

Digital Transformation and Sustainable Outcomes: An Updated Systematic Literature Review (2020–2026)

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ABSTRACT

A systematic review following PRISMA guidelines, this study analyzes Scopus-indexed papers published from 2020 to 2026 to shed light on how digital transformation enables sustainability-oriented outcomes and whether these contributions appear rooted in organizational change rather than representing aspirational disclosures of sustainability-related information. In the initial search phase, a total of 1,208 records were identified; after screening, retrieval, and eligibility assessment of these studies from both electronic databases and hand-searching, only 78 studies were included in the final synthesis. Our findings show that digital transformation drives sustainability through six main avenues, namely ESG governance, eco-innovation, decarbonization, circular economy practices, digital maturity, and social sustainability. However, digital transformation appears to function as "sustainability by other means" only when supported by appropriate organizational capabilities and data governance—including adequate data and analytics support—that enable innovation routines, regulatory pressures, and strategic decision-making processes to be adopted together, at scale, across the organization, given their complementary nature. Furthermore, the review suggests that by relying heavily on quantitative testing that looks for associations between concepts in empirically available datasets, the research base suffers from conceptual inconsistencies and uneven coverage across empirical contexts. The review presents a new conceptualization of digital transformation as an enabler of sustainability, one that comes with specific execution conditions, and identifies a future research agenda to distinguish genuine sustainability effects from the mere prominence of sustainability rhetoric. While digital transformation is gaining traction as a strategic route to drive sustainable outcomes, the literature remains fragmented across topics such as ESG governance, green innovation, decarbonization, circular economy, environmental performance, and social sustainability.

INTRODUCTION

Increasingly recognized in sustainability research today are the roles of data infrastructures, digital platforms, analytics and automation, and governance routines as organizations aspire to redesign their business processes and enhance value creation (Contreras & Saavedra, 2023; Ghanea & Wiener, 2023; Gunner, 2023; Juliana, 2025; Lathifah et al., 2025; Mert, 2022; Miranda Gonçalves, 2023). The literature suggests that digital elements are strongly associated with firms' capabilities in improving ESG performance, carbon emission management, green innovation enablement, circular economy practice implementation, and

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sustainability performance improvement (Ding et al., 2024; Huang et al., 2025; Liu et al., 2025). In line with this, the perception of digital transformation has shifted from being merely an agenda for operational modernization or technology adoption to something more substantive. Due to the transformations it brings to the processes through which organizations create, govern, assess, and maintain value in an increasingly complex commercial landscape, it has instead evolved into a bottom-line argument at the heart of the strategic sustainability debate.

Empirical evidence is increasingly showing that green innovation, driven by digital transformation and digital finance, can be a powerful tool for improving ESG performance (Hoang et al., 2026; Liu et al., 2025; Wu & Li, 2023; Zhao et al., 2023). Research on industrial organizations has also indicated supportive pathways for carbon abatement through digitalized, sustainability-oriented innovation and ESG-related concepts (Huang et al., 2025; Liu et al., 2025). Likewise, the literature reviews overlap digital transformation with corporate ESG performance (Huang et al., 2025), environmental performance (Sun et al., 2026), carbon mitigation (Zhao et al., 2023), green innovation, and sustainable development goals. These developments suggest that sustainability is possibly more of an enduring, final configuration rather than merely one observation scattered along a governance continuum shaped by quality, type, technological capability, innovation process, and organizational responsibility. Therefore, organizational expectations have shifted from environmental damage mitigation toward credible ESG governance, decarbonization competence, resource efficiency, and social accountability.

Digital transformation carries various interpretations depending on the sustainability domain under investigation across several research streams. In green innovation research, it is implicitly seen as a tool for facilitating knowledge recombination, resource integration, and technological experimentation. In ESG-oriented research, digital transformation is typically linked to transparency, disclosure quality, accountability, and governance competence. Carbon studies are often connected to emission monitoring, operational optimization, and carbon reduction efforts. Although this diversity enriches the analytical domain of the field, it also introduces conceptual inconsistencies and restricts more cohesive theoretical development. Therefore, despite the rapid growth of studies in this area, the literature still lacks a consistent definition of both digital transformation and sustainability effects, as well as clear theoretical assumptions about the relationship between digitalization and sustainable performance (Chen et al., 2025; Ding et al., 2024).

As the implementation of technology alone often fails to produce substantial sustainability benefits, a more systematic synthesis is needed to distinguish studies that disentangle econo-environmental mechanisms from those that merely correlate digitalization with vague indicators of sustainability. While existing empirical studies provide useful guidance, they often focus on a single sector, national context, or outcome category. In the absence of an integrative review, it remains unclear whether digital transformation is best viewed as technology adoption, an organizational capability shaped by strategy, a means to governance, or a facilitator of sustainable transformation. This distinction matters, as firms may implement digital technologies while producing little more than symbolic sustainability narratives, limited ESG signaling, or minimal operational change. Thus, the purpose of this

paper is to aggregate recent evidence to clarify which aspects of digital transformation genuinely contribute to sustainable outcomes.

A systematic selection process employing the QUAD approach and PRISMA guidelines, using Scopus as the academic database, was undertaken in this review to identify studies on digital transformation and sustainable outcomes published between 2020 and 2026. Of the initial 1,208 records identified, following screening, retrieval, and eligibility assessment, 78 studies were included in the final synthesis. This body of evidence enables the review to discern both the sustainability outcomes represented as enabled by digital transformation and the mechanisms through which such outcomes are produced. Organizing the literature by outcome domains, causal pathways, and research gaps helps reposition digital transformation away from a neutral process of technology adoption and toward an organizational capability that can potentially allow firms to advance sustainability—contributing to sustainability and strategic management scholarship.

