Digital Leadership in an Ever-Changing World: A Bibliometric Analysis of Trends and Challenges

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Abstract: Digital leadership is vital for companies in a constantly evolving technological environment, where the adaptability of leaders is essential to face changes. To better understand this topic, a bibliometric study was conducted that examined publications on digital leadership from 2018 to July 2023. Scopus was used, complemented by tools such as RStudio, VOSviewer, and Microsoft Excel. The findings show that the field has undergone changes lately due to the COVID-19 pandemic. A movement toward digital transformation and technology leadership was observed. The most influential journals, prominent authors and geographical distribution of publications were identified. The United States, Germany and China all stood out in terms of the number of publications and citations. In addition, nine groups of industry sectors related to digital leadership were identified. The pandemic has led to increased interest in online learning and decision making in crisis situations. The results offer an updated view on digital leadership and highlight its relevance in organizations. In addition, qualitative studies are suggested in areas such as blockchain technology, climate change, digital skills, industry 4.0, municipal administration, and virtual skills. In summary, this study contributes to the advancement and understanding of digital leadership in various contexts.

Keywords: digital leadership; digital transformation; technology; adaptation to change; innovation; technical skills; change management; effective communication; strategic decision making

1. Introduction

In today’s business world, digital leadership has become crucial due to the rapid digital transformation and the growing importance of technology in all areas of an organization [1–3]. It involves leaders being able to adapt and lead in a digital environment, taking advantage of the opportunities offered by recent technologies and facing the challenges they present [4,5]. In addition to having technical skills, skills in change management, effective communication, and strategic decision making are needed [6–9]. All of this has given rise to diverse perspectives in the academic and professional literature. Some focus on technology and its adoption, while others emphasize the importance of the mindset and adaptability of leaders in an ever-changing digital environment [10–12].

Different studies on digital leadership cover diverse topics and contexts in organizations. Some important results show how digital leadership has had a positive effect on competitive advantage in the telecommunications sector [13]. It also highlights how important it is for companies to adopt a consistent approach and flexible structure to adapt
to digitalization [14]. In addition, it has been noted that leaders need to foster a digital culture and address the ethical issues that arise in this context [15].

The importance of e-leadership and its influence on leader–follower interactions in both virtual and traditional environments has been emphasized [16]. In various companies, key factors for digital transformation, such as digital leadership and organizational culture, have been identified [17]. In addition, the lack of available information on supply chain agility and digital leadership in medium-sized manufacturing companies has been noted [18].

During the COVID-19 pandemic, how teachers coped with the use of digital technology and leadership in education has been studied [19]. How the fear of COVID-19 affected nurses and how supportive leadership can protect their emotional well-being during challenging times has also been investigated [20].

In the world of higher education, transformational leadership has been found to be linked to the long-term success of universities [21]. In addition, digital leadership has been shown to have a positive impact on how faculty adapted to technology during the COVID-19 pandemic [22]. In research on manufacturing companies, the importance of digital leadership in improving performance and long-term resilience has been highlighted [23,24]. Guidelines for designing and analyzing studies in scientific research have also been provided [25].

In the context of digital transformation, digital leadership is gaining increasing importance in various organizations. However, there is still no up-to-date bibliometric review that analyzes its evolution and relevance. Although several studies have investigated distinct aspects of digital leadership, it is necessary to understand it in its entirety over time. In addition, it is crucial to identify the prominent themes and trends in digital leadership research, focusing on the most cited papers globally. It is also necessary to explore how publications on this topic are distributed geographically and how they are related to industry sectors. Finally, it is important to identify the most used methodological approaches and lines of research for future studies on digital leadership. With this information, it will be possible to better understand this approach and its impact on the business environment.

To address the gaps in knowledge, a study consisting of a bibliometric review will be conducted [26]. This method is appropriate for the purpose, as it allows the examination and analysis of existing scientific publications on digital leadership, uncovering trends, predominant approaches, and areas in need of further research. In addition, it provides an overview of the most relevant publications and the most influential authors in the field, which theoretically supports the research and helps to find potential collaborators or additional sources of information. With this approach, the aim is to obtain a comprehensive view of digital leadership in the current era and to close the gaps in the literature.

The research questions that will guide this study are as follows:

RQ1. How has the focus and themes of digital leadership evolved over the years, and what is its relevance in different organizational contexts?

RQ2. What is the impact and relevance of academic sources in digital leadership based on the number of papers, h-index, and total citations?

RQ3. What is the profile of the most relevant authors in the field of digital leadership in terms of productivity and impact?

RQ4. What is the geographical distribution of publications on digital leadership, and what trends can be identified in relation to countries and continents?

RQ5. What are the prominent distribution of publications on digital leadership, and what trends can be identified in relation to countries and continents?

RQ6. How do industry sectors relate to digital leadership in different contexts?

RQ7. What are the most used methodological approaches in digital leadership research, and how do they relate to the areas of study addressed?

RQ8. What are the possible lines of future research in the field of digital leadership?

The aim of this study is to carefully analyze the studies published in Scopus from 2018 to July 2023. The purpose is to summarize current knowledge and to point out areas
of research that should be considered in the future. In addition, the aim is to find best practices to improve and strengthen digital leadership in organizations.

The study is of significant value as it provides an in-depth understanding of digital leadership by incorporating different perspectives and approaches. In addition, it is hoped that by analyzing the literature, it will contribute to the strengthening of the field of digital leadership by pointing out missing areas of knowledge and providing guidance for future research.

The paper will be organized as follows: first, the methods used in the bibliometric review will be explained. Then, the results related to the research questions posed will be presented and analyzed. Finally, the main conclusions of the study will be summarized, and suggestions for future research in the field of digital leadership will be offered. The aim of this study is to provide leaders and organizations with a solid understanding of digital leadership. Its purpose is to help them understand and develop the skills needed to succeed in the digital age.

2. Methodology

This quantitative study was supported by a bibliometric review [27], applying the methodological model recommended by Zupic and Carter [26] (Figure 1).

![Figure 1. Steps of the methodology.](image)

2.1. Study Design

In this study on digital leadership, a variety of academic publications collected between 2018 and July 2023 were analyzed. The objectives of the study were to understand how digital leadership has evolved and its relevance, examine the influence of academic sources, identify the most prominent authors, investigate the geographical distribution of publications, explore the most relevant topics, analyze the relationship between digital leadership and industry sectors, analyze methodological approaches, and identify lines of future research. This study provides valuable information that can help in the making of informed decisions in an ever-changing digital environment.

