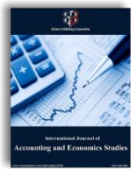
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Research paper



The Mediating Role of Digital Transformation in Linking Dynamic Capabilities to Sustainability Performance: A Systematic Literature Review in Higher Education Institutions

Awatif Ghunaim Almutairi *, Dr. Alyaa Afifah Abu Talib

Graduate School of Management, Postgraduate Center, Management and Science University (MSU), Shah Alam, Selangor. Malaysia
**Corresponding author E-mail: awatifalmutairi828@gmail.com*

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Abstract

This review examines how digital transformation mediates the relationship between dynamic capabilities and sustainability performance in higher education institutions. The analysis focuses on six capability domains: sensing, seizing, reconfiguring, learning, integrating, and coordinating. Using the PRISMA 2020 protocol, searches were conducted on Scopus, Web of Science, IEEE Xplore, and Google Scholar for studies published between 2020 and 2025. A total of 4,850 records were identified, of which 55 met the eligibility criteria for synthesis. Data extraction connects theoretical perspectives, measurement approaches, and empirical evidence on indirect effects to evaluate the consistency and strength of the mediation pathway from capabilities through transformation to sustainability performance. Among these studies, four reported full mediation, six partial mediation, indicating that digital transformation consistently serves as the operational mechanism that converts dynamic capabilities into measurable outcomes. The mediating effect is strongest where leadership commitment, governance maturity, staff skills, and interoperable digital infrastructures are present, and weakest where legacy systems, fragmented policies, or skill shortages persist. Reported transformation routines include data harmonization, platform governance, process redesign, and analytics integration, which collectively enhance sustainable performance. The review integrates the Dynamic Capabilities Theory with the Resource-Based View and the Technology–Organization–Environment framework to clarify boundary conditions for effective mediation and to guide future research on sustainable digital transformation in higher education.

Keywords: *Dynamic Capabilities; Digital Transformation; Sustainability Performance; Higher Education Institutions.*

1. Introduction

In recent years, higher education institutions (HEIs) have experienced profound transformations across their operational, academic, and governance systems to align with global sustainability goals and technological advancement. Within this setting, digital transformation (DT) has evolved beyond limited projects such as online learning tools or digital administration into a comprehensive, institution-wide integration that fosters intelligent ecosystems designed to advance environmental, social, and economic performance (Trevisan et al., 2023; Bygstad et al., 2022). This transformation has been expedited by international sustainability frameworks, including the United Nations Sustainable Development Goals (SDGs), and national initiatives such as Saudi Arabia's Vision 2030, which explicitly associate digital innovation with institutional competitiveness, operational efficiency, and sustainable impact (Alotaibi, 2021; AlAli & Aboud, 2024).
These aspirations are particularly relevant to Gulf and Saudi higher education institutions, as national policy objectives and performance indicators transform digital transformation (DT) from an optional innovation into a strategic imperative for achieving quantifiable sustainability results (Alotaibi, 2021; AlAli & Aboud, 2024). In this context, higher education institutions are progressively anticipated to serve as living laboratories for sustainable development by minimizing carbon emissions, improving accessibility, promoting social inclusion, and strengthening resilience against environmental and economic disruptions (Santos et al., 2025; Li et al., 2024). The strategic necessity involves converting technological adoption into enduring institutional agility, a process aptly articulated by the Dynamic Capabilities Theory (DCT), which emphasizes identifying opportunities, capitalizing on them through innovation, and reorganizing resources and processes to ensure long-term relevance (Teece, 2018; Patrício et al., 2022). This review employs the Dynamic Capabilities Theory to elucidate the causal logic behind mediation. Sensing identifies digital opportunities pertinent to sustainability (e.g., IoT energy monitoring, ESG analytics), seizing mobilizes investment and design decisions for these opportunities, and reconfiguring integrates them into fundamental processes and structures; these three capability microfoundations function through digital transformation routines (platform governance, data integration, interoperability, cybersecurity, and change management). In summary, dynamic capabilities (DC) define the extent and

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intensity of digital transformation (DT), which subsequently translates those capabilities into quantifiable environmental, social, and economic outcomes, thereby serving as the intermediary mechanism connecting DC to sustainability performance (SP).