This study contributes to a more disciplined and impact-oriented research agenda on digital transformation and sustainability in three ways. First, it clarifies the meaning of digital transformation in sustainability-oriented research, noting that the term is often subject to interpretation, as it can describe anything ranging from the implementation of digital tools to comprehensive, organization-wide transformation. Second, it delineates the main mechanisms connecting digital transformation with sustainability outcomes: ESG governance, green innovation, decarbonization and circular economy, environmental performance, and sustainable performance. Third, it reveals the theoretical, methodological, and contextual limitations that continue to restrict the field's capacity to distinguish authentic sustainability impact from symbolic sustainability claims.

Three research questions structure this literature review. RQ1: How is digital transformation conceptualized in recent literature as a driver of sustainable outcomes, rather than mere technological adoption? RQ2: How does digital transformation generate quantifiable sustainability performance through ESG governance, green innovation, decarbonization, circular economy, environmental performance, and social sustainability? RQ3: What theoretical, methodological, and contextual gaps limit our understanding of whether digital transformation's sustainability impact is substantive or merely symbolic?

This research conducts a systematic literature review (2020–2026) to examine how digital transformation enables sustainability outcomes, distinguishing genuine organizational change from symbolic disclosures, by analyzing its conceptualization beyond technological adoption, mapping mechanisms across ESG governance, green innovation, decarbonization, circular economy, and social sustainability, and identifying theoretical, methodological, and contextual gaps. Theoretically, it provides a synthesized framework that reconciles conceptual inconsistencies and challenges technological determinism; practically, it offers guidance for managers and policymakers in designing effective digital sustainability strategies, while identifying research gaps that call for longitudinal, causal, and context-sensitive approaches to evaluating long-term sustainability impact.

METHOD

Review Protocol and Reporting Standard

This research used a systematic literature review to examine the effect of digital transformation on sustainable outcomes in organizational, environmental, and socio-economic contexts. The rationale for this design is that literature on digital transformation and sustainability has proliferated to cover a broad spectrum of topics, from ESG governance, green innovation and decarbonization, to the circular economy and environmental performance as well as sustainable performance and social sustainability. The review was not to provide a comprehensive summary of earlier studies, but rather, through a structured and transparent analytical process, combine outcome domains, explanatory mechanisms and existing research gaps.

The review was guided by a PRISMA-aligned reporting framework, organized through the stages of identification, screening, retrieval, eligibility and inclusion. Applying this framework allowed the study to clearly delineate and replicate the pathway from an initial broad search pool to a more refined synthesis corpus. This publication window was determined as 2020–2026 since this is the interval during which research on digital transformation has had significant growth after the industry 4.0 era, with ongoing increases in artificial intelligence and digital platform adoption and rapidly increasing investigation of sustainability, ESG, and carbon-related topics within organizational studies.

Scopus was used as the main database in this review due to being one of the largest databases available, covering all scientific disciplines and indexing 4200 peer-reviewed journals across business, management, environmental science disciplines, engineering, social sciences & technology. The review focused on studies that provide a significant link between digital transformation and sustainable results. Thus, documents were not included just because they vaguely concerned digitalization or sustainability. Rather, the selection focused on studies in which digital transformation was addressed as a central construct, strategic enabler, mechanism/director/mediator/moderator or organizational capacity towards sustainability-oriented outcomes.

Search Strategy and Eligibility Criteria

Scopus search strategy Structured around three core components centering on the focal construct, outcomes regarding sustainability, and mechanism-related terminology. The search terms in this study were constrained to ensure that the retrieved records retained a focus on digital transformation by confining the phrase quote digital transformation to the title field while searching sustainability and mechanism-related terms within the title, abstract, and keyword fields. Appendix S1: The final Scopus query

We used the following search string: TITLE("digital transformation") AND TITLE-ABS-KEY("sustainable development" OR "sustainable performance" OR "sustainability performance" OR "environmental performance" OR "green innovation" OR "circular economy" OR ESG OR "social sustainability" OR "low carbon" OR CARBON EMISSIONS) AND (LIMIT-TO(DOCTYPE,"ar")OR LIMIT-TO(DOCTYPE,"re"))AND (LIMIT-TO(LANGUAGE,"English"))AND (LIMIT-TO(OA,"all"))

In order to avoid conceptual noise, the query was structured in such a way that digital transformation became the only title-level term of interest, while sustainability related

outcomes and mechanisms were searched at wider fields (bibliographic frame) including title, abstract and keywords. The search was restricted to articles and review papers, limited to English language publications and confined to open-access records in Scopus. The time span for the publication extended from the years 2020–2026. Four records that did not fall within the pre-specified publication time frame were removed after year metadata validation and before screening from these exported records.

Studies were eligible for inclusion if they positioned the digital transformation phenomenon as either a central concept, capability, mechanism, driver, mediator, moderator or strategic enabler that is associated with sustainability-oriented outputs. These records were kept when they outlined at least one substantive sustainability-related outcome, such as sustainable development, sustainable performance, sustainability performance, environmental re-orientation in the field of manufacturing technology and management (green innovation), circular economy (CE) regimes (new business models or servitization), ESG-based comprehensive reviews or low-carbon development pathways or carbon emissions. We excluded studies that either only marginally connected digital transformation to sustainability, or produced a report with no extractable mechanisms or findings, and those for which we deemed the conceptual or empirical relevance to the review questions was insufficient.

