

AI REGULATION VS. AI STANDARDIZATION

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Abstract: *The key specificity of Artificial Intelligence today is that it is a fast-evolving field with yet unknown capabilities and potential. In technical research as well as in media there are new emerging AI-related topics almost every day. We hear a lot about risks of AI but also about so many useful AI applications that help people and companies benefit from better lives or enhanced results of their activity. Businesses developing AI solutions worldwide face significant challenges not only in designing processes but also in putting on the market safe, efficient and reliable technologies. Thus, there is huge time pressure to set the necessary regulatory frame that will enable proper market functioning and encourage innovation in this area. On the other hand, there is considerable pressure from society to have a safe and trustworthy environment to use AI technology. Such expectations are only reasonable as AI development affects all the society and economy at all levels. Therefore, it's important to identify the best regulatory option. Is there a need for binding rules and coercive state measures to regulate markets and social behavior? Or could the consensual technical requirements and ethical principles provide the necessary direction for a reasonable development, function and use of AI? This paper aims at formulating the most suitable regulatory framework to guide further development of AI. The two-step research methodology focuses on analyzing the incipient regulatory initiatives on AI, exploring the published articles in the area as well as the recently approved standards at international level. Based on this analysis authors will assess the pros and cons for the two regulatory options and will further elaborate the arguments for the best setting to regulate AI.*

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1. Introduction

According to the Organisation for Economic Co-operation and Development and the United Nations Conference on Trade and Development, Artificial Intelligence (AI) refers to the ability of machines and systems to acquire knowledge, apply it and demonstrate intelligent behaviour. This includes various cognitive functions such as perception, language processing, reasoning, learning, decision-making, as well as the capability to manipulate physical objects.

Due to their rapidly evolving, highly transformative and multifaceted nature, AI technologies are impacting nearly every aspect of our lives. Definitely, there are remarkable advantages these technologies offer across various sectors, ranging from healthcare and finance to the justice system and defence industry, benefits that were once inconceivable (Erdelyi, 2022). While these new technologies offer numerous advantages, they also come with significant risks. Some of the risks associated with AI are related to technological, data and analytical risks, informational and communicational risks,

economic risks, social risks, ethical risks, legal and regulatory risks (Wirtz, 2022). Without being exhaustive, the list of risks will surely undergo significant changes in the future.

Application of AI in public sector has been slower than in the private sector despite the multiple benefits. Through automating tasks, managing big data and minimizing errors, public administration could enhance effectiveness and performance in its decision-making process. The relevant challenge here is ensuring a transparent and easy-to-understand interaction of AI technologies with citizens so that there could be built a positive attitude and ultimately social trust in using AI and accepting it in public governance.

Considering the global dimension of AI technologies, addressing AI risks requires an interdisciplinary, collaborative, and adaptive approach (Wirtz, 2022). Excessive regulation can impede innovation by restraining creativity and hampering the advancement of new technologies (Stahl, 2022). However, appropriate regulation of AI can address market failures by incentivizing behaviour that benefits society as a whole, rather than individual interests (Erdelyi, 2022). Standardization, on the other hand, plays a crucial role in facilitating compatibility among systems and networks, promoting interoperability and fostering innovation (Cantero Gamito, 2023).

AI regulation and AI standardization represent two distinct approaches in managing the design and applications of AI technologies. While both aim to address challenges and promote responsible AI implementation, they operate in different ways and focus on different aspects of AI governance. AI regulation involves the creation and enforcement of laws, policies, and guidelines by governmental bodies or regulatory agencies to control the behaviour and impact of AI systems. Regulations are legally binding and carry enforceable penalties for non-compliance. Meanwhile, AI standardization involves the development and adoption of voluntary technical standards, guidelines and best practices by industry organizations, consortia or international standards bodies to promote interoperability, quality and consistency in AI systems. Standards are typically non-binding, although adherence may be encouraged or incentivized by industry stakeholders.

The article aims to explore the differences between AI regulation and AI standardization, their benefits, challenges and the balance needed between them in order to achieve the development, adoption, as well as proper governance of AI technologies.

This paper is structured as follows. Section 2 focuses on a literature review, providing insights from published research on the risks, benefits and governance approaches in relation to AI. Following the literature review, Section 3 details the applied research methodology. Further, Section 4 presents the research findings and discussions. Finally, the paper concludes with Section 5, providing conclusions of the research, followed by the list of references.

2. Literature review

The main emphasis of the increasing research in the area of AI is on the need to ensure that our smart technologies will be at the service of the human project not vice versa (Loureiro et al., 2021). Given the highly disruptive nature, AI technologies present substantial challenges and risks, “be it due to imperfections like biases or, paradoxically, because AI is doing its job far too perfectly” (Erdelyi & Goldsmith, 2022).

Considering the different level of development and the leadership ambitions international community is facing AI race. Countries have started to launch ambitious national AI strategies to maintain sustained economic competitiveness in an AI-driven economy (Erdelyi & Goldsmith, 2022). At this point it is indispensable to elaborate a widely accepted governance model of AI through international coordination based on ethical considerations.

The misuse or potential loss of control, especially in critical domains like the legal system, military operations, political communications, transportation, civil defence or nuclear energy, could present a significant threat to human rights, public safety, societal order and also discrimination against individuals.

