
ARTIFICIAL INTELLIGENCE AND ENVIRONMENTAL ACCOUNTABILITY: A LEGAL ANALYSIS OF ENERGY USE, CARBON DEBT AND ECOLOGICAL GOVERNANCE

Anushka Singh, Christ (Deemed to be University), Delhi NCR

ABSTRACT

Artificial Intelligence (AI), the most pivotal revolution of the 21st century, presents a severe environmental and energy crisis. This book chapter explores, in various stages, the ecological impacts led by AI across its lifecycle- mineral extraction, use, and waste disposal. The utilisation of rare earth minerals in AI hardware exposes ecosystems to radioactive by-products, soil contamination, and dangerous rays. Big data centres, the foundation of AI, exert pressures on biodiversity, water, and air through land conversion, overwater withdrawal for cooling, and fossil-fuel-powered electricity usage. These operations result in carbon debt, the long-term climate policy implications of which are unknown. Case studies of Congo's cobalt mines, Oregon and Ireland's data centres, and GPT-3's carbon debt document the extent to which biodiversity and human settlements are displaced or threatened by uncontrolled AI infrastructural growth. Moreover, manufacturing and usage of electronic equipment lead to massive e-waste production, which is harmful to soil and water quality. Against this backdrop, the chapter makes a case for climate-sensitive governing frameworks, carbon-sensitive AI innovation, and deployment of clean energy technologies. AI remains a threat to the larger landscape of environmental sustainability; technological development needs to be in check for the conservation and maintenance of the ecological balance.

Keywords: Artificial Intelligence, Data Centres, Carbon Debt, Loss of Biodiversity, Water Stress, Air Pollution, Climate Governance, Sustainable AI.

Introduction

The environmental and energy hazards of Artificial Intelligence (AI) cannot be understood in isolation from the global legal framework on climate change, sustainability, and corporate accountability. The legal framework has international agreements, domestic environmental laws, and emergent digital governance fashions that were created without consideration of the environmental burden engineered by AI. Therefore, AI's growth has outpaced the legal framework's germination of commensurate environmental protections. This section elaborates upon prior discussion on the relationship between the impacts of AI's life cycle with environmental law, energy regulation, and sustainable development obligations.

1. International Legally Acceptable Foreground

Sustainable development is the legal construct that was established on the premise that development cannot occur at the expense of environmental integrity embedded in the 1992 Rio Declaration¹ and affirmed in the 2015 Paris Agreement. As per Article 4(1)(f) of the UN Framework Convention on Climate Change (UNFCCC), the Parties are to promote sustainable management of sinks and reservoirs of greenhouse gases, including ecosystems.² In contrast, AI's infrastructure directly threatens those sinks and reservoirs with deforestation, soil degradation, and carbon emissions.

The Paris Agreement's Article 2(1)(c) also emphasizes the necessity of financial flows to support low-GHG and climate-resilient development pathways.³ However, the reality is that AI data centres are concentrated in jurisdictions that draw electricity from fossil-fuel-heavy grids, which contravenes this obligation. In principle, any jurisdiction that permits large AI infrastructure must ensure its energy sources are in line with its national obligations to its "Nationally Determined Contributions" (NDCs).⁴ This could be implemented through conditions of licensing for the construction of data centres, requirements to disclose carbon outputs, or including AI usage in national greenhouse-gas inventories.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes

¹ United Nations. (1992). *Rio Declaration on Environment and Development*. UN Doc. A/CONF.151/26.

² United Nations. (1992). *UN Framework Convention on Climate Change*.

³ Paris Agreement, art. 2(1)(c).

⁴ United Nations Environment Programme (UNEP). (2021). *Emissions Gap Report 2021*.

(1989) is relevant in relation to the context of AI.⁵ The rapid obsolescence of AI hardware is contributing to transboundary flows of e-waste, with hardware flowing from the Global North to less-regulated recycling regions in Africa and South Asia. It violates the Basel Convention, but this also violates the Bamako Convention (1991), which prohibits the export of hazardous wastes to Africa.⁶ The international legal community should amend or provide interpretive guidance of these instruments to affirmatively designate wastes from AI hardware as governed by these instruments.

2. Regulatory Gaps and Domestic Legal Frameworks

Environmental laws in different jurisdictions tend to be developed in silos and targeted at a sectoral scope. For instance, in India, the Environment (Protection) Act, 1986, the Water (Prevention and Control of Pollution) Act, 1974, and E-Waste (Management) Rules, 2016 all provide discrete legal frameworks to manage the environment in respect of air, water, and waste, respectively.⁷ None of these laws apply specifically to the environmental impacts of digital technologies. For example, the Information Technology Act, 2000⁸, provides a legal framework for digital activity, but does not attribute environmental responsibility. In the USA, although the Clean Air Act (CAA) and Clean Water Act (CWA) regulate emissions and discharges, operations of data-centres usually fall below thresholds for reporting or are treated under generic industrial permits.⁹

This regulatory gap in environmental legislation is part of a much broader regulatory challenge: environmental governance across jurisdictions was established to govern a set of physical sectors, but is now grappling to reign in an ever-expanding virtual economy. One of the key implications of AI is that it collapses the segregation of economic activity into 'virtual' and 'real'. The environmental impacts of this virtual economy is very real, but appears through a virtual workstream. Governments must now consider conducting a digital-environmental impact assessment (DEIA) for technology related infrastructure projects, or at the very least, establish an evaluation of carbon-footprint, water-stress mapping and biodiversity accounting

⁵ UNEP. (1989). *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal*.

⁶ Organization of African Unity. (1991). *Bamako Convention on the Ban of the Import into Africa of Hazardous Wastes*.

⁷ Government of India. (1986). *Environment (Protection) Act, 1986*

⁸ Information Technology Act, 2000 (India).

⁹ US Environmental Protection Agency (EPA). (2022). *Clean Air Act Overview*.

for all digital-infrastructure project approvals.¹⁰

While the European Union's AI Act (2021) was largely framed through an ethics and safety lens, discussion around whether sustainability metrics ought to be factored into AI conformity assessments is incipient. This is useful given the EU Green Deal (2019) and Corporate Sustainability Reporting Directive (CSRD, 2022)¹¹ that obligates large entities to disclose the Environmental Impact of their digital operations. The EU Data Centre Code of Conduct includes voluntary energy efficiency guidelines. However, as long as it is voluntary, these will not be meaningful.¹²

3. Energy and resource Governance

The disproportionate energy appetite of AI models signifies the need to incorporate AI into national energy-planning frameworks. States can impose renewable energy quota obligations on data centre operators, similar in nature to the Renewable Purchase Obligations (RPOs) established in the Indian market under the Electricity Act (2003)¹³; or carbon pricing policies can be used for AI workloads. A further innovation maybe, algorithmic energy efficiency standards, akin to fuel efficiency benchmarks enforced in the transport space that obliges AI developers to prove the efficiency of computational energy expenditure per training.

