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The Intellectual Evolution of Digital Skills and Competitive Advantage Research: A Scientometric Analysis

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ABSTRACT

Digital skills have become a strategic organizational capability for enabling digital transformation and sustaining competitive advantage. Despite the rapid growth of research in this area, the literature remains fragmented across business, management, innovation, and information systems, limiting a comprehensive understanding of its intellectual development. This study conducts a scientometric analysis of research on digital skills and competitive advantage in business and management. A total of 288 English-language journal articles published between 2015 and 2025 were retrieved from the Scopus database and analysed using bibliometric performance analysis and science mapping techniques. The analysis examined publication trends, influential publication sources, keyword co-occurrence, thematic evolution, and conceptual structure. The findings reveal that the field has evolved from an emerging research topic into a mature and interdisciplinary research domain organized around five major thematic clusters: digital transformation, artificial intelligence, innovation, human capital, and sustainability. More importantly, the results demonstrate that digital skills have progressively evolved from individual competencies into strategic organizational capabilities that link digital transformation with innovation and competitive advantage. Unlike previous narrative reviews, this study provides a systematic scientometric perspective on the intellectual evolution of the field, offering valuable insights for future research and managerial practice.

Keywords: Digital skills; Competitive advantage; Organizational capability; Digital transformation; Scientometric analysis

1. INTRODUCTION

Digital transformation has become a defining force in contemporary business and management. Beyond the adoption of digital technologies, it represents a fundamental organizational transformation that reshapes business models, operational processes, managerial practices, and value creation. As organizations increasingly integrate technologies such as artificial intelligence, big data analytics, cloud computing, the Internet of Things, and digital platforms into their operations, digital transformation has evolved from a technology-driven initiative into a strategic imperative for enhancing organizational competitiveness and long-term development (Vial, 2019). Consequently, firms increasingly compete not only through traditional resources and operational efficiency but also through their ability to leverage digital technologies, redesign organizational processes, and continuously create value in dynamic business environments (Verhoef et al., 2021). This transformation has attracted substantial scholarly attention across business, management, information systems, and innovation research, resulting in a rapidly expanding yet increasingly fragmented body of literature concerning the antecedents, enabling capabilities, and strategic outcomes of digital transformation (Nadkarni & Prügl, 2021). Within this growing research stream, digital skills have emerged as a critical organizational capability supporting digital transformation and strengthening firms' competitive advantage.

As organizations accelerate their digital transformation, digital skills have become an essential capability for effectively adopting, integrating, and leveraging digital technologies. Rather than referring solely to technical proficiency, digital skills encompass a broad range of competencies,

including digital communication, information management, problem-solving, collaboration, creativity, and the ability to adapt to rapidly evolving digital environments (van Laar et al., 2017). These competencies facilitate organizational learning, promote digital innovation, and enhance firms' responsiveness to changing market conditions (van Laar et al., 2020). From a strategic management perspective, digital skills extend beyond individual employee competencies and should be regarded as organizational capabilities that enable firms to transform digital investments into operational improvements, innovation outcomes, and business value (Bharadwaj et al., 2013). Accordingly, organizations possessing stronger digital capabilities are better positioned to redesign business processes, accelerate innovation, and implement digital transformation successfully, highlighting the strategic importance of digital skills in the digital economy (Kraus et al., 2022).

Although digital technologies create significant opportunities for organizational innovation and growth, technological investments alone do not guarantee improved organizational performance or sustained competitive advantage. Organizations differ considerably in their ability to convert digital technologies into business value, and this difference is increasingly associated with the development and effective application of digital skills. Consequently, digital skills have been recognized as a strategic organizational capability that enables employees to utilize digital technologies effectively, support organizational learning, facilitate knowledge sharing, and enhance innovation performance (Cetindamar Kozanoglu & Abedin, 2021). Beyond improving individual work performance, these competencies contribute to collective organizational capabilities that strengthen adaptability and cross-functional collaboration in dynamic business environments (Oberländer et al., 2020). Organizations with stronger digital skills are therefore better equipped to translate digital investments into innovation outcomes, operational excellence, and sustainable competitive advantage (Leão & da Silva, 2021). As a result, business and management research has increasingly recognized digital skills not merely as an individual competency but as a strategic organizational capability for creating long-term organizational value (Mikalef & Pateli, 2017).

Despite the rapid expansion of research on digital transformation, digital skills, and competitive advantage, the existing literature remains fragmented across multiple disciplines, including strategic management, information systems, innovation, human resource management, and organizational studies. Although this interdisciplinary development has generated valuable insights into the antecedents, mechanisms, and outcomes of digital skills in different organizational contexts, the literature has largely evolved through separate research streams, making it difficult to obtain a comprehensive understanding of the field's intellectual structure, thematic development, and conceptual organization (Nadkarni & Prügl, 2021). Existing review studies have primarily examined specific aspects of digital transformation or digital capabilities, whereas relatively limited attention has been devoted to systematically investigating the overall intellectual development of research on digital skills and competitive advantage (Vial, 2019; Kraus et al., 2022). Consequently, important questions concerning publication development, knowledge structure, thematic evolution, and conceptual relationships within this research field remain insufficiently addressed. A comprehensive scientometric analysis is therefore required to provide an integrated understanding of how this body of knowledge has evolved over time.

