

## Key Elements of Leadership 5.0 Within Inter-Organizational Networks – Attempts to Specify Future Research Areas\*

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### Abstract

This article focuses on the growing need for modern leadership models that support coordination and value creation in complex interorganizational networks, currently shaped by advanced digital technologies. Despite the growing interest in Leadership 5.0, research results are scarce, and current research processes – due to the concept's initial stage of development – remain fragmented and incomplete. A coherent framework explaining the specific roles and types of influence of leaders in networked and ecosystem environments is still lacking. This article adopts a conceptual research approach based on an integrated synthesis of literature on the thematic areas of leadership, interorganizational networks, and the guiding principles of Industry 4.0 / 5.0 and Society 4.0 / 5.0. The main contribution is the development of a conceptual framework for Leadership 5.0 embedded in the conditions of interorganizational networks. The proposed framework identifies five key orientations of Leadership 5.0: human-centricity, digital innovation, network-ecosystem, sustainability-resilience, and technological-social competence. Collectively, these orientations emphasise the multidimensional, comprehensive, and integrative nature of contemporary leadership in complex collaborative systems. This provides a rational basis for future empirical research on the impact of leadership in interorganizational networks.

**Keywords:** 5.0 leadership, network leadership, human-centric leadership, Industry 4.0, Industry 5.0, Society 4.0, Society 5.0

### Introduction

The author's intention is to provide a broad perspective on the phenomenon of Leadership 5.0 within inter-organisational networks. Therefore, the discussion considers theoretical foundations in various areas, including in particular the concepts of Society 5.0, Industry 5.0 (in comparison to Industry 4.0), earlier leadership theories (including the preceding concept of Leadership 4.0), and theories of inter-organizational networks. Due to the format of this paper, the aforementioned concepts have been only hinted at or focused on their basic assumptions. The concept of Leadership 5.0 can be fundamentally based on the integration of the systemic and technological foundations of Society 5.0, which involves connecting cyberspace with the physical world to solve complex social problems (Cabinet Office - Government of Japan, 2015; Fukuda, 2020; Narvaez Rojas *et al.*, 2021), complemented by a human-centric perspective, one of the foundations of Industry 5.0, alongside sustainability and resilience (Breque, De Nul and Petridis, 2021; Akundi *et al.*, 2022; van Erp *et al.*, 2024). The literature still lacks coherent models characterizing specific leadership roles and influence in complex network structures in the context of interorganizational collaboration based on the use of data (Big Data models), artificial intelligence, machine learning, cloud computing, digitization, smart factories, Internet-of-Things systems, digitalization, and cybersecurity - particularly with respect to traditional mechanisms for managing such collaborations (Dhanaraj and Parkhe, 2006; Provan and Kenis, 2008).

The main aim of this paper is to propose a conceptual framework for Leadership 5.0 in the context of inter-organisational networks (IONs), as well as to identify future research directions in this area. To be precise, it addresses the problems of how specific leadership roles, influences and relations can be conceptualised in complex networked environments generally shaped by Industry 5.0 and Society 5.0 conditions. The conceptual

Leadership 5.0 model proposed by the author encompasses key elements of this category, identified primarily by researchers in the considered fields. The paper also proposes key research niches for future exploration. The next sections present the theoretical background, followed by the conceptual framework of Leadership 5.0 within inter-organisational networks, future research directions and concluding remarks.

