EXPLORING THE ROLE OF DIGITAL TRANSFORMATION IN ENHANCING SMES SUSTAINABILITY PERFORMANCE: *A SYSTEMATIC LITERATURE REVIEW*

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Abstract
Small and Medium Enterprises (SMEs) play a crucial role in achieving sustainable development goals, yet many still face challenges in maximizing the benefits of digital transformation to improve sustainability performance. Digital transformation is believed to be a catalyst for innovation and operational efficiency, but empirical evidence regarding the extent to which digitalization actually contributes to SME sustainability remains mixed and has not been regularly integrated. This study conducted a Systematic Literature Review (SLR) to identify, synthesize, and evaluate recent research on the relationship between digital transformation and sustainability performance in SMEs. The review process examined 40 scientific articles published between 2021 and 2025 in reputable international journals (Scopus Q1-Q4 and WoS indexed). The analysis was conducted using the PICOS framework and the PRISMA 2020 protocol to ensure transparency and repeatability of the selection process.

The study results indicate that digital transformation significantly impacts SME sustainability performance, particularly through increased resource efficiency, supply chain transparency, and green innovation. However, the success of its implementation is strongly influenced by digital readiness, policy support, and industry and regional contexts. In general, digitalization has been shown to strengthen the economic, social, and environmental dimensions of SME sustainability, although challenges such as limited infrastructure and digital competency remain major obstacles in developing countries. This study makes an important contribution by presenting a conceptual map and synthesized findings that explain how and to what extent digital transformation plays a role in driving SME sustainability performance.

Keywords: Digital Transformation, Sustainability Performance, Small and Medium Enterprises (SMEs), Systematic Literature Review

1. Background

Small and Medium Enterprises (SMEs) play a vital role in global economic development. They contribute significantly to job creation, innovation, and Gross Domestic Product (GDP) growth in many countries. However, amid global challenges such as technological disruption, climate change, and international market pressures, SMEs are required to digitally transform and adopt sustainable business practices (Reim, Sjödin, & Parida, 2022). Digital transformation (D&T) is no longer an option but a strategic necessity for SMEs to compete, survive, and thrive.

Digital transformation refers to the process of adopting digital technologies that fundamentally change how organizations operate and create value (Vial, 2019). Technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), big data analytics, and cloud computing offer significant opportunities for SMEs to improve operational efficiency, enable data-driven decision-making, and enable smarter supply chain integration (Mikalef & Gupta, 2021). Digital transformation is also believed to have significant potential in driving sustainability performance across environmental, social, and economic dimensions (Wang & Esperança, 2023).

Various studies confirm that digital transformation can accelerate the transition to more energy-efficient business processes, reduce waste, increase transparency in environmental and social reporting, and expand stakeholder participation (Chatterjee et al., 2021; Lu, Chen, & He, 2023). For example, the use of blockchain creates sustainable supply chains through real-time material tracking, while IoT enables efficient monitoring of energy consumption in SME production lines. However, despite these identified potentials, a significant gap remains between theory and implementation, particularly in the SME sector.

Other studies show that many SMEs have not yet been able to optimize digital transformation to improve their overall sustainability performance. Key barriers include limited human and financial resources, the lack of a structured digital strategy, and an immature culture of innovation within the organization (Cristea, Nguyen, & Miron, 2022; Yang, Zhang, & Li, 2022). Furthermore, most SMEs lack an integrated sustainability management system, so technology adoption does not automatically translate into improvements in environmental or social aspects (Fonseka, Kumarasinghe, & Wijesinghe, 2022).

Current literature also shows that studies on the relationship between digital transformation and sustainability in SMEs remain fragmented. Many studies only highlight one aspect, either digitalization or sustainability, without clearly explaining the conversion mechanisms between the two (Sankar, Gupta, & Luthra, 2023). Yet, a comprehensive understanding of how digital technology actually translates into improved sustainability is crucial for designing effective SME strategies in the future.

As climate change and sustainability regulations increase in various countries, SMEs are also facing increasing demands for environmental, social, and governance (ESG) performance reporting. Unfortunately, most SMEs lack the infrastructure or capabilities to effectively meet these demands (Alkaraan, Northcott, & Ali, 2022; Broadstock et al., 2021). A planned and strategic digital transformation can help build an accurate, efficient, and integrated ESG reporting system within business processes.

Beyond regulatory aspects, consumer demand is shifting toward products and services that are not only high-quality but also ethical and environmentally friendly. Digital transformation enables SMEs to respond to these changes more adaptively and efficiently. For example, digital marketing allows SMEs to reach a wider market using sustainability as a selling point, while data analytics enable real-time evaluation of consumer preferences (Varadarajan, Jayachandran, & White, 2022).

However, the success of digital transformation in driving sustainability depends heavily on organizational readiness, particularly in terms of innovation culture, digital leadership, and change management (Bag et al., 2021; Chatterjee et al., 2021). Recent studies emphasize the importance of a dynamic capabilities approach to explain how organizations adapt and reconfigure their digital resources in response to sustainability pressures and opportunities.

Therefore, a systematic, evidence-based approach is needed to synthesize empirical and conceptual findings on the role of digital transformation in improving the sustainability performance of SMEs. This study was conducted as a Systematic Literature Review (SLR) using the PICOS framework and PRISMA guidelines.

This review will also explore whether specific contexts enhance the effectiveness of digital transformation in improving the sustainability performance of SMEs. For example, whether certain industry sectors, such as high-tech manufacturing or digital services, demonstrate a stronger relationship between digitalization and achieving sustainability targets. Furthermore, institutional dynamics such as environmental regulatory pressures, government incentives, or international market expectations can be important catalysts in strengthening the role of digitalization in sustainability. By understanding these optimal conditions, stakeholders such as business associations, policymakers, and technology solution providers can design interventions that are more targeted and have long-term impact.

