

López-Figueroa, José Carlos; Ochoa-Jiménez, Sergio; Palafox-Soto, María Olivia;  
Sujei Hernandez Munoz, Dalia

## Article

# Digital leadership: A systematic literature review

Administrative Sciences

## Provided in Cooperation with:

MDPI – Multidisciplinary Digital Publishing Institute, Basel

*Suggested Citation:* López-Figueroa, José Carlos; Ochoa-Jiménez, Sergio; Palafox-Soto, María Olivia; Sujei Hernandez Munoz, Dalia (2025) : Digital leadership: A systematic literature review, Administrative Sciences, ISSN 2076-3387, MDPI, Basel, Vol. 15, Iss. 4, pp. 1-22, <https://doi.org/10.3390/admsci15040129>

This Version is available at:

<https://hdl.handle.net/10419/321273>

## Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

## Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*



*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by/4.0/>

# Digital Leadership: A Systematic Literature Review

José Carlos López-Figueroa <sup>1,\*</sup>, Sergio Ochoa-Jiménez <sup>1</sup>, María Olivia Palafox-Soto <sup>2</sup>  
and Dalia Sujey Hernandez Munoz <sup>3</sup>

<sup>1</sup> Department of Administrative Sciences, Instituto Tecnológico de Sonora, Guaymas 85500, Mexico; sergio.ochoa@itson.edu.mx

<sup>2</sup> Department of Economic, Universidad Autónoma Metropolitana, unidad Xochimilco, Coapa, Villa Quietud, Coyoacán, Ciudad de México 04960, Mexico; marioly95@hotmail.com

<sup>3</sup> Technical Secretariat, Colegio de Bachilleres of the State of Sonora, Hermosillo 83280, Mexico; dalia.hernandez@bachilleresdesonora.edu.mx

\* Correspondence: jose.lopezfigueroa@itson.edu.mx

**Abstract:** The COVID-19 pandemic and digital disruption have transformed the world and organizations on an unprecedented scale, presenting leaders with unique challenges and creating an opportunity to study digital leadership. This area of research is expanding significantly, though it remains in a developmental and maturing phase. To date, theoretical studies are predominant, including systematic reviews, literature reviews, and bibliometric studies. This study conducts a systematic literature review and science mapping of 74 documents published between 2000 and 2022 in the Web of Science database, using VOSviewer software to analyze the field's evolution. Findings reveal that research on digital leadership has grown, with digital transformation, digitalization, COVID-19, information and communication technologies, virtual teams, and creativity emerging as core themes in this domain. This study concludes that the effective implementation of digital leadership requires not only technological skills but also human-centered competencies; its application has predominantly expanded in the education sector, with limited use in construction.

**Keywords:** e-leadership; digital leadership; leadership; virtual; digital; systematic literature review



Received: 10 December 2024

Revised: 18 February 2025

Accepted: 13 March 2025

Published: 1 April 2025

**Citation:** López-Figueroa, J. C., Ochoa-Jiménez, S., Palafox-Soto, M. O., & Sujey Hernandez Munoz, D. (2025). Digital Leadership: A Systematic Literature Review. *Administrative Sciences*, 15(4), 129. <https://doi.org/10.3390/admsci15040129>

**Copyright:** © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

On 11 March 2020, the World Health Organization (WHO) declared COVID-19 a pandemic (World Health Organization, 2020). Nearly three years later, on 4 May 2023, the WHO announced that COVID-19 no longer constituted a public health emergency of international concern (World Health Organization, 2023). Today, COVID-19 is regarded as an established health issue rather than an international health emergency. Globally, this coronavirus—SARS-CoV-2—has impacted the health, economic, political, and security sectors in various ways. According to Mustajab et al. (2020), in the health domain, COVID-19 was declared a pandemic; economically, production was disrupted, leading to financial losses, layoffs, and declining sales; and in organizational settings, remote work, virtual operations, and digital leadership were widely adopted.

The lockdown, as a health measure, highlighted a clear need for social distancing, which changed the ways of living and working within organizations (Unsworth, 2020; Contreras et al., 2020; Tigre et al., 2022). This shift led to the replacement of face-to-face interactions with digital ones (Faraj et al., 2021; Karakose et al., 2022). Additional phenomena arising from the COVID-19 pandemic include remote work, telecommuting, virtual teams, and remote management (Kirchner et al., 2021). In summary, the global

impacts of the COVID-19 pandemic presented new challenges for leaders, positioning it as a pivotal context for studying digital leadership (Gonaim, 2021).

The decision to integrate information and communication technologies (ICTs) for leadership purposes dates back to the late 1990s, coinciding with the rapid rise of the Internet, email, videoconferencing, virtual teams, and collaborative software (Avolio et al., 2014). This shift raised several questions for scholars and practitioners alike, particularly regarding work organization, leadership implications, and how these technologies would affect leadership practices and influence research into the concept.

In this context, leadership processes are increasingly mediated by technology, giving rise to the concepts of digital leadership, e-leadership, and virtual leadership, all of which revolve around the use of technology in leadership practices (Machado & Brandão, 2019; Tintore et al., 2019; Sivulca et al., 2024; Sukmawati et al., 2024). Technological competence is a key component of this form of leadership, as leaders must utilize digital tools to enhance aspects such as collaboration and productivity (Tuschner et al., 2023). “E-leadership” specifically refers to elements associated with the Internet, electronic resources, and the virtual environment (Mustajab et al., 2020; Çuhadar, 2022). Digital leadership is defined as “a social influence process mediated by information technology that brings about a change in attitudes, feelings, thinking, behavior, and/or performance in individuals, groups, and organizations” (Avolio et al., 2000, p. 617). Another definition describes it as using and combining electronic and traditional communication methods, requiring current ICT knowledge, the ability to make informed ICT selections, and technical proficiency in the chosen technologies (Van Wart et al., 2016). A more recent definition associates digital leadership with the Internet of Things, communication between individuals and electronic devices, digitalization, and digital transformation (Karakose et al., 2022). Virtual leadership refers to the ability of leaders to guide their teams and organizations in a digital environment through technology or digital tools (Bin Hasnor, 2024; Sandberg et al., 2022; Cordova-Buiza et al., 2022).

E-leadership, digital leadership, and virtual leadership confirm that leadership occurs in digital or virtual spaces and in ICT-mediated contexts. These three types of leadership involve the ability to guide, support, and manage teams and organizations through the use of technology. While all three are grounded in ICT and technological tools, they differ in their specific focus: e-leadership emphasizes leadership mediated by digital tools, digital leadership adopts a broader perspective by conceptualizing leadership as a process of influence facilitated by ICT, and virtual leadership refers to leaders’ ability to direct and manage teams and organizations through technological tools.

Regarding the current state of the field, the most impactful research from the past three years, as measured by citation counts (100 or more), highlights the work of (Chamakiotis et al., 2021; Gentilin & Madrigal-García, 2021; Khaw et al., 2022; Höddinghaus et al., 2023; Karakose et al., 2022; Tigre et al., 2022), according to Web of Science. These studies focus on the analysis and evolution of the concept of digital leadership in virtual spaces, the management of virtual teams by recognizing digital leadership competencies, and the relationship between digital leadership and concepts such as sustainability. Most of these studies are analytical, specifically bibliometric or literature review studies, with a smaller number being empirical research.

Chamakiotis et al. (2021) conducted a study examining the existing literature on virtual enterprises before COVID-19, covering two decades. Using this background, they explore the potential characteristics of current and future virtual enterprises and the implications for leadership and e-leadership in the new reality. Gentilin and Madrigal-García (2021) carried out research to identify factors associated with digital leadership. Based on this, they propose an analytical and management framework for virtual teams. Their systematic

literature review identifies communication, trust, and team cohesion as the most impactful factors in digital leadership. The primary contribution of their research is a four-phase framework for analyzing and managing virtual leadership.

Khaw et al. (2022) conducted a study to analyze essential leadership elements and assess the impact of digital leadership on sustainable performance. Their research involved a systematic literature review of articles published between 2001 and 2021 on Scopus, identifying five main themes: leadership styles, leadership metrics, antecedents of effective leadership, outcomes of effective leadership, and gaps in current research areas. Karakose et al. (2022) examined the evolution of the field of digital leadership through bibliometric analysis and science mapping techniques. The authors describe digital leadership as an umbrella concept encompassing terms like e-leadership, virtual leadership, technological leadership, and Leadership 4.0. Their findings indicate that digital leadership research is expanding, diversifying, and growing in publication volume. Key themes for understanding digital leadership include technology management, virtual teams, COVID-19, virtual reality, and digital technologies, which have become central to research in this area.

Höddinghaus et al. (2023) conducted a systematic review of 66 empirical studies on digital leadership in virtual settings. They categorized the studies into two groups: those focusing on the effects of leadership within a digitized context and those examining whether leadership effects vary with levels of virtuality. Through this literature review, they propose a research framework that includes a new conceptualization of leadership in virtual work environments, recommendations for standardizing the concept, and suggestions for study designs that could strengthen this field of knowledge. Concluding this review of the current state of the field, Tigre et al. (2022) carried out a bibliometric and network analysis based on 79 documents from 57 journals spanning 2000 to 2020 to identify new perspectives on digital leadership. Their findings indicate that digital leadership remains a prominent research interest, as it has not yet reached maturity. Additionally, the study identifies key digital leadership skills critical in an ever-evolving world.

These studies share the common premise that digital disruption, the expansion of flexible and remote work modalities, increasing workplace digitalization, the development of ICT, and the COVID-19 pandemic have presented new challenges for digital leadership within organizations and virtual teams. In this context, contemporary research reveals that leadership practices have been influenced by the digitalization of workplaces and the integration of technology into organizations. Although remote work is becoming increasingly popular, studies have primarily explored different leadership styles, while the use of technology in leadership practices remains underexamined in organizational contexts. Addressing this gap, the present study aims to bridge it by analyzing 74 studies on the use of technology for leadership purposes between 2000 and 2022. This article presents a systematic literature review, complemented by bibliometric data and supported by VOSviewer software (version 1.6.20). The primary objective is to analyze the body of literature on digital leadership to identify research trends over the past two decades.

The document is structured as follows: The Materials and Methods Section outlines the methodological aspects of the research, including the search equation, procedures, and data analysis approach. In the Results Section, two key aspects are addressed: a descriptive analysis of the publications and identification of the seven primary themes, visualized on a heatmap. The Discussion highlights the ongoing relevance of digital leadership, emphasizing that its application extends beyond digital skills to include human factors such as communication, trust, motivation, and team spirit. In the Conclusions, the study suggests that future research should adopt an empirical approach to test hypotheses related to digital leadership.

