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Veröffentlichungsversion / Published Version

Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:

Luise, G. (2024). The European Path to Artificial Intelligence: The Innovation of the 21st Century. *Perspective Politice*, 17, 99-106. <https://doi.org/10.25019/perspol/24.17.0.10>

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How to cite this paper:

Luise, G. (2024). The European Path to Artificial Intelligence: The Innovation of the 21st Century. *Perspective Politice*. Pages [99-106].

<https://doi.org/10.25019/perspol/24.17.0.10>

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Article

The European Path to Artificial Intelligence: The Innovation of the 21st Century

Abstract: *The contribution provides an overview of the European path towards artificial intelligence as a 21st century innovation. European institutions have played a significant role in the development and adoption of AI, addressing challenges and opportunities along the way. Over the years, the European Union (EU) has promoted initiatives and strategies to foster research, development and responsible use of AI as part of policies aimed at innovation and competitiveness. The European path towards AI is characterised by a commitment to foster collaboration between public and private sectors, to ensure ethical and regulatory standards, and to create a favourable ecosystem for the growth and deployment of AI across Europe.*

This approach reflects an awareness of the strategic importance of AI for Europe's economy, society and global competitiveness in the 21st century.

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Keywords: *artificial intelligence; competitiveness; Europe; innovation; institutions.*

1. Introduction: a definition of “Artificial Intelligence”

The birth of the concept of Artificial Intelligence (AI) has been influenced by a combination of theories, scientific discoveries, and human aspirations that have evolved over the centuries. Giving a complete definition of artificial intelligence is a particularly difficult task and, in fact, many definitions have followed one another over time, especially in recent years thanks to renewed attention from political institutions on the delicate subject (Tomassini, 2001). Suffice it to mention, among the most recent, the European Commission's communication of 25 April 2018, which defines artificial intelligence as the characteristic that distinguishes systems that “exhibit intelligent behaviour by analysing their environment and performing actions, with a certain degree of autonomy, to achieve specific goals” (Communication from the Commission,

2018a; 2018b). A more convincing definition, however, appears to be the one given by Turing in his famous 1950 essay in which he argued that rather than defining what intelligence is, which is a very difficult task, it would be appropriate to compare the results of a given process. If the process could have been qualified as intelligent when performed by a human being, then it could also be defined as intelligent when performed by a machine. Thus, simplifying, according to Turing, artificial intelligence could and can be defined as the science of making computers do things that require intelligence when done by humans (Crevier, 1993).

What is, however, considered the first real definition of artificial intelligence dates back to 31 August 1955, the date of publication of the Proposal for the Dartmouth Summer Research Project on Artificial Intelligence (McCarthy et al., 1955), an invitation to scholars from various disciplines to participate in «a two-month, 10-men study of artificial intelligence to be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire» (McCorduck, 2004). The document is considered to be the first occasion on which the term artificial intelligence was used (Russell and Norvig, 2020) and bore the signatures of John McCarthy, the initiator of the initiative and at the time a mathematician at Dartmouth University; Claude Shannon, an engineer and mathematician at Bell Telephone Laboratories; Marvin Minsky, later co-founder of the Artificial Intelligence Project at MIT; and Nathaniel Rochester, a computer scientist at IBM.

During the conference, a number of programmes capable of intelligent behaviour were presented, such as the logic theorist, which was able to prove theorems of mathematical logic. In an early stage of evolution, artificial intelligence was directed at solving relatively well-formalised problems of a logical nature and was very successful. 1957 saw the appearance of the General problem solver programme, which was intended to emulate human behaviour in solving general problems. By contrast, in 1959, H. Gelertner presented a programme for the proof of geometry theorems and, soon afterwards, one for symbolic integration.

The Dartmouth conference was accompanied by a climate of widespread enthusiasm around the possibilities of artificial intelligence. The conference proposal itself had very ambitious goals, believing that significant results could already be achieved there by representing «an attempt to find ways for machines to use language, to form abstractions and concepts, to solve types of problems now reserved for humans, and to improve themselves. We believe that significant progress can be made on one or more of these problems if a carefully selected group of scientists work on them together for a summer» (Lisbon European Council, 2000).

In reality, the Dartmouth event ended without any revolutionary results, resolving itself into an occasion for meeting and initiating scientific collaborations, rather than continuous research work. Nevertheless, this climate of confidence persisted for the whole of the following decade, characterised by significant progress in the field, which led to the erroneous assumption that most of the goals stated in 1956 were achievable in a relatively short time.

In a second phase, riding on the wave of success, an attempt was made to expand the range of problems to which artificial intelligence could provide an answer, moving towards emulating the human perception system and interacting with the environment, which, on the other hand, was substantially unsuccessful. Indeed, it was soon realised that for the problems of effectively handling incomplete and uncertain information, there was a lack of conceptual models that could support the work of automated systems.