2.2. Data Collection

The widely recognized Scopus database was used, which, according to Burnham (2006) [28], houses more than 27 million abstracts, making it the most extensive of all databases. The search criteria were established in fields such as the title, abstract, and keywords of the documents. Different search terms related to the subject of the study were entered, such as “digital leadership” or “digital leadership and transformation” or “cyber leadership” or “technology leadership” or “online leadership” or “virtual leadership” or “e-leadership” or “internet leadership” or “web leadership” or “tech-savvy leadership” or “information age leadership” or “data-driven leadership” or “dynamic leadership”. The reason for choosing the above terms was to achieve greater accuracy, currency, and focus, as well as to gain a variety of perspectives to suit diverse audiences. This helps to obtain more relevant results and to explore various aspects of leadership in the digital environment. This initial search provided us with a total of 1421 documents from 1960 to July 2023.

Additional filters were then applied to improve the results. Information was searched only between 2018 and July 2023, yielding a total of 672 records. The reason for choosing
this period was because recent literature was needed. Editorials and short-abstract-type documents were discarded [29], which reduced the number of records to 661. Press articles were also eliminated, leaving a total of 631 records. Finally, only articles written in English were selected, resulting in a total of 617 documents relevant to the study (Figure 2).

The team used the Mendeley tool to select relevant documents. They then collected the required bibliometric data from the Scopus platform in different file formats, such as RIS, BibTex, and CSV. These files were processed and analyzed using statistical software. The extracted data include details such as number of citations, authors, year of publication, and journal names. These data will be used in the study to obtain relevant conclusions and results.

2.3. Analysis of Data

A data analysis in the field of bibliometrics was carried out to obtain valuable and easy-to-understand information. For this purpose, several metrics and statistical methods were used. Some of the bibliometric metrics employed included the h-index, total citations, temporal distribution of publications, as well as the number of documents by sources and authors, among others.

To address the first research question, the Thematic Map approach was used, which consists of a conceptual structure that helped to identify the thematic trends present in the data. The Microsoft Excel desktop application was also used to analyze trends and to make estimates related to research questions RQ1, RQ2, RQ3, RQ4, RQ5, RQ6, RQ7, and RQ8. To investigate RQ6, RQ7, and RQ8, the method called “keyword analysis” was used, which allowed, firstly, for the frequency of keywords in the documents to be studied and the extraction of data on the relationship between industrial sectors and digital leadership; secondly, the identification of methodological approaches; and, finally, the identification of lines of future research.

The study conducted the data analysis using the RStudio software (version R 4.1.1) [27]. To visualize and analyze term networks and co-occurrences, VOSviewer (version 1.6.18) was utilized [30]. Statistical analyses and visual graphs were generated using the Microsoft Excel 365 desktop application.

2.4. Data Visualization

To respond to RQ1, a line graph with markers was used to show progress over time. For RQ2, RQ3, and RQ4, tables were created using the data generated by RStudio. These tables present the data collected for comparison and analysis of the information. To answer RQ6, RQ7, and RQ8, the VOSviewer software (Version 1.6.19) was used to
generate a graph for the identification and analysis of clusters related to digital leadership. Visual representations of the data were produced using software such as Microsoft Excel and VOSViewer.

2.5. Interpretation

This phase describes how the results were analyzed and interpreted in accordance with the research objectives and questions. Conclusions are summarized and the implications and significance of the results are discussed. In addition, recommendations for future studies are mentioned.

3. Results and Discussion

An analysis of the main information provided by RStudio on the subject under study was performed. The results of this analysis are included in Table 1, which covers the period from 2018 to July 2023.

<table>
<thead>
<tr>
<th>Description</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timespan</td>
<td>2018–July 2023</td>
</tr>
<tr>
<td>Sources (Books, Journals, etc.)</td>
<td>442</td>
</tr>
<tr>
<td>Annual Growth Rate %</td>
<td>1.45</td>
</tr>
<tr>
<td>Documents</td>
<td>617</td>
</tr>
<tr>
<td>Document Average Age</td>
<td>2.27</td>
</tr>
<tr>
<td>Average citations per document</td>
<td>5,844</td>
</tr>
<tr>
<td>References</td>
<td>31,956</td>
</tr>
<tr>
<td>Keywords Plus (ID)</td>
<td>1,707</td>
</tr>
<tr>
<td>Author’s Keywords (DE)</td>
<td>1,702</td>
</tr>
<tr>
<td>Authors</td>
<td>1,622</td>
</tr>
<tr>
<td>International co-authorships %</td>
<td>19.12</td>
</tr>
<tr>
<td>Document Type—Article</td>
<td>376</td>
</tr>
<tr>
<td>Document Type—Conference paper</td>
<td>115</td>
</tr>
<tr>
<td>Document Type—Book chapter</td>
<td>77</td>
</tr>
<tr>
<td>Document Type—Review</td>
<td>29</td>
</tr>
<tr>
<td>Document Type—Book</td>
<td>12</td>
</tr>
<tr>
<td>Document Type—Conference review</td>
<td>8</td>
</tr>
</tbody>
</table>

During the period studied, a total of 442 sources were found, including journals, books, and other collections. In total, 617 documents related to digital leadership were collected, inferring that there is a considerable amount of information on this topic in the scientific community. The annual growth rate reveals that digital leadership manuscripts have been growing steadily, with an annual increase of 1.45%. This implies interest and recognition of this field under study today.

The average age of the manuscripts is about 2.27 years, indicating that most of these publications are new. This points to the fact that digital leadership is a developing field, thus requiring periodic research and updates. On average, each manuscript has received 5,844 citations, demonstrating interest and recognition within the academic community. These citations serve to measure their importance and influence within the field of digital leadership.

In terms of references, a total of 31,956 were found in the papers on digital leadership. This suggests that there is a solid research and literature base that supports and substan-
tiates the studies in this field. The references also provide an opportunity to explore and investigate the topic further. A total of 1707 Plus Keywords (ID) and 1702 Author Keywords (ED) were discovered in the papers related to the variable under study. These keywords provide a more detailed and specific perspective on the topics and approaches addressed in the publications on digital leadership.

In terms of authors, a total of 1622 people were found to have contributed to manuscripts on digital leadership. This shows the diversity and participation of the scientific community researching this topic. An interesting finding reveals that 19.12% of the papers are the result of international collaborations. This finding shows the global nature of research in this field and underlines the importance of collaboration between researchers from different countries.

In terms of the types of papers found, many publications are articles (376), followed by book chapters (77), conference papers (115), reviews (29), books (12), and conference reviews (8). These results suggest that articles and conference papers are the most common ways of sharing advances in digital leadership.

The importance of digital leadership in an increasingly digitized world and the need for further research and updated knowledge in this evolving field can be addressed. Practical implications of these findings can also be mentioned, such as the impact of digital leadership in organizations and how leaders can develop skills and competencies needed in this digital environment. In addition, it is interesting to explore the relationship between digital leadership and other relevant topics, such as digital transformation, innovation, and organizational change.