Complementary competences that allow organizational learning, coordination, and integration will even assist higher education institutions to face the challenges of governance complexity, technology disruption, and rapidly changing discipline necessity changes (Lukito et al., 2022). This conceptual foundation can be extended because the Resource-Based View also classifies digital assets (including data platforms and cloud/AI infrastructure) and human/managerial competencies as strategic resources, but the value of such resources is realized by reconfiguring them in digital transformation capability-enacting routines. At the same time, the Technology–Organization–Environment framework specifies boundary conditions by nesting digital transformation within the domains of technological readiness, the organization (leadership, culture, governance), and the environment (including policy, funding, and stakeholder expectations). DCT lenses offer both an indirect path from DC to DT to SP and insight into the contextual specificity of its strength. Simultaneously, the lengthy processes of institutionalizing systems along with a range of constraints on their digital capabilities and limited synergies from governance may threaten to translate capabilities gains into sustained performance (Bygstad et al., 2022; Husain, 2022; Fernández et al., 2023).

Environmental performance activities include, for example, intelligent energy monitoring, campus waste minimization, and adoption of renewable energies that are supported by IoT-enabled infrastructure and AI-based analytics (Li et al., 2024; Rawashdeh et al., 2024). Social performance incorporates equity, inclusiveness, and community involvement, where digital technology may provide an opportunity to create access to education, bring diverse participants into play, and foster stakeholder engagement (Olabiyi et al., 2025; Husain, 2022). Performance about economy, efficiency in operations, and cost, as well as economic resilience, are important and become more dependent on integrated data systems and predictive tools for decision-making (Bygstad et al., 2022; Trevisan et al., 2023). The mediating role of digital transformation (DT) in the relationship linking dynamic capabilities with sustainability performance (SP) is reflected in its potentiality to operationalize sensing via real-time data capturing, aid seizing through rapid service innovation and platformization, sustain reconfiguration thanks to iterations of process redesigns, enhance learning thanks to ongoing feedback and knowledge analytics, coordinate by aligning digital processes across functions, and integrate by amalgamating internal as well as external knowledge resources into sustainability-minded strategies (Alotaibi, 2021; Pavlou & El Sawy, 2011).

The strength of this mediating effect depends on a set of facilitating conditions that comprises strategic fit, leadership commitment, human capital readiness, and infrastructural maturity (Fernández et al., 2023; Terán & Arias, 2025). In technologically advanced environments, good governance and investment create an environment in which sustainability driven by digital transformation is possible, but resource-poor colleges or higher education institutions face staff shortages, constraints of legacy systems, and a lack of coherent support from the government (Olabiyi et al., 2025; Husain, 2022). In view of these disparities, it becomes crucial to incorporate the interfaces between DC, DT, and SP in diverse HEI scenarios in order to identify ways that leverage institution-sustainability outcomes. This SLR is driven by a robust sample of promising studies published between 2020 and 2025, integrating empirical and theoretical evidence with respect to the mediating role DT plays in linking DC with SP in HEIs. This study has the potential to advance theory and practice by (1) mapping global evidence, (2) synthesizing findings using multiple methods of analysis of findings, and (3) including a testable mediation model focusing on enablers that could result in standardized indicators. The articulation of this review corresponds to a specific gap in the literature for integrated mediation evidence across geographies and types of institutions, underpinned by three purposes: (i) synthesize findings on the mediation from capabilities to transformation to performance in HEIs between 2020 and 2025, (ii) identify boundary conditions such as leadership, policy alignment, and resource endowments that strengthen or weaken the relationship along the pathway. The contribution of this study is in associating sector-specific transformation processes with sustainability outcomes and presenting implications for decision-making to higher education institutional managers and policymakers following national development strategies, such as Vision 2030, while also offering researchers a unified theoretical backbone that harmonizes DCT with RBV and TOE.

