Research Article

Exploring Digital Business Model Transformation 2020–2025 Using Bibliometric Analysis

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Abstract: Rapid developments in the era of digital transformation, which refer to the emergence of business and technology innovations based on artificial intelligence, big data, and the Internet of Things (IoT), have great potential for strategic sustainability for businesses in the digital age. Efforts to transform digital business models as a global competitive advantage and provide outputs that can be oriented towards future predictions. Digital business models refer to strategic designs for creating platform networks that are implemented through relationships with consumers and cross-sector collaboration. Challenges and opportunities for development between transformation and innovation are necessary in order to create and capture competitive value and provide added value in the digital economy era. The use of bibliometric analysis in research provides direction in understanding the perspectives and issues that require further research, opens up space for exploring publication trends, and identifies the mapping of key concepts that form the basis of main ideas, thereby providing a more structured understanding and developing new research opportunities, especially in the field of digital business models. Bibliometric analysis aims to gain an in-depth understanding of research using the R studio application as a tool for processing data trends over time and VOSviewer as a knowledge map visualization tool. The research was conducted to provide an understanding of current and future developments in a dynamic environment.

Keywords: Bibliometric Analysis; Digital Business Models; Digital Transformation; Sustainability; Technology Innovations

1. Introduction

The development of digital technology has proliferated and changed traditional ways of transacting and interacting. The industrial revolution took place between 1760 and 1850, which had a major impact on various fields, especially technology, which then led to changes in social, economic, and cultural conditions around the world. Digitalization has brought efficiency and effectiveness in driving business activities, as well as increasingly fierce global competition, which has prompted business people to create innovative products and services (Zare & Persaud, 2024). For every Micro, Small, and Medium Enterprise (MSME), digitalization has become a key strategic requirement for business sustainability and market expansion. Business model sustainability is a strategy for companies to remain relevant and keep pace with the changing times.

Digitalization opportunities have a significant impact on economic strategy, including strengthening communication and information for customers, thereby creating better trade interactions (Nam & Kim, 2025). The COVID-19 pandemic has accelerated the shift to online business, and access to online services has been crucial in building businesses, as people have preferred instant purchases that reduce contact with services through online ordering. The sector that has been the focus of attention is MSMEs. In this case, digitization has helped product sales and has indirectly become a driving force for the economy that is able to adapt to technology.

The emergence of technologies such as artificial intelligence, big data analytics, the Internet of Things (IoT), and cloud computing is accelerating the shift in business models. This transformation is a key determinant of a company's sustainability in the face of an increasingly competitive market. In addition to opportunities that serve as benchmarks for development, there are challenges that must be addressed, such as the digital divide and data security for mass media access. Therefore, research on digital business is an important factor in reshaping social structures and consumer behavior (Al Sharari et al., 2025). The broader social and economic aspects include elements of social justice, responsibility, and corporate integrity at the small, medium, and large scales.

Previous studies have highlighted the role of digitization in creating competitive advantage and strategies to drive innovation. The research aims to focus on the growth of digital business models in depth, the relationship between factors that influence the success of digital transformation in business, analyze sustainable digitization, and provide an overview of future research. By understanding the evolution of research trends in the field of digital business, it is hoped that this research can contribute as a reference in designing systems that are inclusive, sustainable, innovative, and adaptive to changes in the global business environment.

In this context, bibliometric analysis plays an important role in mapping the development of research in the field of digital business. Through searching for the most frequently used keywords, publication sources, and theme grouping, the intellectual structure and main direction of growth of this study can be identified. This approach not only provides an overview of the maturity of certain themes such as digital transformation, artificial intelligence, and sustainability, but also highlights new areas that still require further study. Furthermore, bibliometric studies can provide valuable input for policymakers, business practitioners, and academics to align their strategies with global digital trends, so that innovation, inclusiveness, and competitiveness can be achieved simultaneously in an ever-changing business environment.

