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Designing Ethical AI Governance in Sustainable Finance Ecosystems

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Abstract

This literature review explores the transformative potential of Artificial Intelligence (AI) in advancing sustainable development, highlighting its applications across sectors such as finance, construction, healthcare, and cultural heritage. AI's capabilities in data processing, automation, and decision-making enable resource optimization and support progress toward the Sustainable Development Goals (SDGs). However, a major concern is the "principles-to-practices gap," wherein high-level ethical AI frameworks lack clear implementation mechanisms, especially in low-resource or marginalized contexts. The review synthesizes global case studies, including AI deployment in mountain communities and cultural institutions, to demonstrate the value of context-sensitive, human-centric design. These examples reveal how AI can bridge digital divides and empower underrepresented groups when developed inclusively. However, risks of "AI neo-colonialism" persist, as governance models from high-income countries may marginalize diverse development needs. The review identifies shared themes such as data centrality, ethical design, and alignment with SDGs, while highlighting disparities in resources, governance models, and goals across organizations. It underscores the need for adaptive, inclusive AI governance frameworks that balance innovation with accountability. Policy implications include the need for enforceable, risk-based AI regulations, international cooperation for harmonized standards, and investment in explainable AI and infrastructure sustainability. Future research should prioritize empirical studies on governance practices, particularly in the Global South, and develop sector-specific tools to map AI's contributions to sustainability. Ultimately, responsible AI governance must integrate social, cultural, and political dimensions to ensure that AI supports not just innovation, but equitable, inclusive, and sustainable global development.

Keywords: Artificial Intelligence, Sustainable Development, Ethical Governance, SDGs

Introduction

Artificial Intelligence (AI) is changing the world of business at an extremely high pace by creating an influx of innovation and business operational efficiency, which is evolving the way that businesses plan, strategize, and operate in the world of business today (Schiff, 2020). In the financial sector, AI has helped companies make wiser investment decisions, increase the sustainability of portfolio, and improve front-office and back-office processes (Susan Nwadinachi Akinwalere, 2022). This change of technology is characterized by a period when sustainable development is a world agenda as articulated in the Sustainable Development Goals (SDGs) of the United Nations which aims at creating a more all-inclusive and environmentally-sustainable future by the year 2030(zurich, 2025). Artificial intelligence is gaining impressions as playing a key role in this endeavor, in reducing emissions, contributing to energy efficiency, augmenting social inclusion in areas such as smart infrastructure, health systems, and environmental management(Vijayakumar). Yet, the growing popularity of Environmental, Social and Governance (ESG) investment involves some challenging issues e.g. the danger of greenwashing and/or the appearance (or rather, formation) of green financial bubbles, which in ignorance could eventually destabilize finance systems as well as generate a total loss of social trust in the long term (Ziemba, 2024). This paper claims that AI has the potential to become a powerful instrument in detecting and eliminating such risks as long as it is set and used responsibly and with ethical consideration.

Literature Background

In the financial industry, AI has come to be a game changer. It is commonly used in the evaluation of managerial sentiment via the earnings calls, in the identification of latent relationships within markets, as well as in the derivation of understandings by using unconventional data sets such as weather patterns or social media postings (Kazlauskaitė, 2024). AI also enables automation in compliance, fraud detection, client engagement, and risk modeling, all of which enhance the speed and accuracy of financial services (Camilleri, 2023). Moreover, its predictive capabilities are highly valued in sustainable development, where AI helps optimize resource usage and support decision-making aligned with the SDGs (Camilleri, 2023)Key examples include AI-driven energy management systems (SDG 7), smart city planning (SDG 11), and climate resilience strategies (SDG 13). AI further facilitates circular economy efforts by improving traceability, managing material flows, and reducing environmental impact (Smith, 2024).

Given its broad impact, the ethical governance of AI has become increasingly critical. AI Governance (AIG) refers to a combination of rules, tools, and processes designed to ensure AI technologies align with legal norms and institutional values (Oluwagbade, 2025). As AI is widely adopted across both public and private sectors, regulatory frameworks such as the OECD's AI Recommendations and the EU AI Act have emerged to guide responsible use, often using a risk-based classification approach (Smith, 2024). Despite these initiatives, a clear 'principles-to-practice' gap remains, wherein ethical ideals such as fairness, transparency, and safety are rarely implemented in operational settings (Hussain, 2022). Algorithmic bias, data privacy issues, and opaque 'black box' models present major barriers to trust and accountability (TRANSFORMING OUR WORLD:, 2023). Additionally, AI's significant carbon footprint raises concerns about its compatibility with environmental goals, underscoring the need for sustainable development to include sustainability of the technologies themselves (Schiff, 2020).

