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Mapping the Intellectual Structure of Digital Leadership Research: A Bibliometric Analysis of Innovation and School Organizational Performance

Adriantoni[1]* , [1], Riri Marfilinda[2], Elva Zuleni[3], Aan Komariah[4], Meriyanti[5], Tiara Mona Liza[6], Li Kunmei[7]
[1,2,3, 5,6] Universitas Adzkia, Indonesia.
[4] Universitas Pendidikan Indonesia, Indonesia.
[6] Guangxi University of Language, China.
* Corresponding Author. E-mail: adriantoni@adzkia.ac.id

Abstract:
Penelitian ini bertujuan memetakan struktur intelektual kepemimpinan digital dalam kaitannya dengan inovasi dan kinerja organisasi sekolah melalui analisis bibliometrik terhadap 4.893 dokumen publikasi global. Hasil penelitian menunjukkan bahwa kepemimpinan transformasional dan pemberdayaan menjadi tema dominan yang mendorong inovasi dan meningkatkan kinerja institusi pendidikan. Faktor pendukung meliputi hubungan interpersonal yang berkualitas, lingkungan kerja kolaboratif, serta praktik manajemen sumber daya manusia yang adaptif. Temuan ini menegaskan pentingnya kepemimpinan digital dalam membangun ekosistem pendidikan yang inovatif dan responsif. Penelitian ini merekomendasikan penguatan kompetensi kepemimpinan digital bagi pendidik dan pemangku kebijakan guna mengoptimalkan pemanfaatan teknologi dalam meningkatkan kinerja sekolah.

This study aims to map *the intellectual structure of digital leadership in relation to innovation and school organizational performance through a bibliometric analysis of 4,893 global publications. The findings reveal that transformational and empowering leadership are dominant themes that drive innovation and enhance institutional performance. Supporting factors include high-quality interpersonal relationships, collaborative work environments, and adaptive human resource management practices. These results highlight the strategic importance of digital leadership in fostering innovative and responsive educational ecosystems. The study recommends strengthening digital leadership competencies among educators and policymakers to optimize the use of technology in improving school performance.*

Keywords: *Digital Leadership, Inovation,* Performance Improvement, School Organization, *Analisis Bibliometrik.*

INTRODUCTION

Leadership is a critical factor in shaping the vision, culture, and performance of educational institutions (Effendi & Erb, 2024; Malik et al., 2024). In schools, leadership plays a strategic role in aligning policies, motivating educators, and ensuring effective collaboration (Karim et al., 2019). With rapid global and technological change, digital leadership has

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become increasingly essential. It enables school leaders to integrate technology into decision-making, resource management, and teaching practices, thereby driving innovation and organizational efficiency (Szukits & Móricz, 2024; Sacavém et al., 2025).

Several leadership models have been widely applied in educational contexts, such as transformational, transactional, and distributive leadership (Fikriyah et al., 2021; Krisharyuli et al., 2020). However, these models are not sufficient to address the challenges of the digital era. Digital leadership is distinct in its emphasis on leveraging technology to build modern organizational cultures, strengthen collaboration, and support data-driven decision-making (Schmidt et al., 2023; Oyekola, 2024).

Although research on leadership in education is extensive, studies focusing specifically on digital leadership and its relation to innovation and school organizational performance remain limited. Previous bibliometric studies have generally examined leadership in broader contexts such as management, higher education, or general digital transformation—without mapping the intellectual structure of digital leadership in schools. This gap highlights the need for a systematic bibliometric approach to identify dominant themes, influential authors, and emerging trends in digital leadership within the education sector.

This study therefore aims to map the intellectual structure of digital leadership in relation to innovation and organizational performance in schools using bibliometric analysis of 4,893 global publications. By doing so, it provides a clearer understanding of how digital leadership contributes to school effectiveness, highlights research gaps for future studies, and offers practical insights for policymakers and educators to strengthen leadership capacity in the digital era.