In addition, according to the Public Trust Doctrine established by the Indian Supreme Court in *M.C. Mehta v. Kamal Nath* (1997)¹⁴, the State is a trustee of natural resources. The extraction of both groundwater and surface water for AI cooling systems may be challenged on the basis that the diversion of water in such a way is not warranted by ecological considerations. Courts may also demand that conditions of environmental clearance require water-recycling systems or closed-loop cooling options or air-cooling alternatives as a condition for data-centre proposals.

4. Biodiversity and Land Use issues

There are land-acquisition issues in relation to EIA law for scale-level AI campuses. In India, for example, EIA Notification 2006 under the Environment (Protection) Act requires EIA for

¹⁰ OECD. (2023). *AI and Environmental Sustainability: Policy Considerations*.

¹¹ European Commission. (2022). *Corporate Sustainability Reporting Directive (CSRD)*.

¹² European Commission. (2020). *EU Code of Conduct on Data Centres Energy Efficiency*.

¹³ Electricity Act, 2003 (India).

¹⁴ *M.C. Mehta v. Kamal Nath*, (1997) 1 SCC 388 (India).

industrial projects - but the assessment schedules do not explicitly include digital-infrastructure projects¹⁵. This creates an EIA loophole: massive clusters of data-centres with footprint considerations which are potentially the size of every city in North America, evade the EIA process. Amendments to the categories should recognize that AI - cloud-computing - infrastructure should suddenly be Projects "A" which would require the highest level of appraisal.

On an international level, the Convention on Biological Diversity (CBD) and the Aichi Biodiversity Targets obligate states to reduce habitat loss and to incorporate biodiversity values into national planning measures.¹⁶ If AI infrastructure requires deforestation, or if it is to be converted into wetlands, the state has extensive obligations to undertake actions that may include compensatory afforestation, biodiversity offsets, or a strategic environmental assessment (SEA). Not doing so could violate a state's obligations under the CBD. Beyond the impacts of AI on biodiversity loss originating from deforestation, and even outside of wetland conversion, AI's natural tendency toward cumulative data centre development will warrant assessments of cumulative impact rather than individual project based assessments.

5. E-Waste and a Circular Economy

AI hardware and its end-of-life phase offer a regulatory burden and a new opportunity. Under the Extended Producer Responsibility (EPR) principle, producers are assigned responsibility for the waste resulting from consumer behaviour. The EU has operationalised EPR with their Waste Electrical and Electronic Equipment (WEEE) directive to manage electronic waste, although this is more a management approach to e-waste than an EPR mandate, just as this is a managerial approach to e-waste, it does not distinguish AI hardware from general ICT hardware.¹⁷ As AI proliferates hardware and accelerates hardware turnover (which expands the prevalence of e-waste), EPR obligations should be redefined and/or restated according to function and/or longevity. Differentiated fees may incentivise hardware design that is durable and modular or may incentivise hardware design that supports recyclability.

In India, the E-Waste (Management) Rules, 2022 now mandates that producers must adhere to collection targets and recycling commitments, but enforcement of these measures is weak.¹⁸

¹⁵ Government of India. (2006). *EIA Notification, 2006*.

¹⁶ United Nations. (1992). *Convention on Biological Diversity*.

¹⁷ European Parliament. (2012). *WEEE Directive 2012/19/EU*.

¹⁸ Ministry of Environment, Forest and Climate Change (India). (2022). *E-Waste (Management) Rules, 2022*.

Adding AI-specific items (GPUs, ASICs, a server board) in the mandatory recycling schedule would help promote accountability. Additionally, the Indian Constitution Article 48-A¹⁹ requires the State to protect and improve the environment. If this directive principle is judicially expanded to cover the management of digital-pollution, there could even be a constitutional basis for sustained AI governance.

6. Corporate Accountability and ESG Accountability

The corporate governance frameworks for large-scale AI corporations, including machine-learning companies, are beginning to incorporate ESG (Environmental, Social, and Governance) criteria. “Carbon transparency reports” being informed by the incorporation of not just ethics-bias but also, “carbon transparency reports” should be published, which would provide energy used per modelling training, water used, and GHG emissions. Stock exchanges and securities regulators (think SEBI BRSR framework in India) should be able to require such reports, as part of sustainable-regulated reporting. Internationally, this is being instituted by aligning with the Task Force on Climate-related Financial Disclosures (TCFD), and Global Reporting Initiative (GRI) to standardise reporting on these principles.²⁰

In addition, obligations for corporate due diligence, set by instruments such as the EU Corporate Sustainability Due Diligence Directive (CSDDD)²¹, may also capture risks regarding the life cycle of equipment supply chains of AI hardware associated with rare-earth mining. Companies that procure materials from areas of the Congo Basin should ensure their sources comply with environmental and human-rights obligations or risk civil liability or trade sanctions.

7. Employing AI for Climate Governance

The inherent duality of AI—its potential to contribute to climate change and also to help mitigate it— necessitates balanced governance. While AI may lead to the optimisation of renewable-energy electricity grids, has the potential to improve the efficiency of carbon capture, and can be used to monitor deforestation more efficiently than traditional monitoring, these upside benefits will be outweighed if the AI systems themselves lead to additional

¹⁹ Constitution of India, art. 48-A.

²⁰ SEBI. (2021). *Business Responsibility and Sustainability Reporting (BRSR) Framework*.

²¹ European Parliament. (2024). *Corporate Sustainability Due Diligence Directive (CSDDD)*.

emissions. Therefore, "carbon-sensitive AI innovation"²² should be considered a normative policy in which any new projects involving AI are assessed for their overall net climate impact, similar to how any industrial project would be assessed to determine if a carbon budget would be maintained in permitting.

The precautionary principle, which is captured by Principle 15 of the Rio Declaration²³, dictates that, 'In order to protect the environment, the precautionary approach prevails to mitigate potential environmental harm despite any reluctance to act in light of scientific uncertainty. Given the unknown long-term carbon burden of AI expansion, regulators in their governance of AI should adopt a precautionary framework of conditional approvals or moratoria until criteria for sustainability can be established.

Literature Review

Current research projects on artificial intelligence (AI) and the environment coalesce around two key ideas, that AI sits within a materially embedded physical infrastructure (mineral extraction, semiconductor fabrication, data centres, and hardware disposal) that is resource intense, and that the legal and regulatory frameworks that exist are not yet designed to internalise the full menu of environmental externalities produced by the infrastructure. This literature review categorises the growing interdisciplinary literature - legal scholarship, policy reports, technical reports - into three analytic threads: (A) material-supply and manufacturing; (B) operational energy and water; and (C) end-of-life and circular-economy regulation. Each thread identifies key findings and noteworthy regulatory prescriptions highlighted by commentators.

