



THE SCIENTIFIC LITERACY ENABLES POLICYMAKERS TO LEGISLATE ON ARTIFICIAL INTELLIGENCE

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Abstract:

This research emphasises the significance of scientific literacy for policymakers about the future trajectory of artificial intelligence. The ethical concerns surrounding the development of artificial intelligence are of utmost importance due to its potential social effect. Integrating AI systems into many sectors of society, such as healthcare and banking, necessitates adherence to ethical principles. Strict ethical frameworks must be implemented alongside the development of AI to safeguard against biases, privacy infringement, and ethical shortcomings. Researchers, developers, and policymakers must exercise constant vigilance to address concerns about transparency, accountability, and justice in AI systems. The ethical ramifications of artificial intelligence (AI) transcend technology, including significant ethical considerations for both people and society. Active engagement in ethical deliberations among stakeholders involved in AI development is of utmost importance to guarantee AI's responsible and sustainable deployment. This is a pivotal element in realising the whole potential of AI for the betterment of society. Politicians must comprehensively understand the scientific ideas behind AI to enact legislation in this field effectively.

Keywords: artificial intelligence, policymakers, scientific literacy

1. Introduction

The field of Artificial Intelligence (AI) has a diverse and extensive history, with its roots dating back to the 1950s when influential figures such as Alan Turing (Muggleton, 2014) and John McCarthy (Andresen, 2002) established the fundamental principles that underpin its advancement. Artificial intelligence aims to develop intelligent devices that imitate human cognitive abilities, resulting in progress in several domains like automation, healthcare, transportation, and others. The complex interaction of science, ethics, and politics becomes more evident as AI technologies advance. A comprehensive

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grasp of artificial intelligence's historical backdrop and theoretical foundations (AI) is essential for policymakers to traverse the intricate terrain of regulating this revolutionary technology (Dwivedi *et al.*, 2021). Scientific literacy is paramount in providing legislators with the requisite information and competencies to enact legislation about artificial intelligence (AI) that effectively reconciles innovation with ethical deliberations and social ramifications.

The influence of legislation on the ethical and practical aspects of artificial intelligence (AI) use is of utmost importance (Wirtz *et al.*, 2020). Governments may tackle problems such as bias in AI algorithms, privacy concerns, and responsibility for AI decision-making by implementing legislation and regulations. The Act establishes a structure for reducing possible hazards linked to AI technology and guarantees their responsible development and use (Chiappetta, 2023). In addition, legislation can stimulate innovation by offering corporations clarity and assurance when they allocate resources towards AI research and development. The establishment of data protection and privacy requirements in AI applications by the General Data Protection Regulation (GDPR) in the European Union has significantly impacted worldwide conversations around AI governance and accountability (Kronivets *et al.*, 2024). Legislation plays a crucial role in establishing rules that facilitate the appropriate and secure use of artificial intelligence (AI) technology across many sectors of society.

According to Duncan *et al.* (2020) and Weingart *et al.* (2021), the importance of scientific literacy cannot be overstated when it comes to influencing policy-making choices. In artificial intelligence (AI), policymakers must comprehensively understand AI's fundamental scientific concepts, prospective advantages, drawbacks, and ethical implications to formulate efficacious legislation (Stahl *et al.*, 2021). According to Kotsis (2024), possessing scientific literacy enables politicians to effectively interact with specialists, evaluate the credibility of scientific assertions, and make educated choices that align with society's needs and ideals. Governments may foster innovation and mitigate risks associated with AI technology by making policy choices grounded on robust scientific data (Meneceur, 2023). In order to be effective, regulations must strike a balance between promoting developments in artificial intelligence (AI) and tackling the accompanying issues, like data privacy, prejudice, and job displacement. Scientific literacy provides policymakers with the essential resources to effectively traverse the intricate realm of artificial intelligence (AI) and implement policies that foster responsible research and use of AI. Adopting a comprehensive strategy may guarantee that AI technologies positively impact society while minimising adverse consequences (Vinuesa *et al.*, 2020).