Identification of Research Gap

While literature affirms AI's role in financial risk assessment and sustainability planning, there is a lack of focused research on its application in predicting and managing green asset bubbles—a growing concern as ESG investments surge (Ugochukwu, 2024)Most studies address general AI capabilities or outline ethical guidelines, but few explore how AI tools can be directly applied to detect financial market instabilities related to speculative green investing (zurich, 2025). Governance literature remains conceptual, and there is little empirical work analyzing how these principles are enforced in diverse financial contexts. This absence makes it difficult to assess the real-world impact of AI governance frameworks (Wang, 2023). Furthermore, major sustainability plans such as the European Commission's action agenda rarely address the role of fintech or AI in managing systemic ESG-related risks, revealing a disconnect between policy design and technological application (Szpruch, 2023)

Issues such as 'exclusive inclusion,' where AI systems unintentionally exclude vulnerable groups due to narrow algorithmic designs, also remain under-investigated. Although AI systems are marketed as systems that can facilitate social welfare, they tend to overestimate other socioeconomic realities. Sustainable overvaluations, greenwashing and misinterpretation of ESG data may come at high cost without intelligent systems to mitigate the danger. It is therefore necessary to come up with mechanisms that the AI can be used to foresee, track and even prevent the occurrence of asset bubbles in the green assets markets.

Theoretical Framework

This paper uses a socio-technical system theory to establish how the concept of Artificial intelligence (AI) can ethically be incorporated into sustainable finances. This framework appreciates the idea that AI is not just a technology instrument, but that it is a unit that is related to the bigger infrastructure that consists of organizational regulations, human

subjects, cultural practices, and institutions. (Mhlongo, 2024). The socio-technical approach encourages digital tools to be used in the service of social aims, thus placing in charge of AI the evolution of human and environmental lives.

(Akbari, 2023) identify four critical agendas for responsible AI governance: technical, contextual, regulatory, and process-based. The technical agenda lays stress on an accurate algorithm design and data integrity. The contextual agenda makes sure that AI can fit into the cultural, economic, and organizational particularities. The regulatory agenda comprises the framework of law and ethical adherence, whereas process related one is associated with auditability, stakeholdership and observance procedures. (Perini, 2024) they further state that the governance of AI ought to be a recurrent cycle of test, change, and response. This dynamic perception favours the concept which holds that governance strategies should change as trends in technology changes as well as to retain their usefulness. Combining the viewpoints, this study offers an extensive underpinning of the assessment into the moral application of AI to foresee and reduce green asset bubbles in sustainable finance..

Research Objectives and Questions

Having identified a research gap in the first section, the paper will endeavor to use the gap to address the following concept with regards to Artificial Intelligence (AI) strategic incorporation and governance of green asset bubbles, without compromising strong ethical standards. The specific research questions that guide this inquiry include:

1. In what ways can AI technologies be designed and regulated to accurately forecast the emergence of green asset bubbles, considering their unique market characteristics and data-driven complexities?

2. What governance strategies and AI-based interventions can financial institutions and regulators employ to minimize the risks linked to green asset bubbles, promoting financial stability and authentic sustainable investment?

3. How can the principles of transparency, fairness, and accountability be operationalized in AI systems developed for detecting and responding to green asset bubbles, especially in light of algorithmic bias and opaque data processes?

Significance and Contribution

This research contributes meaningfully to both theoretical discourse and practical decision-making. On a theoretical level, it deepens the understanding of AI as both a facilitator and potential barrier to sustainable development by focusing on the relatively underexplored topic of green asset bubbles. By applying a socio-technical governance framework to a complex financial challenge, it provides a pathway to close the persistent 'principles-to-practices' divide in ethical AI governance (Dorian Peters, 2020).

In practical terms, the study provides practical information that can be guided by regulators, investors, and institutions that want to effectively incorporate AI into ESG investing responsibly. It outlines practical options to create AI that aligns with developing ethical standards as well as practical problems like selective inclusion and algorithmic transparency (Raman, 2023).

The recommendations will contribute to the development of more open, broad-based, and stable financial markets, which will facilitate the wider strategy of environmental protection ad economic resilience.

Introduction to the Literature Review

AI has also emerged as a core force of innovation in all fields of production, with tremendous opportunities to facilitate faster work towards the United Nations Sustainable Development Goals (SDGs). Its ability to process multifaceted data, identify trends, and make the best use of data presents the company with a special opportunity to address the issues of sustainability in a data-intensive and efficient way (Giannotti, 2013). In the last ten years, AI developed as a technological facilitator and a strategic instrument in environmental management, energy optimization, healthcare, and sustainable urban development. (Binns, 2018).