Building on the integration of the Dynamic Capabilities Theory, the Resource-Based View, and the Technology–Organization–Environment framework, the conceptual model proposes that digital transformation mediates the relationship between dynamic capabilities and sustainability performance in higher education institutions (Figure 1). Conceptual framework illustrating how digital transformation (DT) mediates the relationship between dynamic capabilities (DC) and sustainability performance (SP). Contextual moderators such as governance maturity, leadership commitment, and digital infrastructure are proposed to influence the strength of this mediation effect.

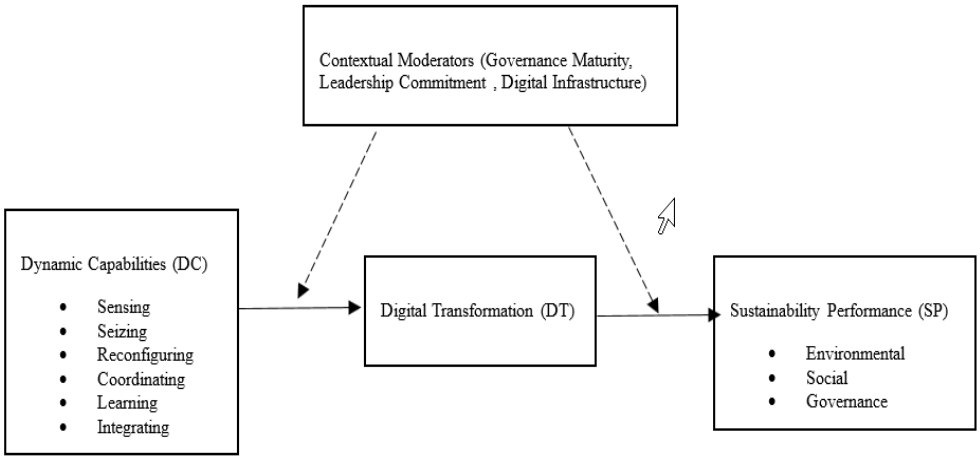


Fig. 1: Conceptual Framework.

2. Methodology

To this end, this study uses a systematic literature review (SLR) as a methodology for investigating the mediating effect of digital transformation (DT) in the relationship between DC and sustainability performance (SP) among higher education institutions (HEIs). This assessment was conducted using one of the most widely used standards for conducting systematic reviews is the PRISMA framework (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). PRISMA provides a transparent and structured methodology for reporting systematic reviews and meta-analyses (Prill et al., 2021). It employs a flow diagram to visually represent the stages of the literature selection

process, from initial identification through screening and final inclusion, thereby enhancing the clarity and reproducibility of the research process. PRISMA checklist ensures methodological rigor and transparency, allowing readers to evaluate the validity and reliability of the review findings. And ensuring transparency and quality at each stage of decision-making: identification, screening, eligibility, and inclusion is illustrated in Figure 2. A more detailed process for Boolean search was applied to retrieve literature on different research topics. This included dynamic capabilities (e.g., "sensing," "seizing," "reconfiguring"), digital transformation (e.g., "smart campus," "e-learning ecosystems"), sustainability performance (e.g., "ESG," "environmental social economic"), and methodological or contextual qualifiers (e.g., "mediat," "capability building," "PLS-SEM," "governance," and "assessment frameworks"). Higher education indicators were established with the use of terms including "higher education," "university," * and "HEI." *. Search was carried out on the closely indexed and subject-diversified databases, i.e., Scopus, Web of Science (WoS), IEEE Xplore, and Google Scholar. Search filters were harmonized for uniformity of meaning across the databases. Only articles published from 2020 to 2025, written in English, were considered. Further subject-area filters were selected for Business, Social Sciences, Education, and Environmental Science. The database search identified 4,850 records: 3,825 from Scopus, 120 from Web of Science, and 905 from IEEE Xplore. After removing 625 duplicates, 4,225 studies underwent title and abstract review. Papers were included if they explored the association between DC, DT, and SP at HEIs and made use of mediation, moderation, or measurement models. The exclusion criteria removed studies not related to higher education, those focused exclusively on K–12 education or industry research, and non-peer-reviewed references, except for foundational works.