Table 1. Search Strategy and Eligibility Criteria

Component		Criteria applied in the review
Database		Scopus
Search field for focal construct		TITLE("digital transformation")
Search field for sustainability outcomes		TITLE-ABS-KEY(...)
Search field for mechanism terms		TITLE-ABS-KEY(...)
Final query	Scopus	We used the following search string: TITLE("digital transformation") AND TITLE-ABS-KEY("sustainable development" OR "sustainable performance" OR "sustainability performance" OR "environmental performance" OR "green innovation" OR "circular economy" OR ESG OR "social sustainability"OR "low carbon"OR CARBON EMISSIONS) AND (LIMIT-TO(DOCTYPE,"ar")OR LIMIT-TO(DOCTYPE,"re"))AND (LIMIT-TO(LANGUAGE,"English"))AND (LIMIT-TO(OA,"all"))
Publication window		2020–2026, revalidated after export before the screening stage
Document type filter		Article and review
Language filter		English
Open-access filter		Open-access records indexed in Scopus
Inclusion criterion 1		The study presents digital transformation as a core construct, mechanism, capability, driver, mediator, moderator, or strategic enabler
Inclusion criterion 2		The study investigates at least one substantive sustainability-related outcome
Inclusion criterion 3		The study contains extractable evidence, mechanism, model, relationship, pathway, or conceptual contribution

Exclusion criterion 1	Records published outside the 2020–2026 timeframe
Exclusion criterion 2	Records in which digital transformation or sustainability is mentioned only as a broad background issue
Exclusion criterion 3	Reports with limited relevance, overly general framing, or no clearly defined sustainability outcome
Exclusion criterion 4	Reports lacking sufficient extractable contribution for addressing the review questions
Final synthesis corpus	78 included studies

Source: Authors' compilation based on PRISMA 2020 guidelines and adapted for this study's research context.

Study Selection and Data Extraction

Using the Scopus search strategy and filters described above, the initial search generated 1,208 records. These records were then processed through a PRISMA-aligned selection procedure consisting of identification, screening, retrieval, eligibility assessment, and final inclusion. Before the screening stage, four records were excluded because they fell outside the established 2020–2026 publication period. DOI and title checks did not identify any duplicate records. As a result, 1,204 records proceeded to the title and abstract screening stage.

Title and abstract screening involved assessing if each record was substantively relevant to the aim of the review. We excluded records if digital transformation was not positioned as the focal construct of our conceptual framework, sustainability was mentioned but only at a global-level context and when there did not exist a clear logical empirical or methodological rationale for how one could derive sustainable outcomes by means of digitalization. Sustainable outcomes included ESG performance, green innovation, carbon reduction, circular economy, environmental performance sustainable performance and social sustainability in this review. In this light, 751 records were excluded through title and abstract screening resulting in 453 reports retained for full-text retrieval.

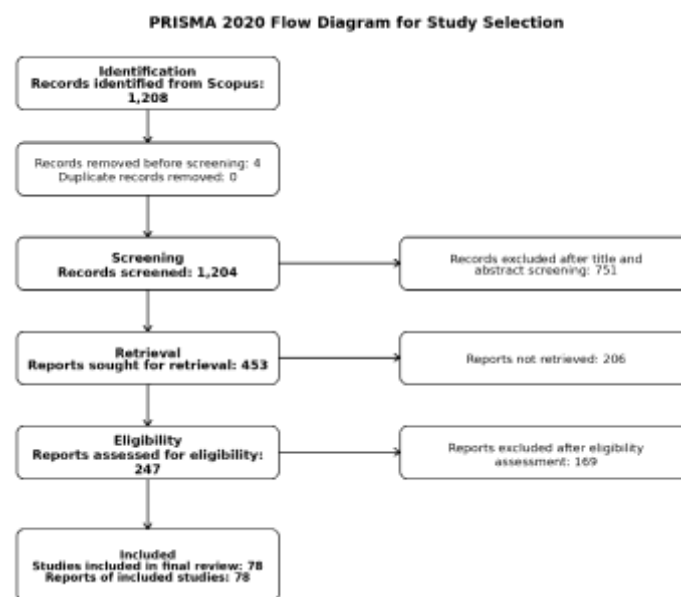
Of the 453 reports that achieved screening-stage criteria, full-text retrieval was performed. Of these reports, 206 could not be accessed through the available full-text sources despite retrieval attempts and were therefore classified as reports not retrieved. The remaining 247 reports were successfully obtained and subsequently subjected to eligibility assessment. At this stage, the criteria were applied more rigorously than during title and abstract screening. Reports were excluded when they were overly broad, conceptually weak, primarily bibliometric or review-based without adequate primary analytical contribution, only indirectly related to digital transformation, or lacking a substantive sustainability outcome.

After the full-text eligibility assessment was completed, 169 reports were excluded. The final synthesis corpus consisted of 78 studies that satisfied the inclusion criteria. These studies formed the evidence base for both the descriptive mapping and thematic synthesis. Data extraction was conducted using a structured evidence matrix that included the author, year, title, journal, DOI, country or research context, research method, sustainability outcome domain, role of digital transformation, mechanism, boundary condition, and synthesis use. This extraction framework enabled the review to connect descriptive research patterns with mechanism-based interpretation.

Table 2. PRISMA Selection Summary

PRISMA stage	Count
Records identified from Scopus	1,208
Duplicate records removed	0
Records removed before screening	4
Records screened	1,204
Records excluded after title and abstract screening	751
Reports sought for retrieval	453
Reports not retrieved	206
Reports assessed for eligibility	247
Reports excluded after eligibility assessment	169
Studies included in final review	78
Reports of included studies	78

Source: Authors' compilation based on PRISMA 2020 selection process

**Figure 1. PRISMA 2020 Flow Diagram for Study Selection**

Source: Generated by the researcher based on Scopus search results and PRISMA 2020 reporting logic.

The PRISMA flow diagram summarizes the selection process used in this systematic literature review. From this stage, we had a total of 1,208 records from Scopus. A total of 4 records (those published before 2020–2026) were excluded prior to screening, and no duplicate records were identified. This screening process yielded 1,204 records based on title and abstract. During the screening stage, 751 records were excluded because they did not meet the substantive relevance criteria of the review. A total of 453 reports were then sought for retrieval. Of these, 206 reports could not be retrieved through accessible full-text sources, while 247 reports proceeded to eligibility assessment. A total of 169 reports were noneligible on full-text review due to failure to meet the final inclusion criteria. Consequently, 78 studies were retained in the final synthesis.

