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**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

1. INTRODUCTION – THE EUROPEAN AI STRATEGY

Like electricity in the past, artificial intelligence (AI) is transforming our world. It is at our fingertips, when we translate texts online or use a mobile app to find the best way to go to our next destination. At home, a smart thermostat can reduce energy bills by up to 25% by analysing the habits of the people who live in the house and adjusting the temperature accordingly¹. In healthcare, algorithms can help dermatologists make better diagnosis, for example detecting 95% of skin cancers by learning from large sets of medical images².

By making sense of vast amounts of data to offer efficient solutions, AI improves products, processes and business models in all economic sectors. It can help companies identify which machines will need maintenance before they break down. AI also transforms public services.

Artificial Intelligence refers to systems that display intelligent behaviour by analysing their environment and taking action — with some degree of autonomy — to achieve specific goals.

We are using AI on a daily basis, for example to block email spam or speak with digital assistants.

Growth in computing power, availability of data and progress in algorithms have turned AI into one of the most important technologies of the 21st century.

The changes brought by AI also raise concerns. Workers fear they will lose their job because of automation, consumers wonder who is responsible in case a wrong decision is taken by an AI-based system, small companies do not know how to apply AI to their business, AI start-ups do not find the resources and talent they need in Europe, and international competition is fiercer than ever with massive investments in the US and China.

To address these challenges and make the most of the opportunities offered by AI, the Commission published a European strategy³ in April 2018. The Commission proposed an approach that places people at the centre of the development of AI (human-centric AI) and encourages the use of this powerful technology to help solve the world's biggest challenges: from curing diseases to fighting climate change and anticipating natural disasters, to making transport safer⁴ and fighting crime and improving cybersecurity.

This strategy supports an ethical, secure and cutting-edge AI made in Europe. It builds on Europe's scientific and industrial strengths⁵ and is based on three pillars: increasing public and private investments in AI, preparing for socio-economic changes, and ensuring an appropriate ethical and legal framework. **To ensure its success, coordination at European level is essential.**

¹ <https://www.la Tribune.fr/entreprises-finance/la-tribune-de-l-energie-avec-erdf/cinq-objets-connectes-pour-economiser-l-energie-545571.html>

² <https://www.theguardian.com/society/2018/may/29/skin-cancer-computer-learns-to-detect-skin-cancer-more-accurately-than-a-doctor>

³ COM(2018) 237

⁴ It is estimated that around 90% of road accidents are caused by human errors, see COM(2016) 787.

⁵ Europe has world-class researchers and start-ups in AI, is a leader in robotics and business-to-business software/platforms. Its strong transport, healthcare and manufacturing sectors should be at the forefront of AI.

2. THE COORDINATED PLAN ON AI – OVERVIEW

In its strategy on AI for Europe, the Commission proposed to work with Member States on a coordinated plan on AI by the end of 2018, with the aim to maximise the impact of investments at EU and national levels, encourage synergies and cooperation across the EU, exchange best practices and collectively define the way forward to ensure that the EU as a whole can compete globally. The proposal of a coordinated plan built on the **declaration of cooperation on AI** launched in April 2018 at the Digital Day and signed by all Member States and Norway⁶. It was **endorsed by the European Council in June 2018**⁷.

Member States (as part of the group on digitising European industry and AI), Norway, Switzerland and the Commission prepared the plan during several meetings between June and November 2018. Exchanges also took place during Competitiveness Council meetings under the Austrian Presidency of the EU.

During these meetings, Member States and the Commission identified a series of common actions to increase investments, pool data – the raw material for AI -, foster talent and ensure trust⁸, building on the European strategy. They prioritised areas of public interest, such as healthcare, transport and mobility, safety, security and energy, as well as important economic sectors such as manufacturing and financial services.

The result of this joint work, the coordinated plan, is the annex to this Communication. It details actions to be started in 2019-2020 and prepares the ground for activities in the following years. It will be reviewed and updated annually.

This Communication highlights the main objectives and initiatives of the plan.

2.1. Common objectives and complementary efforts

The coordinated plan provides a strategic framework for national AI strategies. As of today, five Member States have already adopted a national AI strategy with a dedicated budget⁹. All other **Member States are encouraged to develop their national AI strategy by mid-2019, building on the work done at the European level**. These are expected to outline investment levels and implementation measures.

In the course of next year, Member States and the Commission will also agree on common indicators to monitor AI uptake and development in the Union and the success rate of the strategies in place, with the support of the AI Watch developed by the Joint Research Centre of the Commission¹⁰.

