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Review Article

Leadership in the age of artificial intelligence

Yapay zeka çağında liderlik

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Abstract

Guiding others and creating one's own representation have been enduring desires of humanity since its inception. With the establishment of the field of artificial intelligence (AI) in 1956, humankind moved one step closer to realising this aspiration. Today, AI demonstrates superiority over humans in narrow domains; however, is humanity ready to delegate the uniquely human ability to lead others to AI? This question remains a significant and ongoing debate in the literature. This study examines the transformation of leadership in the AI era in light of this question. The literature review revealed two main themes: AI-supported leadership and AI leadership. AI-supported leadership reflects the widely accepted leadership model in the literature. It is explored under two subdimensions: AI's contributions to leadership roles and the skills and responsibilities of human leaders in the AI era. In contrast, AI leadership, which currently has limited support in the literature, is discussed within the framework of ongoing debates. This study is significant because it examines AI-supported leadership across multiple dimensions and presents current discussions on AI leadership.

Keywords: Artificial Intelligence, Leadership, AI-Supported Leadership, AI Leadership

Jel Codes: M12, O33, M14, D83

Öz

İnsanları yönlendirmek ve kendi temsilini yaratmak, insanlığın var olduğundan beri vazgeçemediği arzular olmuştur. 1956 yılında yapay zekâ disiplininin kurulmasıyla insanlık, bu hayaline biraz daha yaklaşmıştır. Günümüzde yapay zekâ, dar alanlarda insana üstünlük sağlayabilmektedir; fakat insan, insanları yöneltebilme becerisini yapay zekâya devretmeye hazır mıdır? Bu soru, günümüzde literatürde süregelen önemli bir tartışmayı oluşturmaktadır. Bu çalışma, bu sorunun ışığında yapay zekâ çağında liderliğin dönüşümünü incelemektedir. Yapılan literatür incelemesi sonucunda ortaya çıkan iki ana tema, yapay zekâ destekli liderlik ve yapay zekâ liderliği olarak belirlenmiştir. Yapay zekâ destekli liderlik, literatürde yaygın olarak kabul gören liderlik modelini yansıtmaktadır ve bu tema, yapay zekânın liderliğe katkıları ile yapay zekâ çağında insan liderlerin beceri ve sorumlulukları başlıkları altında ele alınmıştır. Diğer yandan, literatürde henüz sınırlı sayıda destekçisi bulunan yapay zekâ liderliği, mevcut tartışmalar çerçevesinde değerlendirilmiştir. Bu çalışma, yapay zekâ destekli liderliği kapsamlı boyutlarıyla incelemesi ve yapay zekâ liderliği üzerine yapılan güncel tartışmaları sunması açısından önem taşımaktadır.

Anahtar Kelimeler: Yapay Zeka, Lderlik, Yapay Zeka Destekli Liderlik, Yapay Zeka Liderliği

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Introduction

The question posed by Alan Turing in 1950, "Can machines think?", is regarded as one of the most significant milestones in the field of artificial intelligence (Turing, 1950). This question, along with the Turing Test that followed, laid the foundation for debates on the extent to which a machine can mimic human intelligence. Shortly after this, in 1956, at the Dartmouth Conference, the discipline of artificial intelligence was formally established on the assumption that all aspects of human intelligence could be imitated by a machine (McCarthy, Minsky, and Shannon 2006). Since then, although the initial goal has not been fully achieved, artificial intelligence technologies—through advances in machine learning, natural language processing, and robotic process automation—have been increasing efficiency and effectiveness in organisations, thereby providing them with a significant competitive advantage (Brynjolfsson and McAfee, 2014). This transformation is not only technological but also brings about a paradigm shift. Concepts closely tied to human identity, particularly leadership, now require re-evaluation in the age of artificial intelligence.

This transformation also brings along various challenges and new debates. One of the major issues concerns the extent to which AI will take over tasks traditionally performed by humans. To what degree can AI become human-like? Which characteristics are uniquely human? Which of these traits can AI assume, and to what extent? These and similar questions remain highly relevant in contemporary discussions.

One of the most prominent human-centred roles in business is leadership. Leadership can be defined as a combination of hard skills, which cover traditional management functions, and soft skills, which involve human relations, communication, and motivation (Xiong, 2022). While hard skills are more prone to automation, delegating soft skills to AI remains a controversial issue today (Skórnóg, 2024). A review of the literature shows that studies in this area seek to answer questions such as: "Can AI be a leader?" "What qualities should human leaders possess in the age of AI?", "What are the effects of AI on leadership functions?", and "In what direction will the concept of leadership evolve in the future?"

This study aims to conceptually examine the transformation of leadership in the age of artificial intelligence. For this purpose, a narrative synthesis approach was adopted to allow for a broader theoretical exploration. Based on a review of the literature, two main themes have been identified: AI-Supported Leadership and AI Leadership. The first explores how AI contributes to leadership processes and the skills human leaders need to acquire, while the second addresses whether AI can directly assume leadership roles. The study is expected to contribute to ongoing debates in this field and provide a foundation for future research.

