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The Impact of Digital Transformation on Business Models: A Bibliometric Study

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ABSTRACT

This study explores the impact of digital transformation on business models through a bibliometric analysis of research indexed in the Scopus database, utilizing VOSviewer for data visualization. The analysis identifies "digital transformation" as a central theme, closely linked to emerging technologies such as artificial intelligence, big data, blockchain, and IoT, which are driving innovation and reshaping traditional business practices. Key research clusters highlight themes of strategic alignment, data-driven decision-making, and technological infrastructure as critical enablers of transformation. Additionally, sustainability and economic inclusivity emerge as new areas of focus, emphasizing the broader societal implications of digital transformation. Geographic and collaborative patterns reveal strong contributions from countries like the United States, China, and Germany, underscoring the global and interdisciplinary nature of the research. Despite the progress, challenges such as cybersecurity, cultural adaptation, and long-term resilience remain underexplored, offering directions for future research. This study provides valuable insights for academics and practitioners seeking to navigate the evolving landscape of digital transformation and business model innovation.

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1. INTRODUCTION

In the contemporary business environment, the imperative for organizations to embrace digital transformation has become indisputable. Digital transformation refers to the integration of digital technology into all areas of a business, fundamentally changing how businesses operate and deliver value to customers [1]. As technology evolves at an unprecedented rate, companies are compelled to adapt to these changes to enhance their competitive edge and sustainability. The advent of technologies such as artificial intelligence, big data analytics, cloud computing, and the Internet of Things (IoT) has not only facilitated the creation of innovative business models but has also disrupted existing ones [2]. The pervasive impact of digital transformation is evident across various sectors, from manufacturing and healthcare to finance and retail, indicating a universal shift towards digital-centric business practices.

The literature on digital transformation is extensive and highlights several key areas of impact. One of the primary areas affected is the business model of companies, where traditional strategies and operations are being reconsidered in the light of digital technologies [3]. Business models describe the rationale of how an organization creates, delivers, and captures value, and in a digital context, these models must evolve to incorporate new modes of value creation and delivery mechanisms. Companies like Amazon and Netflix exemplify this shift, having redefined retail and entertainment industries respectively through innovative digital business models [4]. As these companies demonstrate, digital transformation can lead to enhanced operational efficiencies, improved customer experiences, and new revenue streams.

However, despite the apparent benefits, the journey towards digital transformation is fraught with challenges. Organizations face various hurdles, including technological integration, data security concerns, and the need for a shift in organizational culture and mindset [5]. Moreover, the pace at which technological advancements are occurring demands continuous learning and adaptation, which can strain resources and disrupt traditional business operations. Thus, understanding the dynamics of how digital transformation influences business models is critical for managers and policymakers aiming to navigate this complex landscape effectively [6].

A bibliometric analysis offers a methodical approach to surveying the extant literature and unveiling the intellectual structure and evolutionary trends of research on a particular topic [7]. By analyzing research outputs, citation patterns, and co-authorship networks, bibliometric studies provide insights into the most influential studies, authors, and institutions, as well as emerging trends and gaps in the literature. This approach is particularly suitable for the field of digital transformation, where new themes and technologies continue to emerge, making it crucial to periodically assess the direction and focus of academic and practical inquiries.

Despite the extensive research on digital transformation, there remains a scarcity of comprehensive bibliometric studies that consolidate the existing literature on the impact of digital transformation on business models. Many studies focus on specific aspects of digital transformation or specific industries but lack a holistic view that integrates various dimensions and sectors. This gap hinders the ability of scholars and practitioners to fully understand the breadth and depth of the research, thereby affecting the formulation of strategies that effectively leverage digital transformation for business model innovation. The objective of this study is to conduct a bibliometric analysis of the literature on the impact of digital transformation on business models. This analysis will help identify the key themes, trends, and gaps in the current research. Additionally, it will provide a structured overview of how digital transformation influences business model innovation across different industries, thereby offering valuable insights for academics, industry practitioners, and policymakers.

2. LITERATURE REVIEW

2.1 Overview of Digital Transformation

Digital transformation is characterized by the integration of digital technology into all areas of business, fundamentally altering how companies operate and deliver value to customers. According to [8], digital transformation is not merely about technology but encompasses changes in leadership, different thinking, the encouragement of innovation and new business models, the use of technology to improve the experience of organizations' employees, customers, suppliers, partners, and stakeholders. Research by [9] further expands on this by identifying the dimensions of digital transformation, which include changes in business models, customer experience, operational processes, and corporate culture. This comprehensive approach

ensures that digital transformation can be understood not just in terms of technological adoption but as a holistic organizational change.