## Theoretical background and conceptual foundations

The astonishingly dynamic development of digital technologies – including artificial intelligence, the Internet of Things (IoT), collaborative robots (cobots), cloud computing, edge computing, digital twins, blockchain technology, and 6G networks – is leading to profound transformations in the functioning of contemporary organizations, including their network relationships (Maddikunta *et al.*, 2022). Contemporary concepts – Industry 5.0 (along with the parallel processes of Industry 4.0 – located chronologically earlier) and Society 5.0, and in particular the guidelines they contain for existing organizations, provide a direct basis for explaining the specifics and goals of these transformations. These changes are also driving the growing importance of new forms of leadership, enabling the effective integration of human perspectives, technology, and more general trends, such as the currently particularly important issue of sustainable development. The above-mentioned concepts therefore provide an interpretative framework for the idea of Leadership 5.0, which effectively combines approaches such as adaptive, distributed, responsible and technologically supported leadership. When attempting to characterise Leadership 5.0, it's also worth referencing the assumptions of chronologically younger versions of the analysed initial concepts, examining the guidelines and postulates of such approaches as Industry 4.0, Society 4.0, and Leadership 4.0. This enables us to observe the theoretical transformations that led to the latest version of the analysed concept. It's worth emphasising that in most sectors of the modern economy, the most visible and widespread symptoms of concepts designated 4.0 are currently the most visible, with those labelled 5.0 focused on assumptions for future development.

The concept of Industry 4.0 refers to the de facto fourth industrial revolution, which has revolutionised existing production and management paradigms, creating the foundation for extensive technological ecosystems and smart factories. Industry 4.0 encompasses a range of technological transformations, particularly in the areas of advanced process digitisation, the Internet of Things (IoT), the use of real-time data – especially Big Data – and the integration of cyber-physical systems (CPS), robotics, and industrial automation (Kagermann, Wahlster and Helbig, 2013; Lasi *et al.*, 2014; Lu, 2017; Ghobakhloo, 2018). The main goal here was to build self-organising factories in which machines, systems, and people collaborate in real time and efficiently complete production tasks. The Industry 4.0 concept provides a direct foundation for a new approach – Industry 5.0.

The Industry 5.0 perspective proposed by M. Rada (Rada, 2015; Akundi *et al.*, 2022), formally developed by the European Commission and then deepened in the scientific literature, focuses essentially on three pillars of socio-economic transformation: human-centricity, sustainability and resilience, which means paying special attention to social well-being, ecological security and adaptation to various environmental disturbances (Breque, De Nul and Petridis, 2021; Xu *et al.*, 2021; Akundi *et al.*, 2022; Moraes, Carvalho and Sampaio, 2023; Pereira and dos Santos, 2023; Ghobakhloo *et al.*, 2024; van Erp *et al.*, 2024). Industry 5.0 is viewed as an evolution from Industry 4.0, with the most pronounced shift in focus from technology to humans, as well as from attempts to maximise efficiency to increasing resilience and implementing the principles of sustainable development. In practice, this translates into "collaboration" between humans and intelligent technologies such as Artificial Intelligence (AI), cobots, and predictive systems, with the primary goal of creating resilient, responsible, and inclusive value chains, and with a strong emphasis on the role of humans, placing them at the center of industrial processes (Aslam *et al.*, 2020; Maddikunta *et al.*, 2022).

The concept of Society 4.0 primarily concerns the contemporary phase of social development, based on digitisation, automation, Artificial Intelligence (AI), the use of Big Data, and the widespread adoption of information and communication technologies (ICT) in both economic and social contexts. It is therefore directly linked to Industry 4.0, with the logic of consideration shifting from the industrial sphere to the issues of complex social systems. Characteristic phenomena within Society 4.0 include the development of diverse digital platforms, the implementation of intelligent public services, the algorithmization of social processes, the emergence of the sharing economy, and the expansion of e-government (Kergroach, 2017; Schwab, 2017). The key phenomenon here is the digital transformation of societies, defining the direction of development in technology-driven work, the need to increase the importance of digital competencies in modern communication methods, and the desired economic structures. Therefore, the analysed impacts can be considered at the economic, social, and environmental levels (Turečková *et al.*, 2023). Entirely new challenges and problems are emerging, including deepening inequalities, the marginalization of technologically excluded groups, privacy

and data protection issues – including surveillance, the dependence of proper functioning on access to data, excessive data centralization, and limited individual autonomy (Helbing, 2016), as well as the issue of work automation and requirements for innovative organisational, educational, and leadership models (Brynjolfsson and McAfee, 2014). T. Mazali points out that there are undeniable connections between Industry 4.0 and Society 4.0, due to the interplay between technological transformation and social change – modern digital technologies strongly shape the everyday lives of societies (Mazali, 2018).