Artificial intelligence and leadership

Since the beginning of human existence, individuals have carried both the desire to represent themselves and the urge to influence others. This journey of representation, which began with cave paintings, has evolved alongside the emergence of tools, machines, and, ultimately, artificial intelligence (McCorduck, 2004). The power to influence others, on the other hand, has often been sought in leadership styles shaped by individual traits, behavioural tendencies, and situational conditions (Northouse, 2016). In the end, humans have never abandoned either the urge to self-express or the desire to influence others.

The collaboration between humans and artificial intelligence has manifested in various forms throughout history. What began merely as an imagined possibility has gradually transformed into a tool and cognitive extension of humans (Ünal, 2023). At the 1956 Dartmouth Conference, where the term artificial intelligence was first coined, and systematic studies in the field were launched, McCarthy and his colleagues' main goal was to create a machine capable of imitating all aspects of the human mind (McCarthy et al., 2006). While this ambitious vision was highly exciting, it also sparked numerous criticisms and concerns. Was it possible for humans to lose their dominance on earth to artificial intelligence?

Although this vision has not yet been fully realised, AI has achieved remarkable success against humans by outperforming them in narrow domains. Narrow AI applications, which are designed to perform specific tasks and imitate only a limited portion of human intelligence (Russell and Norvig, 2010), provide the most tangible examples of such achievements. One of the most notable examples in this field is AlphaGo's victories over the European and World Go champions. The game of Go is considered highly complex for AI as it requires advanced strategy, intuition, and creativity. AlphaGo, which was developed based on deep neural networks, was trained through supervised learning by analysing the games of human experts and through reinforcement learning by playing against itself. As a result,

AlphaGo defeated the European Go champion in 2015 and the World Go champion in 2016 (Silver et al., 2016; Silver et al., 2017).

Its successor, AlphaGo Zero, trained itself solely by learning from games it played against itself, without any human expert intervention (Silver et al., 2017). This breakthrough demonstrated AI's ability to solve complex problems without human guidance. Compared to other strategic games such as chess, Go is far more complicated, requiring intuitive and creative moves. This makes it particularly significant in the field of AI (DeepMind, 2016; DeepMind, n.d.). Therefore, AlphaGo's success serves as strong evidence that AI is no longer limited to computation alone but has begun to penetrate areas once considered uniquely human.

Another major development that has kept AI in the spotlight and increased its popularity is generative AI technologies. These technologies attracted massive attention, particularly after OpenAI released ChatGPT to the public in 2022. Within just two weeks, ChatGPT reached 100 million users, breaking a record (Obrenovic, Gu, Wang, Godinic, and Jakhongirov, 2024). ChatGPT is a language model designed to generate human-like responses by analysing vast datasets (Menon and Shilpa, 2023) and is regarded as a milestone in the history of generative AI (Alawida, Abu Shawar, Abiodun, Mehmood, Omolara, and Al Hwaitat,2024). Unlike most existing AI systems, which generally make predictions based on past data, generative AI stands out for its ability to produce original content (İşgüzar, Fendoglu, E., and Şimşek 2024). In this sense, it goes beyond traditional AI applications and is expected to deliver significant economic contributions to business, particularly in knowledge management and creativity (Huang, Grady, and GPT-3, 2022). Generative AI applications are used in many areas critical to leadership activities, such as knowledge creation, sharing, and interpretation; decision support systems; facilitating communication processes; supporting organisational learning; and enhancing creativity (Storey, 2025; Tabata, Wildermuth, Bottomley, and Jenkins, 2025).

As AI begins to cross the boundaries of human capability, its impact is also emerging in the leadership literature. One of the first researchers to address AI's involvement in top management was Clark Holloway. In his 1983 article, he asked: "How and when do we expect a supercomputer to share or take over the functions of a corporate CEO?" (Holloway, 1983, p. 89). Another key point highlighted in his article was that computers were beginning to enter the realm of the brain associated with intuition, imagination, and creativity—the "right hemisphere." Given that personal computers were spreading at the time, Holloway's ideas can be regarded as highly visionary.

While Holloway (1983) argued that computers were beginning to enter domains considered uniquely human, contemporary scholars still maintain that these areas remain exclusively human and cannot be taken over by AI in the near future. On the other hand, some perspectives label such scholars, who insist that leadership is inherently human, as "romantic" (e.g., Quaquebeke and Gerpott, 2023). This study positions itself at the intersection of these perspectives, aiming to examine both AI-supported leadership and AI leadership viewpoints.

Current research on AI and leadership reveals that traditional approaches to leadership are increasingly insufficient and that the skills and responsibilities required for leadership are undergoing transformation (Smith and Green, 2018; Peifer, Jeske, and Hille, 2019). AI affects every aspect of life far more deeply and comprehensively than other technologies (Heukamp, 2020), leading to fundamental changes in the definition of leadership itself (Xiong, 2022).

Leadership has been defined in different ways throughout history. According to Northouse (2016), scholars and practitioners have attempted to explain leadership for over a century, yet no universal consensus has been reached. Although various elements (traits, behaviours, processes, etc.) have come to the forefront in the leadership literature at different times since the 1900s, four common components stand out in leadership definitions: (1) group, (2) influence, (3) common purpose, and (4) process. Within this framework, leadership is a dynamic process in which individuals influence one another to achieve a shared goal.

