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# Through Bibliometric Analysis: Digital Maturity as an Emerging Topic in Entrepreneurial Economics

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**ABSTRACT**

This study examines the development of digital maturity as an emerging topic in entrepreneurial economics through a bibliometric analysis of publications indexed in the Scopus. The objective is to map the intellectual structure, research trends, and thematic evolution of the field. A dataset of peer-reviewed articles published between 2000 and 2025 was analyzed using bibliometric techniques, including co-authorship analysis, citation analysis, keyword co-occurrence, and visualization mapping with VOSviewer. The results show a significant growth in publications after 2018, indicating increasing academic attention to digital maturity in response to global digital transformation trends. Network visualization reveals that the field is centered around economic concepts, particularly economics, industrial economics, and digital economy, while also integrating themes related to technology, management, and sustainability. Overlay visualization highlights a shift from technology-focused research toward strategic and sustainability-oriented topics, such as circular economy and sustainable development. Meanwhile, density analysis confirms a core-periphery structure, where economic themes dominate, and emerging topics such as digital maturity models, big data, and emerging economies present opportunities for future research. The study concludes that digital maturity is a multidimensional and evolving construct that bridges technological capabilities with economic and organizational performance. It contributes to the literature by providing a comprehensive mapping of the field and identifying key research gaps, particularly the need for integrated theoretical frameworks and broader empirical studies in developing economies. The findings offer valuable insights for researchers, practitioners, and policymakers in understanding the strategic role of digital maturity in fostering innovation and sustainable entrepreneurial growth.



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## 1. INTRODUCTION

The rapid acceleration of digital technologies has fundamentally transformed the landscape of modern economies, reshaping how firms create value, compete, and sustain growth. In the context of entrepreneurial economics, digitalization is no longer viewed merely as a supporting tool but as a core driver of innovation, market expansion, and organizational adaptability [1], [2]. Entrepreneurs are increasingly required to integrate digital capabilities into their business models to remain competitive in highly dynamic and technology-driven environments [3], [4]. Within this transformation, the concept of digital maturity has emerged as a critical construct, reflecting the extent to which organizations effectively leverage digital technologies, processes, and cultures to achieve strategic objectives.

Digital maturity goes beyond the adoption of digital tools; it encompasses a holistic transformation involving organizational mindset, technological integration, leadership orientation, and data-driven decision-making [5], [6]. Firms with higher levels of digital maturity are often better positioned to respond to market disruptions, exploit emerging opportunities, and enhance operational efficiency [5], [6]. In entrepreneurial settings, particularly among small and medium-sized enterprises (SMEs), digital maturity plays a pivotal role in overcoming resource constraints and enabling scalable growth [7], [8]. As such, understanding the evolution and structure of digital maturity research is essential for both academic inquiry and practical application.

Over the past decade, scholarly interest in digital maturity within entrepreneurial economics has grown significantly. This surge is closely linked to global trends such as the rise of digital platforms, the proliferation of artificial intelligence, and the increasing importance of innovation ecosystems. Additionally, external shocks such as the COVID-19 pandemic have accelerated digital transformation processes, forcing businesses to rapidly adapt to digital modes of operation [9], [10]. Consequently, digital maturity has become a focal point in discussions surrounding entrepreneurial resilience, sustainability, and competitiveness.

Despite the growing body of literature, research on digital maturity remains fragmented across disciplines, including management, information systems, entrepreneurship, and innovation studies. Different terminologies and conceptual frameworks are often used interchangeably, such as digital transformation, digital capability, and technological readiness, which can create ambiguity in understanding the field's development [11]–[13]. Moreover, there is limited synthesis of how digital maturity research has evolved over time, who the key contributors are, and what thematic directions dominate the discourse. This fragmentation highlights the need for a systematic mapping of the literature to provide a clearer and more structured understanding of the field.