The results of this review are expected to provide academics and practitioners with deeper insights into how SME digital strategies can be more systematically integrated with sustainability initiatives. For example, how data-driven and analytical approaches can be leveraged to support environmentally friendly decision-making, or how digital platforms can be used to educate consumers about the sustainable values of SME products or services. The combination of digital technology and sustainability strategies also opens up opportunities for more inclusive and circular business model innovations, such as sharing economy platforms, product-as-a-service models, or community-based ecosystems.

This systematic review aims to not only synthesize the scattered literature but also build a conceptual framework that can serve as a foundation for further research. This study is also crucial in the context of climate change, market disruption, and increasingly complex global sustainability pressures. Therefore, SMEs, as adaptive and flexible entities, have a significant opportunity to lead sustainable digital innovation, provided they are accompanied by appropriate strategies and adequate institutional support. This study aims to unlock new insights into the complex interactions between technology, strategy, and sustainability within the framework of future SMEs.

2. METHODOLOGY

This study uses a Systematic Literature Review (SLR) approach to explore and synthesize empirical findings related to the role of digital transformation in improving the sustainability performance of Small and Medium Enterprises (SMEs). The search and article selection strategy followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to ensure transparency, traceability, and accuracy in the literature identification and evaluation process.

1) Identification Stage
   The article search was conducted using the Scopus and Web of Science databases, considering that both have extensive coverage of reputable international academic publications (Q1–Q4). The main keywords used in the search process were: "digital transformation" and "sustainability performance" and "SMEs", "technology adoption" and "sustainable development" and "small and medium enterprises", "digital capabilities" and "triple bottom line" and "SMEs". Keywords were combined using Boolean operators (and, or) to accommodate term variations. The publication year range considered was 2020 to 2025, to ensure data relevance and currency. At this stage, 183 articles were identified.
2) Screening Stage
   Initial screening was conducted by evaluating article titles and abstracts to select only those that explicitly discussed the link between digital transformation and sustainability in the context of SMEs. Subsequently, filtering was performed based on the primary scientific fields: Business, Management, and Accounting (n = 74) and Social Sciences (n = 30). After this screening stage, 79 articles were excluded from the topic.
3) Eligibility Criteria
   At this stage, a full assessment of the article content (full text review) is carried out using the following inclusion and exclusion criteria:
   - Inclusion Criteria: (a) Articles focusing on SMEs (Small and Medium Enterprises), (b) Explaining the relationship between digital transformation and sustainability performance (environmental, social, economic), (c) Empirical studies (quantitative, qualitative, or mixed) or theory-based conceptual studies, (d) Published in reputable international journals (Q1-Q4) and (e) Publication period 2020-2025.
   - Exclusion Criteria: (a) Studies that only discuss digitalization or sustainability separately, (b) Not available in full-text version, (c) Review articles without empirical

synthesis, (d) Focus on large companies or the public sector and (e) Based on the above criteria, 40 articles were declared eligible for further analysis.

4) Inclusion Stage
   At this stage, 40 selected articles were extracted and analyzed using a thematic approach and categorization based on the PICOS (Population, Intervention, Comparison, Outcome, Study Design) framework. Each article was classified based on research methodology, industry sector, geographic region, type of digital intervention, and the sustainability dimension measured.
5) Presentation of Results with PRISMA Diagram
   The article selection process is presented in the form of a PRISMA diagram, which depicts the number of articles at each stage: initial identification, title and abstract screening, full-text eligibility assessment, and final articles included in the SLR analysis. This diagram helps increase the transparency of the selection process and allows for replication of similar studies in the future.