2.2 *Digital Technologies and Business Models*

The impact of digital technologies on business models has been profound. Technologies such as AI, blockchain, and IoT have enabled new forms of value creation and market engagement. For instance, [10] discuss how blockchain technology offers decentralized and secure options that can disrupt traditional business models by providing more transparent and efficient transaction mechanisms. Similarly, IoT has facilitated the development of smart products that continuously provide data to improve customer service and product enhancements [11]. Companies like Amazon have leveraged big data analytics to drive customer insights and optimize supply chains, leading to significant competitive advantages [12]. Furthermore, [13] suggest that digital transformation enables the creation of new digital products and services, enhancing an organization's value proposition and creating opportunities for digital monetization.

2.3 *Challenges in Digital Transformation*

Despite the opportunities, the shift towards digital business models is accompanied by significant challenges. [14] note that one of the most significant hurdles is the cultural change required within organizations to adapt to new digital realities. Resistance from employees and lack of digital literacy can severely hamper the successful implementation of digital initiatives. Moreover, security concerns, particularly with data breaches and cybersecurity threats, pose serious challenges for companies transitioning to digital platforms [14]. Organizational readiness and technological infrastructure also play critical roles in the success of digital transformation initiatives. As highlighted by [15], many organizations struggle with outdated IT systems that are not equipped to handle the influx of data and the sophisticated tools required for analytics and mobile technologies. Additionally, strategic alignment between digital transformation and business objectives is crucial, as misalignment can lead to fragmented efforts and wasted resources [15].

3. METHOD

This bibliometric study systematically collected data from the Scopus database, which is renowned for its comprehensive coverage of peer-reviewed literature across various disciplines including technology, business, and management. The search was conducted using specific keywords related to "digital transformation" and "business models" to ensure the relevance of the sourced articles. The search criteria were confined to articles published in English up to the current year to capture the most recent developments in the field. To manage the scope and focus of the analysis, the inclusion criteria limited the selection to research articles and review papers, excluding conference papers, book chapters, and other non-peer-reviewed literature. This approach ensured that the analysis was based on high-quality and impactful academic contributions.

For the analysis of the collected data, VOSviewer software was utilized, a tool specialized for constructing and visualizing bibliometric networks. This software enabled the identification and visualization of the most significant items in the dataset, such as key authors, institutions, countries, and terms frequently associated with digital transformation in business models. VOSviewer offers various methods of analysis, including co-citation, bibliographic coupling, and co-occurrence networks, which facilitated a comprehensive examination of the relationships and clusters within the literature. The analysis focused on mapping the thematic concentrations and tracking the evolution of research trends over time.