A. The consequences of the supply and manufacture of materials. Many have used the label "AI hardware" as an endpoint for complicated mineral supply chains whose extraction brings on significant and well-documented ecological and human rights abuses.²⁴ Industry and policy reports have explicitly noted definitive risks to modern GPU, ASICs, and semiconductor devices being produced from cobalt, lithium, rare-earth elements, and other critical minerals, which generate mining tailings, acid drainage contamination, and problematic radioactive by-

²² Hickel, J., & Dorninger, C. (2022). *AI, Energy, and Degrowth Policy*. *Ecological Economics*, 199, 107-145.

²³ Rio Declaration, Principle 15.

²⁴ OEKO-Institut. (2024). *Environmental and energy impacts of artificial intelligence*. OEKO-Institut. <https://www.oeko.de/en/research/ai-environment>

products; soil and water contamination is generally permanent and transboundary.²⁵ Human-rights reporting and investigation have noted labour abuse, child labour, and toxic exposures in the cobalt mining regions themselves, exacerbating the situation by presenting the link between environmental harm and social welfare abuses.²⁶ Legal commentaries are encouraging supply chain due diligence obligations modeled on OECD Due Diligence Guidance and the UN Guiding Principles on Business and Human Rights and relying on statutory duty of disclosure and remediation bonds for companies with extractive projects supplying AI supply chains.²⁷

B. Operational energy and water burdens.

A second body of literature interrogates the operational footprint of AI - specifically, energy needs for training and inference, and water needs for cooling high-density data centres as a result. Reports and empirical studies suggest that by 2030 hyperscale AI workloads may have dramatically increased electricity consumption in data centres, and that it requires substantial one-time energy consumption to train large language models, sometimes referred to as a model or AI system's "carbon debt".²⁸ Scholars have raised concerns about the lack of corporate disclosures and argue for lifecycle GHG accounting, noting the need to incorporate upstream manufacturing and emissions to avoid underestimating GHG emissions.²⁹ In a legal analysis, commentators suggest applying energy-sector regulatory tools on the digital side as well, including renewable-sourcing obligations, carbon-tracing requirements, and inclusion of AI facilities in national GHG accounting to prevent lock-in of fossil-fuel dependence.³⁰ Water governance scholarship adds to this by examining the toll from cooling needs on aquifers in dry regions and making a case for permitting and conditional licensing for water use as part of the environmental clearances for new data centre projects.³¹

²⁵ International Energy Agency. (2022). *Critical minerals and the energy transition*. IEA. <https://www.iea.org/reports/critical-minerals-and-the-energy-transition>

²⁶ Human Rights Watch. (2023). *Powering AI: Cobalt mining and child labour in Congo*. <https://www.hrw.org/report/2023/powering-ai>

²⁷ OECD. (2016). *OECD Due Diligence Guidance for Responsible Mineral Supply Chains*. OECD <https://www.oecd.org/corporate/mne/mining.htm>

²⁸ Strubell, E., Ganesh, A., & McCallum, A. (2019). Energy and policy considerations for deep learning in NLP. *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*, 3645–3650. <https://aclanthology.org/P19-1355/>

²⁹ Grantham Research Institute on Climate Change and the Environment. (2023). *AI and the environment: Risks and responses*. London School of Economics. <https://www.lse.ac.uk/granthaminstitute/AI-environment>

³⁰ International Energy Agency. (2023). *AI and energy: Policy pathways*. IEA. <https://www.iea.org/reports/ai-and-energy>

³¹ OECD. (2023). *AI and environmental sustainability: Policy considerations*. OECD.

C. End-of-life management and circularity.

Research on e-waste and circular economy interventions highlight the increasing pace of hardware turnover propelled by artificial intelligence's rapid obsolescence and upgrade cycles.³² Technical reports and international monitors project that e-waste associated with AI could, without intervention, exceed millions of tonnes in weight by the year 2030; the toxic mix of e-waste potentially leads to harm to soil and groundwater supply, and informal recyclers in low and middle-income settings are often disproportionately impacted.³³ Legal scholarship has converged around the need for Extended Producer Responsibility (EPR) programs, mandatory producer take-back and material-recovery quotas, and harmonized programs, including a renewed application of the Basel Convention, to prevent the illegal movement of hazardous e-waste across borders.³⁴ Comparative studies suggest that EPR needs to be incorporated in a manner that encourages modularity and repair of servers and chipsets, thus aligning the incentives between intellectual property, procurement and environmental law.³⁵

Responses from laws and policies: points of integration and discontinuity.

Academics and policy analysts agree to a large degree on normative baselines - transparency, lifecycle accounting, supply-chain due diligence, and circularity - but disagree in regard to the institutional design and enforceability of the mechanisms.³⁶ European instruments such as the proposed AI Act and its Corporate Sustainability Reporting Directive demonstrate a compliance architecture designed to integrate AI governance with sustainability metrics - although critics argue that many of the behaviour change measures are voluntary or lacking sufficient enforceability.³⁷ Comparative analysis suggests that jurisdictions with strict environmental and procurement law (and with aggressive and ambitious renewable grids) can implement reform of data-centre siting and permitting faster than states that are more reliant

<https://www.oecd.org/going-digital/ai-environment>

³² Semiconductor Industry Association. (2023). *Sustainability in semiconductor manufacturing*. <https://www.semiconductors.org/sustainability>

³³ OEKO-Institut. (2024). *Environmental and energy impacts of artificial intelligence*. <https://www.oeko.de/en/research/ai-environment>

³⁴ United Nations. (1992). *Rio Declaration on Environment and Development*. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf

³⁵ Ministry of Environment, Forest and Climate Change (India). (2020). *EIA Notification (as amended)*. <https://moef.gov.in/eia-notification-2006>

³⁶ Human Rights Watch. (2023). *Powering AI: Cobalt mining and child labour in Congo*. <https://www.hrw.org/report/2023/powering-ai>

³⁷ United Nations. (2011). *Guiding Principles on Business and Human Rights*.

<https://www.ohchr.org/en/publications/reference-materials-and-tools-guidance/business-and-human-rights>

on fossil generation due to political-economy inertia to impose energy and water conditions.³⁸ In the case of India, commentators map existing constitutional environmental doctrines (like Article 21 rights and the public-trust doctrine) and statutory instruments (like the E-Waste Rules, the Water Act and the EIA notifications) to the AI lifecycle, suggesting that legal reform need not be pure invention or hatched entirely from the imagination but can be realignment and recalibration of statutory instruments and doctrines to the digital age.³⁹

Remedies and policy recommendations.