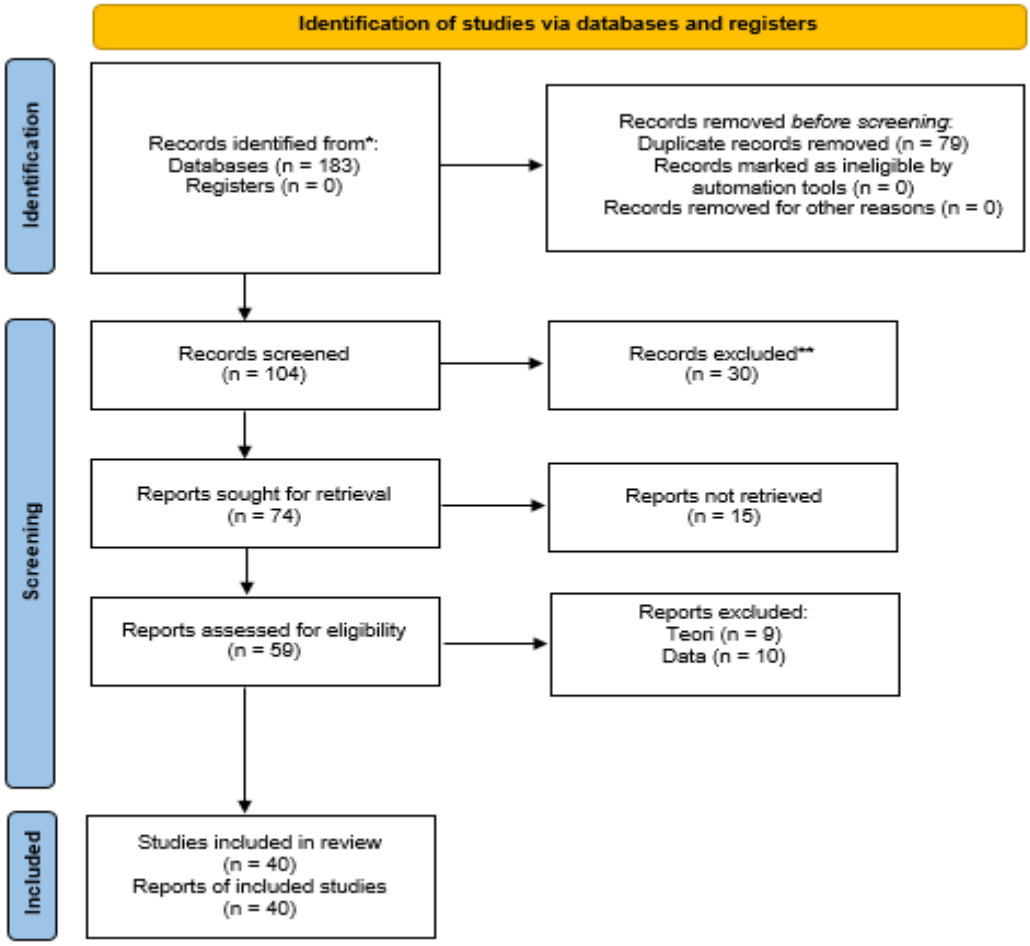

Figure 1. PRISMA diagram

As shown in Figure 1. The PRISMA diagram above, the SLR process was structured systematically and transparently to ensure that the literature selection was conducted objectively and replicably. The goal was to produce a comprehensive and credible review of the relationship between digital transformation and sustainability performance in SMEs, taking into account the theoretical, methodological, and contextual dynamics that have developed in the literature over the past five years. With this approach, it is hoped that the review results will provide strong conceptual contributions and practical strategic direction for researchers and policymakers in the field of sustainability management and technology.

3. RESULTS

Descriptive Analysis

In the Systematic Literature Review (SLR) on the topic of "Digital Transformation and Sustainability Performance in Small and Medium Enterprises (SMEs)," the main findings show that research in this area has increased significantly in the last five years. The analyzed literature indicates that digital transformation is not only seen as a tool for operational efficiency, but also as a key driver of sustainability strategies in the SME sector. Of the 40 articles reviewed, the majority were published in reputable journals in Q1 and Q2, with the highest publication distribution occurring in 2023 and 2024. The majority of studies were conducted in the context of developing countries such as China, India, and ASEAN countries, with a primary industry focus on manufacturing, agribusiness, and technology-based services.

Key Findings and Trends

A systematic review of 40 selected articles shows that digital transformation is increasingly viewed as a strategic force driving sustainability in the Small and Medium Enterprise (SME) sector. The literature over the past five years illustrates the evolution of a deeper understanding of the role of digitalization not merely as an operational tool but as a catalyst for multidimensional sustainable value creation encompassing environmental, social, and economic aspects (the triple bottom line).

One of the central findings from the literature is the importance of organizational readiness, particularly in terms of digital leadership, a culture of innovation, and technological capabilities. SMEs that are able to combine a digital vision with sustainability values tend to be more successful in translating technology investments into tangible outcomes, such as energy efficiency, waste reduction, and social value creation. This is supported by studies such as Cristea et al. (2022) and Fonseka et al. (2022), which show a strong correlation between digital maturity and sustainability performance when supported by solid internal factors.

Beyond internal organizational aspects, many articles also emphasize the critical role of the external context. Regulatory pressures, expectations from global partners, and changing consumer preferences for sustainable products are external factors that reinforce the urgency of digitalization. Studies such as those by Alkaraan et al. (2022) show that institutional support and digital infrastructure at the national level can accelerate technology adoption, which in turn improves the sustainability of SMEs.

However, not all SMEs are on the same page in their digital transformation journey. The digital divide remains a significant issue, particularly for SMEs in traditional sectors or regions with limited access to technology and trained human resources. This challenge has been highlighted by numerous studies, including Lu et al. (2023), who emphasized that without a holistic approach and adequate support, digital transformation can actually widen the competency gap between businesses.

The literature reflects a paradigm shift from simply digitizing processes to leveraging technology to create long-term, sustainable impact. Circular economy-based business models, leveraging big data for ESG reporting, and leveraging digital platforms to reach environmentally conscious consumers are some concrete manifestations of this trend. Therefore, digital transformation in the SME context can no longer be separated from the sustainability agenda; the two reinforce each other and form a strategic foundation for future competitiveness.

Differences and Debates in Theories and Methods

In the literature on digital transformation and SME sustainability performance, several theoretical and methodological approaches have been used, reflecting the complexity and multidimensionality of this topic. However, this diversity of approaches has also given rise to several important differences and debates.

In terms of theoretical frameworks, the two most dominant approaches used are the resource-based view (RBV) and dynamic capability theory (DCT). Several studies use the RBV to explain how internal digital assets can enhance competitive advantage and environmental efficiency (Misra et al., 2024). On the other hand, the dynamic capabilities approach emphasizes the importance of an organization's ability to adapt to changes in the digital environment and sustainability expectations, as seen in the article "Toward a dynamic capability perspective of digital transformation and environmental sustainability performance in SMEs" (He et al., 2024).

However, this approach is debated due to its limitations in explaining external factors such as regulatory pressures or dynamic market demands. Some authors, such as Yang et al. (2023), suggest a complementary approach to institutional theory, as it can capture how social norms, political pressures, and customer expectations influence SMEs' digitalization decisions.

There is also diversity in research methodology. Most studies are quantitative, using survey approaches and structural models such as AMOS SEM and PLS-SEM. However, recent trends indicate an increasing use of mixed methods and qualitative studies based on in-depth interviews, particularly to explore contextual factors and managerial behavior. For example, the article "Uncovering the secrets of sustainable performance: An empirical study on SMEs' digital maturity and green innovation behavior" uses qualitative interviews to explore the role of digital leaders in driving green innovation (Sankar et al., 2025).