2. Literature Review

Research developments in digital business show significant transformation in line with global technological changes. In the early phase (1907-1998), literature on digital business was still limited, with only 36 articles recorded, most of which focused on conventional business. However, after the dot-com bubble crisis in the late 1990s, attention to the issue of business digitalization increased, giving rise to a new phase in research in this field. According to Caputo et al. (2021), early literature on digitalization tended to focus on technological innovation, management strategies, and digital transformation, which later developed into a conceptual framework for understanding modern digital business. Meanwhile, Hausberg et al. (2019) emphasized that research on digital transformation is closely related to finance, marketing, and innovation management. These findings are reinforced by an analysis conducted by Talafidaryani et al. (2023), which states that there are 6,067 publications that identify dominant themes such as digital analytics, digital platforms, and digital transformation as the main focus of literature development.

The literature on digital business has developed into four main groups. First, studies on digital transformation and sustainable business model innovation that emphasize the contribution of Industry 4.0 in promoting business model sustainability (Feliciano-Cestero et al., 2023). Second, research on e-commerce and consumer behavior that focuses on marketing, consumer behavior, and customer experience in the digital space (Kajla et al., 2023). Third, research on emerging technologies and economic development that links big data with new technologies such as AI, big data, and blockchain with economic growth and applicable regulations (Rotolo et al., 2015). Fourth, platform economy and the future of work, which looks at the impact of the platform-based economy on the labor market, transparency, and social inequality (Bernstein, 2017).

Publications have increased significantly, but the literature presented shows that there is still a research gap. Studies reviewing non-technical challenges, such as organizational cultural change, employee resistance, and regulatory frameworks in the transition to a digital business model, are still rarely discussed (Mihardjo et al., 2019). Literature shows that digital business and business model innovation create both opportunities and challenges. On the one hand,

companies are able to create new proportions, improve customer relationships, and develop more innovative value capture mechanisms (Costa-Climent et al., 2023). However, using bibliometric analysis according to Zare & Persaud (2024) found that there were 749 articles that had grown rapidly since 2016, with contributions from major fields such as management, computer science, engineering, and economics.

3. Research Method
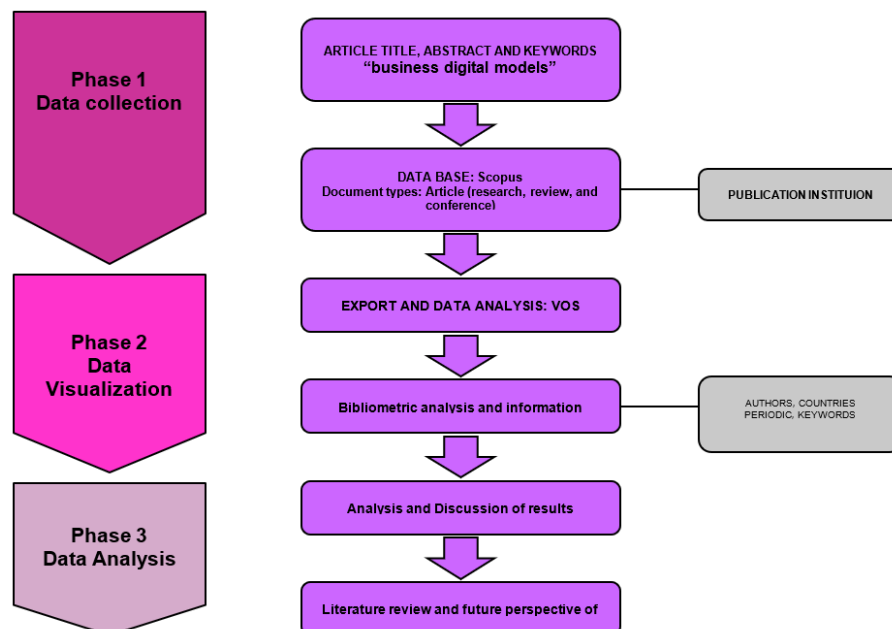
Figure 1. Methodology Phases Applied to the Present Work

This study uses a bibliometric approach to trace developments in the field of digital business. The research data was sourced from Scopus, exported in .csv format, then further processed using R Studio (with the help of Bibliometrix) and visualized using VOSviewer. This approach is considered appropriate because it provides a comprehensive overview of conceptual patterns, dominant themes, and emerging research directions. In addition, this method can show the interrelationships between topics, distinguish between mature and emerging themes, and identify opportunities for future research.

