

Mapping the Digital Leadership Research Landscape on Industri 4.0: A Bibliometric Analysis

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ABSTRACT

Digital leadership encompasses a range of skills, actions, and practices that encourage and inspire employees during the process of digital transformation. Digital leadership focuses on innovation and corporate goals in the Industry 4.0 era. Therefore, this study aims to identify research trends on digital leadership in the Industry 4.0 era globally. This research uses a qualitative approach. All data collection and screening procedures in the Scopus database provided the foundation for this research. A total of 92 eligible published articles from 2019 to 2023 were explored and the scientific landscape was further visualised using Scopus and VOSviewer features. The study's results indicate that 2023 will see the highest volume of publications on digital leadership. The United Kingdom and the United States were recognized as the leading contributors to this body of research. The results also show evidence that the network visualisation consists of 7 clusters. The next research topics on digital leadership that provide great opportunities to be studied more deeply in the era of the industrial revolution 4.0 are e-learning, performance, artificial intelligence, digital manufacturing, digital innovation, digital capabilities, digital storage and sustainability.

INTRODUCTION

The fourth industrial revolution is driven by new digital technologies and integrated into organizational operations (Brixner et al., 2020). These changes do not only focus on the relationship with technology, but also impact human-related aspects (Erol et al., 2016). Due to these changes, it has become important to consider which values, traits, and characteristics leaders should embody or encourage in the workplace during the fourth industrial revolution (Cresnar & Nedelko, 2020). Digital transformation has altered the essence and effectiveness of leadership, necessitating that leaders adopt new leadership styles. In the industrial revolution 4.0 era, leadership emphasizes crafting digital transformation strategies that align with business and organizational development objectives. This involves demonstrating digital leadership traits such as emotional and social intelligence (including empathy and relationship management), cognitive readiness, critical thinking, inventive thinking, agility, and resilience (Haleem et al., 2024). Digital leadership is a fairly recent concept in leadership (Torre & Sarti, 2020). It is defined as a collection of skills, actions, and practices that encourage and energize employees within the framework of digital transformation (Braojos et al., 2020).

A number of studies have been conducted on digital leadership and its impact on organisations. Research conducted by Widyaputri & Sary (2022) found that digital leadership and organisational communication positively and significantly affect the performance of millennial employees. In several surveys across 75 Internet of Things (IoT) companies in Indonesia, digital leadership and customer orientation have been identified as factors that significantly influence business model innovation and company performance (Yopan et al., 2022). Furthermore, Suryadi et al. (2023) found notable differences in the implementation of digital leadership within the education sector. The academic community at public universities in Malang City strongly believes that their leaders must provide the necessary information systems to achieve digital leadership and attain world-class university status. But on the contrary, according to the results of Gunawan et al.'s research (2023), digital leadership does not have a significant impact on performance factors, but has a great impact on organisational commitment. Maharani (2024) in her study found that the application of digital technology at PT Semen Indonesia (Persero) Tbk, caused some employees' performance to decrease because some employees lacked mastery of technological advances. Some employees also lack accuracy when inputting data and errors in a system, causing a decrease in performance in the company. Given this trend, the author aims to explore the trajectory of digital leadership research from 2019 to 2023. This article provides a comprehensive review of the digital leadership concept, offering insights into the current landscape of research in this area. This study seeks to outline the global landscape of digital leadership development using Scopus data. The research utilizes VOSviewer software for data analysis, focusing on assessing the impact of individual researchers, research groups, countries, and journals. This analysis is crucial for gaining insights into the journal's scope and influence.

LITERATURE REVIEW

According to Rudito & Sinaga, (2017) stated that digital leadership is a combination of digital competence and corporate digital culture in utilising opportunities to encourage the achievement of digital transformation. Digital leadership focuses on innovation and company goals in the current era of digital change, with a fast approach and good collaboration between teams and oriented towards work innovation will make digital leadership a new tool in business continuity (Oberer & Erkollar, 2018). Digital leadership is defined by Engesmo & Panteli (2021) As a new paradigm with a distinct leadership approach characterized by remarkable agility, digital leadership entails the style, skills, and competencies needed to realize a digitally empowered business model (Philip et al., 2023). In today's volatile business landscape, digital leaders are tasked with articulating a vision and fostering the conditions necessary to attain digital maturity (Kane et al., 2019).