2. Understanding Artificial Intelligence

The idea and use of artificial intelligence (AI) span various definitions and scopes. Artificial intelligence (AI) encompasses replicating human cognitive processes via computers, including learning, reasoning, and problem-solving (Fogel, 2022). The domain of artificial intelligence encompasses a spectrum that spans from rudimentary

rule-based systems to intricate neural networks that emulate the human brain's operations. The field encompasses several areas of study, including machine learning (Soori *et al.*, 2022), natural language processing (Nagarhalli *et al.*, 2021), computer vision (Ayub Khan *et al.*, 2021), and robots (Vrontis *et al.*, 2022). Comprehending AI's extensive scope and profound nature is essential for legislators seeking to enact legislation efficiently in this swiftly developing domain. By comprehending the capabilities and constraints of artificial intelligence (AI) technology, policymakers may implement well-informed regulations that foster innovation while mitigating possible hazards. In order to properly traverse the complexity of AI legislation, it is essential to possess a strong basis in scientific literacy. Furthermore, possessing a comprehensive understanding of scientific concepts may assist policymakers in effectively managing the promotion of AI progress while simultaneously addressing ethical and social issues (Wróbel, 2022).

Artificial intelligence has grown pervasive in society, with a wide range of applications from recommendation systems to autonomous vehicles. Artificial intelligence (AI) plays a crucial role in healthcare by assisting in diagnoses, medication exploration, and tailored treatment strategies, improving patient outcomes (Sankarnarayanan *et al.*, 2023). In addition, artificial intelligence algorithms are used to examine market patterns within the banking sector, enhance trading techniques, and identify fraudulent behaviour, assuring financial institutions of efficient and secure functioning. Artificial intelligence (AI) in social media platforms facilitates the implementation of targeted advertising, user customisation, and content moderation, enhancing the digital environment's dynamic character. Nevertheless, ethical considerations emerge about data privacy, algorithmic prejudices, and the influence of AI on the labour market. To effectively address these intricacies, policymakers must implement rules that strike a harmonious equilibrium between innovation and the welfare of society (Dirgová Luptáková *et al.*, 2024). By comprehending AI's many and complex uses, legislators can formulate well-informed regulations that foster technical progress while upholding ethical issues.

3. Role of Politicians in AI Legislation

The regulation of artificial intelligence (AI) is paramount to politicians, given its extensive societal implications (Tinnirello, 2022). First and foremost, they need to comprehend the technical facets of AI to formulate efficacious policies that tackle possible hazards while promoting innovation (Taeihagh, 2021). A certain degree of scientific literacy is required to comprehend the complexities of artificial intelligence systems and their ramifications. Additionally, it is essential for lawmakers to actively include professionals, researchers, and stakeholders in order to get a wide range of viewpoints and ideas into the legal frameworks required for artificial intelligence (AI). The involvement of technologists and ethicists is essential in formulating legislation that effectively reconciles innovation with ethical deliberations. Finally, politicians must provide regulatory openness to preserve public confidence and responsibility in using AI. According to Feijóo *et al.* (2020), legislators can effectively negotiate the complex terrain of AI governance and establish a

legal framework that fosters AI technology's secure and ethical development by meeting these obligations. In order to effectively regulate AI, politicians need to possess a comprehensive comprehension of AI principles and actively participate in well-informed decision-making processes.

The challenges legislators encounter in AI policy are diverse and intricate. A significant obstacle is the fast advancement of artificial intelligence technologies, which often surpass the progress of legal frameworks (Zekos, 2022). This situation gives rise to a situation in which policymakers have difficulty staying abreast of the most recent innovations and their possible ramifications on society. Moreover, the multifaceted character of artificial intelligence necessitates lawmakers to possess a comprehensive comprehension of technological, ethical, and legal dimensions, hence presenting a formidable obstacle for those without a scientific foundation. Furthermore, the worldwide scope of AI requires international collaboration and uniform legislation to properly tackle difficulties that transcend national borders (Ala-Pietilä & Smuha, 2021). In order to surmount these challenges, policymakers must actively include specialists from other domains, provide resources towards ongoing education, and cooperate internationally to establish flexible and resilient legal structures that guarantee the responsible use of AI technology for the betterment of society.

