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Article

Beyond Industry 5.0: Leadership 5.0—Driving Future-Ready Organizations

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Abstract

The aim of this paper is to fill the identified gap in the literature regarding mapping key values within Leadership 5.0. Our study indicates that Leadership 5.0 (L5.0) shows a transformative shift in leadership, demanding innovative leaders to adopt agile and digital mindsets, hence fostering innovation whilst balancing human and technological needs in Industry 5.0 settings. Developing people-centric leadership skills is critical in order to build collaborative innovation between humans and machines. In this way, human expertise is integrated with technology, to drive future-ready organizations. Findings show that L5.0 prioritizes continuous learning environments to adapt to rapidly evolving challenges. This ensures that organizations are agile, resilient, and ready for the future. L5.0 recognizes that intellectual capital—driven by human creativity, emotional intelligence, and collaboration—is essential for sustainable innovation in the digital shift. This paper’s theoretical contribution is a conceptual analysis of L5.0. We present a comprehensive and actionable conceptual model for mapping L5.0. We identify five key L5.0 pillars from the literature: human-centric leadership, future readiness and adaptability, a sustainability and ethics focus, collaboration and inclusion values and an innovation and experimentation approach to leadership. We develop a 30-item L5.0 survey instrument, anchored in the literature, and we conduct initial pilot testing for item clarification. The survey instrument application can provide valuable management insights: a road map for assessing the presence and maturity level of L5.0 in organizations.



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Keywords: Industry 5.0; Leadership 5.0; literature review; human-centric leadership; survey instrument

1. Introduction

In an era of unprecedented change, traditional leadership frameworks are scrutinized for their limited ability to address rapid digitalization, new ways of working, need for future readiness, and not least, need for a sustainability focus. This rapid progress in technological advancements is often referred to as ‘Industry 5.0’, hence the growing interest in the concept of ‘Leadership 5.0’—how to best lead in Industry 5.0 contexts. Müller (2020) identifies the key elements of Industry 5.0, to focus on more individualized human–machine interaction technologies that interconnect and combine the strengths of humans and machines. They emphasize the critical role of artificial intelligence to detect, for example, causalities in complex and dynamic systems, leading to actionable intelligence. So, technologies are developed for greater energy efficiency, for renewables, for storage, and autonomy. Both Industry 4.0 and Industry 5.0 are characterized by unique technical

orientations. Industry 4.0 is often described as the fourth industrial revolution, with advancements in automation and smart manufacturing for increased mass production and prioritized profit. Indeed, [Vogel-Heuser and Hess \(2016\)](#) summarize the main principles of Industry 4.0 as optimization for overall effectiveness, data integration, reliability, and secure communications between businesses and data security. Industry 5.0 develops manufacturing beyond the technical optimization of Industry 4.0, to re-introduce the human factor into manufacturing systems. Hence, Industry 5.0 is not a technology-driven revolution, but a value-driven initiative to complement Industry 4.0, as it drives technological transformation with a particular purpose ([X. Xu et al., 2021](#)). Industry 5.0 recognizes the power of manufacturing to achieve societal goals beyond jobs and growth and to become a resilient provider of prosperity by making manufacturing respect the boundaries of our planet ([Breque et al., 2021](#)).

According to [Whitehead et al. \(2025\)](#), the key leadership characteristics within Industry 5.0, when leading in the Industry 5.0 age, include human-centricity, digital mindsets, sustainability, and resilience. The literature prioritizes human well-being ([Demir et al., 2019](#); [L. D. Xu et al., 2018](#)), emphasizes the role of humans as creative problem-solvers in partnership with machines, and focuses on ergonomic work environments, skill development, and meaningful employment ([Whitehead et al., 2025](#)). Instead of replacing human roles, leadership in Industry 5.0 aims for harmonious integration, where robots and humans co-create solutions. While Industry 4.0 focuses on mass customization, Industry 5.0 emphasizes hyper-personalization, delivering tailored products and services through collaborative efforts between humans and technology. Similarly, while Industry 4.0 focuses on the creation of interconnected systems or cyber-physical systems ([Wahlster, 2014](#)), in Industry 5.0 concepts, enrichment of human skills through connectivity is a leading aspect. A combination of human skills and AI capabilities unleash significant opportunities for efficiency gains and stimulate continuous innovation potential ([Sun & Song, 2025](#)).

The purpose of this study is therefore threefold. Firstly, we advance the discourse on L5.0 by examining its theoretical foundations and the practical implications for such purpose-driven leadership values. Secondly, we fill the gap in L5.0 studies as we develop a conceptual model as an actionable framework. Thirdly, to provide management insights, we develop and test a new instrument to measure the presence and maturity of L5.0 in organizations today for companies to utilize as a roadmap for leadership development.

