DOI: 10.71317/jgst.2.8.2026.378

Journal of Global Social Transformation

Journal homepage: https://rjsaonline.org/index.php/JGST

The AI–Climate Nexus in International Relations: Climate Diplomacy, Energy Transition, and Emerging Technology Governance

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ARTICLE INFO

Submission:
June 30, 2026
Revised:
July 13, 2026
Accepted:
July 29, 2026
Available Online:
August 11, 2026

Keywords:
Artificial intelligence, climate diplomacy, energy transition, global governance, geopolitics, environmental justice, regime complexity

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ABSTRACT

The convergence of artificial intelligence (AI) and global climate action has generated a transformative "AI–climate nexus" that is reconfiguring the architecture of international relations. This study investigates how AI redefines climate diplomacy, accelerates the energy transition, and reshapes geopolitical power dynamics. Utilizing a qualitative methodology comprising systematic document analysis of 127 policy and academic sources alongside four comparative case studies, the research identifies three core dynamics. First, while AI enhances emissions verification and renewable grid optimization, it introduces new vulnerabilities, including digital infrastructure lock-in and the substantial carbon footprint of computation. Second, AI drives geopolitical restructuring by shifting leverage toward states with computational supremacy and control over critical mineral supply chains. Third, it exposes severe institutional fragmentation and equity deficits, where the Global South faces acute risks of data colonialism and algorithmic marginalization. Concluding that current polycentric governance regimes are ill-equipped to manage these intersecting crises, the paper advocates for a dedicated, equity-centered multilateral framework, such as a UN AI–Climate Governance Interface. Ultimately, the study argues that aligning emerging technology governance with the Paris Agreement requires embedding the principle of common but differentiated responsibilities into global AI policy.

Introduction

The twenty-first century has witnessed the convergence of two transformative forces, anthropogenic climate change and the rapid proliferation of artificial intelligence (AI), that are collectively reshaping the architecture of global governance. Once treated as discrete policy domains, climate action and digital technology are now inextricably intertwined, generating what scholars have termed the "AI–climate nexus" (Cowls et al., 2021; Rolnick et al., 2022). This nexus refers to the multidirectional relationship in which AI both contributes to and mitigates greenhouse gas (GHG) emissions, while simultaneously altering the epistemic, institutional, and geopolitical conditions under which international climate cooperation occurs. As the Intergovernmental Panel on Climate Change (IPCC, 2023) warns that the window for limiting warming to 1.5 °C is rapidly closing, the integration of AI-driven solutions into multilateral climate strategies has moved from the periphery to the centre of diplomatic negotiation.

Climate diplomacy, traditionally anchored in intergovernmental bargaining under the United Nations Framework Convention on Climate Change (UNFCCC), is being reconfigured by data-intensive modelling, satellite-based verification systems, and algorithmic decision-support tools that alter how states assess compliance, allocate responsibilities, and build trust (Falkner, 2016; Victor, 2011). Concurrently, the global energy transition, encompassing the shift from fossil-fuel-based systems to renewable and low-carbon technologies, has become a site of intense geopolitical contestation, as AI optimizes grid management, accelerates materials discovery for next-generation batteries, and restructures the comparative advantages of energy-exporting and energy-importing states (Geels, 2002; Sovacool et al., 2020). Complicating this picture further, the governance of emerging technologies such as AI, blockchain, and quantum computing remains fragmented across multiple for a, the G7, the OECD, the United Nations Secretary-General's High-Level Advisory Body on Artificial Intelligence, and the newly proposed Global AI Governance frameworks, without a coherent mechanism to align these regimes with climate objectives (Floridi et al., 2018; Jobin et al., 2019). The present study interrogates the AI–climate nexus through the lens of International Relations (IR), asking: How do AI technologies reconfigure the practice and theory of climate diplomacy? In what ways does the AI-enabled energy transition alter power distributions among states and non-state actors? And how can emerging technology governance be designed to serve, rather than undermine, the goals of the Paris Agreement? By synthesizing insights from regime theory, constructivist diplomacy studies, socio-technical transitions research, and science and technology studies (STS), this paper advances the argument that the AI–climate nexus constitutes a distinct and under-theorized governance challenge that demands an integrated analytical framework bridging environmental politics and digital governance.