Quality Appraisal

The aims of this appraisal in order to support the credibility of synthesis include ensuring that studies retained were relevant, clearly defined methods with sufficient detail, and information which would allow analysis because it is usable. Because the types of studies included varied, both in terms of methodology and disciplinary background, this assessment was not done according to a single checklist appropriate to one specific methodological tradition. Rather, the study applied a relevance-and-rigor framework that was better suited for multidisciplinary systematic literature reviews. This approach was adopted, because the main purpose of the quality appraisal was to evaluate how well each study could answer a review question, rather than to classify studies based exclusively on a single methodological hierarchy.

Each full-text report was assessed using four dimensions. Construct relevance is the first dimension that assessed if digital transformation was explicitly considered as a core construct, strategic capability, mechanism, mediator, moderator or enabling condition. The second dimension, outcome relevance assessed if the study reported on some material sustainability related outcome (such as ESG performance, green innovation, carbon reduction, circular economy, environmental performance, sustainable performance or social sustainability). The methodologic transparency dimension (the third dimension) evaluated whether enough descriptive information was available about the study design, data, variables, analytical procedures, or conceptual framework. Dimension 4: extractability considered whether the report was able to be systematically coded and integrated, including findings, mechanisms discovered, or relationships described.

During the eligibility assessment phase, only studies that met these appraisal criteria were eligible for inclusion; reports that did not fulfill them were excluded. This strategy was intended to ensure studies that only peripherally related to the review topics but did not advance its focus (i.e., sustainability or digitalization) would be excluded. Consequently, the synthesis corpus was finalized at 78 studies that made a more substantive conceptual contribution to the empirical evidence base.

Synthesis Approach

The synthesis process consisted of two consecutive steps. The first stage involved descriptive mapping of the 78 included studies based on their distribution in terms of publication year, review domain, country or context, research method and sustainability outcome category. This mapping was undertaken to give a better understanding of the aggregated structure and coverage of the evidence base prior to developing a more thematic interpretation. It also enabled the identification of whether the field was concentrated around particular outcome domains, geographical contexts, or methodological orientations.

The second stage applied thematic synthesis by coding studies according to their dominant sustainability outcome and the mechanism through which digital transformation contributed to that outcome. We engaged in a coding process that yielded six core thematic categories: green innovation and decarbonization; ESG performance and governance-oriented change; carbon reduction or low-carbon performance; circular economy and resource efficiency; digital maturity for sustainable performance, and social sustainability, human-centered digital transformation.

Instead of just viewing digital transformation as a technology adoption process, they framed it as an organizational and strategic mechanism through which firms could govern or influence sustainability outcomes across domains like governance, innovation, carbon management, resource efficiency and capability development. Such a mechanism-oriented analytical strategy allowed the review to go beyond a descriptive inventory of studies, and establish a more interpretive synthesis. Accordingly, the following results section presents both descriptive mapping and thematic interpretation, followed by a reflective discussion of the substantive contribution of digital transformation to sustainability.

RESULT AND DISCUSSION

Thematic Synthesis

1. Green Innovation and Decarbonization

In sum, green innovation is found not only as a sustainability outcome but also as an important mediating mechanism through which digital transformation delivers environmental value across the analysed literature. Here, digital transformation is less viewed as a traditional means of improving efficiency and much more like an enabling infrastructure for instituting cleaner products, greener processes, and sustainability-oriented managerial routines. Digital transformation can enhance businesses' ability to engage in green technological innovation when it brings benefits such as improved information processing, reduced coordination costs, optimized resource allocation and greater responsiveness of organizations to environmental pressures (Chen et al., 2026; Peng et al., 2023; Sun et al., 2025; Wang, 2025).

The environmental significance of digital transformation becomes particularly evident when green innovation acts as the bridge between digitalization and carbon reduction. Industrial and manufacturing enterprise evidence suggests that digital transformation does not directly decrease carbon-intensity. Rather than the direct indirect effect, it manifests itself as an improvement in green innovation capabilities and sustainable redesign of operational processes (Huang et al., 2025; Liu et al., 2025; Yang et al., 2024). This pattern suggests that sustainable impact from digital transformation materializes when firms are enabled to innovate digitally, not when organizations solely implement broader digital systems (up until October–2023). Within this theme, the strongest value of digital transformation lies in its capacity to translate environmental pressures into innovation routines, technological experimentation, and strategic low-carbon responses.

2. ESG Performance and Governance-Oriented Transformation

The second major theme concerns ESG performance and the governance-oriented role of digital transformation. As ESG represents the largest review domain within the final corpus, the findings suggest that digital transformation is increasingly being examined as a mechanism for strengthening corporate governance. Studies within this stream argue that digital transformation can improve ESG performance by enhancing information transparency, disclosure quality, stakeholder monitoring, accountability, and managerial responsiveness (Chen et al., 2025; Ding et al., 2024; Liu et al., 2025; Zhao et al., 2023).

Unlike the green innovation pathway, which emphasizes experimentation and technological development, the ESG pathway is more closely associated with governance discipline. Digitalisation multiplies the capacities of firms in terms of collecting, processing, managing and disclosing sustainability-related information. This role is especially important in

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the ESG space, because investors, regulators, stakeholders and other external actors rely on credible information to assess corporate behavior. Several studies further suggest that the effect of digital transformation on ESG performance may be influenced by its interaction with green innovation, carbon reduction, executive characteristics, or ESG management systems (Huang et al., 2025; Xi & Wang, 2024; Yin, 2025). Accordingly, improvements in ESG performance should not be viewed as an automatic outcome of digitalization. Digital transformation can support ESG performance only when digital tools are embedded within governance routines rather than used merely as symbolic reporting instruments.

3. Carbon Reduction and Low-Carbon Performance

Carbon reduction and low-carbon performance form the third thematic domain in the reviewed literature. This area represents one of the more developed strands of research, reflecting the increasing pressure faced by firms and regions to lower emissions and align digital strategies with decarbonization goals. Studies in this theme connect digital transformation with corporate carbon performance, carbon emission reduction, low-carbon development efficiency, and green low-carbon transition (Guo & Tang, 2024; He et al., 2025; Li et al., 2024; Tang et al., 2025).

