Accountability in the AI Era: Governing Environmental Impact through Algorithmic Sustainability

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Abstract

Artificial intelligence is becoming increasingly embedded in environmental decision-making, where it influences how risks are defined, priorities are established, and regulatory actions are carried out. Current governance approaches tend to emphasize predictive performance, transparency, and ethical principles. Less attention is directed toward the ways in which algorithmic outputs shape administrative decision processes. This policy review assesses artificial intelligence as part of institutional decision-making rather than as neutral analytical infrastructure. Drawing on international governance frameworks published between 2020 and 2025, the analysis assesses how existing policies engage with lifecycle environmental impacts, accountability, and procedural legitimacy. The findings show that risk-based governance and transparency requirements are expanding, yet lifecycle impacts, such as energy use, emissions, and infrastructure dependencies, are not consistently integrated into decision justification and oversight. Accountability mechanisms can show similar limitations. They frequently remain procedural and do not entirely capture how decisions are shaped in practice. Building on the concept of algorithmic sustainability, the review highlights the need to align environmental impacts with institutional responsibility within decision processes. Effective policy design depends on how these relationships are structured, where artificial intelligence influences public outcomes.

Keywords: environmental governance; artificial intelligence; algorithmic sustainability; policy design; decision-making infrastructure

1. Introduction

Artificial intelligence is increasingly used in environmental decision-making across various domains. These include climate risk assessment, land-use planning, environmental monitoring, and regulatory enforcement. In these settings, its function extends past technical support. It helps shape how risks are defined, how priorities are established, and how decisions are carried out within administrative processes. This shift creates a governance challenge. It concerns how decision authority, accountability, and environmental impacts are managed when algorithmic outputs influence public action. Current governance approaches place emphasis on predictive performance, transparency, and ethical principles. Less consideration is given to how artificial intelligence becomes embedded within decision processes and how this affects the exercise of public authority. At the same time, the environmental implications associated with these systems—including energy use, emissions, and infrastructure dependencies across their lifecycle—are not consistently integrated into governance structures (International Energy Agency, 2025; Kaack et al., 2022; United Nations Environment Programme, 2023).

Adopting an institutional perspective, this paper examines how these issues are managed in practice. It draws on the concept of algorithmic sustainability, understood here as the alignment between lifecycle environmental impacts, institutional responsibility, and decision-making methods. The aim is not to add new analytical tools. It is to assess how existing governance frameworks engage with these dimensions and to identify where current policy design remains incomplete.

2. Methods and Analytical Approach

This study uses a qualitative policy review. It relies on a structured examination of international governance frameworks, regulatory instruments, and institutional guidelines published between 2020 and 2025. Source selection was guided by relevance to public-sector applications of artificial intelligence, with attention to how governance and accountability are treated, and notes if environmental impacts are included. It does not evaluate technical system performance. Instead, the focus is on how decision authority is organized when algorithmic systems affect administrative processes.

Particular attention is given to the treatment of lifecycle environmental impacts. These include energy use, emissions, and infrastructure dependencies associated with the development and operation of artificial intelligence systems. Their presence within governance procedures and decision justification is considered an indicator of policy integration. This distinction is important. An institutional lens is applied to identify patterns, gaps, and differences across policy approaches. Rather than proposing a new framework, the review assesses how artificial intelligence is incorporated into environmental decision-making in practice. The objective is to determine whether existing governance structures are consistent with environmental impacts, accountability, and decision processes within administrative settings.

3. Policy Analysis and Governance Gaps

A central issue concerns how environmental impacts are addressed. While policy discussions more frequently recognize the energy consumption and emissions linked to artificial intelligence systems, these factors are seldom integrated into governance procedures or used to justify decisions. Furthermore, lifecycle impacts, from development through deployment, often remain outside the scope of regulatory evaluation. This separation generates a disconnect between environmental objectives and governance mechanisms (International Energy Agency, 2025; Kaack et al., 2022; United Nations Environment Programme, 2023). Limitations are also evident in the way accountability is structured. Governance frameworks commonly rely on forms of personnel oversight and responsibility allocation. In practice, these mechanisms do not always capture how decisions are shaped. This issue is particularly pronounced when algorithmic outputs are consistently integrated into institutional routines. Accountability is still present, but its scope is constrained. It is often procedural.

