



Original Article

Green AI And Sustainable Digital Governance: A Policy Analysis of Data Protection, Energy Consumption, And Environmental Impact in India

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Abstract

The rapid expansion of Artificial Intelligence (AI) and digital infrastructures has markedly enhanced economic growth and governance efficiency; however, it has concurrently engendered considerable environmental externalities, notably characterized by elevated energy consumption, carbon emissions, and resource-intensive data ecosystems. This research rigorously analyzes the notion of "Green AI" in the context of sustainable development, emphasizing the convergence of digital governance, environmental sustainability, and data privacy in India. This analysis examines how new AI technologies, particularly large-scale data processing systems and cloud-based infrastructures, contribute to ecological stress, prompting a reassessment of policy and regulatory frameworks. The study assesses the impact of India's Digital Personal Data Protection Act, 2023, in conjunction with current environmental and digital governance rules, on mitigating the sustainability problems presented by AI-driven systems. It identifies critical regulatory deficiencies, including the lack of environmental accountability within data governance frameworks and the absence of established sustainability indicators for AI implementation. The study presents a normative framework for incorporating environmental issues into digital governance by employing an interdisciplinary approach that merges legal analysis, policy assessment, and sustainability discourse. The paper advocates for the establishment of a "Green AI regulatory model" that integrates principles of energy efficiency, carbon accountability, and ethical data management. It additionally advocates for legislative interventions like green data center standards, ESG-linked digital governance, and incentives for sustainable innovation. The report ultimately enhances the ongoing dialogue regarding the alignment of technological progress with environmental sustainability, providing practical recommendations for policymakers, regulators, and stakeholders within India's digital ecosystem.

Keywords: Green AI, Sustainable Development, Digital Governance, Data Protection, DPDP Act 2023, Energy Consumption, Environmental Sustainability, ESG.

Introduction

The global digital transformation has led to remarkable progress in Artificial Intelligence (AI), big data analytics, and cloud computing, establishing them as essential catalysts for economic growth and governance innovation. This technological acceleration has also generated considerable environmental concerns. Artificial intelligence systems, especially extensive machine learning models, necessitate significant computational resources, leading to considerable energy usage and carbon emissions (Strubell et al., 2019). India, recognized as one of the fastest-growing digital economies, is experiencing swift development in data infrastructure, bolstered by initiatives like Digital India and heightened AI integration across several sectors. Although these advancements improve efficiency and accessibility, they simultaneously increase energy consumption, particularly from data centers, which are anticipated to expand enormously (International Energy Agency [IEA], 2023). The notion of Green AI has arisen as a solution to these difficulties, promoting energy-efficient and ecologically sustainable AI systems (Schwartz et al., 2020). Notwithstanding its increasing significance, India's legislative framework—comprising the Digital Personal Data Protection Act, 2023—primarily emphasizes privacy and data governance, while offering scant consideration to environmental sustainability.

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This study contends that sustainable digital governance necessitates the incorporation of environmental factors into AI legislation. The objective is to examine current policy frameworks, pinpoint regulatory deficiencies, and suggest a thorough model for Green AI governance in India.

Review Of Literature

The ecological ramifications of AI have emerged as a significant field of academic research. Preliminary research underscored the carbon emissions associated with training extensive AI models, indicating that a solitary natural language processing model can produce carbon emissions equivalent to many automobiles throughout their operational lifespans (Strubell et al., 2019). This has prompted demands for enhanced energy-efficient AI methodologies.

Schwartz et al. (2020) presented the notion of Green AI, highlighting efficiency, economic viability, and diminished ecological footprint. They contended that AI research ought to emphasize performance per unit of energy instead of absolute performance measurements.

Patterson et al. (2021) further proved that improving hardware and utilizing renewable energy sources can substantially diminish the carbon footprint of AI systems. The International Energy Agency (2023) indicated that data centers represent roughly 1–1.5% of worldwide electricity usage, underscoring the necessity for sustainable digital infrastructure.

From a governance standpoint, Floridi et al. (2018) suggested ethical frameworks for artificial intelligence, highlighting responsibility, sustainability, and accountability. Nevertheless, the majority of regulatory dialogues predominantly concentrate on privacy, bias, and accountability, rather than environmental issues.

In the Indian context, academic research on the Digital Personal Data Protection Act, 2023 predominantly focuses on privacy rights and data fiduciary responsibilities (Bhandari, 2023). The literature connecting data protection laws to environmental sustainability is sparse, highlighting a considerable study deficiency.

This research enhances the literature by connecting AI governance with environmental sustainability, specifically within the Indian legal context.

Research Methodology

This study adopts a doctrinal and interdisciplinary research methodology, combining legal analysis with policy and sustainability perspectives.

The paper examines statutory provisions of Digital Personal Data Protection Act, 2023, Environmental laws and policies in India and International AI governance frameworks. The doctrinal method is used to interpret legal texts and identify regulatory gaps.

The study relies on secondary data reports from international organizations (IEA, OECD, UN), academic journal articles on AI sustainability and Government policy documents. An interdisciplinary framework is applied, integrating legal analysis, environmental sustainability principles and digital governance models.

Research Objectives

- To analyze the environmental impact of AI and digital infrastructure
- To evaluate existing Indian legal and policy frameworks
- To identify regulatory gaps in sustainable digital governance
- To propose a Green AI regulatory model

Environmental Impact of AI and Digital Infrastructure

AI systems depend significantly on computational processes necessitating high-performance hardware and ongoing data processing. Training big models necessitates substantial utilization of GPUs and cloud infrastructure, resulting in considerable electricity usage (Strubell et al., 2019).

