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Accelerating digital transformation through digital leadership: strategies for innovation, sustainability, and organisational performance enhancement

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Abstract
This study aims to explore how digital leadership accelerates the adoption of disruptive technologies, supports green innovation, and integrates digital transformation with hybrid work models to enhance organisational performance and employee well-being. Utilising a systematic literature review (SLR) approach and analysing 59 open-access articles from the Scopus database, this study identifies key trends in digital leadership literature. The findings show that digital leadership has gained increasing attention since 2021, particularly in the areas of business innovation, organisational resilience, and digital transformation. Major academic contributions come from Indonesia, Germany, and Malaysia. The adoption of AI and blockchain strengthens the effectiveness of digital leadership through data-driven decision-making, operational efficiency, and enhanced transparency. Furthermore, digital leadership promotes green innovation and sustainable business strategies while improving productivity and work-life balance through hybrid work models. The implications of these findings suggest that digital leadership is a key element in guiding organisations to adopt disruptive technologies, introduce green innovations, and design flexible work models. Organisations must develop adaptive, innovative, and technology-driven leadership to remain competitive and sustainable in the digital era.

Keywords: artificial intelligence (AI), digital leadership, internet of things (IoT), organisational performance, systematic literature review.

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Introduction

In recent decades, the digital technology transformation has influenced various aspects of human life, particularly in the fields of business and organisations (Aleid & Almisned, 2024; Prakash et al., 2023; Scott, 2024). Digital transformation, characterised by the adoption of technologies such as Artificial Intelligence (AI), blockchain, and the Internet of Things (IoT), has become a key driver of innovation in the modern era (Firouzi et al., 2023; Kumar et al., 2023). Digital transformation has significantly altered work dynamics. The COVID-19 pandemic accelerated the implementation of hybrid work models, which combine remote work and on-site work (Barath & Schmidt, 2022; Kuzior et al., 2022). While this model offers greater flexibility, its success heavily depends on the organisation's ability to integrate digital technology with employee needs (Chandwani & Shaikh, 2021). Organisations are now required not only to adapt new technologies but also to leverage them to remain competitive and relevant in the global market (Loendorf, 2006). This underscores the importance of digital leadership as a strategic role for cultural change, innovation within organisations (Rokhimah et al., 2024; Rifky & Veri, 2024), creating a productive, inclusive, and adaptable work environment in the digital era.

Digital leadership involves not only the ability to utilise technology to improve operational efficiency but also the capacity to drive sustainable innovation (Benitez et al., 2022; Fang, 2023). One key form of innovation is green innovation, which has the capability to integrate environmental sustainability with economic growth. Previous studies have indicated that organisations adopting green innovation gain a competitive edge in an increasingly sustainability-oriented business ecosystem (Fernando et al., 2019; Senadjki et al., 2024).

The rapid adoption of disruptive technologies, such as AI and blockchain, presents both significant opportunities and new challenges for organisations. While these technologies have the potential to enhance operational efficiency, innovation, and transparency, the current literature remains unclear on their role in strengthening digital leadership and driving organisational effectiveness (Scholz, 2024). The dynamic nature of technology implementation across industries further underscores the need for deeper exploration into how these tools can be leveraged strategically (Saeedikiya el al., 2024). Although considerable research has been conducted on digital transformation and digital leadership, significant gaps persist. One key gap is the limited understanding of how digital leadership accelerates the adoption of disruptive technologies and fosters innovation, particularly in both traditional and modern business models. Additionally, the interplay between digital transformation, hybrid work environments, and employee performance remains underexplored.

This study seeks to bridge these gaps by providing new theoretical and practical insights into the strategic role of digital leadership. It will explore how digital leadership can be harnessed to accelerate digital transformation, promote

innovation, and ensure sustainability, ultimately driving improved organisational performance in the modern business landscape.

Literature review

Digital leadership

Digital leadership is instrumental in ensuring the successful integration of digital tools to facilitate the hybrid work environment, creating a balance between technological infrastructure and employee needs. As companies continue to embrace hybrid work, it is crucial for digital leaders to ensure that technology is not just implemented for the sake of automation but is also aligned with the evolving needs of both remote and on-site employees. By fostering a flexible approach to technology, digital leaders create environments where employees can work efficiently regardless of location, ensuring a seamless connection between digital tools, work processes, and employee productivity (Asfahani et al., 2024; Tworek, 2023).

Digital leadership is not only about managing technology but also about considering the social impact of technological implementation, and emphasising the human aspect of digital transformation. Digital leaders must recognise the human side of digital transformation such as the need for empathy, communication, and employee well-being and incorporate these elements into their leadership strategy. Digital leaders are responsible for ensuring that technologies align with social and environmental sustainability goals, driving long-term ethical leadership. This involves adopting technologies that support societal values such as reducing carbon footprints, enhancing social equity, and protecting privacy. By prioritising environmentally responsible and socially equitable technologies, digital leaders can promote sustainable business practices that meet regulatory and ethical standards, while resonating with customers and stakeholders. Additionally, they must foster transparency, fairness, and inclusivity in decision-making to build a culture of ethical responsibility within the organisation, ensuring that technological advancements contribute to both organisational success and societal well-being (Senadjki et al., 2024).