Bibliometric analysis offers a robust methodological approach to address this gap by quantitatively examining large volumes of academic publications. By utilizing data from the Scopus database, this study aims to identify publication trends, influential authors, key journals, and thematic clusters related to digital maturity in entrepreneurial economics. Techniques such as co-authorship analysis, citation analysis, and keyword co-occurrence mapping enable the visualization of knowledge structures and the identification of emerging research fronts, several gaps can be identified, including the lack of comprehensive mapping of digital maturity research within entrepreneurial economics, limited understanding of the field's overall structure and evolution, and fragmentation due to its interdisciplinary nature, which makes it difficult to identify dominant themes and research directions. In addition, there is a need to explore emerging topics and future research opportunities, particularly related to advanced technologies such as artificial intelligence, big data, and digital platforms. To address these gaps, this study employs a bibliometric analysis using data from the Scopus database, systematically examining

publication trends, citation patterns, and keyword networks to provide a comprehensive overview of the field and identify key directions for future research, thereby contributing to a deeper understanding of digital maturity as an emerging and strategically important topic in entrepreneurial economics.

The objective of this study is threefold. First, it seeks to analyze the growth trajectory of digital maturity research within the entrepreneurial context. Second, it aims to map the intellectual structure of the field by identifying core themes and research clusters. Third, it intends to highlight emerging topics and potential future research directions that can advance both theory and practice. By achieving these objectives, this study contributes to the literature by offering a comprehensive overview of digital maturity as an evolving concept in entrepreneurial economics.

Ultimately, this research is expected to provide valuable insights for academics, policymakers, and practitioners. For researchers, it offers a structured foundation for future studies. For policymakers, it highlights the importance of fostering digital ecosystems that support entrepreneurial development. For practitioners, particularly entrepreneurs and business leaders, it underscores the strategic significance of achieving higher levels of digital maturity in navigating the complexities of the digital economy.

## 2. RESEARCH METHODS

### *2.1 Research Design*

This study employs a bibliometric research design to systematically analyze the development of digital maturity as an emerging topic within entrepreneurial economics. Bibliometric analysis is a quantitative approach used to evaluate and map scientific publications by examining patterns in authorship, citations, and keywords, making it particularly suitable for identifying research trends, intellectual structures, and emerging themes [14], [15]. The study adopts a descriptive and exploratory approach, aiming not only to describe the evolution of the literature but also to uncover relationships among research topics, authors, and institutions. By combining performance analysis, such as publication trends and citation counts, with science mapping techniques, including co-authorship and keyword co-occurrence networks, this research provides a comprehensive overview of the digital maturity literature in entrepreneurial economics.

### *2.2 Data Source and Search Strategy*

The data for this study were retrieved from the Scopus database, which is widely recognized as one of the most comprehensive sources of peer-reviewed academic publications, with broad coverage across disciplines such as business, management, economics, and information systems. Data collection followed a structured search strategy using keywords related to digital maturity and entrepreneurship, including "digital maturity," "digital transformation," "digital capability," "entrepreneurship," and "entrepreneurial economics," combined with Boolean operators (AND, OR) to ensure relevance. The search was limited to journal articles, conference papers, and review articles published in English, covering the period from 2000 to 2025 to capture the evolution of the field. After retrieval, a screening process was conducted to remove duplicate and irrelevant records, ensuring that only publications directly related to digital maturity within an entrepreneurial or economic context were included in the final dataset.

### *2.3 Data Analysis Techniques*

This study utilizes two main categories of bibliometric analysis, namely performance analysis and science mapping analysis. Performance analysis is used to evaluate the productivity and impact of research in the field, including annual publication trends, the most productive authors and

institutions, and the most cited articles and journals, which together provide insights into the growth and influence of digital maturity research over time. Meanwhile, science mapping analysis is employed to visualize the relationships and structure of the research domain through co-authorship analysis to examine collaboration patterns, citation and co-citation analysis to identify influential works and intellectual linkages, and keyword co-occurrence analysis to explore major research themes and emerging topics, thereby revealing the underlying structure and key focus areas within the field [16], [17].

