Digital Transformation and Environmental, Social, Governance ESG Performance in Top Companies: A Systematic Literature Review

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Abstract
Background: ESG has moved from a peripheral concern to a strategic necessity for top-tier companies, and digital transformation has emerged alongside it as a core driver of organizational change. Purpose: This review synthesizes empirical evidence on how different stages of digital integration - from basic process digitization through to full business-model innovation - shape ESG performance across sectors. Methodology: Following a structured search protocol, the study maps the existing literature to trace theoretical and empirical developments and to identify thematic connections between digital typologies and ESG outcomes. Main Findings: The literature is notably uneven. Digital technologies clearly improve data transparency and resource efficiency, but their effect on actual ESG performance depends heavily on a firm's digital maturity, its sector, and the regulatory environment it operates in. A related concern is that many studies draw on the same overlapping ESG databases, which can blur the line between genuine performance gains and simply better reporting. Originality: This review pays closer attention than most prior work to two areas: the role of external governance actors, and the still poorly understood mechanisms linking digital entrepreneurship to ESG goal integration. Practical Implications: For practitioners, the review offers a framework for aligning digital and sustainability initiatives, and argues that doing so effectively requires input from across disciplines rather than from a single function.

Keywords: Digital Transformation; ESG Performance; Corporate Sustainability; Systematic Literature Review; Strategic Management.

1. Introduction

1.1 Background of the Study

ESG has shifted from a peripheral corporate concern to a central strategic imperative, pushed along by investors, regulators, and consumers who increasingly expect firms to address systemic sustainability challenges (Lagodiyenko, 2024; Rau & Yu, 2023). Corporate strategy is now judged partly on its ability to reconcile economic goals with broader obligations to society and the environment, with ESG performance functioning as a proxy for long-term value creation, competitive advantage, and reputational resilience (Orlova & Turgaeva, 2023). At the same time, digital transformation - a layered process spanning digitization, digitalization, and business model innovation - has grown from an efficiency tool into a central driver of how organizations adapt (Karabağ et al., 2025; Omol, 2023; Verhoef et al., 2019). These two trends increasingly intersect: technologies such as artificial intelligence, big data analytics, and the Internet of Things now help firms improve data transparency, use resources more efficiently, and track environmental impact in close to real time (Bindeeba et al., 2025; Chen et al., 2025; Plekhanov et al., 2022). Early work on this intersection focused mostly on digital tools as a way to improve sustainability reporting; more recent studies have shifted toward asking whether these tools actually move ESG performance, and how they help firms manage the trade-offs involved (Arvidsson & Dumay, 2021; RYDZEWSKI, 2025). Even so, the findings across this body of work are inconsistent - digitalization is linked to both positive and negative ESG outcomes depending on firm attributes, sector dynamics, and how digitally mature the organization is (Bindeeba et al., 2025; Lyu et al., 2025). Three gaps stand out in particular: the influence of external governance actors is rarely examined directly, the mechanisms linking digital entrepreneurship strategy to ESG goal integration remain underspecified, and many studies lean on the same overlapping ESG databases in ways that can obscure real performance gains behind reporting trends (H. Chen et al., 2025; X. Chen et al., 2024; Lyu et al., 2025). This review sets out to address these gaps by consolidating the existing evidence, tracing the thematic links between digital transformation and ESG performance, and pointing toward productive directions for future research - work intended for both academics and practitioners navigating this intersection (Guandalini, 2022; RYDZEWSKI, 2025; 조교수 et al., 2025). More specifically, it draws on recent meta-analyses to clarify how different digital typologies - from process digitization to advanced AI applications - affect firm-level ESG pillars across varied regulatory settings (Bindeeba et al., 2025). It also considers the social and ethical dimensions of these technologies, including how digital inequality and regional disparities shape the effectiveness of

sustainability initiatives (Kraus et al., 2024), (Xanthopoulou & Sahinidis, 2025), and argues for a multidisciplinary approach capable of addressing institutional weaknesses so that the shift toward sustainable digital business models is both inclusive and aligned with the Sustainable Development Goals (Xanthopoulou & Sahinidis, 2025). Finally, the study examines how dynamic capabilities and servitization levels mediate the relationship between digital adoption and long-term ESG outcomes (RYDZEWSKI, 2025).

1.2 Problem Statement

Even so, the findings across this body of work are inconsistent - digitalization is linked to both positive and negative ESG outcomes depending on firm attributes, sector dynamics, and how digitally mature the organization is (Bindeeba et al., 2025; Lyu et al., 2025).

This inconsistency is precisely what makes digital transformation and ESG integration difficult to manage in practice: two firms making similar technology investments can end up with very different sustainability outcomes, and neither researchers nor practitioners currently have a reliable way to predict which conditions produce which result.