The societal implications of AI regulation are a complex matter that needs meticulous examination (Aizenberg & van den Hoven, 2020). Given governments' global regulation of AI technologies, it is imperative to comprehensively analyse their possible societal impacts (Wischmeyer & Rademacher, 2020). Legislation determines AI development, deployment, and use in many fields. Appropriate rules are needed to address ethical problems, including algorithmic prejudice, privacy infringement, and employment displacement (Molina *et al.*, 2024). Furthermore, given the rapid progress in AI, it is essential for legislation to possess the flexibility to adapt to evolving technical environments while maintaining social principles. Policymakers may effectively address the challenges of AI integration and mitigate adverse social effects by implementing well-considered and proactive legislation. The ethical and social implications of AI adoption in future research and policymaking agendas will be strongly influenced by the effect of AI laws on society.

4. Importance of Scientific Literacy in Policy Making

Scientific literacy is comprehending, analysing, and assessing scientific information to make well-informed choices on scientific matters (Valladares, 2021). The complex nature of this term encompasses a comprehensive understanding of fundamental scientific concepts and the ability to engage in analytical thinking, logical reasoning, and effective communication about scientific matters (Janoušková *et al.*, 2023). Scientific literacy encompasses many vital elements, including comprehension of the scientific process, differentiation between correlation and causation (Osborne, 2023), identification of bias in scientific research, and assessment of the credibility of scientific sources (Osborne & Pimentel, 2023). Moreover, scientific literacy encompasses using scientific knowledge to

address practical issues effectively and the aptitude to participate in decision-making grounded on empirical evidence (Ben-Horin *et al.*, 2023). Within artificial intelligence legislation, politicians with a considerable degree of scientific literacy can formulate laws firmly rooted in scientific data. This enables them to cultivate advancements in AI technology while simultaneously minimising societal hazards.

According to Tasquier *et al.* (2022), acquiring scientific literacy provides policymakers with the requisite information and analytical abilities to traverse the intricate landscape of developing technologies such as artificial intelligence (AI). Comprehending the fundamental concepts behind artificial intelligence (AI) enables policymakers to formulate rules grounded in empirical facts, thus fostering innovation while mitigating adverse consequences. Policymakers may enhance the effectiveness of decision-making processes by possessing scientific literacy, which enables them to participate in well-informed conversations with experts and stakeholders (Kuziemski & Misuraca, 2020). Moreover, scientific literacy cultivates a more profound understanding of AI's ethical and social consequences, enabling legislators to foresee and tackle the broader ramifications of their legislative measures. In order to ensure that the governance of artificial intelligence (AI) is in line with the collective welfare of society, it is imperative to prioritise the development of scientific literacy among policymakers. This entails balancing technical progress and ethical concerns and effectively managing risks (Michal *et al.*, 2021).

An exemplary case study that offers valuable insights into the direct influence of scientific literacy on policymaking in artificial intelligence (AI) is the General Data Protection Regulation (GDPR) of the European Parliament. This regulation was significantly shaped by scientific reports examining AI's consequences on data privacy and security. Policymakers may develop comprehensive legislation to protect personal data in the digital era by possessing a scientifically literate comprehension of artificial intelligence (AI). Furthermore, research conducted by the National Academies of Sciences *et al.* (2016-10-14) revealed that lawmakers with a considerable degree of scientific literacy had a greater propensity to suggest and endorse artificial intelligence (AI) regulations that effectively reconciled advancements with ethical deliberations. The case studies highlighted the crucial significance of scientific literacy in influencing the development of AI policies that yield societal benefits. Scientific literacy is a fundamental framework for legislators to implement well-informed and progressive laws within the dynamic realm of artificial intelligence.