After reviewing, 4,170 articles were excluded. All the remaining studies were reviewed in full text using a standard data extraction tab with reference to theoretical bases, methodology, and sources. Dynamic capabilities were decomposed into six building blocks: sensing, seizing, reconfiguring, learning, integrating, and coordinating (Pavlou & El Sawy, 2011). The digital transformation framework involved artificial intelligence, cloud computing solutions, smart campus systems, and governance tools. SP was performed with environmental, social, and economic indicators. PLS-SEM findings (reliability, validity, and indirect effects) are reported when applicable. Quality was evaluated with the Joanna Briggs Institute (JBI) checklists, and inter-coder reliability was estimated with Cohen's kappa after coder training. A total of 55 studies were eligible for final synthesis. A PRISMA diagram, which summarizes the entire selection process, is illustrated in Figure 2.

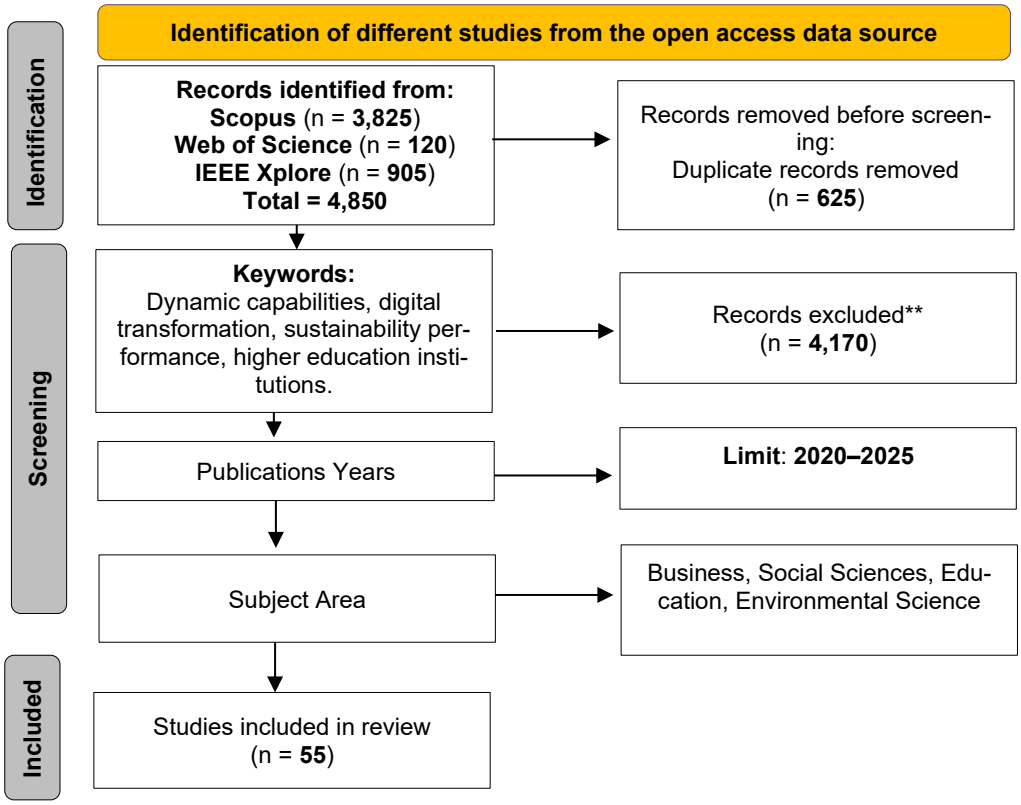


Fig. 2: PRISMA 2020 Flow Diagram Illustrating the Identification, Screening, Eligibility, and Inclusion Process. A Total of 4,850 Records Were Retrieved from Scopus (N = 3,825), Web of Science (N = 120), and IEEE Xplore (N = 905). After Removing 625 Duplicates, 4,225 Records Were Screened, 4,170 Were Excluded, and 55 Studies Were Included in the Final Synthesis.