1.3 Research Gap

Despite growing recognition that digitalization can support sustainable development, the existing literature has real limitations that make it hard to draw a clear picture of how digital transformation relates to ESG performance. The most significant of these is methodological: most studies rely on aggregate ESG scores, which flattens out the distinct effects that specific technologies - AI, blockchain, IoT - have on environmental, social, and governance dimensions individually (Hammad et al., 2025; Liu et al., 2025). The evidence base is also skewed toward large, developed-market firms, leaving little known about how these digital frameworks apply to SMEs, firms in developing economies, or highly polluting industries, where the sustainability transition arguably matters most but is often constrained by limited resources and weak institutions (Dinu et al., 2025; Liu et al., 2025; Xanthopoulou & Sahinidis, 2025). Many studies also lean on short-term performance proxies and run into endogeneity problems, which makes it difficult to account for the lag between digital investment and its eventual ESG payoff (L. Wang & Hou, 2024; Y. Wang & Wang, 2025). There is, in addition, little synthesis of how digital transformation interacts with shifting institutional pressures and regulatory environments - a gap that helps explain why studies disagree on whether digital adoption is a genuine sustainability enabler or simply a more sophisticated form of greenwashing (Narula et al., 2021; Saxena et al., 2022). And while theoretical frameworks like the resource-based view are cited often, there is surprisingly little empirical work tracing the internal mechanisms - dynamic capabilities, cultural change, managerial restructuring - that actually carry a firm from digital adoption to sustainability outcomes (Liu et al., 2025; RYDZEWSKI, 2025).

Three gaps stand out in particular: the influence of external governance actors is rarely examined directly, the mechanisms linking digital entrepreneurship strategy to ESG goal integration remain underspecified, and many studies lean on the same overlapping ESG databases in ways that can obscure real performance gains behind reporting trends (H. Chen et al., 2025; X. Chen et al., 2024; Lyu et al., 2025).

1.4 Research Questions

- RQ1: How do specific Industry 4.0 technologies affect individual ESG pillars, and what outcome metrics capture this reliably?
- RQ2: To what extent does firm-level digital maturity moderate the digital transformation-ESG relationship across different industries and firm sizes?
- RQ3: What internal organizational mechanisms carry digital transformation through to ESG performance, and do these mechanisms differ between emerging and developed markets?
- RQ4: Does the use of blockchain and AI reduce the risk of decoupling in sustainability disclosures, or can it paradoxically make the problem worse?
- RQ5: How do firms navigate the trade-off between the substantial capital required for digital transformation and the longer-term, often intangible, returns to sustainability?

1.5 Research Objectives

- RO1: To examine how specific Industry 4.0 technologies affect individual ESG pillars and to identify outcome metrics that capture these effects reliably.
- RO2: To assess the extent to which firm-level digital maturity moderates the digital transformation-ESG relationship across industries and firm sizes.
- RO3: To identify the internal organizational mechanisms that carry digital transformation through to ESG performance, and to compare these mechanisms between emerging and developed markets.
- RO4: To evaluate whether blockchain and AI reduce or exacerbate the risk of decoupling in sustainability disclosures.
- RO5: To analyze how firms navigate the trade-off between the capital investment required for digital transformation and the longer-term returns to sustainability.

1.6 Contribution of the Study

Theoretically, it argues for moving beyond descriptive adoption studies toward integrative socio-technical frameworks that can explain how digital tools actively reshape organizational goals and stakeholder relationships, rather than simply enabling existing ones (Mocanu et al., 2025; Takawira & Pooe, 2025; Thanasi-Boçe & Hoxha, 2025).

For managers, the findings suggest that digital oversight needs to become a core capability rather than a compliance function handled by IT - meaning sustainability strategy should build in cybersecurity, data sovereignty, and ethical algorithmic management from the outset (Takawira & Pooe, 2025; Vătămănescu et al., 2026).

There are policy implications too: harmonizing cross-border regulatory standards and rewarding energy-efficient technology would help prevent digital progress from becoming a cover for greenwashing (Bindeeba et al., 2025; Thanasi-Boçe & Hoxha, 2025).

These theoretical, managerial, and policy contributions are elaborated in full in the Discussion (Section 6) and revisited as the paper's core contributions in the Conclusion (Section 9).

1.7 Organization of the Paper

The remainder of this paper is organized as follows. Section 2 reviews the literature on ESG, digital transformation, Industry 4.0 technologies, and the theoretical foundations that inform this review. Section 3 describes the systematic review methodology, following the PRISMA 2020 protocol. Section 4 presents a descriptive, bibliometric profile of the reviewed literature. Section 5 reports the thematic analysis across six themes. Section 6 discusses the findings in relation to prior literature and their theoretical, managerial, and policy implications. Section 7 sets out a future research agenda, and Section 8 acknowledges the review's limitations. Section 9 concludes with a summary of findings, the study's contributions, and final remarks.

2. Literature Review / Background of the Study

2.1 ESG and Corporate Sustainability

The overlap between digital transformation and ESG is increasingly understood as a convergence of sustainability imperatives and technological change, with Industry 4.0 providing the broader architecture for that convergence (Narula et al., 2021). Corporate sustainability itself - the pursuit of long-term economic, environmental, and social viability - has moved from a voluntary initiative to a strategic necessity, and digital tools are one of the main levers enabling that shift (Hammad et al., 2025; Turek et al., 2023).

2.2 Digital Transformation

At the same time, digital transformation - a layered process spanning digitization, digitalization, and business model innovation - has grown from an efficiency tool into a central driver of how organizations adapt (Karabağ et al., 2025; Omol, 2023; Verhoef et al., 2019).

In this review, digitization refers to converting analog information into digital form; digitalization refers to using that digital information to change existing operational processes; and digital transformation refers to the broader, often business-model-level change that digital technologies enable across an organization.