It was only in the years following the 1960s that the sector was articulated into specific directions that, with strong interactions with other sectors, attempted to tackle certain delimited

problems, recording some interesting successes and contributing in any case to the in-depth study of the complex problems behind many human activities that are only apparently simple.

Since then, scholars have developed a variety of approaches to artificial intelligence, including expert systems, artificial neural networks, machine learning and more. Artificial intelligence is one of the most innovative and transformative technologies of our time and can be seen as an engine of technological innovation capable of transforming numerous sectors, from industry to healthcare, from education to mobility. Its ability to automate processes, analyse large amounts of data and learn from patterns can lead to new solutions, products and services that improve efficiency, productivity and quality of life. Artificial intelligence can also influence public policy-making and governance through data analysis and information processing. For instance, it can be used to predict public policy outcomes, identify social trends and patterns, and support evidence-based decision-making.

In summary, artificial intelligence has the potential to significantly influence the development of societies and public policies, bringing both opportunities and challenges.

Its development and adoption, therefore, are now essential to maintain and increase Europe's competitiveness in the global economy. European institutions play a key role in fostering innovation and adoption of artificial intelligence through policies, funding and research and development programmes.

The European institutions, again, have a responsibility to lead this process in a responsible, inclusive and ethical manner, ensuring that artificial intelligence is a driver of progress and prosperity for all European citizens.

The development of artificial intelligence has, however, raised numerous questions about its use and the need for specific regulation of the sector coming not only from the institutions of individual countries but also from those of the European Union to ensure uniformity of standards and use of this sensitive sector.

2. European institutions and the approach to artificial intelligence

In recent years, the field of artificial intelligence has been developing rapidly in ever wider areas of social life. Thanks to the widespread capabilities of the Internet, information and artificial intelligence technologies are finding increasing application not only in highly specialised technological areas, but also within commonly used products and services, involving large sections of the population. In the face of the enormous benefits, there are many risks that these technologies entail with regard to fundamental rights and freedoms. The need to provide a common regulatory basis that considers the human, ethical, and socio-economic implications of AI while respecting European principles and values has therefore been brought to the attention of European institutions. In this perspective, the Lisbon Strategy, adopted in 2000, represented an important reference point in the European Union's path towards innovation and competitiveness. Although it did not specifically mention artificial intelligence as one of its pillars, it laid the foundations for the development of policies and initiatives aimed at promoting technological innovation and digitisation, two areas closely related to artificial intelligence.

The Lisbon Strategy had the ambitious goal of making Europe «the most competitive and dynamic knowledge-based economy in the world by 2010» (Lisbon European Council, 2000). To achieve this goal, three main pillars were identified: sustainable economic growth, social

cohesion, and sustainable development. These pillars provided a framework for promoting innovation, research and technological development, which are also central to the development of artificial intelligence. In addition, the Lisbon Strategy emphasised the need to invest in skills and education to meet the needs of a knowledge-based economy. This is particularly relevant in the context of artificial intelligence, as the development and adoption of this technology requires specialised skills in fields such as computer science, data engineering, and cognitive science.

In the years since the Lisbon Strategy, the EU has continued to develop policies and initiatives to promote innovation and digitisation, with increasing recognition of the importance of artificial intelligence.

As of 2017, in fact, a number of initiatives have been launched to develop the principles, structure, and content of specific legislation on artificial intelligence, in the context of a more general agenda involving the regulation of data management, digital market services, and robotics.

It was not until 25 April 2018, however, that the European Commission presented a first real “European strategy” on artificial intelligence through a Communication that is now considered a key document in outlining European strategy and laying the foundations for future EU action in this rapidly evolving field. Specifically, this document presented a broad view of the importance of artificial intelligence for the European economy and society as a whole. It recognised artificial intelligence as a key factor for economic success and emphasised the need to invest in AI research, development and adoption to maintain and improve Europe’s competitiveness in the global marketplace. Furthermore, the paper emphasised the importance of supporting AI innovation and adoption across Europe through public and private investment, as well as through the promotion of collaboration between stakeholders.

For the strengthening of digital skills, which are necessary for the use of new and advanced technologies, the Commission then stressed the need for investment in training to ensure that all Europeans are ready for the digital age and can benefit from the opportunities offered by AI.

The document also made specific reference to what can be defined as the ethical, social, and legal challenges associated with AI, such as the protection of privacy, the transparency of algorithms, and the impact on employment. In this regard, the Commission intervened by emphasising the need to address these challenges through greater cooperation and coordination between EU Member States, ensuring that the development and use of AI is ethical, safe and respectful of human rights.

