Digital Europe Programme, the Commission envisages making available around EUR 1.5 billion to establish world-leading testing and experimentation sites for AI-powered products and services throughout Europe.** These test sites will be identified and developed in close collaboration with Member States in 2019, who will provide a mapping of existing national test sites and will cover the whole AI supply chain from components (neuromorphic computing and quantum technologies) up to integrated applications in areas like health, mobility, energy, security, safety and industrial production.
- ✓ **Member States** will be encouraged to match the investments in the Digital Europe Programme so that an overall investment volume of EUR 3 billion is available. The use of other sources of funding, such as the European Regional Development Fund, will also be encouraged.

(iii) Accelerating AI take-up through Digital Innovation Hubs (DIH)

- ✓ **In 2019 Member States are invited to strengthen their networks of Digital Innovation Hubs** with a focus on supporting their local SME communities in the digital transformation. Member States will be asked to identify the DIHs that have AI competence.
- ✓ **In 2019 and 2020 the Commission will make available more than EUR 100 million for Digital Innovation Hubs in selected, AI-relevant areas** (Big Data, Smart Manufacturing). This includes activities for regions where currently few Digital Innovations Hubs exist, such as in the EU13 countries.
- ✓ In addition, the European Institute of Technology (EIT) activities will contribute to the adoption of AI by the public and private sectors. Between 2018 and 2020, the Union will invest in activities to support EIT Digital and its network of nodes across the Union. This investment will focus on the digital transformation of industries, cities, health, infrastructure, and finance, notably to adapt to the opportunities offered by AI.
- ✓ **Beyond 2020, funding from the Digital Europe Programme is proposed to contribute to establishing Digital Innovation Hubs in every Member State ensuring a broad**

³⁰ The ECSEL Joint Undertaking is a tripartite model of co-investment of the Commission, Member States and the Industry to support research and innovation, including large scale demonstrations and pilots in the areas of microelectronics, small system integration and embedded software with special focus on integration projects.

geographical representation (possibly with, on average, one in every NUTS2 region³¹). It is envisaged that the Union will provide up to EUR 900 million to support the development of these hubs, an amount to be matched by similar amounts from Member States. Horizon Europe is expected to enable Digital Innovation Hubs to engage further in digital transformation experiments and support up to 10 000 SMEs throughout Europe.

D. Skills and life-long learning

Talent is one essential ingredient for AI to be developed and used. AI and digitalisation are rapidly transforming society and the economy as a whole, including the work environment. In Europe, there is a significant and persistent ICT skills gap. Demand for skills in emerging areas such as AI are particularly acute and the problem is growing as the offer lags behind the market. Almost all Member States are facing shortages of ICT professionals, including in the area of AI³². The current offer of specialised higher education programmes is limited and not equally available in all Member States.³³

Poor general technical knowledge in the broader population hampers the accessibility and uptake of AI-based solutions. Access to the necessary skills should be fostered in primary and secondary schools, although training of teachers remains an important challenge. Fast track retraining programmes need to be designed in order to enable the population to gain experience in AI. Technology like Massive Open Online Courses (MOOCs) could be used to scale up learning. The topic of AI needs to become part of non-technical study-programmes through formal and informal education, so as to provide the future workforce with knowledge needed to operate and navigate in a working environment where AI will be part of the day-to-day tasks.

Beside ICT skills, other skills are equally important for a human-centred AI development. Ethics and other non-STEM skills are equally important and should be part of the talent fostering chapter of AI national and international strategies. Furthermore, re- and up-skilling should be accompanied by the modernisation of labour market and social policies in order to better cope with more frequent labour market transitions.

Difficulties in attracting and retaining talent in Europe contribute to the skills gap. Talented researchers and promising start-ups frequently receive attractive offers from abroad. In 2017, 38% of Silicon Valley's population were foreigners who had entered the US to fill a specific job in the tech industry, and 8% of them were European³⁴. Action is in particular needed to attract and retain the best talent in Europe and to create a competitive environment. Closer cooperation with industry will help to ensure the relevance of the learning content to labour market needs.

³¹ Nomenclature of territorial units for statistics, NUTS 2 are defined as basic regions for the application of regional policies.