The debates surrounding AI and leadership focus on whether the "soft skills" of leadership—such as listening, team building, adaptability, and emotional intelligence—traditionally seen as uniquely human (Xiong, 2022) —can eventually be performed by AI. According to Skórnóg (2024), a traditional leader not only makes operational decisions (hard skills) but also builds relationships with employees, develops them, and shapes organisational culture (soft skills). The prevailing view in the literature is that such skills are inherently human, and while AI may support leadership, it cannot fully assume leadership responsibilities (e.g., Antonescu, 2018; Torre, Teigland, and Engstam, 2019; Heukamp, 2020; Tîrnăcop, 2023). This perspective aligns with the human-centred approach of Industry 5.0 and is also associated with contemporary leadership styles, such as holistic, collaborative, hybrid, and shared

leadership (Hwang, 2024). A less common perspective, however, argues that AI may replace human leaders in the future (e.g., Holloway, 1983; Quaquebeke and Gerpott, 2023). According to Quaquebeke and Gerpott (2023), there is not yet a sufficiently rich academic discussion of AI leaders potentially replacing human leadership in corporate governance and beyond.

There is no consensus on how leadership should be defined in the age of AI or under which type of leadership it should be categorised. In this regard, Titareva (2021) and Quaquebeke and Gerpott (2023) have attempted classifications. Titareva (2021), after reviewing studies on leadership in the age of AI, identified three main perspectives: (1) Enhancement, (2) Replacement, and (3) Sceptical approach. From an enhancement perspective, leadership will not fundamentally change; instead, AI will support existing leadership functions. In this view, human leaders and technology collaborate to form a partnership. In the replacement perspective, AI has the potential to take over the roles of leaders and followers; machines will assume not only managerial tasks but also decision-making functions. According to the sceptical perspective, it is still too early to claim that AI will entirely replace human decision-makers; indeed, some argue that AI can never fully replace human leadership.

Quaquebeke and Gerpott (2023) analysed leadership in the digital age by dividing it into three phases: (1) The Now of leadership, (2) The New of leadership, and (3) The Next of leadership. According to the authors, in current leadership, technology merely transfers traditional leadership into digital environments. Although leadership functions are carried out through digital channels, it is still humans who initiate these processes. The second category, "New Leadership," shows similarities with Titareva's (2021) "Enhancement Perspective." This approach focuses on how algorithms support or enhance leadership. The innovation in leadership here is that AI becomes a "partner" in leadership. In this co-leadership model, AI contributes not only to traditional leadership functions but also to communication, creativity, and the development of soft skills. Quaquebeke and Gerpott emphasise that this model has not yet been implemented in the vast majority of organisations. The third category they identify is "The Next of Leadership." In this phase, AI will assume leadership roles, not only enhancing communication but also addressing three core human needs: autonomy, competence, and relatedness. This projection by Quaquebeke and Gerpott diverges from the dominant perspective in the literature.

Other studies in the literature highlight a leadership approach in which AI supports and enhances human leaders, placing human-machine collaboration at the centre. The next section will examine this leadership type in detail.

Artificial intelligence-supported leadership

Artificial intelligence-supported leadership refers to artificial intelligence supporting human leaders at various levels in performing leadership functions. Most studies in this field examine this type of leadership within various conceptual frameworks. In the literature, AI-supported leadership is also referred to as collaborative leadership, digital leadership, Leadership 4.0, co-leadership, hybrid leadership, or shared leadership (e.g., Titareva, 2021; Quaquebeke and Gerpott, 2023; Hwang, 2024; Skórnóg, 2024).

Hwang (2024) defines "hybrid leadership" as a model in which artificial intelligence serves as an advisory role, while human leaders contextualise and make decisions. Titareva (2021), on the other hand, evaluates this type of leadership within the "Enhancement Perspective" and emphasises that artificial intelligence supports existing leadership functions. In this approach, human leaders and technology come together to form a new model of collaboration. Even though technology transforms business processes and organisational culture, the need for human leaders continues. Tîrnăcop (2023) argues that a holistic leadership approach that combines artificial intelligence with traditional human-centred methods is the most effective way to develop emotional intelligence.

Xiong (2022) has stated that artificial intelligence can perform administrative tasks more efficiently and quickly by approaching leadership through two components. Today, artificial intelligence is an effective tool for performing repetitive, mechanical tasks such as data analysis, strategic planning, and design. These functions constitute the "hard" elements of leadership. In contrast, "soft skills" such as listening, team building, and adaptability are considered uniquely human. Xiong's leadership approach parallels Quaquebeke and Gerpott's (2023) "The New of Leadership" classification.