The central mechanism within this theme lies in carbon visibility and operational control. By enabling better monitoring of energy consumption, tracing sources of emissions, identifying inefficiencies and integrating carbon-related information into strategic decision-making, firms may be actively deploying digital transformation to better respond. Nonetheless, the literature also identifies emission reduction as a process that does not occur automatically solely because of an increase in digitalization among firms. New data on the impact of digital transformation often highlights the role of mediators, such as green innovation, green finance policy or ESG practice with industrial and institutional contingent factors (Huang et al., 2025; Liu et al., 2025; Pan & Meng, 2025; Zhang, 2025). As such, carbon reduction provides a robust foundation to evaluate whether a digital transformation creates meaningful sustainability impact. In contrast to ESG reporting, carbon-related outputs really need distinct operating evidence and hence this theme is key in testing whether digital transformation genuinely moves beyond symbolic sustainability acknowledgment.

4. Circular Economy and Resource Efficiency

The fourth framework is more about circular economy and efficient use of resources. This area of research is less advanced relative to ESG- and carbon-related studies, but holds a critical systems-level understanding of sustainability. Circular economy research emphasizes that the theory of change has to go beyond firm-level optimization, as sustainability will also rely on traceability, lifecycle visibility, collaboration and resource coordination across value chains. Digital Transformation in this context can enforce circular economy practices through enhancing material tracking, improving stakeholder coordination, enabling waste reduction and the redesign of production or consumption systems (Arroyabe et al. 2024; Khan et al., 2026; Muneer et al.; Tanveer et al., 2025).

It shows how digital can be one of the ways that coordination of larger ecosystems takes place. Whereas ESG performance is frequently seen through the lens of governance and disclosure, circular economy outcomes demand operational coordination within organizations. Digital tools support such alignment by providing greater transparency of data to connect firms, suppliers, public institutions, and customers via collaborative platforms. Consequently, the

studies in this theme broaden the meaning of digital transformation from a firm-level strategic capability into a value-chain and ecosystem-level capability. However, given the relative scarcity of circular economy studies to date, the jury is still out on this aspect and so all that can currently be said is that evidence in this space is encouraging but not as well-developed as for ESG- or carbon-related pathways.

5. Digital Maturity, Sustainable Performance, and Organizational Capability

The fifth aspect looks at digital maturity and the idea of sustainable performance and capability among organizations. Instead of zeroing in on a single sustainability outcome (e.g. ESG performance or carbon reductions), this avenue of research investigates whether firms actually hold the internal capabilities necessary to convert digitalization into prosperity: sustainable performance. Research on sustainable performance has found that digital platforms, collaboration capabilities, digitally driven proactive sustainability strategies, and eco-innovation buffer the relation between digital transformation and long-term sustainability outcomes (Dhyanasaridewi et al., 2024; Holopainen et al., 2026; Sun et al., 2024; Xu et al., 2023).

As described above, this theme is especially critical in order to explain the diverse outcomes of digital transformations across firms. Digital tools matter, but organizations with greater digital maturity and internal capabilities stand a better chance of turning them into concrete sustainability results. Firms with more limited capabilities, in comparison, can expand the breadth of new technology use without significant reallocation within resource allocation, governance routines or its innovation behavior. This capability-based mechanism hence supports the central conceptual thesis of the review, which notes that digital transformation contributes to sustainability if it is embedded in organizational learning, strategic alignment, data governance and managerial decision-making. It also calls for future research more specifically to differentiate between digital adoption, digital maturity and digital transformation; as these terms are often used interchangeably even though their implications differ.

6. Social Sustainability and Human-Centric Digital Transformation

The sixth theme relates to social sustainability and people-centric digital transformation. While this domain is less mature than ESG performance, green innovation and carbon reduction in the final corpus, it is nonetheless conceptually important as sustainability extends beyond environmental or financial aspects. The power of digital transformation appears to be a knife with two blades, studies related to social sustainability suggest its possible impact on the characteristics of inclusion, quality-of-life, human-centered operations, supply-chain sustainability and wider socio-economic outcomes (Ding et al. 2024; Majeed & Du 2026; Rahman et al. 2025; Sarfraz & Bhutta 2026).

By contrast, the social sustainability pathway is more fragmented and less clearly operationalized than the environmental pathways. While measurable indicators support carbon reduction and green innovation, social sustainability is less definable and assessable consistently. This means that digital transformation only provides indirect connections to social outcomes through governance systems, supply-chain resilience, organizational capability or institutional development. This condition creates both a research opportunity and an unresolved gap. The opportunity lies in expanding digital transformation research beyond environmental and ESG-related metrics. The gap concerns the need for stronger conceptual and

methodological instruments to explain how digital transformation contributes to equity, inclusion, employee well-being, and human-centric sustainability. This theme therefore establishes the basis for the reflective synthesis that follows. particularly the question of whether digital transformation produces genuine sustainability impact or mainly improves the visibility of sustainability claims.

Table 3. Summary of Thematic Findings from 78 Studies

Theme	Sustainable outcome	Main mechanism	Representative studies	Theoretical implication	Managerial implication
Green innovation and decarbonization	Green innovation, low-carbon transition	Digital transformation enables knowledge recombination, resource orchestration, and green technological experimentation	Chen et al. (2026); Huang et al. (2025); Peng et al. (2023); Sun et al. (2025); Wang (2025); Yang et al. (2024)	Digital transformation should be conceptualized as an innovation-enabling capability, not merely as technology adoption	Managers should connect digital investment with green R&D, process redesign, and low-carbon innovation targets
ESG performance and governance-oriented transformation	ESG performance, disclosure, governance quality	Digital systems improve transparency, monitoring, ESG data quality, and accountability	Chen et al. (2025); Ding et al. (2024); Liu et al. (2025); Xi & Wang (2024); Yin (2025); Zhao et al. (2023)	ESG improvement depends on governance routines that translate digital capacity into credible sustainability disclosure	Firms should integrate digital transformation with ESG data governance, reporting discipline, and stakeholder accountability
Carbon reduction and low-carbon performance	Carbon emissions, carbon performance, low-carbon development	Digital transformation supports carbon tracking, energy optimization, operational control, and green innovation mediation	Guo & Tang (2024); He et al. (2025); Li et al. (2024); Liu et al. (2025); Pan & Meng (2025); Tang et al. (2025); Zhang (2025)	Carbon outcomes provide a stronger test of substantive sustainability impact than broad ESG claims	Managers should use digital systems for measurable carbon monitoring, process optimization, and emissions governance
Circular economy and resource efficiency	Circular economy, resource efficiency, waste reduction	Digital tools improve traceability, lifecycle visibility, value-chain coordination,	Arroyabe et al. (2024); Khan et al. (2026); Muneer et al. (2026); Tanveer et al. (2025)	Digital transformation can operate as an ecosystem coordination capability	Firms should use digital platforms to coordinate suppliers, partners, and lifecycle data