The prescriptive literature exists in a depth and programmatic way. Common recommendations include: mandatory disclosures of the AI lifecycle as part of corporate reporting regimes; legally enforceable renewable-purchase (or carbon-intensity) minima for data centres; statutory duties to perform supply-chain environmental diligence and human-rights due diligence, accompanied by civil and administrative penalties, obligations for extended producer responsibility (EPR) that provides graduated fees to incentivize durable and modular design; mandatory DEIA (Digital Environmental Impact Assessments) for large-scale AI infrastructure; and Strategic Environmental Assessments (SEAs) to inform decision-makers about cumulative impacts.⁴⁰ Scholars additionally offer support for market instruments (carbon pricing or environmental fees) for compute-intense activities, together with tax incentives for on-site renewable energy and waste-heat reutilization.⁴¹ The jurisprudence literature offers yet another layer by exploring how courts could use existing doctrines (precautionary principle, polluter pays, rights-based environmental protections) to increase governance over AI externalities in the absence of any recent statutes.

Methodological critiques and research gaps.

Critical scholarship warns that many of the empirical estimates (at least fifteen) do not provide clear tap of data and are model-dependent which makes it difficult to accurately calibrate regulatory options.⁴² There are therefore calls for mandated disclosure of energy and material

³⁸ Government of India. (2014). *Companies (Corporate Social Responsibility Policy) Rules*. <https://www.mca.gov.in/CSR-rules>

³⁹ Central Pollution Control Board (CPCB). (2023). *E-Waste status report*. <https://cpcb.nic.in/e-waste/>

⁴⁰ European Commission. (2021). *Proposal for a Regulation laying down harmonised rules on artificial intelligence (AI Act)*. <https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai>

⁴¹ International Energy Agency. (2023). *AI and energy: Policy pathways*. <https://www.iea.org/reports/ai-and-energy>

⁴² Vinuesa, R., et al. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. *Nature Communications*, 11, 233. <https://doi.org/10.1038/s41467-019-14108-y>

metrics from AI firms, accompanied by independent third party verification, to provide a data basis for energy policy.⁴³

Methodology

This research employs a methodology of doctrinal policy analysis in legal literature, regulatory studies and environmental impact scholarship. The paper draws upon numerous sources: literary and technical reports (for example, from international energy agencies and institutions studying computing sustainability), legal and policy essays about data centre regulation and AI governance, and selected case studies in publicly reported mining data, e-waste and data centre operations. The methodology involves the following steps:

Key recent studies on the environmental impact of AI, computing infrastructure and data centres were identified. For example, the OEKO-Institut report on AI infrastructure projected major consumption of electricity and water by data centres through 2030.

The Grantham Research Institute at the London School of Economics similarly offered an explainer of the direct risks of AI to climate and the environment.

Lifecycle segmentation – The analysis partitions the AI lifecycle into three stages: raw minerals/hardware extraction; operational use (data-centres, machine learning training, inference); and end-of-life (hardware disposal, e-waste). The cradle-to-grave approach enables mapping of distinct impact vectors and associated governmental responsibilities.

Case-study integration – To ground the concepts in abstraction, this study employs case studies centered around geography, indexing some (e.g., cobalt extraction in Congo; data centre proliferation in Ireland/Oregon; carbon debt estimates in large language models) from various sources.

Regulatory and governance framing – The environmental impacts are framed from the perspective of international climate policy, resource governance regimes (e.g. critical minerals supply chain), water law and biodiversity law; situating the analysis in, and focusing the conceptualization, on the regulatory-domain of law/policy instead of purely technical-

⁴³ Grantham Research Institute. (2023). *AI and the environment: Risks and responses*. <https://www.lse.ac.uk/granthaminstitute/AI-environment>

engineering.

Normative recommendations – Drawing from the findings normative recommendations are drawn in regard to legal/regulatory reform, corporate governance, innovation policy and deployment of clean technology.

Limitations of this method must be recognized: many of the measures that would be used (e.g., specific electricity consumption of an AI inference task, full life-cycle mineral extraction externalities) are either opaque or proprietary. As observed by the Grantham Institute, “Energy consumption data is not publicly available.

3. Analysis

3.1 Lifecycle Accountability in AI Infrastructure

Artificial Intelligence (AI) is a transformative force in the 21st century, but the environmental impacts are becoming more apparent. As an emerging form of technology, the environmental impact of AI represents the performance across several stages of its life-cycle – from the extraction of minerals and manufacturing of hardware, to data-centre operations and end-of-life disposal of the hardware.⁴⁴ Every stage has particular environmental impacts on soil, water, air, and biodiversity, with many associated legal and regulatory challenges concerning responsibility, sustainability, and governance. The existing regulatory frameworks, international and domestic, do not accommodate the particular resource intensity of AI within existing environmental and climate legal frameworks, and these frameworks must recognize the principles of “polluter pays,” due diligence and lifecycle accountability into the governance of AI technologies (UNEP, 2023).⁴⁵

In the following section, a thorough legal-ecological assessment of the AI environmental life-cycle will be provided, including discussion on the extractive beginnings of AI hardware, the operational resource pressures of data-centres that use AI hardware, and the urgent growing electronic and data-waste issue at the end-of-life of AI hardware. The assessment will refer to existing international and Indian laws and legal frameworks, while highlighting the need for existing environmental laws in general to adapt, and to confront the rapidly progressing

⁴⁴ OEKO-Institut. (2024). *Environmental and Energy Impacts of Artificial Intelligence*. Berlin: OEKO.

⁴⁵ UNEP. (2023). *AI and Environmental Governance: Policy Report*. United Nations Environment Programme.

sustainability risks of the AI sector.

3.2 Extraction and Manufacturing Effects: Mineral Dependencies, Soil Pollution, and Resource Intensiveness

3.2.1 Rare Earth Extraction and Risk of Radioactive By-products

The extraction of rare-earth and critical minerals, including cobalt, lithium, and neodymium, are key materials to AI hardware, especially in GPUs, semiconductors, or high-performance computing nodes. However, mining processes in these minerals involve the production of tailings, which often contain radioactive elements or heavy metals that can lead to soil and groundwater pollution (International Energy Agency [IEA], 2022). Tailings that contaminated the soil and groundwater may leach uranium, thorium, or radon gas into the surrounding ecosystems and create long-term impacts on ecology and human health.⁴⁶

While we have little available data specific to AI hardware to inform us about such mining externalities, the logic of supply-chain leads to the conclusion that the growing demand for AI accelerates mining pressures of obtaining minerals. The implications of damaging the environment will be consistent with what we continually observe in the electronics manufacturing space: soil erosion, acid mine drainage, and biodiversity loss (Grantham Institute, 2023).⁴⁷ The cobalt mines in the Democratic Republic of Congo demonstrate this point, where artisanal mining has taken place with weak regulatory oversight, leading to waste exposure or human rights violations (Amnesty International, 2022).⁴⁸

International environmental law imposes obligations for the reduction of waste, safe treatment, and the obligation to disclose environmental impacts in supply chains via the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes (1989) and the OECD Guidelines for Multinational Enterprises (2011).⁴⁹ However, implementation has been patchy. From a domestic perspective, India's Environment (Protection) Act 1986 and the Mines and Minerals (Development and Regulation) Act 1957 contained little provision for radioactive materials or soil contamination that might follow from imported mineral supply chains,

⁴⁶ Ibid.