## 2. Materials and Methods

A systematic literature review was conducted following the PRISMA protocol and its four phases: identification, selection, eligibility, and inclusion.

**Identification:** The Web of Science database was used to examine the field of digital leadership. Researchers frequently employ Web of Science for bibliometric and systematic reviews, as demonstrated in studies on this topic (Aydın et al., 2024; Wider et al., 2023; Gunawan et al., 2023). The widespread adoption of Web of Science in systematic reviews is attributed to several key factors. It is the world's oldest, most widely used, and authoritative publication database (Birkle et al., 2020), and it is a comprehensive database that provides an extensive collection of scientific articles across various fields of knowledge and includes a broad citation index, making it a reliable analytical tool for researchers (Li et al., 2017; Z. Wang et al., 2019; Hugar et al., 2019; Ho, 2020). Additionally, it offers a variety of metrics, such as the Journal Impact Factor (JIF), along with alternative indicators like the article citation median and the review citation median (Daugherty et al., 2022).

The search was specifically conducted within the following editions: Social Sciences Citation Index (SSCI), Emerging Sources Citation Index (ESCI), Science Citation Index Expanded (SCI-EXPANDED), Conference Proceedings Citation Index—Social Science & Humanities (CPCI-SSH), Conference Proceedings Citation Index—Science (CPCI-S), Book Citation Index—Social Sciences & Humanities (BKCI-SSH), and Book Citation Index—Science (BKCI-S). The search criteria were as follows: the search focused on titles and author keywords containing the terms “e-leadership” OR “virtual leadership” OR “digital leadership” OR “online leadership” OR “remote leadership” during the period from 2000 to 2022, in all languages, from all countries. From this process, a total of 313 documents related to the topic were obtained.

**Selection:** The results were limited to document types such as Book Review, Review Article, Early Access, Book Chapters, Proceeding Paper, and Article. Accordingly, documents that did not constitute formal publications, such as editorial material and meeting abstracts, were excluded. This process resulted in an electronic file containing 301 documents.

**Eligibility and Inclusion:** A review of each document and its abstract confirmed that all selected publications met the criteria regarding the topic, study focus, and publication type for analysis. This dataset was then used to generate descriptive statistical data in Excel and was processed in .txt format for further analysis in VOSviewer software.

In VOSviewer, a co-occurrence analysis of keywords was conducted using the dataset of 301 documents. Based on author keywords as the unit of analysis, a thesaurus of 14 words was created, yielding a list of 139 words, from which 30 were excluded as they did not correspond to thematic topics, consisted of undefined symbols, or were linking and supplementary words. This resulted in a refined set of 109 keywords, from which a map of 52 interrelated thematic elements was generated. The layout was adjusted for optimal visualization, with an attraction value of 7 and a repulsion value of −3, and a density visualization map was chosen, as shown in Section 3.2.

**Thematic Eligibility and Inclusion:** Based on the most prominent topics according to their occurrence and links, seven thematic sections were established. To examine each in detail, 74 publications were selected based on their contribution to explaining the phenomenon under analysis. These publications are identified in the reference list with an asterisk (\*).

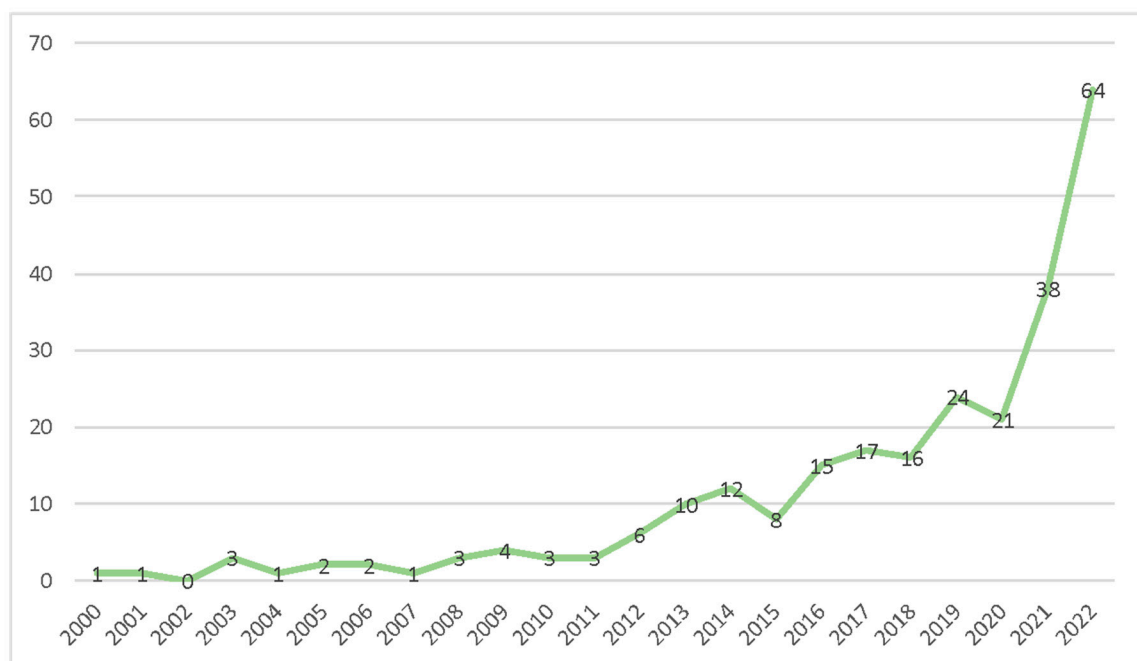
## 3. Results

The descriptive results of the study are presented below, beginning with the progression of published articles from 2000 to 2022, alongside the yearly citation count for these articles. Additionally, the analysis highlights the years with the highest citation counts

within this period, demonstrating that the number of publications per year does not necessarily correlate with the annual citation frequency. A year can exhibit a high citation count despite a relatively low number of publications.

### 3.1. Descriptive Data of the Publications

As previously mentioned, Figure 1 illustrates the evolution of publications from 2000 to 2022. In its early years, digital leadership received limited attention, with only two articles published. The study titled “E-leadership: Implications for Theory, Research, and Practice” by Avolio et al. (2000) was the first publication in this area, standing as the only entry for that year. Similarly, in the following year, Kissler (2001) published an article titled “E-leadership”. This initial period suggests little interest in the topic, which had not yet been consolidated and showed minimal continuity in academic production. Even up to 2011, annual publications did not exceed four articles, highlighting the low priority given to the topic in the research agenda at that time.

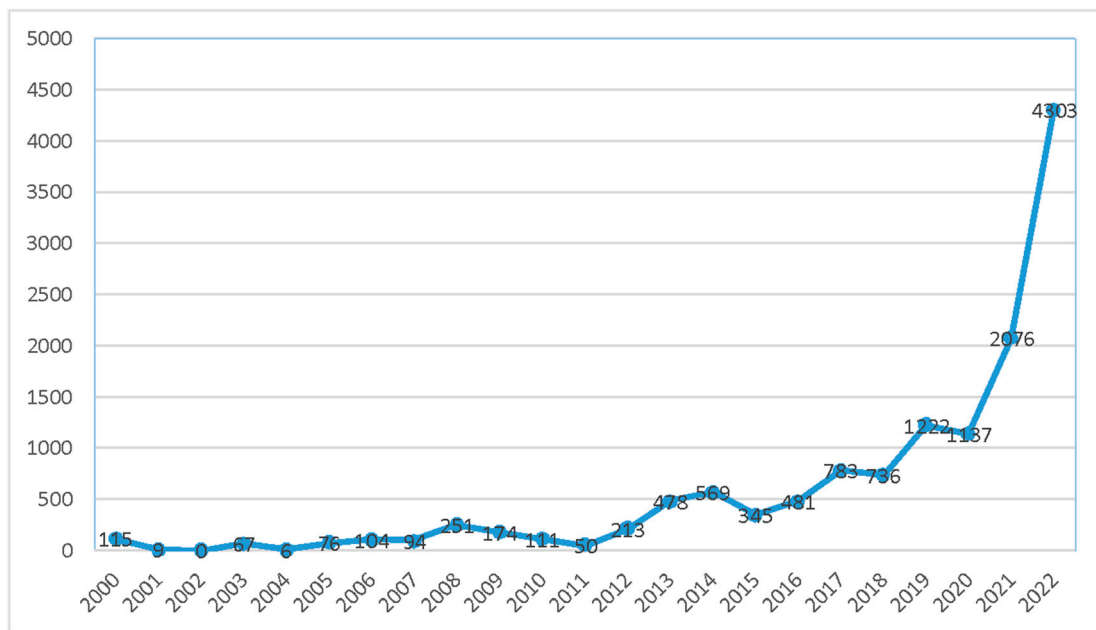


**Figure 1.** Number of publications per year.

However, a notable shift occurred from 2012 onward, as the number of publications progressively increased, albeit with subsequent fluctuations. This surge reflects a growing interest in digital leadership, possibly in response to the accelerated adoption of technologies within organizations. The most significant growth occurred following the COVID-19 pandemic, with the number of publications rising to 38 in 2021 and 64 in 2022, representing an exponential increase and the consolidation of the topic. This trend aligns with the global necessity of adopting technology in leadership practices, positioning digital leadership as a key element in digital transformation, innovation, communication, and organizational relationships (Torres-Martin, 2019).

It is common in academic manuscripts that more recent publications accumulate fewer citations compared to older ones. This is because newer manuscripts do not have sufficient time to be accepted or widely adopted by the research community. Figure 2 provides a chronological overview of annual citations received by articles published between 2000 and 2022, considering both recent and older publications. It is observed that, compared to the 2000s decade, academic publications in more recent years have received a greater number of citations, which could be linked to the increased use of technology in organizations. The

year 2000 stands out, as the only article published that year received 115 citations, significantly surpassing the following two years, which recorded 9 and 0 citations, respectively. However, the period with the highest citation impact corresponds to the years 2019 to 2022, during which the total number of citations exceeded one thousand, reflecting a growing interest in digital leadership in recent years. This does not significantly affect the results, as this study does not focus on bibliometric data such as the number of citations or the most influential authors. Instead, it centers on the study trends concerning the use of technology in leadership practices.