		and circular resource management		across circular value chains	for circularity
Digital maturity and sustainable performance	Sustainable performance, eco-innovation, strategic sustainability	Digital maturity strengthens organizational learning, collaboration, and sustainability-oriented capability development	Dhyanasaride wi et al. (2024); Holopainen et al. (2026); Sun et al. (2024); Xu et al. (2023)	Digital maturity should be separated from simple digital adoption in sustainability research	Organizations should build digital capability, not only acquire digital tools
Social sustainability and human-centric digital transformation	Social sustainability, supply-chain sustainability, inclusion, human-centric outcomes	Digital transformation contributes indirectly through governance, capability, coordination, and institutional development	Ding et al. (2024); Majeed & Du Rahman et al. (2025); Sarfraz & Bhutta (2026)	Social sustainability remains underdeveloped and needs stronger conceptualization in digital transformation research	Managers and policymakers should evaluate social impact, not only environmental and ESG indicators

Source: Authors' compilation based on thematic synthesis of 78 selected studies.

A total of 78 studies, mechanistically synthesized on a broad level, are summarized in figure 6. It is evident that the map indicates that moving to digital transformation brings sustainable outcomes through a number of channels, not one general effect. The paths are different (examples: ESG governance; green innovation; decarbonization notoriously hard to achieve at pace and scale; circular economy; digital maturity; social sustainability, among others), but all overlap with each other. Boundary conditions such as digital readiness, institutional pressure, regulatory environments, organizational maturity and sectoral context shape these pathways. The figure therefore reinforces the central argument of this review: digital transformation becomes meaningful for sustainability when it is translated into governance capability, innovation capacity, carbon management, circular coordination, and organizational learning.

Reflective Synthesis: What Digital Transformation Actually Contributes to Sustainability

When digital transformation is positioned as a strategic organizational capability, rather than the introduction of specific technological tools, it shows its greatest contribution to sustainability. This finding speaks directly to the first review question that asks how more recent studies conceptualize digital transformation as a driver for sustainable outcomes, rather than solely technology implementation. In the literature assessed, little relevance around topical sustainability emerged from digital transformation when merely framed as adoption of digital applications. It adds weight when it converts practices such as organizational data collection, decision-making oversight, innovation coordination, emissions monitoring, ESG reporting to

stakeholders and operational routine redesign. Accordingly, the literature more and more treats digital transformation as an organizational capability that combines tech, governance, learning, and sustainability-oriented action. Evidence from ESG, green innovation and carbon performance (Ding et al., 2024; Huang et al., 2025; Liu et al., 2025) supports this view as sustainability outcomes not only require digital investment but also the integration of digital systems into managerial practices, strategic decision-making processes and environmental governance structures.

Review Question 2: What mechanisms of digital transformation create measurable outcomes in sustainability across ESG governance, green innovation, decarbonization, circular economy, environmental performance and social sustainability. The synthesis identifies six principal mechanism pathways. The first path, ESG governance, shows that digital transformation can enhance transparency, quality of disclosure, monitoring and accountability. The portion, green innovation are the ways that demonstrate how digital transformation leverages knowledge recombination, green research and development, experimentation and orchestration of resources. Finally, decarbonization embodies the fact digital transformation is also able to cover carbon tracking; emissions monitoring and evaluation; energy use optimization; low-carbon process redesign. The fourth pathway circular economy focuses on traceability, lifecycle visibility and value-chain coordination. Digital Maturity (5th pathway): This is about organizational learning, strategic alignment and capability development. Social sustainability, the sixth pathway, which suggests that digital transformation is likely to be conducive toward inclusion (a human interest perspective on shaping information societies), human-centered operations and supply-chain sustainability, but where theory building is still at a more immature stage compared to environmental and governance-oriented streams. These mechanisms jointly show that digital transformation does not create sustainability outcomes via a single one-size-fits-all pathway, but through multiple pathways determined by the targeted sustainability outcome and organizational context in which digital capabilities are embedded.

A total of six pathways are accounted for that either fall under ESG governance (most prevalent) or carbon-related performance. This pattern indicates that recent research largely focuses on sustainability effects amenable to measurement, disclosure, benchmarking and governance. Most ESG-oriented studies tend to explore the role of digital systems in improving information quality and accountability, whereas carbon-based research assesses the potential of digital transformation to reduce emissions or promote low-carbon development. Green innovation sits in somewhat of an isolated spot due to its link with digital transformation with the advent of new invention (tech-based or otherwise) and processes. Collectively, these pathways point to three ways through which digital transformation promotes sustainability goal adding to visibility into governance practices, enabling sustainability-oriented innovation, and improving operational control of environmental performance. Still, these benefits should not be regarded as a natural outcome of going digital. It is only when organizations transition owned digital capabilities into points of governance, innovation, or operational practice that digital transformation becomes an authentic driver for sustainability.