The significance of this inquiry is threefold. First, it addresses a critical gap in IR scholarship, where climate politics and technology governance have largely evolved as parallel literatures with insufficient cross-fertilization (Biermann et al., 2009; Keohane & Oppenheimer, 2016). Second, it responds to urgent policy demands: the 2023 UN Climate Change Conference (COP28) in Dubai explicitly recognized AI as a tool for climate action, while the 2024 Global Digital Compact and subsequent AI governance negotiations have begun to incorporate environmental sustainability clauses (United Nations, 2024). Third, it provides a normative foundation for designing governance architectures that ensure AI deployment in the climate domain is equitable, transparent, and accountable to the principles of common but differentiated responsibilities (CBDR) enshrined in the UNFCCC (Dimitrov, 2016).

The remainder of this paper is structured as follows. Section 2 provides a comprehensive literature review organized around four thematic pillars: climate diplomacy and multilateral governance; AI and its dual role in climate systems; energy transition and geopolitical restructuring; and emerging technology governance. Section 3 outlines the theoretical and methodological framework. Section 4 presents the analysis, and Section 5 concludes with policy recommendations and directions for future research.

Literature Review

Climate Diplomacy and Multilateral Governance

The scholarly literature on climate diplomacy is rooted in the broader tradition of international regime theory. Keohane (1984) established that regimes, defined as "sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations" (p. 57), provide the institutional scaffolding for cooperation under anarchy. Applied to climate politics, this framework explains the architecture of the UNFCCC (1992), the Kyoto Protocol (1997), and the Paris Agreement (2015) as successive attempts to overcome collective-action problems arising from the global commons nature of the atmosphere (Keohane & Oppenheimer, 2016).

Falkner (2016) advanced this analysis by characterizing the Paris Agreement as embodying a "new logic of international climate politics," in which nationally determined contributions (NDCs) replaced top-down binding targets, thereby lowering sovereignty costs and broadening participation. Dimitrov (2016), however, cautioned that the voluntary architecture of the Paris regime creates significant enforcement gaps and risks symbolic diplomacy without substantive mitigation. Victor (2011) similarly argued in Global Warming Gridlock that institutional fragmentation and path dependency in multilateral negotiations produce a "gridlock" that incremental reform cannot resolve, necessitating alternative governance pathways involving clubs, minilateral arrangements, and polycentric networks (Ostrom, 2010).

Constructivist scholars have enriched this institutionalist account by foregrounding the role of norms, identity, and discourse in shaping climate diplomacy. Haas (1992) demonstrated how epistemic communities of climate scientists influenced the formation of the IPCC and, subsequently, the negotiation agendas of the UNFCCC. More recently, Stevenson and Dryzek (2014) examined how discursive contestation over climate justice, historical responsibility, and the right to development shapes North–South negotiations. Bäckstrand and Kuyper (2017) further highlighted the proliferation of non-state and sub-state actors—cities, corporations, transnational advocacy networks, in the post-Paris governance landscape, arguing that climate diplomacy is no longer an exclusively state-centric enterprise.

Despite this rich body of work, the literature has paid comparatively little attention to how digital technologies, particularly AI, are transforming the epistemic and procedural foundations of climate diplomacy. Keohane and Oppenheimer (2016) noted the potential of information technology to enhance transparency and verification, yet their analysis predated the current generation of machine-learning applications. This gap motivates the present inquiry.

Artificial Intelligence and Climate Systems: A Dual-Edged Nexus

The relationship between AI and climate change is inherently ambivalent. Rolnick et al. (2022), in a landmark interdisciplinary survey published in ACM Computing Surveys, catalogued over 600 machine-learning applications relevant to climate mitigation and adaptation, spanning electricity systems, transportation, buildings, industry, agriculture, forestry, and climate prediction. They demonstrated that AI can enhance the efficiency of renewable energy integration, optimize supply chains, improve weather and climate modelling, and accelerate the discovery of low-carbon materials. Cowls et al. (2021) similarly argued that AI constitutes a "general-purpose technology" with pervasive implications for decarbonization, while cautioning that its deployment is unevenly distributed across the Global North and South, risking the reproduction of existing structural inequalities.

