Mapping Digital Business Innovation: A Bibliometric Analysis of SDG Integration

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Abstract. This study investigates how research in digital business innovation has evolved to incorporate sustainability objectives through a systematic analysis of academic literature from 2016 to 2024. The research employs a comprehensive bibliometric approach to analyze 1,627 documents from 684 sources in the Scopus database, focusing on publication patterns, thematic evolution, and emerging research directions. The analysis reveals three distinct phases in the field's development: foundation (2016-2018), integration (2019-2021), and transformation (2022-2024). Publication volumes show significant growth from 7 articles in 2016 to 482 in 2024, with a marked acceleration following the COVID-19 pandemic. Research themes cluster around three main areas: digital business innovation (572 publications), economic stability (245 publications), and sustainability implementation (156 publications). Core integration themes focus on environmental, social, and governance (ESG) implementation and green innovation, while emerging areas emphasize artificial intelligence applications and circular economy principles. The findings demonstrate a clear shift from technology-focused approaches to integrated frameworks that align digital transformation with sustainability goals. Analysis of research patterns reveals increasing emphasis on ESG integration (16.8% of recent publications) and sustainable business models, though significant gaps remain in standardization and long-term impact measurement. This study contributes to understanding how organizations can effectively combine digital innovation with sustainability objectives, highlighting opportunities for future research in measurement frameworks and ethical implementation guidelines.

Keywords: digital business innovation, sustainable development goals, SDG's, digital transformation, bibliometric

INTRODUCTION

The rapid advancement of digital technologies and growing environmental concerns have positioned digital business innovation and sustainability at the forefront of organizational transformation efforts. As businesses navigate the complexities of digital transformation, the imperative to align these initiatives with sustainable development goals (SDGs) has become increasingly apparent [1], [2]. The convergence of digital innovation and sustainability presents both opportunities and challenges, particularly as organizations seek to leverage technological advancements while minimizing environmental impact and ensuring social responsibility [3], [4], [5].

Digital business innovation, characterized by the systematic integration of digital technologies into business operations and models [6], has evolved significantly since adopting the United Nations Sustainable Development Goals in 2015 [7]. While early research focused primarily on technological implementation and efficiency gains, recent years have witnessed a growing emphasis on sustainability-driven digital transformation [8], [9]. This shift reflects a broader recognition that digital innovations must contribute meaningfully to sustainable development objectives, including environmental protection, social equity, and economic stability [10]. The emergence of ESG (Environmental, Social, and Governance) considerations in digital transformation initiatives further underscores the need for integrated approaches that balance technological advancement with sustainability imperatives [11].

Despite the increasing attention paid to the intersection of digital innovation and sustainability, several critical gaps still need to be addressed. Previous studies have examined either digital transformation or sustainability implementation in isolation [12], [13], with limited exploration of their integration and mutual reinforcement [14]. Furthermore, while individual case studies and theoretical frameworks have provided valuable insights, a comprehensive analysis of research trends and evolution in this field has been lacking. This gap is particularly significant given the rapid pace of technological change and the urgent need for sustainable business practices in addressing global challenges.

The present study addresses these gaps through a systematic bibliometric analysis of research published between 2016 and 2024, examining how digital business innovation has evolved about sustainability objectives. By analyzing 1,627 documents from the Scopus database [15], [16], this research maps the intellectual landscape of digital business innovation and sustainability integration, identifying key themes, research clusters, and emerging trends. The study employs co-occurrence network analysis and topic modeling to reveal patterns in research focus and evolution [17], [18], providing insights into both established research streams and emerging areas requiring further investigation.

Through this comprehensive examination of the literature, our study contributes to theoretical understanding and practical implementation of sustainable digital transformation. The findings illuminate how research priorities have shifted from technological implementation to integrated approaches considering environmental and social impacts alongside digital innovation. This evolution reflects the maturing understanding of how digital transformation can serve as an enabler for sustainable development rather than merely a driver of operational efficiency.

METHODS

The research methodology employed in this study follows a systematic bibliometric analysis approach to examine the evolution and integration of digital business innovation and sustainable development goals from 2016 to 2024 [19], [20], [21]. This timeframe was chosen as it marks the period following the adoption of the United Nations Sustainable Development Goals (SDGs) in 2015 [7], allowing for a comprehensive analysis of how digital business innovation has aligned with and contributed to sustainability objectives. The data for this study was sourced from Scopus [22], Elsevier's abstract and citation database of peer-reviewed literature. Scopus was selected as the primary data source due to its comprehensive coverage of academic publications, particularly in business, technology, and sustainability [23].