The research stages were carried out sequentially. First, data collection was conducted using specific keywords in the title, abstract, and author keywords. Second, data cleaning was carried out in R Studio by removing duplicates, stop words, and irrelevant terms so that only the main dataset ready for analysis remained. Third, conceptual analysis was performed using co-word analysis techniques to find relationships between terms and identify research theme groups. Fourth, network visualization was created using VOSviewer in the form of a network map and thematic evolution map, which illustrates the dynamics of themes over time. The methodology must be clearly stated and described in sufficient details.

The bibliometric method was chosen because it provides a comprehensive overview of the development of literature in the field of digital business. This approach allows researchers to identify conceptual patterns, dominant themes, and emerging research directions. Through a combination of R Studio and VOSviewer tools, this study not only presents data in the form of numbers or statistics, but also visualizes the connections between topics so that they are easier to understand systematically. Thus, this method is considered relevant to answer research questions regarding trends, focus, and dynamics of digital business studies within a certain time frame.

Next, the third stage is conceptual analysis using co-word analysis techniques. This technique is used to find connections between terms in the literature and group keywords into specific research themes. In this way, researchers can see how a term relates to other terms, while identifying groups of themes that form research clusters. The fourth stage is network visualization using VOSviewer. At this stage, the data is visualized in the form of a network map and a thematic evolution map. This visualization provides a clearer picture of the dynamics of research themes over time, showing established themes and newly emerging topics.

Overall, this methodology not only produces a more structured mapping of the literature, but also opens up opportunities to find research gaps that have been rarely explored. By combining quantitative analysis of bibliometric data and visual representation from VOSviewer, this study is able to connect empirical evidence with conceptual interpretation. Therefore, the method used can be seen as a comprehensive approach to understanding the development, challenges, and future direction of research in the field of digital business.

4. Results and Discussion

The figure below provides an overview of key information related to research results covering the period from 2021 to 2025. This data includes information from 952 sources and a total of 4,730 documents, with no annual growth in publications. This analysis involves 18,029 authors. Most publications (25.16%) involve international author collaboration, with an average of 3.27 collaborating authors per document. The data includes 15,748 distinct keywords provided by authors and refers to a total of 32,033 citations. On average, the documents are 2.23 years old, and each document has received an average of 15.13 citations. This summary provides insight into collaboration patterns, research impact, and the overall development of the analyzed academic field.

Figure 2. Main Information Overview (Using R Studio)

The dataset features 15.748 author-provided keywords, offering a rich variety of topics or areas of focus within the field. The publications cite a total of 32.033 references, indicating extensive engagement with existing literature. The average age of the documents is 2.23 years, which suggests that the field includes a mix of both recent and slightly older research, providing a balance between historical and contemporary perspectives. This combination illustrates that this field of research continues to evolve, while maintaining its connection to the basic studies that form its foundation. The existence of various keywords also indicates that research in this field is highly interdisciplinary, involving various disciplines such as management, technology, economics, and sustainability. In addition, the relatively young average age of the documents reflects the rapid pace of digital transformation and its impact on business studies, where new concepts, tools, and frameworks continue to emerge. This also emphasizes the importance of bibliometric analysis to trace how research themes emerge, develop, and interact with each other, thereby providing academics and practitioners with a clearer understanding of the intellectual structure and direction of development in this field.
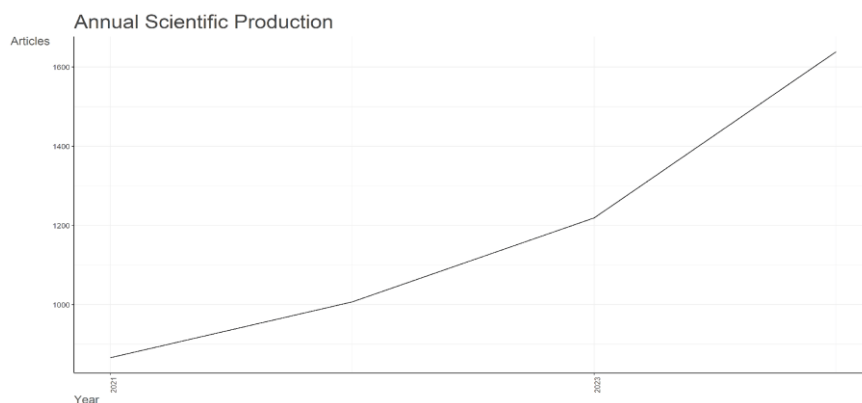
Figure 3. Annual Scientific Production (Using R Studio)

