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CHALLENGES OF REGULATING ARTIFICIAL INTELLIGENCE IN CONTEMPORARY LEGAL SYSTEMS

Abstract: Lawmakers around the world are faced with a contemporary challenge represented by artificial intelligence. It is widely acknowledged that law is, to a significant extent, unable to fully keep pace with rapid technological development, and that increasing efforts are required in order to establish an adequate and effective legal framework in the field of artificial intelligence. The complexity of AI systems, particularly those based on deep learning, further complicates normative regulation, as traditional legal frameworks often struggle to adequately encompass and regulate these technologies. The author intends, by applying comparative and normative methods, to analyse existing regulatory solutions in the field of artificial intelligence, as well as to highlight the main challenges faced by legislators in regulating this area, including the ways in which different legal systems have addressed them. Key challenges of regulating artificial intelligence include issues related to ethical principles, the determination of liability for harm caused by AI systems, the protection of personal data and privacy, as well as the prevention of discrimination and algorithmic bias.

Keywords: *artificial intelligence, regulation, liability, data protection, ethical principles*

1. INTRODUCTION

The past decade has witnessed an evolutionary process that has revolutionized the industry and social norms for Artificial Intelligence (Chavali, Baburajan, Kumar, & Katari, 2024, p. 1250). However, such an evolution has led to a series of complex ethical, legal, and social problems that require an adequate response from the international community. In November 2023, the first Global Summit on Artificial Intelligence Safety was held in the United Kingdom, attended by representatives of twenty-eight states. On that occasion, the Bletchley Declaration was signed, in which participating states recognized the enormous potential of artificial intelligence to enhance human well-being, peace, and prosperity, while at the same time pointing to the risks that its development may generate, including the possibility of serious and even catastrophic harm (Bletchley Declaration, 2023). The signatories committed to international cooperation for the development of human-centered, trustworthy, responsible, and safe artificial intelligence, as well as to joint action aimed at establishing mechanisms for managing the risks posed by this technology. In this way, the Bletchley Declaration represents the first significant international document that highlights both the exceptional potential and the risks associated with the development of artificial intelligence. However, not all stakeholders are focused on the potential risks of AI systems. Thus, at the subsequent summit held in Paris in 2025, the view was expressed that the focus should not primarily be on safety issues, but rather on harnessing the developmental potential of artificial intelligence, and that an excessive emphasis on safety concerns should not slow down technological innovation and global competitiveness (Cyphert, 2025, p. 83).

Despite the existence of different and even opposing views emphasizing that attention should not be primarily directed toward the harmful consequences of artificial intelligence but rather toward its developmental and innovative potential, in both theory and practice there is a prevailing and generally accepted position that the establishment of an adequate regulatory framework is necessary in order to ensure its responsible development and application. This is particularly important given that the application of artificial intelligence penetrates key sectors such as healthcare, finance, and public security. The potential social costs associated with its development and implementation are therefore becoming increasingly significant, including a wide range of consequences, from social inequality to existential risks (Gibson, Tang, 2025, p. 4).

2. Conceptual and theoretical framework of Artificial Intelligence

Artificial intelligence has evolved from theoretical philosophical reflections into one of the fundamental components of contemporary technological systems. The concept of using computer systems to simulate thinking and intelligent behavior was first introduced in 1950 by Alan Turing (Chumakov, 2025, p. 61). However, the term "artificial intelligence" was first used in 1956 by computer scientists from Stanford during the Dartmouth Summer Research Project on Artificial Intelligence (DSRPAI), which marked a turning point that fostered interdisciplinary cooperation (Haenlein & Kaplan, 2019, p. 2; Chumakov, 2025, p. 61). From these initial theoretical and conceptual foundations, the development of artificial intelligence has proceeded through several phases, characterized by gradual technological progress, as well as periods of stagnation and rapid advancement. Contemporary AI development is marked by significant progress in machine learning, the availability of large datasets, and increased computational power, which has enabled its widespread application across various sectors of modern society.