Several debates have also emerged regarding sustainability measurement. Most studies measure sustainability performance from environmental perspectives, such as emission reduction and energy efficiency, but few evaluate social aspects such as workforce inclusiveness or community engagement. A study by Broadstock et al. (2021) in "Can digital transformation improve market and ESG performance?" highlights the importance of the social dimension as an underexplored component of ESG in SMEs.

There are also differences in how the concept of digital transformation itself is defined and operationalized. Some studies view it as the integration of technologies (IoT, AI, big data), while others emphasize it as a process of cultural and business model change. For example, "The missing link between digital transformation and business model innovation in sustainable SMEs" (Chatterjee et al., 2024) argues that digital transformation should be viewed as a strategic process involving changes in organizational vision, culture, and values.

Methodological Approach Used by Researchers

A review of the 40 scientific articles used in this SLR demonstrates the diversity of methodological approaches used by researchers to examine the relationship between digital transformation and sustainability performance in SMEs. The three main approaches used are quantitative, qualitative, and mixed methods.

Most studies use a quantitative approach. This approach generally involves surveys with numerical data and hypothesis testing using advanced statistical techniques such as Structural Equation Modeling (SEM) or Partial Least Squares (PLS-SEM). For example, research by He et al. (2024) in their article "Toward a dynamic capability perspective of digital transformation and environmental sustainability performance in SMEs" uses SEM to examine the relationship between dynamic capabilities and sustainability performance. Another study by Huang et al. (2025) entitled "Digital transformation of Chinese manufacturing SMEs under government intervention" adopts a quantitative model to analyze policy interventions in improving SME digital readiness. Similar findings are also found in the article by Rehman et al. (2025) "Reconciling digital transformation and sustainability: Toward a performance-based integration model," which shows that digital capabilities have a mediating effect on performance-based sustainability. Research by Sankar et al. (2023) in "Role of digitalized sustainable manufacturing in SMEs" also emphasizes the importance of data-driven technology readiness in improving production efficiency. Meanwhile, Bag et al. (2024) showed in his study

that supply chain digitalization through industry 4.0 technology encourages the achievement of ESG targets in the SME manufacturing sector.

Some researchers choose to use a qualitative approach to explore more contextual and in-depth dimensions, such as organizational dynamics, leadership roles, and resistance to digital change. For example, Chatterjee et al. (2024) in their article "The missing link between digital transformation and business model innovation in sustainable SMEs" used in-depth interviews to understand how SME leaders navigate the integration of business model innovation and technology adoption. A similar approach was also applied by Yunis et al. (2025) in "Can digital transformation improve market and ESG performance?", which explored narratives of digital transformation successes and failures in the services sector. Fonseka et al. (2022) highlighted the importance of organizational cultural readiness and values in driving the integration between digital transformation and ESG achievement through an exploratory approach. Meanwhile, Cristea et al. (2022) and Lu et al. (2023) used case studies to identify key barriers and drivers in digital adoption that impact environmental sustainability.

As the complexity of the issues being studied increases, some researchers choose to combine quantitative and qualitative approaches through mixed methods. This approach is used to integrate numerical validity with the depth of empirical narratives. One example of a study using this approach is the article by Sankar et al. (2025), "Uncovering the secrets of sustainable performance: Empirical study on SMEs' digital maturity and green innovation behavior," which combines survey data with interviews with SME managers to explain how digital maturity drives green innovation. Another study by Alkaraan et al. (2022), in "Corporate transformation toward Industry 4.0 and ESG performance," also uses mixed methods to explain the role of digital transformation in strengthening sustainability values in heavy industry SMEs. A triangulative approach is also seen in articles by Broadstock et al. (2021), Varadarajan et al. (2022), and Yang et al. (2022), which collectively demonstrate that a holistic approach is crucial in bridging the gap between technology implementation and expected sustainability impacts.

Theoretical Framework and Model

The literature on digital transformation and SME sustainability performance reflects a multidisciplinary approach that integrates diverse theories of strategic management, innovation, and organization. An analysis of the 40 articles reviewed in this SLR indicates that there is no single dominant theory, but rather four main theoretical approaches that are frequently used, both independently and in an integrated manner: Resource-Based View (RBV), Dynamic Capability Theory (DCT), Institutional Theory, and Stakeholder Theory.

a. Resource Based View (RBV) and Dynamic Capabilities
   The RBV approach is widely used to explain how digital capabilities, whether in the form of technology, human resources, or information structures, become strategic resources in creating sustainability-based competitive advantage (Barney, 1991). Studies such as Fonseka et al. (2022) and Wang & Esperança (2023) show that the use of effectively managed digital technology can strengthen operational efficiency and green innovation in SMEs. However, considering the rapidly changing external dynamics, the RBV was then expanded through the Dynamic Capability Theory approach (Teece, 2007). This theory explains that organizations need not only have resources, but also the ability to sense, capture, and reconfigure these resources adaptively. In this context, He et al. (2024) in their article "Toward a Dynamic Capability Perspective" emphasizes that the ability to absorb and adapt digital technology responsively is the link between digitalization and environmental sustainability performance.
b. Institutional Theory
   While RBV and DCT focus on the internal dynamics of organizations, several studies adopt Institutional Theory to explain the influence of external factors such as regulatory

pressures, social norms, and market expectations. Alkaraan et al. (2022) and Chatterjee et al. (2024) highlight that SMEs' decisions to adopt technology are not solely economically rational but are often influenced by conformity to institutional pressures such as ESG standards, government incentive programs, and demands from global partners.