4. RESULT AND DISCUSSION

4.1 Results

a. Keyword Co-Occurrence Network

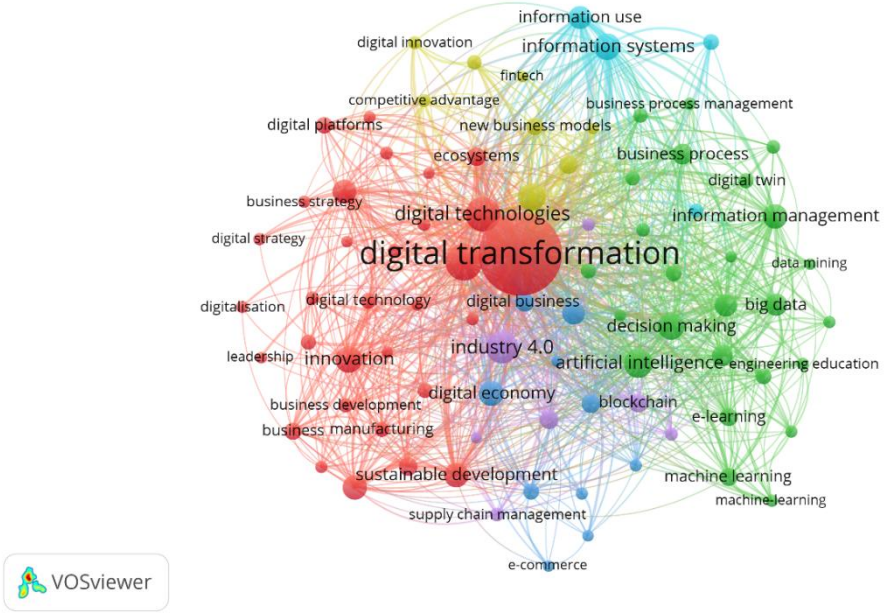

Figure 1. Network Visualization
Source: Data Analysis, 2025

The visualization places "digital transformation" at the core, emphasizing its pivotal role in the current research landscape. The prominence of this term, marked by its large node and central location, highlights its widespread exploration and foundational position in the field. Surrounding this central theme are interlinked concepts that further contextualize its influence on business practices and innovation. The dense network of connections around "digital transformation" suggests a multidisciplinary and interconnected approach to studying this phenomenon. The map reveals several distinct thematic clusters, each represented by a specific color:

1. **Red Cluster: Digital Technologies and Innovation**

   This cluster emphasizes the role of "digital technologies," "innovation," "digital strategy," and "digital platforms." The connections here indicate a strong focus on how technological advancements are driving innovation and reshaping business models. Topics like "business strategy" and "digital business" suggest a close association between technological adoption and strategic planning.

2. **Green Cluster: Data-Driven Decision Making and Management**

   Terms like "big data," "artificial intelligence," "information systems," and "decision making" dominate this cluster. It underscores the importance of data and analytics in enabling informed decision-making processes. The inclusion of "machine learning" and "blockchain" highlights the growing interest in these technologies as tools for business transformation.

3. **Blue Cluster: Information Management and Systems**

This cluster focuses on terms like "information management," "information systems," and "business process management." The strong connections among these terms indicate their critical role in streamlining operations and enhancing efficiency through digital solutions. It also reflects how organizations rely on robust information systems to sustain digital transformation initiatives.

The network demonstrates strong interconnections between clusters, reflecting the interdisciplinary nature of digital transformation research. For instance, terms like "innovation" and "business strategy" bridge the red and green clusters, indicating the interplay between strategic innovation and data-driven technologies. Similarly, connections between "sustainable development" and "digital business" highlight how businesses integrate digital transformation with broader societal goals. The prominence of terms like "artificial intelligence," "blockchain," and "digital twin" suggests emerging trends in the digital transformation landscape. These technologies are shaping new research directions and are likely to influence future business models. The presence of "e-learning" and "engineering education" indicates the growing focus on developing digital skills to support transformation efforts. This visualization underscores the multifaceted nature of digital transformation and its far-reaching implications for business and society. Researchers can leverage the insights from these clusters to identify gaps in the literature and explore underrepresented themes. For practitioners, the findings highlight the importance of adopting a holistic approach to digital transformation, integrating innovation, data-driven strategies, and sustainability to remain competitive in a rapidly evolving environment.