**Figure 2.** Number of citations per year.

Finally, the table below presents the 13 most-cited publications from 2000 to 2022. The table includes three articles with a publication date of 2023; however, their official publication date is 2022. This discrepancy arises from the “early access” filter provided by the Web of Science database. Despite the limitations posed by varying publication dates, early access articles are included to ensure broader research coverage, capture emerging trends, provide a comprehensive understanding of the field, and enhance the overall analysis of this study (W. Liu, 2020; Marx & Bornmann, 2014; Grandbois & Beheshti, 2014; Camps, 2008).

The publication with the highest number of citations, 172, is “E-leadership: Re-examining Transformations in Leadership Source and Transmission” by Avolio et al. (2014), followed by “Digital Leadership: A Bibliometric Analysis” by Tigre et al. (2022), as shown in Table 1. It is worth mentioning that the most-cited publications averaged around 130–140 citations, with the majority being theoretical studies that analyze the existing literature. This can be attributed to the fact that digital leadership has become an increasingly prominent topic in the past decade, with efforts to explore the existing literature, thus contributing to the development of this field of study. Moreover, while 2014 had the article with the highest citations, as shown in Figure 2, it was not the year with the most citations overall. Instead, 2022 holds that distinction with a total of 4303 citations.

**Table 1.** The 13 most-cited articles.

Order	Title	Year	Authors	Citations	Abstract
1	E-leadership: Re-examining transformations in leadership source and transmission.	2014	Avolio, BJ; Sosik, JJ; Kahai, SS; Baker, B.	172	The study aims to examine how the various areas of theory, research, and practice related to e-leadership have evolved, as well as its implications for how it functions, analyzing what needs to be learned and identifying potential emerging topics that could drive e-leadership in the coming decade (Avolio et al., 2014).
2	Digital Leadership: A Bibliometric Analysis	2023	Tigre, FB; Curado, C; Henriques, PL.	150	The study presents a bibliometric analysis of networks that integrates data from Scopus and Web of Science, aiming to provide insights into the evolution of the digital leadership field, based on a review of 79 publications from 57 journals between 2000 and 2020 (Tigre et al., 2022).
3	Do Paradoxical Virtual Leadership and Emotional Intelligence have Relationships? In Particular from Technology Dependence, Geographical Dispersion, and Human Capital Tensions.	2022	Ayelew, Z; Ayanew, M.	147	The study addresses issues related to the relationship between paradoxical virtual leadership and emotional intelligence, investigating what is known and unknown about paradoxical virtual leadership, and describing the relationship between it and emotional intelligence in the existing literature (Ayelew & Ayanew, 2022).
4	Leadership's long arm: The positive influence of digital leadership on managing technology-driven change over a strengthened service innovation capacity.	2023	Brunner, TJJ; Schuster, T; Lehmann, C.	146	The study highlights the capabilities of digital leadership and its positive influence on technology-driven change management through the utilization of service innovations (Brunner et al., 2023).
5	Virtual team performance: E-leadership roles in the era of COVID-19.	2022	Kashive, N; Khanna, VT; Powale, L.	143	The study shows that, following COVID-19, virtual teams have emerged within organizations, making leadership essential. Therefore, the study seeks to understand the factors that contribute to better team performance in virtual teams, from the perspectives of contingency theory and the behavioral complexity theory of leadership (Kashive et al., 2022).

Table 1. Cont.

Order	Title	Year	Authors	Citations	Abstract
6	Leadership in virtual work settings: what we know, what we do not know, and what we need to do.	2023	Hoeddinghaus, M; Nohe, C; Hertel, G.	142	The study presents a systematic review of 66 empirical studies on leadership in virtual work environments, describing conceptual interpretations and methodological approaches (Höddinghaus et al., 2023).
7	Unravelling the Potential of Digital Servitization in Sustainability-Oriented Organizational Performance-Does Digital Leadership Make It Different?	2022	Pham, HQ; Vu, P.K.	142	The study proposes and refines a statistically reliable paradigm to assess the impacts of digital servitization as a facilitator of an intelligent and sustainable service innovation ecosystem, as well as the improvement of performance oriented towards sustainability, demonstrating the role that leadership plays in this process (Pham & Vu, 2022).
8	Subgroup Formation in Diverse Virtual Teams: The Moderating Role of Identity Leadership.	2021	Op'tRoodt, H; Krug, H; Otto, K.	142	The study demonstrates how the outcomes of virtual teams are related to perceived diversity and subgroup formation, also aiming to gain an initial understanding of the role of the social identity approach in leadership within virtual teams (Roodt et al., 2021).
9	The Development and Evolution of Digital Leadership: A Bibliometric Mapping Approach-Based Study.	2022	Karakose, T; Kocabas, I; Yirci, R; Papadakis, S; Ozdemir, TY; Demirkol, M.	141	The study presents a review of the intellectual structure and evolution of the digital leadership field through a bibliometric analysis of scientific mapping (Karakose et al., 2022).
10	Getting Ready for the Future, Is It Worth It? A Dual Pathway Model of Age and Technology Acceptance at Work.	2022	Fasbender, U; Gerpott, FH; Rinker, L.	135	The study presents a dual-path model for the acceptance of age and technology in the workplace, exploring digital leadership as a potential buffer for the harmful relationships between age and technology acceptance (Fasbender et al., 2022).
11	The e-leadership linking inter-organizational collaboration and ambidextrous innovation.	2021	Doghri, SB; Horchani, SC; Mouelhi, M.	133	The study demonstrates the effect of interorganizational collaboration on ambidextrous innovation in virtual companies, as well as the moderating role of e-leadership (Doghri et al., 2021).

Table 1. Cont.

Order	Title	Year	Authors	Citations	Abstract
12	A systematic review and framework for digital leadership research maturity in higher education.	2022	Jameson, J; Rumyantseva, N; Cai, M; Markowski, M; Essex, R; McNay, I.	129	The study presents a systematic review of empirical studies on digital leadership in higher education from 1999 to 2022, analyzing their value, focus, and the research methods involved (Jameson et al., 2022).
13	The Role of Leadership in a Digitalized World: A Review.	2019	Cortellazzo, L; Bruni, E; Zampieri, R.	129	The study presents a comprehensive analysis of the contribution of studies on leadership and digitalization, identifying patterns of thought and findings across various disciplines of social sciences, management, and psychology (Cortellazzo et al., 2019).

It is important to note that the most-cited theoretical articles perform bibliometric analyses, propose models, and conduct systematic reviews related to methodological approaches, evolution, implications, patterns of thought, and their connection to other research variables, such as emotional intelligence, while the most-cited empirical studies focus on leadership capabilities, an understanding of factors, and the relationship with other study variables, such as innovation, sustainability, and identity.

### 3.2. Highlighted Themes

Derived from the co-occurrence analysis of keywords, Figure 3 was generated with 52 terms, of which 13 words stand out. The most important term is highlighted in red within the circle that encompasses the word, and its prominence diminishes in the overall image as the color transitions from red to yellow, with orange serving as an intermediate color.

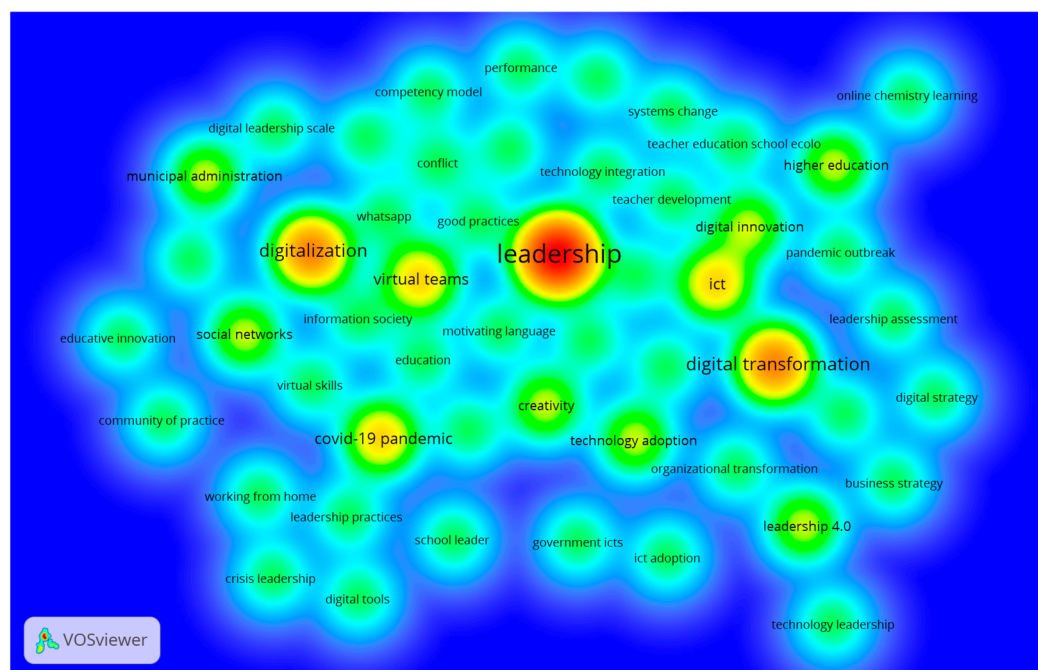


Figure 3. Network of most prominent keywords.

From the terms, the seven most prominent themes were selected based on their presence and representativeness, considering their occurrences, relationships, and weights. These themes show consistency, as seen in Table 2, ordered according to the previously mentioned criteria. Based on the number of relationships, the order exhibits slight variation, with Theme 2, digital transformation, having fewer connections with other themes than Themes 4 (COVID-19 pandemic) and 6 (virtual teams). However, based on the total strength of the links, Theme 2 regains its importance in second place. Therefore, although these seven themes show slight variations in their ranking, their relevance is confirmed, as they represent central, nodal topics within the thematic network, consolidating their significance, which will be further explored below.