In turn, the term Society 5.0, originally defined in Japan, assumes the integration of broadly understood cyberspace with the physical world, which on many levels is to ultimately contribute to a super-smart (or superintelligent) society through the use of advanced technologies (Cabinet Office - Government of Japan, 2015; Ellitan, 2020; Fukuda, 2020; Narvaez Rojas *et al.*, 2021; Holroyd, 2022). This Japan concept, unlike Industry 5.0, has a more general, macroeconomic nature, focusing on solving social problems – including education, public health, administration, and collective mobility – from a new perspective, with the comprehensive support of AI, IoT, Big Data, and robotics (Narvaez Rojas *et al.*, 2021; Alif, Nabila and Ahmad, 2022; Holroyd, 2022). The ultimate goal in this case is to enhance the quality of social life, promote social responsibility, and foster sustainable development (Carayannis and Morawska-Jancelewicz, 2022).

According to B. Oberer and A. Erkollar, the concept of Leadership 4.0 should be perceived through the prism of digitality – “Digital leadership (leadership 4.0) is a fast, cross-hierarchical, team-oriented, and cooperative approach, with a strong focus on innovation. The personal competence of the leader, their mindset as well as their ability to apply new methods and instruments such as design thinking, are critical dimensions for 4.0 leaders” (Oberer and Erkollar, 2018). This concept refers to leadership in the context of the fourth industrial revolution, where competencies in utilising digital transformation tools, integrating modern technologies, and developing digital competencies among employees in organisational management processes become crucial (Moeuf *et al.*, 2018; Soto-Acosta, 2020). When characterizing a Leader 4.0, i.e. one who effectively copes with the conditions of Industry 4.0, one can emphasize digital skills – or even digital agility, systemic thinking enabling work with data, strategic thinking and flexibility towards changes, the ability to combine interpersonal skills with technological support, creativity and focus on innovation, a proactive attitude towards modern technologies, a process approach to problem-solving, a positive attitude towards new technologies and the readiness to adapt them – which applies in particular to AI, various digital tools, automation (Sousa *et al.*, 2019; Guzmán *et al.*, 2020; Molino, Cortese and Ghislieri, 2021; Puhovichová and Jankelová, 2021; Bianco *et al.*, 2023).

The concept of Leadership 4.0 provides a solid, undeniable foundation, and at the same time, a transitional stage towards a more comprehensive and "humanised" approach to Leadership 5.0, the logic of which seems to better address the conditions of contemporary, complex systems, especially interorganizational networks. This latest approach to leadership broadens the spectrum of considerations to include ecosystem and network competencies, coping with complexity, and a strong focus on people, sustainable development, and skilful, technologically supported decision-making.

## **Key elements of leadership 5.0 in interorganizational networks**

The modern form of leadership, defined as Leadership 5.0, should be considered multifaceted, as this category is rooted in at least several of the concepts described previously. In light of the discussion, this new form of influence should incorporate strategic leadership guidelines embedded in the conditions of Industry 5.0, which entails a comprehensive transformation of industrial activity, consumption patterns, and pro-environmental attitudes, focusing on human values, sustainable development, and creating long-term industrial resilience to various environmental turbulences, which will ultimately translate into increased organizational performance (Whitehead *et al.*, 2025). This seems particularly important in the context of the requirements related to the role of leadership in relation to organisational ambidexterity and absorptive capacity in the post-COVID-19 pandemic environment (Chatterjee and Chaudhuri, 2024). According to F. Salvetti and B. Bertagni, key aspects of this new form of leadership include (Salvetti and Bertagni, 2020): teamwork, start-up culture, and matrix management, as digital transformation is not limited to technological changes but is enabled precisely by changes in leaders' approaches and new competencies.