Research method

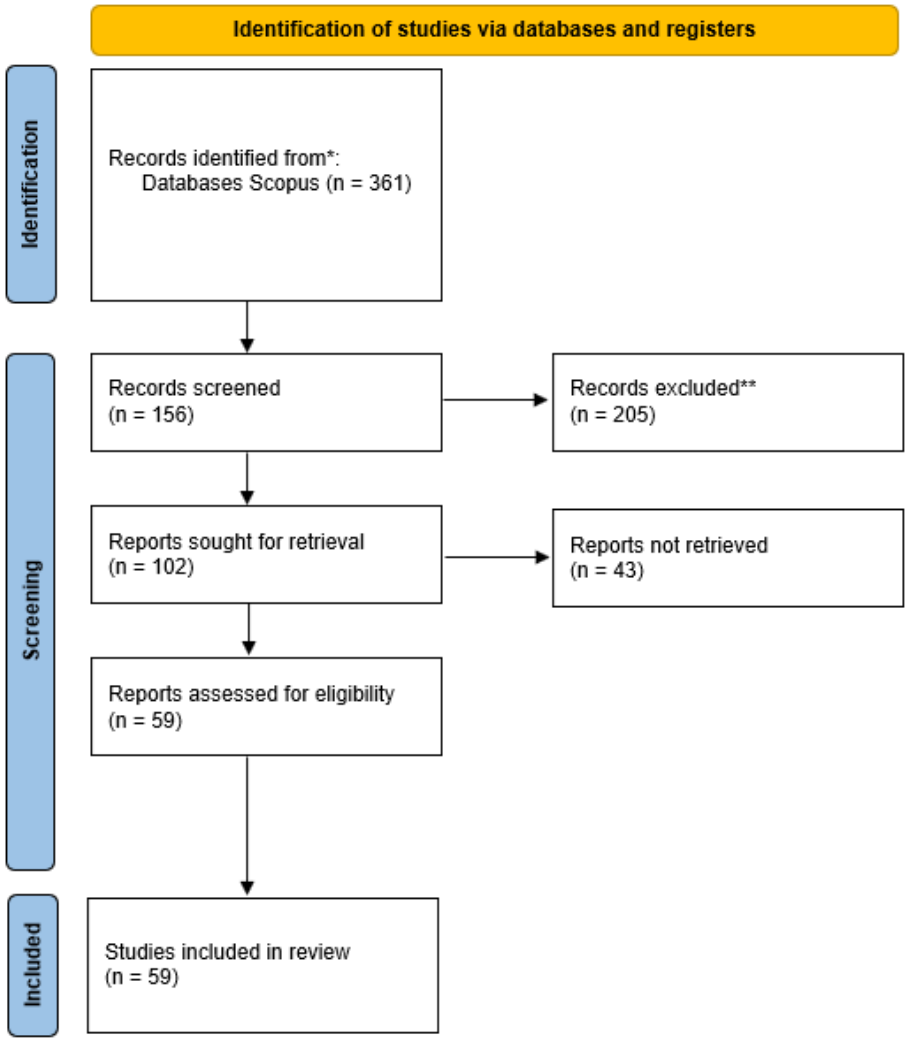
Research approach

This study employs a Systematic Literature Review (SLR) approach. The SLR method follows a well-defined and systematic process, including formulating research questions, developing a protocol, conducting a comprehensive literature search, screening studies, assessing their quality, extracting data, and synthesising findings (Singh, 2017; Višić, 2022). The purpose of this method is to compile a large body of information by identifying key characteristics of a specific topic (Ramey & Rao, 2012).

Subsequently, the researchers conducted a literature search in the Scopus database to analyse the concept of "digital leadership". Scopus is one of the largest

curated abstract and citation databases, covering a wide range of academic journals, conference proceedings, and books at both global and regional levels (Baas et al., 2020; Kirillova, 2017). This database provides access to more than 14,000 titles from approximately 4,000 publishers, offering extensive coverage of scientific literature (Boyle & Sherman, 2005).

Figure 1.
Paper selection procedure



Source: Authors' work (2024)

Figure 1 presents a flow diagram illustrating the selection process of articles included in this review. The first step identified 361 articles from Scopus. The second step reduced the sample by 205 articles that were not from relevant fields of study, namely business, management, and accounting. From the remaining articles, 102 were selected as journal articles, which are considered more credible and provide deeper scientific contributions. The final selection process retained 59 open-access articles, ensuring that the literature included in the review is publicly available without restrictions.

Data collection

This study uses data from journal publications on digital leadership. This study uses Scopus as the primary database to search relevant literature on the research topic. Scopus was chosen because it is one of the largest and most reputable academic citation databases, covering peer-reviewed scientific literature across various disciplines, including business, management, and psychology. We extracted data from the Scopus database using the literature search feature to find research relevant to the study's theme. Scopus provides comprehensive information for each publication, such as citation count, publication year, and frequently cited authors, which helps track the development of the digital leadership topic over time.

We collected the data from Scopus and used VOSviewer software for bibliometric analysis. VOSviewer is a tool used for visualising and exploring bibliometric data, which allows for the analysis of relationships between articles, authors, and the emergence of frequently used keywords in the publications.

Results

Digital leadership research trends

Appendix 1 illustrates the trend in the number of documents published annually from 2015 to 2025, showing a significant increase in recent years. In the initial period (2015–2020), the number of publications was relatively low, ranging from 2 to 21 documents per year. However, after 2020, there was a sharp increase in publications, starting with 27 documents in 2021 and continuing to rise, peaking in 2024 with a total of 155 documents. This surge reflects the growing interest and attention given to research on digital leadership during this period.

The year 2024 marked the peak in the number of publications, confirming the high level of interest in the topic. On the other hand, in 2025, there was a sharp decline, with only 4 documents recorded. This decrease is most likely due to incomplete data availability or because many publications are still in the process of being published. Overall, the chart depicts a growth pattern that began with a slow phase in 2015–2020, followed by rapid growth from 2021, culminating in the peak in 2024. This pattern highlights the increasing relevance and attention paid to the research topic in recent years.

Institutions with the largest contribution to digital leadership research

Appendix 2 illustrates the number of documents published by institutions contributing to digital leadership research, with an emphasis on the top 10 affiliations. Bina Nusantara University ranks first with a contribution of 15 documents, followed by Rheinisch-Westfälische Technische Hochschule Aachen, which produced 7 documents. Other institutions, such as Universiti Kebangsaan Malaysia, NC State University, and National University of Sciences and Technology, each contributed 6 documents. Meanwhile, other institutions made smaller contributions, ranging from 2 to 5 documents. This data reflects the broad

involvement of various global institutions in supporting research on the analysed topic. The distribution highlights the diversity of academic contributions and underscores the importance of international academic collaboration in the development of literature on this subject.

Author productivity in digital leadership studies

Appendix 3 illustrates the distribution of the number of documents published by authors with the largest contributions to digital leadership research. Abbu, H. ranks first with a total of 7 documents. Other authors, such as Gudergan, G., Karakose, T., Mihardjo, L.W.W., and Mugge, P., each contributed 6 documents. Following them, Malik, M. and Raziq, M.M. published 5 documents, while Elidjen, Hoeborn, G., and Mollah, M.A. each contributed 4 documents. This finding highlights the significant contributions of certain authors in enriching the literature on digital leadership. Additionally, the data indicates varying levels of research productivity among authors, which plays a crucial role in advancing new insights and findings in this field.

