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Leading in the Digital Age: The Role of Leadership in Organizational Digital Transformation

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Abstract: In the modern digital age, organizations face unprecedented challenges and possibilities while managing the intricacies of digital transformation. Accelerated technological developments, changing customer preferences, heightened competition, and dynamic regulatory environments necessitate companies to synchronize their business goals with technological innovations. Leadership is crucial in steering businesses through changes, requiring a deep understanding of change processes and the capacity to adjust leadership accordingly. This research addresses the central question: How does leadership effectively promote organizational digital transformation? The study examines how leaders can effectively promote the adoption of advanced technologies and the promotion of innovation, by first exploring the nature of digital transformation within organizations and then analyzing the evolving dynamics of leadership in this context. An integrative review of the Web of Science (WoS) and Scopus databases was conducted, using the search terms: "Leadership" and "Digital Transformation". The findings emphasize that effective leadership is crucial for managing the minutiae of digital transformation, integrating technology into organizational processes to facilitate learning, collaboration, and agility, enabling companies to adapt to market shifts, reduce uncertainty, and enhance decision-making for sustainable growth. By using the right tools and with the right frequency, leaders may develop team cohesion—even at a distance. Attentive digital-age leaders will know how to leverage the right mechanisms, and herein, we hope to give some indication of how that may be achieved, so that digital transformation increases rather than decreases team motivation levels.

Keywords: leadership approaches; digital transformation; innovation

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1. Introduction

In the contemporary digital era, a company's environment is evolving more rapidly, becoming progressively unstable, intricate, and unclear due to swift alterations in competition, demand, technology, and regulatory restraints. This compels firms to synchronize

their business goals with technological advancements since digital transformation concurrently impacts several facets of an organization due to the involvement of various stakeholders in shaping the transformation (Teichert, 2019). Organizations undergoing digital transformation are invited to possess the requisite resources and technical expertise to facilitate effective large-scale change. The digital revolution is changing several facets of work (Schwarzmüller et al., 2018), and these transformations show no indications of slowing down. Leadership and digital transformation are interdependent and should mutually reinforce each other to ensure the implementation and longevity of any digital transformation program inside a company (Zulu & Khosrowshahi, 2021).

Successful digital transformation necessitates a focus on redefining customer value propositions and enhancing operations using digital technology to foster more connection and cooperation with clients (Berman, 2012). During the last several decades, the word leadership has changed so that modern leadership does not focus exclusively on the leader but includes followers, work environment, and culture (Kokot et al., 2021). Leaders play a crucial role in businesses, particularly in driving change, and should exhibit a profound comprehension of this process and be prepared to accept change, recognizing that aligning their leadership skills with the change management approach enhances effectiveness (Sow & Aborbie, 2018). A range of leadership skills are essential for the successful implementation of change. Simultaneously, leaders are invited to inspire an adequate degree of confidence in their teams, therefore fostering an environment conducive to creativity and innovation (Rakovic et al., 2024).

Moreover, leaders should stimulate individuals to execute tasks more efficiently and creatively (Grigore & Coman, 2018). This underscores the need for leaders to not only possess technical skills but also to be adaptable and forward-thinking in their approach to digital transformation. Leaders should also enhance their unique skills to better comprehend changes in dynamic situations through a robust global vision (Elidjen et al., 2019). Additionally, top-tier leaders vary across industries, and significant alterations to the leadership process have been recognized based on environmental conditions (e.g., Carvalho et al., 2023). Furthermore, digital transformation necessitates that leaders swiftly modify current strategies in the contemporary, rapidly evolving landscape and needs endorsement from senior leadership (Zeike et al., 2019).

The research purpose of this review was to examine the role of leadership in digital transformation, highlighting key elements such as the adoption of advanced technologies and the promotion of innovation. The integrative literature review approach was selected for its capacity to synthesize current knowledge comprehensively, facilitating the identification of patterns, gaps, and associations across diverse studies. This methodology is especially appropriate for tackling the research question in this study, as it promotes a multidisciplinary comprehension of leadership's role in digital transformation by synthesizing perspectives from various domains, including management, organizational psychology, and information technology. This strategy carefully consolidates and assesses previous research, establishing a strong foundation for enhancing theoretical and practical insights in this field.

2. Theoretical Background

2.1. Digital Transformation in Organizations

Digital transformation has become a central element in the strategy of modern organizations, reflecting the need to adapt to an environment in constant technological evolution. According to Hossain (2024), "*organizations are growing dependent on cutting-edge technologies to optimize operations and make data-driven choices in an era of digital transformation*" (p. 2). This process is not limited to the adoption of advanced technologies; it involves, first and

foremost, a cultural, structural, and operational change that alters the way organizations create value, interact with their stakeholders, and position themselves on the market. In this context, Benitez et al. (2022), cited by Christianto Leonardo and Santosa (2024), emphasize that "*cultural alignment is essential for fostering an environment conducive to embracing technological changes*" (p. 5). Leadership plays a key role in this context since the success of digital transformation depends on the ability to guide teams through the complexity and uncertainty inherent in this process. In this regard, Mohanty et al. (2024) points out that the concept of digital transformation "*demands substantial changes in traditional management methods, calling for new skills, mindsets, and leadership approaches*" (p. 1364).

Digital transformation can therefore be defined as the strategic integration of digital technologies into all areas of an organization, to improve processes, optimize efficiency, and create new business opportunities. According to Cui (2024a), alluding to Bharadwaj et al. (2013), "*it involves reimagining business processes and models through the integration of digital technologies, which can lead to increased efficiency, innovation, and competitiveness*" (p. 2). However, more than a "simple" technological modernization, digital transformation represents a profound reformulation of business models. Examples include the migration to cloud computing platforms, the automation of processes through artificial intelligence or the mass personalization made possible by data analysis. It is true that, according to Borra (2024b), quoting Borra (2024a):

> In recent years, the intersection of big data, robust computing resources, and advanced algorithms has propelled Machine Learning (ML) and Artificial Intelligence (AI) to the forefront of technological innovation. (p. 2581)

However, it is important to note that innovation lies not only in the tools adopted but also in the ability to integrate them harmoniously and strategically. The speed of technological change has pushed organizations to face unprecedented challenges. Kohli et al. (2024), in the context of the complex adaptation of large companies to an increasingly technological reality, note that "*it is tough for companies like eBay and Amazon to make the cultural changes needed for significant value from DT [Digital Transformation]*" (p. 7). Emerging technologies such as the Internet of Things, blockchain, and predictive analytics have changed consumer expectations and increased the pressure to deliver faster, more efficient, and more personalized products and services. Polozhentseva et al. (2024) state that "*modern technologies help service organizations to increase the volume of services provided, effectively control quality, accelerate and automate business processes*" (p. 3). Companies that fail to adapt will not be able to resist the new paradigm of consumer demand. In addition, digital transformation requires a proactive approach to dealing with ethical and regulatory issues associated with the intensive use of data and cybersecurity. Regarding the growing importance of cybersecurity, Cheng et al.'s (2024) conception of the subject stands out:

> With the emergence of new business forms and new fields during the epidemic period, the development of digital finance is facing more severe cybersecurity challenges, and cybersecurity issues cannot be ignored. (p. 3)

Considering the current state of technological transversality, "*ensuring cybersecurity is the cornerstone of the development of digital finance*". (Cheng et al., 2024, p. 4).