Regardless of the increasing interest, the body of academic research has associated a major knowledge gap pertaining to the sector-specific application of AI in sustainable development. Specifically, such industries like construction, which currently account a substantial portion of energy consumption, emissions and resource use worldwide, are still under-researched in regard to AI-driven sustainability interventions. (Binns, 2018). Moreover, uncertainties regarding ethical risks, algorithmic bias, transparency, and governance mechanisms make rolling out AI in the socially and environmentally sensitive conditions more troubleSome of these concerns relate to beneficial outcomes, but many address issues that harm the social and environmental contexts and the communities in which the AI is deployed (Camilleri, 2023).

The purpose of this literature review is to formulate the main scholarly input on the relationship between AI and sustainability. It discusses three main areas, namely, the use of AI in fulfilling SDGs (emphasizing on the construction field), emerging research field of governing artificial intelligence (AIG), and finally incorporating ethics in AI systems. By

critically engaging with the current body of literature, the review highlights research gaps, emerging conceptual frameworks, and practical governance challenges that must be addressed to ensure responsible, ethical, and impactful use of AI technologies.

Thematic and Conceptual Framework

AI's Applications in Achieving Sustainable Development Goals

AI has proven to be a powerful catalyst for progress across various dimensions of sustainability. Its application ranges from improving energy efficiency to enhancing infrastructure resilience and optimizing healthcare delivery (Giannotti, 2013). In the construction industry, AI adoption is particularly relevant due to the sector's fragmented structure, high material usage, and urgent need for digital transformation.

AI Across Project Phases in Construction

The potential for AI integration in construction can be categorized into four major project phases:

- Planning Phase: During this initial stage, Machine Learning (ML) and Deep Learning (DL) models assist in analyzing historical project data to optimize scheduling, resource planning, and risk forecasting. Tools such as neural networks can detect inefficiencies and inform data-driven decision-making (Hussain, 2022).
- Design Phase: AI-driven generative design software is used to explore multiple architectural configurations, simulating environmental impact, energy efficiency, and material sustainability. ML algorithms can evaluate design alternatives and improve structural performance
- Construction Phase: On-site implementation benefits from automation and robotics, including drone surveillance, robotic bricklaying, and AI-powered safety monitoring systems. DL models process sensor data to anticipate delays and mitigate risks (Dorian Peters, 2020).
- Operation and Maintenance Phase: In post-construction, AI contributes to predictive maintenance, energy usage tracking, and the automation of facility management systems, ensuring the long-term sustainability and safety of built environments (Dorian Peters, 2020).

A systematic literature review has identified nine SDGs that are directly impacted by construction sector practices: SDGs 6, 7, 8, 9, 11, 12, 13, 15, and 17 (Islam, 2025)Of these, the most significant contributions can be made toward:

- SDG 7: Affordable and Clean Energy
- SDG 9: Industry, Innovation, and Infrastructure
- SDG 11: Sustainable Cities and Communities

Beyond Construction: Broader Applications of AI for SDGs

AI has been instrumental in advancing other SDGs beyond construction:

- SDG 3 (Good Health & Well-being): AI tools such as computer vision and ML have transformed diagnostics and health monitoring. AI-powered platforms can detect diseases like breast and cervical cancer, analyze genetic data, and support personalized treatment strategies (Burrell, 2016).
- SDG 7 (Clean Energy): AI enhances energy efficiency through smart grids, solar forecasting, and automated consumption analytics. Technologies such as convolutional neural networks and sensor-based systems are key enablers (Ricardo Vinuesa 1, 2020)
- SDG 11 (Sustainable Cities): AI supports traffic optimization, pollution control, and smart building technologies that contribute to livable, climate-resilient urban environments (Omotayo Bukola Adeoye, 202).
- SDG 16 (Peace, Justice & Strong Institutions): AI contributes to election monitoring, fraud detection, and legal text analysis. However, its use raises concerns about data protection and algorithmic fairness (Sánchez-García)

Key enabling technologies frequently discussed in the literature include Big Data, Decision Support Systems, Internet of Things (IoT), Robotics, and Automation

In the financial sector, AI also supports sustainable investing by enhancing ESG (Environmental, Social, Governance) data analysis, improving transparency, and identifying green asset bubbles (Cowls, 2019)

AI Governance (AIG): Concepts and Challenges

AI Governance (AIG) encompasses the structures, policies, and technologies needed to ensure the ethical and lawful use of AI systems within organizational and societal contexts. It aims to balance innovation with responsibility by aligning AI deployment with regulatory standards and social values (Dwivedi, 2021)