³² There is a lack of more than 80,000 professionals for data handling and management (1 per 20 scientists) http://www.pocbigdata.eu/monitorICTonlinevacancies/general_info/

³³ "In 2018, about two third of the EU Member States have less than 10 Master's programmes strongly focusing on AI. While AI modules are becoming relatively more common across different educational domains, still only one third of the EU Member States have more than 20 Master's programmes including at least one AI module". López-Cobo et al. (2018), Academic offer and demand for advanced profiles in the EU. Artificial Intelligence, High Performance Computing and Cybersecurity. Joint Research Centre Scientific Report.

³⁴ <https://jointventure.org/images/stories/pdf/index2018.pdf>

The Commission adopted a Digital Education Action Plan³⁵ to support technology-use and digital competence development in education. As announced in the April Communication, the European Institute of Innovation and Technology (EIT) is in the process of integrating AI across curricula in the education courses it supports, at Master and PhD level, and the Digital Opportunity Traineeships pilot (2018-20)³⁶ makes available internships in advanced digital skills for Erasmus students. The Blueprint on sectoral cooperation on skills supports the development of sectoral strategies to address the skills gaps³⁷, and improve multidisciplinary approaches by integrating elements of AI into other disciplines.

Mutual recognition of certification, including for studies in new disciplines such as AI, is important. In May 2018, the Commission made a proposal for a Council Recommendation³⁸ on promoting automatic mutual recognition of higher education and upper secondary education diplomas and the outcomes of learning periods abroad. The proposed Council Recommendation invites Member States to make a political commitment to take steps to introduce automatic recognition by 2025.

Talent, skills and life-long learning

- ✓ Skills and education are domains that fall to a large extent under national, and sometimes regional, competences. However, Union level action is important in order to share experiences and seize common opportunities.
- ✓ **Member States are encouraged to :**
 - ✓ **Exchange best practices** on (i) how to reinforce excellence and to retain AI talent in Europe and (ii) on the re- and upskilling of the current workforce (in 2019).
 - ✓ Exchange best practices on how to make full use of the possibilities offered by the EU **Blue Card system** to attract and retain highly-skilled AI professionals in the EU and accelerate its implementation and on how to facilitate AI-related entrepreneurship (by the end of 2019).
 - ✓ **Include the skills dimension in the national AI strategies** (by mid-2019) and map the national education offer, the skills needs (AI also needs to be part of/integrated in other disciplines such as law, human sciences, environment, health) and the training priorities for AI, paying particular attention to inclusion and to attracting more women to AI studies (by end 2020). Strategies should address the whole cycle of formal education, vocational training, higher education and post-docs. At the same time, more focus should be put on life-long learning, in order to allow also people already in employment to acquire and improve their skills related to AI.
 - ✓ Explore how **AI** could be incorporated into the curricula of programmes for secondary and tertiary education, including **vocational training**. Commission will issue a report with the support of the Member States on this by early 2020 and support model actions in selected regions.
- ✓ **the Commission will:**
 - ✓ **Include a component of common PhD programmes and post-PhD programmes in the call for strengthening the AI research excellence centres in 2020** with a focus

³⁵ COM(2018) 22

³⁶ <https://ec.europa.eu/digital-single-market/en/digital-opportunity-traineeships-boosting-digital-skills-job>

³⁷ <http://ec.europa.eu/social/BlobServlet?docId=16962&langId=en>

³⁸ COM(2018) 270

on industrial challenges. The ambition is to establish a unique and world-recognised brand for a European programme for industrially-oriented PhDs in AI and to keep researchers in Europe after they complete their PhDs. The Marie Skłodowska-Curie Actions³⁹ will contribute to this objective.

- ✓ Explore avenues to support the inclusion of AI modules in multi-disciplinary **Master programmes (e.g. in e-health, fintech, e-government) and in adult training programmes with the focus on people with higher education and work experience.**
- ✓ Member States and Commission will work together and develop material to be used in **awareness campaigns** on the benefits of AI.
- ✓ **Beyond 2020** the Commission proposes that the Union provides a total of EUR 700 million to support advanced skills (for AI, HPC and cybersecurity) as part of the Digital Europe Programme through
 - ✓ Master degrees,
 - ✓ On-the-job trainings and traineeships for young people and professionals needing to gain experience
 - ✓ Short-term trainings for the workforce to become knowledgeable in AI.
- ✓ Mainstream ethical principles developed by the Union in the training schemes and programmes proposed above.