2. Literature Review

In today's rapidly changing business environment, traditional command-and-control leadership is no longer sufficient to drive engagement, innovation, or sustainable performance ([Northouse, 2023](#)). There has been a dearth of leadership studies in the last century. Figure 1 illustrates the chronological evolution of major leadership theories developed over the past century, highlighting the progressive shift from individual-centric to relational and, more recently, human- and technology-integrated perspectives. The 'x' signs indicate the time frames on the timeline below. Early frameworks such as the Trait and Behavioral theories (1900s–1950s) emphasized inherent personal attributes and observable leader behaviors as predictors of effectiveness. From the 1960s onward, contingency and path-goal models introduced situational and motivational dimensions, recognizing that leadership effectiveness depends on contextual variables. The late twentieth century saw the emergence of transformational, servant, and charismatic leadership paradigms, reflecting a growing interest in vision, ethics, and follower empowerment. In the twenty-first century, leadership research has increasingly embraced authentic, ethical, adaptive, and digital leadership approaches, aligning with organizational complexity, technological advancement, and moral responsibility. Most recently, inclusive and human-centric leadership

theories (2010s–2020s) have underscored the importance of diversity, psychological safety, and social sustainability, particularly in the context of Industry 5.0. Together, these developments depict a continuous expansion of leadership theory toward greater contextualization, ethical awareness, and integration with evolving societal and technological systems.

Evolution of Leadership Theories (1900s–2020s)

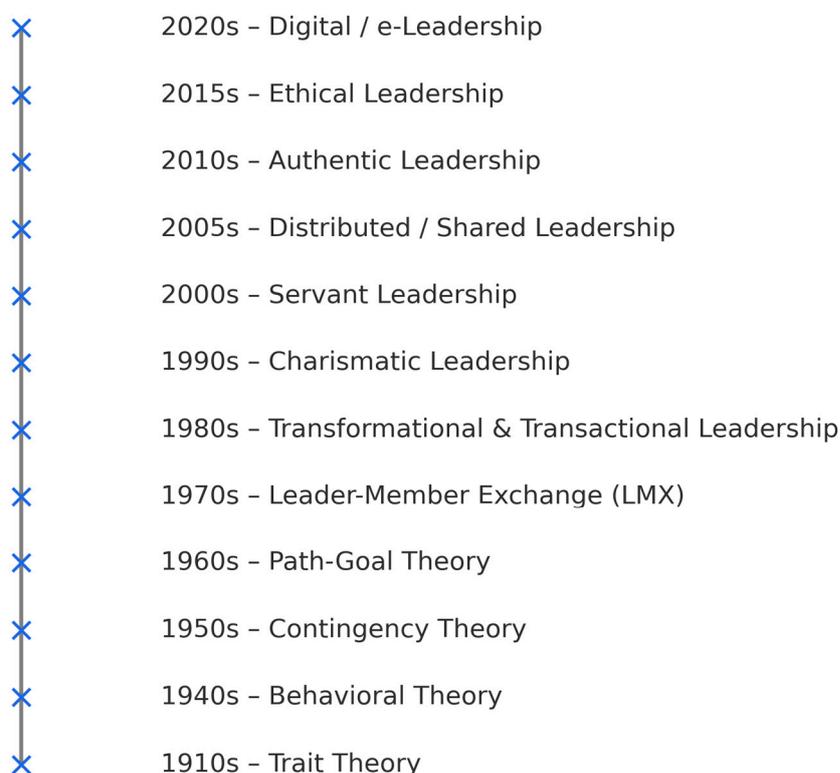


Figure 1. Evolution of leadership theories (1900s–2000s).

According to [Thomas et al. \(2023\)](#), earlier leadership models from the literature above often failed to enhance employee well-being, which is crucial for driving performance and organizational resilience ([Jiang & Ali, 2024](#)). This present study consequently draws on the following key foundational theoretical leadership perspectives identified by [Thomas et al. \(2023\)](#) in the existing literature, identified as the most relevant to frame Leadership 5.0.

2.1. Contemporary Leadership Styles Framing Leadership 5.0

Specific leadership styles at the core of Leadership 5.0 are therefore shown to primarily include servant leadership ([Murari & Gupta, 2012](#)), transformational leadership ([Podsakoff et al., 1990](#)), and digital leadership ([Mwita & Joanthan, 2019](#)). The key characteristics of these three key leadership styles are outlined below.

As depicted in [Table 1](#), above, a leader that combines transformational and servant leadership can be highly effective in an Industry 5.0 setting ([Thomas et al., 2023](#)). By combining elements of transformational leadership at the top level of the organization, they may emphasize corporate goals to inspire commitment and success. Moreover, by including elements of servant leadership at the middle management level, people are prioritized over corporate goals, building positive interactions and relationships ([Thomas et al., 2023](#)). At the operational level, digital leadership is specific to Industry 5.0, as leaders have to have a digital mindset to innovate at the interface of digital technologies and human creativity.

Each level is important for organizational achievement as part of Leadership 5.0 (Thomas et al., 2023).