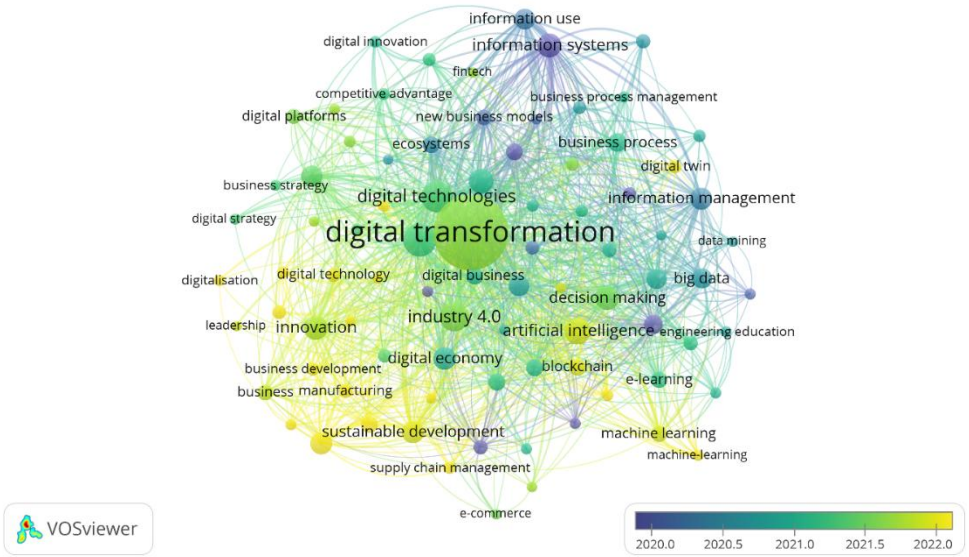

Figure 2. Overlay Visualization
Source: Data Analysis, 2025

The time-based gradient reveals a clear progression in the research field. Earlier studies (darker nodes) focused more on foundational aspects such as "digital technology," "information systems," and "business process management." These terms suggest initial research centered on understanding the technological and managerial fundamentals of digital transformation. In contrast, recent studies (lighter nodes) have shifted towards emerging technologies like "blockchain," "machine learning," and "digital twin," as well as newer applications in areas such as "sustainable development" and "e-learning." This progression underscores the dynamic nature of digital transformation research, adapting to rapid technological advancements and changing business priorities.

The visualization also highlights key research trends and future directions. Terms like "sustainable development" and "digital economy," which have become more prominent in recent years, suggest an increasing focus on aligning digital transformation with broader societal goals, such as sustainability and economic inclusivity. Additionally, the interconnectedness between "big data," "decision making," and "artificial intelligence" reflects the growing reliance on data-driven strategies in business models. For researchers, these insights underscore the need to explore emerging technologies and their societal impacts further. For practitioners, the findings emphasize the importance of integrating cutting-edge digital tools while addressing sustainability and efficiency goals to maintain competitive advantage.

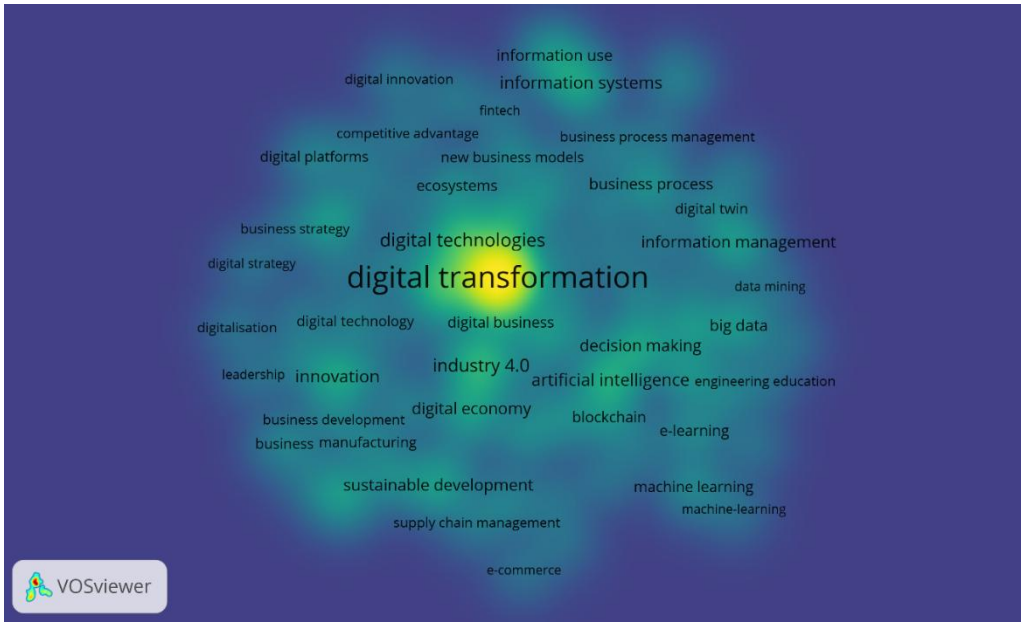

Figure 3. Density Visualization
Source: Data Analysis

The density visualization map emphasizes the prominence and interconnectedness of key terms

in the field of digital transformation, with "digital transformation" clearly at the center. Its bright, high-density area reflects the significant focus this term has received in the literature, establishing it as the central theme. Surrounding it are closely related concepts like "digital technologies," "industry 4.0," and "digital business," which also show high density, indicating their substantial exploration in the research domain. The clustering of these terms reveals their critical role in shaping the discourse on how digital transformation influences business models and operational strategies. The gradual transition to less dense areas highlights emerging or niche topics such as "blockchain," "machine learning," "e-learning," and "sustainable development." While these areas are not yet as heavily explored, their presence in the map indicates growing research interest. Topics like "sustainable development" and "digital economy" show an increasing emphasis on integrating digital transformation with broader societal goals, while terms like "artificial intelligence" and "big data" highlight their centrality in enabling new business strategies.