Key Themes in AI Governance

The literature categorizes AI governance into four main dimensions:

- Technology: Governance must account for the complexity and opacity of AI models. Issues such as algorithmic transparency, explainability, and bias are central concerns. The "black box" nature of AI systems poses significant challenges in interpreting their outputs and establishing accountability (Burrell, 2016).
- Stakeholders and Context: Governance models must include diverse actors, including developers, policymakers, users, and affected communities. Equitable participation and accountability are essential for inclusive and context-sensitive governance (Ivanova, 2023).
- Regulatory Frameworks: A combination of hard law (e.g., EU AI Act, GDPR) and soft governance tools (e.g., voluntary standards, ethical codes) are used to regulate AI. The EU AI Act, in particular, classifies AI systems by risk category and mandates strict oversight for high-risk applications (Calo, 2017).
- Governance Processes: Operationalizing AI governance involves the use of impact assessments, ethical audits, and continuous monitoring tools. However, many organizations struggle to implement these processes effectively, resulting in a "principles-to-practice" gap (Ziemba, 2024)

Governance in the Construction Sector

Construction-specific governance concerns include data security, lack of technical expertise, and ethical misuse of AI technologies. Addressing these challenges requires robust organizational commitment, clear stakeholder roles, and continuous workforce training (Cowls, 2019).

The Interplay Between AI, Ethics, and Sustainability

AI's dual nature—as both a tool for sustainable progress and a source of ethical risk—demands careful integration of ethics into every stage of AI development. While AI offers novel solutions for environmental and social issues, it can also reinforce existing inequalities through biased datasets, opaque decision-making, and high energy consumption (Binns, 2018)

Ensuring AI aligns with ethical principles—such as fairness, accountability, transparency, and respect for human rights—is essential to achieving long-term technological sustainability. In construction, this involves building AI literacy, securing stakeholder buy-in, and promoting a culture of responsible innovation (Ziemba, 2024)

Organizations employing AI for ESG or other sustainability objectives remain legally and ethically responsible for its outputs. AI cannot be used to deflect blame or reduce accountability in the event of harm or failure (Vassilis Galanos, 2021)

Critical Analysis and Synthesis

The existing body of literature presents a compelling foundation for understanding how artificial intelligence (AI) can advance sustainable development goals (SDGs), while also recognizing the critical role of governance mechanisms in ensuring ethical deployment. Several notable strengths are evident across current research streams:

- **Systematic Review Approaches**: Many studies adopt systematic literature review (SLR) methodologies, which provide a structured and reproducible process for synthesizing findings. These reviews enhance the objectivity and transparency of academic synthesis and serve as a reliable foundation for future empirical and conceptual work (Omotayo, 2024).
- **Sector-Specific Mapping of SDGs**: A valuable contribution from existing literature is the identification of SDGs most relevant to specific sectors. For example, the construction industry has been directly linked to SDGs 6 (Clean Water and Sanitation), 7 (Clean Energy), 8 (Decent Work), 9 (Innovation and Infrastructure), 11 (Sustainable Cities), 12 (Responsible Consumption), 13 (Climate Action), 15 (Life on Land), and 17 (Partnerships for the Goals), with SDGs 7, 9, and 11 emerging as the most promising areas for targeted interventions (Chu, 2008).
- **Recognition of AI's Functional Strengths**: The literature consistently emphasizes AI's capabilities in improving efficiency, accuracy, and forecasting. Its application in data analytics, process optimization, and real-time decision-making contributes significantly to resource conservation, emissions control, and adaptive system management (Tomczak, 2022).
- **Growth in Multidisciplinary Research**: There has been a noticeable surge in scholarly and industry interest around AI for sustainable development, reflected in the rapid increase in related publications and cross-sectoral collaboration. This trend highlights the field's growing relevance and encourages global knowledge sharing (Ofori, 2020).
- **Progress in Ethical and Regulatory Frameworks**: The development of governance instruments like the **EU AI Act** and national AI ethics strategies has laid important groundwork for responsible AI deployment. These regulatory efforts aim to create globally applicable standards that ensure fairness, transparency, and accountability in AI systems (Ikhlef Jebbor, 2024)

Key Limitations and Research Gaps

Despite these advancements, several **critical limitations** persist within the existing literature

Limited Empirical Focus in Construction: Although the construction sector is heavily implicated in sustainability transitions, there remains a dearth of empirical research examining how AI is practically implemented in this field to achieve SDG outcomes. Most work remains conceptual or exploratory (Dorian Peters, 2020)

Underdeveloped Implementation Studies in AI Governance: A large proportion of AIG-related studies focus on theoretical frameworks rather than offering real-world, organization-level case studies. This leads to a lack of practical insights on how AIG processes are initiated, evaluated, or embedded within institutional structures (Luciano Floridi, 2019)

Contextual Oversights in AIG Frameworks: Many governance frameworks do not account for the cultural, economic, or regulatory contexts in which AI systems operate. A one-size-fits-all approach limits the applicability and effectiveness of such models in diverse geographies (Wagner, 2018).