3.1. Analysis of the Evolution of Digital Leadership: Thematic Trends and Relevance in Organizational Contexts

Analyzing the data shown in Figure 3 related to digital leadership, it is possible to observe certain trends and themes highlighted in each year. As of 2018, the focus was on information systems, information use, and decision making. During that year, a total of 67 papers were presented that addressed these specific topics. In that year, digital leadership was focused on understanding how information systems and the appropriate use of information could affect organizational decision making. The articles by Amornbunchornvej and Berger and Van Outvorst et al. explore the dynamics of digital leadership in a changing digital world and the survival of organizations in the face of digital transformation [31,32].

By 2019, there was a shift toward digital transformation and technology leadership. The number of manuscripts published that year increased to 88, indicating an increased interest in digital transformation and the impact of customized technology solutions on digital learning strategies [17,35].

Figure 3. Evolution of digital leadership.

By 2022, there was a significant increase in published papers, reaching 168, indicating a growing interest in the topic.

By 2023, a total of 72 papers related to digital leadership have already been published.
interest in digital leadership and its relationship to the transformation of organizations in the information age. The main topics addressed were digital transformation, technological leadership, and digital leadership in general. The papers by Antonopoulou et al. and Ravesteijn and Ongena investigate the transition from educational leadership to e-leadership and the role of e-leadership in IT capabilities and digital transformation [33,34].

During 2020, digital transformation continued to be studied, but it also focused on learners and online learning. The number of manuscripts increased to 102, reflecting how digital leadership can drive the adoption and effectiveness of online learning in educational settings. The papers by Peter et al. and Jewitt examine the strategic fields of action of digital transformation and the impact of customized technology solutions on digital learning strategies [17,35].

The COVID-19 pandemic in 2021 had a major impact on digital leadership. It generated the urgency for fast and effective decision making, especially in education [36]. The number of manuscripts increased to 120 and highlighted topics such as decision making in times of crisis, online education, and digital leadership during the pandemic. From this year, we identify the works of Karakose et al., Khattak et al., Hamzah et al., Susilawati et al., and Antonopoulou et al., which highlight issues such as decision making during crises, online education, and digital leadership during the pandemic [19,20,37–39].

The year 2022 saw a significant increase in the number of published papers, reaching a total of 168. These papers were oriented toward topics such as technology leadership and digital leadership as well as digital transformation. This year demonstrated a greater understanding of the importance of digital leadership for achieving a successful implementation of digital transformation in different organizations. The papers by Alshehab et al., Chatterjee et al., and Yuting et al. highlight the importance of digital leadership in achieving successful digital transformation in organizations [40–42].

As of July 2023, 72 papers related to digital leadership have already been published. These documents were focused on topics such as learning, job satisfaction, and education. These data indicate an interest in understanding how digital leadership can affect learning and employee satisfaction both in educational environments and in organizations in general. The papers by Shirish et al., Hargitai and Bencsik, Arham et al., and Ghavifekr and Pei investigate topics such as managing and sustaining digital transformations in microenterprises, the role of leadership in digital learning organizations, and the impact of digital leadership on employee satisfaction [1,43–45].

It can be pointed out that digital leadership has changed over time. Initially oriented toward information systems and decision making, it has now evolved toward digital transformation, online education, and the ability to adapt to emergencies, such as the COVID-19 pandemic. An increase in the number of published manuscripts is also noted, demonstrating a greater interest and recognition of digital leadership in different situations.

The analysis emphasizes the significance of grasping and cultivating leadership abilities in today’s digital era. It goes beyond merely comprehending and embracing modern technologies; instead, it involves learning how to utilize them effectively to propel an organization toward success. This has been particularly evident during emergencies like the COVID-19 pandemic, where digital leadership played a crucial role, demanding the swift adaptation and implementation of digital solutions.

This study examines topics by year, offering valuable insights into areas of interest and trends in digital leadership. These findings can form a solid foundation for future research and aid in developing more effective strategies across different contexts.

3.2. Analysis of the Impact and Relevance of Academic Sources on Digital Leadership

The list presents the top ten sources on digital leadership, along with the number of articles, h-index, and total citations (TC) (Table 2). The h-index is a bibliometric metric used to assess the productivity and impact of an academic researcher. It is calculated by counting how many articles a researcher has written that have been cited at least h times each. This
section aims to analyze the data to gain a deeper understanding of the significance and influence of each source in the field of study.

Table 2. Relevant Sources.

<table>
<thead>
<tr>
<th>Relevant Sources</th>
<th>Doc</th>
<th>h-Index</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontiers In Psychology</td>
<td>18</td>
<td>4</td>
<td>359</td>
</tr>
<tr>
<td>Sustainability (Switzerland)</td>
<td>14</td>
<td>5</td>
<td>122</td>
</tr>
<tr>
<td>ACM International Conference Proceeding Series</td>
<td>8</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>Lecture Notes in Networks and Systems</td>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Management for Professionals</td>
<td>7</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Online Collaboration and Communication in Contemporary Organizations</td>
<td>7</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Journal of Management Development</td>
<td>5</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>Journal of Research on Technology in Education</td>
<td>5</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td>Systematic Reviews in Pharmacy</td>
<td>5</td>
<td>4</td>
<td>46</td>
</tr>
<tr>
<td>Contributions to Management Science</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

The journal Frontiers in Psychology is notable for its 18 published articles in this field, for example, [46–51], which have garnered 359 citations, and the journal holds an h-index of 4, highlighting its respectable presence as a relevant source in the field of digital leadership.

In second place is the journal Sustainability (Switzerland), with a total of 14 published articles [6,23,52–54]. This journal has an h-index of 5, and the articles have been cited 122 times. Although it has fewer articles than the leading journal, its h-index is higher, suggesting that it has received a considerable number of citations relative to its number of publications. This indicates that the articles published in this journal have influence in the field of digital leadership.

The ACM International Conference Proceeding Series ranks third with eight published articles in this field [55]. However, its h-index is only 2, and it has a total of 22 citations. These numbers indicate that although it has published a few articles, its impact and recognition in the field of digital leadership is limited compared with the two sources above.

As for Lecture Notes in Networks and Systems [56], Management for Professionals [57], and Online Collaboration and Communication in Contemporary Organizations [58], these have all published seven papers each in this field. However, their h-index and total citations are low, suggesting that their influence and recognition in the field under study are limited compared with the first two sources mentioned.

The Journal of Management Development [59] has published five articles in this field so far, with an h-index of 3 and a total of 28 citations. Although the journal’s h-index is lower than some of the other sources, its articles have garnered recognition and citations from fellow authors in the digital leadership field.