Data centers, integral to digital infrastructure, require substantial energy for computation and cooling. The IEA (2023) anticipates a rise in global electricity consumption by data centers due to escalating digital demand. The proliferation of cloud services and digital platforms in India has expedited the growth of data centers. Nonetheless, numerous institutions depend on non-renewable energy sources, hence exacerbating carbon emissions.

The environmental impact encompasses elevated carbon footprint, depletion of resources (water for cooling) and production of electronic waste. These difficulties require the incorporation of sustainability into digital governance structures.

Legal and Policy Framework in India

India's regulatory framework for digital governance predominantly emphasizes data protection and privacy. The Digital Personal Data Protection Act, 2023 delineates responsibilities for data fiduciaries, underscoring lawful processing and user consent.

Nevertheless, the Act fails to address energy utilization in data processing, environmental impact of digital infrastructure and standards for the sustainability of artificial intelligence systems. Environmental legislation in India, including the Environment Protection Act of 1986, does not explicitly govern digital technology or emissions associated with artificial intelligence.

Policy initiatives such as the National Action Plan on Climate Change and Digital India function independently, lacking cohesion between digital advancement and environmental sustainability. This disjointed methodology underscores the necessity for a unified regulatory framework.

Regulatory gaps, Indian policy developments, and Green AI Governance Framework

The analysis of India's governance regarding digital and environmental frameworks indicates a significant regulatory gap, particularly in aligning AI and data-driven technologies with sustainability regulations. The Digital Personal Data Protection Act,

2023 enhances informational privacy but neglects environmental accountability, failing to address the ecological impacts of digital infrastructure.

1. **Lack of Environmental Accountability:** Current regulations do not mandate environmental assessments for AI and data processes, overlooking carbon disclosures, energy consumption, and sustainability audits. This is critical given the high energy demands projected for AI-driven data centers, potentially conflicting with India's net-zero goals.
2. **Absence of Standardized Metrics:** India lacks a cohesive framework for assessing the environmental impact of AI, such as energy use per computation and carbon intensity of models, which hinders compliance and enforcement.
3. **Fragmented Governance:** The disjointed nature of digital and environmental policies presents challenges; however, recent state-level initiatives, like those in Gujarat and Tamil Nadu, begin to promote sustainability in digital infrastructure.
4. **Data Centre Dilemma:** There's a pressing concern over how rapidly rising energy demands from data centers can be aligned with sustainability. Current predictions suggest a rise in data center energy use that could escalate to 3% of national consumption by 2030, emphasizing the critical need for regulatory measures.
5. **Industry-Led Initiatives:** Significant private investments, such as Adani Enterprises' \$100 billion commitment to renewable-powered data centers and the Gujarat government's green data center hub, illustrate a shift towards integrating AI with renewable energy.
6. **Need for ESG Integration:** Sustainability in digital infrastructure is insufficiently reported in ESG frameworks, which currently miss critical aspects like AI lifecycle emissions and energy consumption metrics. A proposed "National Green-Data Mission" aims to align renewable energy use and financial incentives for AI.

To address these issues, a comprehensive Green AI governance framework is necessary that includes:

- Energy Efficiency Standards: Mandating efficient AI design methodologies.
- Carbon Accountability: Implementing mandatory carbon disclosures and lifecycle emissions reports for digital infrastructure.
- Renewable Energy Promotion: Incentivizing renewable integration and sustainable technologies in data centers.
- Policy Integration: Establishing coordination across relevant ministries to create a unified governance approach.

In conclusion, India has the opportunity to establish a sustainable digital governance model that integrates environmental accountability into AI regulations, paving a path towards a resilient digital future. A structured Green AI regulatory model can ensure the country's digital evolution aligns with both technological and environmental sustainability.

Conclusion

AI and digital infrastructure growth have transformed India's development trajectory, making it a global digital economy player. This progress comes with a less obvious but growing environmental cost: rising energy use, carbon emissions, and resource-intensive data ecosystems. This article shows that India's legislative framework, while progressive in data security and digital governance, is structurally inadequate to handle AI-driven systems' environmental externalities.

The regulatory gap between digital innovation and environmental sustainability is a key finding of this study. The Digital Personal Data Protection Act, 2023, and other digital legislation lack sustainability concerns, creating a governance deficit. Additionally, India's environmental laws have not adapted to digital technology's particular issues. This twofold flaw fragments policy and advances technology without ecological accountability.

State-level green data center policies and industry-led investments in renewable-powered AI infrastructure show a shift toward sustainable digital development in India. These activities are fragmented and lack a national framework. Such initiatives may not be enough to mitigate the long-term environmental consequences of large-scale AI deployment without systemic integration.

In this context, the report emphasizes the urgent need for a paradigm change toward Green AI governance, where sustainability underpins digital legislation. Energy efficiency, carbon accountability, ESG integration, and policy convergence form a realistic framework for this goal. Importantly, such a framework may promote responsible innovation, green investment, and worldwide leadership in sustainable technology governance, not just regulation.

Integrating environmental sustainability into digital governance supports India's SDGs and long-term goal of net-zero emissions by 2070. It also allows India to lead worldwide sustainable AI and digital infrastructure norms.

Finally, digital transformation must be technologically advanced and environmentally friendly. India can lead this transformation by creating a comprehensive and forward-thinking Green AI regulatory framework. This approach will maximize AI and digital innovation benefits without compromising environmental sustainability, ensuring a balanced and resilient road to sustainable development.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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