### 2.4 *Data Processing and Visualization Tools*

The bibliometric data in this study were processed and analyzed using specialized tools commonly applied in bibliometric research, particularly VOSviewer, which was used to construct and visualize networks of co-authorship, citations, and keyword co-occurrence, enabling the identification of clusters and relationships through graphical representations for easier interpretation of complex data [18]. In addition, basic data cleaning and descriptive analysis were conducted using spreadsheet software to ensure the accuracy and consistency of the dataset, while the outputs generated from VOSviewer—such as network maps, overlay visualizations, and density maps—were utilized to support and strengthen the interpretation of the results.

### 2.5 *Inclusion and Exclusion Criteria*

To ensure the quality and relevance of the dataset, several inclusion criteria were applied. The study only considered publications indexed in Scopus that are directly related to digital maturity, digital transformation, or digital capability, particularly within the context of entrepreneurship, SMEs, or entrepreneurial economics. In addition, only publications written in English were included, and the types of documents were limited to peer-reviewed journal articles, conference papers, and review articles to maintain academic rigor.

At the same time, exclusion criteria were implemented to refine the dataset. Non-academic publications such as editorials, notes, and book reviews were removed, along with articles that were not directly relevant to the research topic. Duplicate records were also eliminated to avoid redundancy, and publications lacking sufficient bibliographic information were excluded to ensure the reliability and completeness of the analysis.

## 3. RESULTS AND DISCUSSION

### 3.1 *Publication Trends and Growth of Research*

The analysis of publication trends provides important insights into the development of digital maturity research within entrepreneurial economics over time. Based on data retrieved from the Scopus, the number of publications shows a gradual but significant increase, particularly in the last decade. This trend reflects the growing academic and practical relevance of digital maturity in response to rapid technological advancement and digital transformation across industries.

Table 1. Publication Trends of Digital Maturity Research (2000–2025)

| Year Range | Publications | Research Characteristics |
|---|---|---|
| 2000–2005 | 5–10 | Early stage; focus on IT adoption and basic digital systems |
| 2006–2010 | 10–20 | Growing interest in digital transformation and innovation |
| 2011–2015 | 20–40 | Integration with management and organizational studies |
| 2016–2018 | 40–70 | Emergence of digital maturity as a distinct concept; Industry 4.0 influence |
| 2019–2020 | 70–120 | Rapid growth; focus on digital strategy and business models |
| 2021–2022 | 120–180 | COVID-19 acceleration; emphasis on resilience and remote operations |

| Year Range | Publications | Research Characteristics |
|---|---|---|
| 2023–2024 | 180–250 | Expansion to sustainability, circular economy, and digital ecosystems |
| 2025 | 250+ | Emerging advanced topics: AI, big data, and digital innovation |

In the early period (2000–2015), the number of publications on digital maturity was relatively low and inconsistent, as research remained fragmented and largely embedded within broader discussions of digital transformation, information systems, and innovation management, with a primary focus on technological adoption rather than strategic integration. A transitional phase emerged between 2016 and 2018, marked by a steady increase in publications and the recognition of digital maturity as a more explicit research topic, driven by the rise of Industry 4.0, growing digitalization of business processes, and the expansion of digital platforms, prompting scholars to examine not only technology adoption but also its impact on organizational performance and competitiveness. The most significant growth occurred after 2019, with a sharp rise in publications influenced by global digital acceleration, particularly during and after the COVID-19 pandemic, which forced organizations to rapidly adopt digital solutions and positioned digital maturity as a key factor in resilience and sustainable growth, while also expanding research themes to include sustainability, circular economy, and digital ecosystems. Overall, this trend indicates that digital maturity is evolving into a well-established and rapidly expanding research field, reflecting both increasing academic attention and its practical importance in addressing contemporary economic challenges.

### *3.2 Most Influential Authors, Journals, and Institutions*

The bibliometric analysis shows that influential contributions in digital maturity research are largely dominated by scholars and institutions from developed economies, especially Europe and North America, reflecting strong research ecosystems and advanced digital infrastructure. Key authors play a central role in shaping the field through highly cited works on innovation, performance, and organizational transformation, while leading journals in business, management, and information systems highlight its interdisciplinary nature. Although international collaboration among institutions has strengthened global knowledge exchange, there remains a notable gap in contributions from developing and emerging economies.