To visualize the most common research terms and thematic overlaps among the retrieved studies, a word cloud was generated from the abstracts and keywords of the included papers (Figure 3).



Fig. 3: Word Cloud Visualization Based on Abstracts of Included Studies, Illustrating Most Frequent Research Terms.

Source: Authors' Elaboration.

3. Discussion and Factors Influencing The Mediation Effect

This review demonstrates that digital transformation (DT) frequently mediates the relationship between dynamic capabilities (DC) and sustainability performance (SP). Drawing on the Dynamic Capabilities Theory (DCT), the findings suggest that DT serves as an activating mechanism that enables organizations to reconfigure and deploy resources to achieve sustainable outcomes (Pavlou & El Sawy, 2011; Abalroado, 2024). Within the context of HEIs, DT can act as a bridge that translates the sensing, seizing, and reconfiguring capabilities into tangible environmental, social, and governance (ESG) performance indicators (Trevisan et al.,2023; Shenkoya & Kim, 2023; Hashim et al., 2022; Abad-Segura et al., 2020). This transformation aligns with global higher education trends emphasizing digital innovation, institutional efficiency, and sustainable impact (Trevisan et al., 2023; Nthutang et al., 2024). Among the 55 reviewed studies, 12 conducted formal mediation analyses, primarily through Partial Least Squares Structural Equation Modeling (PLS-SEM), with four reporting significant full mediation, six partial mediation, and two no mediation (Rawashdeh et al., 2024; Chen & Wang, 2024; Al-Husain et al., 2025; Asif et al., 2024; Lina et al.,2023). These quantitative findings reinforce that DT is a critical intermediary mechanism connecting DC and SP. However, the mediation strength varies depending on the conceptualization of DT and the maturity level of the institution. For instance, studies that narrowly defined DT as the implementation of isolated technologies (e.g., e-learning platforms) rather than as a systemic transformation reported weaker mediation effects (Bisri et al., 2023; Bui & Nguyen, 2023). This variation underscores the importance of perceiving DT as a multidimensional construct integrating technological, organizational, and human elements (Vial, 2021; Guandalini, 2022).

The mediating effect of DT is particularly strong in HEIs that demonstrate effective leadership, governance, and institutional readiness. Leadership commitment fosters alignment between digital and sustainability strategies, ensuring that transformation initiatives are integrated into the organizational vision and culture (Alenezi, 2021; Alshammari et al., 2024; Alrub & Sánchez-Cañizares, 2025). Governance maturity facilitates interoperability and accountability, allowing universities to leverage analytics, platform governance, and data-driven decision-making to enhance performance (Caputo et al., 2021; Khouj, 2020). Similarly, institutions investing in digital literacy, infrastructure, and cross-functional collaboration are better positioned to translate dynamic capabilities into sustainable outcomes (Chahid et al., 2025; de Almeida Barbosa Franco et al., 2024). These enablers correspond with the Resource-Based View (RBV) and Technology–Organization–Environment (TOE) frameworks, which emphasize how resource orchestration and environmental readiness jointly shape sustainability through digitalization (Bari et al., 2022; Li et al., 2024).

Conversely, weaker mediation occurs in HEIs constrained by legacy systems, fragmented standards, and policy misalignment. Structural rigidity and cultural resistance often limit the reconfiguring capability essential for digital innovation and sustainable change (Bryndin, 2020; Rof et al., 2020). Institutions struggling with inadequate digital infrastructure or staff competencies experience slower data flows and lower integration across systems, hindering analytics-driven sustainability improvements (Bygstad et al., 2022; Husain, 2022). Moreover, limited funding and inconsistent policy frameworks in developing countries reduce institutional agility and readiness (Alsharif et al., 2020; AlAli & Aboud, 2024). These inhibitors highlight the socio-technical nature of DT; technological investments alone are insufficient without corresponding shifts in leadership mindset, institutional culture, and regulatory coherence (Apple & Shields, 2025; Benlaria & Almawishir, 2025).