E. Data: a cornerstone for AI - Creating a Common European Data Space

The current expansion of AI is fuelled by the availability of large data sets combined with increases in computing power and connectivity. Making secure, robust quality data available for a broad range of users across borders is a cornerstone of European policy. Openness to international data flows will continue to be ensured in full respect of the EU rules for the protection of personal data and in accordance with applicable legal instruments, including free trade agreements that the EU concludes with its partners and Commission adequacy findings as regards the level of personal data protection in third countries. Full implementation of sectoral legislation, improving access to and re-use of information (e.g. the INSPIRE⁴⁰ Directive) will provide the domain-specific data needed to support powerful AI applications for the public sector, for analytical or policy monitoring purposes⁴¹.

Where data relating to individuals is processed, the General Data Protection Regulation (GDPR) lays down the rules applicable to the collection, use and sharing of such personal data. Additionally, the recently adopted Regulation on the free flow of non-personal data further facilitates cross-border data flows across the Union as a cornerstone of the Digital Single Market. Consideration will also be given to blockchain-based, fully GDPR- and privacy-compliant solutions for sharing and providing access to data. Proposed rules⁴² on trading practices between online intermediation services such as market places, app stores, or

³⁹ <https://ec.europa.eu/research/mariecurieactions/>

⁴⁰ Directive 2007/2/EC

⁴¹ Cetl V., Tomas R., Kotsev A., de Lima V.N., Smith R.S., Jobst M. (2019) Establishing Common Ground Through INSPIRE: The Legally-Driven European Spatial Data Infrastructure. In: Döllner J., Jobst M., Schmitz P. (eds) Service-Oriented Mapping. Lecture Notes in Geoinformation and Cartography. Springer, Cham.

⁴² <https://ec.europa.eu/digital-single-market/en/business-business-trading-practices>

accommodation booking platforms, set the conditions for predictable and transparent data use amongst hosting services and their business users. Such measures are intended to bring further fairness and trust in business relations and valuable use of data in the online platforms ecosystem.

Action is needed to facilitate sharing of data held by public and private sectors by creating a common European Data Space⁴³: a seamless digital area with the scale that will enable the development of new products and services based on data. In particular, data generated and held by the public sector is often of very high quality and constitutes a major asset for European innovators and businesses.

For increased usage, data within a space should be made interoperable as much as possible, notably by agreeing on aiming for data formats that are open, FAIR, machine readable, standardised and documented, both in the interaction between public and private sectors, within sectors and across sectors⁴⁴.

The Public Sector Information (PSI) directive⁴⁵ sets the framework for the reuse of such data by businesses. Actions should focus on making datasets more easily accessible in practice, notably to start-ups and SMEs and facilitating aggregation. Of particular importance are design and implementation of interoperable data and meta-data formats as well as the deployment of standardised Application Programming Interfaces (APIs) based on the European Interoperability Framework (EIF)⁴⁶.

These actions will complement efforts by the Member States to promote the accessibility, interoperability and re-usability of data in the sectors of high relevance for AI, such as health⁴⁷, (see points below), environment, mobility, security, migration and a sustainable and circular bioeconomy and food system.

Data

AI for areas of public interest: Member States are encouraged to cooperate with the Commission to:

- ✓ **Identify public data sets** to be made more openly reusable across the Union, especially those suitable for training AI applications. This may be supported by a mandate to establish a list of high-value datasets as provided for by the recast proposal of the Public Sector Information Directive, currently under negotiation.