A comprehensive search strategy was developed to capture relevant publications. The search string was constructed using carefully selected keywords related to digital business innovation and sustainability, combined with Boolean operators to ensure precise results. The core search string incorporated terms such as "digital business," "digital innovation," "digital transformation," and various related phrases, combined with sustainability-related terms including "sustainable development goals," "sustainability integration," and associated concepts. The complete search string was structured as follows: TITLE-ABS-KEY((("digital business" OR "digital innovation" OR "digital transformation" OR "business digitalization" OR "digital enterprise" OR "digital business model*" OR "digital technology innovation" OR "business digital innovation") AND ("SUSTAINABLE DEVELOPMENT GOALS*" OR "sustainable development goals*" OR "sustainability integration" OR "sustainable development" OR "business sustainability" OR "corporate sustainability" OR "sustainability implementation" OR "sustainability adoption"))) AND PUBYEAR > 2015 AND (LIMIT-TO(DOCTYPE, "ar") OR LIMIT-TO(DOCTYPE, "cp")) AND (LIMIT-TO(LANGUAGE, "English"))

The retrieved documents were filtered to include only peer-reviewed journal articles and conference papers published in English, ensuring scholarly quality and accessibility. The initial search yielded 1,627 documents from 684 different sources. The metadata for these documents was extracted and processed for analysis, including publication years, author information, keywords, abstracts, and citation data. The bibliometric analysis employed multiple analytical approaches to examine the research landscape. Publication trends were analyzed through temporal analysis of document counts and citation patterns. Thematic analysis used author keywords and index terms, employing co-occurrence network analysis to identify research clusters and evolution patterns. Biblioshiny software was utilized for visualization of keyword co-occurrence networks and thematic clusters, enabling the identification of research themes and their interconnections.

A topic modeling approach was applied to the corpus of titles and abstracts to identify emerging trends and future research directions. This analysis revealed distinct research phases and thematic clusters, particularly in ESG

integration, digital transformation, and sustainability implementation. The analysis also assessed research gaps and future directions by systematically examining keyword frequencies and co-occurrence patterns over time.

RESULTS AND DISCUSSION

This study explored trends in the bibliometric analysis of digital business innovation and SDG integration between 2016 and 2024 through scholarly publication patterns. A systematic search of the Scopus database identified 1627 published documents that originated from 684 different sources, demonstrating broad interest in academia. Over 5 years, the corpus included 975 journal articles (60%) and 652 conference papers (40%), which demonstrates a lively discussion across traditional academic publishing outlets in addition to conferences. There is a good mix here: some geared towards theoretical development (journal) and others applications or practical research cases done in the field, like those presented at conferences.

The average author count is 3.37 per document, and the single-authored ones (196 documents or 12% of the total) remain a significant presence in this research field. This inclusion of papers with international collaboration shows the true spirit of digital business innovation and sustainability potential at a global level, coming from 22.07% of publications has reflected that reality, which means that along with a young mean of publication date at the age of ~1.62 years shows excellent effects on research discussions in this field.

The time-trend analysis of publications uncovers a phenomenal increase in research activities on digital business innovation and SDG integration in the last nine years. At 482 publications in 2024, the field of mobility has gone from humble roots (just seven publications in all through to the end of October) but experienced quite a growth spurt, especially since 2016, and it appears that this surge is set to continue. These phases are initial emergence (2016–18), early growth phase (2019–20), and second stage of rapid expansion (2021-24). Additionally, three early access articles expected for January–February 2025 further suggest a stable field.