**Table 2.** Relationships and weights of the most prominent topics.

Order	Theme	Weight <Occurrences>	Weight <Links>	Weight <Total Link Strength>
1	Leadership	10	20	23
2	Digital transformation	5	8	10
3	Digitalization	5	7	8
4	COVID-19 pandemic	3	9	9
5	ICT	3	8	9
6	Virtual teams	3	9	9
7	Creativity	2	5	5

### 3.2.1. Leadership

A recurring theme in most writings on leadership is the focus on digital or e-leadership. In this typology, not only technological skills are highlighted, but also those related to digital communication in virtual environments for team management (C. Liu et al., 2020; Darics, 2020). Similarly, Saputra and Hutajulu (2020) emphasize the importance of digital leadership for increasing employee motivation and retention, aiming to maintain a balance between personal and work life. Another strand of studies agrees that digital leadership has a positive impact on productivity and organizational performance (Wolor et al., 2020; Gomaa et al., 2021), promotes collaboration (Hafermalz & Riemer, 2020), contributes to the growth and global competitiveness of SMEs (Aramburu et al., 2020), and maintains high performance levels in organizations (Saputra & Hutajulu, 2020; Majchrakova & Kremenova, 2020). All these studies argue that motivation, control, and autonomy within teams, digital organizational culture, and innovation are fundamental pillars for leadership in a digital environment.

In times of crisis, such as the COVID-19 pandemic, or during digital transformation processes, leadership faces significant challenges. In this third line of research, Sandberg et al. (2022) and (Liebermann et al., 2021) note that leaders in the healthcare and public sectors had to adapt to a virtual environment prompted by the pandemic. Similarly, the education sector underwent transformation due to digitalization, incorporating distance learning and practical exercises in virtual environments. In light of these changes, Robertson et al. (2022) suggest that organizational resilience is linked to the maturity of both digital technologies and leadership, as it enables organizations to better adapt to the digital shifts caused by challenges such as the pandemic. Finally, a significant number of studies highlight the influence of information technologies on leadership, particularly in the education sector. In this context, digital leadership enhances the understanding of concepts derived from reflections generated online (McCarron et al., 2021), improves teaching and training (Ellis et al., 2021; Sullivan et al., 2021), and achieves effectiveness in online learning projects (Yilmaz et al., 2020).

### 3.2.2. Digital Transformation

In studies on digital transformation, leadership emerges as a fundamental theme, highlighting the importance of leaders in managing technological change within organizations. In this sense, leaders must combine technological and change management skills. [Davison et al. \(2023\)](#) point out that leaders in organizations play a crucial role in digital transformation, requiring knowledge in technology; however, other authors recognize additional skills, such as the ability to inspire trust ([Zulu et al., 2023](#); [Tuerk, 2023](#)), motivation, and employee well-being ([Weber et al., 2022](#)), for the successful transition to digital.

Nevertheless, the application of technologies within organizations requires overcoming ethical and practical challenges. [Abbu et al. \(2022\)](#) emphasize that leaders who rely on artificial intelligence (AI) to seek solutions must use it in a fair and transparent manner. Digitalization can be considered a source of resistance to change within companies; however, leaders can address this issue by promoting job security and satisfaction ([Oktaysoy et al., 2022](#)). Other authors highlight organizational culture as a factor that can either facilitate or hinder digital transformation, depending on how leaders manage resistance to change ([Busco et al., 2023](#); [Espina-Romero et al., 2023](#)).

Digital transformation has impacted the organizational structures of companies and affected various sectors. Regarding tourism, ([Zentner et al., 2022](#)) researched how digitalization has transformed business models in maritime tourism, highlighting that leaders' technological skills play an important role in the transformation. In healthcare, [Kröplin et al. \(2022\)](#) emphasize the positive advancements of digital technology in surgeries, noting that robots and virtual simulators are tools that assist in patient care and the collection of medical information. In accounting, digital technologies like cloud computing have improved processes and decision making ([Hung et al., 2023](#)). In more traditional sectors like construction, digital transformation is still in its early stages due to leadership challenges and organizational barriers ([Zulu et al., 2023](#)).

### 3.2.3. Digitalization

Digitalization is giving rise to digital leadership, both in personal life contexts and in computer-based work positions, thereby improving decision making in complex and dynamic environments ([Claassen et al., 2021](#)). Moreover, due to the increased use of information and communication technologies, there are now greater opportunities to acquire knowledge across various areas of life, such as the economic, political, cultural, and academic spheres, where leadership skills are considered essential within any organization, also contributing to the introduction of innovation ([Figus, 2021](#)).

In addition to the above, [De Waal et al. \(2016\)](#) emphasize that due to the changes occurring in society, digital skills are essential for guiding leadership, showing the path to follow in order to remain competitive in the market. Therefore, a leader must understand the digital world and the power they hold over the involved parties, ensuring a successful digital transformation within the organizational context. Similarly, [Erhan et al. \(2022\)](#) state that leaders must stay informed about digital advancements and possess skills that go beyond the basic, as greater competitiveness, innovation, and digitalization are required to adapt to the changing and dynamic environment.

It is worth mentioning that the academic field was one of the contexts where digitalization led to a decrease in the quality of education due to the COVID-19 pandemic. In this context, leadership in digital technology began to be employed as a strategy aimed at achieving short, medium, and long-term goals ([Sujaya, 2022](#)). With the pandemic, school leaders had to suddenly shift the entire educational dynamic, transitioning from a traditional classroom setting to a virtual school, which was considered a radical digitalization ([Willermark & Islind, 2022](#)).

However, digitalization has managed to identify opportunities in the digital age by creating knowledge networks across different contexts, thereby contributing to performance, innovation, and better organizational development (Băeșu & Bejinaru, 2020). In this regard, Peiró and Martínez-Tur (2022) emphasize that, due to digitalization, basic, professional, and leadership digital competencies must be created to enable adaptation and greater competitiveness in new ways of working. As various spheres of life modernize, they are becoming increasingly efficient at addressing digital transformation, also contributing to socioeconomic development (Markaryan et al., 2021). An undeniable fact is that digitalization has completely changed the nature of work in any context, making it imperative for leadership to have a positive impact on organizational analysis.

#### 3.2.4. COVID-19 Pandemic

In the context of the COVID-19 pandemic, digital leadership has been addressed, as it brought significant challenges, especially for leaders, and the education sector was no exception. Adaptation, challenges, and vision were key elements for continued survival (Oliveira-Pereira et al., 2023). In this regard, AlAjmi (2022) mentions that educational leaders began to emphasize the use of digital tools and platforms in schools, which had a positive impact on their management. Digital leadership skills contributed to an increase in the use of technology as well as the improvement in management and individual skills, leading the education sector towards a culture of digital learning in this context (Karakose et al., 2021).

According to Kotula et al. (2021), during the pandemic, leaders managed the crisis through universal communication strategies in digital transformation, which allowed them to adapt to the rapidly changing, dynamic, and uncertain environment. As a result, virtual leadership became a response to the COVID-19 pandemic crisis, as the lockdown forced organizations to adapt to the digital world. Supervision, conflict resolution, trust, and other organizational aspects became increasingly challenging (Bizilj et al., 2021).

Undoubtedly, the pandemic challenged the way we work; however, virtual leadership has managed to address complexities by bringing efficiency and effectiveness to activities. It contributes to problem solving, team formation, and spaces for knowledge exchange, while also enhancing communication and trust (Krehl & Büttgen, 2022). This approach fosters a vision of continuous learning that, despite uncertainty, always seeks effectiveness, even with all the implications and challenges posed by the COVID-19 pandemic (Indra et al., 2022). All of this also depends on the personality traits of virtual leaders, which influence the way work is conducted (Vahdati et al., 2023).

It is important to note that the pandemic also brought complications to the psychological well-being of workers, where digital leadership has been a factor with positive effects on it. While it cannot guarantee better psychological well-being, it certainly contributes to improving it, which underscores the importance of its effectiveness (Dewi & Sjabadhyni, 2021). Additionally, Appelgren (2022) points out that it is essential to learn to appreciate the effectiveness of leadership, especially in difficult situations such as remote work. Inspirational leaders who build trust and motivate creativity are crucial, as they help strengthen adaptive performance, with workers becoming more engaged and motivated in the digital world (Tan & Antonio, 2022).

Therefore, Meadows and De Braine (2022) establish that leaders must be trained, enhancing their strengths and identities to face any crisis. A prime example of this is the COVID-19 pandemic, which forced leaders to ensure better performance and adaptation despite existing challenges. The need for leadership in any context is crucial, especially during the pandemic and in a digital environment, where certain behavioral patterns are required for effective leadership (Buluş et al., 2022). These leaders guide employees toward

achieving organizational goals, as well as improved job satisfaction and performance, greater trust, and more meaningful benefits (Al Dilby & Farmanesh, 2023).

### 3.2.5. Adoption of ICT in Organizations

The adoption of information and communication technologies (ICTs) has been widely discussed in the context of organizational leadership. Van Wart et al. (2017) highlight that leaders not only need to be trained in ICT but also need to promote its effective integration within organizations, emphasizing the relevance of technology for organizational success. Similarly, C. Liu et al. (2018) present a leadership model oriented toward technological adoption (ECAM), underscoring that traits such as proactivity and responsibility are key to achieving successful ICT implementation. In the same way, Tahir et al. (2021) examine how digital platforms have optimized management and communication within educational institutions, contributing to more strategic and efficient planning. To assess these advances, Mishra et al. (2016) propose the RAT (Replace, Amplify, Transform) model, which evaluates how ICT has transformed leadership in the educational sector, emphasizing improvements in teacher training and organizational practices.

The accelerated use of ICT, which has even contributed to changing certain leadership practices, was driven by the COVID-19 pandemic. X. Wang et al. (2023) emphasize how leaders have used digital tools, such as forums and instant messaging, to maintain trust and manage teams remotely, highlighting the importance of these mediums for project coordination. Similarly, Reyes Ch et al. (2020) explore the use of applications like WhatsApp in the military for order control and monitoring. However, Chang et al. (2022) analyze how educational leaders have had to quickly adapt digital processes and curricula to ensure the continuity of learning during the health crisis. Torre and Sarti (2020) highlight how mobile and social technologies have transformed labor relations and digital leadership, with leadership capability being key to addressing the challenges posed by the pandemic, suggesting a typology of e-leadership that varies according to the technological maturity level of organizations.

However, despite the previous points, there are challenges and limitations associated with e-leadership. Van Wart et al. (2017) and C. Liu et al. (2018) note that the adoption of ICT is not uniform, as leaders' skills and attitudes toward technology vary significantly. Moreover, in traditional or hierarchical organizations, such as the military, digital leadership may face resistance, making its effective implementation difficult (Reyes Ch et al., 2020). Torre and Sarti (2020) reinforce this view, emphasizing that while e-leadership has gained visibility, obstacles remain, particularly regarding the development of soft skills required to lead in digital environments.