Table 1. Summary overview: Leadership 5.0 literature review.

| Type of Leader | Characteristics | References |
|---------------------------------|--|--|
| Servant leadership | Listening, emphasizing the needs of the team, empathy, healing, awareness, persuasion, conceptualization, foresight, stewardship, growth, community building. | Murari and Gupta (2012) Spears (2010) Van Dierendonck (2011) |
| Transformational leadership | Clear vision, empowering followers, inspire personal progress in others, promoting common goals, demonstrating behaviors that expect high performance from followers, offering support and encouraging creativity. | Podsakoff et al. (1990) Basham (2012) |
| Digital leadership/e-leadership | Advanced collaborative style, integrating Industry 5.0, drives digital transformation, aligns technology with human values. Lead in digital workplaces, blending automation with creativity and craftsmanship. Show transformative vision, good business and digital skills. | Weill and Ross (2009) Weill and Woerner (2018) Avolio and Kahai (2003) |

2.2. Framing Leadership 5.0 Within Industry 5.0

Industry 5.0 builds on Industry 4.0, which was the technological revolution that has changed the way we work and live and has happened at an exponential speed. 5.0 develops the technological cornerstones of Industry 4.0. whilst integrating human-centric dimensions of well-being, such as workplace flexibility, a focus on upskilling, and work–life balance (Sarişik & Demir, 2025).

Hallmarks of Industry 4.0 include autonomous robots, additive manufacturing, augmented reality, big data and analytics, cybersecurity, cloud technology, and not least, the industrial internet of things (Salveti & Bertagni, 2020).

Industry 5.0 differs in key ways from Industry 4.0: in its emphasis on deep tech, research, innovation, resilience, hyper-customization, smart additive manufacturing, human-centric focus, and its dedication to social justice and sustainability (Thomas et al., 2023). Therefore, Industry 5.0 is often claimed to be the fifth industrial revolution (Thomas et al., 2023), which is underway in global business. It goes beyond industrial development and jobs, as it is focused on addressing the significant challenges of the twin transition in business of both digitalization and sustainability whilst focusing on human-centric leadership skills. It is where human-centric leadership meets intelligent systems, technological innovation, and sustainability. Industry 5.0 also aligns manufacturing with environmental goals, emphasizing resource efficiency, reduced waste, and circular economy principles (Nahavandi, 2019). Finally, Industry 5.0 focuses on enhanced resilience in production systems by leveraging advanced digital tools to ensure adaptability to disruptions, such as pandemics and supply-chain crises (Javaid et al., 2021). Hence, leading in Industry 5.0 is

distinguished by its integration of humanity, technology, and purpose-driven goals, making it uniquely suited to address the challenges and opportunities of a rapidly changing, interconnected world (Salveti & Bertagni, 2020).

Moving away from hierarchical and siloed structures, leadership in Industry 5.0 consequently recognizes the need for leaders to be adaptable and resilient in the face of constant change and uncertainty. It moves beyond the focus of Industry 4.0 on productivity and profit, to prioritize the well-being of employees and the broader impact on society: creating a future where technology and people can thrive together. We now develop a conceptual model from the existing literature above in order to identify key leadership theories and constructs that are identified as most pertinent building blocks for L5.0 today.

2.3. Methodology: Conceptual Model Development

In order to develop a conceptual model for Leadership 5.0, a standardized literature review was conducted, according to Schnell et al. (2022). Key words 'Leadership 5.0,' 'transformational leadership,' 'servant leadership,' 'leadership for industry,' 'digital leadership,' 'agile leadership,' and 'Industry 5.0' were added into the search engine of the ORIA software program. A total of 121,955 publications were identified in the period between 1991 and 2025. By refining the search to only contain scientific peer-reviewed articles specifically discussing 'Leadership 5.0' and/or leading Industry 5.0, 59,808 publications were removed. Records were screened with a specific inclusion rule: key words Leadership 5.0 + industry (n = 335). Full-text articles were assessed for eligibility, n280. We consequently identified that the Leadership 5.0 specific journal corpus remains small and under-researched, while Industry 5.0 is large and still growing. Exact-phrase searches were screened in the first pages of the results to identify peer-reviewed journal articles and highly cited reviews that were visible in both Oria and a cross-reference with Google Scholar. This was to enumerate validated journal exemplars and synthesize visible themes related to Leadership 5.0. in a visual thematic analysis. For context on volume growth, we reference peer-reviewed bibliometric studies with explicit Scopus/WoS counts.

By refining the search further to remove non-relevant studies within life sciences, biometrics, military operations, and all industry/leadership articles with no in-text mention of Leadership 5.0, nine articles remained for further review. Please see Figure 2, below, for a PRISMA flowchart summary visualizing the paper selection process.

Please see Table 2, below, for a systematic summary of the studies included by the authors and key focus and insights from our thematic analysis. As depicted in Table 1, after step-by-step screening, just nine articles met the final inclusion criteria.

The literature review therefore indicates that even though articles abound in the popular press, signaling the arrival of leadership within Industry 5.0, namely Leadership 5.0 (L5.0), the conceptual modeling and scientific data collection for L5.0 is scarce and in an early stage of maturity. Clearly, L5.0 can represent a significant evolution in leadership theory as it responds to the demands of a rapidly changing, technology-driven world. Figure 3 below offers a conceptual mapping of the key themes from the Leadership 5.0 literature review above. The following section then elucidates these five key themes within this literature, as we identify the five pillars of Leadership 5.0, summarized in Figure 3 below.

Hence, conceptual mapping of the existing literature within Leadership 5.0 provides a clear framework of the five theoretical pillars. Figure 3 was developed by the authors, utilizing GenAI software to create a visual summary. The five pillars are now discussed below.