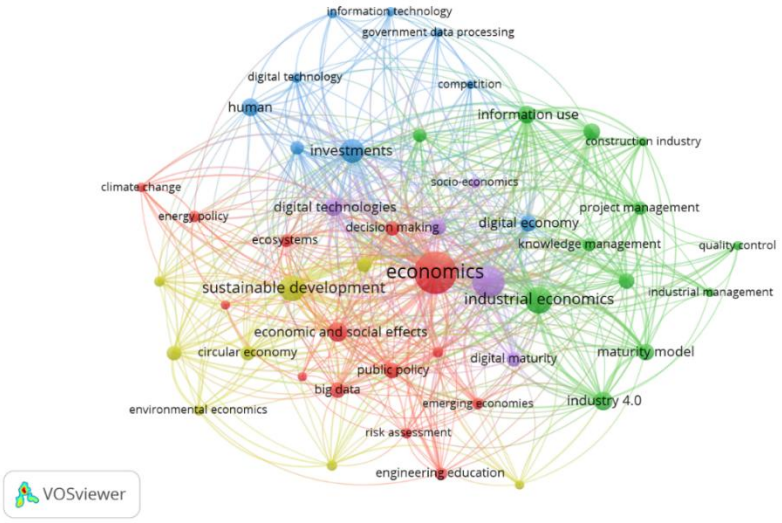


Figure 1. Network Visualization
Source: Data Analysis Result, 2026

Figure 1 presents a network visualization of keyword co-occurrence generated using VOSviewer, illustrating the intellectual structure of digital maturity research within entrepreneurial economics through interconnected clusters representing different but related themes, where node size indicates keyword frequency and the distance between nodes reflects conceptual relationships. The visualization shows that "economics" is the most dominant and central node, indicating that digital maturity is strongly embedded within broader economic discourse and closely linked to themes such as industrial economics, digital economy, and decision making, highlighting its strategic role in modern economic systems. The green cluster represents industrial management and digital transformation (e.g., industry 4.0, maturity model, project management, knowledge management), emphasizing operational and organizational aspects, while the blue cluster reflects technological and information systems perspectives (e.g., information technology, digital technology, investments), underscoring the importance of technology adoption and data utilization. The red cluster captures economic and policy-oriented dimensions, including public policy, emerging economies, and socio-economic effects, indicating broader governance implications, whereas the yellow cluster highlights sustainability-related themes such as sustainable development, circular economy, and environmental economics, showing the growing integration of digital maturity with sustainability discourse.