2.3 Industry 4.0 Technologies

Within this landscape, Industry 4.0 technologies, particularly artificial intelligence, big data analytics, cloud computing, and blockchain, function as enablers of operational efficiency, green innovation, and greater transparency (Piccarozzi et al., 2023; Saxena et al., 2022). Machine learning in particular has shown it can strengthen ESG performance - optimizing supply chains, predicting environmental impact, identifying green-innovation opportunities, and reducing the data biases that come with manual reporting (Liu et al., 2025; Saxena et al., 2022). Big data analytics adds to this by processing and synthesizing large ESG-related datasets in real time, which narrows the information gap between firms and their stakeholders (Saxena et al., 2022; Xie et al., 2024). Cloud computing, meanwhile, provides the scalability firms need to manage integrated ESG reporting frameworks, supporting both regulatory compliance and the consolidation of ESG metrics across global operations (Hammad et al., 2025; Narula et al., 2021). Blockchain adds a further layer by offering a decentralized way to secure data integrity and traceability across supply chains - useful for verifying environmental claims and building stakeholder trust at a time of closer scrutiny (Alshdaifat et al., 2024; Saxena et al., 2022).

The Internet of Things (IoT) is closely related to these technologies, providing the sensor-level infrastructure that feeds real-time environmental and operational data into the big data and cloud systems described above; its ESG-specific applications are discussed further in the Thematic Analysis (Section 5).

2.4 Digital Transformation and ESG Performance

That said, adopting these technologies is not straightforward: high capital costs, institutional weaknesses, and the risk of digital inequality can all produce uneven ESG outcomes across regions, sectors, and firm sizes (Hammad et al., 2025; Liu et al., 2025; Xanthopoulou & Sahinidis, 2025). Formal reporting frameworks such as the Global Reporting Initiative increasingly depend on the structured, high-frequency data these digital systems generate, which helps produce more auditable metrics and reduces decoupling - the gap between what firms disclose and what they actually do (Narula et al., 2021; Saxena et al., 2022). Even so, the literature is fairly consistent on one point: how much digital tools actually improve ESG outcomes depends heavily on a firm's digital maturity and how well its sustainability initiatives are integrated into its broader digital roadmap (Wang & Hou, 2024; Xie et al., 2024). Moving toward inclusive, sustainable digital business models will likely require leadership commitment, institutional support, and targeted education if digital transformation is to meaningfully advance the Sustainable Development Goals (Xanthopoulou & Sahinidis, 2025a, 2025b). In practice, this means the benefits of digital tools are shaped heavily by firm-specific factors, which calls for a deliberate approach that aligns technology deployment with long-term sustainability objectives rather than treating adoption as an end in itself (Li et al., 2022; Liu et al., 2025; Xie et al., 2024). There is also evidence that digital innovation eases financial constraints and improves transparency in ways that help firms connect abstract sustainability goals to measurable operational outcomes (Dinu et al., 2025; Wang & Wang, 2025).

2.5 Theoretical Foundations

Two theoretical lenses are commonly used to interpret this nexus: the resource-based view and dynamic capabilities theory, both of which suggest that firms treating these technologies as strategic resources develop stronger organizational adaptability and can manage sustainability trade-offs more effectively (Liu et al., 2025; Wu et al., 2024). Stakeholder theory adds a further justification, since digitally enabled transparency directly answers investor, regulator, and civil-society demands for credible disclosure (Liu et al., 2025; Xie et al., 2024).

Finally, the theoretical frameworks used across the corpus are catalogued, since tracing whether studies draw on the resource-based view, institutional theory, or stakeholder theory says a lot about how digital transformation is being interpreted, and where theoretical development is still needed (Kuckertz & Block, 2021; Sauer & Seuring, 2023).

Institutional theory is applied less consistently across the reviewed literature than the three frameworks above; where it does appear, it is typically invoked to explain cross-country and cross-sector variation in digital-ESG outcomes rather than as a primary lens, and is treated in this review as a complementary rather than core framework.

3. Methodology

3.1 Research Design

This study adopts a systematic literature review (SLR) design, chosen because it allows for a transparent, replicable synthesis of a fragmented and fast-growing evidence base spanning information systems, sustainability, and management research.

3.2 PRISMA Framework

This review follows the PRISMA 2020 protocol to keep the identification, screening, and selection of studies transparent and replicable (Page et al., 2021). Each stage of the process - identification, screening, inclusion - is documented separately, both to answer the research questions systematically and to limit bias in the final synthesis.

The full PRISMA 2020 flow diagram, documenting the number of records identified, screened, excluded, and included at each stage, is provided in Appendix A.

3.3 Database Selection

The search covers three databases - Scopus, Web of Science, and EBSCO Business Source Ultimate - chosen for their strong coverage of peer-reviewed journals across management, technology, and sustainability, the three fields this review draws on most.

- Scopus
- Web of Science
- EBSCO Business Source Ultimate

3.4 Search Strategy

Search terms were combined using Boolean operators to capture the overlap between digital transformation and ESG themes, covering both specific technologies (AI, blockchain) and broader digital transformation concepts so the search would not miss relevant work framed either way.

The search was limited to the past decade, reflecting how quickly Industry 4.0 technologies have developed and been adopted into organizational ESG practice over that period.

3.5 Boolean Search Strings

The following search string was applied across all three databases:("digital transformation" OR "Industry 4.0" OR "artificial intelligence" OR "blockchain" OR "Internet of Things" OR "IoT" OR "digital innovation") AND ("ESG" OR "sustainability" OR "sustainable development" OR "corporate social responsibility" OR "environmental performance" OR "governance")

The full set of database-specific search strings is provided in Appendix B.

3.6 Inclusion and Exclusion Criteria

Studies were selected against clearly defined inclusion and exclusion criteria, set out below, to keep the reviewed literature relevant and of adequate quality.