This image shows a graph of the number of scientific articles published each year from 2021 to 2025. From 2021 to around 2025, the number of articles rose steadily. The increase was stable, with the most significant increase occurring in 2021. The graph shows a steady increase in scientific articles, indicating that the trend will continue to rise in the coming years. Annual Scientific Production Analysis in R Studio is an important stage in bibliometrics because it provides a quantitative overview of the number of publications produced each year in a particular field of research. Through this indicator, researchers can trace how literature develops, whether there is a steady increase, a surge in a particular period, or even a decline in publication activity. This pattern is usually influenced by external factors such as technological developments, policy changes, and global events that drive increased attention to a particular topic.

In the context of digital business research, the visualization results show a consistent increase in the number of articles from 2021 to 2025, with the most significant increase in 2021. This surge is in line with the post-COVID-19 pandemic period, when digitization became an urgent need in both the business sector and the wider community. This trend shows that topics such as digital transformation, artificial intelligence, and business model innovation are increasingly being researched due to their relevance to the challenges and opportunities in the digital economy era.

Furthurmore, Annual Scientific Production is not just a number, but also an indicator of scientific productivity at the global level. The growth in publications indicates widespread academic interest and increasingly intensive collaboration among researchers across countries. This data also serves as a basis for predicting the direction of scientific development in the future. Thus, this analysis is not only useful in mapping publication dynamics but also in assessing the vitality of a field of study and the potential emergence of new themes.
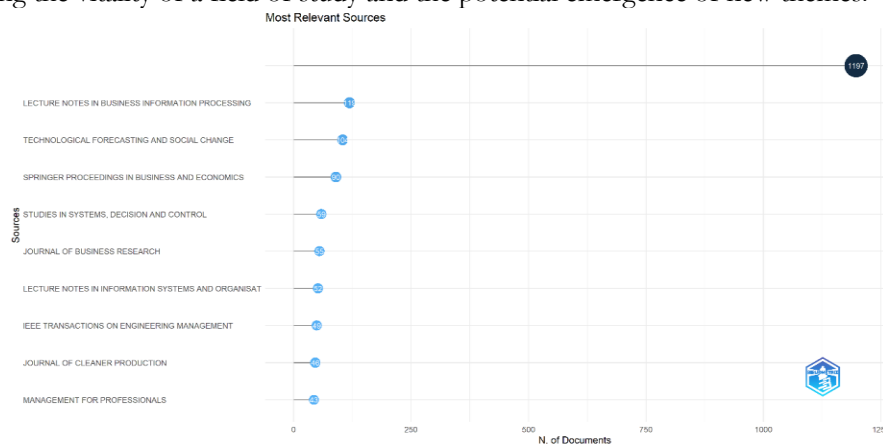

Figure 4. Most Relevant Source (Using R Studio)

The image shows a diagram listing the most relevant scientific publication sources, sorted by the number of documents they contribute. The sources are listed on the left, while the number of documents is shown on the X-axis. Top sources: A collection of articles that

do not have journal name metadata in the dataset, totaling 1197 documents. Other important sources include Lecture Notes in Business Information Processing (119 documents), Technological Forecasting and Social (104 documents), and Springer Proceedings in Business and Economics (90 documents). Each source has a circle indicating the number of documents contributed, with the data shown decreasing in the sorted list.

Figure 5. Most Cited Countries (Using R Studio)