c. Stakeholder Theory
This theory complements previous approaches by emphasizing the role of stakeholders as drivers and determinants of sustainability strategies. Studies by Broadstock et al. (2021) and Cristea et al. (2022) emphasize the importance of employee, customer, local community, and investor engagement in influencing how SMEs develop inclusive and sustainable digital strategies.

d. Conceptual Model: Integration of Theory and Dimensions
Based on findings from various studies, this SLR conceptual model maps the relationship between Digital Transformation, Strategic Capabilities based on RBV and DCT, Institutional Pressures, and Stakeholder Responses, all of which contribute to Sustainability Performance in three main dimensions: environmental, social, and economic. This model reflects that the success of TD in driving sustainability is not linear, but rather the result of a complex interaction between internal factors such as capabilities, leadership, and innovation. External pressures include regulations, market expectations, and active stakeholder engagement. Therefore, the use of an integrative theoretical framework is crucial in explaining the mechanisms of effective and sustainable digital transition in the context of SMEs.

4. GAP IN THE LITERATURE

Theoretical Gaps

Although the literature on digital transformation and sustainability performance of SMEs has grown rapidly in recent years, this systematic review reveals a number of theoretical gaps that still require further attention.

Most studies still rely on a single theoretical approach, particularly the Resource-Based View (RBV), to explain the relationship between digital capabilities and sustainability. While this approach is useful in understanding the importance of internal resources, it is less able to explain the dynamics of strategic adaptation and response to rapid environmental change. Only a small number of studies explicitly adopt Dynamic Capability Theory (DCT), and even fewer integrate it with other theories to more comprehensively understand the digital transformation process (He et al., 2024; Wang & Esperança, 2023).

There is a lack of integration between internal and external organizational theories. While some studies have begun to use institutional theory to highlight regulatory pressures and social norms driving digitalization (Alkaraan et al., 2022), studies that systematically combine institutional theory with internal capability theory (such as DCT) are rare. In the context of SMEs, which are heavily influenced by market structures and public policy, this integration would be extremely useful in explaining variations in the success rate of digital adoption.

Most articles tend to view digital transformation as a purely technical or operational factor, failing to incorporate it into a comprehensive strategic change process within an organization. However, based on the business model innovation approach proposed by Chatterjee et al. (2024), digital transformation should be viewed as a catalyst for changes in business models, organizational values, and stakeholder relationships. Unfortunately, few studies have developed theoretical models that conceptually bridge digitalization, organizational strategy, and sustainability.

There are limitations in explaining the mediation and moderation relationships between digital transformation and sustainability performance. For example, only a small number of articles explain how variables such as digital leadership, innovation culture, or technological

readiness mediate the relationship (Cristea et al., 2022). Similarly, contextual factors such as industry sector, company size, or geographic region are rarely used as moderating variables in robust theoretical models.

There is a lack of theoretical frameworks that explain the social dimensions of sustainability in the context of SMEs. Most research focuses solely on environmental and economic sustainability, while social aspects such as equality, inclusivity, and community development remain underexplored. This presents a significant opportunity for the development of more comprehensive and humanistic theories in the study of digital transformation.

Methodological Gaps

In addition to theoretical gaps, this systematic review also identified several significant methodological gaps in the literature addressing the link between digital transformation and SME sustainability performance. These gaps arise from research design, analytical approaches, and the scope of the data used.

There is a heavy reliance on survey-based quantitative approaches, particularly cross-sectional methods. Nearly two-thirds of the studies in this review used a single time-series data set, which cannot capture the longitudinal dynamics of digitalization change. This limits the understanding of the digital transformation process as a gradual and contextually adaptive journey. Studies such as He et al. (2024) and Bag et al. (2021) do present robust quantitative models, but they fail to explore the non-linear factors that often emerge in SME practices.

Only a few studies have adopted in-depth qualitative approaches such as case studies or exploratory interviews. However, in the context of SMEs, which vary widely in culture, structure, and strategy, these approaches can provide richer insights into barriers, motivations, and best practices for digital transformation. Studies such as Chatterjee et al. (2024) and Cristea et al. (2022), which use qualitative methods, are able to depict the complexities of digital change in a more nuanced way. However, their number remains very limited in the overall literature.

The use of mixed methods, which combine the strengths of quantitative and qualitative approaches, is still relatively rare, although several studies, such as Sankar et al. (2025), have demonstrated the effectiveness of this approach in bridging empirical validity and narrative depth. However, in studies that combine strategic and technological aspects, mixed methods are highly recommended to simultaneously generate generalizations and in-depth understanding.

The limited contextual data is also a problem. Many studies fail to account for important contextual variables such as geographic location, industry sector, digital maturity level, and company size in their analysis models. As a result, the results and implications of these studies tend to be homogenous and less relevant when applied across countries or sectors.

There is a lack of exploration of mediating and moderating mechanisms in the analytical models used. Most studies only examine direct relationships between key variables without investigating how and under what conditions these relationships might change. Only a few articles examine the mediating role of innovation capability or digital leadership, such as those in Wang & Esperança (2023) and Fonseka et al. (2022), which indicate that the relationship between digital transformation and sustainability is not direct but is heavily influenced by intervening and external factors.

Contextual Gaps

This systematic review also revealed a significant contextual gap in the literature on digital transformation and SME sustainability performance. While studies in this area are growing in quantity and quality, most remain concentrated on specific geographic contexts, industry sectors, and SME typologies, limiting the generalizability of the results and their practical relevance to other contexts.

