

**FROM COMPLIANCE TO ACCOUNTABILITY: EVOLVING MODELS OF DATA
GOVERNANCE IN THE AGE OF AI AND BIG DATA**

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Abstract

The expansion of Artificial Intelligence (AI) and big data has exposed the limitations of traditional compliance-based data governance frameworks. Compliance frameworks like GDPR and CCPA offer baseline protections when dealing with large-scale data; however, they are unequipped to deal with the complexities, real-time decision-making demands, scale, and systemic risks posed by modern AI-enabled data ecosystems. This paper explores the paradigm shift from traditional compliance models to dynamic accountability-based governance that relies on ethical stewardship, transparency, and continuous oversight.

The article analyzes how accountability frameworks build trust and mitigate bias in AI systems within a fast-evolving technological landscape. The article uses case studies within the healthcare sector as well as the finance sector to demonstrate the practical implementations of this approach. It also highlights the key challenges inhibiting the adoption of the approach, such as organisational resistance and technical barriers. Finally, the article presents recommendations for policymakers and enterprises to foster responsible data stewardship in the AI era.

Keywords: *Data Governance, AI Ethics, Accountability Frameworks, Regulatory Compliance, Big Data, Algorithmic Transparency*

I. INTRODUCTION

The current digital age has led to the generation of unprecedented amounts of data, which has in turn driven the adoption of artificial intelligence. While this has created transformative opportunities, it has also introduced profound governance challenges. A report by Duarte (2025) indicates that the world now produces 402.74 million terabytes of data daily and 147 Zettabytes of data annually, with rates projected to continue growing as a result of IoT connectivity and the increasing number of people joining online platforms (Duarte, 2025). The rapid expansion of data generation has fueled the rapid expansion of AI, with the global AI market valued at \$391 billion as of 2025 and projected to reach \$1.81 trillion by 2030, driven by rapid adoption across industries (Howarth, 2024). AI tools like ChatGPT have experienced rapid adoption as companies seek to integrate AI solutions in their workplace, achieving annual revenues of above \$10 billion in 3 years, further highlighting the fast adoption rates. Nonetheless, this unprecedented advancement has come with massive societal implications; the AI enabled automation is projected to disrupt over 40% of jobs globally (Butts, 2025). Also, AI agents are likely to amplify risks of algorithmic bias and workforce displacement.

The current frameworks governing data privacy, security, and applications are designed for a slower-based digital environment, and their scope does not expand to this emerging AI space, thus inadequate in this new paradigm. The EU's General Data Protection Regulation (GDPR), once seen as comprehensive and groundbreaking, now exemplifies the limitations of these traditional data governance frameworks. The framework had a reactive focus on breaches of policies; for instance, the framework resulted in €1.2 billion fine to Facebook for transferring EU citizens' data to the US (Deutsche Welle, 2023). This penalty-based system fails to address the proactive risk mitigation needed for real-time AI systems, such as the autonomous vehicles making split-second decisions, to 'surveillance pricing' (dynamic pricing algorithms) that make millions of decisions a day. Policy-makers also take longer to respond to the AI advancement, which implies that regulations will almost always lag as algorithms rate of growth is much faster.

The limitations of the traditional data governance framework and the current AI landscape demand a paradigm shift from compliance to accountability. An accountability framework replaces the reactive legal checklists with a proactive ethical stewardship, which companies do not seek to protect themselves from legal consequences of breaking laws, but rather abide by the highest ethical standards. The compliance framework operates slowly, but accountability is real-time, hence a better framework when regulating an industry that is growing each day. By organisations adopting the accountability framework, they will be best positioned to harness the benefits of AI as they will gain public trust and support. To gauge the importance of this dynamic shift, this article will have the following objectives.

- i) Evaluate the shortcomings of compliance-only models in AI-driven environments.
- ii) Define core components of accountability-based governance.
- iii) Analyze sector-specific implementations and benefits.
- iv) Identify barriers to adoption and propose solutions

II. PROBLEM STATEMENT

The rapid growth of AI has created fundamental governance challenges that traditional frameworks are not well-equipped to address. AI systems operated at unprecedented speeds and scales, making it difficult for reactive traditional systems to regulate them (Bengio et al., 2024). Furthermore, these systems are prone to embedded biases and are likely to breach data protection policies; the inability of the traditional governance framework to address this is a major challenge. The inability of current regulatory approaches to handle this new frontier is due to a fundamental misalignment of AI realities. An established framework, such as GDPR, focuses on prescribing rules rather than offering ethical guidance on the implementation of these technologies. Moreover, the legislative process is often slow to catch up with the fast pace of AI. Even now, when AI is projected to have a market value of \$1.8 trillion by 2030, there is no air-tight regulatory framework (Howarth, 2024).