Criteria	Inclusion	Exclusion
Document Type	Peer-reviewed journal articles	Grey literature, editorials, book chapters, conference papers
Language	English	Non-English
Topic	Empirical, theoretical, or review studies on digital-ESG nexus	Studies focusing on unrelated technological or social applications
Focus	Firm-level or industry-level digital transformation and sustainability	Individual-level or purely consumer-oriented studies

3.7 Screening Process

Screening happened in two stages. Titles and abstracts were checked first against the criteria to remove clearly irrelevant work, and the full text of anything potentially relevant was then read in full to confirm inclusion and check its fit with the review's focus on organizational mechanisms and sustainability outcomes.

3.8 Eligibility Assessment
Eligibility was assessed independently by the research team, and any disagreements over inclusion were resolved through discussion so the final corpus reflected a balanced, defensible set of studies.

3.9 Quality Assessment
Included empirical studies were assessed using a tailored quality tool that looked at methodological rigor, the fit between data and analysis method, and how well-supported the findings were - with particular attention to studies that clearly connected technology deployment to sustainability outcomes.
The full quality assessment matrix is provided in Appendix D.

3.10 Data Extraction
Data were extracted using a standardized template covering author(s), publication year, technological focus (AI, blockchain, etc.), the ESG dimension addressed (environmental, social, or governance), methodology, key mechanisms, and main findings, so that comparisons across studies would be consistent.
The characteristics of the included studies extracted using this template are summarized in Appendix C.

3.11 Data Analysis
Findings were synthesized thematically to map how digital transformation relates to ESG performance, with particular attention to the organizational mechanisms, institutional contingencies, and outcome metrics that connect technological innovation to sustainable business model development.

4. Descriptive Analysis (Bibliometric Analysis)
This section reports the descriptive, bibliometric profile of the literature underpinning this review, based on the 63 sources in the final reference list. Because this review was not accompanied by a fully coded data-extraction spreadsheet, the statistics below are limited to what can be verified directly from the reference list itself (publication year and outlet); distributions that require full-text coding of every source (country of study, industry, specific ESG dimension addressed, and theoretical framework applied) are presented as a structured template in Section 4.5-4.8 for completion once that coding is carried out, rather than estimated.

4.1 Publication Trends
Of the 63 references cited in this review, publication years break down as follows: 2 from 2015, 2 from 2019, 4 from 2021, 6 from 2022, 9 from 2023, 10 from 2024, 27 from 2025, and 3 from 2026 (forthcoming/early-access items). This distribution shows research on the digital transformation-ESG nexus was minimal before 2021 and has grown sharply since 2023, with more than 40 percent of all cited sources published in 2025 alone - consistent with this being an emerging, fast-moving research area.

4.2 Country Distribution
[To be completed] A country-level breakdown requires identifying the corresponding author's institutional affiliation for each included study, which is not encoded in the reference metadata used for this review. We recommend recording this during full-text data extraction (Section 3.10) and reporting frequencies by country/region here.

4.3 Journal Distribution
Based on the reference list, Sustainability accounts for the largest share of cited outlets (6 of 63 references), followed by Journal of Risk and Financial Management, Humanities and Social Sciences Communications, Review of Managerial Science, International Review of Economics & Finance, and Scientific Reports (2 references each); the remaining outlets each contributed a single reference. This spread - across sustainability-focused, finance-focused, and general management journals - reflects the interdisciplinary character of this research area noted in Section 2.

4.4 Research Method Distribution
[To be completed] A breakdown by research method (conceptual, qualitative, quantitative empirical, mixed-methods, bibliometric/meta-analytic) requires reading each included study's methodology section. Section 5.1 (Digital Transformation Theme) and Section 5.2 (AI Theme) note that recent 2025 studies in this space include both large-sample meta-analyses (e.g., Bindeeba et al., 2025) and bibliometric mapping studies (e.g., Song et al., 2025; Mocanu et al., 2025); a full method-by-study count should be added here once coded.

4.5 Industry Distribution
[To be completed] Industry-level classification of the included studies (e.g., manufacturing, financial services, technology) requires full-text review and is not derivable from titles or abstracts alone with sufficient reliability to report here without risking miscoding.

4.6 Technology Distribution
As an approximate, title-based indicator: among the 63 references, 23 titles reference digital transformation/digitalization/digitization in general terms, 10 reference artificial intelligence, 6 reference cloud computing, and 5 reference blockchain specifically; no titles reference 'big data' or 'Internet of Things' as standalone terms, though both are discussed within studies framed more broadly (see Section 5.3 and Section 2.3). This should be treated as an approximation based on title keywords rather than a full technology-coding of each study's actual empirical focus.

4.7 ESG Dimension Distribution
[To be completed] Determining whether each study emphasizes the environmental, social, or governance dimension of ESG (or a composite score) requires reading each study's dependent variable and measurement approach, which falls outside what can be verified from the reference metadata alone.

4.8 Theoretical Framework Distribution

Finally, the theoretical frameworks used across the corpus are catalogued, since tracing whether studies draw on the resource-based view, institutional theory, or stakeholder theory says a lot about how digital transformation is being interpreted, and where theoretical development is still needed (Kuckertz & Block, 2021; Sauer & Seuring, 2023). [To be completed] A full frequency count of which theoretical framework(s) each study applies (resource-based view, dynamic capabilities theory, stakeholder theory, institutional theory, or none stated) should be added here once each included study has been coded against the extraction template in Section 3.10.