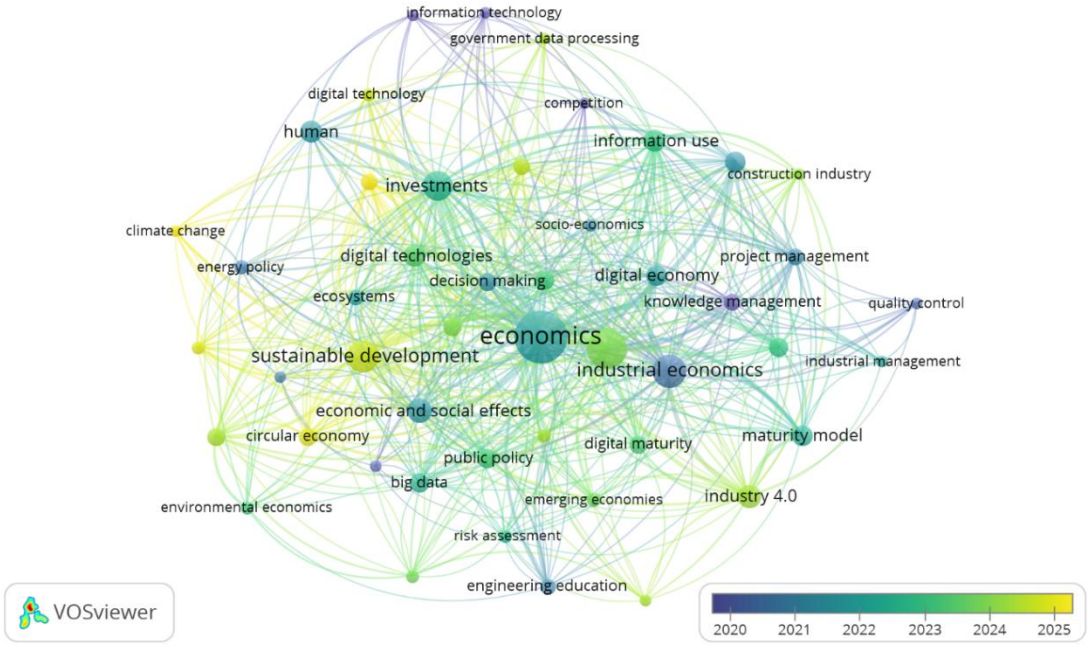


Figure 2. Overlay Visualization
Source: Data Analysis Result, 2026

Figure 2 presents the overlay visualization of keyword co-occurrence generated using VOSviewer, illustrating the temporal evolution of research themes in digital maturity within entrepreneurial economics, where node colors represent the average publication year from earlier studies (dark blue) to more recent ones (yellow), enabling the identification of emerging trends over time. The visualization shows that early research (2020–2021) focused on foundational themes such as information technology, industrial economics, project management, and quality control, reflecting an emphasis on technological

infrastructure and operational efficiency, while the 2022–2023 period (green tones) marks a shift toward broader economic and strategic dimensions, with keywords like economics, digital economy, knowledge management, and decision making becoming more prominent, indicating that digital maturity began to be viewed as a strategic asset influencing performance. More recent trends (2024–2025), highlighted in yellow, reveal the emergence of topics such as sustainable development, circular economy, digital technologies, investments, and industry 4.0, showing a growing integration between digital maturity and sustainability as well as a stronger focus on innovation and resource allocation. Additionally, increasing attention to emerging economies and public policy suggests a shift toward a more inclusive and globally relevant research agenda, although contributions from developing regions remain limited.

Table 2. Most Cited Article

| Citations | Author and Year | Title | Publication |
|---|---|---|---|
| 438 | [19] | Levelized cost of electricity for solar photovoltaic and electrical energy storage | Applied Energy |
| 135 | [20] | An overview of benefits and challenges of building information modelling (BIM) adoption in UK residential projects | Construction Innovation |
| 123 | [21] | The role of national cybersecurity strategies on the improvement of cybersecurity education | Computers and Security |
| 118 | [22] | Integration of 2D materials on a silicon photonics platform for optoelectronics applications | Nanophotonics |
| 91 | [23] | Using electric vehicles for energy services: Industry perspectives | Energy |
| 70 | [24] | Going beyond waste reduction: Exploring tools and methods for circular economy adoption in small-medium enterprises | Resources, Conservation and Recycling |
| 56 | [25] | Reconceptualising the digital maturity of health systems | The Lancet Digital Health |
| 46 | [26] | Federal health information policy: A case of arrested development | Health Affairs |
| 43 | [27] | Socio-economic and cultural effects of disruptive industrial technologies for sustainable development | International Journal of Global Energy Issues |
| 39 | [28] | Pricing of data products in data marketplaces | Lecture Notes in Business Information Processing |