Somerville (2013) asserts that the characteristics needed as a digital leader are critical thinking looking at sustainability, adaptability to the emergence of new technologies, and can strengthen the company's resilience system. Digital leadership involves more than simply integrating email, websites, and social media into daily operations; it primarily focuses on leveraging digital technology (Zeike et al., 2019). Digital leadership can be measured through several indicators, namely visionary leadership, digital capabilities, digital culture, communication and collaboration, and role modelling (Sapta et al., 2023). In summary, digital leadership plays a crucial role in driving organizational change and enhancing resilience amidst digital transformation in the era of the Fourth Industrial Revolution. It combines leadership styles with digital capabilities to maximize the advantages of digital technology, fostering a digital mindset that inspires and supports employees in achieving corporate objectives.

METHODOLOGY

This study employs a qualitative research methodology utilizing a bibliometric technique approach. Bibliometric analysis involves extracting significant insights from scientific literature contributed annually by researchers worldwide (Martinho, 2021). It visually maps research trends, identifies emerging patterns, and tracks the evolution of specific themes (Sanga & Aziakpono, 2023). This research focuses Through a literature review conducted using the Scopus database, which is renowned for its comprehensive coverage of scientific and academic journals, valuable scholarly information was obtained (Kulsum et al., 2022). International journals were extracted from the Scopus database using a search engine. The data for this study comprises articles published between 2019 and 2023, representing the last five years, sourced from journals indexed in the Scopus database.

The data retrieved from Scopus in this study came from 92 documents downloaded with the keywords TITLE-ABS -KEY (digital AND leadership) AND PUBYEAR > 2018 AND PUBYEAR < 2024 AND (LIMIT-TO (SUBJAREA, "BUSI")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT TO (PUBSTAGE,

"final")) AND (LIMITTO (EXACTKEYWORD, "Leadership")) AND (LIMIT-TO (LANGUAGE, "English")). Documents in the form of articles from Scopus are analysed using the features in Scopus and save the article file into RIS form which is then analysed using VOSviwer. VOSviwer is used to visualise and analyse trends in the form of a map based on a co-citation network or create an occurrence network of keywords (Nurmandi et al., 2021). Figure 1 shows the steps taken to collect and analyse the data collected from the Scopus database.

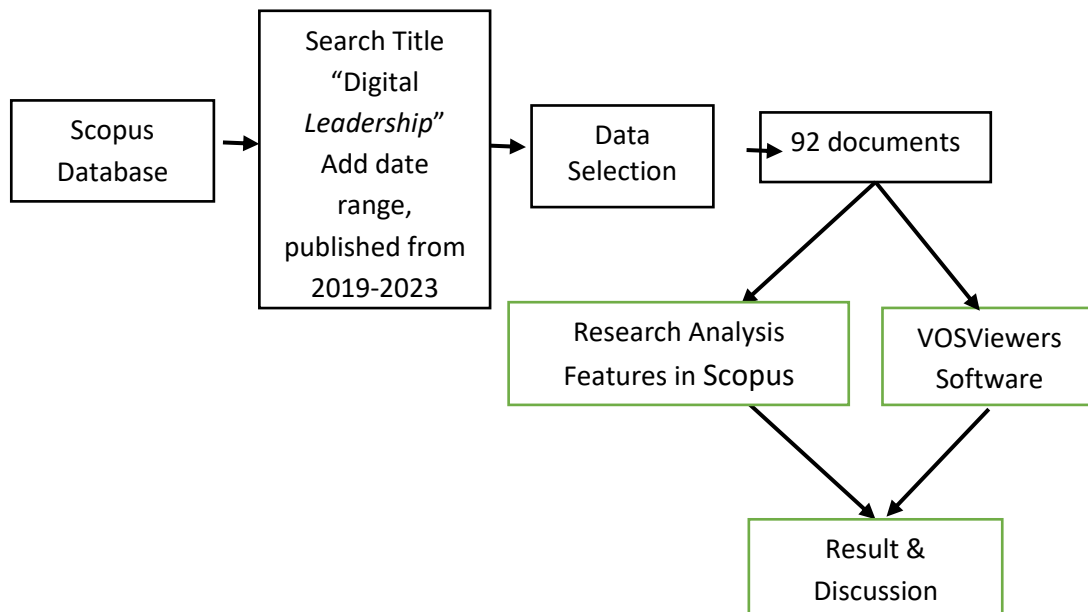


Figure 1. Flowchart of PRISMA used to identify, screen, and input journals for bibliometric techniques (Figure Source: Processed by Authors 2024).