### 3.2.6. Virtual Teams and Leader Competencies

Samartinho et al. (2014) and Ziek and Smulowitz (2014) emphasize the relevance of communication, trust, and coordination for the effectiveness of virtual teams. In this context, Politis (2014) highlights that e-leadership, through practices like feedback and management by objectives, strengthens trust and commitment within teams: however, this can be affected by the technology itself and geographical dispersion (Gheni et al., 2015; Nordbäck & Espinosa, 2019). Additionally, diversity tends to create subgroups due to these differences (Roodt et al., 2021).

In relation to the above, the studies by Contreras et al. (2020) and Chamakiotis et al. (2021) emphasize that building trust and cohesion has become critical, as organizations have abruptly shifted to remote work. Leaders who reconfigured their practices to adapt to this environment have succeeded in promoting more collaborative relationships through communication technologies. Mitchell (2012) confirms that technological interventions can improve coordination and management. Similarly, Korzynski (2013) explores how social

networks enable leaders to better manage online relationships, increasing participation in virtual environments. However, electronic communication tools such as videoconferencing are not always synonymous with better team outcomes. This implies that success depends on both technological tools and the leadership style and interaction practices implemented (Hambley et al., 2007).

Health-oriented leadership has become increasingly relevant in virtual environments due to the rise of workplace stress (Efimov et al., 2020). These leaders promote well-being through boundary management and encouraging physical activity, which enhances the overall health of dispersed teams. (Kordsmeyer et al., 2020) complement this view by emphasizing the importance of health-oriented leadership skills, which involve not only effective team management but also taking care of one's own well-being and that of the team in virtual settings. Emotional intelligence, combined with digital competencies, is crucial for leaders to maintain the well-being and cohesion of their teams in virtual environments (Chaudhary et al., 2022).

### 3.2.7. Creativity

According to Zhu et al. (2022), organizations have undergone various transformations, and they require digital leaders to help them continue thriving. They emphasize leadership as a crucial element that predicts employee creativity, which is fundamental to organizational success. This leadership incorporates technological processes and innovation to adapt to the environment.

Additionally, Naotunna and Zhou (2017) note that leadership is considered crucial and determining, as it enables understanding and boosting creativity in virtual environments, where these factors are becoming increasingly important. At the same time, it fosters self-efficacy in employees. In virtual contexts, leaders can act as motivators in generating new ideas that help the organization survive while also boosting creative performance that supports group decision making (Fan et al., 2014).

## 4. Discussion

This systematic review has demonstrated that digital leadership, or e-leadership, is a highly relevant topic, particularly in the past three years. This is evidenced by the fact that 12 of the 13 most-cited documents on the subject were published after 2020, reflecting the publication trends observed between 2000 and 2022. The most-cited manuscripts are directly related to the study of technology and digitalization in leadership practices within organizations, highlighting the importance of technology for leaders in enhancing virtual teams, improving communication among team members, and delegating tasks effectively.

At the end of the analysis, it was found that leadership remains the most developed and significant topic in structuring the field of study, as it exhibits the highest consistency and density (see Figure 3 and Table 2). Analyzing the network of the most prominent keywords revealed that research in this area focuses primarily on leadership, digital transformation, digitalization, the COVID-19 pandemic, information and communication technologies, virtual teams, and creativity (as shown in Figure 3 and Table 2). These results partially align with the study by Karakose et al. (2022), who highlight virtual teams, COVID-19, virtual reality, and digital technologies as key areas of interest in research in this field. Other studies emphasize the characteristics of successful digital leadership, the relationship between e-leaders and organizational members, and the challenges faced by digital leadership (Terkamo-Moisio et al., 2022).

Regarding the topic of leadership, the most-cited studies are those by Avolio et al. (2014), Tigre et al. (2022), and Ayalew and Ayenew (2022). These works examine both the theoretical and empirical dimensions of e-leadership, exploring how technology affects

leadership dynamics, digital leadership capabilities, and their relationship with variables such as emotional intelligence. The second most significant topic is digital transformation, with the most-cited studies being those by [Brunner et al. \(2023\)](#), [Karippur and Balaramachandran \(2022\)](#), and [Espina-Romero et al. \(2023\)](#). These studies focus on digital leadership capabilities and their influence on organizational change, the most suitable leadership practices for digital enterprises, and leadership in a technological environment. The third key theme is digitalization, with the most-cited authors being [Erhan et al. \(2022\)](#), [Peiró and Martínez-Tur \(2022\)](#), and [Willermark and Islind \(2022\)](#). Their research examines workplace digitalization, digital competencies, and virtual leadership.

The fourth topic is the COVID-19 pandemic, with the most-cited studies being those by [Vahdati et al. \(2023\)](#), [Al Dilby and Farmanesh \(2023\)](#), and [Kotula et al. \(2021\)](#). These works analyze the components of virtual leadership, its effects on job satisfaction, and leadership practices adopted during the pandemic. The fifth most relevant theme is information and communication technologies (ICTs), with the most-cited studies being those by [Kashive et al. \(2022\)](#), [Wakefield et al. \(2008\)](#), and [Van Wart et al. \(2017\)](#). These studies focus on virtual teams, conflicts, and the adoption of ICTs in leadership. The sixth most significant theme is virtual teams, with the most notable studies being those by [Roodt et al. \(2021\)](#), [Cortellazzo et al. \(2019\)](#), and [Liao \(2017\)](#). These works focus on the role and relationships of leaders within virtual teams, as well as digital culture.

The final key theme is creativity, with the most-cited studies being those by [Zhu et al. \(2022\)](#), [Fan et al. \(2014\)](#), and [Naotunna and Zhou \(2017\)](#). These works examine the relationship between digital leadership and creativity, the leader's motivational language and its impact on virtual teams, and leadership styles in relation to creativity.

Other topics addressing the use of technology in leadership practices include digital innovation, universities, municipal administration, social networks, technology adoption, and Leadership 4.0 (see Figure 3).

This work demonstrates that e-leadership is not only linked to the use of digital technologies but also to the leader's capabilities or skills regarding the commitment to using technology. In other words, leaders must take care of the human aspect to successfully implement digitalization ([Weber et al., 2022](#)). In this regard, aspects such as motivation, trust, communication, and teamwork are key elements for successful implementation ([Terkamo-Moisio et al., 2022](#)).

Although various research streams explore different leadership styles within organizations, a gap remains in the literature regarding the use of technology for leadership purposes and its benefits for organizations. The seven main themes identified in this study contribute to advancing knowledge on how to approach digital leadership within organizations. The topic has been extensively studied in sectors such as healthcare, education, and tourism, with less focus on the construction industry. This allows for the proposal of future research directions focused on empirical studies testing hypotheses on digital leadership in relation to digital transformation, digitalization, the COVID-19 pandemic, ICTs, virtual teams, and creativity within organizations.

In an increasingly digitalized world, leaders must develop electronic competencies to manage collaborative relationships ([Cortellazzo et al., 2019](#)), highlighting the need to prepare future leaders in authentic academic environments, anticipating their integration into virtual teams ([Loucks & Ozogul, 2020](#)). This underscores the importance of using e-leadership in managing remote organizations and as a crucial factor for organizational survival in the new reality. Although there is no widely accepted definition of digital leadership among the research community, the analysis has demonstrated that e-leadership is an umbrella concept ([Karakose et al., 2022](#)) that involves terms related to technology and the digital realm. Furthermore, it is an individual capability ([Van Wart et al., 2016](#))

that necessitates the use of virtual communication through six competencies that leaders must master: electronic communication, building social relationships, creating virtual teams, managing digital change, technological competencies, and electronic trust. To develop successful digital leadership, factors such as leadership style, leader traits and characteristics (Orte & Diño, 2019), trust, communication, team spirit (Terkamo-Moisio et al., 2022), and employee commitment to the use of technology are essential (Ahuja et al., 2023).

Additionally, the analysis has shown that in organizations, digital leadership must be capable of consolidating and directing virtual teams, standing out for having advantages not only for the productivity of companies but also for the environment and individuals working remotely (Contreras et al., 2020). Its use in companies is expanding to reduce costs and improve flexibility in structures (Ahuja et al., 2023). Understood this way, e-leadership becomes an important factor for the development of organizations. The field of digital leadership research is still evolving, though the global impact of the pandemic made it a critical factor for the survival of organizations. Currently, its study focuses on areas that specify the use of digital technologies and their relationship with individuals, workplaces, virtual teams, organizations, and the environment.

## 5. Conclusions

This study examines the evolution of digital leadership research in organizations from 2000 to 2022, based on publications indexed in the Web of Science database. It analyzes the most prominent topics, highlighting the 13 most-cited articles, as well as the annual numbers of publications and citations, with 2022 emerging as the most significant year, recording 64 publications and 4303 citations. The most-cited articles were published starting in 2019, except a study by Avolio, Sosik, Kahai, and Baker, published in 2014, which holds the highest number of citations (172), followed by an article by Tigre et al., (2022), which has 150 citations. The 13 most-cited documents include both theoretical and empirical contributions. The theoretical studies focus on mapping the evolution of digital leadership research through bibliometric analyses and systematic reviews, while the empirical studies examine leadership capabilities or skills and their relationship with other variables, such as innovation, creativity, and sustainability.

Based on the analysis, digital transformation, digitalization, the COVID-19 pandemic, ICTs, virtual teams, and creativity in organizations have been the most extensively researched topics related to e-leadership over the past two decades.

This systematic review has shown that digital leadership not only necessitates knowledge and utilization of digital technologies but also underscores the importance of human factors such as motivation, communication, and trust. Furthermore, the analysis reveals that theoretical studies dominate the field, suggesting that future research should focus on empirical studies that investigate the practical implications of technology use in leadership processes, the transition from traditional to virtual leadership practices, and the evolving nature of leadership in digital and technological contexts.

**Author Contributions:** Conceptualization, J.C.L.-F. and S.O.-J.; methodology, J.C.L.-F.; software, S.O.-J.; validation, J.C.L.-F., S.O.-J. and M.O.P.-S.; formal analysis, J.C.L.-F., S.O.-J., D.S.H.M. and M.O.P.-S.; resources, J.C.L.-F.; data curation, S.O.-J., D.S.H.M. and M.O.P.-S.; writing—original draft preparation, J.C.L.-F., S.O.-J., M.O.P.-S. and D.S.H.M.; writing—review and editing, J.C.L.-F. and S.O.-J. All authors have read and agreed to the published version of the manuscript.