Effectiveness of Ethical Principles Remains Debated: Ethical AI principles, though widely articulated, often suffer from weak enforcement mechanisms. Critics argue that many such guidelines remain high-level and do not translate into enforceable standards or risk mitigation protocols (Dwivedi, Hughes, & Ismagilova, 2021)

Operational Challenges and Role Ambiguity: The lack of clarity surrounding stakeholder responsibilities and insufficient integration of ethical audits into project lifecycles results in governance being reduced to symbolic compliance rather than real impact evaluation (Omotayo, 2024).

Geopolitical Inequities in AI Research: AI policy and ethics debates are largely dominated by actors from the Global North, which results in underrepresentation of voices and concerns from developing countries. This disparity restricts the creation of contextually relevant AI applications for sectors such as agriculture, education, and infrastructure in the Global South (Huanga, 2010)

Bias Toward Large Tech Firms in Case Studies: Much of the available literature draws insights from global corporations like Google, Microsoft, and IBM. While useful, this focus does not account for the constraints and challenges faced by small-to-medium enterprises (SMEs) or local governments with limited AI readiness (Felde, 2024)

Lack of Standardization in Terminology: The literature on AIG lacks consistency in its definitions and conceptual boundaries, which complicates efforts to synthesize findings across studies or develop standardized evaluation tools (Cowls, 2019)

Gaps in Data Privacy and Technical Capacity: Despite recognition of privacy and security as major concerns, few studies offer tangible strategies for addressing them. Additionally, there's limited focus on capacity-building, including specialized workforce training for sustainable AI system operation (Teija Vainio, 2010)

In summary, while substantial progress has been made in articulating the "what" and "why" of AI's role in sustainable development, significant gaps remain in understanding the "how" and "where"—particularly in operationalizing ethical AI frameworks and context-sensitive implementation strategies.

Theoretical Foundations

The theoretical underpinnings of AI governance and its application to sustainable development draw from an interdisciplinary mix of ethics, organizational theory, political science, and information systems. Central to this body of work is the **"principles-to-practices" gap**—the recurring challenge of translating aspirational ethical frameworks into tangible practices and enforceable standards (Chu, 2008)

AI Governance (AIG) theory is increasingly aligned with **human-centric and socio-technical approaches**, which treat AI not merely as a technological tool but as a system embedded within societal and institutional norms (Cowls, 2019). These approaches advocate for inclusive design processes, stakeholder participation, and ongoing evaluation mechanisms that consider both technical performance and social impact.

Methodological Foundations

A majority of studies rely on **systematic literature reviews (SLRs)**, often guided by frameworks like **PRISMA** (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). SLRs are favored for their structured approach to synthesizing vast and diverse bodies of research, which helps establish a comprehensive understanding of the field while ensuring transparency and replicability (Akbari, 2023)

SLRs have proven especially useful in:

- Highlighting underexplored areas,
- Clarifying conceptual confusion,
- And mapping sector-specific AI use cases across SDGs.

Emerging Theoretical Models

Several theoretical models and decision-making frameworks are emerging to aid the integration of AI and sustainability:

- **AI for Social Good (AI4SG)**: This concept encapsulates the idea of aligning digital innovation (blue) with environmental preservation (green), emphasizing solutions that create long-term public value while avoiding harm (Chu, 2008).
- **Multi-Criteria Decision-Making (MCDM) Tools**: Tools such as Saaty's Analytic Hierarchy Process (AHP) are increasingly applied to prioritize SDGs, assess trade-offs, and guide corporate sustainability strategies (Vijayakumar, 202). AHP enables organizations to break down complex decision-making into structured hierarchies, integrate qualitative judgments, and assign weights to sustainability indicators.
- **Sustainability Indices**: For instance, the Sustainable Energy Development Index (SEDI) has been employed to evaluate progress in energy systems using environmental, economic, and social indicators (Dorian Peters, 2020)

These theoretical advancements not only enrich the academic discourse but also provide actionable insights for policymakers, industry practitioners, and researchers seeking to integrate AI ethically and effectively into sustainability initiatives.