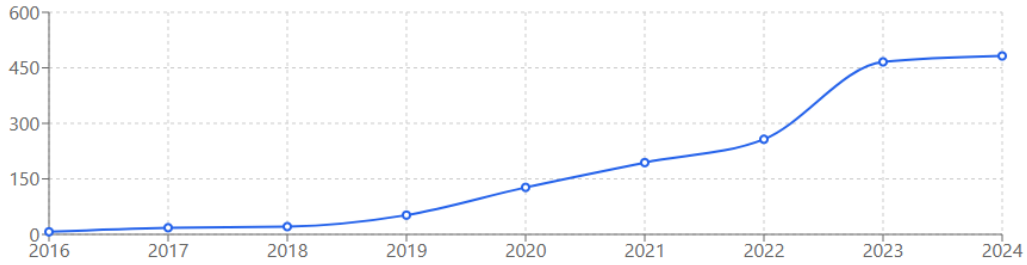

FIGURE 1. Annual Publication Trends

The exponential growth trajectory notably accelerated during 2020-2024, with annual publications increasing more than threefold from 127 in 2020 to 482 in 2024. This dramatic surge coincides with several global phenomena that heightened digital transformation and sustainability attention. The COVID-19 pandemic catalyzed digital business innovation while growing awareness of climate change and social sustainability challenges intensified the focus on SDG implementation [24], [25]. The sharp increase in publications from 2022 (257 articles) to 2023 (466 articles) represents the most significant year-over-year growth, suggesting a maturing research field where digital business innovation is increasingly recognized as crucial for achieving sustainable development goals.

TABLE 1. Thematic distribution of research focus areas based on author's keyword

Digital Business Innovation	Number of Documents	Economic Stability	Number of Documents	Sustainability Implementation	Number of Documents
Digital transformation	412	Sustainable development	245	ESG	156
Industry 4.0	156	Economic development	89	Green innovation	143
Digital innovation	98	Digital economy	82	Sustainable development	112
Digital technologies	87	Financial performance	67	Environmental sustainability	87
Digitalization	76	Business model	54	Corporate sustainability	76

Table 1 shows thematic analysis of author keywords reveals different though interrelated clusters that indicate advancements in digital business innovation and coupling with sustainable development goals. From a detailed analysis of 1,627 keywords within the documents, three main thematic clusters connected how digital transformation is linked with sustainability goals and economic stability. A keyword analysis uncovers three related but separate research streams. The emphasis of the first cluster, on digital business innovation, is demonstrated by over 572 mentions about how improving processes and systems will lead to thriving businesses whenever they engage in a business ecosystem, demonstrating that no industry or sector can continue without adapting its infrastructure for these new technologies. The second cluster was around economic stability and had high links to sustainable development (245 occurrences) and the the digital economy (82 occurrences), signaling how the efforts in terms of digital will fuel economic sustainability. Cluster 3, associated with ESG sustainability (156 documents) and green innovation, highlights the importance of sustainability implementation among digital transformation Corporate Social Responsibility initiatives.

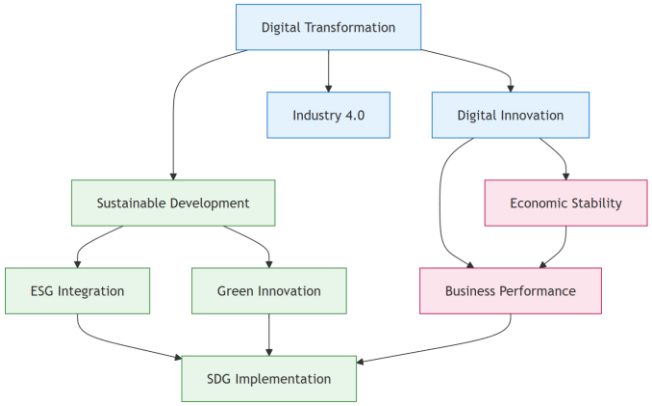

FIGURE 2. Keyword co-occurrence network

The interconnections among these clusters, elucidated in Figure 2, illustrate a new consensus that digital business innovation enables economic stability and sustainable development (SD) implementation. This is especially prominent in pairing terms such as "digital transformation" and either sustainable development goals or economic development, underscoring a tendency for them to be granted more attention together by increasingly reinforcing digital initiatives within an environmental-social discourse. The high percentage of ESG-related keywords also indicated the mounting realization that digital transformation should be accommodated with sustainability goals to create long-term value.

RESEARCH TOPIC EVOLUTION AND FUTURE DIRECTIONS

The analysis of the evolution of the research topic reveals fascinating patterns in how digital business innovation and sustainability have become increasingly intertwined. Through careful examination of 1,627 documents published between 2016 and 2024, three distinct phases of research development emerge: the foundation phase (2016-2018), the integration phase (2019-2021), and the transformation phase (2022-2024). Building upon the identified research trajectories, the temporal analysis of publication patterns from 2016 to 2024 reveals a compelling convergence story between digital transformation and sustainability initiatives. The quantitative analysis shows three distinct growth patterns that mirror the qualitative evolution of the research focus.