⁴⁷ Grantham Institute. (2023). *AI and Resource Extraction: Environmental Implications*. LSE.

⁴⁸ Amnesty International. (2022). *This is What We Die For: Human Rights Abuses in Cobalt Mining*.

⁴⁹ OECD. (2011). *OECD Guidelines for Multinational Enterprises*. Paris: OECD Publishing.

exposing a regulatory gap linking global extraction with local environmental liability.⁵⁰

3.2.2 Energy-Intensive Manufacturing and Water Footprint

Semiconductor fabrication, which is foundational to AI hardware, is also one of the most energy-intensive and water-intensive manufacturing processes globally.⁵¹ Cleanroom maintenance, chemical etching, and lithography equipment all require significant quantities of ultra-pure water and energy. The Semiconductor Industry Association (2023) reported that fabrication plants will use millions of litres of water each day. This upstream energy and water footprint is disregarded in a lifecycle carbon accounting assessment of AI, leading to an underestimate of the environmental burden of deployment (OEKO-Institut, 2024).

Legally speaking, such unaccounted effects create challenges to EIA models that are often out of bounds beyond the nation-state. For example, Principle 17 of the Rio Declaration⁵² Environment and Development encourages states to carry out transboundary environmental impact assessments, but supply-chain emissions and the use of resources for AI manufacturing go largely untracked. Therefore, to have holistic governance through lifecycle assessment, India's EIA Notification (2020) under the Environment Protection Act must be updated to extend governance criteria to include imported hardware components and their embedded emissions.⁵³

3.2.3 Governance of Supply chain in light of Environmental Justice

Mining of AI-critical minerals occurs disproportionately in jurisdictions with weak environmental regulation and high 'social vulnerability.' Cobalt extraction in the Congo is a quintessential example of both environmental degradation and the violation of human rights; children and marginalized groups are often forced into toxic exposure, yet there are limited opportunities to remedy (Human Rights Watch, 2023). The environmental justice role in AI supply chain scrutiny argues that multinational corporations must be held accountable when sourcing from these jurisdictions.

International human rights law mandates that companies engage in human-rights due diligence

⁵⁰ Government of India. (1986). *Environment (Protection) Act, 1986*; Government of India. (1957). *Mines and Minerals (Development and Regulation) Act, 1957*.

⁵¹ Semiconductor Industry Association. (2023). *Water Use in Semiconductor Manufacturing*.

⁵² United Nations. (1992). *Rio Declaration on Environment and Development*.

⁵³ Ministry of Environment, Forest and Climate Change. (2020). *EIA Notification, 2020*.

throughout their supply chains (the UN Guiding Principles on Business and Human Rights, 2011)⁵⁴, however this is only for companies operating in countries where voluntary standards have become legal requirements. In India, corporations that import artificial intelligence-related components and software are still not legally obliged to carry out supply-chain due diligence, therefore making it inappropriate to simply rely on voluntary standards and providing the appropriate regulations under the Companies (Corporate Social Responsibility Policy) Rules, 2014, would be an appropriate domestic route to align India's corporation sustainability with global standards.⁵⁵

3.3 Operational Use: Data Centres, Energy, Water, and Biodiversity

3.3.1 Energy Consumption and Greenhouse-Gas Emissions

AI operations—especially large models during training and inference—represent some of the most intensive computational processes that consume energy. Data centres globally are estimated to account for 1% of total GHG emissions, and this is projected to rise to 2.8% by 2030 due to AI workloads (OEKO-Institut, 2024).⁵⁶ To put this in a more concrete way; power usage as estimated will rise at data centres from 487TWh in 2023 to nearly 1,400TWh by 2030 and is not likely to be compatible in a meaningful way with international climate goals (LSE Grantham Institute, 2024).⁵⁷

The increase in energy consumption leads to what is known in scholarship as "carbon debt", which refers to an irreversible long-term locking in of emissions in the atmosphere, effectively undercutting national obligations under the Paris Agreement (2015) and the UNFCCC pathway to net-zero emissions (Intergovernmental Panel on Climate Change [IPCC], 2022).⁵⁸ In legal terms, carbon debt raises issues of liability and attribution — do the operators of AI and the host state have to give public disclosure, offset or mitigate the emissions of data-centres? India's National Green Tribunal (NGT) may provide the first line of adjudication around some of these climate-link externalities by extending the "polluter pays" doctrine to AI infrastructure (*Sharma v. Union of India*, 2020).⁵⁹

⁵⁴ United Nations. (2011). *Guiding Principles on Business and Human Rights*.

⁵⁵ Government of India. (2014). *Companies (CSR Policy) Rules, 2014*.

⁵⁶ OEKO-Institut. (2024). *Environmental and Energy Impacts of AI*.

⁵⁷ LSE Grantham Institute. (2024). *AI, Data Centres, and Climate Goals*.

⁵⁸ Intergovernmental Panel on Climate Change (IPCC). (2022). *AR6 Synthesis Report*.

⁵⁹ *Sharma v. Union of India*, NGT (2020).

3.3.2. Water Use and Cooling Systems

AI data centres utilize water cooling systems that are especially water intensive, and often using and drawing from municipal and/or groundwater sources. Estimates suggest as of 2024, global estimates on AI workload alone could reach as much as 6.6 billion cubic metres per year of water needed (OEKO-Institut, 2024).⁶⁰ In water depleted regions such as California, Dublin, or states in India, this generates extreme competition for resources, and creates environmental injustice.⁶¹

The Water (Prevention and Control of Pollution) Act, 1974, and Groundwater (Regulation and Management) Guidelines (2020) identify sustainable abstraction under Indian law; these only rarely apply to private AI data centres⁶². Similarly, the UN Water Convention (1992) encourages equitable and sustainable use of trans-boundary water resources and could be applied to India's own regulation of industries that are powered by water-intensive technologies.⁶³ In the case of large data centres, an important aspect of governance reform would be to require water auditing in order to receive clearance under India's Environmental Impact Assessment regime.