Scientometric analysis has become an established quantitative approach for systematically synthesizing large bodies of scientific literature and revealing the intellectual development of a research field (Donthu et al., 2021). Compared with traditional narrative reviews, scientometric analysis enables researchers to identify the knowledge base of a field, uncover relationships among research themes, map conceptual structures, and trace patterns of scholarly development over time (Aria & Cuccurullo, 2017). Furthermore, by combining bibliometric performance analysis with science mapping techniques, scientometric analysis provides a transparent, objective, and

reproducible framework for identifying research hotspots, thematic evolution, and emerging research directions, thereby supporting future theory development and research agendas (Zupic & Čater, 2015). Accordingly, scientometric analysis represents an appropriate methodological approach for developing a comprehensive understanding of research on digital skills and competitive advantage within the business and management literature.

To address the identified research gap, this study conducts a scientometric analysis of journal articles published in the business and management field. Based on a dataset of 288 journal articles indexed in the Scopus database between 2015 and 2025, the study maps the intellectual development of the field by examining publication trends, influential publication sources, keyword co-occurrence patterns, thematic evolution, and the conceptual structure of the research field. By integrating bibliometric performance analysis with science mapping techniques, this study provides a comprehensive overview of the evolution of research on digital skills and competitive advantage. The findings contribute to a more systematic understanding of the field's knowledge structure, conceptual relationships, and thematic evolution, while demonstrating the value of scientometric analysis for synthesizing an increasingly diverse and interdisciplinary body of literature. Furthermore, the results provide a useful reference for future research by identifying major research themes, their conceptual relationships, and their evolutionary patterns, while offering practical insights for organizations seeking to strengthen competitive advantage through the development and application of digital skills. Collectively, this study develops a comprehensive knowledge map that supports future scholarship and evidence-informed managerial decision-making in the context of digital transformation.

2.METHODOLOGY

2.1 Research Design

This study adopts a scientometric approach to systematically examine the intellectual development of research on digital skills and competitive advantage within the business and management literature. Scientometric analysis has become an established methodology for synthesizing large bodies of scientific publications and objectively revealing the intellectual structure, knowledge evolution, and thematic development of a research field (Donthu et al., 2021). Compared with traditional narrative reviews, this approach enables researchers to analyse publication patterns, thematic relationships, and the evolution of research domains using quantitative techniques, thereby providing a comprehensive overview of the development of a research field (Zupic & Čater, 2015).

The analytical framework of this study follows the methodological principles implemented in the Bibliometrix package developed by Aria and Cuccurullo (2017). Rather than relying solely on manual literature interpretation, the scientometric approach integrates bibliographic metadata with quantitative science mapping techniques to ensure transparency, reproducibility, and objectivity throughout the analytical process. Following this framework, the present study examines publication trends, influential publication sources, keyword co-occurrence networks, thematic evolution, and conceptual structure analysis to provide a comprehensive understanding of the intellectual development of research on digital skills and competitive advantage.

Overall, the adopted research design integrates bibliometric performance analysis with science mapping analysis, providing a systematic perspective on the evolution of the research field and establishing a robust methodological foundation for the subsequent empirical analyses.

2.2 Data Collection

The bibliographic data analysed in this study were retrieved from the Scopus database, which is widely recognised as one of the most comprehensive and authoritative sources of peer-reviewed scientific publications in the fields of business, management, and social sciences. Compared with other bibliographic databases, Scopus provides broad journal coverage, standardized bibliographic information, and high-quality citation data, making it particularly suitable for scientometric research (Donthu et al., 2021).

To ensure the relevance and consistency of the dataset, a structured search strategy was employed. The search was conducted using keywords related to digital skills and competitive advantage within the title, abstract, and keywords of publications. The search period covered 2015 to 2025, reflecting the rapid development of research on digital transformation and digital skills during the past decade. To maintain the academic quality and comparability of the dataset, conference papers, book chapters, editorials, notes, reviews, and other non-article document types were excluded.

Following the application of these selection criteria, the bibliographic records were exported from Scopus in a compatible format for subsequent analysis. Duplicate records and documents with incomplete bibliographic information were removed during the data preparation process. The final dataset consisted of 288 journal articles, which provided the empirical basis for the scientometric analyses presented in this study.

2.3 Data Analysis

The bibliographic data were analysed using Bibliometrix (R package) following established scientometric procedures proposed by Aria and Cuccurullo (2017). Bibliometrix provides a comprehensive analytical framework for bibliometric performance analysis and science mapping, enabling researchers to systematically investigate the development, structure, and evolution of a research field. Consistent with established scientometric practices (Donthu et al., 2021; Zupic & Čater, 2015), the present study combines descriptive performance analysis with science mapping techniques to provide a comprehensive understanding of research on digital skills and competitive advantage.

The analysis comprised two complementary components. First, performance analysis was conducted to examine publication trends and leading publication sources. Second, science mapping analysis was employed to investigate keyword co-occurrence, thematic evolution, and conceptual structure, thereby revealing the intellectual development of the research field. Together, these complementary analyses provide both a descriptive overview of the literature and a deeper understanding of the knowledge structure and thematic evolution of research on digital skills and competitive advantage.