But digital transformation is not just about technology. It also requires profound cultural and structural changes. Digitalization alters workflows, challenges traditional hierarchies, and demands a collaborative and agile mindset. Regarding the relevance of this question, Bhuiyan et al. (2024) point out that "*many diversified new technologies, such as data analysis, digital communication, connected objects, intelligent systems, and user experience through digital technology, are now applicable in all sectors, even in traditional industries*" (p. 46). The truth is that organizations, even the most traditional ones, that adopt a culture of

innovation, encouraging calculated risk and experimentation, are best placed to reap the benefits of digital transformation. "*Digital transformation has significantly impacted various aspects of business operations, leading to enhanced operational agility*" (Mishra & Varshney, 2024, p. 33). Thus, resistance to change, often found in organizations with more rigid cultures, is one of the main obstacles to overcome.

For this reason, the implementation of technologies must be conducted based on a careful analysis of organizational needs. According to Cui (2024a), "*organizations that leverage these digital advancements position themselves as leaders in transparency, ultimately enhancing their reputation and stakeholder trust*" (p. 5). However, digital tools, no matter how advanced, will not bring benefits if they are not selected based on specific criteria, such as scalability, compatibility with existing systems, and the ability to generate a return on investment. Even so, digital transformation is precisely "*recognized as the ability to transform existing products and services into more advantageous digital alternatives*" (Fan, 2024, p. 3). Organizations must therefore create multidisciplinary teams to lead digitalization initiatives, combining technical, strategic, and operational skills.

Continuous feedback and iterative adaptation are also crucial components. Digital transformation is not a linear process, but a dynamic one that requires constant adjustments in response to changes in the external environment and the results obtained internally. Indeed, "*digital transformation has revolutionized business operations, driving efficiency, innovation, and customer-centricity*" (p. 33). The ability to monitor key metrics such as operational efficiency, customer satisfaction, and innovation allows the organization to assess progress and adjust its strategies in real time. In this respect, leadership takes center stage. The evaluation of progress, for possible calibration, is preponderant. Ahmadi (2024) indirectly reinforces the importance of constant measurement, stressing that "*leaders must clearly define the problems the organization is addressing, be candid about the challenges ahead, and demonstrate that the chosen strategy is logical*" (p. 5).

Leadership thus acts as a catalyst for change. For this reason, it must be proactive. Precisely about proactive leadership, Cui (2024b), quoting Zheng et al. (2024), states that it "*is instrumental in creating an organizational culture that values innovation and sustainability, ultimately enhancing the effectiveness of digital transformation efforts*" (p. 6). Effective leaders must possess a combination of technological skills, strategic vision, and emotional intelligence. The latter is particularly important in the context of digital transformation, as the process often generates uncertainty and discomfort among employees. Research by Sundvik et al. (2024) "*demonstrates the role of EI in workplace resilience" (p. 14). The same authors also state that "improved workplace resilience positively affects mental health, so organizations should focus on this to mitigate negative impacts*" (p. 14). Therefore, empathetic and inclusive leadership can help build trust and reduce resistance to change.

In addition, leaders need to position themselves as advocates of innovation. This means creating an environment where employees are encouraged to try new ideas and adopt technological solutions. Transformational leadership is what it is all about. Buonocore et al. (2024), quoting Philip (2021) about transformational leaders, state that they are "*educators and facilitators, ensuring continuous learning and fostering a culture of digital literacy*" (p. 6). At the same time, as mentioned above, leaders must ensure that strategic decisions related to digital transformation are made based on concrete data, minimizing risks and maximizing opportunities.

Digital transformation in organizations is a complex and multifaceted process that goes beyond implementing advanced technologies. Kohli et al. (2024), quoting McLaughlin (2017), states that "*digital transformation can significantly improve organizational performance*" (p. 7). However, it also involves a comprehensive transformation that integrates cultural, operational, and strategic changes. Leadership plays a central role in this process, ensuring

not only the adoption of appropriate technologies but also the creation of an organizational culture that promotes agility, innovation, and collaboration. Regarding the central role of organizational culture in the digital transformation process, Ababora et al. (2024) very pertinently state that "*an organization's culture can either promote or impede innovation, depending on dimensions such as involvement, consistency, adaptability, and mission*" (p. 5). Organizations that approach digital transformation strategically and holistically are better prepared to thrive in the digital age.

This section largely analyzes the overarching framework of digital transformation while incorporating specific insights on how leadership enables and propels these processes. The incorporation of leadership-related elements, including cultural alignment and organizational agility, underscores the integral role of leadership in facilitating successful digital transformation. This dual emphasis guarantees a thorough comprehension of the interaction between leadership and technical progress, consistent with the study's primary aim to investigate leadership's function in digital transformation. The subsequent part examines the changing dynamics of leadership in the digital era, focusing on how leaders adjust to and influence the transformative impacts of digitalization within businesses. However, our analysis is a simplification of reality and as such needs to be analyzed with caution, as a guideline, and not as a panacea, as some cases may have unique unforeseen characteristics and variables.

2.2. Leadership Dynamics in the Digital Age

The delivery of goods, services, and solutions is being completely metamorphosed by digital transformation, which makes it more efficient, individualized, and accessible. Leaders with the vision and know-how to capitalize on these shifts would be at the center of this transition.

In this environment, the leadership approaches are focused on promoting innovation across different industries, managing change, and integrating new technology into the business processes. The capacity to lead organizations through the challenges of integrating new digital technology into business systems is a key component of leadership in the realm of digital transformation. These leaders are invited to foresee the long-term effects of technology being used and to comprehend how digital practices connect the organization's systems.