Top contributing countries in digital leadership studies

Appendix 4 shows the number of documents published per country or region, highlighting the 15 countries or regions with the highest contributions. Indonesia stands out as the leading country, with 61 documents, followed by Germany with 43 documents. Other countries, such as Malaysia, China, and Turkey, also show significant contributions, with 36, 35, and 23 documents, respectively. On the other hand, countries like India, Pakistan, and Saudi Arabia have a lower number of publications, ranging from 11 to 15 documents. Overall, this data reflects a global distribution of publications, spanning various geographic regions such as Europe, Asia, and the Middle East, with a particular emphasis on the countries that made the largest contributions in terms of the number of documents.

Subject areas in digital leadership research

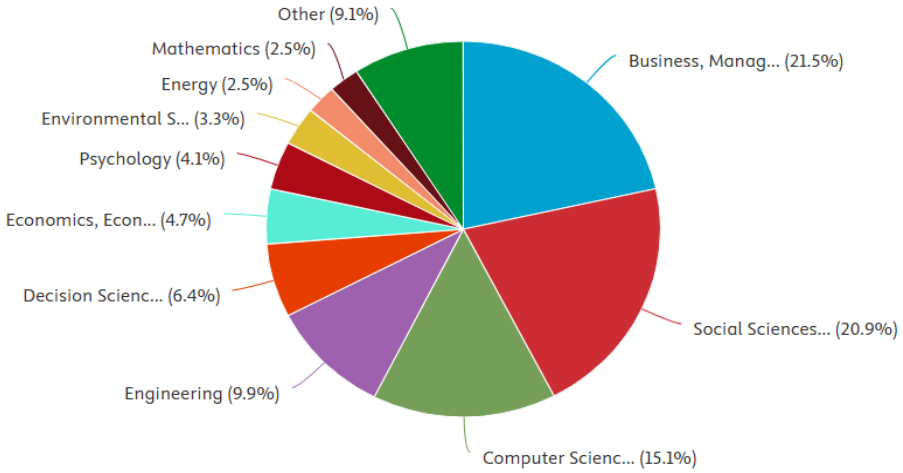
The pie chart in Figure 2 below illustrates the distribution of documents based on academic disciplines, highlighting the proportion of each field's contribution to the total number of documents. The largest contribution comes from Business, Management, and Accounting, which accounts for 21.5% of the total documents, followed by Social Sciences with 20.9% and Computer Science at 15.1%. Additionally, fields such as engineering, decision sciences, economics, econometrics, and finance also contribute significantly, though in smaller proportions.

Some fields have lower contributions, such as mathematics, energy, and environmental science; each contributes between 2.5% and 3.3% of the total documents. Fields like psychology, arts and humanities, and medicine also have relatively small proportions. Meanwhile, disciplines such as chemical engineering,

neuroscience, health professions, materials science, and nursing contribute very limited numbers of documents, ranging from one to three.

Overall, this diagram reflects the multidisciplinary scope of the documents analysed, with a primary focus on management, social sciences, and technology fields such as computer science and engineering. Nonetheless, contributions from various other fields demonstrate that the diversity of research enriches the literature on digital leadership.

Figure 2.
Documents by subject area



Source: Scopus output (2024)

Supporting institutions for digital leadership research

Table 1 displays the top five affiliations that have played a significant role as major sponsors in supporting research related to the analysed topic. The table ranks these affiliations based on the amount of research support they have provided, either in terms of funding or research sponsorship. The National Natural Science Foundation of China is recorded as the largest sponsor with 7 support instances, followed by the Ministry of Science and Technology of the People's Republic of China with 6 supports and the European Commission with 4 supports. Furthermore, the National Office for Philosophy and Social Sciences and Universiti Kebangsaan Malaysia each provided support for three studies. This data offers valuable insights into the most active institutions in funding and supporting research in this field. Research sponsors play a strategic role in determining the direction and priorities of studies and contributing to the scientific advancement of specific topics. The role of these sponsors also reflects the level of institutional commitment and support for the development of literature in the field of digital leadership.

Most cited researchers in digital leadership studies

Table 2 presents a list of the top ten researchers with the highest citation counts, reflecting their significant contributions to digital leadership research. The

high number of citations indicates the important influence of these researchers' work on the development of literature in the field. This table serves as a tool to identify the most influential scholars in this area while providing insights into emerging research trends. This information is valuable for academics and practitioners to understand the dynamics of research and to foster collaboration with key figures in the digital leadership literature.

Tabel 1.

Documents by funding sponsor

Institutions	Number
National Natural Science Foundation of China	7
Ministry of Science and Technology of the People's Republic of China	6
European Commission	4
National Office for Philosophy and Social Sciences	3
Universiti Kebangsaan Malaysia	3

Source: Authors' work (2024)

Tabel 2.

Documents with the highest number of citations

No	Author	Journal	Citation
1	Mihardjo L.W.W.; Sasmoko S.; Alamsjah F.; Elidjen E.	Management Science Letters	97
2	Chatterjee S.; Chaudhuri R.; Vrontis D.; Giovando G.	Journal of Innovation and Knowledge	83
3	Wang X.; Li Y.; Tian L.; Hou Y.	Technovation	75
4	Zulu S.L.; Khosrowshahi F.	Construction Management and Economics	57
5	Sasmoko; Wasono Mihardjo L.W.; Alamsjaha F.; Elidjena	Management Science Letters	44
6	Mihardjo L.W.W.; Sasmoko; Alamsyah F.; Elidjen	Management Science Letters	37
7	Robertson J.; Botha E.; Walker B.; Wordsworth R.; Balzarova M.	International Journal of Retail and Distribution Management	30
8	Karakose T.; Demirkol M.; Yirci R.; Polat H.; Ozdemir T.Y.; Tülübaş T.	Administrative Sciences	29
9	Ehlers U.-D.	Journal of Higher Education Policy and Leadership Studies	27
10	Mihardjo L.W.W.; Sasmoko; Alamsjah F.; Elidjen	Polish Journal of Management Studies	22

Source: Authors' work (2024)

Digital leadership accelerates the adoption of disruptive technologies in business models

Digital leadership has proven to have both direct and indirect influences on innovation in business models, which is a core element of the digital transformation process (Fatima & Masood, 2024). Leaders with digital competence have the ability to visualise and implement innovative business models that align with technological advancements (Yopan et al., 2022). Additionally, digital leadership plays a key role in facilitating open innovation, which involves leveraging new technologies, information, and ideas to create new products, processes, and services. This

approach integrates both internal and external knowledge to drive essential innovation for adapting to disruptive technologies (Fatima & Masood, 2024).