⁴³ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2018:0232:FIN>

⁴⁴ See practices European Open Science Cloud (EOSC) It will foster best practices of global data findability and accessibility (FAIR data), <https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud>

⁴⁵ <https://ec.europa.eu/digital-single-market/en/european-legislation-reuse-public-sector-information>

⁴⁶ APIs facilitate sharing and use of government data between Member States through developing common approaches that should be promoted through experiments and applied research on APIs A study (APIs4DGov) has been started in 2018 by the Joint Research Centre. It aims to be participatory and benefit from work performed in European public administrations at all levels and contributes to the implementation of the European Interoperability Framework and the Building Block approach adopted in the CEF telecom programme. <https://ec.europa.eu/digital-single-market/en/news/new-study-digital-government-apis-apis4dgv-project>

⁴⁷ In the health field, such data sharing is for instance vital for the joint innovation investments prepared under the thematic Smart Specialisation Platform "Artificial Intelligence and Human Machine Interface. With Emilia-Romagna (IT), Autonomous Province of Trento (IT), Baden-Württemberg (DE), Navarra (ES), North Brabant (NL) and Örebro Län (SE) participating. See: <http://s3platform.jrc.ec.europa.eu/artificial-intelligence>

- ✓ Invest together in the necessary tools to facilitate access to, connectivity, interoperability and aggregation of public data including the development of relevant Application Programming Interfaces (APIs) for accessing data of dynamic nature. The action will support the definition and application of data and metadata standards in close cooperation with relevant stakeholders (e.g. European standardisation bodies). The Commission is planning to make available up to EUR 100 million from Horizon 2020 (H2020) and Connecting Europe Facility (CEF).
- ✓ Support the development and operations of a data infrastructure to enable the management and sharing of data in real-time and the experimentation through a data sandbox of data-driven AI-powered services, for governments and public administrations at large, including for secure cross-border trans-European IT systems. Such services are provided through the Public Open Data service infrastructure funded under CEF, which already supports the deployment of the European Data Portal⁴⁸ for facilitating discovery and access to European public data assets including those from Member States Open Data initiatives at the national, regional and local levels.
- ✓ Ensure the further development of the **European Open Science Cloud** as a key asset for the best use of AI in science and technology and in applications ranging from advanced medicine to environment and climate change. Include training and testing of data related algorithms to maximise the benefits of Open Data.
- ✓ Support the development of **blockchain-based and other secure solutions for giving access to data and securing the integrity of data**. The Commission is planning to make available EUR 27 million under H2020 in this area.
- ✓ **Health** is particularly primed to benefit from AI. Patient information, medical records, diagnostic results, and clinical studies are just a few of the data sources available in healthcare. The Commission proposes, as a matter of priority, to concentrate on two big projects:
 - (i) Following commitments made by 19 Member States towards building a research cohort of at least 1 million sequenced genomes accessible in the EU by 2022⁴⁹, the Commission will support an initiative on linking genomics repositories. The Commission will also support building rare disease registries. Organisational, regulatory, security, ethical and technical compliance and interoperability will be duly taken into account. This will be instrumental in allowing AI technologies to be studied, developed and trialled with a view to identifying new knowledge, support clinical research and decision making.
 - (ii) In 2020, the Commission will support – in coordination with Member States – the development of common database of health images initially dedicated to the most common forms of cancer (anonymised, and based on data donorship by patients). The work must meet all necessary organisational, regulatory, security, ethical and technical requirements. It will be combined with relevant AI tools to improve diagnosis, treatment and follow-up.

Overall, the initial EU contribution to these initiatives will be around EUR 35 million from the Horizon 2020 programme. Member States are encouraged to match this amount.

⁴⁸ <https://www.europeandataportal.eu/en/homepage>

⁴⁹ <https://ec.europa.eu/digital-single-market/en/news/eu-countries-will-cooperate-linking-genomic-databases-across-borders>

These initiatives and investments will be a basis for larger scale, common health data space with possible support, starting in 2021, from the Digital Europe Programme.

- ✓ **Geo-information /Earth Observation:** The EU's Copernicus Programme is the biggest provider of earth observation and monitoring information worldwide. Copernicus has adopted a free, full and open data policy and has launched advanced Data and Information Access Services (DIAS), which co-locate a massive amount of structured data and computing capacities. Building on this, the Commission proposes to develop and deploy AI capacities using Copernicus data and infrastructures to foster geo-location based services for climate, agriculture, air quality, emissions, the marine environment, water management, security and migration monitoring and citizen science⁵⁰. It will also launch initiatives to support AI powered exploitation of Earth observation data and information in the public and private sectors.
- ✓ **Linguistic data:** The Commission language resources used for the deployment of AI enabled automated translation and natural language processing services are among the most downloaded datasets on the European Data Portal. To further improve such services, the Commission is planning to make available an additional EUR 10 million from the Connecting Europe Facility to collect further language resources for languages less represented on the web.