Conversely, the energy and material footprint of AI itself has attracted growing scrutiny. Patterson et al. (2021) estimated that training a single large language model can emit as much carbon as five automobiles over their lifetimes, while Luccioni et al. (2023) provided granular accounting of the water and electricity consumption associated with AI inference at scale. These findings have prompted scholars such as Crawford (2021) to conceptualize AI as an extractive industry, embedded in global supply chains of rare-earth minerals, energy-intensive data centers, and labour-intensive data annotation—processes that disproportionately affect communities in the Global South. Thus, the AI–climate nexus is not unidirectional: AI is simultaneously a tool for decarbonization and a source of new emissions and environmental externalities (Höglund & Lövbrand, 2024).

In the domain of climate science, AI has enhanced the resolution and speed of Earth-system models. Ham et al. (2019) demonstrated that deep-learning approaches could simulate El Niño–Southern Oscillation events more accurately than conventional numerical models, while Reichstein et al. (2019) argued that machine learning could unlock previously inaccessible patterns in climate and geoscience data. These advances carry direct implications for climate diplomacy: improved predictive capacity can sharpen the scientific basis for NDC target-setting, while satellite-based AI verification systems (e.g., Climate TRACE, MethaneSAT) can strengthen compliance monitoring under the Paris Agreement's Enhanced Transparency Framework (Falkner, 2016; United Nations, 2015).

However, critical scholars have raised concerns about data colonialism and algorithmic governance in the climate context. Couldry and Mejias (2019) warned that the extraction of environmental data from vulnerable regions by Northern AI firms may constitute a new form of resource appropriation. Eriksen et al. (2024) further argued that AI-driven climate adaptation tools risk embedding Western epistemologies and marginalising indigenous and local knowledge systems, thereby undermining the equity principles central to the UNFCCC.

Energy Transition: Socio-Technical Dynamics and Geopolitical Restructuring

The energy transition is conceptualised in the literature as a socio-technical process involving the co-evolution of technologies, institutions, markets, and cultural practices. Geels (2002) introduced the multi-level perspective (MLP), distinguishing between niche innovations, socio-technical regimes, and landscape pressures as analytical levels through which transitions unfold. Applied to the energy domain, the MLP illuminates how incumbent fossil-fuel regimes resist disruption while renewable-energy niches gain momentum through policy support, cost reductions, and shifting social expectations (Geels et al., 2017).

Savacool et al. (2020) extended this framework by foregrounding questions of justice and equity in energy transitions, arguing that decarbonization policies must address distributional impacts on fossil-fuel-dependent workers, energy-poor communities, and resource-extracting economies. The concept of a "just transition," endorsed in the preamble of the Paris Agreement and elaborated in subsequent COP decisions, has become a central normative reference point in energy diplomacy (United Nations, 2015; Stevis & Felli, 2015).

AI is increasingly recognized as a critical enabler of the energy transition. Machine-learning algorithms optimize variable renewable energy (VRE) generation forecasts, manage demand-response systems, and facilitate peer-to-peer energy trading through blockchain platforms (Savacool et al., 2022). AI-accelerated materials discovery is shortening development cycles for next-generation photovoltaics, solid-state batteries, and green hydrogen electrolysis, potentially altering the technology trajectories available to states (US Department of Energy, 2023). At the systems level, digital twins and AI-driven grid management tools are enabling the integration of high shares of variable renewables, reducing curtailment losses and enhancing grid resilience (International Energy Agency [IEA], 2023).

Geopolitically, the energy transition is reconfiguring the distribution of power among states. Overland et al. (2019) argued that the decline of hydrocarbon rents and the rise of critical-mineral supply chains (lithium, cobalt, rare earths) are generating new dependencies and strategic rivalries, analogous to but distinct from twentieth-century oil geopolitics. AI amplifies these dynamics: states that lead in AI research and deployment gain disproportionate advantages in optimizing renewable systems, designing advanced materials, and controlling digital energy infrastructure, potentially creating new hierarchies in the international system (Bremmer & Suleyman, 2023). Conversely, petrostates face the dual challenge of economic diversification and technological catch-up, with significant implications for the cohesion of OPEC and the geopolitical leverage of the Gulf states, Russia, and other fossil-fuel exporters (Fattouh et al., 2020).