LITERATURE REVIEW

Digital Leadership

Digital leadership has emerged as a response to the Fourth Industrial Revolution, which has reshaped the way people live, work, and learn (Alzahrani et al., 2021). In education, it refers to the use of digital tools and platforms to enhance communication, decision-making, and collaboration within schools. E-leadership is defined as a process of social influence mediated by digital technology that fosters changes in attitudes, behaviors, and organizational outcomes (Alkhayyal & Bajaba, 2023).

Leaders in the digital era must not only adopt technology but also shape a culture of innovation and collaboration. They are expected to demonstrate transformational skills, adaptability, and a forward-looking mindset (Widodo et al., 2023). In higher education, digital leadership has been shown to improve flexibility in learning and academic services (Chavez et al., 2023). However, studies that systematically map its intellectual structure in the context of school leadership remain scarce.

Performance Improvement

Performance improvement in schools involves enhancing student outcomes, teacher effectiveness, and organizational efficiency (LeMahieu et al., 2017). Leadership, organizational culture, and technology are among the main drivers (Wijaya & Eppang, 2021). The Human Performance Model emphasizes knowledge, skills, motivation, and feedback as critical factors (Case et al., 2017).

In education, strategies such as teacher professional development, innovative pedagogies, and technology integration are widely recognized. Yet, limited studies explore

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how digital leadership directly contributes to school performance improvement. This gap underscores the need to examine digital leadership not merely as a management approach, but as a key factor in educational competitiveness.

School Organization

Schools function as complex social systems composed of individuals, structures, and cultures (Dahiru et al., 2018). Classical theories such as bureaucratic, systems, and humanistic perspectives offer valuable insights into organizational effectiveness (Kumari, 2024; Torres, 2022). However, modern schools require more adaptive structures that can integrate technology, support collaboration, and respond to rapid change (Yaxing & Kadir, 2024)

Effective digital leadership plays a central role in aligning these organizational elements to create innovative, responsive, and sustainable educational environments (Eze, 2024). Thus, understanding digital leadership through a bibliometric approach provides a timely perspective on how school organizations can transform in the digital era.

METHODOLOGY

This study adopts a bibliometric approach, which is a quantitative method used to systematically analyze scientific literature (Passas, 2024; Yıldız & Karakuş Yılmaz, 2024; Öztürk et al., 2024). The bibliometric method was chosen because it allows for the mapping of intellectual structures, publication trends, and collaboration networks in the field of educational research, specifically digital leadership. The main focus of this study is to identify the evolution of research on digital leadership in improving the effectiveness of school organizations, along with collaboration patterns and academic contributions at the global level.

Data Source and Search Strategy

The dataset was obtained from the Scopus database, which is recognized as one of the most comprehensive and reputable sources of peer-reviewed literature. The search was conducted in July 2024 using the keywords “digital leadership” AND “school” OR “education” OR “organizational performance.” The search covered publications from 1954–2025, considering this period as representative of the emergence and rapid development of digital leadership in the educational context.

Data Collection and Screening

The initial search retrieved 4,893 documents, including journal articles, conference proceedings, and book chapters related to digital leadership in schools and educational organizations. Although this study intentionally did not apply strict filtering based on year, source type, or language, several basic screening procedures were implemented to ensure data quality. These included:

1. Removing duplicate records.
2. Verifying the completeness of bibliographic information (title, author, year, affiliation, keywords).
3. Excluding records with incomplete metadata (e.g., missing author name).

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The decision not to apply further inclusion or exclusion criteria was made to capture the broadest possible landscape of research development and avoid bias that may arise from limiting data based on specific criteria (Büyükkidik, 2022). This approach provides a more holistic understanding of how digital leadership has evolved across time, contexts, and research traditions.

Data Verification

To ensure data integrity, a completeness check was performed on all bibliographic information. Documents lacking key elements such as title, author name, or year were marked and analyzed only partially, depending on the available metadata. This step was intended to maintain transparency in the analysis process while retaining valuable contributions from the dataset.

Bibliometric Analysis

The bibliometric analysis was conducted using VOSviewer to map keyword co-occurrence, author collaboration, institutional and country networks, and thematic development over time. This analysis aimed to identify the most influential publications, authors, and institutions, as well as to visualize the intellectual structure of digital leadership research in education. By covering the entire dataset without restrictive filtering, the study presents a comprehensive mapping of trends, collaboration patterns, and thematic clusters related to digital leadership, educational transformation, and organizational performance.