Skórnóg (2024) defines technology-enabled leadership as "Leadership 4.0" in relation to developments in Industry 4.0. Leadership 4.0 brings a new perspective to the role of technology in leadership. Artificial intelligence contributes to leadership by increasing productivity, enabling employees to focus on more meaningful tasks by automating repetitive work, and strengthening employee engagement by providing personalised training recommendations. However, there are some reservations about

completely delegating leadership to artificial intelligence. These concerns revolve around human-centric soft skills such as building relationships with employees, motivating them, developing them, and shaping organisational culture. Skórnóg also highlights the sustainability-focused dimension of Leadership 4.0, which integrates social and environmental goals alongside economic objectives.

The author has also examined the potential of artificial intelligence to replace human leaders in businesses through empirical research. According to a survey of employees at different levels across 168 firms, most of which operate in the manufacturing sector, differences in perceptions of artificial intelligence are closely related to business size. In large businesses, where soft skills are as critical as technical skills for management, artificial intelligence is used more as a tool to support leadership. In contrast, the simpler structure of small businesses makes it easier for employees to accept artificial intelligence's leadership roles. In small and medium-sized companies, artificial intelligence takes on some of the leader's responsibilities, particularly in data-driven operations and tactical decisions.

In the literature, the effects of the Industry 5.0 vision are seen in definitions of AI-supported leadership. Industry 5.0 is a human-centred approach that combines human intelligence with machine efficiency and precision in production (Martini, Bellisario, and Coletti, 2024). According to this approach, artificial intelligence should not replace human skills; rather, it should enhance them (Pago, 2024). According to Xiong (2022), artificial intelligence will redefine leadership in the future and collaborate with human leaders. Hwang (2024) emphasises the importance of adopting a collaborative leadership style that combines human judgment with artificial intelligence skills, particularly in high-risk sectors such as healthcare, finance, and aviation.

As a result of the literature review, it has been determined that AI-supported leadership has become a reality in the business world and is generally accepted by authors. AI has the potential to influence leadership at various levels in the short and long term; however, there are differing views on whether AI will completely take over leadership roles and responsibilities, including leadership's soft skills. From a human-centred perspective, the human element must always be present in leadership roles. In contrast, some minority views argue that artificial intelligence will dominate leadership in the future and even completely take over leadership roles. In this context, the following sections will first examine the contribution of artificial intelligence to leadership roles within AI-supported leadership, as well as the skills and responsibilities of human leaders in the age of artificial intelligence. Then, the general concept of artificial intelligence leadership will be examined.

The contribution of artificial intelligence to leadership roles

Artificial intelligence is a field of computer science that aims to develop systems and machines capable of performing tasks that require human intelligence (Martini et al., 2024). More broadly defined, it is a technology that collects and interprets information; identifies and names patterns; produces predictions and results; evaluates and improves its own performance; and can issue commands to other systems and agents (Quaquebeke and Gerpott). Deep learning, machine learning, data analytics, forecasting, and natural language processing are among the artificial intelligence technologies widely used in the business world (Dwivedi, 2025). Although the intelligence provided by artificial intelligence applications has a powerful impact on productivity, it remains at the level of artificial narrow intelligence (Heukamp, 2020). Therefore, it does not pose a threat to humanity by taking over all leadership roles today, but it can support leadership roles (Titareva, 2021).

One of the most frequently cited contributions of artificial intelligence is that it increases productivity by automating routine, repetitive tasks, thereby providing human leaders with more time for strategic thinking and creative decision-making (Antonescu, 2018; Xiong, 2022; Paudel, 2024; Dwivedi, 2025). Its ability to analyse large datasets enables it to provide leaders with predictive insights and improve human decision-making processes (Hwang, 2024). Thanks to AI analytics, leaders can make more accurate, data-driven decisions rather than relying on intuition; it also acts as a catalyst, strengthening teamwork and communication, and providing leaders with feedback and personalised training to help them prepare for the future (Pago, 2024). With artificial intelligence taking on managerial tasks, human leaders can focus on providing better leadership to their employees (Peifer et al., 2022).

Artificial intelligence has certain limitations in addition to the contributions it provides. These limitations include a lack of emotional intelligence (Paudel, 2024), disregarding emotional factors in decision-making processes (Xiong, 2022), a tendency to learn and process information independently of context (de Cremer, 2020), and inadequacies in providing motivation, inspiration, and building trust (Skórnóg, 2024). These limitations, along with the human-centred perspective, reinforce the view that artificial intelligence should continue to be positioned as an assistant or co-leader alongside humans in the future.

Although emotional intelligence is seen as an obstacle to AI-supported leadership, there are also views that AI can be used to support emotional intelligence. According to Dwivedi (2025), the collaboration between AI and emotional intelligence offers an important opportunity to improve business effectiveness and decision-making processes. For example, AI can analyse data to provide insights into employees' strengths, team dynamics, and areas for improvement. This gives leaders a deeper understanding of employees' emotional states, stress factors that negatively affect performance, and participation levels. In addition, artificial intelligence algorithms can predict how a particular decision will affect team morale and cohesion, helping leaders make more inclusive and thoughtful decisions. Dwivedi also emphasises that leadership development programs can be supported by artificial intelligence. Virtual reality and simulation technologies contribute to leaders' emotional management skills. Artificial intelligence facilitates the leader's ability to follow meetings, increase interaction with team members, and prepare presentations by providing instant results and feedback. Natural language processing algorithms contribute to the development of emotional intelligence skills by analysing tone of voice, speaking style, and facial expressions. This enables leaders to strengthen communication with their teams, motivate employees, and make more inclusive decisions.