5. Enhancing Scientific Literacy for Effective AI Legislation

Implementing strategies to enhance scientific literacy among politicians is crucial in facilitating their ability to make well-informed judgments about intricate matters (Kotsis, 2024). The subject matter at hand pertains to artificial intelligence (AI). One potential strategy is the establishment of collaborative alliances among scientific organisations, policymakers, and educational entities to enhance the dissemination of precise and easily understandable scientific knowledge. According to Starke and Lünich (2020),

implementing customised training programs and seminars focused on essential scientific principles about artificial intelligence (AI) can potentially augment lawmakers' comprehension and capacity to participate in legislative procedures actively. Promoting the inclusion of scientific advisers inside political teams may provide significant contributions in terms of scientific expertise and assistance. Moreover, facilitating transparent communication between scientists and policymakers helps cultivate a climate of policymaking based on empirical data, guaranteeing that choices concerning AI are firmly rooted in scientific expertise rather than conjecture or false information (Dwivedi *et al.*, 2024). The enhancement of scientific literacy among politicians may be achieved by implementing these tactics, resulting in enhanced governance in AI legislation.

Establishing appropriate regulations for developing technologies, such as artificial intelligence (AI), necessitates collaboration between scientists and politicians (Luan, *et al.*, 2020). Scientists possess the requisite skills and data to provide policymakers with the information to make well-informed choices, considering AI progress's scientific and social ramifications. These partnerships may serve as a connection between technical expertise and the execution of policies, guaranteeing that laws are based on factual data and scientific agreement (Bhandari, 2023). Through collaboration, scientists and politicians can effectively tackle the intricate ethical, legal, and social dilemmas posed by AI, resulting in decision-making processes that are more informed and more equitable. These collaborative efforts contribute to the improvement of legislative quality and the advancement of responsible innovation in the field of artificial intelligence, eventually yielding societal benefits. Therefore, it is crucial to cultivate these connections in order to develop AI policies that are both efficient and morally upright (Udvaros & Forman, 2023). Training programs focused on artificial intelligence (AI), and scientific ideas are crucial in equipping legislators with the necessary skills to enact legislation within the dynamic and ever-changing technological environment. These systems can assist legislators in comprehending the consequences and prospective social repercussions of artificial intelligence (AI), empowering them to make well-informed judgments about regulatory frameworks and policies. According to Ulnicane and Aden (2023), legislators may enhance their ability to tackle AI law's intricacies by offering educational resources on scientific concepts, including machine learning algorithms, data protection, and ethical issues in AI research. Moreover, training programs have the potential to cultivate cooperation between policymakers and field specialists, resulting in informed and equitable decision-making. Integrating artificial intelligence (AI) and scientific literacy into political education gives politicians the tools to effectively traverse the complex interplay between technology, society, and government. This integration eventually enhances the effectiveness and adaptability of policy-making processes (Straub, 2023). An all-encompassing training program customised to the individual requirements of politicians may enable them to successfully tackle difficulties and capitalise on possibilities associated with artificial intelligence.

Nations that have implemented stringent legislation about artificial intelligence (AI), such as the European Union (EU), Canada, and Singapore, have implemented

extensive policies aimed at tackling the ethical and legal complexities associated with AI (Huang & Peissl, 2023). These policies guarantee openness, accountability, and equity in developing and implementing AI systems. An illustration of this may be seen in the General Data Protection Regulation (GDPR) of the European Union, which sets out requirements for data protection and privacy in AI applications. Simultaneously, Canada's Directive on Automated Decision-Making underscores the need for AI algorithms, which can be explained. The Model AI Governance Framework in Singapore delineates rules that govern the proper use of artificial intelligence (AI), emphasising the significance of human supervision and responsibility in AI systems (Umer & Adnan, 2024). By implementing this legislation, these nations are establishing a universal benchmark for the governance of artificial intelligence (AI), which has the potential to provide valuable guidance to policymakers throughout the globe about the ethical and legal considerations associated with AI technology.