This bar chart shows how often different countries are mentioned or cited. Korea has the most mentions, with 143 citations, followed by Macedonia with 31 citations. Korea and Macedonia dominate the list of frequently cited countries. Each country is represented by a bubble, and the larger the bubble, the more citations that country has received. This diagram helps show which countries are most frequently cited in a simple and visual way.
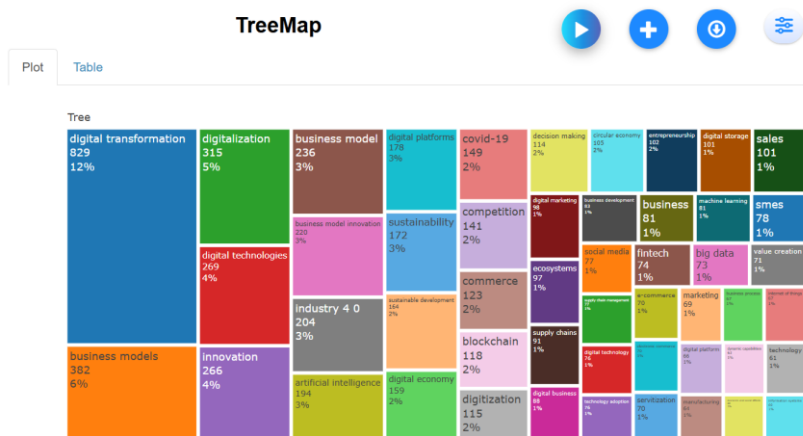
**Figure 6.** TreeMap (Using R Studio)

The TreeMap in the image above displays a visualization of the distribution of keywords frequently used in research on digital business models for the period 2021–2025. The size of the boxes represents the frequency of keyword occurrence, so that the largest box, such as digital transformation (829 times, 12%), indicates the dominance of this theme in the literature. Different colors indicate the grouping of related issues, such as business models, innovation, digitalization, sustainability, and artificial intelligence.

The purpose of this TreeMap is to provide a quick overview of the most prominent research topics while identifying the interrelationships between issues in the field of digital business. Its usefulness is to help researchers understand dominant trends, map areas of research that have already developed, and find new research gaps. Thus, TreeMap serves as a visual tool that facilitates the interpretation of bibliometric data and supports the formulation of future research directions.

Furthermore, TreeMap not only functions as a data visualization tool, but also helps in understanding the hierarchy and priority of issues that are widely discussed in the literature. For example, the presence of keywords such as COVID-19, fintech, big data, and blockchain shows that digital transformation in business is not only seen from the core technology aspect, but also from the influence of external factors and global changes. Thus, TreeMap can be seen as a concise yet information-rich representation that brings together various research themes into one visual map.

These findings emphasize that research in the field of digital business is multidisciplinary and continues to evolve with the dynamics of the times. For researchers, TreeMap is useful for finding research gaps that are still rarely touched upon, while for business practitioners, this information serves as a basis for understanding strategic issues relevant to business sustainability. In addition, for policymakers, this TreeMap can also be a reference in designing a more inclusive, targeted, and empirically-based digitalization strategy. In other words, TreeMap is not just a visual tool, but also an analytical instrument that can enrich the interpretation of bibliometric research results in supporting a more comprehensive study of digital business.
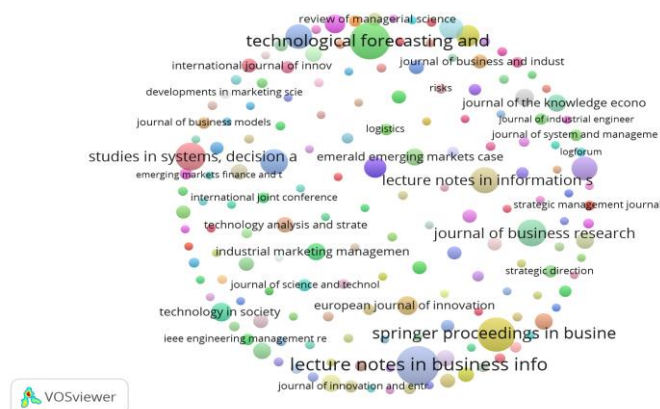
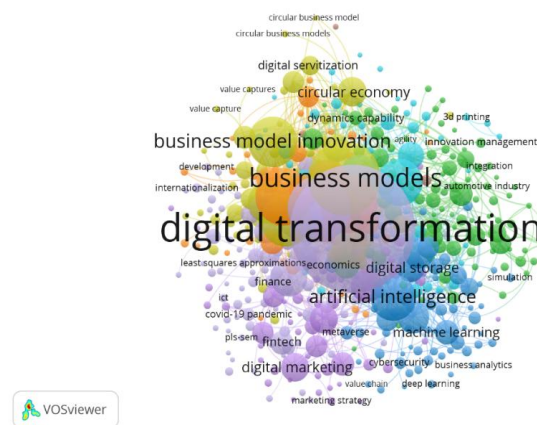**Figure 7.** Network Visualization Citation