**Funding:** The APC was funded by the Program for Promotion and Support of Research (PROFAPI) of the Sonora Institute of Technology (ITSON).

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

- Abbu, H., Mugge, P., & Gudergan, G. (2022, June 19–23). *Ethical considerations of artificial intelligence: Ensuring fairness, transparency, and explainability*. 28th International Conference on Engineering, Technology and Innovation (ICE/IITMC) & 31st International Association for Management of Technology, Iamot Joint Conference, Nancy, France.
- Ahuja, J., Puppala, H., Sergio, R. P., & Hoffman, E. P. (2023). E-Leadership is Un(Usual): Multi-Criteria analysis of critical success factors for the transition from leadership to e-Leadership. *Sustainability*, *15*(8), 6506. [\[CrossRef\]](#)
- Al Dilby, H. K., & Farmanesh, P. (2023). Exploring the impact of virtual leadership on job satisfaction in the post-Covid-19 era: The mediating role of work-life balance and trust in leaders. *Frontiers in Psychology*, *14*, 994539.
- AlAjmi, M. K. (2022). The impact of digital leadership on teachers' technology integration during the COVID-19 pandemic in Kuwait. *International Journal of Educational Research*, *112*, 101928. [\[PubMed\]](#)
- Appelgren, E. (2022). Media management during COVID-19: Behavior of swedish media leaders in times of crisis. *Journalism Studies*, *23*, 722–739. [\[CrossRef\]](#)
- Aramburu, N., North, K., & Zubillaga, A. (2020, September 9–11). *Conditioning factors of digitally-enabled growth strategy in SMEs*. 15th International Forum on Knowledge Asset Dynamics (Ifkad 2020): Knowledge in Digital Age, Matera, Italy.
- Avolio, B. J., Kahai, S., & Dodge, G. E. (2000). E-Leadership: Implications for theory, research, and practice. *Leadership Quarterly*, *11*, 615–668.
- Avolio, B. J., Sosik, J. J., Kahai, S. S., & Baker, B. (2014). E-Leadership: Re-Examining Transformations in Leadership Source and Transmission. *The Leadership Quarterly*, *25*(1), 105–131.
- Ayalew, M., & Ayenew, Z. (2022). Do paradoxical virtual leadership and emotional intelligence have relationships? In particular from technology dependence, geographical dispersion and human capital tensions. *International Journal of Organizational Leadership*, *11*, 1–25.
- Aydın, E., Kırılmaz, S. K., Şimşir, İ., & Ayhün, S. E. (2024). Bibliometric analysis of digital leadership studies. *Journal of Mehmet Akif Ersoy University Economics and Administrative Sciences Faculty*, *11*, 778–818.
- Băeşu, C., & Bejinaru, R. (2020). Knowledge management strategies for leadership in the digital business environment. *Proceedings of the International Conference on Business Excellence*, *14*, 646–656.
- Bin Hasnor, P. H. E. (2024). Developing virtual leadership in digital technology E-commerce. *KnE Social Sciences*, *9*(16), 580–590. [\[CrossRef\]](#)
- Birkle, C., Pendlebury, D. A., Schnell, J., & Adams, J. (2020). Web of science as a data source for research on scientific and scholarly activity. *Quantitative Science Studies*, *1*, 363–376. [\[CrossRef\]](#)
- Bizilj, S., Boštjančič, E., & Sočan, G. (2021). Perceived efficacy of virtual leadership in the crisis of the COVID-19 pandemic. *Changing Societies & Personalities*, *5*, 389–404.
- Brunner, T. J. J., Schuster, T., & Lehmann, C. (2023). Leadership's long arm: The positive influence of digital leadership on managing technology-driven change over a strengthened service innovation capacity. *Frontiers in Psychology*, *14*, 988808. [\[CrossRef\]](#) [\[PubMed\]](#)
- Buluş, Ü. K., Işık, M., Yılmaz, M. M., & Buluş, B. (2022). The importance of leadership in the time of COVID-19: The example of turkish health minister fahrettin koca's youtube shares. *International Journal of Organizational Leadership*, *11*, 51–63. [\[CrossRef\]](#)
- Busco, C., González, F., & Aránguiz, M. (2023). Factors that favor or hinder the acquisition of a digital culture in large organizations in Chile. *Frontiers in Psychology*, *14*, 1153031. [\[CrossRef\]](#)
- Camps, D. (2008). Limitaciones de los indicadores bibliométricos en la evaluación de la actividad científica biomédica. *Colombia Médica*, *39*, 74–79. [\[CrossRef\]](#)
- Chamakiotis, P., Panteli, N., & Davison, R. M. (2021). Reimagining e-leadership for reconfigured virtual teams due to COVID-19. *International Journal of Information Management*, *60*, 102381. [\[CrossRef\]](#)
- Chang, C., Arisanti, I., Octoyuda, E., & Insan, I. (2022). E-Leadership analysis during pandemic outbreak to enhanced learning in higher education. *Tem Journal-Technology Education Management Informatics*, *11*, 932–938. [\[CrossRef\]](#)
- Chaudhary, P., Rohtagi, M., Singh, R. K., & Arora, S. (2022). Impact of leader's e-competencies on employees' wellbeing in global virtual teams during COVID-19: The moderating role of emotional intelligence. *Employee Relations*, *44*, 1042–1057. [\[CrossRef\]](#)
- Claassen, K., dos Anjos, D. R., Kettschau, J., & Broding, H. C. (2021). How to evaluate digital leadership: A cross-sectional study. *Journal of Occupational Medicine and Toxicology*, *16*, 44. [\[CrossRef\]](#)
- Contreras, F., Baykal, E., & Abid, G. (2020). E-Leadership and Teleworking in Times of COVID-19 and beyond: What We Know and Where Do We Go. *Frontiers in Psychology*, *11*, 590271. [\[CrossRef\]](#) [\[PubMed\]](#)
- Cordova-Buiza, F., Aguirre-Parra, P., Garcia-Jimenez, M. G., & Martinez-Torres, D. C. (2022). Virtual leadership as a development opportunity in business context. *Problems and Perspectives in Management*, *20*(2), 248–259. [\[CrossRef\]](#)
- Cortellazzo, L., Bruni, E., & Zampieri, R. (2019). The role of leadership in a digitalized world: A review. *Frontiers in Psychology*, *10*, 1938. [\[CrossRef\]](#) [\[PubMed\]](#)

- Çuhadar, S. (2022). Challenges and opportunities of e-leadership in organizations during COVID-19 crisis. *SEA: Practical Application of Science*, 10, 83–89.
- Darics, E. (2020). E-Leadership or “how to be boss in instant messaging?” The role of nonverbal communication. *International Journal of Business Communication*, 57, 3–29. [CrossRef]
- Daugherty, A., Hegele, R. A., Lu, H. S., Mackman, N., Rader, D. J., & Weber, C. (2022). Web of science’s citation median metrics overcome the major constraints of the journal impact factor. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 42, 367–371. [CrossRef]
- Davison, R. M., Wong, L. H., & Peng, J. (2023). The art of digital transformation as crafted by a chief digital officer. *International Journal of Information Management*, 69, 102617. [CrossRef]
- De Waal, B., Van Outvorst, F., & Ravesteyn, P. (2016). Digital Leadership: The Objective-Subjective Dichotomy of Technology Revisited. In F. Pinzaru, & C. Bratianu (Eds.), *Proceedings of the 12th european conference on management, leadership and governance (ECMLG 2016)* (pp. 52–60). Bucharest, Romania, November 10–11, ACAD Conferences Ltd.
- Dewi, R. K., & Sjabadhyni, B. (2021). Digital leadership as a resource to enhance managers’ psychological well-being in the Covid-19 pandemic situation in indonesia. *South East Asian Journal of Management*, 15, 154–168. [CrossRef]
- Doghri, S. B. S., Horchani, S. C., & Mouelhi, M. (2021). The E-Leadership linking inter-organisational collaboration and ambidextrous innovation. *International Journal of Innovation Management*, 25, 2150043. [CrossRef]
- Efimov, I., Harth, V., & Mache, S. (2020). Health-oriented self-and employee leadership in virtual teams: A qualitative study with virtual leaders. *International Journal of Environmental Research and Public Health*, 17(18), 6519. [CrossRef]
- Ellis, M. L., Lu, Y., & Fine-Cole, B. (2021). Digital learning for north carolina educational leaders. *Techtrends*, 65, 696–712.
- Erhan, T., Uzunbacak, H. H., & Aydin, E. (2022). From conventional to digital leadership: Exploring digitalization of leadership and innovative work behavior. *Management Research Review*, 45, 1524–1543. [CrossRef]
- Espina-Romero, L., Sánchez, J. G. N., Rojas-Cangahuala, G., Garay, J. P., Parra, D. R., & Corredoira, J. R. (2023). Digital leadership in an ever-changing world: A bibliometric analysis of trends and challenges. *Sustainability*, 15(17), 13129. [CrossRef]
- Fan, K., Chen, Y., Wang, C., & Chen, M. (2014). E-Leadership effectiveness in virtual teams: Motivating language perspective. *Industrial Management & Data Systems*, 114, 421–437.
- Faraj, S., Renno, W., & Bhardwaj, A. (2021). Unto the breach: What the COVID-19 pandemic exposes about digitalization. *Information and Organization*, 31(1), 100337–100337.
- Fasbender, U., Gerpott, F. H., & Rinker, L. (2022). Getting ready for the future, is it worth it? A dual pathway model of age and technology acceptance at work. *Work, Aging and Retirement*, 9(4), 358–375.
- Figus, A. (2021). Information society and digital leadership in the globalized educational system: Political approach. In A. G. Shirin, M. V. Zvyaglova, O. A. Fikhtner, E. Y. Ignateva, & N. A. Shaydorova (Eds.), *Education in a changing world: Global challenges and national priorities* (pp. 18–24). European Publisher.
- Gentilin, M., & Madrigal-García, M. A. (2021). Virtual leadership: Key factors for its analysis and management. *Management REVUE Socio-Economic Studies*, 32, 343–365.
- Gheni, A. Y., Jusoh, Y. Y., Jabar, M. A., Ali, N. M., Abdullah, R. H., Abdullah, S., & Khalefa, M. S. (2015, August 24–26). *The virtual teams: E-leaders challenges*. 2015 IEEE Conference on E-Learning, e-Management and e-Services (IC3E), Melaka, Malaysia.
- Gomaa, R., Shaban, S. E., & Sakr, H. (2021). Digital nuclear leadership for safety and security—Towards effective regulatory control. *Journal of Nuclear Sciences And Applications*, 54, 116–125.
- Gonaim, F. A. (2021). Electronic leadership in time of crisis: Challenges and opportunities in the light of COVID-19 quarantine. *International Journal of Education, Culture and Society*, 6, 59. [CrossRef]
- Grandbois, J., & Beheshti, J. (2014). A bibliometric study of scholarly articles published by library and information science authors about open access. *Information Research*, 19, 1–23.
- Gunawan, I., Nurabadi, A., Amalia, N., Hui, L. K., Nabila, A. W., Krisnafitriana, V., Budiarti, E. M., & Wardani, A. D. (2023, October 7). *Bibliometric historiography of important document on electronic leadership research*. 2023 9th International Conference on Education and Technology (ICET), Malang, Indonesia.
- Hafermalz, E., & Riemer, K. (2020). Interpersonal connectivity work: Being there with and for geographically distant others. *Organization Studies*, 41, 1627–1648. [CrossRef]
- Hambley, L. A., O’neill, T. A., & Kline, T. J. (2007). Virtual team leadership: The effects of leadership style and communication medium on team interaction styles and outcomes. *Organizational Behavior And Human Decision Processes*, 103, 1–20. [CrossRef]
- Ho, Y. (2020). Some comments on using of web of science for bibliometric studies. *Environmental Science and Pollution Research*, 27, 6711–6713. [CrossRef] [PubMed]
- Höddinghaus, M., Nohe, C., & Hertel, G. (2023). Leadership in virtual work settings: What we know, what we do not know, and what we need to do. *European Journal of Work and Organizational Psychology*, 33, 188–212. [CrossRef]
- Hugar, J., Bachlapur, M., & Gavisiddappa, A. (2019). *Research contribution of bibliometric studies as reflected in Web of science from 2013 to 2017*. Library Philosophy and Practice (e-journal). 2319. Available online: <https://digitalcommons.unl.edu/libphilprac/2319> (accessed on 2 January 2025).