Studies predominantly come from countries with relatively advanced digital infrastructure, such as China, Germany, or South Korea. These studies provide important insights into how government policies, innovation ecosystems, and access to capital accelerate technology adoption in SMEs (Huang et al., 2025; Bag et al., 2021). However, little literature addresses how SMEs in developing countries with technological limitations, weak institutions, and limited access to capital adopt digital transformation for sustainability. This creates a gap in understanding how digitalization evolves in resource-constrained environments.

Most studies focus on the manufacturing and technology sectors, with very few examining the services, agriculture, or creative economy sectors. Yet, sector characteristics significantly influence the form and impact of digital transformation. For example, service-based SMEs tend to adopt digitalization through platforms and customer interactions, while the agribusiness sector faces challenges in infrastructure access and digital literacy. This lack of cross-sector exploration means that the current literature does not reflect the diversity of digital transformation practices within the SME landscape as a whole (Cristea et al., 2022; Chatterjee et al., 2024).

The reviewed studies rarely differentiate between SME types and sizes, despite the fact that micro, small, and medium-sized enterprises (MSMEs) have very different capabilities, challenges, and transformation needs. Many articles use the term "SMEs" generically without specifying the specific characteristics of the unit of analysis. Consequently, policy interventions or strategic recommendations derived from these studies are difficult to accurately apply to different SME groups.

There is a lack of exploration of the cultural, gender, and demographic aspects of SME owners/managers in relation to digital decision-making and sustainability strategies. Few studies have explored how local values, social structures, or differences in leadership styles influence the effectiveness of digital transformation. For example, cultures of collectivism or authoritarianism within family organizations in some regions can act as barriers or drivers to technology adoption, depending on the context.

Finally, very few studies link digital transformation to changes in the local business ecosystem, such as the role of communities, educational institutions, and governments in supporting the digital sustainability of SMEs. Digital literacy, local social networks, and community dynamics are often key factors unmeasured in quantitative models.

5. FUTURE RESEARCH AGENDA

Based on the identification of theoretical, methodological, and contextual gaps in the literature, this SLR suggests a number of strategic directions for future research to deepen the understanding and practice of digital transformation that supports the sustainability performance of SMEs.

Future research needs to develop an integrative theoretical framework that combines internal and external organizational perspectives. For example, integrating Dynamic Capability Theory with Institutional Theory would enrich our understanding of how SMEs adapt to external pressures while building internal capabilities for sustainable digitalization. This cross-theoretical approach also allows for a more holistic understanding of the relationship between technology strategy, organizational culture, and the complex regulatory context.

Broader and more inclusive contextual research is needed, particularly on SMEs in developing countries, remote areas, or non-traditional sectors such as agriculture, tourism, and the creative economy. These studies can provide new insights into how infrastructure limitations, local norms, and informal practices influence the form and effectiveness of digitalization in improving sustainability performance. Furthermore, cross-country and cross-cultural studies can also compare the success of digital transformation across different institutional systems.

Future research should delve deeper into the mediating and moderating mechanisms in the relationship between digital transformation and sustainability. The roles of digital leadership, organizational culture, innovation capabilities, and cross-sector collaboration should be analyzed as key variables that bridge or strengthen the impact of digitalization on sustainability. This approach will not only enhance theoretical validity but also provide practical guidance for implementing policies and strategies on the ground.

It is crucial to explore the social implications of digital transformation in the context of sustainability, which remains largely under-researched in the literature. How digitalization impacts social inclusion, gender equality, worker well-being, and local community participation is a highly relevant area for discussion, particularly within the framework of sustainable development goals (SDGs). Combining a social-humanistic approach with strategic management will broaden the scientific scope and usefulness of research.

6. CONCLUSION

This systematic review highlights the importance of digital transformation as a strategic driver in improving the sustainability performance of SMEs. An analysis of 40 scientific articles found that digitalization can contribute significantly to the environmental, social, and economic dimensions of sustainability, but this success is highly dependent on an organization's internal capabilities, technological readiness, external pressures, and stakeholder engagement.

The reviewed studies indicate that commonly used theoretical approaches such as the Resource-Based View and Dynamic Capability Theory can help explain the internal mechanisms of digital transformation processes. However, there is a need to integrate these approaches with institutional and stakeholder theories to better understand the complexities of the external environment faced by SMEs. Furthermore, the methodology used is still dominated by quantitative, survey-based approaches, while qualitative and mixed-methods approaches are rarely used despite their relevance in capturing the contextual nuances and dynamics of organizational change.

A gap in the literature is also identified in terms of context, with most research focusing on specific countries and sectors. There is still considerable scope for in-depth studies in the context of developing countries, non-manufacturing sectors, and micro or informal enterprises, which also face unique digitalization and sustainability challenges.

This SLR review not only synthesizes key findings from the existing literature but also proposes a more integrative, longitudinal, contextual, and exploratory future research agenda. It is hoped that the findings and recommendations from this review can serve as theoretical and practical references for researchers, policymakers, and SMEs in designing digital transformation strategies that are not only innovative and adaptive but also oriented towards long-term sustainability.