RESULT

Number of Documents Found and Filters

The Scopus search retrieved 4,893 documents related to digital leadership in education from 2000–2024. Articles dominate (82.5%), followed by conference papers (9.1%), book chapters (3.7%), and reviews (2.3%). This shows that peer-reviewed journal articles remain the primary medium for disseminating research on digital leadership.

Analysis By Document Type

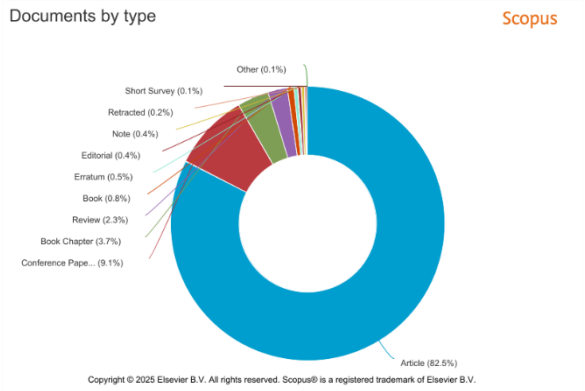

Figure 1. Document Type

The analysis of 4,893 Scopus documents (2000–2024) shows that journal articles dominate (82.5%), followed by conference proceedings (9.1%), book chapters (3.7%), and

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reviews (2.3%) (Figure 1). This indicates that peer-reviewed journals remain the main platform for disseminating knowledge on digital leadership in education.

Publication Trend Analysis by Year

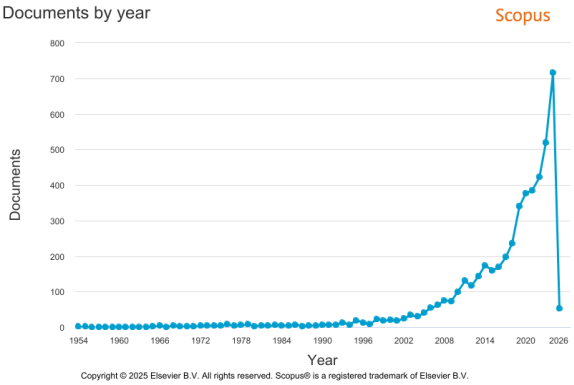

Figure 2. Annual Publication Trends

The number of publications (Figure 2) shows steady growth, with a sharp increase after 2015, coinciding with global digital transformation in education and the COVID-19 pandemic. This suggests a heightened urgency for digital leadership research in schools during periods of technological disruption.

Analysis Based on Journal Sources

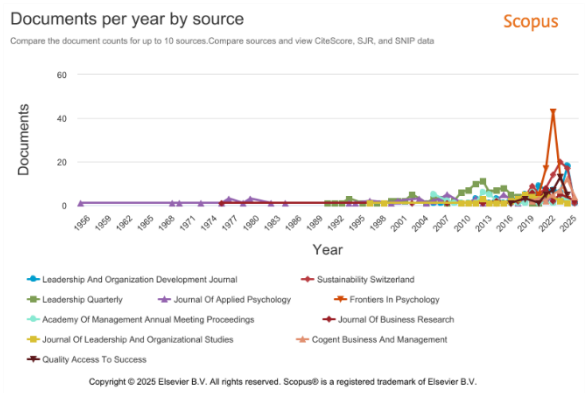

Figure 3. Journal Source

Analysis of journal sources (Figure 3) reveals that Leadership Quarterly, Journal of Applied Psychology, Sustainability (Switzerland), and Frontiers in Psychology are the most productive outlets. The recent rise in sustainability-focused journals reflects the integration of digital leadership with sustainability and organizational resilience.