RESEARCH RESULT

Results	Discussions	Findings
<ul style="list-style-type: none"> • This research utilizes the Scopus database to collect data from 2019 to 2023. • Researchers filter publications by digital leadership, including year, annual document count based on the search criteria, documents by country, subject area, document type, keywords, and language. • The research sample comprises 92 documents 	<ul style="list-style-type: none"> • The results of this co-word analysis using keywords serve as a basis for mapping the co-occurrence of significant terms found in specific articles. • Bibliometric analysis involves visualizing data through network, overlay, and density analyses. <p>1. Network visualisation: In this analysis, 7 research clusters were found.</p>	<p>Scopus analysis shows that research in the United Kingdom and United States plays the most role in digital leadership research. The results of Vosviewer analysis using network visualisation, overlay, and density can be concluded that during Digital Leadership research, the development of research publications</p>

<p>• Bibliometric analysis is performed using VOSviewer software, visualizing data through network, overlay, and density analyses.</p>	<p>2. Overlay visualisation: shows the results of keywords published in 2019 and 2020 such as digital innovation, digital capabilities, higher education, information and communication. Keywords published in 2021 such as digital work, digital technology, industry 4.0, information management, and digital information. keywords published in 2022 such as e commerce, sustainability, e-learning, artificial intelligence, digital manufacturing, and digital innovation. In addition, the year 2023 contains the keywords climate change, data protection, decision making, machine learning, art, digital technology, and digitalisation.</p> <p>3. Density visualisation: shows the results that leadership is a variable that is often researched, because the number is marked with bright colours on the variable. While dark colours such as e-learning, performance, artificial intelligence, digital manufacturing, digital innovation, digital capabilities, digital storage and sustainability are rarely researched. This shows that these variables foster opportunities for further research.</p>	<p>fluctuates.</p>
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DISCUSSION

Analysis of Scopus Search Results

In this study, data was gathered using the Scopus search engine. Elsevier's Scopus website offers the largest repository of scientific literature, comprising peer-reviewed abstracts and citations. The database was selected for its extensive coverage of topic-related data. Scopus searches show publication results that have increased from year to year and countries that contribute to research related to digital leadership. This is shown in Figure 2 and Figure 3.

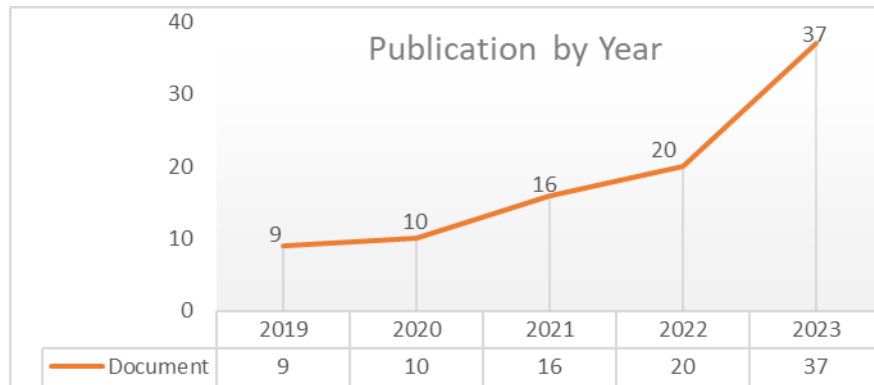


Figure 2. Global trends in publications on digital leadership from 2019-2023.

Figure 2 displays the number of publications from 2019-2023, there are 92 publication documents in the fields of Business, Management, and Accounting studies. The number of publications continues to increase from year to year and experienced a significant increase from 2022 to 2023, there were 37 documents in that year. This shows that the topic of digital leadership is widely studied and in demand by researchers.