Industrial data platforms: The Commission has already launched Research and Development actions on platforms for secure and controlled sharing of proprietary data under Horizon 2020 including industrial data spaces and personal data spaces⁵¹. On the basis of the Commission Communication "Towards a common European data space"⁵², a set of guidelines⁵³ with the aim of providing a toolbox for sharing of data by holders, users, or both was published. Building on this, the Commission will:

- ✓ In 2019, support strategic, next-generation digital industrial platforms through large scale federating projects with an investment of EUR 50 million from Horizon 2020 programme.
- ✓ Member States are encouraged to connect existing and planned national investments in platforms with EU level activities in order to ensure scale up and interoperability.
- ✓ Beyond 2020, the Commission proposes that the Union co-invests with Member States and the private sector in the creation of a common European Data Space that makes data easily available for re-use to innovators, businesses and public sector for up to EUR 1 billion through the Digital Europe Programme, as part of its AI section.
- ✓ Particular attention will be given to developing local ecosystems at the regional and sub-regional levels bringing together local businesses and SMEs, public administrations, training centres, Digital Innovation Hubs and technology infrastructures developing and sharing algorithms trained on high quality local data to address local problems. In this way upskilling and training are linked to local data spaces to foster innovation.

⁵⁰ The Commission has already set up a Framework Partnership Agreement with the Member States to co-finance the use and mainstreaming of space data from Copernicus and Galileo in combination with data available from Member States and other sources.

⁵¹ ICT-13-2018-2019 of [H2020 work programme 2018-2020 Information and Communication Technologies](#)

⁵² <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2018:0232:FIN>

⁵³ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1539766272141&uri=CELEX%3A52018SC0125>

Support centre for data sharing: The Commission will launch by mid-2019 a Support Centre for data sharing, to propose model contracts for the sharing of private sector data, provide practical advice, best practices and methodologies for data sharing and data analytics to all European actors in the data economy.

European High-Performance Computing initiative (EuroHPC): The Commission and Member States will work together on the timely implementation of the EuroHPC initiative in order to develop a pan-European supercomputing infrastructure, which will be critical for AI.

F. Ethics by design and regulatory framework

An appropriate and predictable, ethical and regulatory framework that relies on effective safeguards for the protection of fundamental rights and freedoms is vital for citizens to trust AI and for companies, in need of investment security, to take up new business opportunities. Spearheading the ethics agenda, while fostering innovation, has the potential to become a competitive advantage for European businesses on the global marketplace. In addition, the emerging uptake of AI in the public sector is also bound to raise similar ethical and fundamental rights concerns which need to be addressed up-stream.

As announced in the “Artificial Intelligence for Europe” strategy, the Commission tasked a High-Level Expert Group on AI to draft AI ethics guidelines⁵⁴. A first draft of these guidelines will be ready in December 2018, and a final version is expected for March 2019, after wide consultation through the European AI Alliance⁵⁵. One key principle will be “ethics by design” by which ethical principles are embedded in AI products and services right at the beginning of the design process.

It is important that legislation offers the right framework for AI-driven innovation and uptake of AI solutions, while addressing possible risks raised by the use of, and interactions with the technology, including cybersecurity concerns. This means to provide for “cybersecurity” in the sense of preventing abuse (e.g. hacking or manipulation of the AI algorithms or manipulation of the data processed by the AI algorithm), as well as for the inclusion of mechanisms to ensure the safety of consumers and effective redress to victims in case of damage and to facilitate investigations if the AI system is compromised. AI cyber security requirements would need to be specified and should benefit from the certification scheme under the proposed European Cybersecurity Certification Framework⁵⁶. Moreover, in case of businesses acting in security relevant fields (e.g. financial institutions, producers of radio-active materials, etc.) the use of certain AI products and processes serves public interest therefore their use may be made compulsory.