A precise definition of artificial intelligence is a necessary prerequisite for understanding its concept, its potential applications, and its adequate legal regulation. The importance of defining this concept stems from the fact that artificial intelligence has become an integral part of modern society and is applied in almost all areas of human activity, ranging from smartphones, communication systems, navigation and traffic management, to healthcare, finance, education, public administration, culture, and other fields (Branković, 2017, p. 5). Therefore, an accurate determination of the concept of artificial intelligence represents the foundation for establishing an adequate regulatory framework.

As is the case with the definition of law, there is no universally accepted definition of artificial intelligence (Prlja, Gasmi, & Korać, 2022, p. 25; Sheikh, Prins, & Schrijvers, 2023, p. 15). Artificial intelligence is sometimes defined as the manipulation of symbols for problem solving (Buchanan & Shortliffe, 1985, p. 3), or through tautological formulations such as artificial intelligence being "the part of computer science concerned with developing intelligent computer programs" (Waterman, 1986, p. 10). An intelligent program is one that exhibits behavior similar to that of a human when confronted with a similar problem. It is not necessary that the program actually solve, or attempt to solve, the problem in the same way that a human would (Schildt, 1987, p. 11). In the simplest terms, artificial intelligence can be defined as a computer program that simulates human

cognitive processes (Savčić, 2024, p. 13). The subject of artificial intelligence research essentially concerns the rules governing so-called intelligent human behavior and the creation of formal models of such behavior, through the use of computer programs that simulate it (Prlja, Gasmi, Korać, 2022, p. 30).

It can be observed that what most definitions of artificial intelligence have in common is that they are based on comparisons with human behavior. However, as noted in the literature, the nature of artificial intelligence and the challenges associated with it have significantly changed in recent years, which has led to calls for its "redefinition" (Duan, Edwards & Dwivedi, 2019, p. 65).

Compared to previous generations of information technologies, contemporary AI technologies are characterized by two key features (Custers, Fosch-Villaronga, 2022, p. 8). First, they possess the capability of self-learning, meaning that they can identify patterns in data without human intervention, learn from them, and subsequently make predictions. In this context, artificial intelligence is associated with concepts such as algorithms, data mining, and machine learning, with machine learning distinguished by models that continuously improve through experience, unlike classical algorithms that produce identical outputs for identical inputs. Second, modern AI systems are characterized by a higher degree of autonomy, meaning that they are capable of making independent decisions within predefined objectives. Examples include autonomous vehicles and drones that select optimal strategies in real time to avoid obstacles or adapt to environmental changes, where such solutions are not fully pre-programmed in advance.

Contemporary artificial intelligence is characterized by the following key features: (1) the dual role of data, (2) the changing role of feature extraction, (3) a high degree of adaptability, (4) limited transparency (the so-called "black box" effect), and (5) the possibility of bias within the system (van Giffen, Barth, & Sagodi, 2022, p. 5-6). Modern AI systems are primarily based on the dual role of data, as data are used both in the training phase and during system deployment, while their quality and structure directly affect system performance. Furthermore, deep learning algorithms automatically extract relevant features from data, unlike traditional approaches that require manual feature engineering. These systems also exhibit a high degree of adaptability, as they are capable of continuously adjusting to new data and changes in their environment. At the same time, modern AI technologies are often characterized by limited transparency, since their complex models make it difficult to understand decision-making

processes. Finally, the presence of various forms of bias represents a significant challenge, as such biases may arise from data, system design, or human decisions during development.

Law and AI interact in two fundamental ways: law can regulate artificial intelligence, and artificial intelligence can be applied within legal practice. On the one hand, law performs a regulatory function by establishing rules and standards for the development, deployment, and supervision of artificial intelligence systems, with the aim of ensuring legal certainty, protecting fundamental rights, and minimizing potential risks. On the other hand, artificial intelligence is increasingly used within legal practice as a tool for data analysis, decision support, and the improvement of the efficiency of legal processes. This interaction requires, and simultaneously demonstrates, the growing importance of an interdisciplinary approach to understanding and regulating the relationship between law and modern technological systems.