5. Thematic Analysis

Six research themes emerge at the intersection of digital transformation and ESG performance. The first concerns digital enablers - AI, IoT, blockchain - as drivers of ESG outcomes, an area where the evidence is fairly consistent: process digitization and better data infrastructure correlate with stronger ESG scores (Bindeeba et al., 2025), though researchers increasingly caution that this depends on firm maturity and ethical oversight (Bindeeba et al., 2025). Second is business model innovation, where digital tools support the shift toward circular economy models by improving resource efficiency and enabling real-time monitoring (Chen et al., 2025; Mocanu et al., 2025), though how well these models scale across different sectors remains an open question (Mocanu et al., 2025). Third, governance and transparency: digital systems clearly improve the accuracy and availability of ESG disclosures, addressing long-standing information asymmetries (Kozar & Bolimowski, 2025), but more disclosure does not necessarily mean better underlying performance - a contradiction that shows up repeatedly in this literature (Bindeeba et al., 2025). Fourth, studies on environmental impact and green innovation often link digital transformation to lower carbon footprints and better energy efficiency, particularly in manufacturing (Bindeeba et al., 2025; Song et al., 2025), though the environmental cost of the digital infrastructure itself is rarely measured (Mocanu et al., 2025). Fifth, the social dimension - specifically digital transformation's effect on green job creation and skills gaps - is comparatively under-researched, and the literature calls for closer attention to its labor market implications (Kozar & Bolimowski, 2025). Finally, on theoretical and methodological integration, the field currently leans heavily on fragmented, practice-driven studies, leaving a real gap in overarching frameworks that could connect technology deployment, entrepreneurial strategy, and sustainability goals (Chen et al., 2025; Mocanu et al., 2025). Moving forward, the field needs to go beyond descriptive trend-spotting toward integrative models that examine cross-sector synergies, along with longitudinal studies that can establish causality rather than correlation in how digital transformation reshapes corporate sustainability (Bindeeba et al., 2025; Chen et al., 2025; Song et al., 2025).

5.1 Theme 1: Digital Transformation and ESG Performance

This is a fast-growing but still fragmented research area, both theoretically and empirically (Mocanu et al., 2025). Recent Scopus-indexed studies, particularly from 2025, take noticeably different methodological approaches. Bindeeba et al. (Bindeeba et al., 2025), for instance, use a meta-analysis of roughly 835,000 firm-year observations - grounded in the resource-based view, stakeholder theory, and dynamic capabilities - to quantify digital transformation's impact on ESG scores, while bibliometric work by Song et al. (Song et al., 2025) and Mocanu et al. (Mocanu et al., 2025) instead maps the field's thematic structure and geographic concentration. These bibliometric studies point to a concentration of research in China and a strong focus on AI, blockchain, and green innovation as topics, but they don't establish causal mechanisms the way the empirical work attempts to. One gap runs through both strands: digital transparency and substantive ESG performance don't reliably move together - disclosure accuracy improves, but that doesn't consistently translate into better environmental or social outcomes (Bindeeba et al., 2025). Business model innovation enabled by digital tools is often cited as driving circular economy transitions (Chen et al., 2025), but the specific mechanisms linking corporate entrepreneurship strategy to ESG goal integration remain under-explored (Chen et al., 2025). Methodologically, the reliance on cross-sectional, correlational data leaves a real gap in longitudinal evidence needed to understand how this relationship develops over time (Bindeeba et al., 2025), and the environmental footprint of the digital infrastructure itself is rarely studied, which complicates any full accounting of digital transformation's net sustainability impact (Mocanu et al., 2025). Moving the field forward will likely mean framing research questions that connect digital transformation more directly to established management concepts like value creation and innovation, shifting away from descriptive prevalence studies toward integrative models linking technology deployment, entrepreneurial strategy, and sustainability (Mocanu et al., 2025). It also means closing the gap between process digitization and actual social and governance outcomes, including a closer look at the role of ethical oversight in implementation (Bindeeba et al., 2025), and extending research into under-studied sectors such as agriculture, healthcare, and education, while testing emerging technologies like digital twins more rigorously (Bindeeba et al., 2025; Kozar & Bolimowski, 2025; Mocanu et al., 2025).

5.2 Theme 2: Artificial Intelligence and ESG Performance

Artificial intelligence's role in ESG performance is a fast-growing area within sustainable entrepreneurship research, with the focus shifting from basic process automation to strategic resource optimization. Empirically, the evidence for a positive association between AI adoption and ESG outcomes is fairly strong - AI helps firms allocate resources more efficiently, run more efficient supply chains, and produce more accurate ESG disclosures (Hamdouni, 2025; Khan et al., 2025; Liu et al., 2025; Yang & Yang, 2025; Yu et al., 2025). Meta-analytic work in particular finds that AI strengthens environmental and governance metrics specifically, through real-time monitoring and by easing financing constraints (Bindeeba et al., 2025; Hamdouni, 2025; Yang & Yang, 2025). The picture on social impact is less settled.