- Hung, B. Q., Hoa, T. A., Hoai, T. T., & Nguyen, N. P. (2023). Advancement of cloud-based accounting effectiveness, decision-making quality, and firm performance through digital transformation and digital leadership: Empirical evidence from Vietnam. *Heliyon*, 9(6), e16929. [\[CrossRef\]](#)
- Indra, R., Ritonga, M., & Kustati, M. (2022). E-leadership of the school principals in implementing online learning during Covid-19 pandemic at public senior high schools. *Frontiers in Education*, 7, 973274. [\[CrossRef\]](#)
- Jameson, J., Rumyantseva, N., Cai, M., Markowski, M., Essex, R., & McNay, I. (2022). A systematic review and framework for digital leadership research maturity in higher education. *Computers and Education Open*, 3, 100115. [\[CrossRef\]](#)
- Karakose, T., Kocabas, I., Yirci, R., Papadakis, S., Ozdemir, T. Y., & Demirkol, M. (2022). The development and evolution of digital leadership: A bibliometric mapping approach-based study. *Sustainability*, 14(23), 16171. [\[CrossRef\]](#)
- Karakose, T., Polat, H., & Papadakis, S. (2021). Examining teachers' perspectives on school principals' digital leadership roles and technology capabilities during the COVID-19 pandemic. *Sustainability*, 13(23), 13448. [\[CrossRef\]](#)
- Karippur, N. K., & Balaramachandran, P. R. (2022). Antecedents of effective digital leadership of enterprises in asia pacific. *Australasian Journal of Information Systems*, 26, 1–35. [\[CrossRef\]](#)
- Kashive, N., Khanna, V. T., & Powale, L. (2022). Virtual team performance: E-leadership roles in the era of COVID-19. *Journal of Management Development*, 41, 277–300. [\[CrossRef\]](#)
- Khaw, T. Y., Teoh, A. P., Khalid, S. N. A., & Letchmunan, S. (2022). The impact of digital leadership on sustainable performance: A systematic literature review. *Journal of Management Development*, 41, 514–534.
- Kirchner, K., Ipsen, C., & Hansen, J. P. (2021). COVID-19 leadership challenges in knowledge work. *Knowledge Management Research and Practice*, 19, 493–500.
- Kissler, G. D. (2001). E-Leadership. *Organizational Dynamics*, 30, 121–133.
- Kordsmeyer, A. C., Mette, J., Harth, V., & Mache, S. (2020). Health-oriented leadership in virtual teamwork. *Zentralblatt Fur Arbeitsmedizin Arbeitsschutz Und Ergonomie*, 70, 76–82. [\[CrossRef\]](#)
- Korzynski, P. (2013). Online social networks and leadership implications of a new online working environment for leadership. *International Journal of Manpower*, 34, 975–994. [\[CrossRef\]](#)
- Kotula, N., Kaczmarek-Ciesielska, D., & Mazurek, G. (2021). Social media E-Leadership practices during the COVID-19 pandemic in higher education. In J. Watrobski, W. Salabun, C. Toro, C. Zanni-Merk, R. J. Howlett, & L. C. Jain (Eds.), *Knowledge-based and intelligent information & engineering systems* (KSE 2021) (pp. 4741–4750). Elsevier Science BV.
- Krehl, E., & Büttgen, M. (2022). Uncovering the complexities of remote leadership and the usage of digital tools during the COVID-19 pandemic: A qualitative diary study. *German Journal of Human Resource Management-Zeitschrift Fur Personalforschung*, 36, 325–352.
- Kröplin, J., Huber, T., Geis, C., Braun, B., & Fritz, T. (2022). ESurgery-Digital transformation in surgery, surgical education and training: Survey analysis of the status quo in germany. *European Surgery-Acta Chirurgica Austriaca*, 54, 249–258. [\[CrossRef\]](#)
- Li, K., Rollins, J., & Yan, E. (2017). Web of science use in published research and review papers 1997–2017. *Scientometrics*, 115, 1–20.
- Liao, C. (2017). Leadership in virtual teams: A multilevel perspective. *Human Resource Management Review*, 27, 648–659.
- Liebermann, S. C., Blenckner, K., Diehl, J. H., Feilke, J., Frei, C., Grikscheit, S., Hünsch, S., Kohring, K., Lay, J., Lorenzen, G., & Reinhardt, J. (2021). Abrupt implementation of telework in the public sector during the COVID-19 crisis challenges to transformational leadership. *Zeitschrift Fur Arbeits-Und Organisationspsychologie A&O*, 65, 258–266.
- Liu, C., Ready, D., Roman, A., Van Wart, M., Wang, X., McCarthy, A., & Kim, S. (2018). E-Leadership: An empirical study of organizational leaders' virtual communication adoption. *Leadership & Organization Development Journal*, 39, 826–843.
- Liu, C., Van Wart, M., Kim, S., Wang, X., McCarthy, A., & Ready, D. (2020). The effects of national cultures on two technologically advanced countries: The case of e-leadership in south korea and the united states. *Australian Journal of Public Administration*, 79, 298–329. [\[CrossRef\]](#)
- Liu, W. (2020). A matter of time: Publication dates in web of science core collection. *Scientometrics*, 126, 849–857. [\[CrossRef\]](#)
- Loucks, S., & Ozogul, G. (2020). Preparing business students for a distributed workforce and global business environment: Gaining virtual leadership skills in an authentic context. *Techtrends*, 64, 655–665. [\[CrossRef\]](#)
- Machado, A. M., & Brandão, C. (2019). Leadership and technology: Concepts and questions. In A. Rocha, A. Hojjat, L. Reis, & L. Costanzo (Eds.), *New knowledge in information systems and technologies. WorldCIST'19 2019. Advances in intelligent systems and computing* (1st ed., pp. 764–773). Springer.
- Majchrakova, J., & Kremenova, I. (2020). Reverse mentoring as an innovative supplement to traditional mentoring and coaching within a company environment (siemens AG). In L. G. Chova, A. L. Martinez, & I. C. Torres (Eds.), *14th international technology, education and development conference (Inted2020)* (pp. 2386–2392). Valencia, Spain, March 24, IATED.
- Markaryan, M., Bilyi, D., & Yuldashev, S. (2021). Legal peculiarities of “digitalization” of the economy in the context of the development of the information society in ukraine. *Baltic Journal of Economic Studies*, 7, 123–129. [\[CrossRef\]](#)