Recent research suggests that emerging technologies, such as artificial intelligence (AI), machine learning, and the Internet of Things (IoT), strengthen the mediating role of DT by facilitating real-time sustainability analytics and predictive management (Alotaibi & Alshehri, 2023; Trevisan et al., 2023; Madkhali & Sithole, 2023). For example, AI-driven analytics enable universities to monitor carbon footprints, optimize energy efficiency, and assess ESG performance dynamically, effectively enhancing the translation of dynamic capabilities into sustainability gains (Li & Zhang, 2024). However, as highlighted by Alshammari et al. (2024), the success of such technologies depends on cultural openness, leadership support, and digital competencies, confirming that DT is both a technological and human-centered transformation.

From a theoretical standpoint, these findings expand the DCT by integrating it with RBV and TOE, illustrating that DT operates as a mechanism of capability activation that transforms intangible resources into sustainable outcomes (Sousa-Zomer et al., 2020; Iden & Bygstad, 2025). Governance maturity, leadership vision, and institutional readiness emerge as boundary conditions moderating the DC→DT→SP relationship (Ferigotti et al., 2019; Karman & Savanevičienė, 2021). Methodologically, the reviewed studies indicate a need for longitudinal and multi-level research designs to capture the evolving nature of digital transformation and sustainability in educational contexts (Prill et al., 2021; Patrício et al., 2022).

Practically, the findings provide actionable guidance for HEI leaders and policymakers seeking to align with Saudi Vision 2030 and global sustainability agendas. A four-stage roadmap is proposed: (1) assess digital and dynamic capability baselines; (2) align governance structures with digital and sustainability policies; (3) embed analytics and AI-driven tools into performance monitoring; and (4) continuously evaluate ESG outcomes using integrated dashboards (Sharabi et al., 2023; Benlaria & Almawishir, 2025). Through this cyclical process, institutions can strengthen the mediating mechanism of DT, translating dynamic capabilities into measurable sustainability impact and long-term institutional resilience.

4. Research Gaps and Future Directions

Despite growing evidence that digital transformation (DT) mediates the relationship between dynamic capabilities (DC) and sustainability performance (SP) in different contexts, several research gaps remain that limit the empirical maturity of the field in the higher education sector. The current body of literature provides valuable insights but still lacks a cohesive understanding of how DT mechanisms operate across institutional and contextual boundaries to translate dynamic capabilities into measurable sustainability outcomes. From a theoretical perspective, the micro foundations of DC—sensing, seizing, and reconfiguring—are not yet fully understood in relation to their digital and sustainability dimensions. While previous studies support DT as a mediator, many treat it as a broad or undefined construct, neglecting the underlying routines and governance processes through which digital initiatives enable resource reconfiguration for sustainable advantage (Pavlou & El Sawy, 2011; Abalroado, 2024; Guandalini, 2022). More theoretical clarity is also required regarding the moderating role of governance maturity, institutional readiness, and leadership vision in shaping this relationship (Ferigotti et al., 2019; Karman & Savanevičienė, 2021). Integrating the Dynamic Capabilities Theory (DCT) with the Resource-Based View (RBV) and Technology–Organization–Environment (TOE) framework could provide a unified model that captures how internal resources, technological infrastructure, and external pressures interact to produce sustainability outcomes (Bari et al., 2022; Li et al., 2024).

Methodologically, most studies in this domain rely on cross-sectional designs and the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach, which limits causal inference and the ability to capture temporal dynamics (Acosta-Prado & Tafur-Mendoza, 2024; Nurhayati & Astono, 2024). Future investigations should employ longitudinal, experimental, or mixed-method designs to trace how DT capabilities evolve and how their mediating effects develop over time (Prill et al., 2021). Incorporating big-data analytics, text mining, and bibliometric techniques can enhance understanding of how digital and sustainability transformations co-evolve in academic environments (Trevisan et al., 2023). Meta-analytic approaches could also be useful to assess the consistency and strength of mediation across different contexts and methodological traditions (Benavides et al., 2020; Díaz-García et al., 2022).