Research Gaps and Justification

Although a growing body of literature underscores the transformative role of Artificial Intelligence (AI) in advancing the United Nations Sustainable Development Goals (SDGs), significant research gaps continue to hinder the practical implementation of ethical and sustainable AI governance. A central gap is the scarcity of empirical studies that explore how AI governance (AIG) is applied within organizations. The majority of current contributions remain largely conceptual, offering normative or theoretical models without sufficient validation through real-world case studies (Binns, 2018). As a result, there is limited understanding of how governance mechanisms—such as ethical audits, oversight bodies, or impact assessments—are effectively integrated and sustained within organizational contexts (Dwivedi, Hughes, & Ismagilova, 2021)

Another closely related issue is the inadequate contextualization of AIG frameworks. Many studies adopt a one-size-fits-all approach, overlooking the influence of organizational, geographic, regulatory, or cultural variables. This lack of granularity often results in superficial or overly idealistic applications of ethical principles, which do not reflect the operational realities of AI implementation.

Consequently, questions persist regarding the efficacy of existing ethical frameworks and regulatory mechanisms—such as the EU AI Act—in addressing sector-specific challenges, particularly in dynamic, data-intensive environments

Moreover, despite widespread agreement on the need for operationalizing ethical AI principles, research still falls short in clearly defining stakeholder roles and responsibilities across the AI development lifecycle. The absence of frameworks that map internal (e.g. developers, executives) and external (e.g. regulators, civil society) stakeholder interactions can result in fragmented governance, diluted accountability, and limited public trust (Dorian Peters, 2020)

A critical geopolitical concern is the dominance of the Global North in shaping the discourse on AI ethics and governance, which has led to the underrepresentation of perspectives from the Global South. Scholars have noted that current AI policies often fail to address local needs in low- and middle-income countries, such as those related to financial inclusion, agricultural sustainability, or infrastructure development (Wang, 2023). This imbalance not only reinforces global inequality but also risks the design of AI tools that are misaligned with local socio-economic and environmental priorities.

Within sectoral contexts like construction, the literature remains underdeveloped in terms of examining AI's multidimensional contributions to sustainability across the full project lifecycle—from planning and design to operations and maintenance. The construction industry, known for its energy intensity and environmental footprint, offers a fertile ground for empirical investigations into AI-driven innovations that contribute to SDGs such as SDG 7 (Clean Energy), SDG 9 (Industry and Innovation), and SDG 11 (Sustainable Cities).

Collectively, these research gaps call for greater empirical inquiry, especially into the practical, context-specific implementation of AI governance, stakeholder engagement processes, and inclusive AI design strategies. Bridging these gaps will be essential to translating the principles of ethical AI into actionable governance structures, thereby ensuring that AI systems are both effective and aligned with societal sustainability objectives (Felde, 2024).

Conclusion

This literature review establishes that AI holds immense potential as a transformative force for sustainable development. Its application across key sectors—including construction, finance, healthcare, and smart urban development—illustrates its capacity to process large datasets, automate decision-making, and drive significant improvements in resource

efficiency and socio-environmental outcomes (Giannotti, 2013). When deployed responsibly, AI systems can optimize energy usage, streamline operations, enhance transparency, and contribute meaningfully to global SDG attainment (Huanga, 2010).

However, this potential can only be fully realised if AI is governed through robust ethical frameworks and organizational practices that ensure fairness, transparency, and accountability (Kazlauskaitė, 2024). A major theme emerging from this review is the "principles-to-practices gap"—the disconnect between high-level ethical guidelines and their operationalization in real-world settings (Islam, 2025). Although normative principles for ethical AI are increasingly codified in national and regional policies, they often lack enforceable mechanisms, clear stakeholder guidance, or context-sensitive adaptation strategies (Ofori, 2020).

The current scholarship is also skewed by a Global North perspective, which risks marginalizing low-resource countries and their unique challenges. As such, a key recommendation is for future studies to adopt more inclusive and diverse research methodologies, capable of integrating insights from underrepresented regions and communities (Kazlauskaitė, 2024). This will help ensure that AI solutions are not only technically sophisticated but also socially equitable and environmentally sustainable.

In essence, this review reinforces the imperative for developing actionable AI governance strategies that align technological innovation with ethical responsibility and global sustainability priorities. AI must be designed and deployed not only to avoid harm but to actively advance the public good, particularly in high-stakes domains such as finance, construction, and climate resilience. Achieving this will require cross-sectoral collaboration, empirical research, regulatory innovation, and continuous stakeholder engagement.