In-depth technical expertise and a diverse range of skills are key to effectively navigate the complexities of AI regulation, as well as fostering cross-industry knowledge sharing, in order to prevent the formation of silos (Stahl, 2022). Trust alleviates concerns, reduces perceived risks, encourages greater adoption of AI and fosters a willingness to embrace transformative changes, while holding significant importance, by heavily influencing whether a technology should be embraced or not (Robinson, 2020). However, there is a risk associated with providing false assurances of fair, trustworthy, and ethical AI, particularly when there is no accountability framework in place to enforce sanctions in cases of failure to adhere to these assurances (Stahl, 2022). Although not legally mandatory in all cases, ethical behaviour is often expected and contributes to trust and cooperation within communities. Even if there is no uniform ethical code, many societies and communities share common ethical concepts and principles, such as fairness, honesty and respect (Robles Carrillo, 2020).

Some authors argue that AI technologies support implementation of sustainable development goals. However, such contribution could be perceived critically. The use of AI technologies needs IT resources that are only present in computation centres having an immense energy consumption and a big ecological footprint with potential increase in the future (Kopka & Grashof, 2022). AI is expected to enhance efficiency generating new jobs and cutting costs with redundant activities and low-skilled workers. This will increase inequalities posing new questions about sustainability.

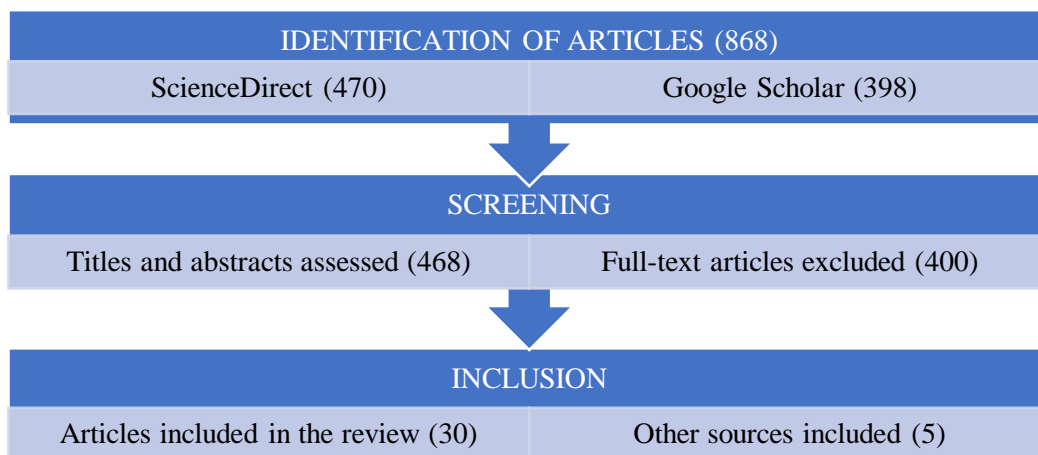
There is an increasing number of initiatives driven by industry, corporate governance, attempting to develop or strengthen standardisation. Likewise, states around the world are developing public strategies and regulations to address AI-related issues arising in their societies. The majority of authors do not see ethics or private initiatives and legislative interventions as contradictory but as complementary ways needing for mutual supportive interaction in order to achieve a trustful, safe and competitive environment for the AI application (Stahl, 2022).

3. Research approach

This paper is based on a thorough research of the current published literature related to the way Artificial Intelligence could be governed. The literature research is completed with desktop research and conceptual analyses of the current legal framework in three regions of dynamic AI development on the globe: European Union, China and United States of America. Further, a brainstorming session conducted by the authors led to identification of pros and cons for both approaches – governing AI through regulation vs. governing AI through standardization. The debates took into consideration benefits and risks related to the AI development and use as these are identified and detailed in the state-of-the-art research.

The literature review followed a systematic approach through applying search terminology and some identification criteria in two databases, namely ScienceDirect and Google Scholar. Main terms used in the queries were “Artificial Intelligence”, “AI governance”, “AI regulation”, “AI standards”, “AI standardization”, “AI risks”. After eliminating duplicate records, a number of 868 articles were identified in several research disciplines. Narrowing the results to economics, management and social sciences disciplines and focusing only on articles published in English after 2018, another 400 articles were excluded out of the initial results. For the remained 468 articles, titles and abstracts were assessed based on their relevance to the research theme. 30 articles were accepted as relevant and have been full-text reviewed. In addition to these, authors have identified and analysed other sources, precisely legal documents regulating AI published on official websites as well as international standards elaborated on the matter. The PRISMA flow diagram below provides an overview of the process from the initial identification to the results included in this paper.