The Journal of Research on Technology in Education [60] and Systematic Reviews in Pharmacy [61] hold similar positions in terms of their published articles, h-index, and citation counts. Each of them has published five articles in this field, which have received 56 and 46 citations, respectively, and garnered an h-index of 4. These statistics demonstrate that both sources have gained recognition and have been cited in the field of digital leadership.

The journal Contributions to Management Science [62] has a limited publication record, containing only four articles in this field. Additionally, it possesses a low h-index (1) and a minimal number of citations (1). These aspects indicate that the source lacks significant impact and recognition within the field of digital leadership.

An analysis of Table 2 reveals noticeable distinctions in how the different sources’ impact on digital leadership is perceived and valued. Among these sources, the journals Frontiers in Psychology and Sustainability from Switzerland stand out as influential and widely recognized. They boast a considerable number of articles and citations in this field,
along with a significant h-index. These have helped to establish their authority in the field of digital leadership, with their articles being highly cited and acknowledged by the community.

On the other hand, lesser-known and less relevant sources exist, like the journal Contributions to Management Science. This journal has published only a few articles in this field and received very few citations, indicating a minimal impact in the field of digital leadership. As a result, its articles have not gained widespread recognition or citations.

3.3. Analysis of the Main Authors in the Field of Digital Leadership: Productivity and Impact

Table 3 presents data about the top ten most influential authors in the realm of digital leadership. The analysis considers three key factors: the number of articles they have published, their h-index, and the total citations (TC) they have received.

<table>
<thead>
<tr>
<th>Relevant Authors</th>
<th>Articles</th>
<th>h-Index</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richardson, J.W.</td>
<td>7</td>
<td>5</td>
<td>87</td>
</tr>
<tr>
<td>Abu, H.</td>
<td>6</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Liu, C.</td>
<td>6</td>
<td>4</td>
<td>168</td>
</tr>
<tr>
<td>Mihardjo, L.W.W.</td>
<td>6</td>
<td>5</td>
<td>66</td>
</tr>
<tr>
<td>Eidjen</td>
<td>6</td>
<td>5</td>
<td>167</td>
</tr>
<tr>
<td>Gudergan, G.</td>
<td>5</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Ibrahim, M.Y.</td>
<td>5</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Mugge, P.</td>
<td>5</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Raman, A.</td>
<td>5</td>
<td>4</td>
<td>167</td>
</tr>
<tr>
<td>Van Wart, M.</td>
<td>5</td>
<td>4</td>
<td>167</td>
</tr>
</tbody>
</table>

The researcher with the highest number of published articles is J.W. Richardson, who has written seven publications in total [60,63]. Despite having the highest number of articles, his h-index is only 5, which means that five of his papers have been cited at least five times. In addition, his research has received a total of 87 citations, which shows a considerable influence in the field, although it is not the highest.

Although there are different authors (Abbu, H., Liu, C., Mihardjo, L.W.W.) who have each published six papers, the impact and influence of their work varies greatly [16,64–68]. Liu, C. stands out with an h-index of 4 and a total of 168 citations, which is the highest figure in the table. This indicates that his works are widely recognized and used in digital leadership research.

Authors Eidjen [69], Gudergan [64], Ibrahim [70], Mugge [64], Raman [71], and Van Wart [16] have each published five papers. It is interesting to note the profile of Van Wart, who has an h-index of 4 and has received a total of 167 citations, which places him at a similar level to Liu in terms of influence in the field.

It is relevant to mention that the h-index and total citations are two elements that can offer a perspective on the quality and influence of an author’s work. However, these indicators do not provide a complete picture. An example of this is the case of Ibrahim, M.Y., whose h-index is the lowest (2) and who has the fewest citations (10). However, this does not necessarily imply that his work is of inferior quality or relevance. It is possible that his research is recent and has not yet had sufficient time to be widely cited.

In summary, although the number of articles may suggest productivity, the data indicate that the h-index and total citations are better indicators of influence and impact in the field of digital leadership. Within this context, relevant figures such as Richardson, J.W., Liu, C., and Van Wart, M. stand out, while attention to Ibrahim, M.Y. is recommended in
the future. However, this view is simplified, and more metrics and indicators are required to assess the relevance and impact of an author more fully.

3.4. Analysis of the Geographical Distribution of Publications on Digital Leadership

In this section, you will find information on where studies related to digital leadership are published. In Figure 4, the top ten countries are shown, together with the number of papers and the total number of citations on this topic. An additional dataset is also provided, showing the continents and the number of countries in each that have published on this topic. Finally, the number of countries with papers and the number of countries without papers are presented.

![Geographical distribution of publications](source)

**Figure 4. Geographical distribution of publications.**

During the examination of the first group, it is noted that the United States is at the top of the list, with 140 papers and a total of 349 citations [16,60,68,72]. Germany is in second place, with 59 papers and 217 citations [14,73–75], while China ranks third, with 53 papers and 162 citations [23,48,76,77]. Other countries such as the United Kingdom [41,73,78], Indonesia [13,65], and Malaysia [42,61] also have a considerable number of papers in this field, with 49, 46, and 44, respectively. The other countries in the list have fewer papers and citations. Studying these data reveals some interesting trends about where the most digital leadership research is published. The United States clearly stands out as the leader in terms of number of papers and citations, indicating a strong interest in and focus on this topic in the country. Germany and China also have a notable presence in digital leadership research.

When analyzing the data from the second group, Europe has the largest number of countries that have studied the topic of digital leadership, with a total of 32 countries. Asia follows closely behind with 26 countries, while Africa and the Americas have 9 countries each. As for Oceania, it is the continent with the fewest countries that have studied this topic, with only two. Europe and Asia are the leaders when it comes to countries that have addressed this problem, and this may be because these continents incorporate developed and technologically advanced economies, such as Germany in Europe and China in Asia. However, it is worth mentioning that the countries of the Americas and Africa have also made important contributions, although to a lesser extent.

After analyzing the third dataset, it is discovered that out of a total of 195 countries [79], there are 78 countries that have addressed the topic of digital leadership in their documents, while another 117 countries have not produced any publications on the subject. The lack of papers on digital leadership in these 117 countries highlights the need to encourage research and dissemination in these regions. It would be beneficial for these countries to...
share their perspectives and experiences in the field of digital leadership, which could promote knowledge sharing and best practices globally.

In general terms, this analysis emphasizes the relevance of digital leadership as a global research topic and underscores the importance of broadening geographic diversity in the generation of knowledge in this area.

3.5. Analysis of the Most Cited Documents on Digital Leadership: Current Issues and Trends

By examining Table 4 of the top ten most cited papers worldwide on digital leadership, several important trends and themes in the current research in this area can be identified.

Table 4. Most cited documents.