To enhance the visualization of thematic relationships, VOSviewer (version 1.6.20) was employed to construct the keyword co-occurrence network because of its strong capability in mapping and visualizing relationships among research topics. Accordingly, Bibliometrix provided the analytical framework for bibliometric performance analysis, thematic evolution, and conceptual structure analysis based on Multiple Correspondence Analysis (MCA), whereas VOSviewer (version 1.6.20) was employed to visualize the keyword co-occurrence network. Keyword standardization was

performed prior to science mapping to improve the consistency of keyword co-occurrence, thematic evolution, and conceptual structure analyses.

2.4 Analytical Procedure

The analytical procedure followed a systematic workflow consisting of four sequential stages. First, bibliographic records were retrieved from the Scopus database using predefined search criteria and eligibility restrictions. Second, the retrieved records were screened and prepared for analysis by removing duplicate entries and documents with incomplete bibliographic information. Third, the cleaned dataset was analysed using bibliometric performance analysis and science mapping techniques to examine publication trends, influential publication sources, keyword co-occurrence, thematic evolution, and conceptual structure. Finally, the analytical results were interpreted to identify the intellectual development of the research field, major research themes, and patterns of thematic evolution, thereby providing a comprehensive understanding of research on digital skills and competitive advantage.

3. RESULTS

3.1 Publication Trends
3.2

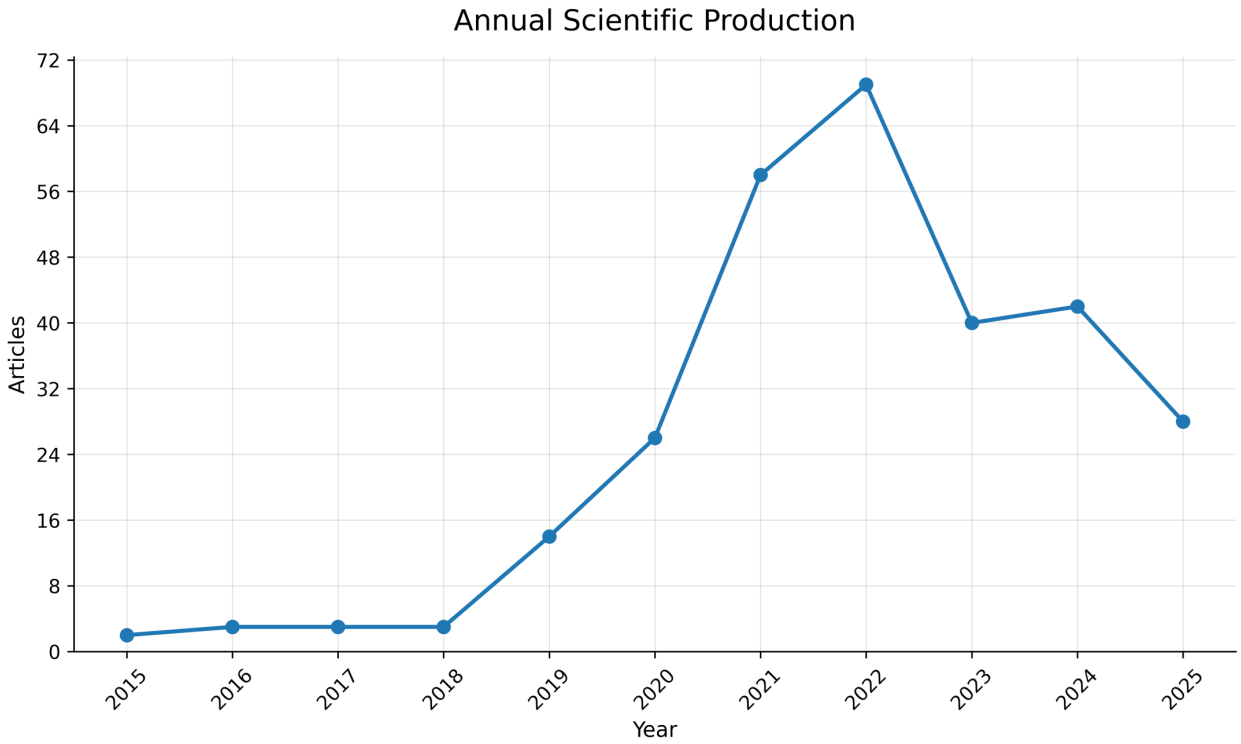

Figure 1. Annual scientific production from 2015 to 2025.

Figure 1 presents the annual scientific production on digital skills and competitive advantage based on the final dataset of 288 journal articles published between 2015 and 2025. Overall, the

publication trend demonstrates a clear transition from an emerging research topic to a rapidly expanding field, followed by a period of sustained scholarly attention.

Research output remained limited during the initial stage (2015–2018), with only two to three publications appearing each year. This relatively low level of scientific production suggests that the relationship between digital skills and competitive advantage had not yet become an established research topic within the business and management literature. During this period, existing studies primarily focused on conceptual discussions of digital competencies and their potential implications for organizational performance.

From 2019 onwards, the field entered a phase of rapid expansion. Annual publications increased from 14 articles in 2019 to 26 in 2020, before more than doubling to 58 publications in 2021. Research output reached its highest level in 2022, with 69 published articles. This substantial increase coincided with intensified research activity related to digital transformation and organizational digitalization.