⁶ <https://ec.europa.eu/digital-single-market/en/news/eu-member-states-sign-cooperate-artificial-intelligence>

⁷ <https://www.consilium.europa.eu/en/press/press-releases/2018/06/29/20180628-euco-conclusions-final/>

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

⁹ 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 their broader digitisation strategies. Austria, Belgium, the Czech Republic, Denmark, Estonia, Germany, Italy, Latvia, Poland, Portugal, Slovenia, Slovakia and Spain are in the process of developing strategies.

¹⁰ https://ec.europa.eu/knowledge4policy/ai-watch_en

Europe is currently behind in private investments in AI¹¹. Without major efforts, the EU risks losing out on the opportunities offered by AI, facing a brain-drain and being a consumer of solutions developed elsewhere. This is why the European AI strategy has set ambitious, yet realistic, targets: **in the Union, public and private investments in AI must be scaled up in order to reach the target of EUR 20 billion per year over the next decade**. As a first step, the Commission is increasing investment in AI under the research and innovation framework programme Horizon 2020 to EUR 1.5 billion in the period 2018-2020. This amount corresponds to a 70% increase relative to period 2014-2017. If Member States and the private sector make similar efforts, total investments in the Union will grow to more than EUR 20 billion for the period 2018-2020¹², thus positioning the Union to further increase efforts over the next decade, with investment gradually reaching EUR 20 billion per year. This would correspond to an annual investment of EUR 7 billion by the public sector (Member States and Commission), on par with other continents. **The Commission proposed, under the next programming period 2021-2027, that the Union invests in AI at least EUR 1 billion per year from Horizon Europe and the Digital Europe programmes**¹³.

Taking these targets into account, Member States have agreed that ambition is required and that national efforts need to be increased. Coordinated public efforts will help leverage more private investments.

While public investment plays an important role, an important duty for regulators is to eliminate the obstacles due to **fragmented markets**. Products and services are increasingly interlinked and digitised. In this context, it is of utmost importance to avoid market fragmentation in strategic sectors such as artificial intelligence, including by strengthening key enablers (e.g. common standards and fast communication networks). A real Single Market with an integral digital dimension¹⁴ **will make it easier for businesses to scale up and trade across borders** and thereby further boost investments.

2.2. Towards a European AI public-private partnership and more financing for start-ups and innovative small and medium-sized enterprises¹⁵

Member States and the Commission will also reinforce cooperation with the private sector. The Commission will bring companies and research organisations together to develop a common strategic research agenda on AI, defining priorities in line with the needs of the market and encouraging exchanges between sectors and across borders. **This will pave the way for a new research and innovation partnership on AI, fostering collaboration between academia and industry in Europe**. As part of this contractual partnership, the private sector is expected to commit to specific and high investments in AI. This partnership

¹¹ Europe totalled around EUR 2.4-3.2 billion in 2016, compared with EUR 6.5-9.7 billion in Asia and EUR 12.1-18.6 billion in North America. Source: 10 imperatives for Europe in the age of AI and automation, McKinsey, 2017.

¹² This may include investments from European Structural and Investment Funds. Five regions have AI related priorities in their smart specialisation strategies: Lower Saxony [DE], Pohjois-Savo [FI], Łódzkie [PL], North-West [RO] and North-East [RO]. See: <http://s3platform.jrc.ec.europa.eu/map>

¹³ The proposals for the next multiannual financial framework, in particular the new Digital Europe Programme and Horizon Europe, the most ambitious ever EU research and innovation framework programme, support the European AI strategy.

¹⁴ See the Commission's recent communication "The Single Market in a changing world" (COM(2018)772).

¹⁵ See section B of the coordinated plan for details on the proposed actions.

will build on existing partnerships in robotics and big data¹⁶, representing EUR 4.4 billion of investments, of which the majority (EUR 3.2 billion) comes from the industry. Stakeholders have already confirmed their support for setting up an AI partnership¹⁷.

Moreover, the Commission aims at making available resources for start-ups and innovators in AI and blockchain to help them grow their business. EUR 100 million should be initially mobilised in 2020, which could be further complemented through the participation of interested national promotional banks and other institutions. This could help prepare for strengthening access to finance for AI under the InvestEU programme from 2021 onwards.

At the same time, the Commission is making progress in setting up the **European Innovation Council** to support cutting-edge technologies and the most innovative start-ups. In response to the call of the European Council in June 2018¹⁸, a new pilot initiative¹⁹ will be launched in early 2019 and will include support for the next generation of human-centric AI technologies.