Figure 1: PRISMA flow diagram for literature review



Source: Authors' completion

4. Findings and discussion

4.1 Regulation approach

The discussion around AI is vivid and complex, not lacking contradictory views, depending both on the various concerns of individuals, and on the depth of understanding on how the AI actually works and how it can evolve. Regulating AI is clearly a very complex process starting from the very definition of the scope of the regulatory effort. From the individuals' perspective, concerns are mostly related to various risks posed by AI in terms of safety, freedom, and identity. From the companies' perspective, however, issues related to liability correlated to the objective of developing AI and increase capabilities in as much as possible, which is inherently experimental and hardly controllable, generates an equivocal attitude and concerns related to the risks they would undertake when AI development may lead to unexpected results that they can hardly predict. Governments, on the other hand, are in a difficult position to calculate the impact of further developments of AI in order to assess the right balance between restrictions imposed by the regulatory framework, and incentives or at least freedom allowed for advancing the technology. It is recognised that the AI can be of great added value to the public services, and can generate significant economic value if sufficiently developed. In terms of liability, another question is related to the various actors in the value chain and how they can contribute to the misuse of AI systems. Furthermore, as AI continues to evolve, new risks can be expected to arise, either due to the actual changes generated by machine learning which may not be entirely predictable, or by its application in new fields or manners where there isn't enough data at the time of regulation to properly identify or make assessments of.

By looking at the regulatory efforts in three different systems, the US, the EU and China, authors aim at identifying the role of the regulations and what they can cover without stifling the technological progress, as well as the limitations of the regulatory framework and the potential need for further defining AI governance through other instruments, like standardization. It is equally important to observe the different approaches that lay behind the actual regulations in the three regions of the world, both to better understand and predict further behaviour of the market, and to identify potential gaps, whereas standardization can bring more clarity and accountability. The development of AI is a global matter, and it can be expected that different regulatory frameworks would hamper development unless common solutions can compensate for gaps or help clarify and reduce restrictions where needed.

In the United States, the AI related regulatory landscape is characterized by a decentralized approach, as is usually the case in the US. While at the federal level the need for AI regulation is clearly recognized, progress has been somewhat slow, with no federal law passed so far, while consensus has yet to emerge. Federal legislators have proposed various bills and held committee hearings to address the opportunities and challenges presented by AI technologies. On the other hand, states have passed laws addressing AI-related concerns, most of them related to various aspects that seemed more stringent

locally, such as data privacy or protection against discriminatory practices in hiring, which may occur because of partial automation of processes. Some states have also established task forces or advisory boards, to study AI and make policy recommendations. The National Conference of State Legislatures has been active in promoting awareness of key AI risks and circulating best practices in AI regulation. Overall, the regulatory approach in the United States reflects a decentralized and fragmented effort to address the challenges posed by AI technologies, and it reflects the general behaviour, whereby law follows practice. It is clearly the more liberal approach of the three, so far.

In contrast to the United States, China has taken a more centralized and proactive approach to AI regulation. With a rapidly growing AI market, the Chinese government has implemented comprehensive regulatory measures at the national, regional, and local levels and was the first player to start regulating the field explicitly, since 2021. In theory these measures aim to balance the promotion of innovation with the need for legal governance and ethical considerations in AI development, however concerns have been expressed that the approach may lead eventually to further limiting the freedom of speech. Covering various aspects of AI technology, including some that are not in focus for the other two systems, such as, for instance, preventing monopolistic behaviour, China has enforced provisions to regulate deep fake technologies comprehensively, ensuring supervision over their use and dissemination, and has provided AI-based personalized recommendations, emphasizing user rights protection and transparency. Furthermore, China has taken steps to promote the safe and ethical development of AI, particularly in the realm of generative AI, with accent on preventing bias, but also in terms of intellectual property rights, and the rights of individuals. Overall, China's regulatory approach reflects a concerted effort to establish a comprehensive framework for AI governance, emphasizing core values such as privacy, security, fairness, and ethical conduct. The centralized nature of China's regulatory system allows for swift implementation and enforcement of regulations, contributing to a more unified approach to AI governance compared to the United States

The European Union (EU) is a key player in the global landscape of AI regulation, adopting a comprehensive and rights-based approach to AI governance, which translates in a number of regulations, the most relevant of which is the Regulation on Artificial Intelligence recently adopted by the European Parliament, although the European Commission's proposal dates since 2021. The EU's regulatory framework is anchored by the General Data Protection Regulation (GDPR), which sets strong requirements for the processing of personal data and has significant implications for AI systems that rely on data. In addition to the GDPR, the EU has proposed and enacted various regulations and directives specifically targeting AI technologies. The proposed EU Artificial Intelligence Act is built on risk-based approach, whereby AI systems are categorized based on the level of risk assessed in relation to human rights protection, but not only. The highest level of risk is attributed to AI applications used in critical infrastructure, law enforcement, and healthcare, for which strong requirements are imposed for transparency, accountability, and human oversight. The AI Act explicitly forbids certain AI applications, such as biometric classification systems based on sensitive features and undirected extraction of facial images from the Internet or CCTV footage to create facial recognition databases. In addition to the Artificial Intelligence Act, the EU's Digital Services Act (DSA) and Digital Markets Act (DMA) address issues related to online platforms and algorithmic decision-making, with a similar aim to ensure transparency and accountability and to prevent discrimination or other harmful impact on human rights. Overall, the EU's regulatory approach presents itself as a comprehensive attempt to cover for fundamental rights and ethical principles, without compromising the potential for innovation and AI development. The risk-based approach is the expression of the clear intent to preserve a favourable environment for further research and development and to avoid over-regulation in cases where risks are lower.

4.2 Standardization approach

In terms of standards development, international standardization of emerging AI technologies is already underway, although AI is not sufficiently mature. In this paper authors have agreed to refer

exclusively to international standards as AI is a global phenomenon, it has no boundaries and affects the markets globally. Therefore, national standardizing initiatives are more valuable being up taken at international level.