The development of efficient policy addressing artificial intelligence (AI) necessitates the presence of scientific literacy among politicians (Stolpe & Hallström, 2024). According to Hudson *et al.* (2023), politicians who comprehensively comprehend scientific concepts are more adept at effectively addressing the intricate challenges associated with AI technology. Proficient policymakers with scientific knowledge may accurately perceive the intricacies of AI policies, effectively managing the trade-off between innovation and ethical concerns and possible hazards. According to Buhmann and Fieseler (2023), individuals possess the capacity to critically evaluate scientific data, enabling them to make well-informed judgments that contribute to the betterment of society. Studies suggest that legislators with a strong understanding of scientific principles are more inclined to adopt evidence-based ways of crafting policies, resulting in more thorough and progressive laws in artificial intelligence. By promoting the incorporation of scientific literacy into political leadership, policymakers have the potential to cultivate a more favourable atmosphere for the formulation and execution of AI policies that place equal emphasis on public welfare and technical progress.

An essential element is the need for interdisciplinary cooperation among professionals in technology, ethics, law, and policy to formulate comprehensive and progressive rules. Furthermore, comprehending the social ramifications of AI applications is essential to developing legislation that is both effective and advantageous to the public interest. By examining AI legislative efforts, policymakers may pinpoint optimal strategies and potential drawbacks to guide forthcoming regulatory frameworks that foster AI technology's responsible development and use.

6. Future Prospects and Recommendations

With the rapid advancement of AI, the future of AI law has become a central concern. One hypothesis posits the need to implement extensive regulatory measures to effectively tackle AI technology's ethical and social ramifications, guaranteeing that its use is by human values and rights. This law needs to strike a delicate equilibrium between promoting innovation and mitigating possible hazards, including but not

limited to prejudice, discrimination, and privacy issues. Furthermore, legislators will encounter difficulty staying abreast of the fast advancement of AI systems, necessitating flexible frameworks that can promptly adjust to emerging technologies. Developing solid regulations that support ethical AI deployment and nurture responsible innovation will need collaborations across governments, industry experts, and stakeholders. The future of artificial intelligence (AI) laws will profoundly impact both the technical domain and the societal structure.

Several proposals might be proposed to improve scientific literacy among policymakers and facilitate the development of more effective laws for artificial intelligence (AI). In order to make well-informed judgments, policymakers need to engage in ongoing education and training about pertinent scientific ideas and breakthroughs in artificial intelligence (AI) technology. This may include various educational activities such as workshops, seminars, and engagement with domain experts. Furthermore, policymakers must emphasise fostering multidisciplinary cooperation among scientists, engineers, ethicists, and policymakers to formulate all-encompassing AI regulations that consider both technological and ethical ramifications. Finally, policymakers must give precedence to openness in the decision-making procedures about AI laws, guaranteeing that the general public is adequately informed and actively engaged in the deliberations (Brauner *et al.*, 2023). Policymakers may effectively traverse the intricate terrain of AI law by incorporating these principles, establishing a robust scientific literacy basis.

A more profound comprehension of AI technology's fundamental principles and possible consequences will empower legislators to make well-informed choices that balance innovation and ethical issues (Coulthart *et al.*, 2024). Enhanced scientific literacy among legislators facilitates a deeper understanding of the intricate nature of artificial intelligence (AI) processes, enabling the development of more comprehensive legislative frameworks to tackle bias, privacy, and transparency (O'Shaughnessy *et al.*, 2023). Moreover, a deeper understanding of artificial intelligence (AI) principles will enhance the exchange of information between policymakers and industry professionals, promoting cooperation and facilitating well-informed decision-making. According to König *et al.* (2023), integrating scientific literacy into the legislative process enables policymakers to take proactive measures in addressing the developing issues presented by AI technologies. This approach ensures that legislation is both adaptable and thorough.