Quaquebeke and Gerpott's (2023) "The New of Leadership" approach is also important for demonstrating how artificial intelligence develops soft skills in leadership. The authors' approach defines a leadership model in which artificial intelligence accompanies humans as a partner or co-leader. According to this perspective, artificial intelligence supports relationship-oriented and change-oriented leadership. Amber, a chatbot, is cited as an example of an AI application that develops relationship-focused leadership. Based on automated emotion analysis, Amber provides leaders with insights into employee experiences and recommendations for intervention via a dashboard. According to Quaquebeke and Gerpott, an algorithm can scan emails and provide suggestions on how a human leader can respond in a more empathetic, guiding, and proactive manner. Similar applications are currently used in dating apps.

The authors associate change-oriented leadership with the ability to develop an engaging vision for employees, exude charismatic energy and enthusiasm, and argue that creativity and inspiration are not unique to humans. They support this view by citing the example of YuMi, a collaborative robot developed by ABB, which performed with the Lucca Philharmonic Orchestra alongside Italian tenor Andrea Bocelli in 2017 (Reuters, 2017). This example is presented as a symbolic illustration of how robots can support human creativity. Quaquebeke and Gerpott also note that software such as AIVA, WavTool, and Jukebox can generate melodies that inspire artists.

According to the literature review, artificial intelligence applications support leaders in performing various management functions and may even help develop human leaders' soft skills. However, for artificial intelligence to be used effectively in businesses, human leaders also have certain responsibilities. The next section will discuss the skills human leaders need and the responsibilities they must assume in the age of artificial intelligence.

The characteristics and responsibilities of human leaders in the age of artificial intelligence

The increasing use of artificial intelligence in the business world is radically transforming the concept of leadership. In this transformation process, human leaders must guide both employees and artificial intelligence systems, while also developing new standards in communication, ethics, and control (Smith and Green, 2018). Traditional leadership approaches are insufficient to meet these new tasks and responsibilities. The requirements of the AI era demand different skills and roles from leaders. Based on a literature review, the fundamental skills and responsibilities that human leaders must possess in the AI era have been examined under five headings.

(1) Artificial intelligence literacy

(2) Human-centred perspective

(3) Ethical leadership

(4) Formulating strategic vision

(5) Change management and building culture

Artificial intelligence literacy

Artificial intelligence literacy is one of the most emphasised leadership skills in the literature. In the age of artificial intelligence, leaders are expected to have command of technology, understand AI systems, and evaluate the effects of these technologies on the organisation (Paudel, 2024). Data, the main component of AI systems, is critical to their proper functioning. Leaders should be able to obtain the

necessary, high-quality data to sustain operations and understand how the data is processed (Heukamp, 2020; Peifer et al., 2022).

Managing and supervising AI operations has become one of the most important responsibilities of today's leaders (Torre et al., 2019). In this context, AI systems need to be transparent and interpretable, and the leader is expected to understand how the technology works and to convey its contributions to the organisation to team members (Xiong, 2022; Krishnan, 2024). Therefore, leaders need to have at least a basic level of knowledge about AI. According to Heukamp (2020), the leader should be able to ask the right questions of AI, evaluate the answers, and even develop analytical skills to the level that enables understanding of complex systems such as deep learning.

Human-centered perspective

Another widely accepted view in the literature is that leaders should have a human-centred perspective. The vision of Industry 5.0 has significantly influenced the spread of this view. Martini et al. (2024) state that Industry 5.0 was developed to overcome the challenges encountered in Industry 4.0 and aims to meet societal needs by placing humans at the centre. In line with this vision, a human-centred perspective advocates creating AI systems that do not replace human skills but enhance them. It also emphasises that humans should be involved in all processes, from the planning to the construction and implementation of AI (Martini et al., 2024). According to Uddin (2023), the human-centred AI approach is also of great importance for ensuring employee well-being in businesses that use AI.

A human-centred perspective also defines the framework of human–machine collaboration. A healthy division of roles between AI and humans can increase both organisational performance and employee satisfaction. For example, Peifer et al. (2022) state that as AI takes over various managerial tasks, the human leader can devote more time to demonstrating employee-centred leadership. This allows more room for humans in the realm of soft skills, where AI remains insufficient. According to Tîrnăcop (2023), a holistic approach that combines AI capabilities with human-centred methods will be the most effective way to develop emotional intelligence.

In addition, maintaining balance in AI–human collaboration is critical. According to Hwang (2024), leaders must strike a balance between using AI as a tool and over-controlling it. AI should support employees rather than replace them, and the leader should instil trust in employees regarding the use of technology (Krishnan, 2024).