Source: Scopus, 2026

Table 2 shows that the most cited articles in this research area originate from multiple adjacent fields, indicating that digital maturity is inherently multidisciplinary and shaped by intersections across energy, construction innovation, cybersecurity, health systems, digital policy, circular economy, and data-driven business models. The dominance of Lai and McCulloch's study on the levelized cost of electricity highlights the importance of economic evaluation in technology adoption, suggesting that digital maturity is closely linked to investment feasibility, efficiency, scalability, and long-term value creation, a pattern also reflected in studies on electric vehicles and circular economy adoption in SMEs. Additionally, sector-specific research, such as Georgiadou's work on BIM and studies on digital health systems and

policy, emphasizes that successful digital maturity depends on organizational, institutional, and governance factors, not merely technology implementation. The table further underscores the growing role of risk, cybersecurity, and data monetization, as seen in research on national cybersecurity strategies and data marketplace pricing, which expand the discussion toward digital governance and value capture. Notably, the most cited works are published in high-impact, application-oriented journals, indicating that the intellectual foundation of digital maturity in entrepreneurial economics is strongly influenced by practical, industry-driven challenges, reinforcing its status as an emerging and evolving concept shaped by cross-disciplinary insights.

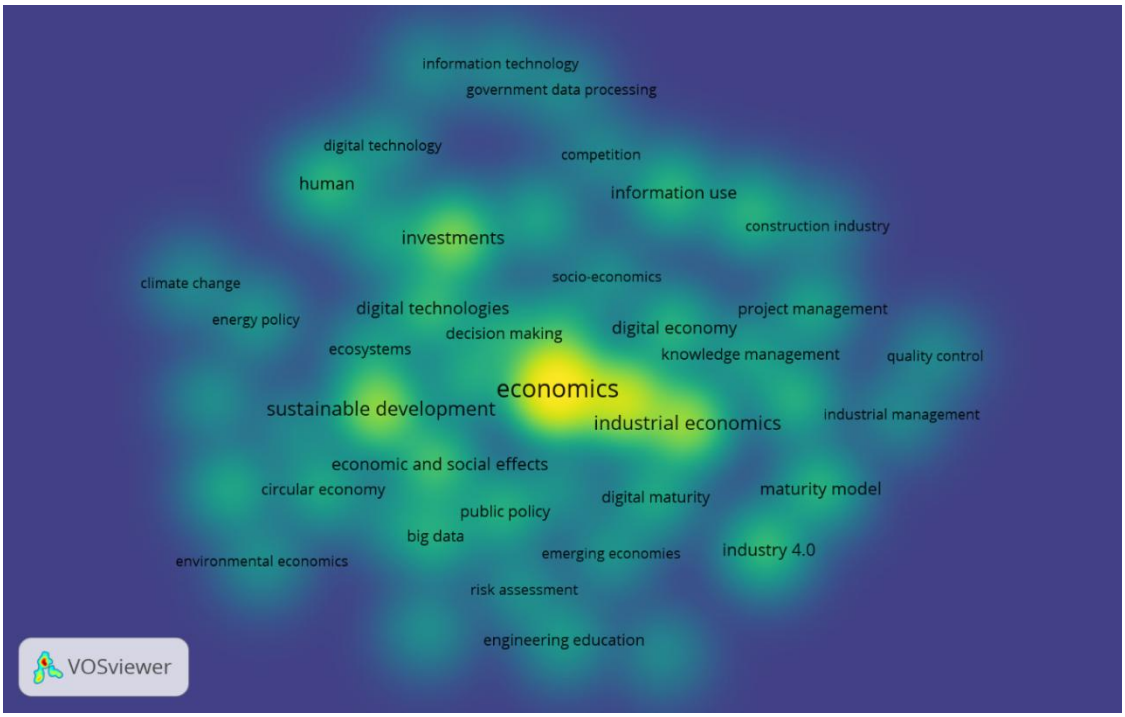


Figure 3. Density Visualization
Source: Data Analysis Result, 2026

Figure 3 presents the density visualization of keyword co-occurrence generated using VOSviewer, showing the concentration of research topics in digital maturity within entrepreneurial economics, where brighter areas indicate higher focus. The keyword "economics" appears as the most central theme, highlighting that digital maturity is strongly grounded in economic perspectives such as productivity, efficiency, and value creation, supported by related terms like digital economy and decision making. Another prominent area is "sustainable development," indicating growing integration with sustainability topics such as circular economy and environmental economics. In contrast, keywords like digital maturity, maturity model, and industry 4.0 appear less dense, suggesting they are still developing, along with emerging topics such as big data and emerging economies. Overall, the visualization shows a core-periphery structure, with economic themes at the center and technological and sustainability topics expanding outward, confirming that digital maturity remains an evolving research field.