Digital leaders are often characterised by creativity, deep insights, a global vision, and strong collaboration skills. These traits enable them to respond effectively to market changes, seize emerging opportunities, and transform organisational paradigms to integrate disruptive technologies (Mihardjo et al., 2019). By promoting innovation, adopting open innovation strategies, and developing dynamic capabilities within organisations, digital leadership becomes a critical factor in accelerating the adoption of disruptive technologies in business models.

The role of emerging technologies (AI and blockchain) in enhancing digital leadership effectiveness

AI, such as machine learning and natural language processing, helps leaders make better decisions by analysing large amounts of data and finding patterns that are hard to see on their own (Karakose et al., 2023). Tools such as ChatGPT, for instance, can assist leaders in generating complex text, providing insights for strategic planning, and enhancing operational efficiency. In the financial sector, AI plays a crucial role in improving customer service and automating business processes, enabling leaders to maintain competitiveness and adapt to changing market demands. Additionally, through features like more efficient authentication and enhanced security measures, AI helps leaders ensure both security and operational efficiency in a constantly evolving digital landscape (Al Issa & Omar, 2024).

Blockchain technology plays an important role in building digital trust, an essential element for the effectiveness of digital leadership. Blockchain provides a secure and transparent mechanism for verifying transactions and interactions, reducing the risk of fraud and increasing stakeholder trust (Mo et al., 2023). When integrated with other Industry 4.0 technologies, blockchain allows leaders to create a trustworthy digital environment, strengthening trust among users and partners. The decentralised nature of blockchain also promotes collaboration and innovation by enabling secure and transparent data sharing across organisational boundaries. This capability supports leaders in fostering innovation and adapting to the increasingly complex hybrid environments (Bellis et al., 2024).

By supporting agile leadership practices, blockchain helps leaders navigate uncertainty and complexity in the dynamic digital landscape. The integration of AI and blockchain in digital leadership practices holds enormous potential for enhancing organisational effectiveness and driving innovation (Al hadrawi & Reniaty, 2023) As these technologies continue to evolve, leaders are expected to remain adaptable and open to new approaches to harness the potential of technology in addressing emerging challenges.

The relationship between green innovation and digital leadership in enhancing organisational sustainability

Green technology innovation has been recognised as a key driver of organisational sustainability. These initiatives involve the development of environmentally friendly technologies and processes that contribute to improving environmental, economic, and social performance. Organisations are encouraged to invest in research and development of green technologies, integrating sustainability goals into product design and supply chain management (Laradi et al., 2024). Additionally, innovations in green management, such as the adoption of environmental certifications and green knowledge management, also make significant contributions. These innovations are considered intangible resources that can provide competitive advantages and are difficult for competitors to imitate.

Digital leadership, on the other hand, plays a strategic role in improving organisational performance by promoting knowledge sharing, enhancing team adaptability, and creating a positive work environment. Effective digital leaders are able to leverage digital tools to align technological advancements with organisational goals, thus driving innovation while supporting sustainability (Niu et al., 2022). The combination of digital capabilities and sustainability vision allows leaders to effectively integrate green innovation into organisational strategies.

The interaction between green innovation and digital leadership becomes a key element in advancing organisational sustainability. Digital leaders can encourage the adoption of green technologies by fostering a proactive innovation culture, integrating environmentally friendly technologies into business operations, and enhancing stakeholder engagement in the sustainability agenda. This approach not only supports sustainability but also provides a competitive advantage for organisations in the global market.

Integrating digital transformation with hybrid work necessitates enhancing employee performance

Digital transformation, characterised by the strengthening of IT capabilities and dynamic innovation, has become a key element in enhancing organisational performance. IT capabilities enable organisations to adapt to technological advancements, while innovation supports the development of new solutions that not only improve employee performance but also create a balance between work and personal life. Organisations that strengthen their IT capabilities and foster innovation are in a better position to support hybrid work models, where employees can work efficiently from various locations (Chatterjee et al., 2023).

Digital leadership plays a crucial role in ensuring the successful integration of digital transformation with the needs of hybrid work. Leaders who understand and optimally leverage digital tools are able to effectively guide teams, ensuring that digital transformation not only supports organisational goals but also meets the flexibility needs of employees (Gledson et al., 2024; Gunawan et al., 2023).

The hybrid work model offers flexibility for employees to balance personal and professional responsibilities, which is essential in maintaining high performance. Digital transformation provides the infrastructure and tools necessary to support remote work arrangements, including collaboration platforms and cloud-based management. Organisations that prioritise work-life balance through hybrid work models tend to increase employee satisfaction and productivity, ultimately positively impacting overall organisational performance (Chatterjee et al., 2023).

The integration of digital transformation with hybrid work models creates significant opportunities for organisations to build work environments that support flexibility, innovation, and work-life balance. By leveraging IT capabilities, fostering innovation, and implementing effective digital leadership, organisations can create an optimal hybrid work model that supports employee needs and achieves strategic goals.

Factors influencing digital leadership

Digital leadership is a complex concept influenced by various factors. Based on the abstract analysed, the main factors that affect digital leadership include socio-demographic aspects, skills, leadership styles, organisational culture, and adaptation to technology and the market (Karakose et al., 2024). The details of these factors can be found in Table 3, providing a comprehensive overview of the key elements discussed.

Tabel 3.