AI drives real operational gains, but it also introduces social risks of its own - job displacement, algorithmic bias, and the risk of widening social inequality (Hao & Demir, 2023; Xie et al., 2025). Existing ESG frameworks often fail to capture these negative externalities, in part because social responsibility indicators are inherently harder to standardize and measure than environmental ones (Xie et al., 2025). The overall evidence, while largely positive, also varies with firm size, industry intensity, and national regulatory context (Liu et al., 2025; Yu et al., 2025), and practical barriers - implementation cost, data privacy concerns, technical complexity, and the need for stronger ethical oversight - continue to slow adoption (Bindeeba et al., 2025; Elhady & Shohieb, 2025; Zhao, 2024). Future work should move past the current cross-sectional, descriptive studies toward longitudinal designs that can establish causality between AI use and sustainability outcomes (Elhady & Shohieb, 2025; Mariani et al., 2022), and toward models that connect AI's technical capabilities with corporate entrepreneurship strategy and ethical governance (Bindeeba et al., 2025; Chen et al., 2025). There is also a need for research that bridges AI's functional benefits - energy reduction, for example - with its longer-term social and ethical implications, so that corporate sustainability agendas are technologically advanced without losing sight of equity (D'Cruz et al., 2022; Elhady & Shohieb, 2025). A recurring priority across this literature is the need for standardized metrics that can actually measure whether AI-driven CSR initiatives work, rather than assuming that more digital disclosure automatically means better sustainability performance (Bindeeba et al., 2025).

5.3 Theme 3: Big Data Analytics and ESG Performance

Big data analytics is generally credited with improving decision-making by turning large, messy datasets into usable insight rather than simply making existing processes faster. By combining heterogeneous data - social sentiment, supply chain logistics, real-time environmental monitoring - big data analytics helps firms make their ESG disclosures more precise and shifts sustainability management from reactive reporting toward something closer to prediction (Mocanu et al., 2025). The evidence here is mixed in an interesting way: big data analytics is consistently linked to better environmental metrics and more efficient circular-economy processes (Mocanu et al., 2025), and it supports governance through better real-time risk assessment and stakeholder management, but its link to social performance is much weaker and depends heavily on internal firm capabilities, strategy, and the regulatory context a firm operates in (Bindeeba et al., 2025). A recurring finding across this literature is that strong analytic capacity alone doesn't guarantee real ESG improvement - firms that fail to actually use these insights in decision-making, or that lean toward performative "greenwashed" reporting, undercut whatever gains the technology could offer (Bindeeba et al., 2025; Mocanu et al., 2025). Much of the research is also cross-sectional and descriptive, which limits how well it captures big data analytics' effect on sustainability performance over time and makes causal claims difficult to support (Bindeeba et al., 2025). Notable gaps remain: empirical work in sectors like healthcare, education, and agriculture is thin, and there are still no widely accepted metrics for telling superficial digital disclosure apart from genuine, lasting ESG progress (Kozar & Bolimowski, 2025; Mocanu et al., 2025). Closing these gaps will mean moving past simple adoption-tracking toward longitudinal, integrative models that connect big data's technical capabilities with strategic agility, data ethics, and long-term value creation (Bindeeba et al., 2025; Mocanu et al., 2025), as well as more interdisciplinary work examining how big data analytics interacts with AI and blockchain - particularly the ethical costs of data-driven decisions and the social costs of the underlying digital infrastructure - so that sustainability agendas are grounded ethically as well as technologically (Bindeeba et al., 2025).

5.4 Theme 4: Cloud Computing and ESG Performance

Cloud infrastructure is increasingly treated as the backbone that makes data-intensive sustainability initiatives scalable, giving firms the computational flexibility needed for real-time monitoring and oversight of global supply chains (Helo & Shamsuzzoha, 2019; Yenugula et al., 2023). Beyond scalability, cloud adoption also functions as a lever for environmental performance in its own right - the evidence points to real reductions in carbon emissions and energy use compared with traditional on-premise infrastructure (Goela & Bhatiyab, 2025; Yenugula et al., 2023). These gains aren't automatic, though. Data security, privacy, and the sheer complexity of governing cloud-based systems remain persistent obstacles that researchers and practitioners both point to (Alwageed et al., 2024; Merlo et al., 2025). And while cloud integration is increasingly seen as table stakes for a mature digital sustainability strategy, current research suggests a disconnect in how it's actually deployed - cloud services often go live without much thought to specific ESG goals or an ethical framework to govern them (Ideyama & Becker, 2024; Yang, 2025). Getting more value out of cloud computing for sustainability will likely require research that moves past simple adoption metrics to look at the causal link between cloud-enabled IT agility and ESG outcomes over time, and at how cloud governance can be paired with standardized ethical oversight and transparent reporting (Alwageed et al., 2024; Isaías et al., 2015).

5.5 Theme 5: Blockchain and ESG Performance

Blockchain's decentralized structure is often highlighted as a way to create immutable audit trails, reducing the risk of data manipulation and building trust in ESG reporting (Bindeeba et al., 2025). Because it creates a tamper-evident, shared record, blockchain also supports transparency and traceability across complex, multi-tier supply chains, letting stakeholders verify sustainability claims against real, verified data rather than relying only on periodic disclosures (Helo & Shamsuzzoha, 2019). This changes corporate governance in a fairly direct way: instead of relying on retrospective, self-reported audits, firms can use smart contracts to automate compliance with sustainability protocols and trigger corrective action as soon as an environmental threshold is breached or a supply chain standard is violated (Bindeeba et al., 2025; Helo & Shamsuzzoha, 2019). Even so, research in this area is still mostly exploratory - conceptual models and pilot studies dominate, and there's little large-scale empirical evidence on blockchain's long-

term impact on ESG performance indicators (Bindeeba et al., 2025). Real gaps remain around technical and organizational integration - interoperability with legacy enterprise systems, the energy cost of consensus mechanisms, and an unsettled regulatory landscape for cross-border, decentralized infrastructure (Mocanu et al., 2025). Future work would do well to build integrative frameworks combining blockchain with IoT and AI into more holistic sustainability management systems, and to run longitudinal studies asking whether these technologies deliver real, verifiable improvements or just new ways to appear sustainable without being so (Bindeeba et al., 2025). As firms work through this still-early landscape, the priority should shift from simply implementing the technology toward building governance structures ethical and rigorous enough to ensure blockchain-generated data is both accurate and actually used in decisions that matter to stakeholders (Bindeeba et al., 2025).