3. Regulatory Challenges of Artificial Intelligence

As previously noted, the relationship between artificial intelligence and law manifests itself through two primary dimensions: on the one hand, law seeks to normatively regulate the development and application of artificial intelligence, while on the other hand, AI is increasingly used as a tool within legal practice and decision-making processes. Although the theoretical foundations of artificial intelligence date back to the mid-twentieth century and its intensive development has been ongoing for decades, there is still no unified and comprehensive international legal framework that systematically regulates this field. Existing regulatory approaches are fragmented, often confined to national jurisdictions, and insufficiently harmonized, which further complicates the establishment of a coherent system of rules at the global level. The reasons for such a state of affairs are multiple, which underscores the need for an interdisciplinary approach.

One author identifies several weaknesses in the regulatory and legal framework:

I. data ownership: it is necessary to define who owns the data contained in databases used for training AI systems

II. data acquisition methods: it is necessary to ensure that data used for training systems are obtained lawfully

III. handling and processing of collected data: it is necessary to define who has access to such data and for what purposes

IV. storage and retention of collected data: it is necessary to determine whether, and for what purposes, the permanent storage of training data is

required, as well as how such data will be stored and preserved in the future (Zirojević, 2024, p. 104).

In the legal literature, one of the key reasons for the absence of an adequate regulatory framework is identified as the exceptionally rapid pace of technological development worldwide. The regulation of artificial intelligence faces significant obstacles in terms of how this technology is developed and applied, given its decentralized and uncoordinated nature. Such a diffuse character, combined with its inherent capacity for self-learning, complicates regulatory control and may render both ex ante and ex post regulation ineffective (Ragil, Folster, 2025, p. 177). In the context of rapid technological change, it is emphasized that legislators should avoid overly detailed and rigid regulatory interventions, as these may restrict innovation and limit the adaptability of systems (Harasimiuk, Braun, 2021, p. 95). Nevertheless, the requirement that law follows and responds to social and technological development is not a new phenomenon, but rather a constant feature in the evolution of legal systems, which have continuously adapted over time to changes across different areas of social life.

However, what makes the regulation of AI technologies particularly difficult is its global nature. Artificial intelligence is a global issue, and any regulatory approach that does not recognize the need for a certain level of international cooperation is unlikely to produce meaningful long-term effects (Cyphert, 2025, p. 86). First, one of the key problems is that, in the absence of internationally harmonized rules, the regulation of artificial intelligence would be inconsistent across states. This creates space for so-called "forum shopping," where companies choose jurisdictions with more lenient regulatory regimes. In this way, more strictly regulated states may lose technological investment, while regulation at the global level may gradually be relaxed in order to attract capital and innovation. Such a process may lead to a "race to the bottom," in which states lower standards of protection and accountability, ultimately weakening user safety and the protection of rights. Second, artificial intelligence represents a global issue due to its inherently transnational nature, as its effects and applications do not recognize national borders (Zaidan, Ibrahim, 2024, p. 3).

As the application of artificial intelligence increasingly permeates key sectors such as healthcare, finance, and public security, the potential social costs associated with its development and deployment are becoming increasingly significant, encompassing risks ranging from the deepening of social inequalities to existential threats (Gibson & Tang, 2025, p. 4). Precisely because artificial intelligence is increasingly embedded in various sectors of human activity and does not constitute a single, clearly

demarcated field, its regulation is inherently more complex. The literature emphasizes that machine learning-based artificial intelligence systems are characterized by a high degree of heterogeneity, as they differ in terms of their mode of operation, purpose, and fields of application, while their performance is simultaneously continuously evolving and improving over time (Coglianese, 2023, p. 4). Artificial intelligence already affects a wide range of sectors today, and it is expected to become present in almost all areas of social and economic life in the future.