Although researchers have examined leadership in virtual environments for numerous years (Avolio et al., 2014), this area of study experienced significant acceleration due to the pervasive challenges posed by the coronavirus disease pandemic (COVID-19) (Stoker et al., 2022). Researchers have examined how technology can enhance leadership, in the distinctions in ethical and trust-related dimensions of leadership between virtual and in-person interactions (Lee, 2009), the development of team dynamics (e.g., Larson & DeChurch, 2020), and the specific challenges of. transparency that leaders face in these contexts (Turesky et al., 2020). This expanding corpus of studies underscores the increasing necessity for leaders to adjust their behaviors in response to digital change's intricacies while preserving organizational effectiveness. Building on this perspective, the "house of success" model proposed by Ziadlou (2020) emphasizes how important leadership is in navigating change and transition as well as forging international relationships to build lasting and sustainable organizational systems, in a fast-paced digitalized world. According to the model, digital transformation is the basis, leadership and management are the house's pillars, and the quadruple objectives represent the transformation's ultimate purpose. Digital leadership is highlighted by the "house of success" model as one of the rooms that might result in creating a successful digital transformation perspective toward long-term

sustainable growth. This model illustrates the foundational role of digital transformation, supported by leadership, to achieve sustainable organizational development.

According to El Sawy et al. (2020), digital leadership means doing the right things for the strategic success of digitalization and its business environment. Tigre et al. (2023) assert that essential leadership attributes for success in a digital environment encompass communication, direction setting, transparency, creativity, trust, cooperation, agility, empowerment, and adaptability. Research on digital leadership mostly investigates virtual teams (Perizade et al., 2017), communication (Darics, 2020), and performance (Roman et al., 2019). Comprehending digital leadership is essential as businesses require leaders who can identify innovative methods to be effective during uncertain periods (Matzler et al., 2018), and who are actively involved in expedited decision-making and change management (e.g., Jäckli & Meier, 2020). To thrive in a rapidly evolving corporate landscape, digital leadership should effectively oversee organizational dynamic capabilities while maintaining a market-oriented approach. Effective leaders recognize that the integration of digital technologies may revolutionize their organizations. Furthermore, effective digital leaders articulate a vision for the anticipated transition and recognize that digital technologies can fundamentally alter industry dynamics (Alanazi, 2022).

The future of leadership will need a blend of conventional and contemporary digital capabilities. Leaders are invited to develop their knowledge of data analysis, artificial intelligence, and cybersecurity to navigate an increasingly complicated organizational system. Still, Quaquebeke and Gerpott (2023) contend that the essence of digital leadership, referred to as the "NOW", lies in the mere transference of traditional leadership practices into a digital context, notwithstanding the progress made in this domain. The researchers characterize the "NEW" reality of leadership primarily as an enhanced leadership paradigm, wherein leaders are assisted by algorithms that indicate, for instance, which team members require additional attention, what the leaders should prioritize at any given moment, or how to improve team dynamics. In the process, the AI also delivers linked background data by recognizing trends in people-related data. The foundational data are either autonomously collected (e.g., communication patterns derived from electronic channels, physiological data created by wearables, and mobility) or provided by team members (e.g., pulse-check surveys). Nonetheless, under the "NEW" paradigm of leadership, people preserve the authority to make decisions and implement them. The discourse on the "NEW" role of humans in leadership is in its nascent phase. Also, consciousness, intelligence, and compassion are fundamental human attributes that AI cannot emulate, hence contesting the notion of complete substitution of human leaders by AI (Hougaard & Carter, 2024). These authors assert that, unlike AI, consciousness is a trait of humans that evolved over billions of years. It provides context and aids individuals in gaining perspective. Conversely, AI possesses an extraordinary ability to generate material at rates and in manners unparalleled by humans. In alignment with the augmented-leaders paradigm, the mutually beneficial answer is to symbiotically supply context to AI-generated information. Moreover, according to Dixit and Maurya (2021), while leaders recognize that AI will affect the workforce by automating repetitive and analytical tasks, this leads to an increased demand for emotional intelligence (EI) competencies, which machines will still lack in the same manner as humans. Integrating awareness, wisdom, compassion, and emotional intelligence with AI-driven leadership may provide an effective strategy for addressing the challenges of our brittle, anxious, nonlinear, and incompressible world (BANI) (Cascio, 2020). Though, in the "NEXT" of leadership, AI may not only assist but replace human leadership, entirely taking over task-oriented, relational, and change-oriented roles normally linked to human leaders. The ramifications of this alteration are significant (Quaquebeke & Gerpott, 2023). Therefore, the subsequent inquiry is: what remains for human leaders?

It is necessary to reflect upon this question, and hopefully, the debate is open. Nevertheless, human leaders still have responsibilities that include managing ambiguity, addressing ethical challenges, and cultivating a collective sense of purpose and meaning inside organizations. Human leaders continue to collaboratively establish fundamental criteria for assessing algorithmic leadership and maybe change the core AI to ensure its congruence with the organization's values and goals.

3. Methodology

The bibliographic research method used in this study combined a systematic search of online databases with an integrative analysis of the results. This methodology sought to adhere to Torraco's (2016) five-phase paradigm, guaranteeing a systematic and thorough synthesis of the current state of knowledge. The integrative review method contributes to the systematic visualization of the state of the art (Machado et al., 2020), on the research topic and its timeline up to the level of production by area, avoiding the minimization or repetition of studies, or even the tendency to bias when looking at a specific topic. A systematic review (SR) is a widely recognized method of knowledge synthesis (Higgins & Green, 2011; Kastner et al., 2012) that employs explicit and systematic approaches to gather and combine results from primary studies that address a well-defined research question (Page et al., 2021). This approach is designed to reduce potential bias in the processes of identifying, selecting, synthesizing, and summarizing results (Moher et al., 2015) and aligns closely with Torraco's (2016) framework for integrative reviews, particularly in its emphasis on methodological rigor and comprehensiveness. It was then developed in accordance with the guidelines for conducting systematic and integrative reviews of the Preferred Reporting Item for Systematic Reviews and MetaAnalyses (PRISMA) method (Steil et al., 2022), guided by the research question: How can digital leadership effectively promote digital transformation in organizations?

Torraco's (2016) five-phase framework was chosen as the methodological basis for this study because of its organized and methodical approach, which closely corresponds with the interdisciplinary and complex character of the research objectives. The framework provides a solid basis for conducting integrative reviews, facilitating the synthesis of information across several disciplines, and offering insights that connect theoretical and practical perspectives.