Emerging Technology Governance: Fragmentation, Convergence, and the Climate Dimension

The governance of emerging technologies has been characterized by scholars as fragmented, polycentric, and often reactive. Bradshaw and Levy (2020) documented the proliferation of AI governance initiatives across national, regional, and international levels, noting the absence of a single authoritative regulatory body comparable to the International Atomic Energy Agency (IAEA) for nuclear technology. Jobin et al. (2019) conducted a systematic analysis of 84 AI ethics guidelines worldwide and found broad rhetorical convergence on principles such as transparency, fairness, and accountability, but significant divergence in implementation mechanisms and enforcement capacity.

Floridi et al. (2018), in their influential "AI4People" framework, proposed a set of ethical principles for a "good AI society," emphasizing beneficence, non-maleficence, autonomy, justice, and explicability. While this framework was not designed with climate objectives in mind, subsequent work by Floridi and Cowls (2022) explicitly addressed the intersection of AI ethics and environmental sustainability, arguing for a "green AI" agenda that embeds ecological considerations into the design, training, and deployment of AI systems.

At the multilateral level, governance of AI and related digital technologies has accelerated since 2023. The United Nations Secretary-General's High-Level Advisory Body on Artificial Intelligence (2024) issued recommendations for an International AI Governance framework, while the G7 Hiroshima AI Process (2023) and the EU AI Regulation (European Parliament, 2024) represent regional and plurilateral approaches. The Global Digital Compact, adopted alongside the Summit of the Future in 2024, included provisions linking digital technology governance to the Sustainable Development Goals (SDGs), including climate action (United Nations, 2024). Nevertheless, scholars such as Egede (2024) and Amani and Mlambo (2024) have critiqued these processes for insufficient representation of the Global South, raising concerns that AI governance architectures may entrench existing power asymmetries rather than advance equitable climate outcomes.

The intersection of technology governance and climate governance remains under-theorised. Biermann et al. (2009) proposed the concept of "Earth system governance" to capture the polycentric, multi-scalar nature of governance challenges in the Anthropocene, yet their framework did not anticipate the specific governance demands posed by AI. Similarly, the literature on regime complexity and institutional interplay (Raustiala & Victor, 2004; Oberthür & Stokke, 2011) provides analytical tools for understanding how overlapping governance regimes interact, but has not been systematically applied to the AI–climate interface. This study seeks to address this lacuna by theorising the AI–climate nexus as a distinct governance domain requiring coordinated institutional responses across the UNFCCC, the UN Technology Facilitation Mechanism, the ITU, the OECD, and emerging AI governance bodies.

Synthesis and Identification of Gaps

The foregoing review reveals four principal gaps in the existing literature. First, IR scholarship on climate diplomacy and scholarship on AI governance have developed largely in parallel, with limited cross-disciplinary engagement (Keohane & Oppenheimer, 2016; Jobin et al., 2019). Second, while the technical potential of AI for climate mitigation and adaptation is well documented (Rolnick et al., 2022; Reichstein et al., 2019), the geopolitical and institutional implications of AI deployment for multilateral climate cooperation remain under-explored. Third, the energy transition literature has examined socio-technical dynamics (Geels, 2002) and justice dimensions (Sovacool et al., 2020) but has only recently begun to account for the transformative role of AI in reshaping energy geopolitics (Overland et al., 2019; Bremmer & Suleyman, 2023). Fourth, there is no comprehensive governance framework that integrates AI regulation, climate governance, and energy policy into a coherent analytical and normative architecture suited to the complexities of the AI–climate nexus (Floridi & Cowls, 2022; United Nations, 2024).

This paper addresses these gaps by proposing an integrated analytical framework that draws on regime complexity theory, socio-technical transitions research, and critical technology governance scholarship to examine the AI–climate nexus as a constitutive feature of contemporary international relations.

Methodology

Research Design

This study adopts a qualitative research design grounded in interpretivist epistemology, which is well suited to examining the discursive, institutional, and normative dimensions of international governance (Creswell & Poth, 2018). Given the exploratory and interdisciplinary nature of the AI–climate nexus, a single-method quantitative approach would be insufficient to capture the multi-scalar, polycentric character of the governance landscape (Biermann et al., 2009). Accordingly, the research employs a triangulated qualitative strategy combining three complementary methods: (a) systematic document analysis, (b) thematic discourse analysis, and (c) comparative case study analysis. This design aligns with the recommendations of George and Bennett (2005), who advocate methodological triangulation in case study research to enhance construct validity and analytical depth.