Following the publication peak in 2022, annual output remained at a relatively high level, with 40 publications in 2023 and 42 in 2024, indicating that research activity has stabilized rather than declined. The lower number of publications recorded for 2025 (28 articles) should be interpreted with caution, as the bibliographic data were collected before the completion of the publication year.

Overall, the observed publication trajectory suggests that research on digital skills and competitive advantage has evolved from an emerging topic into a well-established area of inquiry with sustained academic attention.

3.2 Influential Sources

Table 1. Top 10 Most Productive Publication Sources (N = 288)

Rank	Source	Records	Percentage (%)
1	Sustainability	69	23.96
2	PLOS ONE	26	9.03
3	Heliyon	20	6.94
4	Energies	9	3.13
5	Behavioral Sciences	9	3.13
6	Scientific Reports	8	2.78
7	International Journal of Environmental Research and Public Health	6	2.08
8	Applied Sciences	5	1.74
9	Journal of the Knowledge Economy	5	1.74
10	Education Sciences	4	1.39

Note. Records refers to the number of publications retrieved from the final Scopus dataset (N = 288). Percentage (%) was calculated as the number of records published by each source divided by the total number of records in the dataset. The top ten publication sources contributed 161 records (55.90%), indicating that research output is concentrated in a relatively small number of journals.

Table 1 presents the ten most productive publication sources in the field of digital skills and competitive advantage. Together, these sources contributed 161 records, accounting for 55.90% of the final dataset, indicating that research output is concentrated in a relatively small group of publication sources.

Among all sources, Sustainability ranked first with 69 records (23.96%), substantially exceeding all other journals. PLOS ONE ranked second with 26 records (9.03%), followed by Heliyon with 20 records (6.94%). These three publication sources alone accounted for 115 records, representing

39.93% of the entire dataset, highlighting their dominant role in disseminating research on digital skills and competitive advantage.

The remaining sources published between four and nine records each, including Energies, Behavioral Sciences, Scientific Reports, International Journal of Environmental Research and Public Health, Applied Sciences, Journal of the Knowledge Economy, and Education Sciences. Although individual publication outputs were relatively modest, the diversity of these sources demonstrates that research on digital skills and competitive advantage is distributed across journals covering business and management, sustainability, organizational studies, education, engineering, and interdisciplinary sciences. Overall, the distribution of publication sources suggests that the field has developed a relatively concentrated publication pattern while maintaining broad interdisciplinary coverage.

3.3 Research Hotspots: Keyword Co-occurrence Analysis

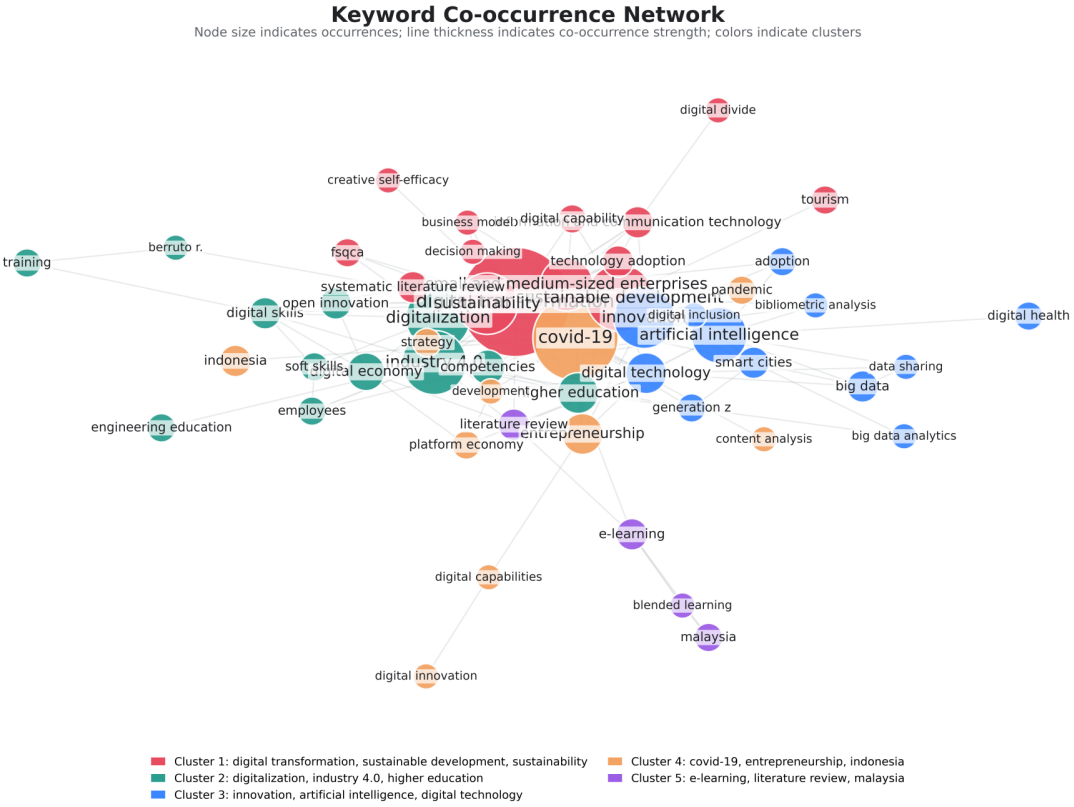

Figure 2. Keyword Co-occurrence Network

Note: Node size represents keyword occurrences, line thickness indicates co-occurrence strength, and node color denotes cluster membership. The network includes keywords occurring at least twice in the final dataset.