This framework is specially designed to tackle the primary inquiry of how leadership can effectively promote organizational digital transformation, as it offers a structured and methodical approach for performing an integrative review, allowing for a thorough synthesis of knowledge across various domains. The framework commences with the methodical articulation of the research challenge, guaranteeing that the investigation remains concentrated and cohesive. This step is essential for directing the following phases and ensuring consistency with the study's objectives. Torraco's methodology prioritizes the meticulous delineation of research sources, facilitating the identification of high-quality, peer-reviewed literature from reputable databases, including the Web of Science (WoS) and Scopus. This guarantees the integration of interdisciplinary perspectives from fields such as management, organizational psychology, and information technology, which are essential for examining the complex nature of leadership in digital transformation. The framework includes stringent selection criteria, enabling the identification of the most significant and pertinent studies while mitigating potential biases. The study guarantees the reliability and validity of the findings by implementing stringent inclusion and exclusion criteria. Torraco's technique prioritizes the comprehensive assessment and scrutiny of chosen works, facilitating a more profound comprehension of theoretical and empirical contributions. This evaluative phase strengthens the analysis and guarantees that the review is both thorough

and methodologically rigorous. The analytical synthesis step culminates in a cohesive integration of data, facilitating the identification of patterns, gaps, and links within the literature. This synthesis is crucial for connecting theoretical and practical viewpoints, offering new insights into the function of leadership in digital transformation. Torraco's framework is well suited for this study, since it combines methodological rigor with the necessary flexibility to investigate an interdisciplinary research subject, providing a solid foundation for enhancing understanding in this vital area.

Thus, of the three phases proposed by Torraco, this research utilized two in full: the formulation and the definition of research sources. These phases were chosen for their direct pertinence to the study's aims and the intricacy of the research subject. The principles of analysis, synthesis, and conclusion were interwoven throughout the research process, albeit not expressly applied as distinct procedures. The iterative examination of selected studies allowed for the identification of patterns, gaps, and connections, ensuring a rigorous and comprehensive review aligned with the study's aims.

Building on the formulation phase, search terms were defined during the planning stage to reflect the research problem comprehensively. The search terms were defined during the planning phase as follows: "Leadership" AND "Digital Transformation" OR "Technology Transformation" AND "Industry 4.0" AND "Digitization". The Boolean operator OR was employed to maximize the inclusion of studies relevant to the research theme. Similarly, the wildcard (*) was utilized to refine and broaden the search by capturing variations in the spelling of terms within the literature. It is important to highlight that these variations in search expressions fall within the same conceptual framework, as the meaning of a concept is inherently tied to its context. Furthermore, during the planning phase, it was determined that the specified terms would be applied to the "title," "abstract," and "keywords" fields, with no restrictions on time, language, or other criteria that might limit the scope of the results.

By employing Torraco's (2016) integrative review framework, this study underscores a commitment to methodological rigor and interdisciplinarity, which are crucial for examining complex issues like digital leadership and transformation. The intentional emphasis on the formulation and definition of research sources was motivated by the evolving nature of the research domain, guaranteeing that the fundamental steps were carefully executed to establish a reliable basis for subsequent analysis. While the remaining phases—analysis, synthesis, and conclusion—were not explicitly delineated, their principles were inherently included in the iterative processes of literature review and theoretical integration. This methodological approach boosts the study's transparency and replicability while demonstrating a balanced application of rigor and flexibility, aligning with the standards of high-impact academic research.

4. Discussion

The first phase, research formulation, involved articulating the central question that guides this study: *How can digital leadership effectively promote digital transformation in organizations?* To answer this question, a database search was carried out; the search began and ended in January 2025.

The second phase, defining research sources, established criteria for selecting the databases and studies. The Web of Science (WoS) and Scopus databases were chosen based on their recognized academic rigor, comprehensive interdisciplinary coverage, and robust indexing of peer-reviewed publications. The choice of the Web of Science (WoS) database and Scopus for the topic "Leading in the Digital Age" was based on criteria of relevance, comprehensiveness, and academic impact. These databases are widely recognized for their quality and rigor in the indexing process, which includes peer-reviewed publications

only, of high credibility, ensuring the reliability and validity of the sources used. Moreover, these databases have robust interdisciplinary coverage, encompassing areas such as management, information technology, organizational psychology, and social sciences, all of which are crucial for exploring the topic of digital leadership and its relationship with digital transformation. This breadth allows for a more comprehensive and rich analysis of the topic, facilitating the identification of relevant research in different contexts and perspectives. Another determining factor was the access to a vast number of articles and conferences with metrics such as citation counts, enabling the prioritization of studies with greater academic impact. The integration of fields such as "Title", "Abstract", and "Keywords" allows the delimitation of relevant terms, such as "Leadership" and "Digital Transformation", ensuring that the results reflect the state of the art on the subject.

To enhance transparency, replicability, and methodological rigor, the study adhered to the guidelines of the PRISMA-ScR checklist (Tricco et al., 2018). As shown in Figure 1, efforts were made to follow the steps outlined in the flowchart: identification, screening, eligibility assessment, and inclusion of articles.