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Analysis By Subject Areas

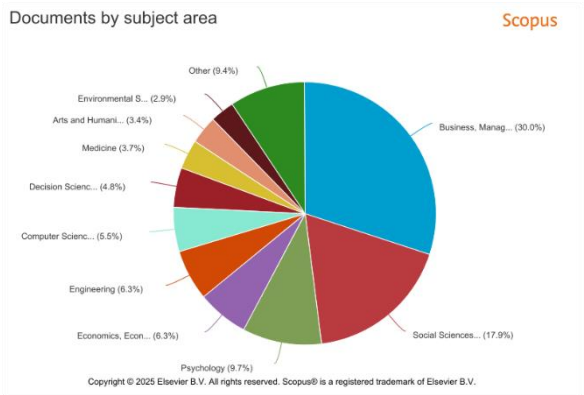

Figure 4. Distribution of Research Subjects Areas

Subject distribution (Figure 4) shows dominance in Business and Management (30%), followed by Social Sciences (17.9%) and Psychology (9.7%). This demonstrates that digital leadership is still primarily studied from an organizational and behavioral perspective, although connections with education are growing.

Analysis Based on Institutions

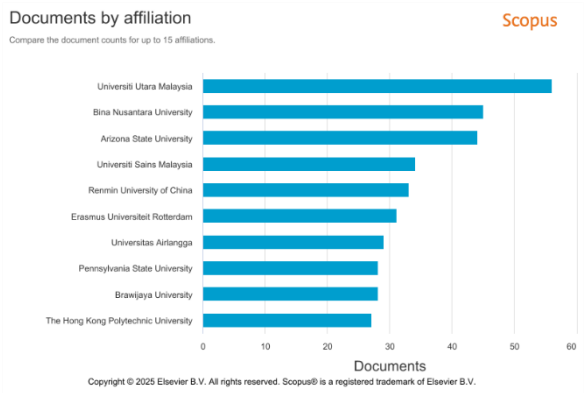

Figure 5. Analysis Based on Institutions

Figure 5 shows that Universiti Utara Malaysia, Bina Nusantara University, and Arizona State University contribute significantly, while Universiti Sains Malaysia and Renmin University of China also show notable involvement. This highlights Southeast Asia's rising influence in digital leadership research, complementing contributions from Western institutions.

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Analysis by Country

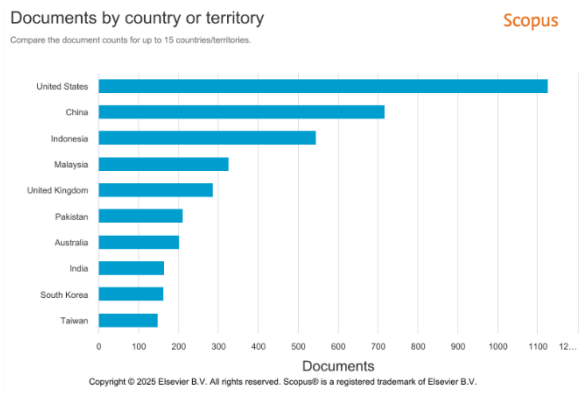

Figure 6. Distribution of Documents by Country

Figure 6 highlights the dominance of the United States and China, with Indonesia and Malaysia emerging as active contributors. This reflects both global leadership in research productivity and regional growth in Southeast Asia.

Keyword Based Analysis

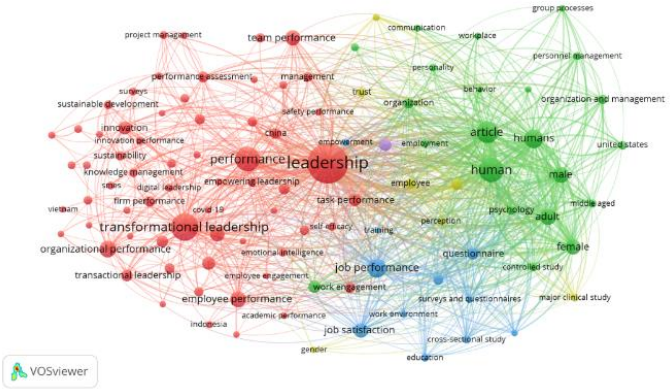

Figure 7. Leadership Keywords

The keyword co-occurrence mapping (Figure 7) reveals that “transformational leadership” and “empowering leadership” form the dominant clusters, strongly associated with themes such as performance, innovation, and knowledge sharing. This finding aligns with previous studies emphasizing the central role of transformational leadership in driving digital change (Büyükkidik, 2022). However, unlike earlier research that focused mainly on managerial effectiveness, this study highlights the emergence of new terms such as sustainability, green HRM, and emotional intelligence. These developments indicate a broadening of the research agenda toward an interdisciplinary perspective, linking digital leadership with sustainability, organizational well-being, and emotional competencies of educators. Consequently, research in this field is shifting from a narrow focus on technical efficiency to a more holistic framework that integrates technology, human factors, and institutional sustainability.