Ethical leadership

For a human-centred perspective to take root and for human–AI collaboration to be effectively sustained, ethical leadership emerges in the literature as a fundamental responsibility that leaders must apply with great sensitivity. In today's organisations, AI makes significant contributions such as increasing productivity and efficiency, enabling human employees to focus on more meaningful tasks by automating routine and repetitive work, and taking on some administrative–managerial functions so that leaders can devote more time to their soft skills. However, alongside all these benefits, ethical concerns and risks regarding AI also come to the forefront, occupying an important place in the literature.

Organisations face various challenges in the use of AI, such as algorithmic bias, data security, ethical and moral issues, transparency in algorithms, protection of personal privacy, and the extent to which responsibility should be assigned to AI (Xiong, 2022). Therefore, ethical leadership is of great importance in upholding the principles of fairness, accountability, and openness (Uddin, 2023). The leader should know how to leverage AI, question its outputs, and relate them to real business situations (Heukamp, 2020). In addition, leaders should develop ethical frameworks to ensure the responsible and ethical use of AI (Paudel, 2024).

According to Hwang (2024), incomplete or incorrect data may cause AI to produce inaccurate outputs; therefore, leaders should not trust AI unconditionally. This situation may weaken interpersonal connections, especially in sectors such as healthcare, where empathy and human relations are critical. AI may fall short in dealing with moral and complex issues; therefore, human oversight and supervision are of great importance (Hwang, 2023).

In conclusion, in the age of AI, ethical leadership stands out in the literature as a highly significant responsibility. Leaders should adopt a human-centred perspective, establish ethical frameworks, and lead the embedding of an ethical culture within organisations. Furthermore, a leader profile that can think critically and assume a supervisory role is key to this process of technological transformation.

Formulating strategic vision

A prominent view in the literature is that human leaders will continue to bear the responsibility for determining the organisation's direction. According to Quaquebeke and Gerpott (2023), motivating and communicating with people to guide them toward organisational goals is a typical leadership feature. It falls within a safe domain that AI cannot take over. The authors state that AI, through its pattern recognition, is used to provide recommendations for the strategy development process in organisations; in the future, it may have the potential to offer suggestions on areas leaders should focus on and on team dynamics. However, at present, the superiority of human leaders in strategic direction-setting continues.

Torre et al. (2019) also support the view that AI cannot replace boards of directors. Nevertheless, for leaders to be effective, they need to understand and manage AI strategically. In this context, leaders should help organisations identify opportunities, manage data effectively, and promote innovation through AI.

According to Canton (2019), the effective leader in the age of AI is the "future smart leader." These leaders are individuals who can anticipate today's trends, such as sustainability and AI, and integrate these opportunities into their strategies. By asking the right questions, they can detect signals of new trends early and thus build forward-looking, highly adaptive organisations.

In the age of AI, leaders should be able to set clear goals and articulate a vision and strategy for its use. Accordingly, they need to understand the technology, grasp its organisational impacts, and assess the feasibility of AI initiatives (Davenport and Fauty, 2018; Paudel, 2024). One of the important qualities leaders should possess is the ability to distinguish what is beneficial and acceptable for the organisation—namely, having advanced judgment and common sense (Heukamp, 2020).

According to Martini et al. (2024), a human-centred approach is an important factor leaders should consider when developing a business strategy. This approach, inspired by Industry 5.0's goals, supports human centrality and the fulfilment of societal needs. The authors argue that this perspective requires a new type of entrepreneur who is sensitive to innovation, capable of identifying new opportunities for sustainability, and able to work in harmony with the sectoral ecosystem and public and private institutions. In this context, leaders need to integrate not only technological developments but also human-centred values, transparency principles, and stakeholder participation into strategic decision-making processes (Peifer et al., 2022).

The literature review highlights a leader profile that embraces a participatory and inclusive management approach, is prudent, and is future-oriented. It also emphasises that human leaders will continue to guide organisations. An effective leader should create a clear, explicit vision and be able to share it with followers. In strategic direction setting, it is necessary to consider not only developments in AI technologies but also key factors such as sustainability, human-centred approaches, and stakeholder participation.

Change management and building culture

One of the most important skills for leaders in the age of AI is managing change and building a culture that sustains this change. At this point, the leader needs to develop and effectively use the soft skills where AI is still weak (Xiong, 2022). According to Krishnan (2024), an effective leader is empathetic, communicates effectively with people, alleviates concerns about AI, and supports employees in using AI appropriately. The leader's coaching approach will make an important contribution by reducing stress associated with the change process and increasing employee satisfaction (Skórnóg, 2024).

Leaders should build a culture based on collaboration. This collaboration should manifest both among human employees and in the interaction between humans and AI. The literature emphasises a collaborative culture. For example, Heukamp (2020) likens the leader to a conductor who develops people and organises collaboration, while Davenport and Fouty (2018) highlight the concept of symphonic leadership. The term "Symphonic C-suite," first used by Deloitte (2018), refers to top executives working collaboratively. Davenport and Fouty also emphasise that for this collaboration to occur, the leader must be humble. In this context, humility in the age of AI means accepting that no one can know everything and being open to different perspectives when necessary.