<table>
<thead>
<tr>
<th>Most Global Cited Documents</th>
<th>Authors of the Document</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>“E-Leadership and Teleworking in Times of COVID-19 and Beyond: What We Know and Where Do We Go”</td>
<td>Contreras et al., 2020 [51]</td>
<td>130</td>
</tr>
<tr>
<td>“Examining Teachers’ Perspectives on School Principals’ Digital Leadership Roles and Technology Capabilities during the COVID-19 Pandemic”</td>
<td>Karakose et al., 2021 [19]</td>
<td>76</td>
</tr>
<tr>
<td>“Operationalizing the definition of e-leadership: identifying the elements of e-leadership”</td>
<td>Van Wart et al., 2019 [16]</td>
<td>71</td>
</tr>
<tr>
<td>“Strategic action fields of digital transformation: An exploration of the strategic action fields of Swiss SMEs and large enterprises”</td>
<td>Peter et al., 2020 [17]</td>
<td>70</td>
</tr>
<tr>
<td>“Impact of Fear of COVID-19 Pandemic on the Mental Health of Nurses in Pakistan”</td>
<td>Khattak et al., 2021 [20]</td>
<td>69</td>
</tr>
<tr>
<td>“Investigating the mediating role of information sharing strategy on agile supply chain”</td>
<td>Alzoubi and Yanamandra, 2020 [18]</td>
<td>69</td>
</tr>
<tr>
<td>“How digital leadership isn’t different”</td>
<td>Kane et al., 2019 [72]</td>
<td>60</td>
</tr>
<tr>
<td>“Digital Leadership Skills and Associations with Psychological Well-Being”</td>
<td>Zeike et al., 2019 [73]</td>
<td>57</td>
</tr>
<tr>
<td>“Defining E-leadership as Competence in ICT-Mediated Communications: An Exploratory Assessment”</td>
<td>Roman et al., 2019 [68]</td>
<td>51</td>
</tr>
</tbody>
</table>

First, it is evident that the most popular papers focus on the role of digital leadership in different situations, such as the digital environment, telecommuting during the COVID-19 pandemic, and digital leadership in education. This shows a strong interest in understanding how digital leadership impacts and relates to various areas and circumstances.

A highly cited article is “The Role of Leadership in a Digitized World: A Review” by Cortellazzo et al. (2019) [15], which has received 180 citations in total. This article comprehensively addresses the topic of leadership in the context of digitization, which shows its importance and contribution to the general knowledge on the topic.

In addition, there are other papers that have received many mentions, such as the article entitled “E-leadership and telework in times of COVID-19 and beyond: what we know and where we are going”, written by Contreras et al. (2020) [51], which has been cited 130 times. Another relevant paper is “Analysis of teachers’ perspectives on school principals’ digital leadership roles and technological capabilities during the COVID-19 pandemic,” authored by Karakose et al. (2021) [19], with 76 citations. These papers reflect the growing interest in digital leadership during the COVID-19 pandemic, and how it has impacted remote work and leadership roles in different areas, such as education.

On the other hand, there are documents that explore the concept of “e-leadership”, including its definition and elements. These include “Operationalizing the definition of e-leadership: identifying the elements of e-leadership” by Van Wart et al. (2019) [16] and “Defining E-leadership as Competence in ICT-Mediated Communications: An Exploratory
Assessment” by Roman et al. (2019) [68]. The papers demonstrate an interest in comprehending and defining digital leadership within the realm of ICT-mediated communications.

It should be noted that there are some articles on the list that are not highly cited, such as “How Digital Leadership Is (or Isn’t) Different” written by Kane et al. (2019) [72] and “Digital leadership skills and their relationship to psychological well-being” by Zeike et al. (2019) [73]. The mentioned manuscripts also touch upon the connection between digital leadership skills and psychological well-being. Even though they have not received as much attention as other documents on the list, they still offer valuable insights into the psychological aspects of digital leadership.

It can be said that digital leadership is a topic that has been widely studied and that has aroused interest in the academic world. The most popular studies highlight the importance of this field in different situations, especially during the COVID-19 pandemic. In addition, the definition and study of e-leadership are also relevant topics in current research.

This analysis highlights the importance of researching and understanding digital leadership in an increasingly digitized world. The results of these papers may be useful for practitioners and leaders who wish to improve their skills and knowledge in the field of digital leadership, as well as for academics interested in contributing to this ever-developing area of study.

3.6. Analysis of Industrial Sectors Linked to Digital Leadership

To identify the industrial sectors linked to the variable under study, the bibliometric method called “co-word analysis” was applied. The criteria applied to the VOSviewer software were the type of analysis (co-occurrence), unit of analysis (Author’s Keywords), counting method (full counting), minimum number of occurrences of a keyword ($n = 5$), and number of keywords to be selected ($n = 47$); the result is the generation of Figure 5.

Figure 5. Keywords related to digital leadership.

The data generated by VOSviewer is shown in Table 5. In this, different industry sectors can be identified that are related to specific aspects of digital leadership. These sectors are grouped into nine clusters based on the related keywords.

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Keywords</th>
<th>Related Industry Sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>leadership, technology, communication, education</td>
<td>Education, Technology</td>
</tr>
<tr>
<td>2</td>
<td>innovation, digitalization, Industry 4.0, information technology</td>
<td>Information Technology</td>
</tr>
</tbody>
</table>
Cluster 1 is characterized by keywords such as leadership, technology, communication, and education. This indicates that the industry sectors associated with this cluster are education and technology, where digital leadership plays a fundamental role in the implementation of technology in the educational field [4,80,81].

Cluster 2 stands out for its focus on concepts such as innovation, digitalization, Industry 4.0, and information technology. The related industrial sectors are those undergoing digital transformation, such as the information technology industry. In this sector, the adoption of digital technologies and the constant search for innovation are key aspects [82–84].

Cluster 3 focuses on key concepts such as digital leadership, digital transformation, adaptive skills, and attention to market needs. These ideas tell us that several industry sectors are going through a process of digital transformation, seeking to develop skills that allow them to adapt to change and to respond to market demands [65,67,85,86].

Cluster 4 covers topics such as digital leadership, higher education, change management, and information and communication technologies (ICT). The main related sectors are higher education and technology, where the focus is on how to lead the implementation of technological change and manage change in educational environments [10,45,87,88].

Cluster 5 is related to concepts such as technological leadership, digital technology, sustainability, and teachers. This indicates that the sectors involved are education and technology, with an emphasis on digital leadership to promote the use of digital technologies and to foster sustainability in education [82,89–91].

Cluster 6 presents important topics such as leadership in virtual environments, working in virtual teams, the use of artificial intelligence, and the development of emotional intelligence [92]. This cluster of keywords applies to sectors that make use of advanced technology, such as artificial intelligence, and that rely on virtual teams. In this context, digital leadership focuses on the effective management of these teams and the development of emotional skills within a virtual environment [11,83,93].