Figure 2 presents the keyword co-occurrence network generated from the final dataset of 288 publications. After keyword standardization and data cleaning, the network comprised 52 high-frequency keywords, 146 co-occurrence links, and five thematic clusters, providing an overview of the conceptual structure of research on digital skills and competitive advantage.

The network is characterized by several prominent keywords, including digital transformation, artificial intelligence, digital skills, innovation, and competitive advantage. These keywords occupy central positions within the network, exhibiting relatively large node sizes and numerous

connections with other concepts. Their prominence suggests that these keywords constitute the core research topics within the field.

The clustering analysis identified five distinct research themes. Cluster 1 (Digital Transformation and Organizational Capability) encompasses studies related to organizational change, digital technologies, and capability development. Cluster 2 (Artificial Intelligence and Digital Technologies) focuses on artificial intelligence, intelligent systems, and emerging digital technologies. Cluster 3 (Innovation and Competitive Advantage) includes research addressing innovation capability, strategic management, organizational performance, and competitive advantage. Cluster 4 (Human Capital and Digital Skills) covers workforce competencies, digital capability development, education, and skills acquisition. Cluster 5 (Sustainability and Digitalization) contains studies linking digital technologies with sustainable development and environmental management.

The distribution of keywords across the five clusters demonstrates that the literature is organized around multiple interconnected research domains. Strong co-occurrence relationships are observed among the central concepts, particularly between digital transformation, artificial intelligence, innovation, digital skills, and competitive advantage, indicating substantial connections among these research topics. In addition, the network exhibits relatively dense inter-cluster linkages, reflecting considerable conceptual overlap among the identified thematic domains.

Overall, the co-occurrence network demonstrates a well-connected thematic structure consisting of five major research domains. Digital transformation, artificial intelligence, innovation, digital skills, and competitive advantage constitute the core concepts within the field, while the relationships among the identified clusters illustrate the breadth and interconnectedness of contemporary research on digital skills and competitive advantage.

3.4 Thematic Evolution

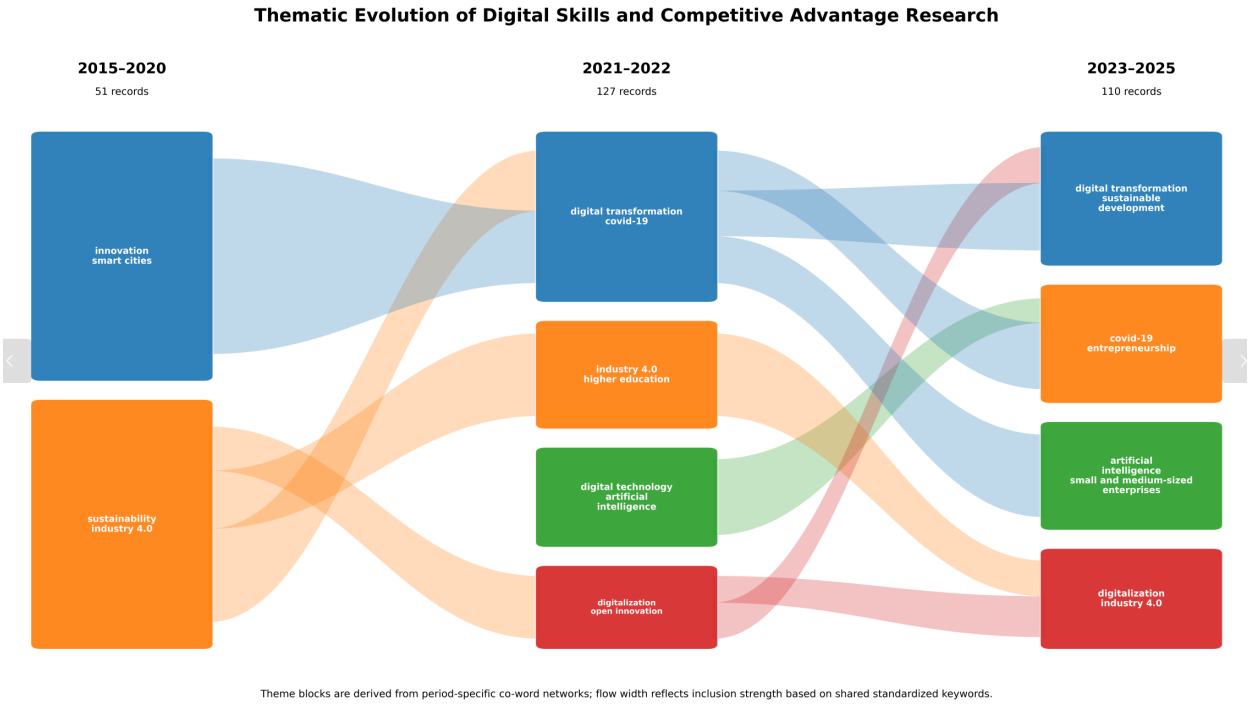

Figure 3. Thematic Evolution of Digital Skills and Competitive Advantage Research

Note: Theme blocks were derived from period-specific keyword co-occurrence networks. Block size reflects the number of related records, while flow width indicates thematic inclusion strength based on shared standardized keywords across consecutive periods.