The interpretation of Leadership 5.0 is not a simple concept. It is typically based on combining various perspectives and attitudes towards specific socioeconomic phenomena. One of the most interesting approaches to the complexity and comprehensiveness of this category is presented by L. Weber in his master's thesis, specifying the following five requirements for Leaders 5.0 (Weber, 2022): the digital nomad (fluency in

technology area), the international (communication in every channel), the communicator (coaching along with humble inquiry), the creator (ability to create teams, empathy, listening), the purpose driven (self-awareness). D. Balcerzyk and J. Žukovskis, in turn, propose an entire Leadership 5.0 ecosystem, which includes (Balcerzyk and Žukovskis, 2024): artificial intelligence (AI), VUCA environment (variability, uncertainty, complexity ambiguity), people, relation of influence, as well as Industry 5.0.

Furthermore, the characteristics and determinants of Leaders 5.0's actions should not be overlooked. These will essentially be technologically supported decisions of a strongly pro-social and sustainable nature, typically embedded in inter-organizational networks and complex ecosystems, which currently constitute the dominant form of cooperation between business units, where hierarchy is replaced by interdependence, and the dominant form of value creation are networks of relationships enabling effective knowledge exchange and innovation generation (Dhanaraj and Parkhe, 2006; Provan and Kenis, 2008; Nambisan and Baron, 2013; Shipilov and Gawer, 2020). In such conditions, traditional leadership proves insufficient and unsuited to current challenges, while the importance of distributed, integrative, boundary-spanning, adaptive, or even extreme leadership concepts is growing (Marion and Uhl-Bien, 2001; Plowman *et al.*, 2007; Uhl-Bien, Marion and McKelvey, 2007; Hannah *et al.*, 2009; Crosby and Bryson, 2010; Ernst and Chrobot-Mason, 2010; Uhl-Bien and Arena, 2018; Breque, De Nul and Petridis, 2021). However, there is still a lack of coherent leadership models that combine aspects of Industry 5.0 requirements with the complex conditions of interorganizational networks, i.e., operating in an environment of increasingly advanced technology and rapidly growing interdependence.

Following this line of considerations, the author of this study also proposes considering Leadership 5.0 in the context of a wide spectrum of phenomena and activities, which will show in the most comprehensive way possible the complexity of this category, resulting from combining interdependencies, uncertainty, joint value creation, managing various relationships, technological and social competences, focusing on people, designing processes based on guidelines for sustainable development, resilience and responsibility – especially in the field of using advanced technologies. The following are key aspects and components of the Leadership 5.0 concept analysis, based on studies of the relevant literature and proposals by various authors (Dhanaraj and Parkhe, 2006; Provan and Kenis, 2008; Nambisan and Baron, 2013; Uhl-Bien and Arena, 2018; Elia, Margherita and Passiante, 2020; Fukuda, 2020; Shipilov and Gawer, 2020; Soto-Acosta, 2020; Ivanov, 2021; Corke, 2022; Maddikunta *et al.*, 2022; Thomas *et al.*, 2024; van Erp *et al.*, 2024):

- **human-centric orientation** – leadership focused on people, their competencies, and well-being, ethical and responsible behaviours of leaders, supporting and assisting colleagues in adapting to change, especially in the area of advanced technologies,
- **digital-innovation orientation** – creation of augmented leadership based on the use of data analytics, automation principles, and digital tools, including the interoperability of technology platforms, digital twin-based simulations, and, above all, artificial intelligence algorithms in decision-making processes,
- **network-ecosystem orientation** – leadership in a distributed, adaptive, and boundary-spanning form, the leader as an orchestrator crossing organisational boundaries, coordinating the flow of knowledge and the processes of creating new types of value, basing actions on mutual trust in order to build effective innovative synergies,
- **sustainability-resilience orientation** – leaders' actions are based on the principles of sustainable development, respect for resources, and the principles of social existence and interaction, they are also characterised by resistance to changes and disruptions in cooperation processes, especially sudden and unpredictable ones, occurring in the organisational environment,
- **techno-social competence orientation** – leadership based on multi-aspects, understood as the skilful and effective combination of technological, social, and cultural competencies, the ability to operate in multicultural environments, eliminate socio-cultural barriers, and adapt to the principles of various local, regional, and global communities, while simultaneously efficiently utilising technologically advanced solutions.