Influence on the application of governance measures is further shaped by institutional capacity. Differences in technical expertise, regulatory resources, and organizational readiness affect implementation across contexts. As a result, the integration of governance requirements into administrative systems varies. Some institutions adapt these measures effectively, while others meet persistent limitations. Taken together, these observations show that current policy approaches remain centered on systematic safeguards. The integration of lifecycle impacts, institutional responsibility, and decision-process dynamics remains incomplete.

4. Discussion and Policy Implications

The patterns identified in current governance approaches point to a structural limitation. Artificial intelligence is often treated as an object of oversight rather than as a component of decision-making operations. In practice, this distinction does not hold. Once integrated into administrative routines, algorithmic systems participate in developing classifications, priorities, and thresholds that guide public action. Their influence is therefore not confined to technical performance. It extends into the exercise of decision authority.

This change has implications for accountability. Existing frameworks assign responsibility to human actors and require forms of oversight that ensure compliance. Yet the pathways through which decisions are formed become less visible when algorithmic outputs are repeatedly used within institutional processes. The issue is not the absence of accountability. It

is its limited reach. Mechanisms that operate at the level of procedure do not entirely capture how outcomes are produced or how responsibility is distributed (Tironi & Rivera Lisboa, 2023). Environmental aspects follow a similar pattern. Although policy discussions recognize the energy demand and emissions associated with artificial intelligence, these impacts are not consistently incorporated into governance procedures or decision justification (International Energy Agency, 2025; Kaack et al., 2022; United Nations Environment Programme, 2023). The result is a separation between environmental objectives and the operational logic of governance. Systems may comply with regulatory criteria while playing a role in environmental pressures that remain insufficiently examined.

Dealing with these limitations requires a change in orientation. Artificial intelligence needs to be understood as part of the decision-making infrastructure. Governance must therefore engage with the points at which algorithmic outputs influence administrative action. This includes clarifying the role of these systems within decision processes and distinguishing between levels of influence. Where influence is greater, oversight must also become more demanding (Organisation for Economic Co-operation and Development (OECD), 2019; Regulation (EU) 2024/1689 Rules on Artificial Intelligence, 2024; United Nations Educational, Scientific and Cultural Organization (UNESCO), 2021).

Implementation depends on how governance principles are translated into institutional practice. Integrating lifecycle environmental assessment into administrative procedures is one requirement. Another concern is the ability to trace how decisions are shaped, which depends on documentation and review mechanisms that remain effective over time. These systems evolve. Periodic reassessment is necessary (National Institute of Standards and Technology, 2023; Treasury Board of Canada Secretariat, 2024). This alignment remains incomplete in current governance practice.

5. Conclusion

Artificial intelligence is becoming more integrated into environmental governance. It influences how decisions are defined, justified, and implemented. Current policy approaches emphasize transparency and risk management. However, they do not fully address the ways algorithmic outputs influence decision-making processes or how environmental impacts are accounted for throughout the system lifecycle. The gap that emerges is institutional. It reflects an inconsistency between governance structures and the operational role of artificial intelligence within administrative systems. Responding to this challenge requires attention to how decision-making is organized in practice. Integrating lifecycle environmental impacts into governance procedures is one condition. Another concerns the ability to trace how decisions are formed when algorithmic outputs are used. Accountability must remain connected to influence. This is essential. The question is no longer whether artificial intelligence should be used in environmental decision-making. But it should be how its incorporation can remain consistent with environmental objectives and institutional responsibility. The answer depends on how governance evolves within practice.?

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