This lag in the regulatory framework creates a dangerous void that can result in development of unconstrained development of generative AI tools that are capable of mass disinformation. Moreover, the current system is focused on compliance; hence, there are no meaningful incentives for organisations to exceed the minimum requirement. As a result of these challenges, there needs to be a paradigm shift from compliance to active accountability, which requires companies engaged in AI to demonstrate responsibility from algorithmic design to deployment impact. Effective accountability, by transforming AI governance from legal checklists into a critical

competitive advantage and social contract, will enable organisations to harness the long-term benefits of AI by gaining the trust of consumers.

III. CORE PRINCIPLES OF ACCOUNTABILITY-BASED GOVERNANCE

3.1 Risk-Based Impact Assessments

To address data governance challenges posed by AI, a modern framework requires proactive identification of potential harms, which can be achieved by rigorous impact assessments. As opposed to traditional compliance-centric systems, modern systems must evaluate AI systems throughout their lifecycle (Kurumayya, 2025). For instance, AI Fairness 360, by IBM, offers comprehensive tools to evaluate and mitigate bias in datasets and models. This enables organisations to have a comprehensive set of fairness metrics and bias mitigation (Varshney, 2018). Modern framework needs to integrate such assessment applications that ensure continuous monitoring and correction of biases and errors. The EU is modernising its framework by implementing the AI Act, which enforces transparency, ensuring AI systems are developed and deployed responsibly (Emma, 2024).

3.2 Transparency

An accountability-based framework requires transparency and explainability. Already, the EU's GDPR has established the 'right to explanation', implying that the relevant authorities have a right to information about individual decisions made by algorithms, intended to improve algorithmic accountability (Kaminski, 2021). Currently, emerging platforms like SHAP (SHapley Additive exPlanations), can offer post-hoc interpretation of black-box models, which improves both the accountability and explainability of decisions made by algorithms (Ekanayake et al., 2022). The algorithmic transparency and explainability principle of the accountability-based framework helps bridge the gaps between the technical teams and regulators, which enables better policy formulation and fostering of trust between organisations, users, and governments.

Ethical Considerations in AI Development: Venn Diagram

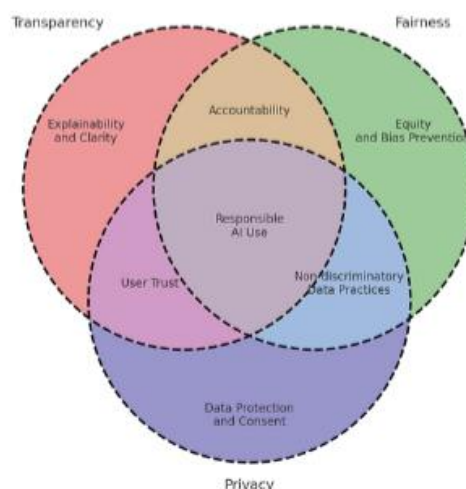


Figure 1: Transparency and accountability in AI (Radanliev, 2025)

3.3 Ethical Oversight Mechanisms

Establishing an effective regulatory framework centred on accountability requires robust and diverse oversight mechanisms. Due to the scale and speed of AI systems, governments alone cannot over the necessary oversight, hence there is a need for governments, organisations involved, as well as third parties, such as non-governmental organisations, to corroborate and offer the necessary oversight. The Global AI Ethics and Governance Observatory has already been set up to ensure there is collaboration in oversight. The body offers a centralised repository of information, insights, and resources that guides organisations, policymakers, and academics in navigating the ethical and governance dimensions of AI (European Commission, 2024). Establishing ethical oversight mechanisms enables the private sector to have a clear guideline as well as participate in enriching the regulatory framework with technical expertise, as well as market information, which is needed for the sector to thrive.