Table 1. Most Cited Article

Citations	Author and Year	Title
2179	[16]	Digital transformation: A multidisciplinary reflection and research agenda
1612	[17]	"So, what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy
1480	[18]	Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal
1390	[19]	Literature review of Industry 4.0 and related technologies
1236	[20]	Industry 4.0, digitization, and opportunities for sustainability
877	[21]	Reflections on societal and business model transformation arising from digitization and big data analytics: A research agenda
800	[22]	Digital transformation by SME entrepreneurs: A capability perspective
767	[5]	Digital innovation as a fundamental and powerful concept in the information systems curriculum
703	[1]	Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective
689	[23]	Medical internet of things and big data in healthcare

Source: Scopus, 2025

b. Co-Authorship Visualization

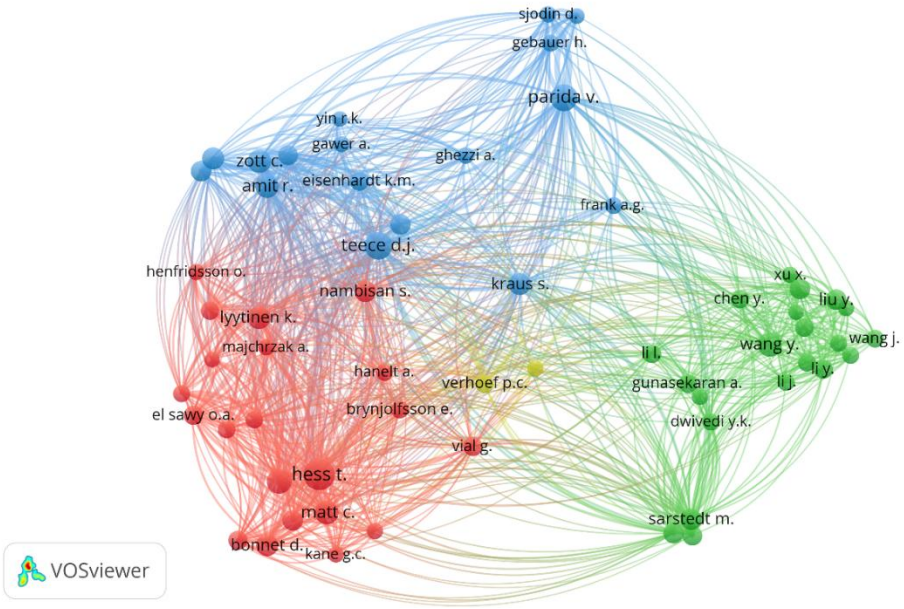

Figure 4. Author Visualization
Source: Data Analysis

The co-authorship network visualization highlights influential authors and collaboration patterns in digital transformation research. The map consists of three main clusters, each representing groups of researchers frequently collaborating. The red cluster includes authors such as Hess T., Matt C., and Kane G.C., indicating their significant contributions to digital transformation, particularly in strategy and organizational change. The green cluster features authors like Wang Y., Gunasekaran A., and Sarstedt M., emphasizing their focus on operational and technological aspects, including supply chain and big data. The blue cluster comprises authors like Zott C., Teece D.J., and Gawer A., reflecting their work on innovation, ecosystems, and dynamic capabilities. The dense connections within clusters and between prominent authors suggest active collaboration, with cross-cluster links indicating interdisciplinary research. This network underscores the collaborative and diverse nature of digital transformation studies, integrating strategic, operational, and innovation perspectives.