Factors influencing digital leadership

Factor	Description	References
Socio-demographics	Age, gender, education level, and location	Tanucan et al. (2023)
Interpersonal skills	Effective communication and collaboration skills	Eitan & Gazit (2024); Darvish et al. (2024)
Digital literacy	Ability to use digital tools and platforms	Eitan & Gazit (2024); Khurniawan et al. (2024)
Technology capabilities	Proficiency in operating technology	Khurniawan et al. (2024);
Transformational leadership	Inspire and motivate followers	Eitan & Gazit (2024); Juharyanto et al. (2021)
Strategic leadership	Clear vision, defined goals, and adaptability	Abidi et al. (2023); Senadjki et al. (2024)
Organisational culture	Support for innovation and agility	Abidi et al. (2023); Sestino et al. (2024)
Supportive environment	Training and support for digital leadership development	Tanucan et al. (2023); Hanandeh et al. (2024)
Adaptability	Adaptability to rapid technological change	Khurniawan et al. (2024); Tworek (2023)
Strategic use of digital tools	Effective use of digital tools and platforms	Hanandeh et al. (2024); Ravesteijn & Ongena (2019)

Source: Authors' work (2024)

Key skills for effective digital leadership

The key factors necessary for effective digital leadership, such as visionary thinking, creativity, digital skills, interpersonal communication, growth mindset, integrity, and data-driven decision-making, play a crucial role in navigating digital transformation and achieving organisational success. These factors are essential for leaders to drive innovation, foster strong communication, and make informed decisions in the digital age. They contribute to improved marketing performance and business outcomes by enabling leaders to strategically leverage resources, manage change, and build strong relationships with customers. The detailed explanation of each factor, along with relevant studies that support these concepts, can be found in Appendix 5.

Ethical challenges in data-driven decision-making in digital leadership

The ethical challenges in data-driven decision-making in digital leadership are outlined across various layers, including oversight and accountability, leader digital competencies, the decision-making process, and basic principles. These factors involve ensuring transparency, equipping leaders with the necessary digital skills, establishing processes for risk audits and algorithm fairness, and upholding foundational values such as privacy, fairness, and sustainability. All these details and explanations can be found in Appendix 6. The ethical challenges in data-driven decision making in digital leadership have several factors: First, digital leadership often involves decision-making based on big data, raising concerns about individual privacy protection and the security of sensitive organisational data (Eitan & Gazit, 2024; Elia et al., 2024; Ravesteijn & Ongena, 2019; Zia et al., 2024). Second, decision-making algorithms may contain biases that lead to unfairness within organisations, affecting hiring, promotions, and resource allocation (Abdulrahman & Mohammed, 2024; Asfahani et al., 2024; Saraih et al., 2021; Srivastava et al., 2023; Tigre et al., 2024; Zia et al., 2024). Third, digital leaders have a responsibility to enhance digital ethics literacy among their teams, ensuring responsible data usage and ethical technology implementation (Abdulrahman & Mohammed, 2024; Eitan & Gazit, 2024; Sestino et al., 2024; Tigre et al., 2024). Honest and transparent communication is crucial in conveying data-driven decisions to all stakeholders, fostering trust and accountability in digital leadership (Darvish et al., 2024; Gunawan et al., 2023; Ravesteijn & Ongena, 2019; Tigre et al., 2024).

Fourth, there is a need to balance technological decision-making with human judgment to consider moral and emotional aspects of decisions, ensuring a holistic approach to leadership (Senadjki et al., 2024; Srivastava et al., 2023). Ensuring equitable access to technology for all segments of society is a critical ethical issue in digital leadership, preventing technological exclusion and fostering inclusive innovation (Gunawan et al., 2023; Srivastava et al., 2023).

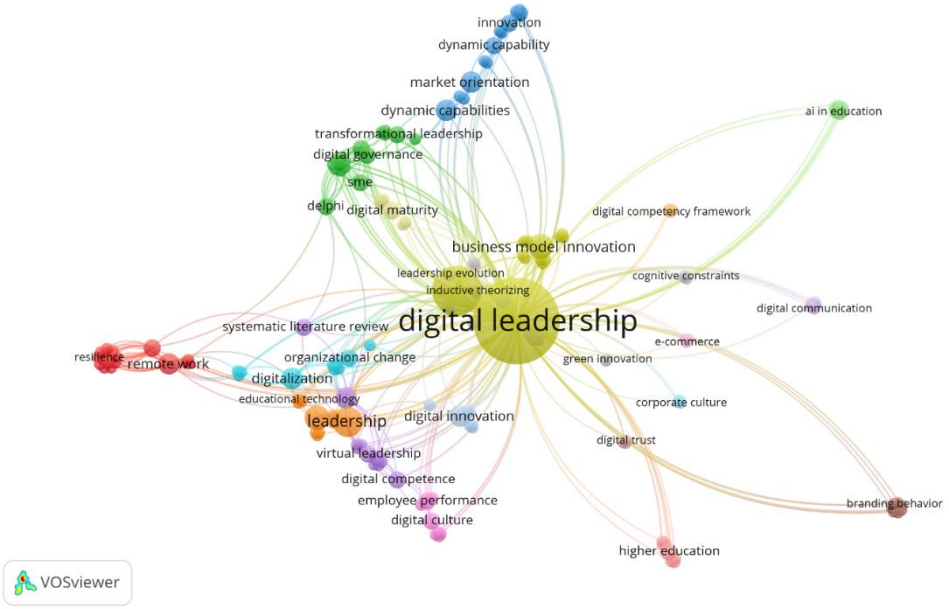
Conceptual map of digital leadership

The conceptual map places digital leadership at the centre, acting as the brain of an organism, controlling and coordinating various functions across the ecosystem. This central node represents the driving force of digital transformation, influencing all other clusters and ensuring that the organisation thrives in a digital environment. All of the information and explanations provided are available in Figure 3. The green cluster is associated with innovation, which is crucial for the growth and adaptation of the organism. Just as an organism evolves to meet environmental challenges, digital leadership fosters growth through business model innovation, digital competency frameworks, and green innovation. These aspects reflect the organism's evolutionary traits, enabling it to stay competitive and resilient in an ever-changing world. The red cluster focuses on remote work, organisational resilience, and digital transformation. This can be compared to the immune system of an organism, which protects and adapts to external disruptions. In the same way, digital leadership ensures the organisation's survival by maintaining agility and business continuity, even when faced with challenges such as remote workforce management and digital adaptation.

The blue cluster emphasises change management, dynamic capabilities, and market adaptability, resembling the hormonal regulation in an organism. Just as hormones regulate bodily functions to maintain balance, digital leadership helps the organisation adjust its strategies and responses to environmental changes. This adaptability allows the business to stay market-oriented and growth-focused, navigating through industry shifts and emerging trends. The yellow cluster represents trust and leadership evolution, which can be likened to the organism's nervous system. The nervous system facilitates communication and coordination between different parts of the body. Similarly, digital leadership plays a key role in building digital trust within the organisation and fostering a culture of collaboration, communication, and trust, both internally and externally. Leadership evolution mirrors the way an organism's communication systems adapt to new stimuli to maintain balance.