An adequate safety and liability framework guaranteeing a high level of safety and effective redress mechanisms for victims in case of damages is essential for building trust in AI.

⁵⁴ <https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence>. This work builds on the work of the European Group on Ethics in Science and New Technologies.

⁵⁵ http://ec.europa.eu/research/ege/pdf/ege_ai_statement_2018.pdf

⁵⁶ <https://ec.europa.eu/digital-single-market/en/european-ai-alliance>

⁵⁶ <https://ec.europa.eu/digital-single-market/en/eu-cybersecurity-certification-framework>

Moreover, with the appropriate safeguards in place, regulatory sandboxes, and other methods for policy experimentation and development, can play an important role to encourage AI based innovation for areas where the law provides regulatory authorities with a sufficient margin of manoeuvre. In 2019, a focus will be put on assessing whether the regulatory framework in Europe is fit for purpose for AI-enabled technologies in general and for connected and automated driving in particular.

Innovation Deals⁵⁷ can serve as tools within the boundaries of existing legislation for assessing regulatory barriers linked to the development and deployment of AI. Innovation Deals are voluntary cooperation agreements between the EU, innovators, and national, regional and local authorities. The objective of an Innovation Deal is to gain an in-depth understanding of how an EU rule or regulation works in practice. If the rule or regulation is found to be an obstacle to innovations, the deal will make it visible and feed into possible further action.

Other important elements for creating an integrated European home market for AI-enhanced products, services and applications are, for example, data protection and privacy⁵⁸, consumer protection and compliance with competition law by design. In addition, important considerations for the development and uptake of AI in particular in areas with a high societal and policy stake are related to fairness, transparency and accountability of algorithmic decision-making and related governance models⁵⁹ and impact of AI on human behaviour⁶⁰.

Finally, intellectual property (IP) issues should also be explored, to ensure that the related regulatory framework properly addresses a number of challenges that are specific to AI, and is thus able to promote its development effectively.

Ethics by design and the regulatory framework

- ✓ The Commission tasked a High-Level Expert Group on AI to draft **AI ethics guidelines**. A final version is expected for March 2019.
- ✓ The Commission will firmly respect and anchor the “ethics by design” principle in its calls for proposals that deal with artificial intelligence.
- ✓ **The Commission, taking into account the input from the Member States, is assessing whether and to what extent the existing legislation is fit for purpose** to allow for the new opportunities and tackle the challenges raised by AI, taking into account the policy

⁵⁷ https://ec.europa.eu/info/research-and-innovation/law-and-regulations/identifying-barriers-innovation_en

⁵⁸ Building on the existing regulatory framework such as the General Data Protection regulation which entered into application in May 2018.

⁵⁹ Regulatory approaches in the [General Data Protection Regulation](#), the [Markets in Financial Instruments Directive](#), the [proposal for a regulation on promoting fairness and transparency for business users of online intermediation services](#), the [Commission Recommendation on measures to effectively tackle illegal content online](#) proposal, all set a precedent and models for meaningful transparency and risk assessment and risk management. The Commission is further exploring (supported by the European Parliament AlgoAware pilot project) areas of concern and opportunities in algorithmic decision making in the online platforms environment, where different approaches to meaningful transparency, fairness and accountability can enhance trust. The analysis is carefully considering the balance set by the regulatory framework in place and the enforcement of recent rules, as well as technical, market and societal developments, and exploring policy and regulatory tools.

⁶⁰ The Joint Research Centre HUMAINT project aims to understand the impact of AI on human behaviour, with a focus on cognitive and socio-emotional capabilities and decision making (<https://ec.europa.eu/jrc/communities/community/humaint>).

recommendations proposed by the AI High-Level Expert Group.

- ✓ By mid-2019, the Commission will publish a report on potential gaps in and orientations for the safety and liability framework for AI.
- ✓ The Commission is ready to support stakeholders on the application of EU rules to the development and deployment of AI, for example in the fields of competition and State aid, where necessary and in the appropriate format.
- ✓ **In 2019 Member States and Commission will discuss the creation of environments⁶¹ that are conducive to innovation such as regulatory sandboxes⁶², and public testing arrangements for specific AI applications in Europe.** Following these discussions Member States will be encouraged to create such environments and public testing arrangements for AI solutions by the end of 2020. To this end, Member States will be encouraged to establish a one-stop-shop for companies that are developing AI applications to discuss the specific needs for the creation of such environments and testing arrangements.