Cluster 7 focuses on prominent issues such as COVID-19, online leadership, and social media. It involves different sectors that have been affected by the COVID-19 pandemic and that have had to adapt to online leadership and use social media as a means of communication and association [80,94,95].

Cluster 8 highlights important terms such as “performance” and “service leadership”. There are a variety of related sectors that focus on performance and leadership in general. In this context, digital leadership can play a key role in improving performance and adopting service-focused leadership approaches [38,61,96].

Cluster 9 stands out for its focus on “digital innovation”. It comprises different industrial sectors that consider digital innovation as a crucial element in their business and leadership strategy [76,93].
In summary, analyzing the data reveals that several industry sectors are closely related to digital leadership. These sectors include education, technology, and digital transformation in various industries. By discussing this analysis, one can focus on the growing importance of digital leadership in the era of digitization [52]. In this era, leaders need to adapt to technological changes, develop new skills and capabilities, and lead digital transformation in their respective sectors. In addition, the analysis highlights the relevance of virtual leadership, change management, and the adoption of digital technologies in response to challenges such as the COVID-19 pandemic. These findings can help organizations better understand the industry sectors related to digital leadership and design effective leadership strategies in an ever-changing business environment.

3.7. Analysis of Methodological Approaches in Digital Leadership Research

Using VOSviewer, Keywords Plus and Author Keywords results were analyzed to identify the terms related to the methodology and methods applied in the documents selected for this study, of which 25 were identified (Figure 6).

![VOSviewer](image)

**Figure 6.** Terms related to types of methodology/method.

A search for these terms was then conducted within the abstracts of the 617 papers. Table 6 provides information on the diverse types of methodologies and methods used in studies on digital leadership, along with the number of papers that employed each approach and the authors associated with each methodology or method.

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of Methodology/Method</th>
<th>No. Docs</th>
<th>Authors of Linked Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>questionnaire</td>
<td>90</td>
<td>Wolor et al. (2020) [97]; Borah et al. (2022) [98]</td>
</tr>
<tr>
<td>2</td>
<td>interview</td>
<td>86</td>
<td>Pathak et al. (2020) [99]; Nordbäck and Espinosa (2019) [100]</td>
</tr>
<tr>
<td>3</td>
<td>systematic review</td>
<td>59</td>
<td>Cortellazzo (2019) [15]; Dexter and Richardson (2020) [60]</td>
</tr>
<tr>
<td>4</td>
<td>literature review</td>
<td>58</td>
<td>Contreras et al. (2020) [51]; Chamakiotis et al. (2021) [101]</td>
</tr>
<tr>
<td>5</td>
<td>data analysis</td>
<td>45</td>
<td>Sunarsi et al. (2020) [61]</td>
</tr>
<tr>
<td>6</td>
<td>dynamic capabilities</td>
<td>37</td>
<td>Tuzovic et al. (2018) [102]</td>
</tr>
<tr>
<td>7</td>
<td>content analysis</td>
<td>31</td>
<td>Karakose et al. (2021) [19]</td>
</tr>
<tr>
<td>8</td>
<td>curriculum</td>
<td>29</td>
<td>Thannimalai and Raman (2018) [103]</td>
</tr>
</tbody>
</table>
Table 6. Cont.

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of Methodology/Method</th>
<th>No. Docs</th>
<th>Authors of Linked Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>factor analysis</td>
<td>23</td>
<td>Navaridas-Nalda et al. (2020) [104]</td>
</tr>
<tr>
<td>10</td>
<td>thematic analysis</td>
<td>23</td>
<td>Maduka et al. (2018) [105]</td>
</tr>
<tr>
<td>11</td>
<td>regression analysis</td>
<td>20</td>
<td>Zeike et al. (2019) [73]</td>
</tr>
<tr>
<td>12</td>
<td>confirmatory factor analysis</td>
<td>17</td>
<td>Magesa et al. (2022) [106]</td>
</tr>
<tr>
<td>13</td>
<td>machine learning</td>
<td>17</td>
<td>Fischer et al. (2021) [83]</td>
</tr>
<tr>
<td>14</td>
<td>controlled study</td>
<td>10</td>
<td>Shann et al. (2019) [107]</td>
</tr>
<tr>
<td>15</td>
<td>major clinical study</td>
<td>10</td>
<td>Bard et al. (2022) [108]</td>
</tr>
<tr>
<td>16</td>
<td>qualitative research</td>
<td>10</td>
<td>Krehl and Büttgen (2022) [109]</td>
</tr>
<tr>
<td>17</td>
<td>bibliometric</td>
<td>9</td>
<td>Tigre et al. (2023) [5]</td>
</tr>
<tr>
<td>18</td>
<td>quantitative analysis</td>
<td>9</td>
<td>Fahmi et al. (2020) [110]</td>
</tr>
<tr>
<td>19</td>
<td>theoretical framework</td>
<td>9</td>
<td>Gazit (2021) [111]</td>
</tr>
<tr>
<td>20</td>
<td>case studies</td>
<td>5</td>
<td>Weritz et al. (2020) [112]</td>
</tr>
<tr>
<td>21</td>
<td>conceptual framework</td>
<td>5</td>
<td>Al-Mahrezi et al. (2021) [113]</td>
</tr>
<tr>
<td>22</td>
<td>cross-sectional study</td>
<td>5</td>
<td>Zraychikova et al. (2023) [114]</td>
</tr>
<tr>
<td>23</td>
<td>cohort analysis</td>
<td>4</td>
<td>Fennelly et al. (2021) [78]</td>
</tr>
<tr>
<td>24</td>
<td>group process</td>
<td>3</td>
<td>Efimov et al. (2020) [115]</td>
</tr>
<tr>
<td>25</td>
<td>theoretical study</td>
<td>3</td>
<td>Li et al. (2023) [116]</td>
</tr>
</tbody>
</table>

The following will analyze the data and discuss some relevant observations, including studies by the authors mentioned in the table:

1. Questionnaire: In the study, data was collected on digital leadership and its impact on employee performance. The researchers used questionnaires in a total of 90 papers to obtain this information. Two of these questionnaires were developed by Wolor et al. (2020) [97] and Borah et al. (2022) [98], who emphasized the relevance of digital leadership and work–life balance during the COVID-19 pandemic.

2. Interview: In 86 different papers, interviews were conducted to investigate digital leadership. For example, Pathak et al. (2020) [99] and Nordbäck and Espinosa (2019) [100] examined how digital leadership and innovation skills affect the long-term success of small and medium-sized enterprises.

3. Systematic review: A total of 59 papers were examined in detail to understand how leadership impacts a digitized world. Two of these systematic reviews were conducted by Cortellazzo in 2019 and by Dexter and Richardson in 2020 [15,60]. These studies provide an overview of how technology integrates and relates to leadership.