2.3. Strengthening excellence in trustworthy AI technologies and broad diffusion²⁰

Member States and the Commission aim to scale up national research capacities and reach critical mass through **tighter networks of European AI research excellence centres**. The objective is to foster cooperation among the best research teams in Europe, so that by joining forces they can tackle major scientific and technological challenges in AI more efficiently.

Bringing state-of-the-art AI applications to the market requires experimenting and testing in real-world environments. As part of the implementation of the Digitising European Industry strategy²¹ adopted in 2016, the Commission is already supporting large-scale pilots and experiments in areas such as smart farming, smart cities and connected and autonomous vehicles.

Lessons will be drawn from these pilots and experiments. To optimise investment and avoid duplication of efforts, the Commission proposes that **several large-scale reference test sites, open to all actors across Europe, will be developed using up to EUR 1.5 billion** from the AI strand of the proposed Digital Europe programme, building on the strong base of existing centres of excellence in Member States. Examples of testing facilities that Member States are putting in place include the cross-border testing of connected and autonomous driving²² and real scale experimentation of smart hospitals. In the case of connected and autonomous mobility, the identification of such testing facilities and the tests themselves will be coordinated, first, by the single EU-wide platform referred to in the EU strategy for mobility

¹⁶ Public-private partnerships on robotics ('SPARC') and big data ('Big Data Value') represent EUR 1.2 billion in public investment plus EUR 3.2 billion in private investment for 2014-2020, giving EUR 4.4 billion in total.

¹⁷ The Big Data Value Association, the private partner in the big data public-private partnership, has adopted a position paper on AI which includes a recommendation to move towards a partnership on AI (November 2018). <http://bdva.eu/sites/default/files/AI-Position-Statement-BDVA-Final-12112018.pdf>

¹⁸ <https://www.consilium.europa.eu/en/press/press-releases/2018/06/29/20180628-euco-conclusions-final/>

¹⁹ In 2018 alone, 74 innovative SME-projects and start-ups have been funded to develop AI related innovations in the European Innovation Council pilot phase.

²⁰ See section C of coordinated plan for details on proposed actions.

²¹ COM(2016) 180

²² <https://ec.europa.eu/digital-single-market/en/cross-border-corridors-connected-and-automated-mobility-cam>

of the future²³ and, subsequently, by the corresponding partnership to be established under Horizon Europe.

It is equally important to foster the broadest possible uptake of AI in the economy, in particular by start-ups and small and medium-sized enterprises. By raising public awareness and sharing the latest scientific advances and tried and tested state-of-the-art technologies developed in Europe, we can ensure that every company, small or large, high-tech or not, as well as the public sector, can grasp these digital opportunities. The proposed new Digital Europe programme provides for co-investment by Member States and the Commission in **digital innovation hubs** across Europe, including via the Cohesion Policy funds. The programme will further facilitate the diffusion of AI capacity in each Member State and will link to an AI on-demand-platform²⁴. To this end, in 2019 Member States will identify AI digital innovation hubs in their territory.

2.4. Adapting our learning and training programmes and systems to better prepare our society for AI²⁵

Rapid technological progress means that the world of work will be significantly transformed, and sooner rather than later. In particular, technological changes will modify the skills required of workers, meaning that potentially very large numbers of workers will need to up-skill. Thus, more focus needs to be put on life-long learning. One specific aspect of change concerns those workers who will actually design and implement the AI solutions of the future. Almost all Member States are facing shortages of Information and communications technology professionals, and there are currently more than 600 000 vacancies for digital experts²⁶. Moreover, talented researchers and promising start-ups frequently receive interesting offers from abroad. For example, in 2017 there were 240 000 Europeans in Silicon Valley²⁷, many of whom entered the US to fill a specific job in the tech industry. Europe must be able to train, attract and retain talent of this kind, and encourage entrepreneurship, diversity and gender balance.

Member States will therefore exchange best practices on how to reinforce excellence and retain talented workers, as well as on how to step up and accelerate efforts to fully introduce and exploit the possibilities offered by the current legal migration acquis, including the blue card²⁸, to attract talent. The blue card is a work permit allowing high-skilled non-EU citizens to work and live in the EU. Skills should also be covered in the national AI strategies which are to be published by mid-2019. The strategies should address AI-relevant skills within the formal education cycle, including in vocational training and higher education, as well as ways to improve opportunities for Masters and PhDs in AI.