In 2017 Joint Technical Committee 1 Artificial Intelligence of ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) was set up in order to tackle aspects involved in the development of these technologies. Standardization in this area was considered critical in order to allow AI to integrate with other technologies, thus, to evolve.

The committee has conducted a consistent activity since, taking a unique ecosystem approach looking at all aspects of AI and intending to first develop a set of key horizontal standards for use by other technical committees dealing with AI applications. Besides working on fundamental standards for terminology, use cases and applications, JTC 1 is also exploring how can standardization contribute to ease societal concerns posed by the fast-evolving AI, such as reliability, accuracy and usability.

Aside from the need for technical standards to codify knowledge and realize compatibility and interoperability to drive the development and large-scale implementation of AI technologies, there is an intense demand for commonly agreed international norms related to ethics, trust and governance of technology. These aspects need to be addressed across the entire AI system lifecycle, including but not limited to assessment methods, ways to treat biases or vulnerabilities, safety functions.

Some of the standardization documents already developed and published internationally are worth mentioning here:

- ISO/IEC 5339: 2024 Information technology — Artificial intelligence — Guidance for AI applications
- ISO/IEC TR 5469:2024 Artificial intelligence — Functional safety and AI systems
- ISO/IEC 23894:2023 Information technology — Artificial intelligence — Guidance on risk management
- ISO/IEC TR 24027:2021 Information technology — Artificial intelligence (AI) — Bias in AI systems and AI aided decision making
- ISO/IEC TR 24368:2022 Information technology — Artificial intelligence — Overview of ethical and societal concerns

The first international standard recently published on AI management systems is ISO/IEC 42001:2023 Information technology — Artificial intelligence — Management system. It provides the commonly agreed frame for establishing and continually improving an AI management system considering the involved risks and opportunities of AI, balancing innovation with governance. Considering the implications of AI technologies in almost every domain of human activity standardizers need to liaise with so many other areas dealing with consumer protection, health applications, data privacy or smart manufacturing for example. All these linked areas and many others will need to consider AI implications, therefore commonly agreed solutions on cross-cutting issues are fundamental.

Using standards for AI governance is already an option for the most developed economies. In Europe, the AI Regulation defines ex ante essential requirements to design AI systems and conformity assessment methods to put such technologies on the market. European standards will provide the mandatory design requirements and harmonised schemes for conformity assessment. Recently updated United States Standards Strategy acknowledges the relevance of standards for enhancing the competitiveness of the US industry. While, China Standards 2035, sees standards as playing a significant role in the country's aspirations for AI leadership (Gamito, 2023).

4.3 Discussion

Identifying the best option for AI governance in order to achieve a safe and competitive AI market requires a nuanced and multifaceted approach on various factors.

Key findings regarding the endeavours for AI regulation are considered below:

Dynamic Nature of AI and Complexity: AI technologies are constantly evolving, making it difficult for static regulatory frameworks to remain relevant and effective over time. The complexity of

AI systems, including machine learning algorithms and neural networks, further complicates regulatory efforts. Approaches that are flexible, adaptive, and responsive to technological advancements are essential. Often, governments rely on the expertise and capabilities of various governance stakeholders, potentially leveraging public-private partnerships or co-regulatory models (Wirtz, 2022).

Ethical and Societal Implications: AI raises numerous ethical and societal concerns, such as bias and discrimination, privacy infringement, job displacement and autonomous decision-making. Crafting regulations that address these concerns while fostering innovation is a significant challenge. AI is a tool aiming at increasing human well-being ultimately, consequently it is necessary to establish a universal governance framework to serve people and societal needs (Carrillor, 2020).

Global Governance: Given the global nature of AI deployment and development, research often highlights the necessity for international collaboration and harmonization of regulations to avoid fragmentation and ensure consistency. Establishing effective global governance mechanisms for AI regulation is challenging due to geopolitical tensions, differing cultural norms, and competing interests among nations; different countries may have divergent approaches and priorities. This disparity between the global nature of a problem and the localized nature of governing laws underscores the need for transnational regulation (Erdélyi, 2022). Achieving international agreements is crucial but often face significant difficulties as the interests of states / administrations are mostly of competing nature in their pursuit for global leadership.

Interdisciplinary Collaboration: Comprehensive AI regulation requires collaboration among stakeholders from diverse fields, including policymakers, technologists, ethicists, economists, social scientists, among others. In order to navigate the emerging transnational and national complexities, it is imperative to learn from past experiences in other regulatory fields and to prioritize interdisciplinary and multi-stakeholder collaboration in the formulation of sustainable AI policies (Erdélyi, 2022).

Transparency and Accountability: Ensuring transparency and accountability in AI systems is a significant challenge, particularly given the complexity of many algorithms and the opacity of decision-making processes. Regulatory measures must promote transparency while balancing proprietary interests and trade secrets. In compliance with Article 13 of the European AI Regulation, the design phase assumes a critical role in ensuring accountability within AI systems, with its importance extending to subsequent operational phases. Accountability is not confined solely to the design phase but permeates throughout the entire lifecycle, facilitating meaningful human oversight and interaction at each stage.