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Author Collaboration Analysis

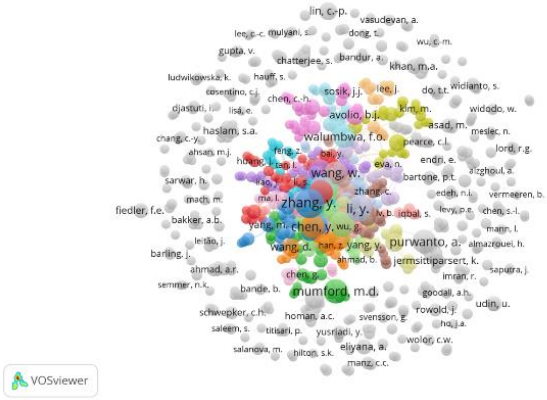

Figure 8. Author Collaboration

The co-authorship network (Figure 8) demonstrates several clusters of collaboration, with a number of prominent authors acting as central nodes. This structure reflects an active yet fragmented research community. Consistent with earlier bibliometric analyses in educational management (Öztürk et al., 2024), the results indicate that cross-institutional and cross-country collaboration remains limited. Nevertheless, this study advances the discussion by highlighting emerging contributions from Southeast Asian countries, particularly Malaysia and Indonesia, which are increasingly visible in the discourse on digital leadership. While the dominance of the United States and China underscores their strong research capacity, it also exposes gaps in contributions from developing countries, where digital leadership challenges are equally pressing. The academic implication is the need to strengthen international collaborations and establish broader research consortia that can produce more globally representative findings.

DISCUSSION

This bibliometric analysis confirms that transformational and empowering leadership remain the core themes of digital leadership scholarship. While this finding is consistent with prior works (Büyükkidik, 2022; Öztürk et al., 2024), the present study makes a novel contribution by demonstrating how these leadership models are increasingly integrated with digital innovation, sustainability, and emotional intelligence in the education sector. Compared with earlier bibliometric reviews that broadly examined leadership or school management, this study underscores that research on digital leadership in schools is now evolving toward:

1. Interdisciplinary integration – bridging management, psychology, and education.
2. Geographical diversification – with Southeast Asian institutions, particularly from Malaysia and Indonesia, emerging as notable contributors.
3. New thematic directions – including sustainability, personalized learning, and collaborative practices.

The co-authorship analysis further indicates that the research landscape remains fragmented, signaling opportunities for stronger international collaboration. The dominance of U.S. and Chinese publications reflects concentrated research capacity but simultaneously

points to an imbalance, as the perspectives and challenges of developing countries remain underrepresented.

By mapping these developments, this article contributes a comprehensive overview of digital leadership scholarship in education, offering strategic insights for both researchers and practitioners. The study's novelty lies in its identification of future research trajectories—particularly the integration of digital leadership with sustainability, equity, and professional development in schools. Such directions not only enrich the academic literature but also provide practical guidance for building adaptive and sustainable educational ecosystems in the digital era.

CONCLUSION

Digital leadership plays a crucial role in enhancing school organizational performance by integrating technology, emotional intelligence, empowerment, and sustainability to foster collaboration, innovation, and knowledge sharing. The novelty of this study lies in mapping the integration of digital leadership with sustainability and empowerment in the school environment, showing its potential to strengthen management efficiency and 21st-century competencies. Practically, these findings highlight the importance of systematic digital leadership training for school principals and policymakers to build adaptive and innovation-oriented schools. However, this study is limited to bibliometric data from Scopus without filtering, which may restrict representativeness. Future research should expand to other databases, apply refined inclusion criteria, and combine bibliometric mapping with qualitative approaches to provide deeper contextual insights.

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