3.3.3 Land-use, Biodiversity, and Local Ecosystem Impacts

The nature of data centres is they take up large amounts of land; this often means habitat loss, deforestation, and loss of biodiversity. For example, data centres currently use one-fifth of all electricity consumption in Ireland and displaced agricultural land and peri-urban land (Procurement Magazine, 2023).⁶⁴ Similarly, in Oregon, USA, some data centre campuses use as much electricity as 1.5 million homes (HEC, 2023).⁶⁵ In India as with "AI and digital parks" raises similar questions over the loss of ecologically fragile land.

Legal obligations for biodiversity protection and sustainable land use exist under the Convention on Biological Diversity (1992) and India's Biological Diversity Act of 2002.⁶⁶ However, Environmental Impact Assessments for data centres typically treat indirect

⁶⁰ OEKO-Institut. (2024). *AI Energy and Water Estimates*.

⁶¹ HEC. (2023). *Sustainable Data Infrastructure Report*.

⁶² Government of India. (1974). *Water (Prevention and Control of Pollution) Act, 1974*.

⁶³ United Nations Economic Commission for Europe. (1992). *Convention on the Protection and Use of Transboundary Watercourses and International Lakes*.

⁶⁴ Procurement Magazine. (2023). *Ireland's Data Centre Energy Footprint*.

⁶⁵ Ibid.

⁶⁶ Government of India. (2002). *Biological Diversity Act, 2002*.

ecological externalities, including power-transmission line-induced habitat fragmentation and noise and thermal pollution from cooling apparatus, as negligible. This is why the biodiversity offsets and ecological compensatory elements of licensing practices for AI facilities should be legally required.⁶⁷

3.3.4 Case Studies: Ireland, Oregon, and GPT-3

Ireland is considered a global leader in data-centre investments. In 2024, data centres consumed around 21% of the electricity in Ireland, which adds significant stress to the electricity grid and poses serious environmental conflicts (Procurement Magazine, 2023).⁶⁸ Oregon has experienced similar, if not the same, realities. Oregon has seen resource diversion and increases in energy tariffs from large AI campus developments for rural communities (HEC, 2023).⁶⁹ The GPT-3 model, trained by OpenAI, is said to have consumed over 1,300 MWh of electricity, which is equivalent to the annual electricity use of about 120 homes in the U.S. (Datacentre Magazine 2023).⁷⁰ The above examples are demonstrations of the operational footprint of AI, which is not hypothetical; it causes tangible ecological and socio-economic displacement.

3.4 End-of-Life Phase: E-Waste and Disposal

3.4.1 Hardware Obsolescence and E-Waste Generation

AI-related hardware becomes obsolete at a rapid pace due to ongoing innovation cycles. The frequency with which GPUs and servers are upgraded contributes to overwhelming levels of electronic waste (e-waste). The OEKO-Institut (2024) estimates that AI-specific hardware alone could be responsible for up to 5 million tonnes of e-waste generated by 2030. This will add to the alarming levels of waste worldwide. The improper disposal or informal processing of e-waste can expose workers to toxic metals and chemicals.⁷¹

Under international law, both the Basel Convention (1989) and its Ban Amendment (2019) restrict the transboundary movement of hazardous e-waste.⁷² However, these obligations could be bypassed through loopholes allowing it to be shipped under the terms "refurbished

⁶⁷ Sharma, R. (2024). *Biodiversity Governance and Digital Infrastructure*. *NUJS Law Review*, 17(2), 88–102.

⁶⁸ Procurement Magazine. (2023). *Ireland's Data Centre Energy Footprint*.

⁶⁹ HEC. (2023). *Oregon Data Centre Impacts Report*.

⁷⁰ Datacentre Magazine. (2023). *GPT-3 Energy Use Assessment*.

⁷¹ WHO. (2022). *E-Waste and Human Health*. World Health Organization.

⁷² UNEP. (1989). *Basel Convention on Hazardous Wastes*.

equipment". As a signatory to the Basel Convention, India has taken steps to domesticate these obligations into the E-Waste Management Rules, 2022, which emphasizes extended producer responsibility (EPR) and take-back schemes.⁷³ Enforcement of these laws is weak, especially variance in the informal recycling of e-waste that is responsible for processing >90% of India's e-waste (Central Pollution Control Board [CPCB], 2023).

3.4.2 Soil and Aquifer Pollution from E-Waste

The AI hardware that has been discarded contains hazardous pollutants like lead, cadmium, mercury, and brominated flame retardants. If the products of e-waste disposal are inadequately processed, the contaminants enter the soil and water systems, creating pollution and risks for agriculture and human health (World Health Organization [WHO], 2022). Research indicates that informal recycling zones like Seelampur in Delhi show high rates of heavy metals in soil and aquifer water (CPCB, 2023).⁷⁴ The AI sector's rapid turnover of more advanced chips adds to this burden through the continuous cycle of hazardous waste generation without sufficient disposal controls.

Legally, action needs to be taken to provide a stronger framework for hazardous waste management under the Environment (Protection) Act of 1986 and to maintain compliance with Schedule II of the E-Waste Rules related to environmentally sound dismantling.⁷⁵ The extended producer liability principle should be rigorously enforced to ensure that AI equipment manufacturers accept full responsibility for any post-consumer waste.

3.4.3 Recycling, Resource Recovery, and Circular Economy

The establishment of circular economy frameworks presents a possible pathway for mitigation. The recovery of rare metals from AI hardware reaching the end of its life may reduce reliance on virgin extraction of minerals. The European Union Circular Economic Action Plan (2020) offers a model that is ripe for adoption in India and other countries.⁷⁶ Domestically, India's National Resource Efficiency Policy (Draft, 2019), calls for the establishment of a National Recycling Authority to manage resource recovery and secondary material markets.⁷⁷ These

⁷³ Central Pollution Control Board. (2023). *E-Waste Status Report, 2023*.

⁷⁴ CPCB. (2023). *Soil and Groundwater Contamination Study: Seelampur Cluster*.

⁷⁵ Environment (Protection) Act, 1986; E-Waste Rules, 2022, Schedule II.

⁷⁶ European Commission. (2020). *Circular Economy Action Plan*.

⁷⁷ NITI Aayog. (2019). *National Resource Efficiency Policy (Draft)*.

policies should align with the AI sector to fully connect extraction, use, and disposal.