Contextually, the existing evidence base is heavily skewed toward developed and resource-abundant nations, with limited empirical exploration in developing regions such as the Middle East and Africa. Institutional, cultural, and policy differences may significantly influence the extent to which DT enhances sustainability in HEIs (AlAli & Aboud, 2024; Alotaibi, 2021). In Saudi Arabia, the integration of digital innovation into higher education aligns with Vision 2030, which emphasizes the role of technology and sustainability as drivers of socio-economic transformation (Allmnakrah & Evers, 2020; Moshashai et al., 2020). Future studies should therefore conduct comparative and multi-level analyses to capture how national policies, digital maturity, and institutional typologies shape the DC–DT–SP nexus (Caputo et al., 2021; Alwakid et al., 2021).

Applied research also faces challenges in the operationalization and measurement of both DT and SP constructs. Many studies lack standardized instruments to assess digital capabilities or to quantify sustainability indicators across environmental, social, and governance dimensions (Benlaria & Almawishir, 2025; Chahid et al., 2025). Developing validated scales and integrated digital dashboards could enhance comparability and transparency in reporting sustainability outcomes (Sharabi et al., 2023; Li & Zhang, 2024). Furthermore, the incorporation of artificial intelligence (AI), machine learning, and Internet of Things (IoT)-enabled monitoring offers promising avenues for real-time evaluation of ESG performance and continuous improvement of sustainability strategies (Alotaibi & Alshehri, 2023; Madkhali & Sithole, 2023). Overall, future research should deepen theoretical understanding of the interplay between digital transformation and sustainability, employ longitudinal and comparative methodologies, and design practical measurement tools to bridge the gap between theory and implementation. Advancing these areas will not only enhance the academic rigor of DT-sustainability research but will also equip HEIs with the insights necessary to strengthen institutional resilience, digital maturity, and alignment with global sustainable development goals.

5. Conclusion

This systematic literature review demonstrates that digital transformation can serve as a pivotal mediating mechanism linking dynamic capabilities to sustainability performance in higher education institutions. The evidence confirms that digital transformation enables universities to sense opportunities, seize innovations, and reconfigure resources to achieve measurable progress across environmental, social, and governance dimensions. Institutions with strong leadership, mature governance systems, and high levels of digital readiness tend to achieve superior sustainability outcomes, while those constrained by legacy systems, fragmented policies, or limited digital skills experience weaker mediation effects. These findings highlight the importance of organizational culture, strategic alignment, and institutional readiness in realizing the transformative potential of digital technologies.

The review also provides a comprehensive theoretical perspective by integrating the dynamic capabilities, resource-based, and technology–organization–environment frameworks into a unified understanding of how internal resources, technological infrastructures, and external institutional conditions interact to shape sustainable digitalization. Empirical results across the analyzed studies confirm the robustness of digital transformation as a mediating factor, though variations across contexts suggest the influence of boundary conditions such as governance maturity, institutional strategy, and leadership vision. Understanding these conditions is essential for explaining when and how digital initiatives translate into sustained environmental and social value.

Practically, the study offers a strategic roadmap for universities seeking to integrate digital transformation with sustainability agendas. This process involves assessing institutional capabilities, aligning governance frameworks with sustainability goals, embedding analytics and artificial intelligence tools into decision-making systems, and continuously monitoring performance through integrated digital dashboards. Such a framework is particularly relevant in the context of national transformation strategies, where education, innovation, and sustainability are recognized as key drivers of socio-economic development. By adopting this holistic approach, higher education institutions can enhance digital maturity, strengthen strategic agility, and position themselves as catalysts for sustainable progress.

Ultimately, digital transformation is not merely a technological shift but a comprehensive organizational evolution that redefines how institutions create and sustain value. When effectively integrated with dynamic capabilities, it becomes a strategic bridge connecting

institutional potential with long-term sustainability impact. As universities continue to navigate complex technological and environmental challenges, embracing digital transformation as a catalyst for sustainability will be critical for achieving enduring institutional excellence, resilience, and societal relevance.

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