Finally, the purple cluster focuses on digital competence and employee performance, analogous to the organism's muscular system. Just as muscles enable movement and physical performance, the workforce's digital competencies, nurtured by digital leadership, ensure that employees are well-equipped to meet the demands of the digital era. This cluster reflects the importance of developing a skilled workforce that can contribute to the overall success and resilience of the organisation.

Figure 3.
Conceptual visualisation of digital leadership



Source: Authors' work (2024)

Discussion

This paper underscores the transformative power of digital leadership in advancing organisational performance, enabling the adoption of disruptive technologies, and fostering innovation in the digital era. The role of digital leaders in shaping business strategies is increasingly critical as organisations navigate the complexities of digital transformation, particularly through the integration of emerging technologies such as Artificial Intelligence (AI) and blockchain. By leveraging their digital competencies, digital leaders can guide their organisations in implementing innovative business models that respond to market demands and technological advancements (Fatima & Masood, 2024). The leadership practices align with the evolving business models that are vital for achieving organisational resilience and staying competitive in the digital landscape (Yopan et al., 2022).

Digital leadership and the acceleration of disruptive technologies

The concept of digital leadership has evolved significantly in recent years, from a focus on technology management to a broader view encompassing strategic influence over business models. Digital leadership not only adopt disruptive technologies but also catalyse open innovation within organisations, which is essential for business model innovation. Open innovation involves leveraging external and internal ideas to foster technological advancements that shape business products, processes, and services (Fatima & Masood, 2024). The ability of digital leadership to foster a culture of innovation within organisations is seen as a critical enabler of technological adaptation, especially in fast-paced industries like finance, healthcare, and manufacturing (Mihardjo et al., 2019).

Leaders who possess creativity, deep insights, and a global vision are equipped to not only adapt to technological changes but also drive them. These qualities allow digital leaders to navigate market shifts and anticipate emerging opportunities, thereby transforming organisational structures and business models to integrate disruptive technologies effectively (Mihardjo et al., 2019). Such leaders promote dynamic capabilities within their organisations, which are critical for embracing emerging technologies and maintaining organisational agility in an ever-evolving business environment (Senadjki et al., 2024).

Emerging technologies and their role in enhancing digital leadership effectiveness

The advent of AI and blockchain technology has substantially expanded the scope and impact of digital leadership. AI tools, including machine learning algorithms and natural language processing, have proven instrumental in helping digital leaders make data-driven decisions. The ability to analyse vast amounts of data and uncover hidden patterns empowers digital leaders to improve operational efficiency, strategic planning, and decision-making processes (Karakose et al., 2023). In industries such as finance, AI technologies like Chatgpt and machine learning models are transforming customer service, process automation, and strategic forecasting (Al Issa & Omar, 2024). Moreover, the use of AI enhances organisational decision-making by providing insights that help leaders adapt to volatile market conditions, thereby ensuring sustained competitiveness.

Blockchain technology enhances the trustworthiness of digital leadership decisions by providing transparent and secure systems for transaction verification (Mo et al., 2023). Blockchain's decentralised nature not only ensures data integrity but also fosters collaboration across organisational boundaries, an essential aspect of today's increasingly interconnected business environment. By enabling secure data sharing, blockchain reduces the risk of fraud, builds trust among stakeholders, and promotes collaboration across industry sectors (Bellis et al., 2024). Furthermore, blockchain supports agile leadership practices by providing transparency and fostering innovation in complex, hybrid environments. Thus, the integration of AI and blockchain positions digital leadership as a cornerstone for organisations aiming to thrive amidst technological uncertainty and complexity.

Green innovation and sustainability through digital leadership

The growing emphasis on sustainability has heightened the importance of green innovation, particularly in sectors heavily impacted by environmental regulations and consumer demand for eco-friendly solutions. Green innovation refers to the development of technologies and practices that reduce environmental impacts while driving economic performance. Digital leadership plays a strategic role in promoting green technologies by ensuring that they are integrated into organisational strategies and product designs (Laradi et al., 2024). Digital leaders

influence organisational culture by encouraging sustainability goals, facilitating the adoption of environmentally friendly practices, and driving the development of green technologies within their operations.

By leveraging digital tools, digital leaders can better align technological advancements with sustainability objectives, ensuring that business operations contribute positively to environmental outcomes while also creating long-term economic value (Niu et al., 2022). This dual approach not only promotes environmental stewardship but also provides organisations with a competitive edge in markets increasingly driven by sustainability metrics. Moreover, environmental certifications and green knowledge management become integral to the value proposition of organisations, serving as intangible resources that enhance brand reputation and organisational resilience (Laradi et al., 2024).

The synergy between digital leadership and green innovation becomes evident as leaders encourage proactive innovation cultures and integrate green technologies into every aspect of business operations. As digital leadership fosters innovation, it also facilitates stakeholder engagement in the sustainability agenda, reinforcing the organisation's position in global markets that prioritise eco-conscious practices (Niu et al., 2022). This strategic intersection of digital leadership and green innovation not only drives organisational sustainability but also strengthens business resilience against environmental, regulatory, and market changes.

The integration of digital transformation with hybrid work models

The hybrid work model has emerged as a key feature of post-pandemic workplace strategies, offering employees the flexibility to work remotely or on-site. This shift has placed digital transformation at the primary of organisational strategies aimed at enhancing employee performance and overall productivity (Chatterjee et al., 2023).

As organisations increasingly embrace hybrid work models, digital leaders are required to optimise IT capabilities and digital tools to foster collaboration, innovation, and employee well-being. Research indicates that organisations that leverage digital leadership effectively in hybrid environments tend to see improved employee satisfaction, increased productivity, and stronger organisational performance (Gledson et al., 2024; Gunawan et al., 2023). Digital leaders are responsible for crafting a vision that integrates technology with flexible work policies, ensuring that digital tools not only support organisational goals but also meet the evolving needs of employees in dynamic work settings.

The success of hybrid work models depends heavily on the organisation’s ability to prioritise work-life balance while ensuring operational efficiency. Digital leaders who foster a culture of innovation and flexibility, while simultaneously enhancing employee performance, position their organisations to excel in a highly competitive and evolving business environment (Chatterjee et al., 2023). As digital

tools continue to evolve, the role of digital leadership in facilitating hybrid work will remain essential for organisations striving to create optimal work environments.