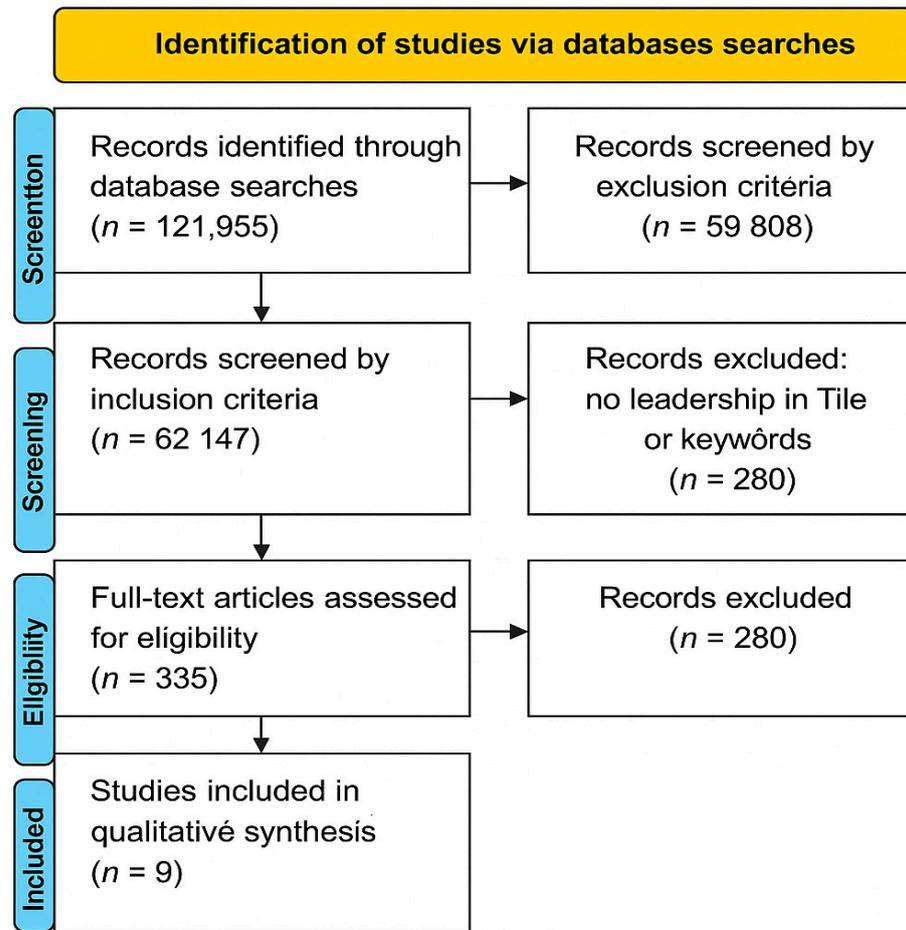


Figure 2. PRISMA flow chart visualizing the paper selection process. Source: Page et al. (2021) and Bos-Nehles et al. (2017) and processed by the authors.



Figure 3. Conceptual mapping: the 5 pillars of Leadership 5.0.

Table 2. Leadership styles at the core of Leadership 5.0.

| Article Title | Key Insights | References |
|---|--|--|
| Strategic Leadership 5.0: Reality or Illusion? | This study initiates an exploration into strategic leadership within the context of the emerging Industry 5.0 (I5.0) era, integrating strategic leadership theory with the principles of Industry 5.0. Highlights ethical, purpose-driven, sustainable leadership, flatter hierarchies, cross-functionality, and strategic innovation. | Whitehead et al. (2025) . Strategic Leadership 5.0: Reality or Illusion? <i>Journal of the Knowledge Economy</i> , 1–29. |
| Leadership 5.0: An Agile Mindset for a Digital Future | Highlights agility, inclusiveness, collaboration, and ethical purpose as three pillars within Leadership 5.0, emphasizing leadership as a driver of digital transformation beyond technology. Highlights purpose-driven strategy, resilience building, continuous learning and systems thinking. | Salveti and Bertagni (2020) . Leadership 5.0: an agile mindset for a digital future. <i>International Journal of Advanced Corporate Learning</i> , 13(2), 57. |
| Leadership 5.0. A New Approach in Higher Education | Focuses on defining challenges and proposing new leadership training methods for future engineers in higher education, emphasizing human-centric and adaptable leadership skills for complex, digital environments. Highlights human–technology balance, employee empowerment, future readiness, and purpose-driven leadership. | Serrano and Mosquera-Bolaños (2022) . Leadership 5.0. a new approach in higher education. <i>IEEE Revista Iberoamericana de Tecnologías del Aprendizaje</i> , 17(4), 393–400. |
| Higher Education Leadership and Curricular Design in Industry 5.0 Environment | Examines the role of higher education institutions in preparing leaders for Industry 5.0, focusing on a curricular redesign that integrates sustainability, human-centric approaches, and digital literacy. Future readiness, continuous learning. | Bakir and Dahlan (2023) . Higher education leadership and curricular design in Industry 5.0 environment: a cursory glance. <i>Development and Learning in Organizations: An International Journal</i> , 37(3), 15–17. |
| The Impact of Leadership Behaviors on Organizational Innovative Performance and Learning in AI-Driven Industry 5.0 Environments | Explores how leadership behaviors foster organizational innovation and learning in AI-driven Industry 5.0 environments, highlighting the constructive interaction between artificial intelligence and human expertise, well-being and employee empowerment, and also human—technology balance. | Alshaibani et al. (2025) . The impact of leadership behaviors on organizational innovative performance and learning in AI-driven Industry 5.0 environments. <i>Development and Learning in Organizations: An International Journal</i> , 39(3), 18–21. |
| Intellectual Capital in Society 5.0 by the Lens of the Knowledge Creation Theory | Reviews the development of the knowledge creation theory in the context of Society 5.0, emphasizing the roles of intellectual capital, innovation, and human creativity and leadership in building sustainable, knowledge-based societies. Highlights creative problem solving, systems thinking and resilience building for long-term impact. | Konno and Schillaci (2021) . Intellectual capital in Society 5.0 by the lens of the knowledge creation theory. <i>Journal of Intellectual Capital</i> , 22(3), 478–505. |