- Marx, W., & Bornmann, L. (2014). On the problems of dealing with bibliometric data. *Journal of the Association for Information Science and Technology*, 65, 866–867.
- McCarron, G. P., Olesova, L., & Calkins, B. (2021). An exploratory examination of student-led, asynchronous collaborative online discussions in fostering higher-order cognitive skills and ethical leadership learning. *Online Learning*, 25, 79–100. [\[CrossRef\]](#)
- Meadows, S., & De Braine, R. (2022). The work identity of leaders in the midst of the COVID-19 pandemic. *Frontiers In Psychology*, 13, 958679.
- Mishra, P., Henriksen, D., Boltz, L. O., & Richardson, C. (2016). E-Leadership and teacher development using ICT. In R. Huang, Kinshuk, & J. K. Price (Eds.), *ICT in education in global context: Comparative reports of innovations in k-12 education* (pp. 249–266). Lecture Notes in Educational Technology. Springer.
- Mitchell, A. (2012). Interventions for effectively leading in a virtual setting. *Business Horizons*, 55, 431–39. [\[CrossRef\]](#)
- Mustajab, D., Bauw, A., Irawan, A., Rasyid, A., Akbar, M., & Hamid, M. (2020). COVID-19 pandemic: What are the challenges and pppportunities for e-leadership? *Fiscaeconomia*, 4, 483–497.
- Naotunna, N. P. G. S. I., & Zhou, I. (2017). Virtual leadership and creativity of virtual employees: The mediating role of creative self-efficacy. In W. Aimin (Ed.), *Proceedings of the 14th international conference on innovation and management* (Vols I & II, pp. 132–135). Wuhan University Technology Press.
- Nordbäck, E. S., & Espinosa, J. A. (2019). Effective coordination of shared leadership in global virtual teams. *Journal Of Management Information Systems*, 36, 321–350.
- Oktaysoy, O., Topcuoglu, E., & Kaygin, E. (2022). A study on digital leadership scale adaptation. *International Journal of Organizational Leadership*, 11, 407–425.
- Oliveira-Pereira, J., Sá, S., Pascoinho, J., Guimarães, L., Costa, E., & Pinto, A. S. (2023). Remote leadership: A (re)qualification of school leaders in portugal. In A. Mesquita, A. Abreu, J. V. Carvalho, & C. H. P. DeMello (Eds.), *Perspectives and trends in education and technology, ICITED 2022* (pp. 857–867). Springer Singapore PTE Ltd.
- Orte, C. J. S., & Diño, M. J. (2019). Eliciting E-leadership style and trait preference among nurses via conjoint analysis. *Enfermería Clínica*, 29, 78–80. [\[CrossRef\]](#)
- Peiró, J. M., & Martínez-Tur, V. (2022). ‘Digitalized’ competences. A crucial challenge beyond digital competences. *Journal of Work and Organizational Psychology-Revista de Psicología Del Trabajo y de Las Organizaciones*, 38, 189–199.
- Pham, H., & Vu, P. (2022). Unravelling the potential of digital servitization in sustainability-oriented organizational performance—Does digital leadership make it different? *Economies*, 10(8), 185. [\[CrossRef\]](#)
- Politis, J. (2014). The Effect of e-leadership on organisational trust and commitment of virtual teams. In V. Grozdanic (Ed.), *Proceedings of the 10th european conference on management leadership and governance (ECMLG 2014)* (pp. 254–261). Zagreb, Republic of Croatia, November 13–14, ACAD Conferences Ltd.
- Reyes Ch, R. P., Recalde Herrera, L., Andrade Daza, G., Gómez Bravo, V., & Pérez Vaca, H. (2020). E-leadership using whatsapp, a challenge for navy organizations: An empirical study. In A. Rocha, & R. P. Pereira (Eds.), *Developments and advances in defense and security* (pp. 171–181). Springer.
- Robertson, J., Botha, E., Walker, B., Wordsworth, R., & Balzarova, M. (2022). Fortune favours the digitally mature: The impact of digital maturity on the organisational resilience of sme retailers during COVID-19. *International Journal of Retail & Distribution Management*, 50, 1182–1204.
- Roodt, H., Krug, H., & Otto, K. (2021). Subgroup formation in diverse virtual teams: The moderating role of identity leadership. *Frontiers in Psychology*, 12, 722650.
- Samartinho, J., Silva, P., & Faria, J. (2014). Good practices in virtual leadership—The E-3cs rule (communication, trust and coordination). In C. Vivas, & P. Sequeira (Eds.), *Proceedings of the 15th european conference on knowledge management (ECKM 2014)* (Vols. 1–3, pp. 1272–1282). ACAD Conferences Ltd.
- Sandberg, D. S., Pennington, C. M., & Lindquist, M. A. (2022). Virtual leadership: Ceos and c-level executives of healthcare organizations in the united states reimaged new roles as virtual leaders. *Journal of Leadership Studies*, 16, 61–69.
- Saputra, N., & Hutajulu, G. E. (2020). Engaging the millennials at office: Tracking the antecedents of holistic work engagement. *Journal of Management Studies*, 21, 342–354.
- Sivulca, A., Abrudan, M., Sala, D. C., & Bibu, N. (2024). Navigational dynamics in the digital age: Digital leadership and e-leadership in organizational transformation. *Analele Universității Din Oradea*, 33, 618–625.
- Sujaya, K. (2022). Digital leadership competencies to improve the quality of high schools in tasikmalaya city in the post-pandemic COVID-19. *Eurasian Journal of Educational Research*, 222–235.
- Sukmawati, M., Giatman, M., & Maksum, H. (2024). E-Leadership: Concept and influence of digital leadership. *Jurnal Teknologi Informasi Dan Pendidikan*, 17, 87–97.
- Sullivan, E. E., Moftah, D., Mbye, P., Weilnau, T., & Tobin, J. N. (2021). An E-leadership training academy for practicing clinicians in primary care and public health settings. *Journal of Clinical and Translational Science*, 5, e83. [\[PubMed\]](#)

- Tahir, L. M., Ping, C. S., Atan, N. A., Ali, M. F., & Yusof, S. M. (2021). Evaluating the practice of Ict-based E-leadership: The experiences of private-based secondary teachers. *International Journal of Emerging Technologies In Learning*, 16, 74–85.
- Tan, R., & Antonio, F. (2022). New insights on employee adaptive performance during the COVID-19 pandemic: Empirical evidence from indonesia. *Journal of Entrepreneurship Management and Innovation*, 18, 175–206.
- Terkamo-Moisio, A., Karki, S., Kangasniemi, M., Lammintakanen, J., & Häggman-Laitila, A. (2022). Towards remote leadership in health care: Lessons learned from an integrative review. *Journal of Advanced Nursing*, 78, 595–608.
- Tigre, F. B., Curado, C., & Henriques, P. L. (2022). Digital Leadership: A Bibliometric Analysis. *Journal of Leadership & Organizational Studies*, 30(1), 40–70. [CrossRef]
- Tintore, M., Mayo, I. C., Lobos, M. Q., & Pares, I. (2019). Leadership and E-Leadership in the life histories of educational leaders throughout the world. *Edmetic*, 8, 17–36.
- Torre, T., & Sarti, D. (2020). The “Way” toward E-Leadership: Some Evidence from the field. *Frontiers in Psychology*, 11, 554253.
- Torres-Martin, C. (2019). Virtual leadership in educational ecosystems. *Edmetic*, 8, 1–16.
- Tuerk, A. (2023). Digital leadership role in developing business strategy suitable for digital transformation. *Frontiers in Psychology*, 13, 1066180. [CrossRef] [PubMed]
- Tuschner, C., Hörsch, H., & Von Korfflesch, H. (2023). *Leading virtual teams in the context of e-leadership: Insights from a leader’s perspective on traits and behaviors*. Elsevier BV.
- Unsworth, K. (2020). Human Relations Virtual Special Issue: Virtual Working. *Human Relations*, 73, 1036–40. [CrossRef]
- Vahdati, S., Naghavi, M. A. S., Vaezi, R., & Sharifzadeh, F. (2023). discovering the antecedents of virtual leadership in universities and higher education institutions of iran during Covid-19 pandemic: A qualitative study. *Journal of Management Development*, 42, 352–372. [CrossRef]
- Van Wart, M., Roman, A., Wang, X., & Liu, C. (2016). Operationalizing the definition of e-leadership: Identifying the elements of e-leadership. *International Review of Administrative Sciences*, 85, 80–97. [CrossRef]
- Van Wart, M., Roman, A., Wang, X., & Liu, C. (2017). Integrating ICT adoption issues into (e-)Leadership Theory. *Telematics And Informatics*, 34, 527–537. [CrossRef]
- Wakefield, R. L., Leidner, D. E., & Garrison, G. (2008). A model of conflict, leadership, and performance in virtual teams. *Information Systems Research*, 19, 434–455. [CrossRef]
- Wang, X., Wei, X., Van Wart, M., McCarthy, A., Liu, C., Kim, S., & Ready, D. H. (2023). The Role of E-Leadership in ICT Utilization: A Project Management Perspective. *Information Technology & Management*, 24, 99–113.
- Wang, Z., Zhao, H., & Nie, H. (2019). Bibliometric Analysis of Rumor Propagation Research through Web of Science from 1989 to 2019. *Journal of Statistical Physics*, 178(2), 532–551. [CrossRef]
- Weber, E., Büttgen, M., & Bartsch, S. (2022). How to take employees on the digital transformation journey: An experimental study on complementary leadership behaviors in managing organizational change. *Journal of Business Research*, 143, 225–38. [CrossRef]
- Wider, W., Tanucan, J., Jiang, L., Fauzi, M., & Uytico, B. (2023). *Mapping the Trends of Digital Leadership Research: A Bibliometrics Study*. Advance. Available online: [https://www.researchgate.net/publication/373128024\\_ScholarOne\\_-\\_Mapping\\_the\\_Trends\\_of\\_Digital\\_Leadership\\_Research\\_A\\_Bibliometrics\\_Study](https://www.researchgate.net/publication/373128024_ScholarOne_-_Mapping_the_Trends_of_Digital_Leadership_Research_A_Bibliometrics_Study) (accessed on 5 January 2025).
- Willermark, S., & Isind, A. S. (2022). Adopting to the virtual workplace: Identifying leadership affordances in virtual schools. *Journal of Workplace Learning*, 35, 22–37. [CrossRef]
- Wolor, C. W., Solikhah, S., Fidhyallah, N. F., & Lestari, D. P. (2020). Effectiveness of e-training, e-Leadership and Work life balance on employee performance during COVID-19. *Journal of Asian Finance Economics and Business*, 7, 443–450.
- World Health Organization. (2020). *Alocución de apertura del director general de la oms en la rueda de prensa sobre la COVID-19 celebrada el 11 de marzo de 2020*. Available online: <https://www.who.int/es/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020> (accessed on 5 January 2025).
- World Health Organization. (2023). *COVID-19 Ya No Es una emergencia de salud pública de importancia internacional*. Available online: <https://www.paho.org/es/noticias/8-5-2023-covid-19-ya-no-es-emergencia-salud-publica-importancia-internacional> (accessed on 5 January 2025).
- Yilmaz, R., Yilmaz, F. G. K., & Keser, H. (2020). Vertical versus shared E-Leadership approach in online project-based learning: A comparison of self-regulated learning skills, motivation and group collaboration processes. *Journal of Computing in Higher Education*, 32, 628–654.
- Zentner, H., Spremić, M., & Zentner, R. (2022). Effect of management’s competencies and digital skills on digital business model maturity for SMES. *Interdisciplinary Description of Complex Systems*, 20, 514–532.
- Zhu, J., Zhang, B., Xie, M., & Cao, Q. (2022). Digital leadership and employee creativity: The role of employee job crafting and person-organization Fit. *Frontiers in Psychology*, 13, 827057.

- Ziek, P., & Smulowitz, S. (2014). The impact of emergent virtual leadership competencies on team effectiveness. *Leadership & Organization Development Journal*, 35, 106–120.
- Zulu, S. L., Saad, A. M., Ajayi, S. O., Dulaimi, M., & Unuigbo, M. (2023). Digital leadership enactment in the construction industry: Barriers undermining effective transformation. *Engineering Construction and Architectural Management*, 31(10), 4062–4078. [[CrossRef](#)]

**Disclaimer/Publisher’s Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.