Ethical challenges in data-driven decision-making

Despite the tremendous potential of data-driven decision-making in enhancing digital leadership, it also raises several ethical challenges that require careful attention. One of the key concerns is the protection of individual privacy and the security of sensitive data. The use of big data and advanced analytics often involves personal information, raising concerns about data misuse and the breach of privacy (Eitan & Gazit, 2024; Zia et al., 2024). Digital leaders are responsible for ensuring that data usage complies with ethical guidelines and that privacy protections are in place, thereby safeguarding stakeholder trust.

Moreover, the use of algorithms in decision-making introduces the risk of bias, which can affect fairness in processes such as hiring, promotions, and resource allocation. The presence of biases in algorithms can lead to inequitable outcomes and undermine the legitimacy of organisational practices (Abdulrahman & Mohammed, 2024). Digital leaders must actively address these biases by implementing fair and transparent algorithms, ensuring that all organisational decisions are equitable and just (Tigre et al., 2024).

Additionally, as digital leadership continues to rely on data-driven decision-making, leaders must balance the use of technology with human judgment, incorporating ethical considerations, emotional intelligence, and moral values into the decision-making process. Digital leadership should not only be about leveraging technology but also about considering the social and moral implications of its implementation (Asfahani et al., 2024; Tworek, 2023). The ability to make ethical decisions, particularly in the use of AI and other data-driven technologies, is essential for building trust and fostering a culture of ethical leadership within organisations (Srivastava et al., 2023). Finally, ensuring equitable access to technology is another critical ethical issue in digital leadership. Digital leaders must ensure that technology is accessible to all segments of society, preventing technological exclusion and fostering inclusive innovation. By aligning technology implementation with social and environmental sustainability goals, digital leaders can create long-term value for both the organisation and the broader community (Gunawan et al., 2023; Srivastava et al., 2023).

Conclusion, limitation, and future research

This study highlights the essential role of digital leadership in driving digital transformation, adopting disruptive technologies like AI and blockchain, and promoting organisational sustainability and employee performance. Digital leaders are key in integrating these technologies to enhance innovation, operational efficiency, and competitiveness in a fast-evolving market. They also facilitate the

success of hybrid work models by aligning digital tools with employee needs, boosting productivity while maintaining a healthy work-life balance. Additionally, digital leadership supports green innovation and sustainability, strengthening organisations' positions in a market increasingly focused on environmental concerns.

However, the study has limitations. The SLR approach, while comprehensive, may not capture industry-specific or regional differences in digital leadership practices. It also does not examine the job tenure, degree, and personal qualities of digital leaders, which could provide deeper insights into their influence. Furthermore, the long-term impact of digital leadership on organisational performance remains unexplored, leaving an opportunity for future research.

Future studies should focus on the synergies between digital transformation, leadership, and sustainability. Research on optimising hybrid work models across industries would be valuable, as well as investigating how digital leaders' personal characteristics impact innovation and sustainability. Longitudinal studies on the enduring effects of digital leadership on performance and employee well-being would also be important to enhance understanding in both academic and practical contexts.

Author contribution

Muhammad Kahfi Nasrun: Conceptualisation, Investigation, Formal Analysis, Resources, Writing-Original Draft. **Heru Susilo**: Investigation, Formal Analysis, Writing-Review and Editing. **Tri Wulida Afrianty:** Investigation, Formal Analysis, Writing-Review and Editing.

Declaration of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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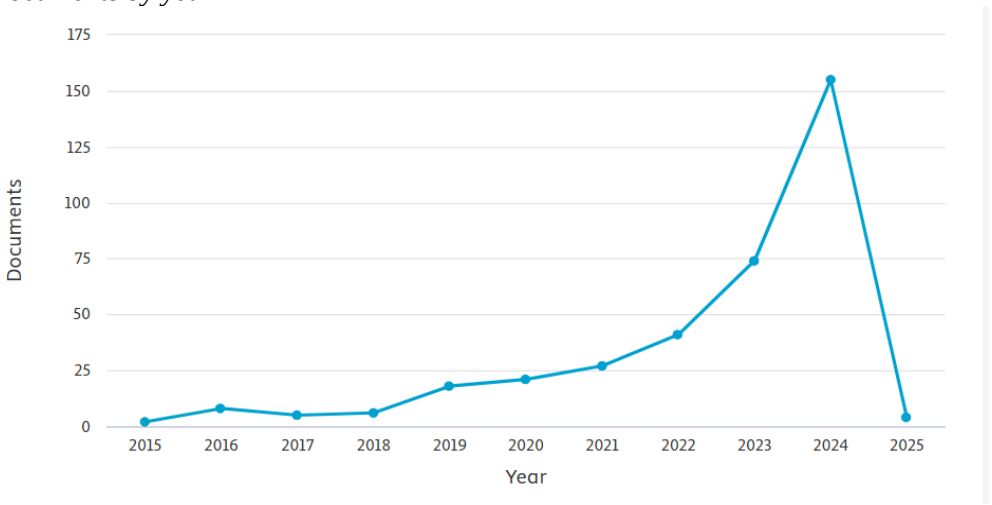
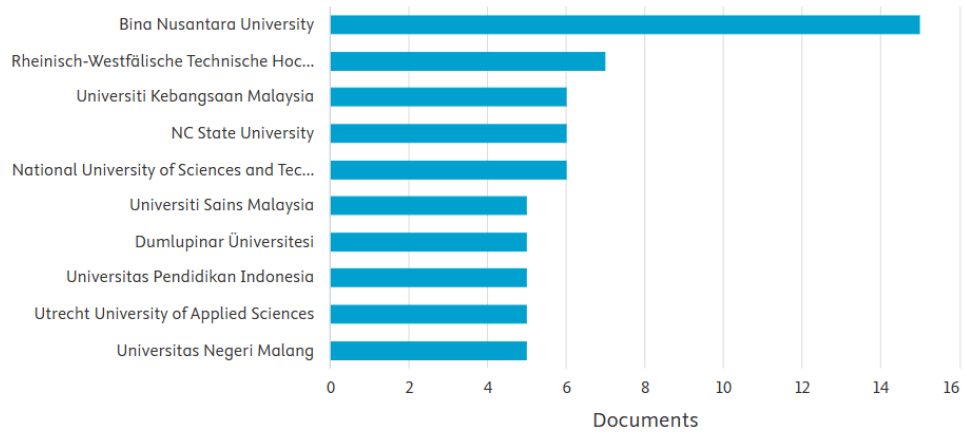
Appendix 1.
Documents by year