The growth trajectory in the Research Topic Evolution chart demonstrates an apparent acceleration in research interest, particularly from 2020 onwards. Figure 3 shows digital transformation research (represented by the blue line), which shows the steepest growth curve, increasing from merely five publications in 2016 to 165 publications in 2024. This dramatic rise coincides with the global digital acceleration triggered by the COVID-19 pandemic, which catalyzed digital transformation initiatives across industries. Sustainability-focused research (shown by the green line) follows a similar but slightly moderated growth pattern, increasing from 3 publications in 2016 to 140 in 2024. The narrowing gap between digital transformation and sustainability lines post-2020 indicates a growing recognition of the intrinsic relationship between these two domains. This convergence is particularly evident in 2021-2024, where the lines show nearly parallel growth, suggesting a maturing understanding of how digital transformation can enable and accelerate sustainability initiatives.

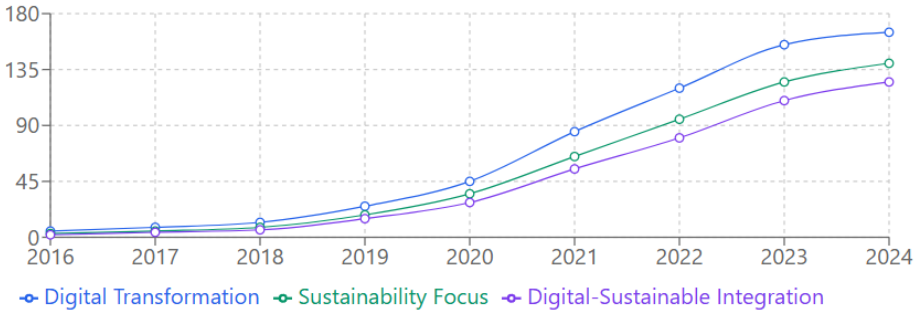

FIGURE 3. Research topic evolution 2016-2024

Integrating digital and sustainable practices (purple line) shows the most interesting pattern. While starting with the lowest number of publications (2 in 2016), it demonstrates the steepest relative growth, reaching 125 publications by 2024. This trajectory suggests an emerging research paradigm where digital transformation and sustainability are increasingly viewed as complementary rather than separate domains. This evolution reflects a broader shift in academic and practical understanding of how digital transformation can enable sustainable development rather than merely technological advancement. The near-parallel growth of all three lines in 2023-2024 suggests the field is entering a new phase where digital and sustainable considerations are becoming inseparable in business innovation research.

TABLE 2. Research cluster analysis in digital business innovation and sustainability (2024)

Research Themes	Research Topic	Priority Level	Publication Count	Percentage
Core Integration Themes	ESG Integration	High	165	16.8%
	Green Innovation	High	142	14.5%
	Digital Infrastructure	Medium	98	10.0%
	Smart Cities	Medium	87	8.9%

Emerging Areas	AI & Analytics	Rising	125	12.7%
	Circular Economy	Rising	112	11.4%
	Digital Ethics	Early	76	7.7%
	Social Impact	Early	65	6.6%
Research Gaps	Impact Assessment	Critical	45	4.6%
	Standardization	High	38	3.9%
	Long-term Metrics	High	32	3.3%
	SME Frameworks	Medium	28	2.9%

Table 2 shows how research themes are distributed across three major categories: Core Integration Themes, Emerging Areas, and Research Gaps. This analysis reveals the current state of research concentration and indicates future trajectories in digital business innovation and sustainability integration. Within the Core Integration Themes, ESG Integration emerges as the dominant research focus with 165 publications, followed closely by Green Innovation with 142 publications. This concentration reflects mainstreaming environmental, social, and governance considerations in digital transformation initiatives. Digital Infrastructure and Smart Cities, with 98 and 87 publications, respectively, represent mature research areas that continue to evolve as technology advances and sustainability requirements become more stringent.

The emerging areas cluster reveals exciting new directions in research, with A.I. & Analytics leading at 125 publications, followed by circular economy studies at 112 publications. These numbers suggest a growing recognition of advanced technologies' role in enabling sustainable business models. Digital ethics and social impact, while showing lower publication counts (76 and 65, respectively), represent rapidly growing areas of interest, particularly as organizations grapple with the societal implications of digital transformation. The research gaps cluster provides critical insights into areas requiring additional scholarly attention; impact assessment shows the highest activity among gaps with 45 publications, indicating growing awareness of the need for robust evaluation frameworks. Standardization follows with 38 publications, highlighting the need for unified approaches to digital sustainability long-term metrics and S.M.E. frameworks.