Figure 3 illustrates the thematic evolution of research on digital skills and competitive advantage across three consecutive periods (2015–2020, 2021–2022, and 2023–2025). The thematic evolution analysis was based on period-specific keyword co-occurrence networks, with thematic continuity identified through shared standardized keywords between adjacent time periods.

During the 2015–2020 period, the research landscape was characterized by a relatively limited number of themes centered on digital transformation, digitalization, innovation, and organizational capability. These themes formed the conceptual foundation of the field and primarily reflected the adoption of digital technologies and their implications for organizational development. The thematic structure during this stage was comparatively concentrated, with fewer research themes and relatively simple relationships among them.

In the 2021–2022 period, the thematic structure became more diversified. Several themes expanded from the earlier research base, with artificial intelligence, digital skills, innovation, and organizational capability emerging as increasingly prominent topics. The thematic evolution network indicates that multiple themes from the previous period continued into this stage through shared keyword connections, while additional themes developed around digital technologies and capability development. Compared with the previous period, both the number of themes and the complexity of thematic relationships increased substantially.

During 2023–2025, the thematic landscape exhibited further diversification and stronger interconnections among research themes. Topics related to artificial intelligence, digital transformation, competitive advantage, digital skills, and sustainability occupied more prominent positions within the evolution network. Several themes demonstrated continuity across all three periods, while others emerged through the integration of concepts originating from multiple earlier themes. The increasing number of cross-theme connections indicates a more interconnected conceptual structure in the recent literature.

Overall, the thematic evolution analysis reveals a progressive expansion of the research field over time. Early research themes associated with digital transformation and organizational capability continued to develop throughout the study period, while new themes related to artificial intelligence, digital skills, sustainability, and competitive advantage gradually became integrated into the knowledge structure. The evolution pathways shown in Figure 3 demonstrate both thematic continuity and thematic diversification, reflecting the dynamic development of research on digital skills and competitive advantage during 2015–2025.

3.5 Conceptual Structure of the Research Field

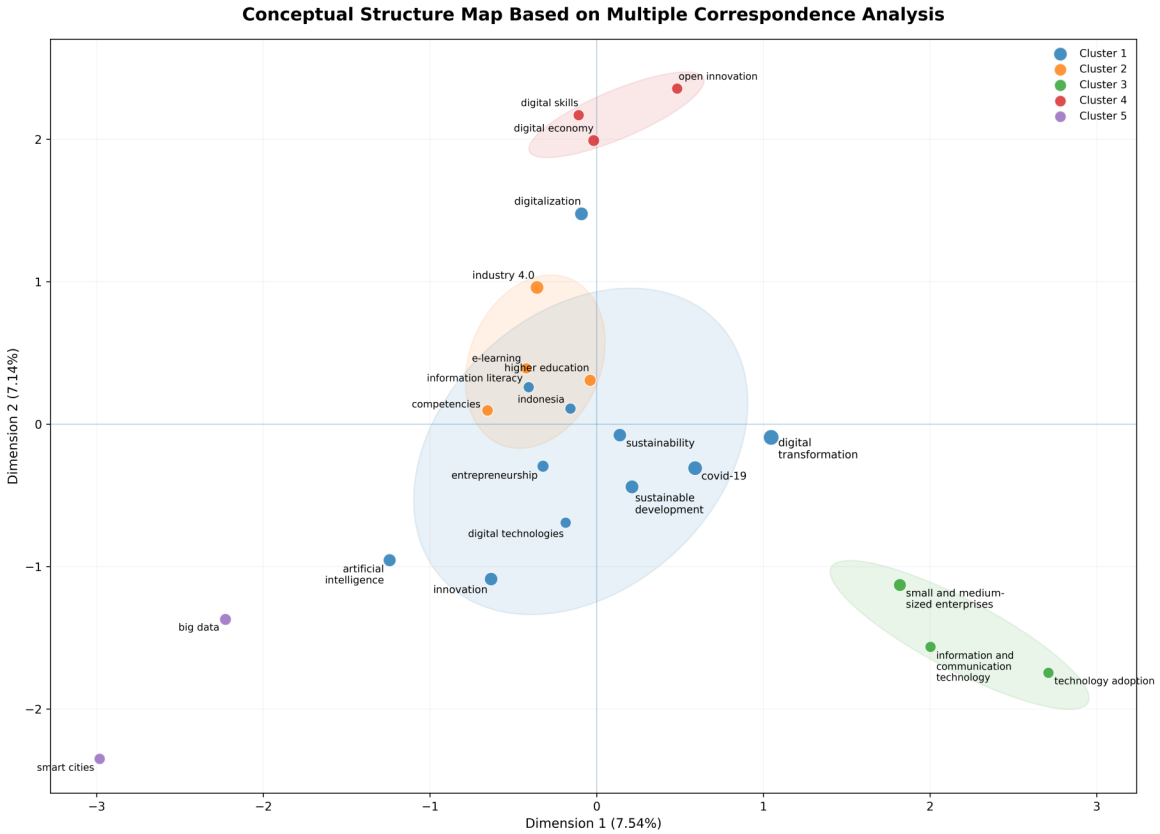

Figure 4. Conceptual Structure Map Based on Multiple Correspondence Analysis

Note: Figure 4. Conceptual structure map of digital skills and competitive advantage research based on Multiple Correspondence Analysis (MCA).