Resource Constraints: Many regulatory agencies lack the expertise, resources and funding necessary to develop and enforce AI regulations effectively. Addressing these resource constraints is essential for ensuring robust oversight and enforcement mechanisms.

Harmonization with Existing Laws: AI regulation must be harmonized with existing legal frameworks, including data protection, consumer protection and antitrust laws. It is important to note that it is not a legal vacuum (Carrillo, 2020). First, there are legal provisions and principles that apply to all individuals and social activities, including development of AI. Then, there are regulations that could apply to AI related issues through analogy, as for example regulation related to liability for defective products. Some argue that current laws governing citizens on tort and liability should be reviewed and potentially extended to include AI systems to regulate who will be liable, for instance, if AI systems and robots caused bodily harm to others (Loureiro et al, 2021). Ensuring consistency and coherence across regulatory domains is essential for minimizing regulatory fragmentation and avoiding conflicting requirements.

Unintended Consequences: Regulatory measures aimed at addressing specific AI risks may have unintended consequences, such as stifling innovation, impeding competition or disproportionately burdening certain stakeholders. Some say “a machine is able to think and act like human”. Others say that “machines do not understand, they / it simulates understanding” (Carrillo, 2020). Anticipating and mitigating these unintended consequences is essential for crafting effective regulations.

Key findings regarding AI standardization are to be taken into consideration as well:

Soft law: this is how standards are perceived - regulations with legal relevance but lacking binding force - encompasses industry standards, best practices, and certification programs. This form of regulation, compared to hard law - legally binding regulations - appears inevitable and highly suitable for the evolving and dynamic landscape of AI governance, as it facilitates swift implementation and adaptation while holding global applicability. Technical standards are rapidly emerging as indispensable tools for both the development and adoption, as well as the governance of AI technologies (Wirtz, 2022). In the light of the above, Marchant (2019, p. 1) highlights that the "governance gap" in AI will predominantly be addressed by so-called "soft law," due to its agility in implementation and adjustment, coupled with its international applicability. This underscores the significant contribution of organizations and industries in shaping a global AI governance system. The incorporation of the public interest dimension into standardization enhances its position and influence as a "transnational hybrid authority," which encompasses a blend of public and private actors (Graz, 2019).

Rapid Technological Evolution: AI technologies evolve rapidly, with new algorithms, frameworks, and techniques emerging frequently. Standardization efforts must keep pace with these advancements to remain relevant and effective, requiring agility and flexibility in standards development processes.

Interoperability and Compatibility: Standardization efforts aim to promote interoperability and compatibility among AI systems and components, facilitating integration, communication and cooperation between different systems and stakeholders. Bridging interdisciplinary gaps and aligning diverse interests and perspectives can be challenging but is essential for developing comprehensive standards.

Addressing Fragmentation: The proliferation of diverse AI technologies and approaches can lead to fragmentation and interoperability challenges, as different regions may have divergent regulatory requirements, cultural norms and technical preferences. Achieving global harmonization and interoperability is crucial but often difficult to attain. Standardization initiatives seek to mitigate these issues by providing common frameworks and protocols. The standardization process engages a wide array of stakeholders, each with their own divergent interests and agendas, increasing thereby the complexity of the process (Desouza et al., 2020). Gamito, 2023 brings to attention the fact that the development and adoption of standards may prioritize the interests and preferences of specific stakeholders rather than those of society as a whole, since standards are typically formulated by standard-developing organizations (SDOs), which are frequently private entities.

Promoting Trust and Adoption: AI systems can be complex and opaque, making it challenging to standardize their behaviour, performance and outcomes. Standards must address issues such as algorithmic transparency, interpretability and accountability to ensure trustworthiness reliability and fostering societal benefits.

While AI holds significant power in its ability to solve problems accurately and impartially, its lack of transparency can pose challenges by generating rules that are not adequately documented, thus diminishing human oversight and eroding trust (Leyer & Schneider, 2021). Standards delineate AI capabilities in terms of technical feasibility and provide the foundational architecture for AI development (Cantero Gamito, 2023), playing thus a critical role in fostering trust in AI systems and facilitating their integration with other technologies. A critical concept that has emerged in the AI governance landscape is "Trustworthy AI". Key global standard-setting organizations such as the Institute of Electrical and Electronics Engineers (IEEE) and the International Standards Organization (ISO) are actively involved in ongoing projects dedicated to Trustworthy AI. The ISO has developed a trust framework for handling multi-sourced data, encompassing data use obligations and controls, data provenance records, quality and integrity, chain of custody, immutable proof of compliance, security, and privacy (Valero, 2022).

Balancing Innovation and Standardization: Standardization should support innovation by providing common frameworks, protocols, and best practices without stifling creativity or impeding progress. Achieving this balance requires careful consideration of industry needs, market dynamics, and other stakeholders' needs as standards are known to be industry-driven.

Resource Constraints: Developing and maintaining AI standards requires significant resources, including expertise, funding, and infrastructure. Many standardization organizations and initiatives face resource constraints, which can impede progress and limit the effectiveness of standardization efforts.

Legal and Regulatory Considerations: AI standards must be harmonized with existing legal and regulatory frameworks, including data protection, consumer protection, intellectual property, and liability laws. Ensuring consistency and coherence across regulatory domains is essential for minimizing legal uncertainties and facilitating compliance.