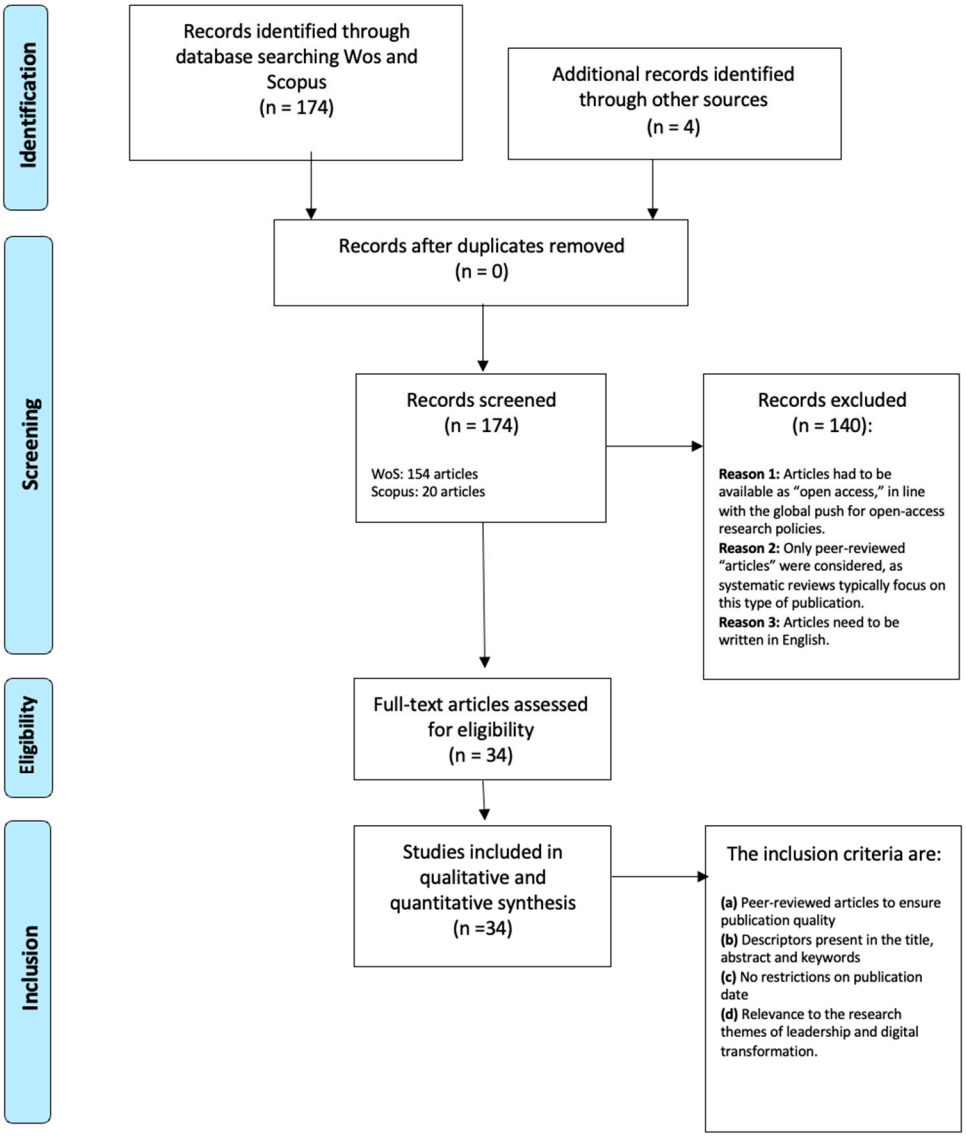

Figure 1. PRISMA fluxogram describing the research performed.

The PRISMA-ScR protocol follows a series of methodological steps, including defining and justifying eligibility criteria, outlining information sources, detailing the search strategy

across databases, explaining the data presentation process, and synthesizing the findings. Each of these steps is described below:

Step 1: Identification: During the identification phase, the search query utilized was "Leadership" AND "Digital Transformation" OR "Technology Transformation" AND "Industry 4.0" AND "Digitalization". The search process, conducted in January 2025, yielded 174 articles: 154 from the Web of Science (WoS) and 20 from Scopus.

Step 2: Screening: To include the largest number of relevant publications, three inclusion criteria were applied: (a) articles had to be available as "open access", in line with the global push for open access research policies, (b) only peer-reviewed "articles" were considered, as systematic reviews typically focus on this type of publication, and (c) articles need to be written in English in this stage, articles were screened by reviewing their titles, abstracts, and keywords, which resulted in 30 articles from the Web of Science and 4 from Scopus advancing to the next phase, leaving a total of 34 articles.

Step 3: Eligibility: The eligibility phase involved further analysis of titles and abstracts while cross-referencing data between databases to eliminate duplicates. After this screening, 30 articles from the Web of Science and 4 from Scopus satisfied the eligibility criteria, resulting in 34 articles for full-text evaluation.

Step 4: Inclusion: In the final step, all 34 articles were incorporated into both the qualitative and quantitative syntheses. According to PRISMA guidelines, there are no specific requirements regarding the minimum or maximum number of articles to be included. As highlighted by Moher et al. (2009), the review process identifies the available literature, and after applying eligibility criteria, the final number of articles reflects the filtered and relevant research.

The inclusion criteria were as follows: (a) peer-reviewed articles to ensure publication quality, (b) descriptors present in the title, abstract, or keywords, (c) no restrictions on publication date, and (d) relevance to the research themes of leadership and digital transformation. Conversely, exclusion criteria included the following: (a) books and conference proceedings, and (b) articles that did not align with the research objectives, articles lacking full access, either through the database, author correspondence, or alternative platforms like Google Scholar, ResearchGate, and Emerald Insight.

To answer the research question, "How can digital leadership effectively promote digital transformation in organizations?", 34 articles described in Table 1 were read and analyzed in depth. This analysis integrated theoretical and empirical contributions, identifying key patterns, gaps, and connections across the literature.

Table 1. Articles for analysis.

ID	Authors	Database	Article Title
1	Daxbacher et al. (2024)	WoS	Critical Success Factors in Digital Transformation Projects in the Brazilian Automotive Industry: A Qualitative Study
2	Ramadan et al. (2023)	WoS	Toward Digital Transformation and Business Model Innovation: The Nexus Between Leadership, Organizational Agility, and Knowledge Transfer
3	Gao et al. (2023)	WoS	Top Management Team Career Experience Heterogeneity, Digital Transformation, and the Corporate Green Innovation: A Moderated Mediation Analysis
4	Zulu and Khosrowshahi (2021)	WoS	A Taxonomy of Digital Leadership in the Construction Industry

Table 1. *Cont.*

ID	Authors	Database	Article Title
5	Rialti and Filieri (2024)	WoS	Leaders, Let's Get Agile! Observing Agile Leadership in Successful Digital Transformation Projects
6	Alieva and Powell (2023)	WoS	The Significance of Employee Behaviours and Soft Management Practices to Avoid Digital Waste During a Digital Transformation
7	Anna et al. (2022)	WoS	Model of State Support for the Digital Transformation of the Manufacturing Industry in Russian Regions
8	Wendt (2021)	WoS	Organized Futures. On the Ambiguity of the Digital Absorption of Uncertainty
9	Afzal and Panagiotopoulos (2024)	WoS	Coping with Digital Transformation in Frontline Public Services: A Study of User Adaptation in Policing
10	Hoeyng and Lau (2023)	WoS	Being Ready for Digital Transformation: How to Enhance Employees' Intentional Digital Readiness
11	Babkin et al. (2022)	WoS	Digitalization of Industry in Russia and Kazakhstan: The Best Practices
12	Alexopoulos et al. (2022)	WoS	Digital Transformation of Production Planning and Control in Manufacturing SMEs-The Mold Shop Case
13	Stefanovic et al. (2021)	WoS	Digitainability and Financial Performance: Evidence from the Serbian Banking Sector
14	Ehlers (2020)	WoS	Digital Leadership in Higher Education
15	Balcioğlu and Artar (2024)	WoS	The Evolutıon of Dıgıtal Leadershıp: Content and Sentıment Analysıs of the New York Tımes Coverage
16	Zeike et al. (2019)	WoS	Managers' Well-Being in the Digital Era: Is It Associated with Perceived Choice Overload and Pressure from Digitalization? An Exploratory Study
17	Ben Ghrbeia and Alzubi (2024)	WoS	Building Micro-Foundations for Digital Transformation: A Moderated Mediation Model of the Interplay Between Digital Literacy and Digital Transformation
18	Gutu et al. (2024)	WoS	The Limits of Learning Engagement and Academic Leadership Within the Higher Education Digitalization Process—Analysis by Using PLS SEM
19	Reuter and Floyd (2024)	WoS	Strategic Leaders' Ecosystem Vision Formation and Digital Transformation: A Motivated Interactional Lens
20	Sazonov (2022)	WoS	Development of Strategic Mechanisms for High-Tech Enterprises in the Digital Economy Environment
21	Lanzolla et al. (2021)	WoS	The Digital Transformation of Search and Recombination in the Innovation Function: Tensions and an Integrative Framework
22	Victorova et al. (2021)	WoS	The Interrelation between Digital and Tax Components of Sustainable Regional Development
23	Ukolov et al. (2021)	WoS	Adaptation to Digitalization as the Basis of State Management's Quality: A New Methodology Based on Industrial and Manufacturing Engineering and the Perspectives of Drones
24	Conceicao et al. (2023)	WoS	The Key Competencies for the Future of Work-A Bibliometric Study
25	Marnewick and Marnewick (2022)	WoS	Digitalization of project management: Opportunities in research and practice
26	Varbanova et al. (2023)	WoS	Industry 4.0 Implementation Factors for Agri-Food and Manufacturing Smes in Central and Eastern Europe