Another challenge in the process of regulating artificial intelligence is the lack of technical knowledge and institutional capacity among legislators worldwide. Given that the development of modern AI systems is predominantly led by the private sector, public institutions often lag behind in understanding their technical characteristics and potential implications. Such an imbalance makes it difficult to design effective legal rules, particularly considering that the quality of the regulatory framework largely depends on the expertise of the institutions responsible for its adoption and implementation. Accordingly, strengthening the technical and institutional capacities of regulatory bodies is identified as one of the key prerequisites for successful regulation.

On the other hand, the literature also emphasizes that carefully designed regulation does not necessarily constitute an obstacle to innovation, but may in fact contribute to directing it towards safer and socially responsible solutions. Therefore, the fundamental question is not whether artificial intelligence should be regulated, but rather how to establish a regulatory framework that simultaneously protects the public interest and enables further technological advancement.

In addition to legal and technical challenges, the regulation of artificial intelligence is further complicated by political factors. In many states, there is a degree of reluctance toward expanding regulatory powers of the state and establishing new supervisory bodies, which may reduce legislators' willingness to adopt comprehensive regulatory frameworks in this field. Accordingly, the effectiveness of future regulation will depend not only on the quality of normative solutions, but also on the existence of political will for their adoption and consistent implementation.

Despite the challenges associated with regulating artificial intelligence, according to the OECD (Organisation for Economic Co-operation and Development), at least 50 countries have developed or are currently developing a "national artificial intelligence strategy", and several of them have succeeded in translating it into legal frameworks aimed at addressing

risks and minimizing the negative effects of its application (Ragil, Folster, 2025, p. 177).

4. Fundamental legal issues of AI regulation

The regulation of artificial intelligence does not merely constitute a technical issue, but simultaneously raises a range of legal and ethical challenges. Its application affects key areas of law, including the protection of privacy, ensuring transparency, the realization of fairness and the prohibition of discrimination, labour relations, the protection of intellectual property, as well as issues of security, with all these segments being directly exposed to the impact of AI use by states, the private sector, and individuals.

One of the main problems identified in the analysis of AI regulation is the issue of potential infringement of the right to privacy (Jędrzejczak, 2024, p. 89). AI technology significantly enhances the capacity to collect, analyse, and integrate extremely large volumes of data from diverse sources at an unprecedented level. In addition, such technology is now widely accessible to various individuals and organizations worldwide. Although information technologies have previously affected privacy, these new capabilities substantially increase the risk of privacy violations that were not sufficiently taken into account in the past (Verma, 2024, p. 155).

As artificial intelligence becomes increasingly present in everyday life, concerns regarding potential violations of human rights are also growing (Verma, 2024, p. 155). Some authors argue that artificial intelligence has had more negative than positive effects on civil liberties, particularly with regard to the protection of informational privacy, equality, freedom of speech and expression, the right to assembly, and freedom of work and employment (Bakhtawar, 2024, p. 54). In the sphere of social and political rights, AI-based tools have caused serious human rights concerns, including manipulation of public opinion, undermining the integrity of democratic processes, unauthorized collection and misuse of data for political purposes, disinformation campaigns, as well as the creation and deepening of discrimination and bias (Zuboff, 2019).

The issue of accountability is based on the establishment of mechanisms ensuring that persons who develop or deploy artificial intelligence systems act in accordance with established rules. This entails a clear delineation of roles and the legal determination of responsibility of all involved actors for compliance with ethical guidelines, as well as ensuring that the application of AI systems remains within the bounds of applicable ethical norms and standards.

Transparency represents a key element of both the regulatory and ethical framework, requiring that algorithms and decision-making processes be understandable and accessible to users and other stakeholders. This enables insight into the manner in which systems operate, the factors influencing decisions and their outcomes, thereby reducing the "black box" effect and strengthening trust in AI systems.