3.5 Regulatory and Governance Implications

Environmental governance in the context of AI necessitates an integrated, multi-layered legal approach across climate, energy, water, and waste regulation. The precautionary principle – identified under Article 21 of the Indian Constitution (as seen in *Vellore Citizens' Welfare Forum v. Union of India*, 1996) – provides a normative basis for preemptive regulation of AI's environmental costs.⁷⁸ Similarly, international law signaled by the Paris Agreement and UNEP Sustainable Digitalization Agenda (2023) recognized the need for digitally-enabled transformation to follow climate commitments.⁷⁹

Key regulatory implications are:

Lifecycle Assessments (LCA) requirement for AI infrastructure projects to assess the embedded carbon, water, and material footprint.

Supply-Chain Transparency Laws mandating disclosure of the source of minerals and environmental due diligence, similar to the EU's Corporate Sustainability Due Diligence Directive (2023).

Carbon Accounting Standards for data-centre emissions to be included within a national GHG inventory.

Water Use Permit and Ecological Compensation Mechanisms evaluating water within the environmental clearance process.

Strengthening of EPR Regimes to promote proper recycling and material recovery of AI hardware.

Through these developments, the environmental costs of AI can be internalized within a corporate or state accountability framework.⁸⁰

⁷⁸ *Vellore Citizens' Welfare Forum v. Union of India*, (1996) 5 SCC 647.

⁷⁹ UNEP. (2023). *Sustainable Digitalization Agenda*.

⁸⁰ Esty, D. C. (2023). *Regulating AI for Climate Accountability*. *Yale Journal on Regulation*, 40(3), 322–355.

4. Conclusion

Conclusion and Issues for Future Work

Now widely framed as a disruptive phenomenon across the technological, economic, and social landscapes, Artificial Intelligence (AI) has presented a new set of challenges in governance of the environment and energy in sustainable ways. This research has traced the ecological footprint of AI throughout its lifecycle—from the extraction of rare earth and critical minerals to the ricocheting operational energy and water intensity of data centres to the eventual end-of-life disposal of e-waste. The implications of our findings reveal a sobering contradiction: while AI is increasingly framed as a godsend for facilitating environmental improvements and sustainability—through climate modelling, energy forecasting, and precision agriculture—it contradicts a myriad of extensive and often unrepaired environmental externalities. Indeed, without sufficient environmental governance intervention to treat AI simply as an innovation phenomenon, AI is intimately prone to exasperating the ecological crises AI is frequently sought to ameliorate.

Equally important are the legal implications. Existing environmental legal frameworks—a combination of international legal principles as well as statutes of domestic-adopted environmental legal principles—are just beginning to consider the scope and complexity of ecological implications AI may arise. In this respect, the aforementioned recommendations suggest an integrated legal- policy framework of climate-sensitive AI governances, resource and supply-chain governances, data-centre energy and water-use governances, e-waste governances, and equitable environmental justice attached with principles that will create possibly condensing environmental perspectives.

4.1 Climate-Sensitive AI Governance

A primary focus must be the establishment of climate-sensitive AI governance structures that integrate, at a minimum, the environmental costs associated with AI into regulatory design. Internationally, instruments like the Paris Agreement (2015) and the UN Sustainable Development Goals (SDGs)—specifically, Goal 7 (Affordable and Clean Energy), Goal 12 (Responsible Consumption and Production), and Goal 13 (Climate Action)—create normative expectations that should be explicitly brought to bear on digital and AI infrastructure. To this end, states must impose legal barriers and obligations on AI operators/developers to report and

mitigate not only their energy consumption, but also their carbon emissions and water use in the development and operationalization of AI models (UNFCCC, 2021).

Just as carbon-intensive industries like steel and cement are subject to carbon-tracing and disclosure obligations, so too should AI data centers and AI development clusters. As early examples of integration, the European Union proposes elements of an AI Act (2024) and the proposed Corporate Sustainability Reporting Directive (CSRD) that would require transparency around environmental indicators for high-risk, large-scale AI use cases (European Commission, 2023). In a country like India, with its Digital India Mission and proposed Green Data Centre Policy (2023), similar provisions could easily be conceived, including requiring environmental impact assessments (EIAs) at the deployment of any AI, and requiring AI operators to disclose its "energy intensity per computation" metric as part of an Environmental Management System.

Moreover, the idea of "polluter pays", which is part of Indian law after the case *Vellore Citizens Welfare Forum v. Union of India* (1996 5 SCC 647), should also apply to AI infrastructure. Operators who are responsible for emissions due to their computational and data-processing activities should also take the externalities they create into account (which could be accomplished, for example, through carbon-offset fees, sustainability taxes on AI, or contributions to developments in renewable energy). By connecting AI governance to environmental law, States can mitigate the risk of innovation proceeding beyond planetary boundaries, especially in regards to carbon usage.

4.2 Reforms in Supply Chains and Resource Governance

The hardware that undergirds AI systems—e.g., semiconductors, GPUs, and storage solutions—is based on supply chains that are troubled by ecological concerns and human rights abuses. The extraction of cobalt, lithium, and rare earth metals, in particular, poses urgent concerns related to radioactive by-products, soil pollution, and child labour in companies in the Democratic Republic of Congo (OECD, 2023). Under international law, the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals (2016), as well as the UN Guiding Principles on Business and Human Rights (2011) impose due diligence on corporations to assess, prevent, and address (i.e., remedy) harm.

From a legal perspective, States should impose full lifecycle disclosure and supply chain

transparency on AI hardware manufacturers. This could be enacted through legislative instruments requiring environmental and social impact assessments (ESIAs) for mineral sourcing, potentially in tandem with remediation bonds to ensure ecosystem restoration following mineral extraction. The Indian government's Critical Minerals Strategy (2023) and Mines and Minerals (Development and Regulation) Act, 1957, could be revised to explicitly include the sourcing of AI-relevant minerals in a high-risk environmental category. This would allow India's digital growth to continue in concert with commitments to obligations under the Convention on Biological Diversity (CBD, 1992) and the Rio Declaration (1992), both of which stress sustainable resource use and intergenerational equity. Furthermore, there will need to be global cooperation to address the geopolitical concentration of AI-critical minerals. The recently proposed Global AI Resource Governance Treaty, based on the Basel Convention (1989) and Minamata Convention on Mercury (2013), could provide the institutional framework for enforcing due diligence on a cross-border basis, along with tailings and waste repatriation requirements. Without a harmonized legal framework, the environmental impacts of producing AI hardware may become a digital externality, exported to the Global South.