Table 1. *Cont.*

ID	Authors	Database	Article Title
27	Tagscherer and Carbon (2024)	WoS	Digital Servitization and Leadership: A Holistic View on Required Leadership Traits and Skills
28	Рахманов et al. (2024)	WoS	Quantitative Appraisal and Scientometric Exploration into the Digitization of Education
29	Aktaş et al. (2022)	WoS	Real-Time Data Analysis (RTDA) and Proposed Innovative Business Models: A Conceptual Study of the Tourism Industry
30	Liu et al. (2024)	WoS	The Future of digitalized Project Practices Through Data-Savvy Talent: A Digital Competence Formation Perspective
31	Senadjki et al. (2023)	Scopus	Unlocking the Potential: The Impact of Digital Leadership on Firms' Performance Through Digital Transformation
32	Hargitai and Bencsik (2023)	Scopus	The Role of Leadership in Digital Learning Organizations
33	Zaytsev et al. (2021)	Scopus	Building a Model for Financial Management of Digital Technologies in the Areas of Combinatorial Effects
34	Dold and Speck (2021)	Scopus	Resolving the Productivity Paradox of Digitalised Production

The analysis of 34 articles revealed that 22 adopted qualitative and quantitative approaches, 11 exclusively used qualitative analysis, and 1 applied content analysis. From the review and evaluation of the studies, two central themes emerged that were directly related to the main problem of this research: digital leadership and digital transformation. These categories will be described below.

4.1. Digital Leadership

Digital leadership is a crucial factor in driving digital transformation in organizations. According to Daxbacher et al. (2024), digital leaders require strategic vision, foresight, and technical competencies to address the complexities of the digital environment. These skills not only facilitate the adoption of new technologies but also positively impact financial performance, fostering innovation and a culture of continuous learning. Additionally, transformational leaders inspire teams to use their creativity and skills to innovate, establishing adaptive organizational cultures. Leaders in learning organizations play an essential role in training and developing digital skills, increasing readiness and confidence in the use of technologies related to Industry 4.0 (Ramadan et al., 2023). This support accelerates the adoption of digital tools and contributes to strategic alignment with technological innovations. In this sense, leaders who apply forecasting models and resource allocation strategies can identify investments that maximize organizational benefits (Gao et al., 2023). Leadership 4.0 requires flexibility and collaboration (Zulu & Khosrowshahi, 2021). A horizontal, team-oriented leadership style helps leaders tackle the complexities of the "productivity paradox", reducing gaps between digital strategies and operational implementation. Furthermore, Rialti and Filieri (2024) reinforce that innovative leadership is better prepared to solve technological challenges and explore new business models, aligning resources and organizational objectives with a digital future. Digital literacy emerges as a central element for successful digital transformation. According to Ehlers (2020), leaders who integrate digital literacy into strategic management strengthen organizational maturity, building solid foundations for technological adaptation and sustainable innovation. Conversely, Zeike et al. (2019) underscores the negative impacts of digital "overload" on the psychological well-being of managers, emphasizing the importance of balancing technological pressures with organizational support. In the educational context, digitalization requires new forms of academic leadership (Balcioğlu & Artar, 2024).

Approaches focused on engagement and digital inclusion create environments conducive to innovation and institutional performance. Academic leadership, when combined with digital technologies and transformational styles, stimulates positive changes and prepares institutions for future challenges. Adapting to the demands of the digital environment requires the development of specific competencies. Ukolov et al. (2021) demonstrate that leaders who integrate digital tools and agile methods enhance operational efficiency and collaboration, promoting a dynamic and resilient environment. Additionally, Tagscherer and Carbon (2024) emphasize the importance of training programs led by managers to prepare teams to face the demands of competitive and digitized markets. Finally, creating collaborative ecosystems is a strategic differentiator. According to Lanzolla et al. (2021), leaders who adopt integrative approaches align their organizations with the demands of digital ecosystems, fostering innovation and efficiency. Digital leadership, therefore, acts as a mediator between organizational capabilities and strategic objectives, directly influencing financial performance, resilience, and innovation in times of technological change (Senadjki et al., 2023). Hargitai and Bencsik (2023) emphasize that support for training and the development of digital skills increases organizational readiness and strengthens adaptive cultures. Visionary leaders who invest in collaborative and sustainable strategies, as described by Zaytsev et al. (2021), enhance digital transformation and align organizational resources with long-term goals. Moreover, integrating digital strategies with operational practices, eliminating gaps, and maximizing the benefits of technological investments are of paramount importance (Dold & Speck, 2021). In conclusion, digital leadership is an essential driving force for digital transformation, responsible for aligning strategies, fostering innovation, and preparing organizations for a competitive and sustainable future.