G. AI for the Public Sector

AI applications can contribute to better public services in a variety of ways, for example by enabling smarter analytical capabilities and better understanding of real-time processes (e.g. population, economic, environmental and climate change) in economy, society and environment, including the detection of criminal activities such as tax fraud and money laundering.

AI-enabled solutions can deliver shorter and richer feedback loops for all levels of governance, providing an opportunity to speed up, improve the efficiency and effectiveness of service delivery. They have the potential to:

- increase the quality and consistency of services delivered,
- improve the design and implementation of policy measures,
- allow more efficient and targeted interventions,
- enhance the efficiency and effectiveness of public procurement, and
- strengthen security, identity management, improve health and employment services.

For beneficiaries of public support, AI-enabled decision can simplify the relationship between authorities and beneficiaries through the integration of wider public interest or regulatory considerations in daily decision-making (through targeted communication, behavioural nudges etc.)

AI can improve citizen-government interaction through conversational systems (including digital assistants and government chatbots), multilingual services and automated translation.

⁶¹ While regulatory sandboxing is a powerful and sometimes needed tool, in other circumstance innovation can be supported with softer approaches such as innovation centers and policy labs that advice and participate more or less hands on.

⁶² For selected areas where the law provides regulatory authority with a sufficient margin of manoeuvre.

Efforts are also under way to apply AI in the social and health sector, to support doctor's decision making, or to support early recognition of young people's marginalisation.⁶³

As outlined above, concrete measures are proposed to open up public sector data for the use by AI applications in areas of public interest such as for medical images or genomics.

Member States are encouraged to engage in peer-learning with other Member States, especially with respect to regulatory sandboxes and testing arrangements.

AI for the public sector

- ✓ Building on and scaling up current investments engaged under the Digital Service Infrastructure actions in the current Connecting Europe Facility Programme and ISA² Programme, the Union will progressively increase efforts for the take-up of AI in areas of public interest, such as healthcare, transport, security and education. Beyond 2020 under the proposed Digital Europe Programme, Member States and the Union will co-invest in the full deployment of EU-wide AI-enabled services in areas of public interest.
- ✓ **In 2019, Member States and the Commission are planning to engage in peer-learning** and EU-wide exchange of best practices, experiences and data⁶⁴. They will work together to produce an overview of the relevant applications already in place in the Member States, their impact and added value in support of public service delivery. The Commission is also ready to assist public buyers, for instance by setting up an assistance hub for purchasing AI and cybersecurity solutions. One concrete example is the framework of the European Public Employment Services (PES) Network, where national PES will exchange best practices on AI in service delivery, in matching and automatic processes.⁶⁵
- ✓ **Member States are encouraged to work with the Commission to identify areas for joint procurement of AI solutions**, leading to efficiency gains and better value for money. One concrete example are AI-powered self-healing systems in cybersecurity where the combined buying power of the Union and all Member States can facilitate the development and scaling up of EU-developed solutions. The aim is to issue a joint report by mid-2019 to describe areas where joint procurement is envisaged. Beyond 2020 the Commission proposes to begin work under the new Digital Europe Programme.
- ✓ **In 2019, the Commission is planning to offer eTranslation**, the AI-enabled automatic translation service developed under the Connecting Europe Facility, to public administrations in Member States. The Commission proposals for the Horizon Europe and the Digital Europe programmes foresee investments in further developing natural language processing services and tools to enhance multilingualism in the public sector.

⁶³ <https://www.sitra.fi/en/news/artificial-intelligence-based-systems-help-achieve-better-services-cost-savings-social-health-sector/>

⁶⁴ The European Commission is walking the talk and deploying actions in the AI@EC action plan to support deployment of AI solutions in Trans-European Systems (TES) supporting key EU policy areas in cooperation with Member States.