Technical standards are swiftly emerging as indispensable tools for the development, adoption and governance of AI technologies (Straub, 2023).

Both AI regulation and standardization are crucial components of the broader governance framework for AI that require a collaborative and multidisciplinary approach aiming to promote innovation, ensure safety and ethical use, and maximize societal benefits while minimizing risks.

It is not easy to outline the most adequate approach to govern AI mainly due to the following elements. Firstly, the invisibility or non-materiality of Artificial Intelligence frames a reality that is not easily understandable. Secondly, due to limited consciousness, at social and political levels, about the existence and importance of AI, its complexity and scalability may not be foreseen. Therefore, the authors identified the main advantages and disadvantages related to both governing approaches - AI regulation and AI standardization - in the following tables.

Table 1: AI Regulation PROs and CONs

AI regulation	
PROs	CONs
1. Sets binding rules	1. Bureaucratic inertia
2. Based on moral principles	2. Lack of expertise / skills challenges
3. Aims at protecting human fundamental rights	3. Political influence or will (funding)
4. Provides legal certainty, security for all affected stakeholders	4. Reduced transparency
5. Establishes sanctions for misuse of AI-based technologies reinstating social order and rule of law	5. Reduced inclusiveness
6. Compliance with regulations presume some level of state recognition	6. 6. Limited to national boundaries
7. Ensures technology-neutral provisions	7. Moral / ethical rules are different across the globe
8. Could provide urgent solutions if needed	8. May not keep up with the rapid evolution of AI
9. Better responses to societal needs	9. Perception of law as a set of limitations and prohibitions
	10. Legal language could be complex
	11. Legal processes take time
	12. Difficulties to achieve international agreements due to different / divergent interests of states in the context of race for global leadership
	13. Over-regulation risks could hamper innovation
	14. May excessively focus on risks of AI, while neglecting the relevant benefits and advantages

Source: Authors' analyses

Table 2: AI Standardization PROs and CONs

AI Standardization	
PROs	CONs
1. Global / international relevance	1. Solutions are likely to be agreed between experts from countries with a certain level of economic and technological development, excluding others
2. Enhanced potential for harmonization	2. Adherence is voluntary
3. Standards are assumed on voluntary basis	3. Prescriptions could be too technical
4. Future-proof (more flexibility for changes)	4. Do not have the capacity to sanction negative use
5. Based on international consensus leading to self-enforcing	5. Geo-political influence
6. Multi-stakeholder community	6. In order to achieve compromise, delicate issues could be left out of the content resulting ambiguity
7. Allows interdisciplinary approaches	
8. Availability of in-depth knowledge and thorough expertise	
9. Industry-driven and industry relevant	
10. Public interest dimension of standardization	
11. Compliance with a certain standard/s gives presumption of certain quality	
12. Enables interoperability and network compatibility	
13. Better response to market needs	
14. More likely to be successful diffused	
15. Promotes and increases trust in AI systems	
16. Sets a reference for the application of conformity assessment	
17. Could pave the way to hard regulation	
18. Has the potential to reduce fragmentation	
19. Conducted usually by independent organisations	

Source: Authors' analyses

Collaboration among stakeholders from academia, industry, government and civil society, and ongoing research are essential for developing and refining these frameworks in response to evolving challenges and opportunities.

The comparison between the regulatory approaches of the US, China, and the EU reveals distinct philosophies and priorities in AI governance. The United States' decentralized approach, with sector-specific laws and guidelines addressing various aspects of AI development and deployment, allows for flexibility and innovation and seems to be allowing more space and time to companies to explore while observing the general behaviour and potential risks that may occur. While federal agencies like the National Institute of Standards and Technology (NIST) provide standards and guidance for AI technologies, there is no comprehensive federal AI regulation comparable to the EU's AI Act and it is expected that existing laws and principles, such as consumer protection, antitrust, and civil rights statutes would naturally cover, from a legal perspective, AI-related issues. This rather loose approach may be leading to potential gaps in AI governance, privacy protections, and ethical considerations, at least on short term. In contrast with the US approach, China's regulatory framework emphasizes state control, national security, and societal stability and, from this perspective, it seems to offer more predictability and to enable swift implementation and enforcement. Although the Chinese approach attempts to equally

promoting technological innovation, it raises concerns about potential implications of the strict regulation both on the rhythm of AI development, and for freedom of expression and privacy right. Moreover, compliance with China's stringent AI regulations may become a barrier to entry for foreign companies aiming at operating in the Chinese market or could lead to trade disputes for those already present there. On the other hand, the EU's risk-based approach prioritizes fundamental rights and ethical principles, seeking to avoid imposing administrative burdens on companies generating or using AI systems with lower risk. While the EU's regulatory framework enhances consumer trust, promotes fairness, and fosters global harmonization, it may face challenges related to slow adaptation, compliance costs, and potential innovation restraints.

Although all the three approaches show concern both for human rights and ethical principles protection, and for preserving a proper environment for AI development, there are clear differences of focus between the three, which have implications for AI development and global market dynamics. Various incentives and constraints respectively will shape different behaviours and, while the AI further permeates the societal infrastructure and becomes more generally used, international cooperation and alignment on AI regulation will be critical to ensuring responsible development of AI.