Theoretical and Analytical Framework

The analytical framework integrates three theoretical traditions. First, regime complexity theory (Raustiala & Victor, 2004; Oberthür & Stokke, 2011) provides the lens for mapping the overlapping, sometimes conflicting, institutional arrangements governing climate, energy, and digital technologies. Second, the multi-level perspective (MLP) on socio-technical transitions (Geels, 2002; Geels et al., 2017) offers a structural account of how AI innovations interact with incumbent energy regimes and broader landscape pressures such as climate change and geopolitical rivalry. Third, critical technology governance scholarship (Crawford, 2021; Couldry & Mejias, 2019) foregrounds questions of power, equity, and epistemic justice that are central to evaluating whether AI deployment in the climate domain reinforces or challenges existing global hierarchies.

These three lenses are operationalized through an integrated coding scheme (see Table 1) that guided the analysis of all collected documents.

Data Collection

Systematic Document Analysis

A purposive corpus of 127 primary and secondary documents was assembled and analyzed between January 2024 and June 2026. The corpus comprised four categories: Multilateral agreements and declarations (n = 22): Including the UNFCCC (1992), the Kyoto Protocol (1997), the Paris Agreement (2015), the Enhanced Transparency Framework, COP26–COP29 decisions, the Global Digital Compact (2024), the G7 Hiroshima AI Process (2023), and the EU AI Act (European Parliament, 2024). National and regional AI strategies (n = 31): Covering AI and digital strategies of 24 countries and 7 regional organizations, selected based on their prominence in AI development, climate vulnerability, or energy-transition leadership. Institutional reports and policy briefs (n = 43): Published by the IPCC, IEA, UNEP, World Bank, OECD, ITU, and the UN Secretary-General's High-Level Advisory Body on Artificial Intelligence. Peer-reviewed academic literature (n = 31): Identified through systematic searches in Scopus, Web of Science, and JSTOR using the Boolean string: ("artificial intelligence" OR "machine learning" OR "AI") AND ("climate diplomacy" OR "climate governance" OR "energy transition" OR "technology governance") AND ("international relations" OR "global governance"), limited to publications from 2015 to 2026.

Thematic Discourse Analysis

Following Fairclough's (2013) critical discourse analysis (CDA) framework, the corpus was examined for dominant narratives, framing strategies, and silences concerning the role of AI in climate governance. Particular attention was paid to how multilateral texts construct the relationship between technological innovation and climate justice, and how responsibility, accountability, and equity are discursively positioned.

Comparative Case Studies

Four illustrative cases were selected to ground the analysis in concrete governance practices:

- Case 1: The Climate TRACE initiative (AI-based emissions tracking).
- Case 2: The EU AI Act's environmental sustainability provisions.
- Case 3: India's National AI Strategy and its intersection with renewable energy targets.
- Case 4: The African Union's AI Continental Strategy and climate adaptation priorities.

Cases were selected using the "most different systems" design (Przeworski & Teune, 1970), ensuring variation across geography, development status, and governance capacity.

Data Analysis Procedure

Document analysis followed a structured three-phase procedure adapted from Braun and Clarke's (2006) thematic analysis. In Phase 1, documents were coded inductively using NVivo 14 software, generating 214 initial codes. In Phase 2, codes were clustered into 12 candidate themes aligned with the three theoretical lenses. In Phase 3, themes were refined, merged, and validated through peer debriefing and iterative re-reading, yielding five final analytical themes: (i) AI-enabled climate diplomacy and verification; (ii) AI and energy system transformation; (iii) geopolitical restructuring; (iv) governance fragmentation and regime interplay; and (v) equity and justice dimensions.

Trustworthiness and Limitations

Trustworthiness was ensured through triangulation across data sources, member-checking with three domain experts, and maintenance of a reflexive audit trail (Lincoln & Guba, 1985). Limitations include the exclusion of non-English language documents, the rapidly evolving nature of AI governance (which may render some findings time-sensitive), and the inherent subjectivity of interpretivist analysis.

Results

The triangulated qualitative analysis of 127 policy documents, institutional reports, and academic texts, alongside the four comparative case studies, yielded five major thematic findings regarding the AI–climate nexus in international relations. These findings illuminate how artificial intelligence is reconfiguring the epistemic foundations of climate diplomacy, accelerating yet complicating the global energy transition, reshaping geopolitical power dynamics, exposing severe fragmentation in global governance, and exacerbating long-standing equity deficits between the Global North and South.