### *3.3 Discussion*

The findings of this study confirm that digital maturity is evolving into a central concept within entrepreneurial economics, yet its development remains strongly rooted in

broader economic discourse. Across the network, overlay, and density visualizations, the dominance of the keyword economics indicates that digital maturity is still interpreted through the lens of economic performance, efficiency, and value creation. This suggests that scholars are not treating digital maturity as an isolated construct, but rather as an extension of existing economic and managerial theories [1], [2]. Consequently, digital maturity serves as a bridge that connects technological advancement with economic outcomes, reinforcing its relevance in understanding how firms compete and grow in digital environments.

At the same time, the results reveal a clear multidimensional structure of the research field. The clustering patterns show that digital maturity is simultaneously linked to industrial management, information systems, public policy, and sustainability. This indicates that the concept has expanded beyond its initial technological focus and now encompasses organizational, strategic, and societal dimensions. In particular, the presence of themes such as industry 4.0, knowledge management, and project management highlights the importance of internal organizational capabilities, while keywords like public policy and emerging economies emphasize the external institutional environment [29], [30]. This multidimensionality supports the argument that digital maturity should be conceptualized as a dynamic capability rather than a static technological condition.

The temporal evolution analysis further demonstrates that the field is undergoing a significant shift in research orientation. Earlier studies were primarily concerned with technological infrastructure and system implementation, reflecting a focus on "how to adopt" digital technologies. However, more recent research increasingly addresses "how to leverage" these technologies for strategic and sustainable outcomes. The emergence of keywords such as sustainable development, circular economy, and investments indicates that digital maturity is now being positioned as a driver of long-term value creation, not only for firms but also for society. This shift reflects a broader transformation in the literature, where digitalization is no longer viewed as an operational necessity, but as a strategic imperative.

Another important insight from this study is the strong influence of interdisciplinary knowledge on the development of digital maturity research. The most cited articles originate from diverse fields such as energy, healthcare, cybersecurity, and construction, suggesting that the concept is shaped by real-world applications across multiple industries. This cross-sectoral influence enriches the theoretical development of digital maturity but also contributes to fragmentation in the literature. As a result, there is still a lack of unified frameworks that can comprehensively explain how digital maturity operates across different contexts. Addressing this fragmentation represents an important direction for future research.

Finally, the findings highlight both opportunities and challenges for advancing the field. While digital maturity has gained significant attention, its core concepts—such as maturity models and digital capability—remain relatively less dense compared to broader economic themes, indicating that the field is still in a developmental stage. This opens opportunities for scholars to refine theoretical models, develop more robust measurement frameworks, and explore under-researched contexts such as SMEs in developing economies. For practitioners and policymakers, the results emphasize the need to move beyond technology adoption toward building integrated

digital ecosystems that support innovation, sustainability, and inclusive economic growth.

## 4. CONCLUSION

This study provides a comprehensive bibliometric overview of digital maturity as an emerging research domain within entrepreneurial economics, showing rapid growth in recent years and highlighting its increasing importance in shaping economic and business landscapes. The findings reveal that digital maturity is closely linked to economic performance, industrial development, and innovation, while also demonstrating a strong interdisciplinary nature that integrates perspectives from information systems, management, economics, and sustainability, positioning it as a dynamic capability for organizational adaptation and competitiveness. However, the concept is still evolving, with areas such as maturity models and applications in emerging economies remaining underexplored. The study also identifies a shift in focus from technological adoption to strategic and sustainability-oriented perspectives, indicating that digital maturity is increasingly viewed as a driver of long-term value creation and resilience. Overall, this research contributes by mapping the intellectual structure of the field and suggests that future studies should develop more integrated frameworks, expand empirical analysis across diverse contexts, and explore advanced technologies, while practitioners and policymakers should focus on strengthening digital ecosystems to support sustainable entrepreneurial growth.

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