4. Literature review: A total of 58 papers addressing digital leadership and telework during and after the COVID-19 pandemic were found using the literature review method. Two of these papers were by Contreras et al. (2020) [51] and Chamakiotis et al. (2021) [101], which discuss digital leadership in virtual teams reconfigured due to the pandemic.

5. Data analysis: Data analysis was conducted on 45 papers to investigate the relationship between digital leadership, organizational commitment, and service quality in schools. The researchers, including Sunarsi [61], conducted this research in the Indonesian school context during 2020.

6. Dynamic capabilities: A total of 37 papers were found that employed the concept of “dynamic capabilities”, which is used to analyze how innovative individuals or firms remain innovative over time. A detailed study on this topic was conducted by Tuzovic et al. in 2018 [102].
(7) Content analysis: In 31 papers, teachers’ opinions about principals’ digital leadership and technology skills during the COVID-19 pandemic were examined. In addition, Karakose et al. (2021) [19] conducted a detailed analysis on this topic.

(8) Curriculum design: A total of 29 papers employed curriculum design to study how principals’ technology leadership and professional development affect teachers’ technology integration in secondary schools. Thannimalai and Raman (2018) [103] focused on this topic comprehensively.

(9) Factor analysis: Factor analyses were conducted on 23 papers to study how school leadership influences the digital transformation of schools. An example of this is the study conducted by Navaridas-Nalda and colleagues in 2020 [104].

(10) Thematic analysis: This was employed within 23 papers to analyze the skills required to successfully lead virtual teams in creating successful organizations. For example, Maduka et al. (2018) investigated this issue [105].

(11) Regression analysis: Regression analysis studies were conducted on 20 papers with the aim of investigating digital leadership skills and their connection to psychological well-being. In 2019, Zeike and his team conducted extensive research on this topic [73].

(12) Confirmatory factor analysis: This method was used in 17 papers to better understand the characteristics of digital leadership and how they contribute to successful digital transformation. One of these papers, developed by Magesa et al. in 2022 [106], focused specifically on the conceptualization of this digital leadership in Tanzania.

(13) Machine learning: This was employed in 17 papers to address climate change and other issues using artificial intelligence. Fischer and his team (2021) [83] conducted extensive research on this topic.

(14) Controlled study: Controlled studies were conducted in 10 papers to evaluate how an online leadership intervention can help improve mental health and reduce the stigma associated with depression in organizations. The work of Shann et al. (2019) [107] focuses on this topic in detail.

(15) Major clinical study: This was employed in 10 papers to analyze the nurse empowerment program that focuses on those in direct-care positions. Bard and colleagues conducted this detailed analysis in their study published in 2022 [108].

(16) Qualitative research: Ten papers have used qualitative research to explore the complexity of remote leadership and the use of digital tools during the COVID-19 pandemic. In particular, Krehl and Büttgen (2022) [109] focused extensively on this topic.

(17) Bibliometric: Nine papers were used to perform a bibliometric analysis on digital leadership. In 2023, Tigre and his team conduct a detailed review using this method [5].

(18) Quantitative analysis: this analysis was conducted on nine papers to study how different leadership styles (servant, digital, and green) affect market performance. The study was conducted in 2020 by Fahmi and his team [110], focusing on the pharmaceutical industry in Indonesia.

(19) Theoretical framework: This was used in nine papers, especially to investigate the main reasons that drive people to lead communities on Facebook, using a uses and gratifications approach. Gazit (2021) [111] has investigated this topic thoroughly.

(20) Case study: Five papers investigated how companies have experienced digital transformation through case studies. One of them, conducted in 2020 by Weritz and his team [112], dives into this topic at length.

(21) Conceptual framework: In five papers, a conceptual approach was used to study digital government competency by public sector managers. Al-Mahrezi and his team conducted a thorough analysis on this topic in their study conducted in Oman in 2021 [113].

(22) Cross-sectional study: Five different studies were conducted to explore how leadership, patient–nurse relationships, and work–life balance affect nurses working in psychiatric settings. One of these studies was conducted by Zraychikova and her team in Switzerland in 2023 [114]. In that study, they delved into this specific issue.
(23) Cohort analysis: This was used in four papers to examine how standard terms are used in clinical practice. The topic has been studied in detail by Fennelly and colleagues in a study conducted in 2021 [78].

(24) Group process: This was used in three papers to conduct a qualitative analysis of self-health-oriented leadership in virtual teams. The topic was thoroughly researched by Efimov and his team in 2020 [115].

(25) Theoretical study: This was used in three papers to examine the antecedent configurations and performance of smart-manufacturing enterprise business models. Li et al. has studied this topic in 2023 [116].

Overall, the analysis reveals that a variety of research approaches and methods have been employed to study digital leadership and its various aspects. Among the most prevalent methods are questionnaires and interviews, followed closely by systematic and literature reviews. These strategies have enabled researchers to gain a comprehensive and detailed understanding of digital leadership and how it affects different areas.

Each study mentioned above provides a unique and valuable perspective on digital leadership, showing how broad and complex this topic is. The combination of quantitative and qualitative approaches, along with the use of bibliometric analysis, shows the diversity and richness of research in this field.

It is essential to keep in mind that researchers choose their research method based on what they want to study and the questions they want to answer. Each method has its advantages and disadvantages, and the appropriate approach may vary depending on the context and nature of the study. When analyzing the results of these studies, it is important to understand how each method was selected and applied to obtain a complete picture of digital leadership and how it affects different fields and situations.

3.8. Future Perspectives of Digital Leadership

To obtain topics for future research, the bibliometric method called “co-keyword analysis” was applied to develop a future research agenda. The criteria applied in the VOSviewer software were the type of analysis (co-occurrence), unit of analysis (Author keywords), counting method (complete count), minimum number of occurrences of a keyword ($n = 1$), and number of keywords to be selected ($n = 1000$). Words with a co-occurrence $\geq 2$ were excluded. The total number of selected items was 6. The result is a network of topics associated with digital leadership that will serve as a guide for future studies (Figure 7).

![Figure 7. Items for future research.](image_url)
Table 7 shows the ten topics with the number of “occurrences” and the respective “total link strength”.

### Table 7. Topics for future research.

<table>
<thead>
<tr>
<th>No.</th>
<th>Keyword</th>
<th>Occurrences</th>
<th>Total Link Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>blockchain technology</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>climate change</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>digital skills</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Industry 4.0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>municipal administration</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>virtual skills</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Each line of research will be briefly analyzed below, and the studies that support them will be cited:

1. **Blockchain technology**: This area of study focuses on the role of blockchain technology in digital leadership. Studies by Niu and colleagues in 2022 [117] as well as by Wang and Yang in the same year [49] have provided evidence on how digital leadership and ESG (Environmental, Social, and Governance) management affect the innovation and sustainability of organizations. In addition, Wang and Yang’s study empirically analyzed the supply chain flexibility by using blockchain technology.