Source: Scopus output (2024)

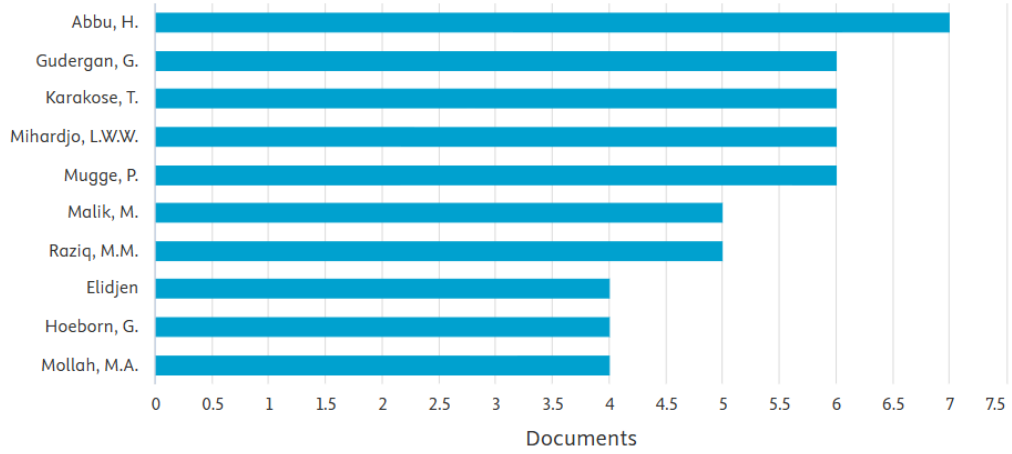
Appendix 2.
Documents by affiliation



Source: Scopus output (2024)

Appendix 3.

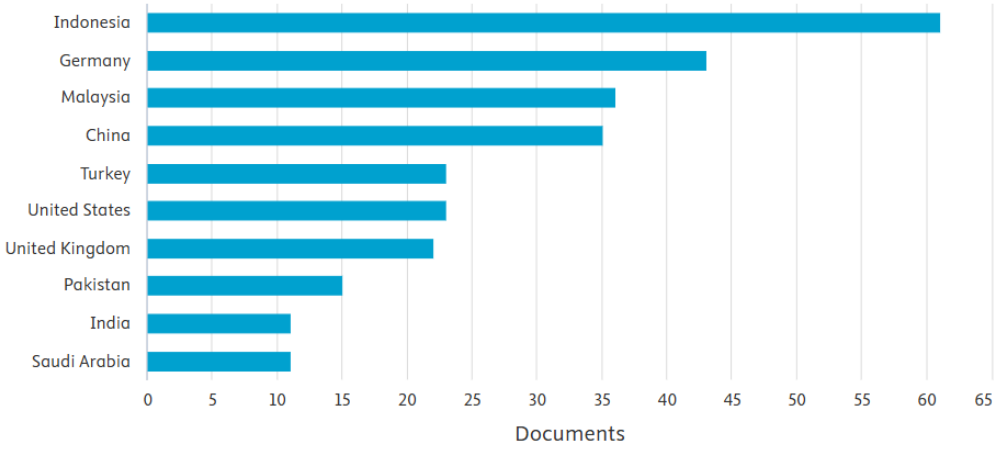
Documents by author



Source: Scopus output (2024)

Appendix 4.

Documents by country



Source: Scopus Output (2024)

Appendix 5.

Key skills for effective digital leadership

Key factors	Description	Reference
Visionary and strategic thinking	Digital leaders must be able to envision the future and steer the organisation in digital transformation. This includes strategic decision-making and action.	Yopan et al. (2022) mo et al. (2023) mihardjo et al. (2019)
Creativity and innovation	Digital leaders need to formulate and implement innovative ideas to meet future business needs and drive innovation within the user-centred enterprise.	Yopan et al. (2022) mo et al. (2023) wang et al. (2023)

Key factors	Description	Reference
Skills and competencies		
Digital skills and technology proficiency	The ability to use digital tools, communication applications, and advanced technologies such as big data, IOT, and blockchain to improve relationships between companies	Abbu et al. (2022) Mo et al. (2023) Jäckli & meier (2020) Widyaputri & Sary (2022) Jewitt (2020)
Interpersonal and communication skills	Effective communication skills, including listening, giving constructive feedback, as well as storytelling and transparency to build trust.	Zia et al. (2024) Abbu et al. (2022) Annisa et al. (2024) Saraih et al. (2022) Asfahani et al. (2024)
Personal traits		
Growth mindset	Embrace continuous learning and development to stay relevant in the digital age	Abbu et al. (2022) Ertiö et al. (2024) Bellis et al. (2024) Munsamy et al. (2023) Rakovic et al. (2024)
Integrity and honesty	Maintain ethical standards and integrity to build trust within the organisation	Malik et al. (2024)
Data and decision making		
Data-driven decision making	Utilising data to guide decisions and strategies in the digital age	Browder et al. (2024) Mccarthy et al. (2024)
Algorithm reprogramming ability	Using advanced technologies such as ai for better decision-making.	Browder et al. (2024)

Source: Authors' work (2024)

Appendix 6.

Ethical challenges in data-driven decision-making in digital leadership

Layer	Keywords	Description
Oversight and accountability	Public transparency, ethics committee	Ensuring transparency and forming an ethics committee to oversee decisions (Felzmann et al., 2020)
Leader digital competencies	Technology knowledge, digital empathy	Equipping leaders with technological proficiency and the ability to empathise in digital contexts (Schiuma et al., 2024)

Layer	Keywords	Description
Decision-making process	Risk audit, algorithm validation, stakeholder engagement	Establishing processes for risk identification, algorithm fairness, and inclusive stakeholder participation (Decker et al., 2025)
Basic principles	Privacy, fairness, sustainability	Upholding privacy, fairness, and sustainability as the foundational values of decision-making (Rezaei et al, 2024)

Source: Authors' work (2024)