Table 2. Cont.

| Article Title | Key Insights | References |
|--|---|--|
| Technological Innovation and Building a 'Super Smart' Society: Japan's Vision of Society 5.0 | Explores Japan's Society 5.0 vision, which combines technological innovation with sustainability to address economic and social challenges, aligning with Leadership 5.0's emphasis on ethical and human-centric leadership. Highlights diversity and equity and human–technology balance for psychological well-being for a sustainable society. | Holroyd (2022) . Technological innovation and building a 'super smart' society: Japan's vision of society 5.0. <i>Journal of Asian Public Policy</i> , 15(1), 18–31. |
| Trust in Artificial Intelligence and the 5.0 leadership | Explores how technology leaders look to the fifth industrial revolution and the synergy between artificial intelligence, autonomous machines, and humans. When discussing the subject of leadership of the new generation 5.0, and the issue of leadership competences, trust building is critical. Issues discussed include psychological safety to develop trust, ethics, resilience building when trust is low, and long-term impact. | Balcerzyk and Czainska (2024) . Trust in Artificial Intelligence and the 5.0 leadership. In <i>Digital Synergy</i> (pp. 94–100). CRC Press. |
| Industry 5.0—past, present, and near future. | Defines Industry 5.0 as a humanized vision of technological transformations in industry, balancing the current and future needs of the workers and society with the sustainable optimization of energy consumption, materials processing, and product lifecycles. It presents a tertiary study of literature reviews on Industry 5.0, supported by a bibliometric analysis. Highlights key themes such as agility and flexibility, human–technology balance, future readiness, continuous learning, creative problem solving, stakeholders, and collaborative leadership. | Barata and Kayser (2023) . Industry 5.0—past, present, and near future. <i>Procedia Computer Science</i> , 219, 778–788. |

2.3.1. Human-Centric and Emotional Intelligence Approach in a Tech-Driven World

Leadership 5.0 emphasizes putting people first, even as organizations adopt elevated levels of automation, AI, and digital tools, balancing technology with human-centric leadership practices to maintain employee engagement ([Avolio & Kahai, 2003](#)). Unlike earlier frameworks (e.g., Leadership 4.0, which focuses on adapting to Industry 4.0 technologies), Leadership 5.0 integrates empathy, emotional intelligence, and human well-being into the core of leadership. Leaders are tasked with bridging the gap between technological innovation and human connection, ensuring that technology empowers, rather than replaces, people ([Kane et al., 2015](#)). Leaders in the Leadership 5.0 framework are expected to demonstrate self-awareness, empathy, and people skills, which are critical for building trust and motivating teams. According to [Goleman \(1998\)](#), emotional intelligence is elevated to the same importance as technical expertise, creating a balanced and people-friendly approach to leadership, as self-awareness, composure, conflict resolution inspiring teams, and empathy are core components of emotional intelligence (EI).

2.3.2. Ethical, Purpose-Driven, and Sustainable Leadership

Leadership 5.0 is rooted in values-based leadership ([George, 2007](#)), prioritizing ethical decision-making, integrity, diversity, and inclusion in teams and a focus on long-term

societal impact. Leaders are no longer just focused on profits or efficiency; they aim to make purpose-driven decisions that benefit employees, communities, and the planet through ethical leadership, as ethical leadership significantly impacts employee trust, organizational culture, and long-term sustainability (Brown et al., 2005). Through the establishment of renewable energy-facilitated systems, such as circular processes that reuse, repurpose, and recycle natural resources, sustainable leadership includes reducing waste and environmental harm, and AI and additive manufacturing tools support such sustainability leadership.

Authentic leaders ground their decisions in purpose and values, ensuring ethical practices and long-term success. Hence, leaders who integrate sustainability into their strategies create resilience and adaptability in their organizations, applying sustainability as a leadership and moral imperative (Bansal & Song, 2017; Carroll, 1991).