BIBLIOGRAPHY

Abbes, I. (2025). Strategic pathways for innovation and sustainability in digital transformation: Insights from leading global companies. Social Sciences and Humanities Open, 12(December 2024), 101906. https://doi.org/10.1016/j.ssaho.2025.101906

Avelar, S., Borges-Tiago, T., Almeida, A., & Tiago, F. (2024). Confluence of sustainable entrepreneurship, innovation, and digitalization in SMEs. Journal of Business Research, 170(October 2023). https://doi.org/10.1016/j.jbusres.2023.114346

Belas, J., Kliestik, T., Dvorsky, J., & Streimikiene, D. (2025). Exploring gender-based disparities in the digital transformation and sustainable development of SMEs in V4 countries. Journal of Innovation and Knowledge, 10(2), 100681. https://doi.org/10.1016/j.jik.2025.100681

Boonmee, C., Mangkalakeeree, J., & Jeong, Y. (2025). Towards sustainable digital

transformation: AI adoption barriers and enablers among SMEs in Northern Thailand. Sustainable Futures, 10(September), 101169. https://doi.org/10.1016/j.sftr.2025.101169

Chaichana, T., Reeve, G., Jaisan, C., & Chakrabandhu, Y. (2024). Modeling and assessing new SME digital business status for visualizing virtual economics and sustainability economic indicators: Empirical evidence from poultry business. Heliyon, 10(9), e30624. https://doi.org/10.1016/j.heliyon.2024.e30624

Chatzistamoulou, N. (2023). Is digital transformation the Deus ex Machina towards sustainability transition of the European SMEs? Ecological Economics, 206(January), 107739. https://doi.org/10.1016/j.ecolecon.2023.107739

Cheng, Z., Jin, X., & Kwak, W. J. (2025). Using the new positive aspects of digital leadership to improve organizational sustainability: Testing moderated mediation models. Acta Psychologica, 255(March), 104963. https://doi.org/10.1016/j.actpsy.2025.104963

Chung, L., Tan, K. H., & Yoshie, O. (2025). Sustainable circular economy: Unpacking the unintended consequences of digital transformation in Japanese SMEs. Technological Forecasting and Social Change, 221(September), 124335. https://doi.org/10.1016/j.techfore.2025.124335

Clemente-Almendros, J. A., Nicoara-Popescu, D., & Pastor-Sanz, I. (2024). Digital transformation in SMEs: Understanding its determinants and size heterogeneity. Technology in Society, 77(October 2023), 102483. https://doi.org/10.1016/j.techsoc.2024.102483

Costa Melo, DI, Queiroz, GA, Alves Junior, PN, Sousa, TB de, Yushimito, WF, & Pereira, J. (2023). Sustainable digital transformation in small and medium enterprises (SMEs): A review on performance. Heliyon, 9(3), e13908. https://doi.org/10.1016/j.heliyon.2023.e13908

Cuevas-Vargas, H., Armendáriz-Esparza, D.A., González-Vega, A.M. del C., & Cossio-Vargas, E. (2024). Digitalization strategies and sustainability benefits in Mexican SMEs: Unveiling the mediating role of innovation. Procedia Computer Science, 242, 1299–1306. https://doi.org/10.1016/j.procs.2024.08.135

Fortier, J., Gamache, S., & Fonrouge, C. (2025). Reconciling digital transformation and sustainability: Towards a tailor-made strategy for manufacturing SMEs. IFAC-PapersOnLine, 59(10), 1053–1058. https://doi.org/10.1016/j.ifacol.2025.09.178

Garay Gallastegui, L.M., & Reier Forradellas, R. (2024). FASECO: A Framework for Advanced Support of E-Commerce and digital transformation in SMEs with natural language processing-enhanced analysis. Journal of Open Innovation: Technology, Markets, and Complexity, 10(4), 100412. https://doi.org/10.1016/j.joitmc.2024.100412

Hadi, NU, Almessabi, B., & Imran Khan, M. (2025). Leveraging industry 4.0 and circular open innovation for digital sustainability: The role of circular ambidexterity. Journal of Open Innovation: Technology, Markets, and Complexity, 11(2), 100545. https://doi.org/10.1016/j.joitmc.2025.100545

Hafeez, S., Shahzad, K., & De Silva, M. (2025). Enhancing digital transformation in SMEs: The dynamic capabilities of innovation intermediaries within ecosystems. Long Range Planning, 58(3), 102525. https://doi.org/10.1016/j.lrp.2025.102525

Hafeez, S., Shahzad, K., Helo, P., & Mubarak, M. F. (2025). Knowledge management and SMEs' digital transformation: A systematic literature review and future research agenda. Journal of Innovation and Knowledge, 10(3), 100728. https://doi.org/10.1016/j.jik.2025.100728

Huang, Y., Liu, Q., Xiong, N., & Liu, C. (2025). Digital transformation and environmentally sustainable innovation: Based on machine learning and text analysis methods. Journal of Environmental Management, 393(January), 127090. https://doi.org/10.1016/j.jenvman.2025.127090

Huiping, Z., & Ao, Z. (2025). How does digital platform capability affect digital innovation? Evidence from manufacturing SMEs in China. Technological Forecasting and Social Change, 221(September), 124338. https://doi.org/10.1016/j.techfore.2025.124338

Jie, H., Gooi, L.M., & Lou, Y. (2025). Digital maturity, dynamic capabilities and innovation performance in high-tech SMEs. International Review of Economics and Finance, 99(November 2024), 103971. https://doi.org/10.1016/j.iref.2025.103971

Karikari, F.A., Boateng, S.A., Fumey, M.P., Opoku, A., & Adela, V. (2025). Digital transformation and green practices: pathways to sustainable SME performance in Ghana. Scientific African, 30(October), e03026. https://doi.org/10.1016/j.sciaf.2025.e03026

Kim, J., & Jin, W. (2024). Impact of digital capabilities on entrepreneurial performance in SMEs. Journal of Innovation and Knowledge, 9(4), 100609. https://doi.org/10.1016/j.jik.2024.100609

Kiran, K.S., Gupta, S., Luthra, S., & Jagtap, S. (2023). Role of digitalized sustainable manufacturing in SME'S: A bibliometric analysis. Materials Today: Proceedings, (xxxx). https://doi.org/10.1016/j.matpr.2023.02.234