The Transformation of Climate Diplomacy and Verification

The analysis reveals that AI technologies are fundamentally altering the epistemic infrastructure of multilateral climate diplomacy by shifting how greenhouse gas (GHG) emissions are monitored, verified, and negotiated. Historically, compliance with international climate agreements relied heavily on self-reported national inventories, which were often subject to political manipulation and significant time lags (Falkner, 2016). However, the integration of AI with satellite telemetry and remote sensing, exemplified by independent initiatives like Climate TRACE and MethaneSAT, has introduced real-time, high-resolution emissions tracking. The document analysis indicates that these AI-enabled verification tools reduce information asymmetries between negotiating parties, thereby strengthening the "ratchet mechanism" of the Paris Agreement by making it increasingly difficult for states to overstate their mitigation progress (United Nations, 2024). Furthermore, machine-learning algorithms are now routinely employed by the Intergovernmental Panel on Climate Change (IPCC) and national meteorological agencies to generate high-fidelity climate models, which directly inform the ambition levels of Nationally Determined Contributions (NDCs) (Ham et al., 2019).

Despite these technical advancements, the thematic discourse analysis uncovered a profound political tension regarding AI verification. While Northern states and multilateral institutions predominantly frame AI-driven monitoring as a necessary tool for "transparency" and "accountability," representatives from the Global South frequently interpret these same technologies through the lens of surveillance and conditionality. Developing nations express concern that AI verification could be weaponized to impose unilateral trade sanctions or withhold climate finance, thereby undermining the principle of state sovereignty and the cooperative spirit of the United Nations Framework Convention on Climate Change (UNFCCC) (Dimitrov, 2016). Consequently, while AI enhances the technical capacity for climate diplomacy, it simultaneously introduces new friction points regarding data sovereignty and the political interpretation of algorithmic outputs.

AI as a Catalyst and Complication in the Energy Transition

The findings demonstrate that AI is acting as a critical socio-technical enabler of the global energy transition, though its decarbonization benefits are highly uneven. Across the electricity, transport, and industrial sectors, AI applications such as variable renewable energy (VRE) forecasting, digital twin grid management, and predictive maintenance are estimated to reduce energy-related CO_2 emissions by 5% to 10% by 2040 (International Energy Agency [IEA], 2023; Rolnick et al., 2022). In the realm of materials science, AI-accelerated discovery is drastically shortening the research and development cycles for next-generation solid-state batteries and green hydrogen electrolysers, potentially accelerating the timeline for global cost parity with fossil fuels (US Department of Energy, 2023).

However, the comparative case study of India's National AI Strategy highlights the structural limitations of this transition. While India leverages AI to integrate its ambitious target of 500 GW of renewable energy by 2030, the domestic AI ecosystem remains heavily reliant on foreign cloud infrastructure and proprietary algorithms developed by Northern technology conglomerates (Government of India, 2024). This dependency creates a "digital energy lock-in," where the physical infrastructure of the energy transition (solar panels, wind turbines) may be domestically owned, but the digital nervous system managing it is controlled by foreign entities. Furthermore, the analysis identifies a critical paradox: the AI systems required to optimize the energy transition are themselves highly resource-intensive. The carbon and water footprints associated with training large language models and powering data centers represent a growing environmental externality that currently lacks standardized accounting mechanisms in global energy policy (Luccioni et al., 2023; Höglund & Lövbrand, 2024).

Geopolitical Restructuring and New Hierarchies of Power

The integration of AI into climate and energy systems is actively reconfiguring geopolitical power distributions, creating new hierarchies based on technological and computational supremacy. The document analysis confirms that AI leadership is increasingly functioning as a form of climate leverage. States that dominate AI research and semiconductor manufacturing—namely the United States, China, and the European Union—possess disproportionate agenda-setting power in defining global standards for green technology, smart grids, and carbon accounting (Bremmer & Suleyman, 2023). This technological dominance allows these actors to export their regulatory frameworks and technical standards, effectively shaping the global rules of the energy transition.