The visualization with VOSviewer in the image shows a map of the connections between journals that frequently appear in certain fields of research. The size of the circles indicates the frequency of appearance or number of citations for each journal, so that large circles such as Technological Forecasting and Social Change, Journal of Business Research, and Lecture Notes in Information Systems/Business Information illustrate their dominant influence. The color differences indicate the grouping of related research themes or topics, while the distance between circles reflects the closeness of the relationship, both in terms of citations and similarity of research fields. For example, Technological Forecasting and Social Change appears close to Review of Managerial Science and Journal of Business and Industrial Marketing, indicating a connection between research on innovation, managerial strategy, and business marketing. In general, this map reveals several main clusters, namely research groups related to innovation and technology, business and management, as well as information systems and the knowledge economy. Thus, it can be concluded that these publications form an interconnected scientific network that supports the development of cross-disciplinary studies, especially on the topics of innovation, digital transformation, and modern business management.

The results of the co-occurrence visualization further clarify how the interconnection between journals is not only technical in nature, but also reflects the direction of multidisciplinary scientific development. The interconnection map shows that major themes such as innovation, digital transformation, and business sustainability are the common threads that connect various journals from different scientific backgrounds. This indicates that digital transformation cannot be understood solely from a technological perspective, but also requires integration with the fields of management, marketing, economics, and information systems. In other words, the literature review that appears in dominant journals illustrates a scientific consensus that the challenges of the digital era require a collaborative, cross-disciplinary approach.

Furthermore, the distance between circles that illustrates citation proximity shows how a journal is often referenced in closely related research. For example, the proximity between Technological Forecasting and Social Change and Review of Managerial Science indicates a research focus on innovation management strategies integrated with aspects of technology development prediction. Similarly, the closeness to the Journal of Business and Industrial Marketing confirms that digital innovation is inseparable from marketing strategies and efforts to create added value for consumers. Thus, this connection shows that developments

in academic literature emphasize the important role of innovation as a link between the dimensions of technology and market needs and modern business strategies.

From a broader perspective, the results of this mapping provide an important contribution to understanding the dynamics of digital business literature globally. The connectivity map shows that each research cluster does not stand alone, but rather complements each other to form a more complete understanding of how digital transformation affects contemporary business and management patterns. The presence of clusters of innovation and technology, business and management, and information systems and knowledge economy indicates an academic awareness that business sustainability in the digital era requires synergy between technological advances, organizational strategies, and economic policies. Therefore, this co-occurrence visualization serves not only as a conceptual map but also as a strategic guide for researchers, practitioners, and policymakers in formulating research directions and policies that are more relevant to global needs.

**Figure 8.** Network Visualization Co-occurance (Using Vos Viewer)

This network map shows several clusters in different colors representing research themes. The green cluster groups issues related to emerging technologies such as artificial intelligence, machine learning, and blockchain. The orange/yellow cluster highlights business models and innovation, while the purple cluster emphasizes digital marketing, fintech, and COVID-19 pandemic issues. The blue cluster relates to technical aspects such as cybersecurity, deep learning, and business analytics. These four clusters are interconnected through digital transformation, thereby strengthening their role as the center of gravity for research.

The keyword network visualization shows that digital transformation is at the center of digital business research. This is because the term appears most frequently and is highly connected to various other themes, such as business models, artificial intelligence, machine learning, digital marketing, and the circular economy. This central position confirms that digital transformation acts as the main link across research clusters, thus forming the foundation for the development of digital business studies.

In addition to emphasizing the central position of digital transformation, this network visualization also shows how each cluster intersects and forms a complex research ecosystem. For example, the close connection between business model innovation and the circular economy indicates that sustainability strategies have become an important focus in the development of digital business models. Meanwhile, the relationship between artificial intelligence and machine learning with themes such as cybersecurity and business analytics shows that the use of advanced technology cannot be separated from aspects of data security and information analysis.