Kokubun, K. (2025). Ambidextrous SMEs for a sustainable society. A narrative review considering digitalization, open innovation, human resources and green innovation. Next Research, 2(4), 100839. https://doi.org/10.1016/j.nexres.2025.100839

Malewska, K., Cyfert, S., Chwiłkowska-Kubala, A., Mierzejewska, K., & Szumowski, W. (2024). The missing link between digital transformation and business model innovation in energy SMEs: The role of digital organizational culture. Energy Policy, 192(February). https://doi.org/10.1016/j.enpol.2024.114254

Maseda, A., Iturralde, T., & Arzubiaga, U. (2025). Unpacking the role of entrepreneurial orientation in the digital transformation of family SMEs: The importance of leadership structure and generational involvement. Technological Forecasting and Social Change, 219(March), 124248. https://doi.org/10.1016/j.techfore.2025.124248

Merín-Rodrigáñez, J., Dasí, À., & Alegre, J. (2024). Digital transformation and firm performance in innovative SMEs: The mediating role of business model innovation. Technovation, 134(May). https://doi.org/10.1016/j.technovation.2024.103027

Muhammad, SS, Dey, BL, Kamal, MM, Samuel, L., & Alzeiby, EA (2025). Digital transformation or digital divide? Smes' use of AI during global crisis. Technological Forecasting and Social Change, 217(October 2024), 124184. https://doi.org/10.1016/j.techfore.2025.124184

Oh, S., & Hwang, S. (2025). How does digital capability translate into export performance?: The critical mediating role of GVC upgrading. Asia and the Global Economy, 5(2), 100116. https://doi.org/10.1016/j.aglobe.2025.100116

Pan, Q., Liu, P., Lin, Z., & Zhu, B. (2025). Digital transformation of Chinese manufacturing SMEs under government guidance: Conflict analysis based on GMCR with prospect stability. Information Sciences, 719(July), 122475. https://doi.org/10.1016/j.ins.2025.122475

Pangarso, A., Greece, A., Umbara, T., Hendriyanto, R., Sisilia, K., & Panutur, SS (2025). Uncovering the secrets of sustainable performance: Empirical studies on ethical behavior, fortitude culture, ambidextrous governance and digital innovation using combined importance-performance map analysis. Sustainable Futures, 10(1), 101181. https://doi.org/10.1016/j.sftr.2025.101181

Rahman, SA, Taghizadeh, NS, Tipu, SAA, & Far, SM (2025). Leveraging dynamic capabilities for digital transformation: Exploring the moderating role of costs in environmental performance of SMEs. Journal of Open Innovation: Technology, Markets, and Complexity, 11(2), 100523. https://doi.org/10.1016/j.joitmc.2025.100523

Rajagopal, R., Hettiarachchi, C., & Zürn, S. G. (2024). Using a Result-Oriented Systems

Thinking approach to design and evaluate strategies for the digital transformation management of small and medium-sized enterprises (SMEs). Sustainable Manufacturing and Service Economics, 3(April), 100023. https://doi.org/10.1016/j.smse.2024.100023

Saeedikiya, M., Salunke, S., & Kowalkiewicz, M. (2024). Toward a dynamic capability perspective of digital transformation in SMEs: A study of the mobility sector. Journal of Cleaner Production, 439(September 2023), 140718. https://doi.org/10.1016/j.jclepro.2024.140718

Seppänen, S., Ukko, J., & Saunila, M. (2025). Understanding determinants of digital transformation and digitizing management functions in incumbent SMEs. Digital Business, 5(1). https://doi.org/10.1016/j.digbus.2025.100106

Shirwa, A.M., Hassan, A.M., Hassan, A.Q., & Kilinc, M. (2025). A cooperative governance framework for sustainable digital transformation in construction: The role of digital enablement and digital strategy. Results in Engineering, 25(January), 104139. https://doi.org/10.1016/j.rineng.2025.104139

Silva, R.P., Mamede, H.S., & Santos, V. (2025). A new proposed model to assess the digital organizational readiness to maximize the results of the digital transformation in SMEs. Journal of Innovation and Knowledge, 10(1). https://doi.org/10.1016/j.jik.2024.100644

Succurro, M., & Donati, C. (2025). The role of the regulatory framework in enhancing SMEs' digital transformation. International Review of Law and Economics, 83(November 2024), 106263. https://doi.org/10.1016/j.irle.2025.106263

Tom, C., & Jos, C. (2025). Linking environmental sustainability, digital transformation, and innovation*: Evidence from micro-enterprises and SMEs*. 10(October). https://doi.org/10.1016/j.jik.2025.100849

Wang, G., Mansor, Z. D., & Leong, Y. C. (2024). Linking digital leadership and employee digital performance in SMEs in China: The chain-mediating role of high-involvement human resource management practices and employee dynamic capability. Heliyon, 10(16), e36026. https://doi.org/10.1016/j.heliyon.2024.e36026

Wang, S., & Esperança, J. P. (2023). Can digital transformation improve market and ESG performance? Evidence from Chinese SMEs. Journal of Cleaner Production, 419(June). https://doi.org/10.1016/j.jclepro.2023.137980

Wang, S., & Zhang, H. (2025). Enhancing SMEs sustainable innovation and performance through digital transformation: Insights from strategic technology, organizational dynamics, and environmental adaptation. Socio-Economic Planning Sciences, 98(November 2024). https://doi.org/10.1016/j.seps.2024.102124

Xia, T., & Chen, X. (2025). Unlocking sustainable production pathways: Digital transformation driving green dual innovation in Chinese enterprises. Cleaner Environmental Systems, 19(July). https://doi.org/10.1016/j.cesys.2025.100301