Simultaneously, the transition to an AI-driven, electrified global economy has shifted geopolitical vulnerabilities from hydrocarbon reserves to critical mineral supply chains. The extraction and processing of lithium, cobalt, and rare earth elements—essential for both AI hardware and renewable energy storage—have generated new South–North and South–South dependencies, with the Democratic Republic of the Congo, Chile, and China occupying central nodes in this new geopolitical architecture (Overland et al., 2019). Conversely, traditional petrostates face acute pressures to diversify their economies as AI-driven energy efficiencies and renewable adoption threaten long-term hydrocarbon demand (Fattouh et al., 2020). The case study of the African Union's AI Continental Strategy further illustrates this dynamic: while the strategy explicitly links AI to climate adaptation and agricultural resilience, its implementation is severely constrained by a lack of domestic computational infrastructure, forcing African states into extractive data-sharing agreements with Northern technology firms that risk replicating neo-colonial economic structures (Amani & Mlambo, 2024; Crawford, 2021).

Governance Fragmentation and Regime Interplay

A central finding of the study is that the global governance architecture for the AI–climate nexus is characterized by severe fragmentation and regime complexity, lacking a cohesive institutional framework to manage overlapping risks. Applying regime complexity theory (Raustiala & Victor, 2004), the analysis mapped the institutional mandates governing this space and found profound disconnects. The UNFCCC and the Paris Agreement provide the normative framework for climate action but contain no binding provisions or dedicated mechanisms for governing AI, relying instead on outdated technology transfer paradigms (United Nations, 2015). Conversely, emerging AI governance bodies, such as the OECD AI Principles, the G7 Hiroshima AI Process, and the UN Secretary-General's High-Level Advisory Body on AI—treat environmental sustainability as a peripheral or voluntary consideration rather than a core regulatory mandate (Jobin et al., 2019; United Nations, 2024).

The European Union's AI Act (2024) represents the most advanced legislative attempt to bridge this gap by requiring high-risk AI systems to report their environmental footprint. However, the discourse analysis reveals that the EU's unilateral, extraterritorial approach generates sovereignty concerns among developing nations, who view it as a form of "green digital protectionism" rather than genuine multilateral cooperation. While the UN Global Digital Compact (2024) attempts to link digital governance to the Sustainable Development Goals (SDGs), it lacks the enforcement mechanisms required to compel state or corporate compliance.

Consequently, the current governance landscape is defined by forum-shopping and regulatory arbitrage, where technology companies can exploit the institutional gaps between climate regimes and digital governance bodies to avoid comprehensive environmental accountability (Oberthür & Stokke, 2011).

Equity, Justice, and the Distributional Deficit

The critical discourse analysis exposed a persistent "distributional deficit" in how the AI–climate nexus is governed, revealing that current trajectories risk exacerbating global inequalities and undermining the principle of Common but Differentiated Responsibilities (CBDR). A primary concern identified in the literature is "data colonialism," wherein environmental and climate data extracted from the Global South are harvested by Northern AI firms to train proprietary models, with the resulting intellectual property and economic value retained in the Global North (Couldry & Mejias, 2019). Furthermore, algorithmic bias in climate modeling was identified as a significant justice issue; because AI models are predominantly trained on historical data from the Global North, they frequently exhibit lower predictive accuracy for extreme weather events in tropical, arid, and Southern Hemisphere regions, thereby marginalizing the adaptation needs of the most climate-vulnerable states (Eriksen et al., 2024).

The analysis also highlighted a profound tension regarding the just transition of the workforce and the epistemic justice of indigenous communities. As AI automates traditional energy and extraction industries, the resulting labor displacement disproportionately affects working-class communities in fossil-fuel-dependent regions, yet AI-driven retraining programs remain underfunded in international climate finance frameworks (Sovacool et al., 2020). Moreover, the reliance on algorithmic, top-down climate adaptation tools frequently marginalizes indigenous and local knowledge systems, privileging Western technocratic epistemologies over localized, context-specific ecological knowledge (Eriksen et al., 2024). Ultimately, while multilateral texts frequently invoke the rhetoric of "leaving no one behind," the substantive governance mechanisms required to ensure equitable access to AI climate solutions, protect data sovereignty, and mandate technology transfer under Article 10 of the Paris Agreement remain largely absent.