5. Regulatory Approaches to Artificial Intelligence

The regulatory framework at the global level is developing at an accelerated pace, accompanied by an increasingly pronounced institutionalisation of rules in the field of artificial intelligence. While the European Union leads with comprehensive horizontal legislative solutions, other jurisdictions opt for more flexible models, which are often sector-specific or hybrid in nature. Such diversity of approaches stems from differing economic objectives, political and legal systems, cultural contexts, and levels of technological development.

On a global scale, several dominant approaches to artificial intelligence regulation can be identified, reflecting the varying legal, political, and economic priorities of states and regions, namely:

1) Risk-based approach - regulation is based on the classification of AI systems according to their level of potential harm, with stricter rules reserved for high-risk applications.
2) Human-centric or ethical approach - the focus is placed on the protection of fundamental rights, fairness, transparency, non-discrimination, and human oversight of AI systems.
3) Innovation-driven approach - priority is given to fostering technological development and competitiveness, using flexible mechanisms such as regulatory sandboxes and pilot projects.
4) Data protection approach - AI is regulated through existing data protection frameworks, with particular emphasis on the processing of personal data, profiling, and automated decision-making.
5) Hybrid and sector-specific approach - a combination of general rules and specialised regulations tailored to individual sectors such as healthcare, finance, or public administration.
6) Multi-stakeholder approach - the involvement of state authorities, industry, academia, and civil society in the design and implementation of regulatory frameworks.

Nevertheless, despite differences in regulatory models, a gradual convergence can be observed with respect to key regulatory principles and

instruments, particularly through the adoption of risk-based approaches and standards that place the human being at the centre of regulation.

The European Union and North America have developed different regulatory responses to the key challenges posed by artificial intelligence, particularly in relation to privacy, transparency, and accountability. While the EU applies a centralised, legally binding, and risk-based approach grounded in comprehensive instruments such as the AI Act and the GDPR, North America relies on a more flexible, sector-specific, and predominantly soft-law regulatory model.

In the European Union, the protection of privacy and data constitutes the foundation of regulation, while transparency and accountability are ensured through strict requirements applicable to high-risk AI systems, including mandatory documentation, human oversight, and impact assessments. In contrast, in North America these issues are addressed indirectly, through existing legal frameworks, internal governmental policies, and voluntary standards, with a particular emphasis on innovation and market development.

CONCULSIONS

The regulation of artificial intelligence represents one of the most complex contemporary legal issues. The principal challenges of legal regulation arise from rapid technological development, the high degree of autonomy and adaptability of AI systems, as well as their widespread application across virtually all areas of social and economic life. The analysis indicates that existing legal systems still do not provide a unified and globally harmonised regulatory framework, but rather that the development of normative solutions is fragmented, with differing approaches at the national and regional levels.

Despite the diversity of regulatory models, a common denominator can be identified in the aspiration to establish a balanced approach that simultaneously enables technological progress and protects fundamental human rights. Dominant contemporary trends, such as the risk-based approach and the concept of human-centric and ethical artificial intelligence, indicate a gradual convergence of regulatory philosophies at the global level.

The analysis of fundamental legal issues shows that the application of artificial intelligence raises a range of challenges, particularly in the areas of privacy protection, prevention of discrimination, ensuring transparency, and determining liability for harm caused by AI systems. These challenges are

further intensified by the complexity of the technology, its inherent characteristics, as well as the lack of internationally harmonised rules.

In light of the above, it may be concluded that the key challenge of future artificial intelligence regulation lies not only in the adoption of legal norms, but also in their harmonisation, effective implementation, and adaptation to rapid technological development. Accordingly, the central task for legislators is the establishment of a regulatory framework that simultaneously ensures legal certainty, the protection of fundamental rights, and the promotion of innovation, alongside strengthened international cooperation in this globally significant field.

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