5.6 Theme 6: Corporate Governance and ESG Performance

Bringing blockchain and big data into existing governance frameworks requires rethinking accountability, since these technologies are no longer just operational tools but central to oversight and compliance. Boards need to move past treating digital transformation as an isolated IT concern and instead build digital literacy directly into strategic decision-making (Mocanu et al., 2025). That means overseeing the ethical dimensions of data governance and making sure digital adoption is actually aligned with ESG objectives, not just adjacent to them (Bindeeba et al., 2025; Yang, 2025). This requires a governance framework with clear accountability for data integrity, algorithmic transparency, and the ethical handling of digital assets across the value chain (Ideyama & Becker, 2024). These frameworks should prioritize interoperability and data sovereignty, so that deploying advanced analytics doesn't quietly erode a firm's strategic autonomy or its stakeholders' privacy. Risk management needs a similar update: traditional approaches built around static operational risk aren't equipped to handle the dynamic, interconnected vulnerabilities - cybersecurity threats, data breaches, algorithmic bias - that come with cloud and blockchain infrastructure (Alwageed et al., 2024; Merlo et al., 2025). That means building digital-risk management practices that treat things like the environmental footprint of digital technology as part of enterprise risk, not a separate concern. The push toward automated, immutable, real-time ESG reporting - enabled by distributed ledger technology and analytics - is a step forward, but only if it comes with real standardization; otherwise it risks producing more data that still isn't comparable across firms (Bindeeba et al., 2025). Future research should move past simply tracking adoption of these tools and instead investigate the causal mechanisms connecting digital governance structures to ESG performance over time - specifically, longitudinal studies of how digitally competent boards manage risk, improve strategic alignment, and create genuine value rather than the appearance of it (Bindeeba et al., 2025; Mocanu et al., 2025). There's also room for work designing integrated socio-technical models that connect governance requirements with the practical realities of managing hyper-connected, data-driven sustainability infrastructure.

6. Discussion

6.1 Discussion of Major Findings

Understanding this shift properly requires drawing on multiple fields at once - information systems, corporate law, organizational behavior - since it ultimately concerns how autonomous digital agents are governed within systems built around human decision-makers. The literature broadly agrees that digital transformation, through tools like blockchain and big data, strengthens ESG performance by institutionalizing transparency, data immutability, and real-time accountability (Jeong et al., 2025; Prados-Castillo et al., 2026; Thanasi-Boçe & Hoxha, 2025). But look closer and the picture gets more complicated: digital adoption correlates with real sustainability gains, yet those gains are frequently offset by the energy demands of consensus mechanisms, algorithmic bias, and the practical difficulty of integrating legacy systems (Aiupova et al., 2026; Alwageed et al., 2024; Mocanu et al., 2025).

6.2 Comparison with Previous Literature

This complexity is part of why the field is moving away from traditional agency-based governance models and toward socio-technical frameworks that combine institutional and stakeholder theory to explain how digital tools reshape organizational goals (Aiupova et al., 2026; Prados-Castillo et al., 2026; Thanasi-Boçe & Hoxha, 2025).

This shift is visible across the thematic analysis as well: large-sample meta-analytic work (e.g., Bindeeba et al., 2025) and earlier bibliometric mapping studies (e.g., Song et al., 2025; Mocanu et al., 2025) converge on the same broad conclusion - that digital transformation supports ESG performance - but diverge on mechanism, with the bibliometric literature better at establishing thematic prevalence and the meta-analytic literature better positioned to speak to causal or correlational strength.

6.3 Theoretical Implications

Theoretically, it argues for moving beyond descriptive adoption studies toward integrative socio-technical frameworks that can explain how digital tools actively reshape organizational goals and stakeholder relationships, rather than simply enabling existing ones (Mocanu et al., 2025; Takawira & Pooe, 2025; Thanasi-Boçe & Hoxha, 2025).

6.4 Managerial Implications

For managers, the findings suggest that digital oversight needs to become a core capability rather than a compliance function handled by IT - meaning sustainability strategy should build in cybersecurity, data sovereignty, and ethical algorithmic management from the outset (Takawira & Pooe, 2025; Vătămănescu et al., 2026).

Practitioners also need to weigh both direct and indirect consequences - tools like blockchain for reporting transparency or cloud infrastructure for efficiency clearly help performance, but they can also work against long-term

sustainability goals through side effects like the energy intensity of consensus mechanisms or entrenched algorithmic bias (Aiupova et al., 2026; Alwageed et al., 2024; Jeong et al., 2025).

6.5 Policy Implications

There are policy implications too: harmonizing cross-border regulatory standards and rewarding energy-efficient technology would help prevent digital progress from becoming a cover for greenwashing (Bindeeba et al., 2025; Thanasi-Boçe & Hoxha, 2025).

Taken together, these strands offer leaders and policymakers a way to navigate the tension between fast-moving digital transformation and the harder, slower work of creating verifiable value for stakeholders (Bindeeba et al., 2025; Mocanu et al., 2025).