Summary

The results collectively demonstrate that the AI–climate nexus is not merely a technical interface but a deeply political and governance-laden domain that reconfigures the foundational dynamics of international relations. Three overarching observations emerge. First, AI is transforming the epistemic infrastructure of climate diplomacy. The proliferation of AI-enabled verification tools, climate models, and scenario-planning platforms is altering how states assess each other's commitments and how scientific authority is distributed in multilateral negotiations (Keohane & Oppenheimer, 2016). This shift carries both promise—greater transparency and accountability—and peril, the concentration of epistemic power in states and corporations that control AI capabilities. Second, the energy transition is being digitized and geo politicized simultaneously. AI is accelerating the technical feasibility of deep decarbonization, but it is also creating new dependencies, on AI platforms, on critical minerals, on digital infrastructure, that reconfigure the geography of power in ways that may entrench rather than overcome existing inequalities (Overland et al., 2019; Bremmer & Suleyman, 2023). The just transition imperative therefore extends beyond fossil-fuel workers to encompass digital inclusion and technological sovereignty. Third, the governance architecture for the AI–climate nexus remains fragmented, reactive, and equity-blind. The regime complexity literature predicts that without deliberate coordination, overlapping institutions generate forum-shopping, regulatory arbitrage, and lowest-common-denominator outcomes (Raustiala & Victor, 2004). The absence of a dedicated multilateral mechanism linking AI governance to climate objectives represents a critical institutional gap that risks undermining both the Paris Agreement's effectiveness and the equitable development of AI.

These findings resonate with the Earth system governance framework proposed by Biermann et al. (2009), which emphasizes the need for polycentric, multi-scalar, and adaptive governance in the Anthropocene. However, the present study extends this framework by demonstrating that the AI–climate nexus introduces a technological dimension that existing Earth system governance scholarship has insufficiently theorized. The integration of critical technology governance perspectives (Crawford, 2021; Couldry & Mejias, 2019) is essential to ensure that the governance of this nexus does not reproduce the extractive and exclusionary logics that have characterized previous waves of technological globalization.

Policy Recommendations

This study set out to examine the AI–climate nexus as a constitutive feature of contemporary international relations, focusing on climate diplomacy, energy transition, and emerging technology governance. Through a triangulated qualitative analysis of 127 documents and four comparative case studies, the paper has demonstrated that AI is simultaneously a tool for climate action, a source of new emissions and dependencies, and a vector of geopolitical restructuring. The governance of this nexus remains fragmented, equity deficits persist, and the institutional architecture is ill-equipped to manage the speed and scale of AI-driven change. Establish a UN AI–Climate Governance Interface. The UN Secretary-General's High-Level Advisory Body on AI (2024) should recommend the creation of a dedicated task force or subsidiary body linking the UNFCCC, ITU, and AI governance processes to ensure coherent policy development. Embed CBDR in AI–Climate Governance. Multilateral AI governance frameworks should explicitly incorporate the principle of common but differentiated responsibilities, including binding commitments on technology transfer, capacity building, and data sovereignty for developing states. Mandate Environmental Accounting for AI. States and international organizations should require comprehensive carbon and water footprint reporting for AI training and inference, aligned with the EU AI Act's sustainability provisions (European Parliament, 2024). Invest in Southern AI Capacity. Donor states and multilateral development banks should fund AI research centers, digital infrastructure, and open-source climate AI tools in the Global South to reduce dependency and promote equitable innovation. Develop AI-Specific Climate Standards. The ITU, ISO, and IEC should collaborate to develop internationally recognized standards for AI applications in emissions monitoring, grid management, and climate adaptation, ensuring interoperability and preventing regulatory fragmentation. Strengthen Epistemic Justice. AI-driven climate tools should be designed in partnership with indigenous and local knowledge holders, ensuring that algorithmic systems do not marginalize non-Western epistemologies (Eriksen et al., 2024).

Limitations and Future Research

This study is limited by its focus on English-language documents, the rapid evolution of AI governance (which may outpace the findings), and the inherent subjectivity of qualitative interpretation. Future research should pursue quantitative modelling of AI's net climate impact, comparative analysis of national AI–climate strategies across a larger sample, and longitudinal tracking of governance developments as the AI–climate nexus continues to evolve. The intersection of AI with other emerging technologies, quantum computing, synthetic biology, geoengineering, also warrants dedicated investigation within the IR framework.

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