Each of the three approaches can be equally embraced or criticized depending on the point of view we choose to adopt. From a company's perspective, the American system may be preferable, although sometimes lack of unity and precision of regulation may lead to legal disputes, the outcome of which cannot be predicted entirely. From an individual's point of view, the Chinese system may seem more secure, however it may also end up limiting own freedom. The EU approach may seem to be the more moderate one, covering fundamental human rights and also allowing some space for innovation.

Overall, where regulation is in place, there seems to be a series of advantages related to (a) protection of human rights and safety, by setting clear rules for AI systems' behaviour and usage, including safeguarding against discrimination, bias, and unethical practices in AI decision making; (b) higher consumer confidence in AI due to the law guaranteed transparency, accountability and reliability, which can lead to greater adoption and thus faster development; (c) preventing unfair advantages for companies that might exploit the technology with no consideration for ethical implications, and thus ensuring a fair competition and equitable chances for innovative SMEs or startups; (d) fostering responsible innovation by integrating ethical principles in the regulatory framework.

On the other hand, there are also some disadvantages in regulating the field if the aim is to set out all the rules of the game in the legal framework. Overly prescriptive regulations can slow down innovation and hinder the development of new AI technologies. Moreover, if significant, the effort to comply with such regulations may create an artificial advantage to larger companies and create a barrier to SMEs and startups through administrative burdens. Also, given the fast development of the technology and the lack of predictability as to how it may develop and what further risks may occur in the process, governments could not keep up with the rhythm of such developments and regulations may soon become obsolete or, if too strict in terms of authorization processes, they may become a barrier for development imposing excessively bureaucratic procedures. Also, if compliance is too costly, it may be a deterrent factor for investing in AI research and development. Beyond these general unwanted effects of any type of regulation, divergent regulatory approaches across jurisdictions can create barriers to international collaboration and trade in AI technologies. Inconsistencies in regulations may impede the interoperability of AI systems and hinder cross-border innovation and deployment. On the other hand, regulations can only cover a limited spectrum of aspects and it lacks the vocation to define, to the required level of detail, all that is related to concrete technical aspects, including interoperability requirements, or quality assurance methods and best practices. Such aspects are generally the object of standardization, rather than regulation.

5. Conclusions

As AI technologies continue to advance and permeate every aspect of our lives, it is imperative that we navigate the complex ethical landscape with vigilance and foresight. By embracing

interdisciplinary collaboration, transparent communication and ethical governance, we can harness the transformative potential of AI. Some authors (Wirtz et al., 2022) argue that identifying and assessing the risks constitute the starting point of regulation processes. The following step would be “matching the risks with the proposed solutions within an integrative approach.” Such an integrative approach could be possible within public-private partnerships as co-regulation models.

While regulation plays a crucial role in setting legal frameworks, ensuring compliance and safeguarding against potential risks, standardization focuses on technical aspects such as interoperability, quality assurance and best practices.

The regulatory landscape surrounding AI is indeed complex and multifaceted, with each major player - the United States, China and the European Union - adopting distinct approaches reflective of their respective political, economic and societal contexts. While the United States embraces a decentralized approach, prioritizing flexibility and innovation, China opts for a centralized, proactive stance aimed at state control and stability. Meanwhile, the European Union takes a comprehensive, rights-based approach, seeking to balance regulatory oversight with innovation and ethical principles.

While each approach has its merits and drawbacks, it is essential to strike a balance between regulation and innovation. Overly prescriptive regulations risk stifling innovation and hindering technological progress, particularly given the rapid pace of AI development. Moreover, the lack of predictability in technological advancements challenges governments' ability to keep pace with regulatory requirements, potentially rendering regulations obsolete or overly burdensome. Standardization emerges as a complementary mechanism to regulation, addressing technical aspects such as interoperability and quality assurance that may fall outside the scope of regulatory frameworks. By promoting consistency and compatibility among AI systems, standardization can facilitate cross-border innovation and deployment while ensuring adherence to best practices. Technical standards are rapidly becoming key instruments for the governance of AI technologies (Wirtz et al., 2022).

AI regulation and AI standardization highlights the need for a balanced approach that addresses both regulatory oversight and technical standardization in the development and deployment of AI technologies. As AI technologies continue to evolve rapidly, policymakers and standardization bodies must remain agile to keep pace with advancements and address emerging challenges.

In navigating the complex terrain of AI, embracing public-private partnerships or co-regulation models will be crucial in developing flexible, adaptive regulatory frameworks, synergizing to foster innovation, a balanced approach of the ethical considerations and societal concerns, while promoting responsible AI development and deployment in a rapidly evolving technological landscape.