The Commission will support Masters and PhDs in AI through the proposed closer cooperation between AI research excellence centres and, more broadly, the EU's research and innovation programmes. Interdisciplinarity will be supported by encouraging joint degrees,

²³ COM(2018) 283

²⁴ <http://ai4eu.org/>

²⁵ See section D of coordinated plan for details on proposed actions.

²⁶ https://www.pocbigdata.eu/monitorICTonlinevacancies/general_info/

²⁷ <https://jointventure.org/images/stories/pdf/index2018.pdf>

²⁸ Council Directive 2009/50/EC on the conditions of entry and residence of third-country nationals for the purposes of highly qualified employment. The Commission made a proposal to review this act - COM(2016) 378.

for example in law or psychology and AI. Moreover, digital skills that facilitate the development and use of AI, should be included in all education and training curricula.

Given the disruptive nature of many of the technological advances, policy-makers will develop strategies to deal with employment changes in order to ensure inclusiveness, as the pace with which some jobs will disappear and others appear is likely to accelerate, while business models and the way tasks or jobs are performed will change. This may make it necessary to modify current labour market and social protection arrangements to support transitions in the labour market. The Commission has established a high-level expert group on the impact of the digital transformation on EU labour markets that will deliver a report addressing these issues in spring 2019²⁹.

2.5. Building up the European data space essential for AI in Europe, including for the public sector³⁰

Further developments in AI require a well-functioning data ecosystem built on trust, data availability and infrastructure³¹. The General Data Protection Regulation (GDPR)³² is the anchor of trust in the single market for data. It has established a new global standard with a strong focus on the rights of individuals, reflecting European values, and is an important element of ensuring trust in AI. This trust is especially important when it comes to the processing of healthcare data for applications driven by AI. The Commission would like to encourage the European Data Protection Board to develop guidelines on the issue of the processing of personal data in the context of research. This will facilitate the development of large cross-country research datasets that can be used for AI.

AI needs vast amounts of data to be developed. Machine learning, a type of AI, works by identifying patterns in available data and then applying the knowledge to new data. The larger a data set, the better AI can learn and discover even subtle relations in the data.

Once trained, algorithms can correctly classify objects that they have never seen, in more and more cases with accuracies that exceed those of humans. Hence, access to data is a key ingredient for a competitive AI landscape, which the EU should facilitate in full respect of personal data protection rules.

The entry into application of the free flow of non-personal data Regulation³³ in the course of 2019 will help unlock data, in particular machine-generated data, and greatly ease the cross-border operation of businesses in the Union. 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.

²⁹ <https://ec.europa.eu/digital-single-market/en/news/appointment-members-high-level-expert-group-impact-digital-transformation-eu-labour-markets>

³⁰ See sections E and G of the coordinated plan for details of the proposed actions.

³¹ "Data is the lifeline of AI" see chapter 12 of the Joint Research Centre Report on "Artificial Intelligence: a European Perspective" <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/artificial-intelligence-european-perspective>

³² Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data.

³³ Regulation (eu) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a framework for the free flow of non-personal data in the European Union

Agreement on the review of the Public Sector Information Directive³⁴ will also increase the amount of data available for innovation.

The creation of common European data spaces in a number of areas such as manufacturing or energy will constitute a major asset for European innovators and businesses. These common European data spaces will aggregate data, both for public sector and for business-to-business, across Europe and make them available to train AI³⁵ on a scale that will enable the development of new products and services. Rapid development and adoption of European rules such as interoperability requirements and standards is essential. The Union must also provide support to ensure the seamless access to, exchange and reuse of such data sets. The identification of high-value data sets by Member States will help make them more openly reusable. The Commission also contributes with large quantities of earth observation data and information from its flagship Copernicus programme.

AI applications in healthcare are particularly promising. **In 2020 the Commission will support via Horizon 2020 — in coordination with Member States — the development of a common database of health images** (anonymised, and based on patients voluntarily donating their data). This image database will initially be dedicated to the most common forms of cancer, **using AI to improve diagnosis and treatment**. The work will meet all necessary regulatory, security, and ethical requirements.

AI tools are crucial to the future work of public administrations. Member States and the Commission will engage in peer learning and discuss areas for **joint procurement of AI solutions, including cybersecurity**, as well as specific challenges for the public sector. When AI is implemented, for example, for security and law enforcement, particular legal and ethical challenges arise, considering that public administrations are bound to act as prescribed by law, that they need to motivate their decisions and that their acts are subject to judicial review by administrative courts.