According to Peifer et al. (2022), the leader is a designer who shapes the relationship and interaction between AI and employees. They play an active role in determining how tasks are distributed between humans and AI and consider ethical issues throughout this process. Xiong (2022) highlights the importance of balance in shaping this relationship. Leaders should not rely entirely on AI in decision-making and must consider potential social impacts. They should also be able to effectively communicate

the technology to team members and ensure that employees recognise its benefits. A work environment that encourages ethical decisions should be supported by continuous learning (Xiong, 2022).

For a leader to manage human–human and human–AI interactions effectively in a complex and uncertain environment, they need highly developed emotional intelligence and an adaptable/agile leadership style (Paudel, 2024). Bourton, Lavoie, and Vogel (2018) argue that leaders need strong inner agility to adapt to the AI era. According to the authors, inner agility is the ability to act without being stuck in past experiences or known truths, to cope with uncertainty, and to produce creative solutions.

In conclusion, an effective leader in the age of AI is someone who can manage change by leveraging soft skills and building an organisational culture that is open to collaboration, ethical values, continuous learning, and innovation.

Based on the literature review, the skills and responsibilities that human leaders should possess in AI-supported leadership are summarised in Figure 1.

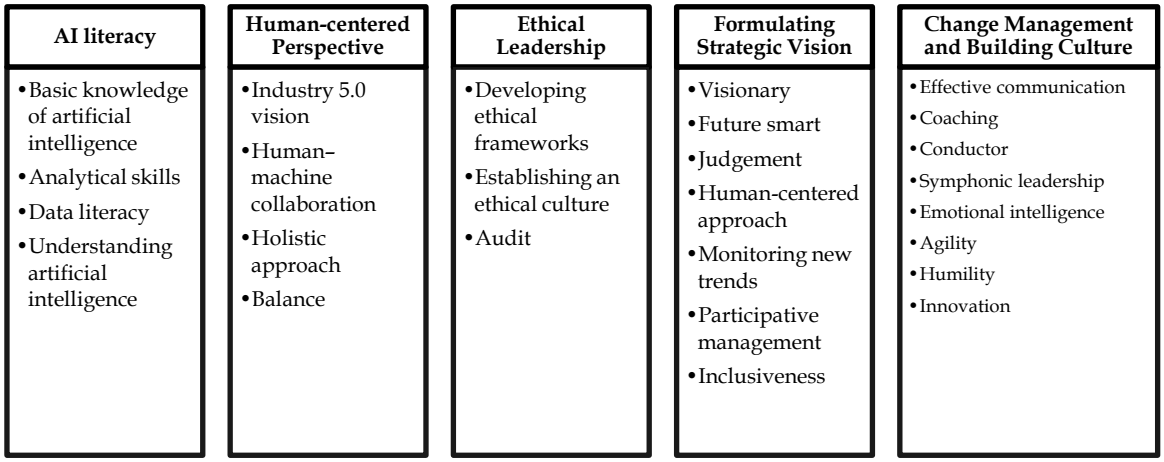

Figure 1: Skills and Responsibilities of the Human Leader in AI-Supported Leadership

Source: Produced by the author

Up to this point, the contributions of AI to leadership and the skills and responsibilities that human leaders should possess in the age of AI have been examined in detail. In the majority of studies, the prevailing view is that leadership in the AI era will continue through the collaboration of humans and AI. As summarised in Figure 1, human leaders need to possess certain core skills and assume specific responsibilities. However, some researchers argue that AI could replace human leaders in the future, or at least consider this possibility in their studies. In the next section, a leadership model in which AI assumes leadership tasks will be discussed.

Artificial intelligence leadership

AI Leadership is a leadership model in which AI assumes all leadership functions. Compared to AI-supported leadership, studies on this less common model are limited. This section examines research that argues AI leadership could be possible in the future and supports this view with various arguments.

Quaquebeke and Gerpott (2023) are among the strongest proponents of the view that leadership will transition to AI in the future. According to the dominant perspective in the literature, real leadership involves guiding people toward organisational goals through motivation and communication, a competence that lies within a comfort zone AI cannot take over. The authors label academics who argue that future leadership is inherently human and will never be transferred to AI as "romantic." Examining AI leadership under the category of "The Next of Leadership," the authors suggest that, in the future, AI will assume authority rather than merely assisting human leadership. AI leaders will not only communicate better but also guide followers by analysing their fundamental psychological needs.

Quaquebeke and Gerpott explain how AI could meet human needs within the framework of Self-Determination Theory. In this context, rather than issuing direct commands, AI can offer informative options to help employees make more autonomous decisions (a need for autonomy). Additionally, by providing automated and individualised feedback, AI can encourage real-time learning and strengthen employees' sense of competence (need for competence). AI can also facilitate coworker matching and use chatbots to manage issues such as depression and anxiety, thereby fostering a sense of belonging among employees (the need for relatedness).

While explaining how AI could assume leadership, Quaquebeke and Gerpott also highlight potential challenges. One such challenge is the moral dilemma. When AI assumes leadership roles, responsibility may become unclear. Granting AI the authority to make ethical decisions could lead to dangerous outcomes, as machines that do not perceive human values like humans may make decisions lacking empathy, humour, and social context.