4.2. Digital Transformation

Digital transformation is a multifaceted process that combines technology, organizational culture, and strategic innovation. According to Daxbacher et al. (2024), it serves as a critical mediator between digital leadership and financial performance. Organizations that adopt sustainable practices and have leaders with advanced digital skills achieve greater operational efficiency and competitiveness, driving transformations in business models and sustainability. The digital readiness of the workforce is fundamental to the success of this process. A culture of digital trust helps overcome resistance, strengthens digital transformation initiatives, and establishes a solid foundation for innovation. Strategic planning also plays a central role. Leaders who use mathematical models to optimize resource allocation, as highlighted by Gao et al. (2023), maximize the benefits of digital technologies and accelerate organizational digitalization. This approach enables efficient resource utilization and rapid adaptation to the ever-evolving digital environment. The integration of horizontal and vertical processes within organizations is equally essential. According to Zulu and Khosrowshahi (2021), aligning corporate strategies with operations bridges the gap between strategic planning and execution, optimizing value chains and fostering impactful technological innovations. Moreover, external factors also influence digital transformation like public policies and institutional constraints that are key drivers for accelerating digitalization and creating sustainable digital ecosystems (Rialti & Filieri, 2024). Aligning internal strategies with these external elements positions organizations more competitively in the global market. Emerging technologies, such as IoT and predictive analytics, play a transformative role since these technologies are revolutionizing production cycles, enhancing operational efficiency, and driving innovation in industrial sectors (Babkin et al., 2022). Furthermore, Stefanovic et al. (2021) introduce the concept of "digitainability", demonstrating that companies combining digitalization with sustainability can improve their reputation and financial performance. In SMEs, challenges like

financial limitations hinder the full implementation of digital solutions (Alexopoulos et al., 2022). However, technologies such as cloud computing offer opportunities to increase organizational agility. Varbanova et al. (2023) emphasize that leadership is a decisive factor in overcoming these obstacles and ensuring competitiveness. In the education sector, digitalization is reshaping teaching methods and Balcioğlu and Artar (2024) highlight the need for investments in technology and teacher training to improve engagement and academic performance, preparing leaders for digital challenges. Similarly, Рахманов et al. (2024) demonstrate how the inclusion of digital technologies in educational systems expands access and effectiveness in crisis situations, such as pandemics. The integration of real-time data analytics is also transforming sectors like tourism. Aktaş et al. (2022) show that these tools create more agile and personalized business models, promoting collaboration among stakeholders. However, their effectiveness depends on leaders with clear vision and advanced digital skills. In the realm of project management, digitalization is redefining competencies and organizational structures (Liu et al., 2024). Investing in talent with analytical and digital skills is essential to effectively deal with the complexity of data-rich environments. Senadjki et al. (2023) highlight that a green organizational culture, mediated by digitalization, promotes innovation and sustainability by aligning technology with business objectives. Therefore, digital transformation demands robust strategies and alignment with emerging technologies and trust and continuous learning facilitate the adoption of Industry 4.0 technologies, ensuring competitiveness (Hargitai & Bencsik, 2023). Economic aspects are also central, and mathematical models have been proposed to optimize investments in digital technologies, assessing their financial and strategic impacts (Martynov et al., 2024). In the manufacturing sector, Dold and Speck (2021) demonstrate how digitalization can address productivity paradoxes by integrating technologies into operational processes and generating value through data-driven business models. Finally, digital transformation requires ongoing monitoring of its organizational implications. According to Zaytsev et al. (2021), creating robust economic models is vital for digital sustainability, providing practical tools for leaders to evaluate and adjust strategies in response to a constantly evolving market.

4.3. Driving Digital Transformation: The Role of Effective Digital Leadership

Drawing upon the findings of the integrative review it becomes clearer that digital leadership is a key element in shaping the success of digital transformation initiatives. Digital leadership goes beyond operational management, acting as a strategic facilitator that links technological progress with organizational goals while promoting resilience and adaptation. The findings indicate that digital leaders not only affect technological adoption but also instigate significant cultural and structural transformations within enterprises. An essential finding from the review is that digital leadership necessitates a mix between technical expertise and strategic vision. Leaders proficient in anticipating future challenges and opportunities can more effectively allocate resources to high-impact activities, hence improving organizational preparedness for digital transformation (Gao et al., 2023). This predictive method alleviates inefficiencies typically linked to the execution of digital strategies and guarantees coherence between technical investments and overarching business objectives. Effective leaders cultivate environments of trust and collaboration, allowing firms to surmount operational barriers that hinder transformation initiatives (Zulu & Khosrowshahi, 2021). The core of the topic is that digital leadership basically involves generating value by integrating technology with human talents. Leaders that emphasize the cultivation of digital literacy within their teams establish a basis for enduring innovation and operational flexibility (Ehlers, 2020). This investment in human capital not only expedites the integration of Industry 4.0 technology but also enhances

the organization's ability to adjust to a continually evolving technological environment. Zeike et al. (2019) cautions that the demands of constant technological involvement may result in management digital fatigue, underscoring the necessity of reconciling innovation with well-being. The review emphasizes the revolutionary potential of digital ecosystems. Leaders who adopt integrative strategies can align their corporate competencies with external networks, promoting collaborative innovation and mutual growth (Lanzolla et al., 2021). This approach puts businesses as active participants in extensive digital ecosystems, allowing them to adapt swiftly to alterations in regulatory and commercial conditions. Moreover, strategic alliances and collaborative networks assist in alleviating difficulties like resource scarcity, especially for smaller firms facing budgetary limitations in digital transformation. Moreover, proficient digital leadership necessitates a sophisticated comprehension of corporate culture and its significance in transformation. Leaders who cultivate adaptive cultures that prioritize experimentation and learning empower teams to investigate creative business models and surmount reluctance to change (Ramadan et al., 2023). This adaptability is essential in tackling the "productivity paradox," wherein the advantages of technology progress are not always evident in organizational performance (Zulu & Khosrowshahi, 2021). A frequently neglected aspect of digital leadership is the capacity to maneuver the convergence of digital transformation and sustainability. By integrating technical investments with sustainability principles, executives foster long-term business success and societal impact. This linkage boosts reputational capital and assures that technical breakthroughs promote both innovation and responsible progress (Rialti & Filieri, 2024). In this scenario, leadership transcends organizational boundaries, impacting wider societal and environmental results. In summary, the integrative review indicates that digital leadership is a complex and dynamic catalyst for digital transformation, merging technological potential with human and organizational competencies. Effective leaders integrate technical proficiency with strategic foresight, cultivating environments of creativity and adaptation while confronting the difficulties posed by technological advancement. By means of strategic resource allocation, ecosystem collaboration, and dedication to sustainability, digital leadership guarantees that companies stay competitive, resilient, and in accordance with the requirements of the digital age. This analysis underscores the essential role of leadership in managing the intricacies of digital transition, providing a basis for future research and practical implementation.