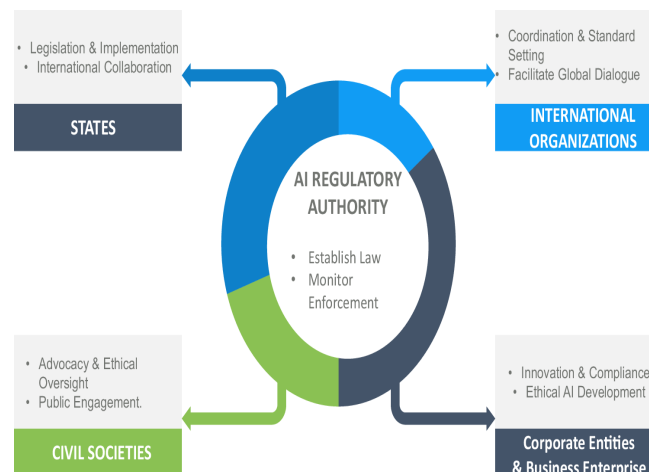


Figure 2: Complex and Rapidly Changing Regulatory Landscape (Zaidan and Ibrahim, 2024).

IV. SECTOR-SPECIFIC APPLICATIONS

4.1 Healthcare: Bias Mitigation in Diagnostic AI

The healthcare sector is among the most sensitive sectors where algorithmic biases can have fatal consequences. Despite this, it's among the sectors that are rapidly embracing to enhance various aspects of patient care, such as diagnosis, treatment, and administrative functions (Kuo, 2023). A case of algorithmic bias was shown in 2019 when an algorithm used to manage the healthcare of millions of Americans had a significant bias against black patients. Optum, a United Health Group, system used for evaluating the intensive healthcare needs for patients significantly underestimated the amount of care black patients need compared to white patients, this resulted to less money being used by black patients with the same level of needs as which patients (Paul, 2019; Chin et al., 2023). Having an accountability-based framework for AI systems will mitigate these challenges of bias, ensuring success in the implementation.

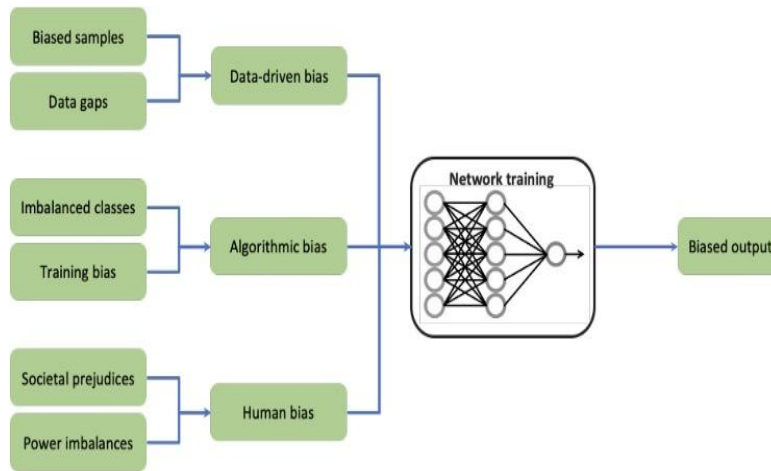


Figure 3: Addressing bias in big data and AI for health care (Norori, 2021)

4.2 Finance: Fairness in Credit Scoring

AI offers significant opportunities for fintech companies to analyse vast amounts of consumer data quickly and extend financing based on creditworthiness. However, the use of social media data in credit scoring, using AI, has raised concerns about discrimination and bias. Consumer Financial Protection Bureau (CFPB) is already adopting mechanisms for scrutinising discriminatory conduct, conducted using AI and machine learning, that violates federal prohibitions on unfair practices within the financial markets (Plunkett, 2022). Adopting an accountability-based framework will enable the relevant authority to deal with fairness issues among Fintech embracing AI, as it enables transparency and proactive monitoring needed for massive transactions. Moreover, by addressing biases, the fintech companies will be able to increase their clients, as people do not have a fair of being overcharged on interest based on biases.