2.3.3. Inclusive and Collaborative Culture

Leadership 5.0 promotes a culture of continuous innovation, where leaders encourage experimentation, risk-taking, and creative problem solving. Leaders create environments where employees feel empowered to challenge the status quo and explore the latest ideas so that 5.0 ties innovation directly to human collaboration and purpose, ensuring that technology and creativity serve broader societal goals. By fostering diversity, equity, and inclusion (DEI), leaders actively create environments where diverse teams can thrive and contribute their unique perspectives (Shore et al., 2018; Cox & Blake, 1991). It encourages collaborative, coaching-based leadership (Colgate, 2025), where decision-making is shared and employees at all levels are empowered to participate in shaping the organization's future. Consequently, L5.0 moves beyond hierarchical models, embracing flatter, more inclusive structures that value input from all stakeholders and value belonging and engagement in cross-functional collaborative teams.

2.3.4. Future Readiness and Adaptability

While earlier leadership models may have focused on adapting to technology (e.g., Leadership 4.0), Leadership 5.0 integrates human values alongside technological innovation. Leaders in this model are not only technologically savvy but also demonstrate emotional intelligence and ethical foresight to ensure that technology serves people, not the other way around. With a future-ready focus, Leadership 5.0 prioritizes resilience and adaptability in a way that earlier models did not, preparing organizations for both the known and the unknown.

By leveraging adaptability and future readiness mindsets, L5.0 managers can enhance employee adjustment to new work environments, improve connectivity among diverse work groups, support continuous learning, and build resilience to ongoing changes. Moreover, a manager's own personal resilience, to manage continuous changes, alterations in work modes, and technological developments, will facilitate productivity and well-being among employees, due to increased adjustment, connectivity, and resilience in a flexible work environment.

2.3.5. Innovation and Experimentation

Leadership 5.0 is designed for an uncertain and fast-changing world, emphasizing future readiness and the ability to navigate complexity. Leaders focus on building adaptive organizations that thrive amidst disruption and global challenges, such as climate change, geopolitical instability, and technological advancements. With systems thinking and upskilling logic, leaders focus on continuous learning for themselves and their teams to develop digital mindsets for future readiness. This is true at all phases of the adoption of innovation in organizations (Damanpour & Schneider, 2006), according to Edmondson (1999).

Leaders who create such psychologically safe environments do so through inclusiveness and opportunities for experimentation. Creativity, curious mindsets, and innovation thrive in environments that encourage calculated risks and celebrate experimentation, creative problem solving, and rapid prototyping.

After completing the literature review above to map the five pillars of Leadership 5.0, we now develop a scale to measure a leader's Leadership 5.0 maturity level.

3. Leadership 5.0 SURVEY Questionnaire Scale Development

Two general approaches to measurement development are defined by [Nunnally and Bernstein \(1994\)](#). The empirical approach criterion is referenced and the theory-driven approach is construct-oriented ([House et al., 2004](#); [Warner-Söderholm, 2013](#)). Project GLOBE ([House et al., 2004](#)) chose the theory-driven approach and [Nunnally and Bernstein \(1994\)](#) posit that such an approach has an advantage that the target construct can be specified in relation to the relevant theory before items are written ([House et al., 2004](#)). So, any potential biases which could affect the scale can be specified, and so such scales can exhibit acceptable levels of face validity ([Warner-Söderholm, 2013](#)). This present study also applies a theory-driven approach, applying the theoretical frameworks in the literature summarized above to develop survey items from the existing literature to measure the five constructs in the survey. The Likert-type response range for all items, in line with the literature, is one to seven, with one measuring 'completely disagree' and seven measuring 'completely agree'.

3.1. Human-Centric Leadership and Emotional Intelligence Items

Human-centric leadership and emotional intelligence are items that are anchored in the literature. There are questions to measure people skills in leaders, including empathy, emotional intelligence, and prioritizing people over processes. The 10 items below are adapted from earlier validated scales: the Identity Leadership Scale ([Van Dick et al., 2018](#)) and the Emotional Intelligence Scale ([Davies et al., 2010](#)).

- I prioritize the well-being and development of my team members.
- I actively listen to and value input from all members of my team, regardless of their roles.
- I create a safe and supportive environment where team members feel comfortable sharing ideas and concerns.
- I treat all team members fairly and equitably in decision-making processes.
- I inspire my team to find purpose and meaning in their work.
- I am aware of my own emotions and how they affect my leadership decisions.
- I remain calm and composed during challenging situations.
- I demonstrate empathy when addressing the concerns or needs of my team members.
- I handle conflicts within my team constructively and fairly.
- I use emotional intelligence to inspire and motivate my team effectively.

3.2. Ethical, Purpose-Driven, and Sustainable Leadership Items

Ethical, purpose-driven, and sustainable leadership items are anchored in the literature. There are questions to measure the promotion of sustainability, ethical decision-making, and long-term societal impact. There are five items adapted from the Service Leadership Scale ([Murari & Gupta, 2012](#)) and the Values-Based Leadership Scale ([Hendrikz & Engelbrecht, 2019](#)).

- I consider the social and environmental impact of my leadership decisions.
- I actively promote ethical practices and integrity in my team and organization.
- I encourage my team to align their work with sustainability goals and values.