The third review question concerns with the theoretical, methodological and contextual gaps within current contributions in theorizing whether digital transformation achieves real sustainability impact or just symbolic sustainability impact. This problem is particularly

significant for the future of the field. Review of the 185 papers showed that a vast majority of existing literature continues to report positive links between digital transformation and sustainability outcomes. Still, it is hard to even know if these are indicative of a fundamental organizational change. A key concern is that digital transformation appears to make sustainability practices more visible without changing the fundamental environmental or social impact. Better ESG disclosure, for instance, may enhance stakeholder perceptions but not necessarily prove carbon reduction, circularity or social inclusion. Likewise, there can be a greater availability of data with the transition to digital systems, yet more access does not equal better decision making for sustainability. As a result, the distinction between symbolic sustainability claims and substantive sustainability impact remains one of the most critical unresolved issues in this field of research.

Several theoretical gaps are also apparent. Digital transformation, digital adoption, digital maturity, digital capability and digital strategy are often used interchangeably even if they describe different levels of change within an organization. This overlap reduces theoretical precision. The claimed sustainability effects may be overstated when basic technology adoption is often confused with transformation. That suggests that follow-up research needs more well-defined concepts about the existence of digital tools, the robustness of digital processes, and organizational capability transformation. In terms of methodology, the field continues to rely almost exclusively on quantitative association testing, especially panel and econometric methods. While these approaches are helpful in discovering empirical patterns, they usually contribute little to the processes firms enact to translate digital capabilities into sustainability results internally. To illustrate how digital transformation reforms decision-making, innovation routines, carbon practices, and governance systems as they evolve over time, future research should rely on more longitudinal causal-process-mixed method-multilevel research designs.

Contextual limitations are equally significant. The descriptive mapping also demonstrates that the evidence base is extremely insular or highly concentrated in certain institutional settings, even at times in larger national contexts (i.e. This focus is important as it provides deep insight into firms facing significant policy, ESG and carbon pressures. That said, this down shot also raises worries regarding the generalizability of our results. Digital transformation might not function the same way in countries with weaker digital infrastructure, or more permissive regulatory systems, lower levels of ESG enforcement and different industrial structures. As such, the value of digital transformation in sustainable development will probably be moderated by institutional pressure, regulatory quality, organizational maturity, sectoral characteristics and their access to digital capabilities. In this context, future work should extend to investigate if the pathways identified in this review translate/transfer outside emerging economies: whether into developed markets, small and medium-sized enterprises, public-sector organizations or supply-chain ecosystems

In summary, the reflective synthesis demonstrates that digital transformation supports sustainability most convincingly at such time, and to such an extent as it becomes a capability for governing, innovating, decarbonizing, coordinating and learning concretely. Hence, I contend that the academic debate on digital transformation and sustainability should progress beyond asking whether there exists a statistically significant relationship between digital transformation and sustainability outcomes to addressing whether digital transformation

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generates objectively verifiable impacts on sustainability. Future scholarship must separate symbolic reporting from operational change, digital adoption from digital transformation, and airy sustainability talk from real sustainability results. The strategic management question is not just if firms make use of digital technologies, but whether the use of those technologies enhances the way in which firms are able to sustain value responsibly over time with them.

Theoretical Contributions

Advancing the literature of digital transformation as a sustainable capability instead of adoption neutrality findings the results indicate that digital transformation is not meaningful until it changes an organization's ability to govern, innovate, decarbonize, orchestrate resources and learn. However, this distinction is important in light of the existing literature which sometimes uses an interchangeable sense of digital transformation, digitalization, digital adoption, digital maturity and/or digital capability. The synthesis illustrates that these concepts should not be seen as interchangeable. Digital adoption mostly speaks to the availability / usage of digital tools, while digital transformation implies greater reconfiguration and even realignment of organizational processes and strategic routines. Transformational change almost always generates more sustainability impact than adoption alone.

The first theoretical contribution lies in identifying multiple pathways through which sustainability outcomes are generated. Instead of presenting digital transformation and sustainability as a single direct relationship, this review identifies at least six distinct pathways: ESG governance, green innovation, decarbonization, circular economy, digital maturity, and social sustainability. The pathways identified show that digital transformation works through different mechanisms depending on the sustainability outcome being studied. Digital transformation serves a particular role in CSR & ESG research by mediating through transparency, the quality of disclosure and data governance, and accountability to key stakeholders (Chen et al., 2025; Ding et al., 2024; Zhao et al., 2023). It works through knowledge recombination, resource orchestration, and technological experimentation in green innovation research (Peng et al. 2023; Sun et al. 2025; Wang 2025). For carbon-related research, digital transformation facilitates monitoring and emission tracking to energy optimization as well as low-carbon process redesign (Huang et al., 2025; Liu et al., 2025; Tang et al., 2025). This variability by efficacy type contributes to the apparent contradictions in prior studies across separate sustainability domains.

The second contribution addresses the need to differentiate between symbolic sustainability visibility and substantive sustainability impact. However, the review suggests that digital transformation could better signal sustainability practices without necessarily providing evidence of operational improvement. A notable example in ESG research, better disclosure, better reporting systems and better transparency may lead to a perception of superior performance but do not equate emission reduction, circularity or social inclusion. Theoretical Implication Future studies will need to conceptualize and measure the differences between sustainability communication practices and transformative change. A firm may become more digitally visible without becoming more environmentally or socially responsible. Digital Transformation should thus not be theorized as simply an ESG score driver but a conditional capability that may or may not yield tangible sustainability outcomes as a function

of governance quality and the maturity of the organization (or more pointedly, its management).

Third, it advances literature on digital sustainability through the adoption of strategic management logic. Digital transformation impacts sustainability via capability development, institutional response and strategic alignment to the evidence. This positions digital transformation within a capability-based view of the firm. Digital technologies become valuable when they are embedded within managerial routines, data governance systems, innovation processes, and environmental strategies. The importance of this contribution is the detournement of technological determinism. That digital transformation does not create sustainable results by itself, organizations need to transform data into governance discipline, innovation capacity and operating change.