Finally, computing capacity is essential to process data. The European High-Performance Computing Initiative³⁶ (EuroHPC) is pooling resources to develop the next generation of supercomputers to process big data and train AI. In that context, the ongoing partnership with Member States and industry on microelectronic components and systems (ECSEL³⁷) as well as the European Processor Initiative³⁸, which aims at creating low-power processor technology for high-performance computing, data-centres and autonomous vehicles, are key to developing an independent and innovative European ecosystem in high-end chip design.

2.6. Developing ethics guidelines with a global perspective and ensuring an innovation-friendly legal framework³⁹

To gain trust, which is necessary for societies to accept and use AI, the technology should be predictable, responsible, verifiable, respect fundamental rights and follow ethical rules.

³⁴ Proposal for a Directive of the European Parliament and of the Council on the re-use of public sector information (recast) COM(2018) 234.

³⁵ Links to data repositories will be made available through the AI-on-demand platform, providing services to the AI community.

³⁶ <https://ec.europa.eu/digital-single-market/en/eurohpc-joint-undertaking>

³⁷ <https://www.ecsel.eu/>

³⁸ <https://ec.europa.eu/digital-single-market/en/news/european-processor-initiative-consortium-develop-europes-microprocessors-future-supercomputers>

³⁹ See sections F and H of coordinated plan for details on proposed actions.

Otherwise, the use of AI may lead to undesirable outcomes, such as creating an echo chamber where people only receive information which corresponds to their opinions, or reinforcing discrimination, as in the case where an algorithm turned racist within 24 hours due to exposure to racist material⁴⁰.

Crucially, humans should understand how AI makes decisions. Europe can become a global leader in developing and using AI for good and promoting a human-centric approach and ethics-by-design principles.

To anchor such principles more firmly in the development and use of AI, the Commission appointed an independent AI high-level expert group with the task of developing draft AI ethics guidelines. **A first version will be published by the end of 2018 and the experts will present their final version of the guidelines to the Commission in March 2019 after wide consultation through the European AI Alliance**⁴¹. The ambition is then to bring Europe's ethical approach to the global stage. The Commission is opening up cooperation to all non-EU countries that are willing to share the same values.

Further developments in AI also require a regulatory framework that is flexible enough to promote innovation while ensuring high levels of protection and safety. The Commission is in the process of assessing whether the national and EU safety and liability frameworks are fit for purpose in light of these new challenges or whether any gaps should be addressed. To this end the Commission will publish by mid-2019 a report on the potential gaps in and orientations for the safety and liability frameworks for AI.

2.7. Security-related aspects of AI applications and infrastructure, and international security agenda

There is a need to better understand how AI can impact security in three dimensions: how AI could enhance the objectives of the security sector; how AI technologies can be protected from attacks; and how to address any potential abuse of AI for malicious purposes.

The increasing potential and sensitivity of AI applications in many areas of the digital economy and society, such as autonomous mobility or avoiding power blackouts, means it is highly relevant to establish cybersecurity requirements for AI.⁴²

The application of AI in weapons systems has the potential to fundamentally change armed conflicts and therefore raises serious concerns and questions. The Union will continue to stress that international law, including International Humanitarian Law and Human Rights Law, applies fully to all weapons systems, including autonomous weapons systems, and that States remain responsible and accountable for their development and use in armed conflict. The EU's position further remains that human control must be retained in decisions on the use of lethal force and built into the full life-cycle of any weapons system⁴³.

⁴⁰ <https://www.theguardian.com/technology/2016/mar/24/tay-microsofts-ai-chatbot-gets-a-crash-course-in-racism-from-twitter>

⁴¹ <https://ec.europa.eu/digital-single-market/en/european-ai-alliance>

⁴² This principle is set out in the Cybersecurity Joint Communication of September 2017 (JOIN(2017) 450).

⁴³ The High Representative of the Union for Foreign Affairs and Security Policy will, with the support of the Commission, build on consultations in the United Nations, the Global Tech Panel, and other multilateral fora, and coordinate proposals for addressing these complex security challenges.

3. CONCLUSIONS

AI is already a part of our daily lives, but its potential is much larger than we have seen so far. For Europe to become a leading player in AI, it needs to build on its strengths and support the development of an ethical, secure and cutting-edge AI made in Europe.

The Commission therefore invites:

- the European Council to endorse the coordinated plan;
- Member States to implement the coordinated plan, including the development of national AI strategies by mid-2019, outlining investment levels and implementation measures;
- the co-legislators to swiftly adopt the remaining legislative initiatives which are essential for the success of the European AI strategy, including the proposals put forward in the context of the next multi-annual financial framework.