- I will communicate the importance of contributing to a sustainable and equitable future.
- I prioritize projects and initiatives that align with ethical and environmental values.

3.3. Inclusive and Collaborative Culture Items

Inclusive and collaborative culture items are anchored in the literature. There are questions to measure fostering diversity, equity, and collaboration within teams. Five items were adapted from the Transformational Leadership Questionnaire (Alban-Metcalfe & Alimo-Metcalfe, 2007).

- I create an inclusive culture where diverse perspectives are valued and encouraged.
- I ensure that all team members have equal access to opportunities and resources.
- I encourage cross-functional collaboration and knowledge-sharing within and beyond my team.
- I actively seek the input of underrepresented voices when making decisions.
- I foster trust and unity among team members from divergent backgrounds.

3.4. Future Readiness and Adaptability Items

Future readiness and adaptability items are anchored in the literature. There are questions to measure the leveraging of technology while ensuring it enhances human connection for future readiness. The five items below are adapted from the multifactor leadership questionnaire (Antonakis et al., 2003) and the e-leadership literature (Avolio & Kahai, 2003).

- I effectively integrate digital tools and technology to improve team productivity and collaboration.
- I encourage my team to develop digital skills and embrace technological advancements.
- I ensure that technology is used to enhance, rather than replace, meaningful human interactions.
- I am adaptable to changes brought about by digital transformation.
- I empower my team to use technology creatively to solve problems and innovate.

3.5. Innovation and Experimentation Items

Innovation and experimentation items are anchored in the literature. There are questions to measure the encouragement of creativity, adaptability, and experimentation. The five items below are developed from the Leadership Practices Inventory by Posner and Kouzes (1988) and relevant Industry 5.0 readiness studies.

- I inspire my team to think creatively and explore new ways of solving problems.
- I encourage experimentation and allow team members to take calculated risks.
- I create an environment where innovation is celebrated and rewarded.
- I motivate my team to continuously learn and adapt to emerging challenges.
- I actively implement innovative ideas and practices to improve processes and outcomes.

4. Data Collection Leadership 5.0 Scale Items

The sampling method applied in this pilot survey is convenience sampling. Convenience sampling is a non-probability research method where participants are chosen based on their proximity, availability, and ease of access, making it quick and inexpensive. While useful for preliminary research, this method carries a considerable risk of bias and limits the generalizability of the findings, as the sample may not be representative of the broader population. To mediate this bias risk, a specific empirical setting was selected: namely, the sample was narrowed down to the managers of international publicly owned organizations in Germany. After implementing minor amendments indicated during the

pre-data collection focus group interview stage (minor changes to wording for international clarity), the complete questionnaire was sent to the response group of German managers in the period July–September 2025. Two demographic items were included to meet the GDPR data collection guidelines regarding anonymity and confidentiality. These were (1) organizational level and (2) function within the organization. Please see Appendices A–C for more details.

Data Analysis: Results of the Pilot Study

For validation of the five concepts, a small data sample was collected from German technology firms and the technical departments of multipurpose companies. The test sample size was $n = 16$. To support data organization, three questions were included to clarify the organization level of the respondent’s role, functional work area, and gender. Gender data were checked to ensure data collection from both genders but is not included in the analysis. As no personal information was collected, an Ethics Committee approval was not deemed necessary for the survey. An overview of the research flow is depicted in Figure 4.