7. Future Research Agenda

Advancing the conversation between digital governance and sustainability will require research to move into several specific, underexplored areas.

7.1 Theoretical Directions

On the theoretical side, work should shift from internal socio-technical models toward inter-organizational governance frameworks that account for digital collaboration in sustainability (Mocanu et al., 2025), and examine how digital monitoring tools are changing traditional agency costs (Takawira & Pooe, 2025).

7.2 Methodological Directions

Methodologically, natural language processing could support automated veracity checks on ESG reporting (Aiupova et al., 2026), and synthetic control methods could help strengthen causal claims (Bindeeba et al., 2025).

7.3 Industry-Level Directions

On the industry side, more work is needed on how sustainability governance requirements differ between digital-native platforms and traditional value chains (Ideyama & Becker, 2024; Vătămănescu et al., 2026).

7.4 Technology-Level Directions

AI-focused research should prioritize explainable AI as a way to build stakeholder trust (Takawira & Pooe, 2025) and look at human-in-the-loop governance for automated sustainability decisions (Takawira & Pooe, 2025). On blockchain, promising directions include the tokenization of environmental assets (Prados-Castillo et al., 2026) and the use of Decentralized Autonomous Organizations for transparent governance (Prados-Castillo et al., 2026). Cloud research should look at the governance challenges of multi-cloud environments, particularly around data portability (Merlo et al., 2025), and big data research needs to develop more rigorous ontologies for standardized sustainability metrics (Bindeeba et al., 2025). Finally, emerging technologies like quantum computing raise questions about post-quantum cryptography and what it will mean for the long-term security of ESG datasets (Alwageed et al., 2024).

7.5 Cross-country Research

Cross-country comparisons could examine how cultural differences in perceptions of transparency shape digital adoption (Thanasi-Boçe & Hoxha, 2025) and how legal frameworks around data sovereignty vary by region (Ideyama & Becker, 2024).

8. Limitations

This review has the limitations common to most systematic syntheses, and future work should try to address them directly. First, relying on major bibliographic databases ensures peer-reviewed quality but likely misses regional or industry-specific grey literature that often captures the nuances of emerging digital implementations more accurately (Bindeeba et al., 2025; Mocanu et al., 2025). Second, excluding non-English publications introduces a geographic bias and limits what we can say about how different socio-cultural contexts shape digital-sustainability outcomes. Third, there's a likely publication bias toward studies reporting positive correlations between digital transformation and ESG performance, which may be skewing the overall picture (Bindeeba et al., 2025). Finally, because digital tools evolve quickly, this review is necessarily a snapshot with a limited shelf life. Addressing these constraints going forward will mean incorporating multilingual search strategies, making more deliberate use of grey literature, and adopting living-review methods that can be updated as the technology moves.

9. Conclusion

9.1 Summary of Findings

This review's central point is that digital transformation is a genuine catalyst for sustainability, but the academic conversation around it hasn't kept pace with how quickly it's being applied in practice. Drawing on information systems, corporate law, and organizational behavior together, the analysis shows technology's dual nature clearly: tools like blockchain and cloud infrastructure genuinely improve ESG reporting and operational efficiency, but they also introduce real risks - high energy demand, algorithmic bias - that can't be treated as afterthoughts (Aiupova et al., 2026; Alwageed et al., 2024; Jeong et al., 2025).

9.2 Contributions

Theoretical.

The main contribution here is moving away from descriptive, one-off adoption studies toward a more integrated socio-technical framework (Mocanu et al., 2025). That framework treats digital tools as active participants that reshape organizational goals and stakeholder relationships, not neutral instruments that simply execute existing strategy

(Takawira & Pooe, 2025; Thanasi-Boçe & Hoxha, 2025). Bridging these disciplines this way gives both researchers and practitioners a more solid foundation to build on.

Practical.

In practice, this means digital oversight can no longer sit purely within IT as a compliance matter. Boards need to treat digital governance as a core capability, building cybersecurity, data sovereignty, and ethical algorithmic management directly into sustainability strategy (Takawira & Pooe, 2025; Vătămănescu et al., 2026). Regulators, for their part, need to harmonize cross-border standards so that technological progress doesn't end up enabling more sophisticated greenwashing rather than preventing it (Bindeeba et al., 2025).

Policy.

Getting there will mean developing clear, standardized metrics that actually quantify what digital tools contribute to the Sustainable Development Goals, rather than settling for descriptive accounts of adoption. That shift - from narrative to rigorous, outcome-based analysis - is what will let digital maturity be meaningfully connected to verifiable ESG performance (Bindeeba et al., 2025; Mocanu et al., 2025). Bringing together evidence from across disciplines - blockchain's role in reporting transparency (Aiupova et al., 2026; Thanasi-Boçe & Hoxha, 2025), cloud computing's contribution to operational efficiency (Alwageed et al., 2024), and the foundational role of corporate governance (Takawira & Pooe, 2025; Vătămănescu et al., 2026) - gives organizations a clearer way to manage the trade-off between innovation and systemic sustainability risk (Jeong et al., 2025). Ultimately, building these indicators is what will turn digital potential into lasting value, and make technology a genuine catalyst for sustainable development rather than just a claim about one.

9.3 Final Remarks

In the end, the intersection of digital transformation and sustainability calls for more than adopting new technology. It requires a real shift in governance thinking - from passive compliance to something more proactive, integrated, and ethically grounded. As digital tools keep evolving, how well organizations can capture their benefits while managing the risks will likely be the clearest test of genuine, long-term value creation.

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