References

- Amariles, D., Baquero, P. (2023). Promises and limits of law for a human-centric artificial intelligence, *Computer law & security review* 48 (2023) 105795, <https://doi.org/10.1016/j.clsr.2023.105795>
- Beccacece Satornino, C., Du, S., Grewal, D. (2024). Using artificial intelligence to advance sustainable development in industrial markets: A complex adaptive systems perspective, *Industrial Marketing Management* 116 (2024) 145–157, <https://doi.org/10.1016/j.indmarman.2023.11.011>
- Benvenuti, M., Cangelosi, A., Weinberger, A., Mazzoni, E., Benassi, M., Barbaresi, M., Orsoni, M. (2023). Artificial intelligence and human behavioral development: A perspective on new skills and competences acquisition for the educational context. *Computers in Human Behavior*, Volume 148, November 2023, 107903 <https://doi.org/10.1016/j.chb.2023.107903>
- Carrillo, M. (2020). Artificial intelligence: From ethics to law, *Telecommunications Policy* 44 (2020) 101937, <https://doi.org/10.1016/j.telpol.2020.101937>
- Carsten Stahl, B., Rodrigues, R., Santiago, N., Macnish, K. (2022). A European Agency for Artificial Intelligence: Protecting fundamental rights and ethical values, *Computer law & security review* 45 (2022) 105661, <https://doi.org/10.1016/j.clsr.2022.105661>

- Correia Loureiro, S., Guerreiro, J., Tussyadiah, I. (2021). Artificial intelligence in business: State of the art and future research agenda., *Journal of Business Research* 129 (2021) 911–926, <https://doi.org/10.1016/j.jbusres.2020.11.001>
- Erdelyi, O., Goldsmith, J. (2022). Regulating artificial intelligence: Proposal for a global solution, *Government Information Quarterly* 39 (2022) 101748, <https://doi.org/10.1016/j.giq.2022.101748>
- Farrow, E. (2019). To augment human capacity—artificial intelligence evolution through causal layered analysis. (2019) *Futures* 108, 61–71. <https://doi.org/10.1016/j.futures.2019.02.022>
- Gamito, M. (2023). The influence of China in AI governance through standardisation, *Telecommunications Policy* 47 (2023) 102673, <https://doi.org/10.1016/j.telpol.2023.102673>
- Gesk, T., Leyer, M. (2022). Artificial intelligence in public services: When and why citizens accept its usage, *Government Information Quarterly* 39 (2022) 101704, <https://doi.org/10.1016/j.giq.2022.101704>
- Giudice, M.D., Scutto, V., Ballestra, L.V., Pironti, M. (2021). Humanoid robot adoption and labour productivity: a perspective on ambidextrous product innovation routines. (2021) *International Journal for Human Resources Management* 1–27. <https://doi.org/10.1080/09585192.2021.1897643>
- Jarrahi, M., Askay, D., Eshraghi, A., Smith, P. (2023). Artificial intelligence and knowledge management: A partnership between human and AI, *Business Horizons* (2023) 66, 87e99, <https://doi.org/10.1016/j.bushor.2022.03.002>
- Kopka, A., Grashof, N. (2022). Artificial intelligence: Catalyst or barrier on the path to sustainability? *Technological Forecasting & Social Change* 175 (2022) 121318, <https://doi.org/10.1016/j.techfore.2021.121318>
- Morandini, S., Fraboni, F., De Angelis, M., Puzzo, G., Giusino, D., Pietrantoni, L. (2023). The Impact of Artificial Intelligence on Workers’ Skills: Upskilling and Reskilling in Organisations (2023) *The International Journal of an Emerging Transdiscipline*, February 2023 <https://doi.org/10.28945/5078>
- Nawaz Khan, A., Jabeen, F., Mehmood, K., Soomro, M., Bresciani, S. (2023). Paving the way for technological innovation through adoption of artificial intelligence in conservative industries, *Journal of Business Research* 165 (2023) 114019, <https://doi.org/10.1016/j.jbusres.2023.114019>
- Robinson, S. (2020). Trust, transparency, and openness: How inclusion of cultural values shapes Nordic national public policy strategies for artificial intelligence (AI), *Technology in Society* 63 (2020) 101421, <https://doi.org/10.1016/j.techsoc.2020.101421>
- Straub, V., Morgan, D., Bright, J., Margetts, H. (2023). Artificial intelligence in government: Concepts, standards, and a unified framework, *Government Information Quarterly* 40 (2023) 101881, <https://doi.org/10.1016/j.giq.2023.101881>
- Stone, D., Lukaszewski, K., Johnson R. (2024). Will artificial intelligence radically change human resource management processes? *ORG DYN* 53 (2024) 101034
- Stuurman, K., Lachaud, E. (2022). Regulating AI. A label to complete the proposed Act on Artificial Intelligence, *Computer law & security review* 44 (2022) 105657 <https://doi.org/10.1016/j.clsr.2022.105657>
- Willcocks, L. (2020). Robo-Apocalypse cancelled? Reframing the automation and future of work debate. (2020) *J. Inf. Technol.* 35 (4), 286–302. <https://doi.org/10.1177/0268396220925830>
- Wirtz, B., Weyerer, J., Kehl, I. (2022) Governance of artificial intelligence: A risk and guideline-based integrative framework, *Government Information Quarterly* 39 (2022) 101685, <https://doi.org/10.1016/j.giq.2022.101685>

- Zirar, A., Ali, S., Islam N. (2023). Worker and workplace Artificial Intelligence (AI) coexistence: Emerging themes and research agenda, *Technovation* 124 (2023) 102747
- Zuiderwijk, A., Chen, Y., Salem, F. (2021). Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda, *Government Information Quarterly* 38 (2021) 101577, <https://doi.org/10.1016/j.giq.2021.101577>