Leadership 5.0 should therefore be considered a highly comprehensive and complex concept. A 5.0 leader will skillfully combine all their competencies to adapt to highly dynamic environments and situations, while simultaneously acting in accordance with established values and principles, fulfilling the role of integrator, coordinator, and orchestrator. The presented framework represents a logical progression of contemporary forms of leadership, reflecting their constant evolution and providing a real response to current challenges.

## Proposed future research areas and methodology

Based on the concepts described above, which formed the basis for the creation of the category under consideration (more specifically, Industry 4.0 and 5.0, Society 4.0 and 5.0, as well as Leadership 4.0), as well as on the analysis of issues specifically related to the idea of Leadership 5.0, the broad scope for further exploration becomes clear. Each of the identified areas constitutes a distinct, complex field of analysis, but a holistic approach reveals a target set of issues focused on aspects of the relationship between people and advanced – today's and future – technologies, the growing dynamics and unpredictability of the economic environment, and the need to define the practical functioning of a new type of leader. Collectively, these aspects constitute a set of current and future challenges for contemporary leaders, but they are also gradually becoming specific requirements, the fulfilment of which will determine the fate not only of the leader himself, but also of the individuals, organisations, and sometimes entire inter-organisational networks and ecosystems associated with him.

Given that Leadership 5.0 is a comprehensive, broad, multidimensional, and constantly evolving concept, further empirical research is required to thoroughly explore and understand it, and above all, to translate the identified theoretical orientations into practical application in organisational practice. It seems particularly important to examine the mechanisms of real leadership influence, integrated with the previously characterised technological solutions, embedded in extensive interorganizational networks, and incorporating the principles of sustainable development and social responsibility into practice. The proposed conceptual framework for potential future research is the model proposed above, encompassing five main orientations. In turn, from a more specific perspective, it is worth considering the following proposed directions for empirical research:

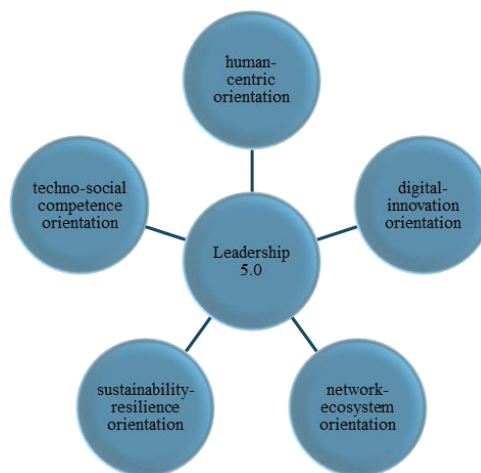
- integrating practical AI applications with a human-centric approach – at the intersection of these seemingly weakly logically related issues, an area of broad applications for leaders emerges, for example, in the context of strategic decision-making (Maddikunta *et al.*, 2022; Tîrnăcop, 2023; Shal, Ghamrawi and Naccache, 2024),
- methods of measuring trust in contemporary leaders in complex inter-organizational networks and ecosystems – trust in a leader is an undeniable condition for the success of a given system, therefore, it is necessary to identify a methodology for its measurement, especially in the context of highly technologically oriented leaders and determining the validity of the basis for their decisions (Brown, Treviño and Harrison, 2005; Ysa, Sierra and Esteve, 2014; Rahman *et al.*, 2015; Dutta and Kumaravel, 2016; De Brún and McAuliffe, 2020)
- operationalisation of Leadership 5.0 competencies – research aimed at developing detailed Leadership 5.0 competency models seems justified, including in particular the analysis of their practical applications in specific conditions that fit the concepts of Industry 5.0 and Society 5.0 (Uhl-Bien and Arena, 2018; Salvetti and Bertagni, 2020; Corke, 2022; Whitehead *et al.*, 2025)
- potential of combining digital twins with Leadership 5.0 – digital twin technology seems particularly useful in the practical activities of Leadership 5.0, who can use it to test and simulate the effects of specific decisions, especially in conditions of high turbulence and unpredictable economic development (Ciolacu *et al.*, 2023; Rosen and Pattipati, 2023; Salvo, 2023; Taranukha, Semenova and Pankov, 2023).