4.4. Practical Implications for Leaders

This integrative study highlights numerous actionable solutions for leaders seeking to implement effective digital transformation programs. Leaders are invited to prioritize the cultivation of digital literacy throughout the firm, ensuring staff possess the skills and confidence to properly adopt and utilize new technology. Systematic training initiatives, coupled with continuous assistance, can address skill deficiencies and improve workforce preparedness (Ehlers, 2020; Ramadan et al., 2023). Secondly, incentivizing a culture of collaboration and psychological safety is essential, as it promotes innovation and diminishes resistance to change. Leaders are welcomed to utilize horizontal leadership approaches to eliminate operational silos, hence promoting fluid cross-functional communication and decision-making (Zulu & Khosrowshahi, 2021). Third, it is imperative to balance technological adoption with employee welfare. Implementing strategies to mitigate digital weariness, including moderate workloads and supporting policies, can maintain long-term engagement and productivity (Zeike et al., 2019). Leaders should prioritize both technological advancement and sustainability, ensuring that digital plans are in harmony with overarching societal and environmental objectives. In doing so, they not only ensure organizational competitiveness but also establish their organizations as ethical

and progressive entities within their industry (Rialti & Filieri, 2024). These methods offer a framework for leaders to manage the intricacies of digital transformation, guaranteeing coherence between technological progress and organizational achievement.

5. Limitations and Future Research

This study, while comprehensive, has some limitations that should be acknowledged. Firstly, the integrative review methodology, although systematic, may have inherent biases due to the selection and interpretation of sources. The trusted WoS and Scopus databases, while extensive, may exclude relevant studies not indexed in these databases, potentially limiting the scope of the findings (Torraco, 2016). Secondly, the study's focus on digital leadership within the context of digital transformation may not fully capture the specificities of leadership in other contexts or industries. The rapidly evolving nature of digital technologies means that findings may quickly become outdated as new technologies and leadership strategies emerge (Schwarzmüller et al., 2018). Additionally, the study predominantly draws on literature from developed economies, which may not be entirely applicable to developing countries with different technological infrastructures and cultural contexts (Teichert, 2019). Thirdly, the qualitative nature of the integrative review means that the findings are interpretative rather than definitive. The lack of empirical data limits the ability to generalize the results across different organizational settings. Future research could benefit from quantitative studies that provide statistical validation of the proposed leadership frameworks and their impact on digital transformation outcomes (Zulu & Khosrowshahi, 2021). Future research should address these limitations by expanding the scope and methodology of studies on digital leadership and transformation. One promising area is the exploration of digital leadership in diverse cultural and economic contexts. Comparative studies between developed and developing countries could provide deeper insights/results into how digital leadership practices must be adapted to different environments (Benitez et al., 2022). Another important direction is the longitudinal study of the impact of digital leadership. Given the fast-paced nature of technological change, longitudinal research could track the evolution of digital leadership practices and their long-term effects on organizational performance and employee well-being (Zeike et al., 2019). This approach can help us to understand the sustainability of digital transformation initiatives over time. Moreover, future studies should incorporate mixed methods approaches to combine the depth of qualitative insights with the generalizability of quantitative data. This may involve case studies, surveys, and experimental designs to test the effectiveness of different digital leadership strategies in various organizational contexts (Rakovic et al., 2024). Also, there is a need for research on the ethical implications of digital leadership. As digital technologies become more integrated into organizational processes, leaders must cross complex ethical issues related to data privacy, cybersecurity, and the digital divide. Investigating how leaders can ethically manage these challenges will be important for the responsible implementation of digital transformation (Cheng et al., 2024). In this sense, future research can provide a more comprehensive understanding of digital leadership and its role in driving successful and sustainable digital transformation. Therefore, this study contributes to opening this discussion, helping us understand the challenges and opportunities we are facing and those we are about to face. With the advent and development of digital media, including reels on social media and other videos, citizens and workers, in general, are becoming more used to and trusting of digital interactions. The challenge is to generate that trust and avoid the obvious pitfall of being confused with fake news or other disinformation. Collaborators are looking for sincere digital leadership, and it may be worthwhile to coach and train them for added awareness of the pitfalls of being digitally connected—at all levels of the organization—from top to bottom. In this way, the

digital transformation may reap the benefits it has set out to achieve and that leadership seeks. Future studies would do well to also focus on these aspects of digital change. These issues are, to date, and due to the novelty involved with the recent and increasing digital transformation we are witnessing, and taking part in, still under-researched.

6. Concluding Remarks

A danger of the advancement of technology is, as Harari (2024) has predicted, a societal regression in human capacity due to an overreliance on artificial intelligence, among others, and perhaps new and unpredictable power given to something we cannot control. It will be up to human beings to show that these predictions are not well founded and that we will rise to the occasion and use technology to our benefit. Technology may indeed elevate standards of living generally, across the board, although we are living in times of war and aggression rather than focusing on improving quality of life, at present. Never, we may say, has leadership been so important and crucial as in the digital age. It will be [superior] leadership that will determine how we fair as a species—annihilation or progression towards God-like status? Only time will tell.

Similarly, of course, at the lower organizational level, a temptation may be to forego investing in human capital to use machines and AI. AI may hence take on jobs to date given to human beings. This will subtract from and diminish human capital creation. It will be up to individual leaders—charged with creating value—to collaborate with their peers and to ensure progress due to the omnipresence of technology, and not the opposite.

In his treatise on leadership, Kissinger (2022) had already made reference to change and to the explosion in technology, regarding communication but also weapons. The recent phenomena that social media and the Internet have in general also changed the landscape, making it more visual, moving away from the era of print, and thus bringing more emotion to all that surrounds us (Kissinger, 2022). Leaders must be aware that "the Internet makes news and data more immediately accessible than ever", adding responsibility to those working in communications but also to those who lead, due to the added transparency and threat of over-exposure—in all respects and to different publics—just a click away. This surplus of data and information, Kissinger (2022) argues, has not made us wiser as individuals, and certainly has been detrimental to our memories, due to the ease of accessing information (Kissinger, 2022). Nothing like hardship and challenge to kinder the human spirit? To a degree, certainly.

The technological powers, including television and social media, "rely on images that inflame the passions, threatening to overwhelm leadership with a combination of personal and mass emotion" (Kissinger, 2022, p. 407). Leaders must be aware of or suffer the consequences of an emotional marketplace.

Finally, Acemoglu and Johnson (2023), two of the three Nobel Prize winners in Economic Sciences, in 2024, also wrote on the relationship between human beings and technology over time. Technology is not something new, and we have been having a thousand-year struggle with it, they state. Certainly, in all settings, technology may broaden rather than lessen the divide between the masses and the elites. It will be up to leadership to level the playing field and bring technology to all for shared prosperity—whether within or outside the organizations in which we circulate and make our livelihoods. Increased inequality? Democracy with less and less participation? These are failures we cannot afford if one is to deem leadership a success and key to our futures.

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