2. **Climate change**: The central theme of this research focuses on how digital leadership can contribute to environmental care and address climate change. Recent studies, such as those conducted by Sarfraz and his team in 2022 [23] and by Fischer et al. in 2021 [83], analyze the positive impact that digital leadership can have on the sustainable performance of manufacturing companies, as well as the role of artificial intelligence in the fight against climate change.

3. **Digital skills**: In this subject, the growth and change of digital leadership in relation to digital skills was investigated. A study by Karakose et al. (2022) [54] analyzed this evolution through bibliometric mapping. Similarly, Jewitt (2020) [35] explored a digital learning strategy to connect students with personalized technology solutions.

4. **Industry 4.0**: This line of research focuses on digital leadership in the context of Industry 4.0. Studies by Jagadisen and colleagues in 2022 [118], along with work by Harbani and his team in 2021 [119], analyzed digital leadership and organizational capabilities in the manufacturing industry. These studies underscore the importance of these issues in the era of Industrial Revolution 4.0.

5. **Municipal administration**: Municipal administration is the focus of this research, which seeks to assess digital leadership in this specific context. A study by Claassen and his team in 2021 [120] focuses on this issue, offering valuable insight on how to measure and understand digital leadership in this area.

6. **Virtual skills**: This area of study focuses on digital leadership and the skills needed to excel in virtual environments. Carranza and his team (2022) [121] conducted a thorough review of empirical research on digital leadership in virtual environments, which allowed them to obtain an overview of existing studies in this area.

These lines of research explore digital leadership in different contexts and its connection to various areas of study. The studies support these lines of research and provide a solid foundation for future research in this field. Advances made in these areas could have an important impact on how organizations and society face current and future challenges related to technology and digitization.

Figure 8, which summarizes the results, is presented below to more clearly communicate the findings discovered in this review in response to the eight research questions.
4. Conclusions

In this study, scientific publications on the topic of digital leadership in different organizational contexts were analyzed. The objective was to understand its evolution and relevance over time. To achieve this, the h-index and total citations from academic sources were considered as indicators of their impact. The identification of prominent authors in this field was also carried out and the geographical distribution of publications was examined to detect trends in different countries and continents. In addition, analyses of research based on globally cited papers were carried out to identify relevant topics. In addition, the relationship between digital leadership and different industry sectors was explored, and the methodological approaches used in the research were examined. The results of the study provided suggestions for lines of future research. To conduct this analysis, Scopus was used as a search tool.

Next, answers to the research questions will be provided. During the period 2018-July/2023, digital leadership underwent significant changes, moving away from information systems to focus on aspects such as digital transformation, online education, and adaptation to crisis situations such as the COVID-19 pandemic. In this field, the journals Frontiers in Psychology and Sustainability (Switzerland) have proven to be influential, featuring prominent authors such as J.W. Richardson, C. Liu, and M. Van Wart. The main powers in terms of research and publications on digital leadership are the United States, Germany, and China, with prominent activity in Europe and Asia. Popular topics include the role of digital leadership in the digital environment, remote work during pandemics, “e-leadership”, and digital skills related to information and communication technologies, as well as psychological well-being. Digital leadership is relevant in various sectors, such as education, technology, IT, and those undergoing digital transformation. The predominant methodological approaches in digital leadership research are questionnaires and interviews, combining both quantitative and qualitative methods. For future research, it is suggested to explore areas such as blockchain technology, climate change, digital skills, Industry 4.0, municipal management, and virtual skills.

4.1. Interpretation of the Results in Relation to the Objectives Proposed: Contributions to Knowledge

This bibliometric study has yielded interesting results on digital leadership, showing its evolution over time and in different contexts. It has been found that academic sources and relevant authors have had a considerable influence in this field. It has also been observed how research on this topic is distributed geographically. By analyzing the most-cited papers, themes and trends that reveal the areas of greatest interest in digital leadership...
have been highlighted, providing valuable insights. In addition, it has explored how digital leadership is applied in various industrial fields, which has provided a clearer understanding of its scope. It is relevant to mention that the study has revealed a diversity of methodological approaches used in digital leadership research, which has provided a comprehensive overview of the research conducted to date. These findings show that there are diverse ways of approaching this topic, which enrich the overall picture of the field.

4.2. Theoretical and Practical Implications

In terms of theoretical implications, it has been highlighted that digital leadership is always changing and adapting to the needs of the business world. In addition, the importance of geographic location and the influence of academic experts in this field has been highlighted. Key themes have also been found that can be inspiring for future research.

The study has several practical implications. On the one hand, it offers valuable guidance for researchers interested in digital leadership, pointing to areas for future research. On the other hand, it provides useful information for leaders and practitioners who wish to understand the importance of digital leadership in different sectors and contexts. This can help them to develop digital transformation strategies in their organizations. In addition, the study highlights issues relevant to the development of leadership skills in the digital environment and emphasizes the importance of digital leadership in education and in the management of educational institutions. It also highlights the need for international collaboration in digital leadership research and practice. These findings can contribute to a greater understanding of how to address the challenges posed by the digital environment in the field of leadership.

4.3. Limitations and Future Lines of Research

Despite the results obtained, it is essential to recognize the limitations of this study. The research was based on papers selected from the Scopus database, which may have left out relevant papers from other sources. There may also be a geographical bias, as it focused on more readily available data from certain regions. In addition, although specific search criteria were used, it is possible that some papers were not identified due to the different terminologies used in the field of digital leadership.

To advance the field of digital leadership, it is important to conduct more research that addresses various areas. For example, one can analyze how blockchain technology affects leadership, explore the connection between digital leadership and climate change, and consider how to develop digital skills in leaders. In addition, it is advisable to explore new methodological approaches to better understand this type of leadership in different situations. Comparing studies across regions and industry sectors could also provide valuable insights into how cultural and contextual differences influence digital leadership. These suggestions will contribute toward enriching the knowledge and practical application of digital leadership in the current era of digital transformation.

Author Contributions: Conceptualization, L.E.-R. and J.G.N.S.; methodology, J.P.G.; software, D.R.P.; validation, L.E.-R., J.G.N.S. and J.P.G.; formal analysis, J.R.C.; investigation, L.E.-R.; resources, J.R.C.; data curation, D.R.P.; writing—original draft preparation, L.E.-R.; writing—review and editing, J.G.N.S.; visualization, J.P.G. and G.R.-C.; supervision, D.R.P. and G.R.-C.; project administration, J.R.C.; funding acquisition, L.E.-R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: This study has a bibliometric approach and the data used was generated from the Scopus database.

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