4.3 Energy and Water-Use Regulation for Data Centres

AI's operational phase is similarly challenging regarding energy intensity and water stress. Analysis has shown that the energy consumption involved in training one large-scale model, for example GPT-3, is equal to the lifetime emissions of multiple cars (Strubell, Ganesh, & McCallum, 2019). Furthermore, the impact of water-dependent cooling systems for data centres has also affected local aquifers most pressurefully evident in dry locations such as Arizona, Dublin, and Tamil Nadu. This raises the legal question of a more appropriate regime for environmental licensing of data centres, similar to a permit required by industrial pollution standards. Safely, according to Indian law, data centres should be classified as a "water-intensive industries" according to the Water (Prevention and Control of Pollution) Act, 1974 and hence would require clearances by the State Pollution Control Boards (SPCBs) and a biodiversity impact statement. Additionally, the local community could participate under the Environmental Impact Assessment Notification (2006) to evaluate and challenge, or condition, the approval of data-centre approvals that may disrupt the ecological balance. At the international level, regulatory frameworks like the EU Data Centre Energy Efficiency Code of Conduct (European Commission, 2022) and Singapore's Green Data Centre Standard, show that grid-impact attestation requirements, renewable sourcing obligations, and cooling water

recirculation standards can be established. India could incorporate these standards into its National Digital Communications Policy (NDCP) and Energy Conservation Act (2001), requiring renewable purchase obligations (RPOs), and setting limits to water abstraction for AI-intensive facilities. Enforcement mechanisms might include differential tariffs applied to AI facilities operating on fossil energy and financial incentives to socially desirable AI systems that relied on communities' renewable powered clusters.

4.4 Clean Energy and Circular Technology Integration

The pairing of AI infrastructures with clean energy systems represents a technological and legal imperative. Clean energy siting and energy integration—situating data centres adjacent to hydropower systems, solar, or wind clusters—should be codified in law as part of urban-planning legislation and environmental licensing frameworks. Waste unit-condensate recovery systems could be integrated with AI data centre systems to recover waste heat for district heating, desalination, and/or carbon recovery initiatives that comply with SDG 12 on resource efficiency.

Modeling conducted by the International Energy Agency (IEA, 2023) indicates that the application of waste-heat recovery technologies, for example, has the potential to reduce net emissions by up to 10% for hyperscale AI data centres. Therefore, it is in the best interest of national governments to include waste-heat recovery and similar enabling technologies in their Nationally Determined Contributions (NDCs) under the Paris Agreement. The Bureau of Energy Efficiency (BEE) in India could enact mandatory energy-performance benchmarks for AI facilities, with compliance to these benchmarks being linked to fiscal incentives offered under the Perform, Achieve, and Trade (PAT) Scheme. Laws mandating on-site solar panels, battery storage, and rainwater harvesting could be enshrined within the Environment (Protection) Rules, 1986, which could be amended to require such installation.

4.5 Extended Producer Liability (EPR) and E-Waste Regulation

At the end-of-life for AI, there is an increasing crisis of e-waste. Old AI hardware, including servers, chips, and batteries, represent a significant amount of e-waste. The Global E-Waste Monitor (2024) notes that there are over 62 million tonnes of e-waste, and less than 20% is formally recycled. The Basel Convention is designed to regulate this transboundary movement and disposal of hazardous wastes, but compliance with the convention fails to be met across

jurisdictions. In this context, legal systems must impose Extended Producer Responsibility (EPR) on manufacturers of AI hardware. The E-Waste (Management) Rules, 2022 in India present a viable model of imposing EPR and obligating producers of products to establish take-back programs, recycling targets, and the public reporting of e-waste amounts. Such an obligation must be extended to explicitly include AI hardware and peripherals, so that the costs related to environmental impacts from advancements related to AI are internalized across the supply chain. Corporations should be mandated to publicly report annually on compliance with EPR requirements, and EPR reports should be verified by third-party auditors and conducted under the auspices of the Central Pollution Control Board (CPCB). Globally, the OECD Council Recommendation on Resource Productivity (2016) and Circular Economy Action Plan (EU, 2020) can guide respective global and harmonized standards. The legal positioning of AI industries within the circular economy maintains a standard for not only recovering resources, but also preventing pollution burden from contamination in the soil and water system from toxic materials.

4.6 Fair Allocation of Environmental Impacts

AI's ecological footprint is also an environmental justice issue. The burdens of mineral extraction, pollution, and data-centre siting are disproportionately placed on underserved communities- often those who are not benefitting from the economic benefits of AI. This inequality constitutes a structural lack of intra-generational equity and the right to a clean environment recognized in Article 21 of the Indian Constitution and reiterated in *Subhash Kumar v. State of Bihar* (1991 1 SCC 598). To remedy these inequities, States should implement geographical load-balancing strategies to distribute computational workload to less burdened grids, and consider a protocol to ensure that the AI's infrastructural expansion process precedes a social-impact assessment (SIAs). Community consent protocols, as utilized under the Forest Rights Act (2006) and the Panchayats (Extension to Scheduled Areas) Act, 1996, should apply to AI-related infrastructural projects. Internationally, the Escazú Agreement (2018) serves as a relevant regional precedent for procedural rights in environmental decision-making that could be employed for AI governance as well.

4.7 Lifecycle Accounting and Corporate Disclosure

In conclusion, it will need to be mandatory for AI to undergo lifecycle accounting concerning its environmental impact. Corporate sustainability reporting needs to disclose AI-specific

lifecycle analysis (LCA) covering the extraction, manufacturing, energy usage, and end-of-life stages of the AI system being used. The disclosed lifecycle accounting will be necessary for regulatory oversight of AI driven corporate sustainability disclosures that align with ESG (Environmental, Social, and Governance) measures. Under the Companies (Accounts) Rules, 2014, and the Business Responsibility and Sustainability Report framework mandated by the Securities and Exchange Board of India (SEBI, 2022), there should be disclosures tied to AI which cover the carbon intensity, water use, and waste produced per computational unit. The disclosures can be linked to global best practices backed by standards like the Global Reporting Initiative (GRI 305) and the Task Force on Climate-related Financial Disclosures (TCFD), increasing transparency across different countries and jurisdictions.

4.8 Final Thoughts

As a final point, though AI has an important role in creating significant opportunities for addressing sustainability challenges—through enhanced energy systems, climate forecasting, and natural resource management—its material infrastructure cannot be assumed to be environmentally harmless. The combination of AI with, for example, cloud computing, 5G, and the Internet of Things (IoT) is projected to increase global energy consumption by about 20% by 2030 (IEA, 2023). Lacking governance around AI technologies, societies risk positioning themselves into a high-carbon digital economy that undermines the various targets encompassed in the Paris Agreement and diminishes the more ambitious agenda for achieving a climate-resilient just ecological transition.

Consequently, we require an AI governance framework infused with climate law. It must encompass international cooperation, national legislation, and corporate accountability towards all components of a shared ethical vision of sustainable innovation. As we have illustrated throughout this paper, ensuring that this AI revolution occurs in a sustainable way is neither a purely technical or uncertain technological challenge, but rather a legal and ethical obligation to safeguard ecological integrity for present and future generations.

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