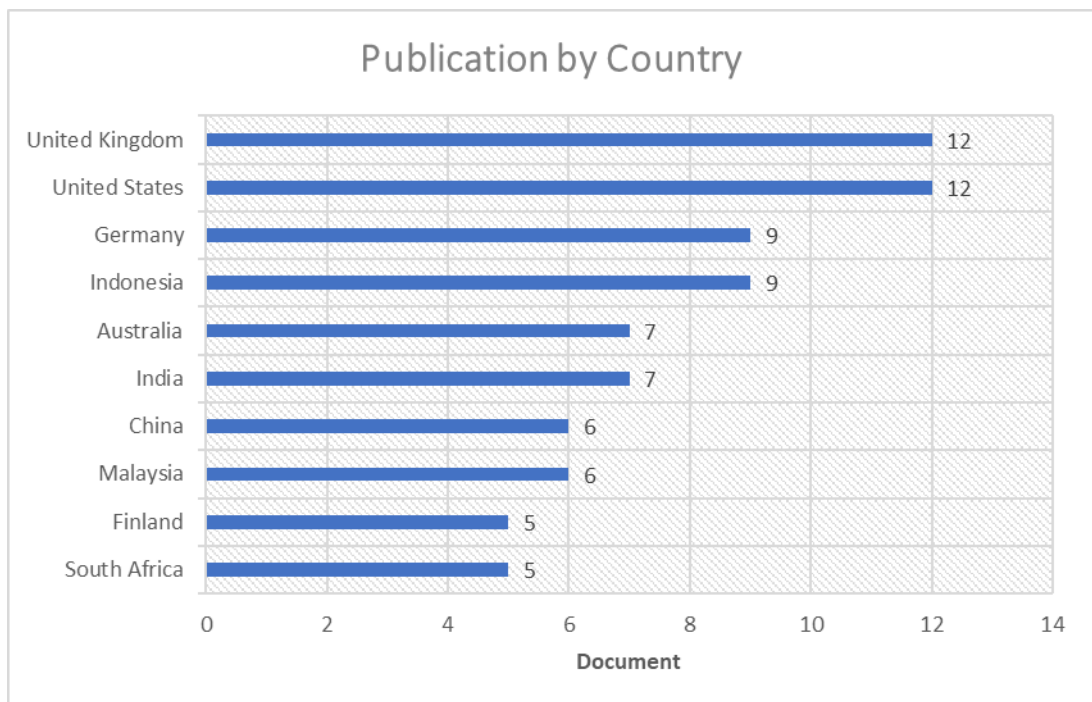


Figure 3. Shows the top 10 countries that contribute the most to digital leadership research publications.

In Figure 5, the overlay visualisation shows the development of research from 2019-2023 can be seen from the colours of the nodes and years. The blue coloured nodes contain keywords published in 2019 and 2020, such as digital innovation, digital capabilities, higher education, information and communication, and metadata. Similarly, dark green nodes such as digital work, digital technology, industry 4.0, information management, and digital information indicate keywords published in 2021. Light green nodes indicate keywords published in 2022, such as e-commerce, sustainability, e-learning, artificial intelligence, digital manufacturing, and digital innovation. In addition, yellow nodes represent keywords published in 2023, such as climate change, data protection, decision making, machine learning, art, digital technology, and digitalisation. This shows that research related to digital leadership continues to grow from year to year.



Figure 6. Density Visualization 2019-2023

Figure 6 Visualisation of the 2019-2023 density shows that leadership is the most frequently researched variable as it is marked in bright colours, followed by digital leadership and industry 4.0. Meanwhile, dark colours such as e-learning, performance, artificial intelligence, digital manufacturing, digital innovation, digital capabilities, digital storage and sustainability are rarely researched. This suggests that these variables present opportunities for further research.

CONCLUSIONS AND RECOMMENDATIONS

In this research, we examine emerging trends in the topic of digital leadership. The study concluded with a descriptive analysis based on Scopus and bibliometric analyses. Bibliometric analysis was employed to track the evolution of digital leadership research using co-occurrence data and keywords. The dataset was collected from Scopus metadata and analyzed using VOSviewer software. The analysis yielded the following results:

1. Bibliometric analysis, utilizing VOSviewer for network, overlay, and density visualizations, produced bibliometric mapping results. It is evident that research publications on digital leadership showed development

and enhancement from 2019 to 2023 over the course of five years. The final mapping depicts the evolution of digital leadership based on keyword co-occurrence, identifying relationships between scientific concepts and dominant clusters.

2. The results of this research provide broad insight into the development and potential for conducting research on the topic of Digital Leadership in the future, especially in the era of industrial revolution 4.0. Topics related to e-learning, performance, artificial intelligence, digital manufacturing, digital innovation, digital capabilities, digital storage and sustainability are still open for further research.
3. Digital leadership encompasses a range of skills, behaviors, and practices aimed at inspiring and motivating employees during digital transformation. It prioritizes innovation and achieving organizational goals within the context of Industry 4.0.

ADVANCED RESEARCH

This research has limitations in terms of the data sources used because it only uses a database from Scopus, Data from other sources, such as Web of Science, was not utilized in this study. Future research developments are encouraged to explore additional data sources, such as Web of Science, to conduct comparative analyses with data obtained from multiple databases. This approach could provide deeper insights and broader perspectives on the topic. In addition, software other than VOSviewer, which has not been used in this research, can be used as an analysis tool in the future.

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