In summary, it can be said that the 2018 Communication laid the foundation for a European strategy on AI, emphasising its importance for economic competitiveness, societal challenges and collaboration between EU Member States (Communication from the Commission, 2018a; 2018b).

In parallel, the Commission established a “High Level Expert Group” on AI which published, in April 2019, the Ethical Guidelines for Trustworthy Artificial Intelligence. These Guidelines identify three fundamental components for an AI that can be considered “trustworthy”: legality, ethicality, technical and social robustness. On the basis of these principles, the Expert Group identified seven requirements for trustworthy AI: 1. human intervention and oversight; 2. technical robustness and security; 3. confidentiality and data governance; 4. transparency; 5. diversity, non-discrimination and fairness; 6. social and environmental well-being; 7. accountability.

On the basis of this ethical-legal framework, the same Expert Group also published a recommendation on policy and investment in artificial intelligence (High-Level Expert Group on

Artificial Intelligence, Policy and Investment Recommendations for Trustworthy AI, 2019). Gathering and developing these recommendations, in February 2020, the European Commission published the White Paper on Artificial Intelligence (European Commission, 2020). The document articulates in detail the policy options set out in 2018 for an AI “made in Europe”, combining the goal of “trustworthy” technology with the promotion of European excellence in research and industry. As far as the legal sphere is concerned, the White Paper defines interventions on fundamental rights and data governance, security and liability regimes, harmonisation and effectiveness of legislation as priorities. For its part, the European Parliament has also played an active role in the debate and policy-making on Artificial Intelligence (AI), adopting resolutions and participating in legislative initiatives aimed at regulating and promoting responsible use of AI in the European Union. In particular, the Resolution on Responsibility (European Parliament, 2020) is relevant for the definition of AI contained in Article 3(a) of the Proposal, and for the adoption of a risk-based approach to regulation. Furthermore, the European Parliament has been actively involved in the formulation of legislative initiatives on AI, such as the proposal for a regulation submitted by the European Commission in 2021. Here, the Parliament helped to define the priorities, guidelines and provisions of this document, ensuring that they are in line with the values and objectives of the European Union.

The path, briefly summarised here, culminated in the Proposal for a European Regulation, known as the “AI Act” (European Commission, 2021), which provides a comprehensive legal framework for the development and use of artificial intelligence in Europe.

3. The European Union and the primacy of AI legislation

The European Union today has taken a leadership role in promoting AI regulation at the international level, helping to establish global standards for the responsible and safe use of AI.

Indeed, on 14 June 2023, the European Parliament adopted its negotiating position on the Artificial Intelligence Act, the world’s first draft of AI regulation proposed by the European Commission in April 2021 (European Commission, 2021). This event initiated the negotiations – known as “trialogues” – that led to the approval of the final AI regulation on 13 April 2023 with 523 votes in favour, 46 against and 49 abstentions.

The Commission’s proposal, in fact, was the culmination of a regulatory development around AI that began with the aforementioned Commission Communication.

The stated aim of the draft legislation was to address the dangers associated with certain applications of artificial intelligence, while at the same time promoting the development and dissemination of this technology without frustrating the market. To this end, the Commission chose a risk management approach, borrowing an approach already adopted, in other forms, in previous pieces of legislation (Gellert, 2018). The proposal envisages a division of artificial intelligence applications into four classes of risk, subjecting each of them to a different regulatory regime. Firstly, certain applications of artificial intelligence are identified that are prohibited in the context of the Union, due to their potential harm to human dignity and a wide range of individual rights. These are, for example, technologies aimed at influencing a person’s behaviour in order to direct it in a harmful direction towards him/herself or others (Art. 5(1)(a)), systems aimed at exploiting a person’s specific vulnerabilities such as disabilities or minors (Art. 5(1)(b)), social credit assessment systems that lead to detrimental consequences for the individuals involved in contexts unrelated to the one in which the source data were collected

(Art. 5(1)(c)). A special regime is reserved, then, for the use of real-time biometric identification systems, which is only allowed for the purpose of searching for missing crime victims and minors, preventing terrorist attacks, or prosecuting perpetrators and suspects of the serious crimes referred to in Article 2(2) of Framework Decision 2002/58/JHA on the European Arrest Warrant (Article 5(1)(d)).

Secondly, an extensive list of artificial intelligence applications, identified by Article 6 of the Proposal, is considered high-risk. The provision delimits the perimeter of the category through a system of cross-references to the annexes of the legislative text, making it difficult to read.