4.3 Smart Cities: Privacy-Preserving Surveillance

Smart cities are emerging as an attractive urban arrangement as countries move towards a more efficient and sustainable future. However, the issues of surveillance and data protection in this aspect remain a major issue of contention (Zieliński, 2025). An effective accountability framework can address these challenges by enabling solutions such as edge computing that ensure all private and sensitive data is stored and analysed locally, while also promoting transparent policies in regards to data retention and use. This will enable the cities to balance between their security and the efficient needs for their fundamental rights through accountable governance.

V. LIMITATION/CHALLENGES TO ADOPTION

5.1 Organisational Resistance

The transition from compliance-focused data governance frameworks to accountability-based ones faces significant barriers from private enterprises. As indicated by Annesi et al (2025), a significant portion of executives still view governance as a regulatory cost as opposed to a source of competitive advantage. As a result, the ethics teams are understaffed and underfunded, making it

difficult to successfully implement accountability frameworks that are effective. Thus, for this paradigm shift to succeed, there needs to be a shift in executives' view of governance, which can be achieved by the government offering incentives and non-governmental bodies empowering clients to support enterprises that are intentional in promoting accountability and transparency.

5.2 Technical Barriers

AI systems are in their early stage of development; as such, the level of sophistication and applications are not yet mapped out effectively (Hossain et al., 2025). This also implies that monitoring tools like IBM's AI Fairness 360 cannot effectively address unstandardized metrics that exist today. The interoperability challenges due to a lack of standardisation translate to challenges with monitoring, promoting transparency, and ensuring optimal response. To address these challenges, countries need to work together to encourage standardisation of the systems as well as the metrics used. This level of cooperation will allow a seamless shift from compliance to accountability.

5.3 Global Coordination

Lack of a global framework for promoting accountability is another barrier, particularly for the complex multinational organisations. Major players like the EU, China, and the USA work independently rather than coordinating. This undermines the accountability policies as companies that do not want the policies can often shift their headquarters to nations that do not have such policies.

VI. THE FUTURE SCOPE

6.1 Emerging Solutions

To boost accountability and transparency of AI systems, enterprises and regulators are now turning to algorithmic auditing. Already, companies like the O'Neil Risk Consulting & Algorithmic Auditing (ORCAA) are offering auditing and AI system certifications (O'Neil et al., 2024). Auditing enables collective governance of sensitive datasets while maintaining individual rights. It also empowers policymakers by offering the technical metrics that need to be gauged and optimised, i.e. provides the target line and guidelines that policies should consider. Moreover, it enables enterprises to identify AI challenges and risks and rectify them before they damage the company's reputation or cause financial losses.

6.2 Policy Recommendations

To ensure that the data governance framework aligns with the speed of AI advancement, policymakers need to adopt a multi-stakeholder approach that balances innovation with ethical practices. International harmonisation is critical, allowing governments to converge around the key principles of fairness, transparency, and redress. Moreover, the policymakers need to mandate transparency for high-risk AI through a public registry of algorithms as well as training data sources. This will foster trust and address risks of biases. Finally, there should be more public and private collaboration to ensure policies do not stifle innovation by working together for prosperity of all.

VII. CONCLUSION

The rapid rise of AI and big data has transformed the governance landscape, exposing the limitations of the traditional compliance-based frameworks. As this article has demonstrated, the current reactive and compliance-centric regulatory approaches are barely effective while dealing with slower-moving technological eras and thus utterly incapable of dealing with the complex and real-time demands of modern AI systems. The documented cases of algorithmic bias in healthcare as well as lending platforms underscore the need for an urgent regulatory framework that addresses these challenges. An accountability framework offers a viable path to replace compliance with ethical stewardship. Accountability entails adopting risk-based impact assessments, promoting transparency, having an ethical oversight team, and prioritising coordination to bridge the trust gap between technology developers and the public. Nonetheless, challenges still persist in the implementation of the accountability-based framework. Organisational resistance is a major challenge as executives still consider governance and regulatory compliance as a cost rather than a competitive advantage and value drivers. This creates a challenge as the success of the accountability approach requires the cooperation of all the stakeholders. However, the emergence of algorithmic auditing platforms offers solutions to compliance, as now the regulators have a way to compare and evaluate the algorithms. A future where AI is central to the operations of key systems is inevitable; to ensure these systems serve all the stakeholders, there is a need to embrace accountability as the guiding principle.

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