Key Findings and Insights: AI in Marginalized and Cultural Contexts

In the case of mountain communities, the application of AI has significantly contributed to enabling progress toward the 2030 Agenda. Specifically, it has demonstrated that human-centric AI design, when attuned to local socio-economic and infrastructural realities, can overcome barriers traditionally faced by rural populations in accessing and utilizing technology (Omotayo Bukola Adeoye, 202). This approach helped address the digital divide and foster inclusion, highlighting the need for context-sensitive innovation in global development initiatives.

However, a deeper insight from this case concerns the risk of "neo-colonialism" in AI governance, wherein dominant models from high-income countries are imposed as universal standards. Such practices risk marginalizing under-resourced regions, making it harder for them to meet stringent AI governance norms, which are often resource-intensive and shaped without their input (Felde, 2024). These concerns reinforce the importance of equitable AI governance that accommodates diverse development contexts.

In a parallel case, Taurino (2023) explored AI's integration into the museum and cultural heritage sector, positioning it as a vehicle for cultural sustainability. Through experimental applications such as algorithmic art and AI-curated collections, the study revealed that AI can challenge traditional curatorial hierarchies, promote inclusivity, and interrogate embedded biases within digital systems (TRANSFORMING OUR WORLD:, 2023). Notable projects like *Museum Marginalia* and *This Recommendation System is Broken* exemplified how AI can decentralize knowledge systems and reframe underrepresented narratives within museum collections.

Theoretical Implications of Case Studies

These case studies collectively suggest that AI governance must move beyond technical frameworks to engage with socio-political and cultural dimensions. The mountain communities' example, in particular, challenges the prevailing notion of universal governance models and underscores the necessity for localized, participatory approaches This reinforces the call for collaborative governance, where AI solutions are co-designed with the communities, they aim to serve (Cowls, 2019)

The museum sector case expands the theoretical scope of AI and SDGs by highlighting cultural sustainability—a relatively underrepresented pillar in sustainability literature. It illustrates that AI not only transforms how institutions engage with their collections but also redefines the cultural narratives that underpin identity, belonging, and inclusion (Taurino, 2023). Consequently, AI governance must consider the implications of algorithmic design in cultural interpretation and the preservation of diversity (UNESCO, 2022).

Analysis and Synthesis of Case Studies

A cross-case synthesis reveals several key themes and distinctions:

Shared Themes

- **Data Centrality**: In every case, the effectiveness of AI hinges on access to and the ethical use of structured and unstructured datasets, whether for environmental monitoring (Global Mangrove Trust), cultural analysis (Taurino), or SDG alignment (Dwivedi, Hughes, & Ismagilova, 2021)
- **Ethical Design Principles**: Principles such as fairness, transparency, and accountability consistently underpin responsible AI across all cases.
- **SDG Alignment**: Each initiative connects explicitly to one or more SDGs, reinforcing the idea that **AI is a catalytic tool** for global sustainability objectives (Tomczak, 2022)

- **Governance necessity**: Whether through formal policy (e.g., corporate AI ethics codes) or project-based accountability protocols, robust governance emerges as essential for successful AI implementation (Dorian Peters, 2020)

Patterns and Divergences

- **Scale and resources**: large corporations (e.g., Google, IBM) demonstrate broad-scale governance capacity, while smaller organizations (e.g., cultural institutions or NGOs) operate with limited resources, underscoring the need for **scalable and adaptable governance frameworks**
- **Governance focus**: While corporate entities focus on comprehensive internal policies, sector-specific projects like the Global Mangrove Trust emphasize **technical and data governance**, and the model centers on **AI-assisted decision-making**.
- **Breadth of SDGs targeted**: Some cases address broad sustainability agendas (e.g., environmental monitoring, finance), while others focus on **niche or overlooked goals**, such as cultural expression and local empowerment.

Policy Implications

The findings of this research carry vital implications for policymakers and regulatory bodies working to align AI innovation with global sustainable development goals. First and foremost, there is a pressing need for the establishment of robust, harmonized, and risk-based regulatory frameworks to govern AI deployment effectively (Dorian Peters, 2020). Without adequate regulation, AI poses significant risks to sustainability, as its economic, environmental, and social impacts may remain unchecked or inadequately mitigated (Cowls, 2019)To address this, national and regional governments must priorities the translation of ethical AI principles into enforceable legislation, ensuring both technological neutrality and regulatory proportionality, thereby accommodating a broad spectrum of AI applications while safeguarding public welfare (Hussain, 2022)