Furthermore, the emergence of issues such as fintech, metaverse, and the COVID-19 pandemic in the purple cluster shows that digital business research not only discusses core technologies but also responds to global social, economic, and health dynamics. This proves that digital business literature is adaptive, capable of adjusting to new challenges and opportunities that arise. Thus, this network map not only illustrates the conceptual relationships between topics but also provides a clear direction on how digital transformation is the main connector in the development of cross-disciplinary research.
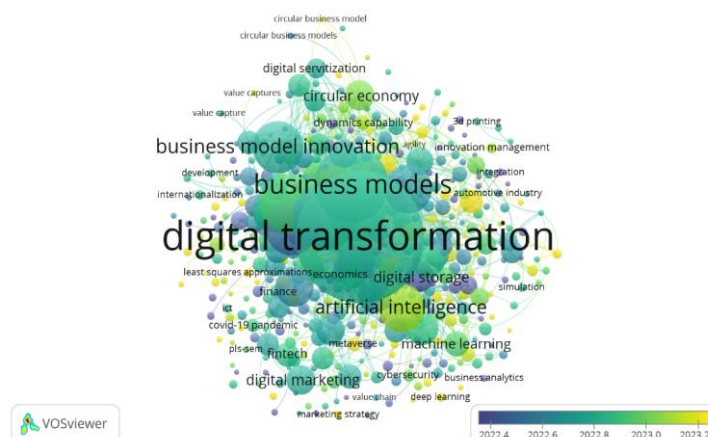
Figure 9. Overlay Visualization (Using Vos Viewer)

The overlay visualization image depicts the keyword network as well as the research time dimension. The colors on the nodes represent the publication period, from blue (earlier, around 2022) to yellow (more recent, closer to 2023). The size of the nodes reflects the frequency of occurrence, while the central position indicates extensive connectivity. The results show that digital transformation is the most dominant term and acts as the main connector in digital business literature.

Digital transformation is most strongly linked to business models and business model innovation, emphasizing the importance of business model adaptation in the digital era. Its connection to artificial intelligence, machine learning, and cybersecurity shows the integration of cutting-edge technology in supporting the transformation process. On the other hand, the connection with digital marketing, fintech, and COVID-19 issues confirms its relevance to changes in consumer behavior and global dynamics. In addition, its connection with the circular economy and sustainability reflects the latest research direction that links digitization with sustainable development.

Overall, this overlay shows that digital transformation is at the center of the literature and connects various research themes, ranging from business innovation to the use of new technologies. The dominance of green and yellow colors around it indicates that this topic has continued to grow rapidly over the past two years and has become an important foundation for future digital business research.

5. Conclusions

Bibliometric research using R Studio and VOSviewer tools facilitates systematic mapping of literature development, especially on key topics in the field of digital business. The research stages begin with data collection from Scopus, analysis based on network visualization and overlay results aimed at reading research patterns and dynamics. The analysis results show that digital transformation is the main keyword and center of the digital business research network. This central position indicates its high frequency and role as a cross-theme connector.

Research related to digital business models using bibliometric analysis has opened up insights and information about trends and research focus on business sustainability in the digital era. The matrix presented shows that business sustainability is a topic that has experienced steady growth over time, making the development of digital transformation a relevant topic. The visualization shows that the literature tends to focus on digital business strategies, marketing, the use of artificial intelligence technology, and digital financial tools. Overlay analysis shows the evolution of research topics over time, revealing temporal research trends, thereby identifying emerging topics and detecting potential new areas of study.

More broadly, this study has several important implications. From a theoretical perspective, the results of the analysis reinforce our understanding of how digital transformation and innovation are interconnected in shaping adaptive and sustainable business models. From a policy perspective, these findings emphasize the importance of regulations that can bridge the digital divide, strengthen data security, and create an inclusive digital ecosystem. Meanwhile, from a practical standpoint, the results of this study can serve

as a reference for businesses, especially MSMEs, in integrating technologies such as AI, fintech, and digital platforms as strategies to increase global competitiveness.

Thus, this study not only provides a comprehensive overview of the direction of digital business literature, but also emphasizes the urgency of digital transformation as the foundation for sustainable economic development. In addition, the analysis results also open up opportunities for further research that can highlight non-technical aspects, such as organizational culture, changes in consumer behavior, and regulatory frameworks, which have received little attention in the literature to date..

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