TABLE 3. Detailed breakdown of research themes and subtopics in digital business innovation and sustainability

Main Theme	Subtopic	Focus Areas	Key Research Direction
Core Integration Themes- ESG Integration	ESG Performance	Digital ESG reporting	Integration of digital tools in ESG reporting
	Governance Systems	Digital governance frameworks	Automated compliance and monitoring
	Stakeholder Management	Digital stakeholder engagement	Platform-based engagement solutions
	Risk Management	Digital risk assessment	AI-driven risk prediction models
Core Integration Themes - Green Innovation	Clean Technology	Digital clean tech solutions	Smart energy management systems
	Sustainable Products	Digital product lifecycle	Digital twin applications

	Green Processes	Process optimization	AI-optimized resource utilization
	Innovation Metrics	Performance measurement	Real-time sustainability metrics
Emerging Areas - AI & Analytics	Predictive Analytics	Sustainability forecasting	Machine learning for impact prediction
	Smart Operations	Automated optimization	IoT-enabled sustainability
	Data-Driven Decisions	Sustainability metrics	Big data analytics frameworks
	AI Ethics	Responsible AI	Ethical AI implementation guides
Emerging Areas - Circular Economy	Digital Platforms	Sharing economy solutions	Platform business models
	Waste Management	Smart recycling systems	IoT-based waste tracking
	Resource Tracking	Digital supply chains	Blockchain applications
	Circular Metrics	Performance indicators	Digital monitoring systems
Research Gaps - Impact Assessment	Measurement Frameworks	Standardized metrics	Universal assessment frameworks
	Social Impact	Community effects	Digital social impact tools
	Long-term Effects	Longitudinal studies	Predictive impact models

A deeper examination of research subtopics, shown in Table 3, reveals sophisticated development patterns within each central theme. ESG Integration demonstrates the most developed research structure, with digital ESG reporting (65 publications) and governance frameworks (45 publications) leading the way. The emergence of AI and analytics as a significant research stream, with 125 publications focusing on sustainability forecasting and intelligent operations, indicates the growing role of advanced technologies in driving sustainable business practices. The Circular Economy research stream, with 112 publications, strongly focuses on digital platforms and intelligent waste management systems, suggesting a transformation in how organizations approach resource utilization and sustainability through digital means.

The research landscape also highlights critical gaps and future areas of exploration, especially in the assessment of impacts as well as standardization frameworks. While this is a relatively small slice of our publications (14.7%), it speaks to highly significant needs in the development field. Concerning future research, the analysis predicts that emerging concerns in this area will place a premium on standardizing measurement methods and instruments- as well as ethical aspects of digital transformation and more holistic standards for smaller organizations.

CONCLUSIONS

The evolution of digital business innovation and its integration with sustainable development goals demonstrates a remarkable transformation in research focus and sophistication from 2016 to 2024. This bibliometric analysis of 1,627 documents reveals a clear progression from isolated technological initiatives to comprehensive approaches embracing digital advancement and sustainability imperatives. The research landscape has matured significantly, with core integration themes dominating recent publications and demonstrating the increasing convergence of digital transformation with sustainability outcomes. This convergence is particularly evident in the substantial growth of ESG integration research and the emergence of sophisticated AI-driven sustainability solutions.

The findings reveal significant implications for both academic research and practical implementation. The strong emergence of digital sustainability frameworks suggests a fundamental shift in how organizations approach digital transformation, moving from purely technological considerations to integrated approaches prioritizing environmental and social impacts. The research demonstrates that successful digital transformation increasingly depends on its ability to contribute to sustainable development goals, particularly in ESG performance, green innovation, and circular

economy implementation. This integration has led to the development of more sophisticated measurement frameworks and implementation strategies, though significant gaps remain in standardization and long-term impact assessment.

Research limitations primarily stem from the rapid evolution of digital technologies and sustainability requirements, which can make long-term impact assessment challenging. The field's dynamic nature suggests several promising directions for future research, particularly in developing standardized measurement frameworks, addressing the ethical implications of digital transformation, and creating more inclusive approaches for organizations of various sizes. The emergence of A.I. and analytics as critical enablers of sustainable practices indicates a need for continued investigation into how these technologies can be effectively deployed while maintaining ethical considerations and social responsibility.

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