Figure 4 presents the conceptual structure of the research field based on Multiple Correspondence Analysis (MCA) of author keywords. The analysis identified five conceptual clusters, representing the principal thematic dimensions of digital skills and competitive advantage research within the business and management literature.

The largest cluster is centered on digital transformation, incorporating closely related concepts such as digitalization, innovation, sustainability, artificial intelligence, COVID-19, and sustainable development. The close spatial proximity of these keywords indicates that organizational digital transformation has become the dominant conceptual foundation of the field.

A second cluster is associated with Industry 4.0 and competency development, linking keywords including industry 4.0, higher education, competencies, and e-learning. This cluster reflects growing scholarly attention to workforce capability development and educational adaptation in response to digital transformation.

The third cluster focuses on technology adoption in small and medium-sized enterprises (SMEs). Keywords such as small and medium-sized enterprises, information and communication technology, and technology adoption are positioned together, suggesting a coherent research stream examining digital adoption within smaller business organizations.

A fourth conceptual cluster emphasizes the relationship between digital skills and innovation, combining digital economy, digital skills, and open innovation. This cluster highlights the increasing importance of workforce digital competencies as strategic resources supporting innovation and organizational competitiveness.

Finally, a smaller cluster is composed of big data and smart cities, representing an emerging research direction that connects data-driven technologies with broader digital ecosystems and urban innovation.

Overall, the conceptual structure demonstrates that research on digital skills and competitive advantage has evolved into several interconnected thematic domains. Digital transformation occupies the central position within the conceptual space, while the remaining clusters represent complementary research themes.

4. DISCUSSION

4.1 Principal Findings and Research Development

The findings of this scientometric analysis indicate that research on digital skills and competitive advantage has undergone substantial intellectual development over the past decade. What initially emerged as a relatively specialized topic has progressively evolved into an important research domain within the broader fields of business and management. This development reflects the growing recognition that digital skills are no longer viewed merely as individual competencies but increasingly as strategic organizational capabilities that enable firms to respond to technological change, enhance innovation, and sustain competitive advantage. Consequently, research has expanded from examining the operational application of digital technologies to exploring how digital capabilities contribute to organizational transformation and long-term value creation.

The rapid expansion of this research field is closely associated with the accelerating pace of digital transformation across industries. As organizations increasingly adopted artificial intelligence, big data analytics, cloud computing, and other digital technologies, scholars began to shift their attention from technological adoption itself toward the organizational capabilities required to create business value from these technologies. This transition is also consistent with broader developments in strategic management, where competitive advantage is increasingly understood as depending not only on technological resources but also on the capabilities that allow organizations to integrate, adapt, and continuously reconfigure those resources in dynamic environments. Within this context, digital skills have become an important mechanism through which organizations strengthen innovation capability, improve organizational resilience, and support sustainable competitive performance.

Another notable finding is the gradual formation of a more coherent intellectual structure within the research field. Rather than remaining fragmented across different disciplinary perspectives, studies have increasingly converged around several interconnected themes, including digital transformation, artificial intelligence, innovation, organizational capability, sustainability, and competitive advantage. The close relationships among these themes suggest that contemporary research has moved beyond isolated investigations of digital technologies and has instead adopted a more integrated perspective that emphasizes the interaction between technological development, organizational capability, and strategic performance. This growing conceptual integration also indicates that digital skills have become a central element connecting multiple streams of business and management research.

Overall, the observed patterns demonstrate that research on digital skills and competitive advantage has entered a stage of increasing maturity. The field is characterized not only by sustained scholarly attention but also by a progressively clearer conceptual organization and stronger thematic interconnections. These developments suggest that digital skills have evolved from being regarded primarily as employee-level competencies to becoming an essential

organizational capability for achieving competitive advantage in digitally transformed business environments. Building upon these findings, the following discussion considers the theoretical and practical implications of this evolving body of knowledge.

4.2 Theoretical and Practical Implications

The findings of this study provide important theoretical insights into the evolving role of digital skills in business and management research. Rather than being treated solely as individual competencies, digital skills have progressively emerged as organizational capabilities that enable firms to create and sustain competitive advantage in increasingly digitalized business environments. The intellectual development of the research field demonstrates a clear transition from technology-oriented perspectives toward capability-oriented explanations, suggesting that organizations derive competitive value not simply from adopting digital technologies but from developing the capabilities required to integrate, utilize, and continuously adapt these technologies in support of organizational objectives.