Given the specific nature of the identified areas of potential future research on the practical functioning of Leaders 5.0, it is essential to select appropriate research tools that will capture the characteristics of the phenomenon under consideration. The author of this study proposes primarily qualitative methods at this stage. Properly focused, they will allow for precise contextualization and the details of the process-oriented nature of leadership influence, realised primarily within interorganizational networks and complex business ecosystems. Therefore, potentially more effective approaches in this case may include: case studies, participant observation, research using structured or semi-structured interviews aimed at experts in modern leadership and simultaneously managers at middle and senior levels in companies from advanced technology sectors (e.g., AI software sector, semiconductor and microelectronics sector, medtech and biotech, advanced automotive and e-mobility, aerospace industry), documentation analysis, and triangulation of specific qualitative methods. In the author's opinion, a combination of case studies, participant observation, and the indicated interviews may prove most appropriate. Due to the limited information in the literature and the lack of comprehensive models that combine the described issues, this should enable the capture of subtle details that may prove crucial for the further development of the proposed model.

## Conclusions & Discussion

This article presents a conceptual approach to the phenomenon known as Leadership 5.0, a new, multidimensional approach to leadership that, given the current economic conditions, is embedded in the realities of exceptionally dynamic and diverse changes, with a particular focus on technological, social, and strictly organisational aspects. The author sees the main foundations of Leadership 5.0 in other, currently very popular concepts shaping today's economic environment, namely Industry 4.0 and 5.0, Society 4.0 and 5.0, as well as the still highly relevant Leadership 4.0 model. Due to their focus on human aspects, as well as the many common features, complementarity, and co-evolution of Industry 5.0 and Society 5.0 (Huang *et al.*, 2022), these two concepts seem to provide the best analytical foundation for Leadership 5.0, which appears to be the most logical proposition given the growing interdependence of people and technology coexisting in complex interorganizational networks and collaborative ecosystems.

The proposed model of five partial orientations – human-centric, digital-innovation, network-ecosystem, sustainability-resilience, and techno-social competence orientation – presented simplified in Figure 1, clearly indicates that an effective Leader 5.0, especially in complex collaborative systems, must combine multiple perspectives, consider a multitude of factors simultaneously, and make strategic decisions based on them – but importantly, with significant technological support. Only the integration of the identified areas should constitute a complete picture of the Leader 5.0 – simultaneously integrator, coordinator, and orchestrator. Omitting any aspect can undermine their actions.



**Figure 1: Leadership 5.0 conceptual model**

*Source: elaborated based on (Dhanaraj and Parkhe, 2006; Provan and Kenis, 2008; Nambisan and Baron, 2013; Uhl-Bien and Arena, 2018; Elia, Margherita and Passiante, 2020; Fukuda, 2020; Shipilov and Gawer, 2020; Soto-Acosta, 2020; Ivanov, 2021; Corke, 2022; Maddikunta et al., 2022; Thomas et al., 2024; van Erp et al., 2024).*

An analysis of the relevant literature reveals a limited number of studies that comprehensively characterise Leadership 5.0. Typically, this category is mentioned in a simplified form, with the assumption that further research is necessary. There is also a distinct lack of empirically verified models of this category, especially in precisely defined network or ecosystem contexts. Therefore, the author currently proposes four areas of research focused on the practical application of Leader 5.0: integrating practical AI applications with a human-centric approach, methods for measuring trust in contemporary leaders within complex interorganizational networks and ecosystems, operationalising Leadership 5.0 competencies, and the potential of combining digital twins with Leadership 5.0. Research within the indicated topics aims to develop the final concept of Leadership 5.0, as well as precisely characterise Network Leadership 5.0, which operates primarily within the conditions of interorganizational networks. The author is open to proposals for expanding the presented Leadership 5.0

model, as well as for collaboration on the research agenda and proposals for further research areas, which will ultimately allow for a more comprehensive understanding, recognition, and explanation of the analysed concept.

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