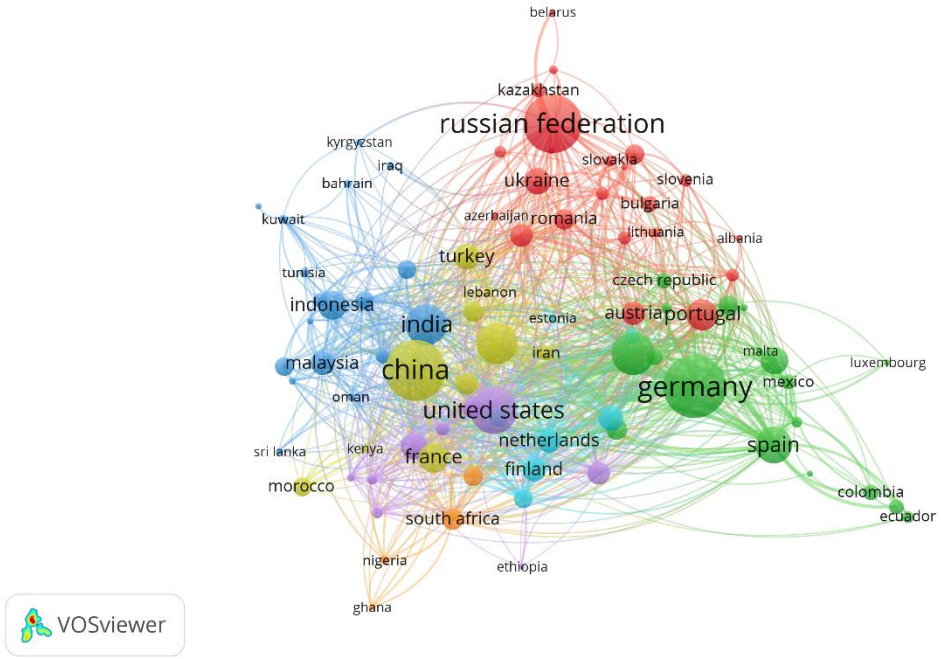

Figure 5. Country Visualization
Source: Data Analysis

This co-authorship network map based on countries illustrates the global collaboration in digital transformation research. The green cluster, led by countries like Germany, Spain, and Portugal, highlights strong research activity and partnerships across Europe. The red cluster, dominated by the Russian Federation, Ukraine, and other Eastern European countries, reflects their collaborative efforts within their region. The blue cluster, including China, India, and the United States, underscores their prominent roles in global research, often acting as hubs for international collaborations, especially in Asia and North America. Connections between clusters indicate robust cross-regional cooperation, with countries like the United States and Germany acting as bridges between regions. This map demonstrates the widespread and interconnected nature of digital transformation research, highlighting both regional collaborations and global linkages.

4.2 Discussion

a. Key Insights from the Bibliometric Analysis

The bibliometric analysis of the impact of digital transformation on business models provides valuable insights into the state of academic research, its thematic structure, and emerging trends. The co-occurrence and co-authorship networks highlight the diversity and interdisciplinarity of the field, reflecting its significance across technological, managerial, and operational domains. "Digital transformation" emerged as the central focus, underscoring its role as a critical enabler of innovation and competitiveness in the modern business environment. Concepts such as "digital technologies," "artificial intelligence," and "big data" appeared prominently in the network, suggesting their foundational importance in driving transformative changes in business models. Additionally, emerging terms like

"sustainable development" and "blockchain" highlight new directions in the research field. The growing emphasis on sustainability signals a shift in how digital transformation is not only being leveraged for operational efficiency and revenue generation but also for achieving broader societal and environmental goals. This aligns with global calls for integrating sustainability into business strategies, marking an evolution in the objectives of digital transformation initiatives.

b. Thematic Clusters and Their Implications

The bibliometric visualization revealed distinct clusters of research themes, each representing different aspects of digital transformation. The red cluster, focused on "innovation" and "digital strategy," highlights the strategic considerations required for digital transformation. This cluster underscores the need for businesses to adopt innovative practices and align digital strategies with overarching business goals. This finding reinforces the argument made by [8] that digital transformation is not just a technological challenge but a strategic imperative. The green cluster, emphasizing "data-driven decision making," "artificial intelligence," and "big data," reflects the critical role of data and advanced analytics in shaping modern business models. This aligns with the findings of [24], who emphasized the competitive advantage provided by data-driven decision-making. The centrality of these terms suggests that future business success will depend heavily on the ability to harness data for actionable insights, optimize processes, and enhance customer experiences. The blue cluster, which includes themes like "information systems" and "business process management," highlights the importance of robust technological infrastructure and efficient processes for successful digital transformation. This cluster emphasizes the need for organizations to modernize legacy systems and adopt integrated information management practices, as suggested by [25]. These insights suggest that businesses need to invest in digital infrastructure and process re-engineering to fully capitalize on the potential of digital transformation.

c. Geographic and Collaborative Patterns

The country-level co-authorship network provides insights into the geographic distribution of research efforts. Countries like the United States, China, and Germany emerged as leading contributors, reflecting their strong research ecosystems and active roles in advancing digital transformation. The dense connections among European countries, particularly Germany, Spain, and Portugal, highlight the collaborative nature of research within this region. Similarly, China and India demonstrate active collaboration within Asia and with global partners, indicating the growing importance of these economies in shaping the discourse on digital transformation. The prominent role of the United States as a bridge between regions underscores its position as a global leader in digital transformation research. This finding is consistent with its technological leadership and the presence of leading academic institutions and corporations driving innovation. The collaborative patterns suggest that digital transformation research benefits from cross-border knowledge sharing, which enhances the field's diversity and interdisciplinarity.