Secondly, the imperative for international cooperation and standardization is undeniable. The complexity and global reach of AI technologies demand that countries engage in cross-border governance collaboration, using platforms such as the United Nations, OECD, or G20 to develop common frameworks and ethical baselines (Schiff, 2020). As science diplomacy becomes increasingly relevant, there is an urgent need to bridge philosophical, legal, and cultural divides that currently hinder unified AI governance. Without such global agreement—particularly on issues like digital rights and algorithmic accountability—there is a risk of exacerbating existing global inequalities and reinforcing power asymmetries in AI deployment (Szpruch, 2023)

A third important implication is the need for governments to actively shape AI as a vehicle for inclusive value creation. Rather than simply regulating AI as a risk, public policies should encourage AI's capacity to generate value for all stakeholders, through instruments like value alignment, sustainable performance metrics, and transparency requirements. This includes addressing the infrastructure and energy demands of AI systems—especially those reliant on data centers and high-performance computing—by ensuring the sustainability of energy sources and data ecosystems. National AI strategies must also map out sector-specific applications of AI for the SDGs, outlining where and how AI can best serve climate, education, finance, or public health goals (Ivanova, 2023).

Moreover, policymakers must respond to the "black box" nature of AI, which creates opacity around decision-making processes. Regulation should mandate that AI systems offer explainability, interpretability, and traceability, especially in high-risk sectors like healthcare, criminal justice, and finance. The EU's AI Act provides a strong precedent by categorizing AI systems based on risk and imposing different compliance obligations accordingly—a model that could be replicated or adapted in other jurisdictions to guide responsible investment and ethical deployment (Dorian Peters, 2020).

Limitations and Directions for Future Research

While this research contributes meaningfully to the discourse on AI and sustainability, several limitations must be acknowledged. Firstly, much of the current academic work, including this study, relies heavily on theoretical and conceptual analyses, with relatively limited primary empirical evidence (Susan Nwadinachi Akinwalere, 2022). Many reviewed studies—particularly those focused on the construction sector—draw upon a restricted set of peer-reviewed articles, which may not fully reflect the diversity of real-world contexts, projects, or stakeholder perspectives.

Additionally, most case studies in the ethical AI literature tend to focus on large multinational corporations such as Google, Microsoft, or IBM. While these offer valuable insights into best practices, they may not reflect the experiences of SMEs or organizations in the Global South, which often lack the same resources, technical infrastructure, or institutional support to implement ethical AI governance (Camilleri, 2023). Similarly, the identification and mapping of AI capabilities to specific SDGs often involve subjective interpretation, with varying priorities across sectors, regions, and stakeholders (Binns, 2018).

Another challenge is the fast-evolving nature of AI itself. As new models, tools, and algorithms emerge, findings can quickly become outdated, making it difficult to generalize long-term implications without continual updates and reassessment (Wang, 2023)

To address these gaps, future research should priorities empirical studies that explore the implementation of AI governance at the organizational level. This includes in-depth qualitative and quantitative research on how firms develop, monitor, and adapt AIG structures in real-time . There is also a need for research that maps the entire stakeholder ecosystem surrounding AI—including AI vendors, regulators, data scientists, investors, and civil society groups—across different regions and sectors (Cowls, 2019)

Moreover, studies should explore the unique barriers and opportunities for AIG in low-resource environments, including start-ups and public sector institutions in developing countries. Understanding how these actors interpret and apply ethical AI principles will be critical to ensuring global inclusivity (Luciano Floridi, 2019).

Other potential research directions include:

- Investigating the trade-off between privacy and collaboration in AI design;
- Proposing new institutional governance models such as AI ethics boards;
- Mapping AI methods to specific SDG targets across sectors and regions;
- Developing standardized indicators for assessing “Green AI” and “Fair AI” outcomes.

Continued literature reviews, case-based inquiries, and cross-regional comparisons will be crucial to building a dynamic and inclusive knowledge base on responsible AI for sustainable development (Chu, 2008)

In summary, this study reinforces the view that Artificial Intelligence has enormous potential to contribute to the achievement of the Sustainable Development Goals. Sectors such as construction, finance, and environmental monitoring can particularly benefit from AI’s analytical and predictive capabilities. However, this promise can only be realised if AI governance frameworks are carefully developed and rigorously enforced.

The challenge lies not in defining abstract ethical principles, but in operationalizing them through policy, regulation, and practice. This paper has contributed by synthesizing key theoretical foundations, providing actionable insights for policymakers and practitioners, and highlighting the need for more inclusive and contextualized research. If AI is to truly serve as a force for sustainable and equitable development, its governance must be rooted in transparency, fairness, and stakeholder collaboration.

Ultimately, navigating this emerging frontier will require continued interdisciplinary collaboration between scholars, technologists, civil society, and policymakers. Together, they can shape a future in which AI development aligns with the core values of social justice, environmental stewardship, and human dignity.

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