Another approach to AI leadership in the literature is presented through future CEO models developed by Ünal and Kılınç (2021). Using the "Vizier-Shah" analogy, the authors propose four futuristic CEO models. This analogy is used to define the role AI plays in leadership. The first two models, "Vizier" and "Vizier-Shah", can be considered under AI-supported leadership. In the Vizier model, AI replaces the board of directors and becomes the human leader's "right hand." Final decision-making authority remains with the human, while AI serves as a supportive and strategic advisor. The "Vizier-Shah" model is a product of a transhumanist perspective, in which AI is integrated into the human body and mind; the resulting "superhuman" model could assume leadership roles in organisations.

The other two CEO models, "Shah" and "Swarm-Shah," represent AI leadership. The "Shah model" envisions a future in which AI reaches general intelligence, and humans are no longer the dominant species on the planet. At this level, AI can mimic all human cognitive processes and therefore assume leadership roles. However, achieving this scenario requires solving "hard problems" and overcoming ethical and legal barriers. Based on participants' opinions, the authors note that even if AI achieves general intelligence, AI leadership could be controversial due to costs, human selfishness, potential chaos, polarisation, and conflicts. The "Swarm-Shah model" represents a leadership system based on swarm intelligence, operating with a distributed architecture and collective consciousness. In this model, decision-making processes are conducted by numerous AI components rather than a central leader. The Internet of Things, Industry 4.0, and distributed systems are considered the first stages of this transformation. If humans become unnecessary or irrelevant in the system's operation, the "Swarm-Shah model, which makes decisions based on collective intelligence, can take over.

David de Cremer (2020), in his book *Leadership by Algorithm*, also supports the view that algorithms could replace human leaders in the future. He emphasises that the world is becoming increasingly complex for human intelligence. Although human intelligence is creative and sophisticated, it has limitations in analysing large amounts of data quickly to make effective decisions. According to de Cremer, this is where algorithms enter the leadership equation and can assume many of the functions of human leadership. Therefore, AI leadership in organisations is not a utopian idea. Algorithms can be cheaper, more efficient, and more impartial in their actions than humans.

Titareva (2021), based on her literature review, treats AI leadership under a "replacement perspective." According to this view, AI could replace both leaders and followers, and this transformation may occur much faster than anticipated. Therefore, ethical and legal dimensions must be carefully evaluated. Titareva also links this perspective to the phenomenon of an ageing population. As the population ages, AI leaders may become a necessity rather than an option. Citing direct quotes from the literature, she suggests that robot leaders, who do not experience fatigue or emotions and make rational decisions, could be more successful in crisis management. However, she also warns that decisions based solely on rationality could have negative organisational impacts and emphasises that humans program AI systems. This could magnify human errors, potentially leading to disastrous outcomes.

Tîrnăcop (2023) examines AI leadership within the framework of virtual leadership, referring to leadership conducted through AI in virtual environments. This type of leadership provides a competitive advantage by enabling rapid feedback, facilitating information transfer, supporting project discussions, and increasing efficiency by reducing costs. The author emphasises the important role of ethics in implementing virtual leadership, arguing that the goal should be to enhance human intelligence rather than replace it. Therefore, while AI assumes leadership roles in virtual settings, maintaining the human element is essential. This approach can be considered within the scope of AI-supported leadership when compared to other methods.

The literature review shows that studies support the view that AI leadership could be possible in the future and provide arguments to that effect. While some authors treat this development as inevitable, others consider AI leadership only as a possibility or a debated perspective. Further studies are needed to comprehensively examine the features and dimensions of AI leadership.

Conclusion

In the academic field, discussions about artificial intelligence began with the question, "Can machines think?" and continued with the assumption that all of human cognitive processes could be transferred

to a machine. Today, this debate revolves around whether AI can replace humans and lead. Based on these discussions, this study examined the nature of leadership in the AI era through two themes: (1) AI-supported leadership and (2) AI leadership.

AI-supported leadership is a widely accepted model in the literature. In this study, this type of leadership is analysed along two dimensions: "AI's contribution to leadership roles" and "the characteristics and responsibilities of human leaders in the AI era." The greater number of studies on this topic compared to AI leadership has allowed the leadership model to be examined in different dimensions. In the literature, AI-supported leadership has been defined in various ways, including hybrid, collaborative, and shared leadership; however, there is a need for studies that examine this leadership model across its dimensions. In this respect, this study stands out in the literature.

On the other hand, the view that AI could fully assume leadership roles in the future has relatively few supporters in the literature. Therefore, more theoretical and empirical research is needed to examine AI leadership in different dimensions. This study includes not only AI-supported leadership but also perspectives on AI leadership, contributing to the creation of a discussion platform in this area.

AI-supported leadership is a reality today. At the same time, AI leadership is currently overshadowed by the influence of the human-centred perspective; however, rather than completely ignoring this possibility, discussing it is beneficial for preparing for the future—paradigm shifts advance by overturning current value judgments. A minority view today may become dominant in the future; therefore, developing a flexible perspective rather than evaluating the future solely from today's standpoint allows us to navigate this process with minimal harm.

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