d. Emerging Technologies and Their Impact

The prominence of emerging technologies such as artificial intelligence, blockchain, and IoT in the analysis underscores their transformative potential in reshaping business models. AI and machine learning, for example, enable personalized customer experiences, predictive analytics, and process automation, providing businesses with a competitive edge. Blockchain technology, highlighted in recent research, offers secure and transparent mechanisms for transactions and data sharing, with potential applications in supply chain management, finance, and beyond [11]. The presence of "digital twin" in the analysis reflects its growing application in industries such as manufacturing and healthcare, where it is used to create virtual replicas of physical assets for monitoring and optimization. These technologies collectively represent the next frontier of digital transformation, driving new business models and revenue streams. However, their successful adoption requires addressing challenges such as data privacy, cybersecurity, and technological readiness, as noted by [26].

e. Alignment with Sustainability Goals

The inclusion of "sustainable development" as an emerging theme highlights the growing recognition of digital transformation as a tool for achieving sustainability objectives. This aligns with global initiatives such as the United Nations Sustainable Development Goals (SDGs), which call for innovative approaches to addressing environmental and social challenges. Digital transformation enables businesses to reduce their carbon footprints, optimize resource utilization, and create sustainable value chains, thereby contributing to the global sustainability agenda. Moreover, the focus on "digital economy" in the analysis reflects the economic implications of digital transformation, particularly in fostering inclusivity and economic growth. By enabling access to digital tools and platforms, businesses can empower small and medium enterprises (SMEs), reduce barriers to entry, and promote economic equality. This highlights the dual role of digital transformation in driving both business innovation and societal progress.

f. Challenges and Future Research Directions

While the bibliometric analysis highlights significant advancements in digital transformation research, it also reveals gaps and challenges that warrant further exploration. For instance, the lack of prominence of certain terms like "cybersecurity" and "organizational culture" suggests a need for more focused research on these critical aspects. As noted by Kane et al. (2015), the cultural and human dimensions of digital transformation are often underestimated, yet they play a pivotal role in determining its success. Another area requiring attention is the long-term impact of digital transformation on business sustainability and resilience. Longitudinal studies could provide valuable insights into how businesses adapt to and sustain digital initiatives over time. Furthermore, industry-specific research could uncover unique challenges and opportunities in sectors such as healthcare, education, and manufacturing, where digital transformation is particularly impactful. Finally, the role of government policies and regulations in facilitating or hindering digital transformation remains

underexplored. Future research could examine how policy frameworks influence the adoption and diffusion of digital technologies, particularly in emerging economies. This could provide valuable insights for policymakers aiming to create enabling environments for digital transformation.

4.3 Practical Implications

For practitioners, the findings of this study offer actionable insights into how to approach digital transformation strategically. Businesses need to adopt a holistic perspective, integrating technological innovation with cultural and organizational changes. Investing in data analytics capabilities, modernizing IT infrastructure, and fostering cross-functional collaboration are critical steps for achieving successful digital transformation. Moreover, aligning digital initiatives with sustainability goals can provide businesses with a competitive edge while contributing to societal well-being. Companies should explore how emerging technologies can be leveraged to address environmental and social challenges, thereby creating shared value for all stakeholders.

5. CONCLUSION

This study provides a comprehensive bibliometric analysis of the impact of digital transformation on business models, shedding light on the key themes, trends, and collaborative patterns in the research landscape. The findings reveal that digital transformation is a central and interdisciplinary area of study, driven by emerging technologies like artificial intelligence, big data, blockchain, and IoT. These technologies are reshaping business models, enabling innovation, operational efficiency, and sustainability. The analysis also highlights the growing emphasis on aligning digital transformation with societal goals, such as sustainable development and economic inclusivity. While significant progress has been made, challenges such as cybersecurity, cultural adaptation, and long-term sustainability remain underexplored, signaling opportunities for future research. By addressing these gaps and leveraging global collaboration, both researchers and practitioners can maximize the potential of digital transformation to drive innovation, competitive advantage, and societal progress.

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