This evolution is consistent with the resource-based view and the dynamic capabilities perspective, which emphasize that sustainable competitive advantage depends not only on valuable resources but also on an organization's ability to reconfigure and deploy those resources in response to environmental change (Barney, 1991; Teece et al., 1997; Teece, 2007). The findings indicate that digital skills increasingly function as strategic organizational capabilities that connect technological investment with innovation, organizational learning, and business performance. In this sense, digital skills should be understood not as an isolated human resource attribute but as an integral component of organizational capability development within the broader process of digital transformation.

Another important implication concerns the increasing integration of research themes across disciplinary boundaries. The close conceptual relationships among digital transformation, artificial intelligence, innovation, sustainability, and competitive advantage suggest that contemporary research has gradually moved beyond fragmented investigations of individual technologies. Instead, scholars increasingly adopt a holistic perspective in which technological development, organizational capability, and strategic performance are examined as mutually reinforcing elements. This growing conceptual integration indicates that research on digital skills has become an important bridge connecting strategic management, innovation studies, information systems, and organizational research, thereby strengthening the interdisciplinary foundation of the field.

From a practical perspective, the findings highlight that investments in digital technologies alone are unlikely to generate sustained competitive advantage without corresponding investments in organizational capability development. Managers should therefore view digital skills as strategic assets embedded within organizational processes rather than as isolated employee competencies. Developing digital skills requires continuous learning, knowledge sharing, cross-functional collaboration, and organizational support to ensure that technological investments translate into innovation and long-term business value. For organizations undergoing digital transformation, cultivating digital capabilities should become an integral component of strategic planning rather than a stand-alone training initiative.

The findings also have implications for policymakers and educational institutions. As digital transformation continues to reshape industrial structures and labor market requirements, collaboration among governments, universities, and industry becomes increasingly important for developing workforces capable of adapting to rapidly changing technological environments. Policies promoting lifelong learning, digital literacy, and industry-oriented education can contribute to

strengthening national digital capabilities while supporting organizational competitiveness and sustainable economic development.

4.3 Future Research Directions

The present study also identifies several promising directions for future research. As the intellectual structure of the field continues to evolve, future studies should move beyond describing the importance of digital skills and instead investigate the mechanisms through which digital capabilities contribute to organizational competitiveness under different technological and institutional conditions.

First, greater attention should be devoted to understanding the interaction between digital skills and emerging digital technologies. The growing prominence of themes such as artificial intelligence, big data, and digital transformation suggests that future research should examine how employees and organizations develop new digital capabilities to effectively collaborate with intelligent technologies. Rather than focusing solely on technology adoption, future studies could explore how digital skills influence organizational adaptation, decision-making, innovation processes, and strategic performance in increasingly AI-enabled business environments.

Second, more research is needed to investigate the relationship between digital skills and sustainable organizational development. The thematic evolution of the literature indicates that sustainability has become increasingly integrated with digital transformation research. Future studies could therefore examine how digital capabilities contribute to environmental sustainability, social responsibility, and long-term organizational resilience. Such research would provide a more comprehensive understanding of how digital transformation supports sustainable competitive advantage beyond short-term productivity or financial performance.

Third, additional empirical evidence from different organizational and national contexts is required. Existing studies remain concentrated in specific industries and geographical settings, limiting the generalizability of current knowledge. Comparative research across countries, industries, and organizational sizes—particularly among small and medium-sized enterprises (SMEs)—would improve understanding of how institutional environments, organizational resources, and cultural factors shape the development and effectiveness of digital skills. Cross-country comparative studies may also reveal important differences in digital capability development under diverse economic and policy conditions.

Finally, future research would benefit from adopting more longitudinal and multi-level research designs. Most existing studies provide cross-sectional evidence, offering only limited insight into how digital capabilities evolve over time. Longitudinal studies could examine the dynamic development of digital skills throughout organizational digital transformation processes, while multi-level research could investigate the interactions among individual competencies, team capabilities, organizational learning, and strategic outcomes. Such approaches would contribute to a deeper understanding of how digital skills create sustained competitive advantage in rapidly changing digital environments.

5. CONCLUSION

This study provides a comprehensive scientometric analysis of research on digital skills and competitive advantage in business and management based on 288 Scopus-indexed journal articles published between 2015 and 2025. By combining bibliometric performance analysis with science

mapping techniques, the study identifies the publication trends, influential publication sources, conceptual structure, keyword relationships, and thematic evolution of the field.

The findings demonstrate that research on digital skills has experienced rapid growth and increasing conceptual maturity over the past decade. More importantly, the knowledge structure of the field indicates a clear transition from viewing digital skills as individual competencies toward recognizing them as strategic organizational capabilities that support digital transformation, innovation, and sustainable competitive advantage. These findings contribute to a more systematic understanding of the intellectual development of this emerging research domain and provide a foundation for future academic inquiry.

Despite these contributions, the study has several limitations. The analysis is restricted to English-language journal articles indexed in the Scopus database and therefore does not capture relevant studies published in other languages or databases. Future research may extend the scope by incorporating multiple bibliographic databases, additional document types, and updated datasets to provide a more comprehensive understanding of this rapidly evolving field.

Overall, this study offers a structured overview of the evolution of digital skills research and highlights its growing significance within business and management scholarship. As digital transformation continues to reshape organizations and industries, digital skills are expected to remain a central capability for achieving sustainable competitive advantage.

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