Practical and Managerial Implications

The results have important implications for managers who want to link digital transformation with sustainability strategy. For example, managers should not treat digital transformation as a purely technology investment divorced from sustainability goals. Our review suggests that digital tools create sustainability value only when they are explicitly linked to defined sustainability goals (carbon output, ESG monitoring and reporting, green innovation, circularity or sustainable performance). Thus, digital transformation initiatives must be assessed not just on the basis of efficiency metrics but also quantifiable sustainability benefits. Your dataset only goes to October 2023 so firms have to decide if the digital investments help carbon visibility, reduce resource waste, enable green products or also strengthening ESG accountability.

Second, we need to improve the ESG data governance of organizations. Along the ESG pathway, this transformation can drive transparency, disclosure, monitoring relationship and accountability. But in fact, this value is contingent on data integrity and the governance routines that attend to sustainability information. For this reason, managers should build systems that tie sustainability data to decisions rather than limit it to reports. Digital ESG reporting tools, dashboards and analytics platforms should be interlinked with managerial accountability, internal controls and stakeholder relay. In the absence of these governance mechanisms, digital transformation would serve to only enable better formatting of reports whilst leaving underlying sustainability practices relatively unchanged

Third, the Green Innovation and Decarbonization pathways suggest managers should align digital transformation with innovation and operational processes. Digital systems can also Identify energy inefficiencies, Energy benchmarking for monitoring emissions, Process control solutions for greater efficiency, Innovation of low-carbon products or processes. But these advantages are only attainable via coordinated effort among sustainability teams, operations managers, IT units, research and development departments and finance functions. Digital transformation strategy will not be truly impactful for sustainability if it is kept within the IT department. Hence, through-out the whole company and not just a digital team manager should take the approach of digital sustainability more as a transformation of the organization than as in a narrow field of significance only.

Fourth, the pathway before us from a circular economy perspective indicates that there should be a lot of digital transformation realignment across organizational boundaries.

Typically, the collaboration is required in the aspects of traceability, lifecycle visibility and resource efficiency with suppliers, customers, regulators and platform partners. Such a scenario is especially relevant in the case of manufacturing, construction, supply-chain systems, and raw material industries. Digital platforms should be leveraged not just to optimize internal operations by managers, but also to coordinate circular value chains. Digital transformation augments circularity when it enhances visibility of material flows, product lifecycle data, recovery systems, and interorganizational coordination.

Lastly, the concentration of evidence means that caution may be warranted in extrapolating findings to other institutional environments. Digital transformation might play a different role depending on the country: each one has a different regulatory system, level of enforcement around ESG and corporate purpose, availability of digital infrastructure (particularly in emerging markets), carbon policies, and market maturity. Challenges associated with innovation may differ between emerging markets and developed market firms. This means that managers need to localize digital sustainability strategies rather than assuming a single model of digital transformation will yield the same sustainability outcomes in all contexts.

Policy and Institutional Implications

This review also provides several policy implications. Policy frameworks need to guide digital firms beyond tokenism towards sustainability in a quantifiable fashion, to make sure that the aim of digital transformation is sustainable. Governments and regulators could do their part as well by increasing the strength of ESG disclosure standards, carbon reporting regulations, green finance mechanisms and digital infrastructure. Institutional pressure may push firms to adopt digital systems not only for efficiency improvements (but also, to increase accountability, cut emissions and improve sustainability governance).

Even if digital transformation and sustainability may be mutually beneficial, this does not imply automatic alignment in policy design. The digital infrastructure can pad the monitoring of sustainability, but it can also increase energy use and exacerbate data inequity and dependency on technology. Thus, while the use of digital tools is widely supported in policy making as a means to achieve better environmental performance and carbon mitigation (in specific sectors), one should promote a more responsible way of digital transformation. Appropriate incentives for green digital innovation, digital carbon accounting, circular economy platforms and low-carbon industrial transformation could also assist firms in transforming these digital capabilities into observable sustainability results.

Further, the results would call for institutional backing of SMEs and organizations that lag behind with their level of digital maturity. While large firms might have more resources to leverage digital platforms, ESG systems, and carbon monitoring technologies (which smaller firms might not yet achieve), small and medium-sized enterprises (SMEs) face limited financial capacity, data infrastructure, and skilled personnel. The absence of institutional support could lead to greater gaps in sustainability capabilities between large and smaller firms following all this. Hence, policymakers should consider support instruments for instance digital maturity programs, sustainability data infrastructure, green innovation grants and technical assistance for carbon and ESG reporting.

On the level of broader institutions, we suggest that sustainability-oriented digital transformation needs to be coordinated between augments such as firms, regulators, providers of technologies, Investors and civil society. Shared standards, interoperable data systems and credible verification mechanisms underpin ESG transparency and circular economy systems and carbon governance. Hence, public policy thus must not only boost digital adoption but likewise the institutional conditions of verifiability on digital sustainability claims.

CONCLUSION

This systematic literature review of 78 studies published from 2020 onward finds that digital transformation is not merely the adoption of technology, but a strategic organizational capability that supports sustainability through ESG governance, green innovation, decarbonization, circular economy practices, digital maturity, and social sustainability. The review shows that the sustainability impact of digital transformation depends on how digital tools are integrated into governance, organizational learning, carbon management, and resource coordination systems. However, the literature still lacks clear explanations of how digital transformation produces sustainable outcomes internally, as many studies only demonstrate positive correlations rather than causal mechanisms. Consequently, the review argues that digital transformation becomes meaningful for sustainability only when supported by strong governance, innovation capacity, and strategic alignment, while future research should adopt more longitudinal, causal, and context-sensitive approaches to evaluate its long-term sustainability impact. Future research should adopt longitudinal and mixed-method designs to establish causal mechanisms, develop precise conceptual frameworks distinguishing digital adoption from transformation, and expand geographical coverage beyond China to include developed markets and SMEs. Practitioners should integrate digital initiatives with explicit sustainability goals and ESG governance, while policymakers should strengthen disclosure standards and carbon regulations to ensure digital transformation delivers measurable sustainability outcomes rather than symbolic disclosures.

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