7. Conclusion

In summary, the level of scientific literacy plays a crucial role in influencing the capacity of legislators to enact legislation that is both effective and relevant to matters about artificial intelligence (AI). A comprehensive examination of the available scholarly works demonstrates that a solid grounding in scientific principles empowers policymakers to comprehend the intricacies of artificial intelligence (AI) technologies, assess prospective hazards, and arrive at well-informed perspectives about regulatory frameworks.

Politicians with advanced scientific literacy are more adept at interacting with experts, evaluating AI policies' consequences, and communicating with the public. The results above highlight the need to augment scientific literacy among government officials to effectively tackle the problems presented by artificial intelligence within a swiftly changing technological environment. Incorporating scientific education into policymaking may result in superior decision-making that is well-informed and grounded in facts, hence fostering responsible development and use of AI. In summary, our study underscores the significant importance of scientific literacy in influencing the development of efficient solutions for AI governance.

The profound consequences of scientific literacy in artificial intelligence (AI) have significant ramifications for future governance. As legislators confront the complexities associated with regulating artificial intelligence (AI) technologies, it becomes essential to comprehend the scientific concepts behind these advancements thoroughly. Policymakers with scientific literacy can formulate more efficient and well-informed policies, balancing technical progress, ethical concerns, and social consequences. Governments may effectively traverse complex AI ecosystems by basing policy choices on scientific understanding and promoting innovation while mitigating possible hazards. Furthermore, adopting a scientifically literate approach to policymaking can foster multidisciplinary cooperation among scientists, engineers, ethicists, and policymakers. This collaboration may contribute to creating comprehensive and forward-looking regulatory frameworks for developing and implementing artificial intelligence. Incorporating scientific literacy into policy-making processes is crucial to maintaining the relevance and adaptability of laws within the dynamic realm of artificial intelligence.

Further study on scientific literacy and its influence on policymaking for artificial intelligence should concentrate on the efficacy of educational programs in improving legislators' knowledge of AI. Investigating these programs' exact content and distribution methods might give significant information about optimising their effect. Furthermore, investigating the function of multidisciplinary cooperation in increasing scientific literacy among legislators might provide a comprehensive strategy for resolving the complexities of AI law. Furthermore, longitudinal studies that follow the long-term impact of scientific literacy on AI policy choices would help us better understand its long-term consequences. Future studies on these topics may give practical advice for establishing educational efforts that successfully educate legislators with the information they need to negotiate the complex environment of AI policy.

To summarise, it seems clear that increasing scientific literacy among legislators is critical to properly legislating for artificial intelligence. The complexity of AI technology needs a comprehensive understanding of its ramifications for society, the economy, and ethics. By providing policymakers with the essential information and abilities, they can make informed choices that determine the future of AI governance. Furthermore, establishing multidisciplinary cooperation among scientists, politicians, and the general public is critical for drafting comprehensive legislation considering all stakeholders' viewpoints. While problems persist, such as the quick rate of technology breakthroughs and varying degrees of scientific literacy, it is critical to prioritise constant learning and

communication to traverse these complexities effectively. Governments must continue improving their scientific literacy to meet the diverse problems and possibilities artificial intelligence presents.

Conflict of Interest Statement

The author declares no conflicts of interest.

About the Author

Konstantinos T. Kotsis, from 1981 to 2000, served as a Faculty Member specialising in solid-state physics and x-ray diffraction at the University of Ioannina's Physics Department. Since 2000, he has been a Faculty Member at the Department of Primary Education at the University of Ioannina, and in 2012, he was a Full Professor specialising in Physics Education. He has experience teaching in many University Departments, such as Physics, Chemistry, Computer Science, Biological Applications and Technology, and Primary Education at the University of Ioannina and Aristotle University of Thessaloniki, Greece. His articles have been published in scientific International and Greek journals.

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