High-risk systems will have to comply with stringent requirements concerning the quality of datasets, transparency, comprehensibility of results and the possibility of human control and intervention in their operation. To this end, the suppliers of these technologies have specific obligations concerning the development of a procedural and documentary system of risk management, and their placing on the market must be preceded by an assessment of conformity with the requirements of the Proposal (Art. 43) followed, in the event of a positive outcome, by the affixing of the CE mark on the product (Art. 49). These requirements, on the other hand, are not considered binding for the marketing of AI systems other than high-risk ones, which form the third hazard class considered by the regulation. The placing on the market of these technologies, in the proposal's intentions, will be left largely to self-regulation, so much so that the text provides for an explicit invitation to operators in the sector to draw up codes of conduct, with the aim of adhering, adapting them where necessary, to the requirements laid down for the dissemination and use of high-risk systems (Art. 69).

Finally, the Commission proposal provides for specific transparency burdens for some particular AI systems, regardless of their risk class. These are technologies used for direct interaction with human beings, to detect emotions, to implement proliferation activities based on biometric data or to generate and manipulate extremely realistic content. In such cases, the Draft Regulation provides for the obligation to inform those involved of the interaction with an intelligent agent, of its use for emotional or biometric profiling purposes, or of the artificial nature of the content generated by the AI (Article 52). The fulfilments envisaged by the Proposed Regulation are accompanied by a range of sanctions, including very severe ones, for non-compliance. The act (Art. 71) only determines the amounts for the most significant violations, ranging from a minimum of EUR 10,000,000, or 2 per cent of the previous year's annual worldwide turnover, whichever is higher, to a maximum of EUR 30,000,000 or 6 per cent of annual turnover. The maximum penalty is provided for the use of artificial intelligence applications banned by Article 5 and for non-compliance with the dataset integrity criteria laid down in Article 10. The definition of penalties for violations not covered by the Proposal, however, is left to each member state.

Submitted, as already mentioned, on 21 April 2021, the Proposal underwent a public consultation process lasting just over three months (26 April – 4 August), which was followed by a period of re-discussion of the text, based on the input received, before proceeding with the legislative process by submitting the act to the first reading of the Parliament (European Commission, 2021).

The final approved regulation still has to undergo final verification by the lawyer-linguists and should be finally adopted before the end of the legislative term. In addition, the law still has to be formally approved by the Council. It will enter into force 20 days after publication in

the Official Journal of the EU and will start to apply 24 months after entry into force, except for: prohibitions on prohibited practices, which will apply six months after entry into force; codes of good practice (nine months after); rules on general purpose AI systems, including governance (12 months); and obligations for high-risk systems (36 months).

However, the doubt arises that once the AI Act is passed, it will provide for a two-year period during which the rules will be loosely enforced to allow companies to comply. Since it is likely that the legislation will not come into force until 2026, the EU will probably have to rely on the voluntary compliance of companies in the AI sector to ensure transparency, security, and respect for citizens' rights and privacy from the outset.

4. Conclusions

“We are making history! [...] The European Parliament has just passed the world's first Artificial Intelligence Act”. This is how the President of the European Parliament Roberta Metsola announced on a social platform the approval of the AI Act. The European Union is in fact the first in the world to have almost definitively passed legislation to regulate artificial intelligence systems, and it is expected that other legislators, e.g. from the United States, will follow Europe in drafting their own legislation.

Indeed, the development of Artificial Intelligence (AI) in Europe has been characterised by a strong and proactive commitment on the part of the European institutions to promote responsible, ethical and safe use of the technology. The European institutions have demonstrated a balanced approach that aims to maximise the benefits of AI while mitigating the associated challenges and risks (CEPS, 2019).

Through targeted policies and initiatives, the European Union (EU) has promoted clear and transparent regulations to ensure that AI is developed and used with respect for fundamental EU values such as human dignity, social justice, and non-discrimination. At the same time, the EU has supported innovation and competitiveness by investing in research and innovation and promoting collaboration between the public and private sectors.

The European institutions have also taken a leadership role in fostering international cooperation in the field of AI, working with global partners to develop common standards and promote the adoption of ethical and transparent rules globally. This international engagement is crucial to address global challenges such as the protection of human rights in the digital age and the management of AI-related risks.

However, despite the progress made, challenges and areas for improvement remain. The EU must continue to closely monitor technological developments and adapt its policies and regulations accordingly. It is also essential to maintain an open and inclusive dialogue with all stakeholders to ensure that decisions taken fully reflect the values and interests of the EU and its citizens.

In summary, the behaviour of the European institutions in the development of AI reflects a cohesive and determined commitment to promoting responsible and sustainable use of technology while ensuring Europe's innovation and competitiveness in the global landscape.

Conflicts of interest

The author declares no conflict of interest.

About the author

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