⁶⁵ A second example is the activity foreseen under AI Watch to develop a methodology to identify risks and opportunities, drivers and barriers of the use of AI in public service provision. AI Watch will provide an overview of the use and added value of AI tools supporting public service delivery by looking at most relevant examples in prioritized public services. Based on the results of the analysis the task will draw up recommendations on the way forward for further development of AI based systems and solutions in government. Another example is the co-innovation initiatives between the European Commission and Member States on the deployment of AI-based solutions for smart public services.

- ✓ **In 2020**, in line with the Tallinn Ministerial Declaration on eGovernment, Member States, with the support of the Commission, and in particular exploiting the role of the DIHs proposed under the next multi-annual financial framework, are encouraged to devote resources for experimentation with AI-enabled services to understand better the added value and potential impact of AI-enabled public services and policy making. AI-based solutions will also benefit the justice⁶⁶ and law enforcement sectors. Another promising public application sector is the monitoring and enforcement of single market rules for goods, services and people.
- ✓ **Member States and the Commission** are planning to continue to develop integrated earth observation and AI machine learning solutions to support evidence-based policy making, implementation and monitoring in areas such as climate change, environmental protection, agriculture, urban development, disaster response, migration, infrastructure monitoring.

H. International cooperation

With AI currently being discussed all around the world and in many international fora such as the UN, OECD, the G7 or the G20⁶⁷, international outreach is crucially important. The development of AI will benefit from international cooperation, in particular among advanced countries with research and innovation strengths and investments in AI. The joint development of international standards will facilitate AI deployment and acceptance. The Union will promote the AI ethics guidelines internationally and open up a dialogue and cooperation with all non-EU countries and stakeholders from third countries that are willing to share the same values.

To make these efforts a success, however, Member States and the Union should attempt to align bilateral outreach efforts related to AI between individual Member States and third countries and pool their efforts pushing for a responsible development of AI at the global level. The Union needs to speak with one voice to third countries and the world at-large on this topic. In synergy with activities of the Member States, the EU should also seek alliances with stakeholders - tech companies, academia and other parties - to engage in a multi-stakeholder alliance at the global level for responsible AI.

Moreover, the Union will organise an international ministerial meeting on AI in the first half of 2019 with the aim of forging a global consensus on the ethical implications of AI. Furthermore, the EU is using its Foreign Policy Instrument to engage with international partners on regulatory and ethical matters. Some Member States propose an intergovernmental process similar to the panel on Climate Change. As regards the international security dimension, the AI policy will build on the work of the High Representative in the Global Tech Panel and within the United Nations and other multilateral fora.

Finally, the Union will contribute its expertise and dedicated financial means to anchor AI more firmly in **development policy**. Artificial intelligence is destined to make impactful contributions to global challenges as well as development policy. AI-powered precision farming, for example, promises to reduce pesticides, fertiliser and water consumption, making

⁶⁶ E.g. solutions based on predictive justice implementations and LegalTech applications.

⁶⁷ ISO/IEC JTC1/SC 42

it an ideal technology to help a growing population in the developing world. AI can also be used to model weather, climate and other natural phenomena so that local populations can e.g. be warned in case of extreme weather conditions or imminent disasters and adapt in advance. AI and digital technologies can underpin affordable high-tech solutions including for people in precarious circumstances, while respecting ethical and privacy issues.

International Cooperation

- ✓ The Union will reach out to its **international partners and promote AI ethics guidelines** internationally in the course of 2019.
- ✓ Member States and the Union are encouraged to align their international outreach efforts on AI and ensure that Europe sends consistent messages to the world.
- ✓ The Union will organise **an international ministerial meeting on AI in 2019** with the aim of forging a global consensus on the ethical implications of AI.
- ✓ The Union will contribute its expertise and dedicated financial means to anchor AI more firmly in **development policy**. A particular focus will be given to Southern Mediterranean countries and Africa.

Links:

Commission Communication 'Artificial Intelligence for Europe'

<https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe>

Declaration of cooperation on Artificial Intelligence

<https://ec.europa.eu/digital-single-market/en/news/eu-member-states-sign-cooperate-artificial-intelligence>

AI Alliance

<https://ec.europa.eu/digital-single-market/en/european-ai-alliance>