RESEARCH FLOW, DATA ANALYSIS, FINDINGS

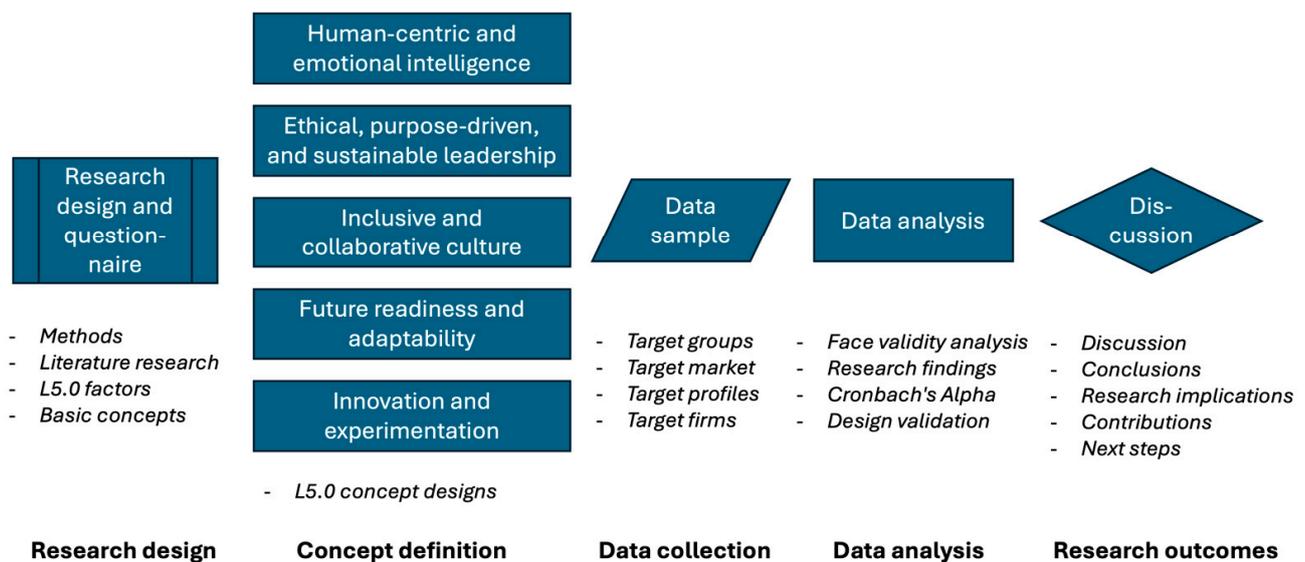


Figure 4. Research flow, data analysis, and findings.

Data collection and analysis were split into five phases: sample collection, summary of survey results, conceptual analysis, statistical analysis, and discussion and conclusions. The five phases are summarized in Figure 5.

Values for each of the five items were aggregated to the construct level to understand distribution as part of this pilot study. Then, the data were analyzed to check face validity. With such a small sample ($n = 16$), one cannot make assumptions, yet the novel initial findings indicate that the survey method provides relevant research constructs and has a high level of face validity. As an indicator for the appearance and clarity of the survey methods, the use of words like leadership, inclusivity, and collaboration in the construct definitions and indicators support this view.

The collected results were summarized to outline empirical outcomes and sample distribution. The sample yielded 144 individual data points. While male respondents dominated, both the male (75%) and female (25%) genders were represented in the survey. None of the respondents chose to not disclose their gender. The majority of the survey

participants reported holding a senior management position (eight), followed by other roles at their organization (six) and two held C-Suite positions. The sample consists mostly of technology company (62.5%) and technical department (12.5%) employees, while a quarter indicated that they worked in other functions.

DATA ANALYSIS APPROACH

Core of data analysis

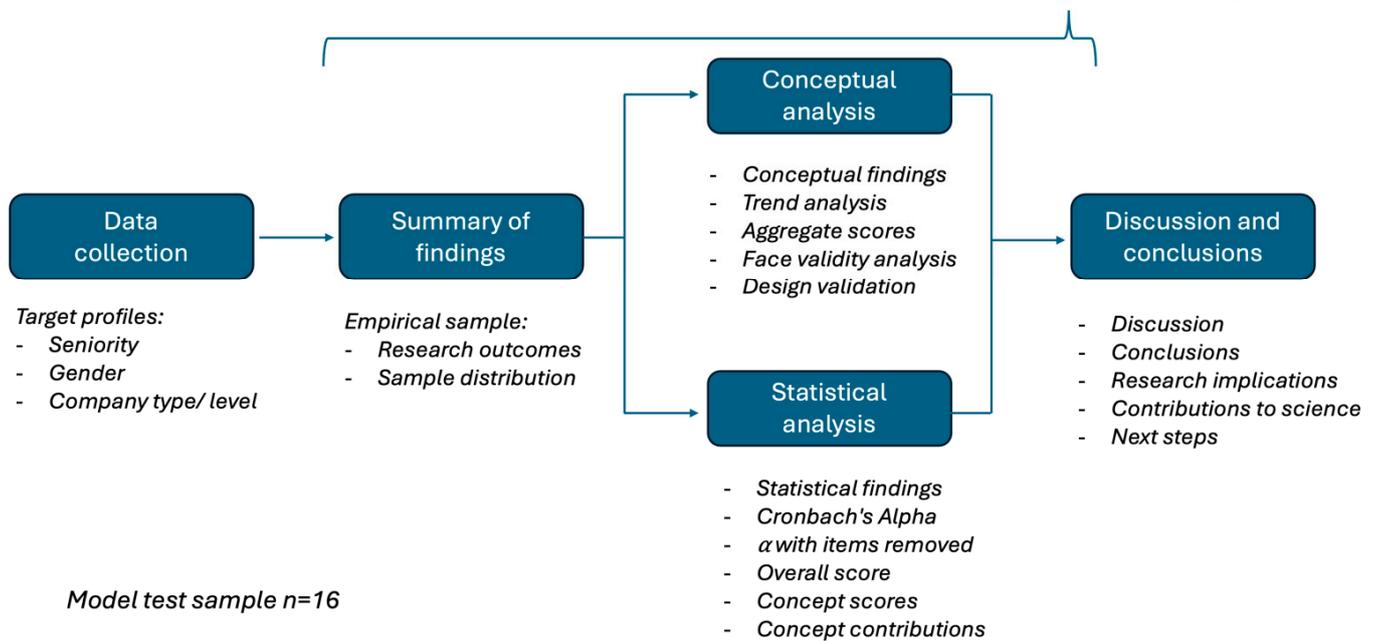


Figure 5. Data analysis approach.

For the conceptual assessment, an aggregated score between one and seven was established for each construct, with one indicating low support and seven the highest support for any survey statement. A review of the results indicates that questions in the questionnaire were relevant and meaningful. This is because answers were spread across the spectrum, and no inputs were received for the negative extreme where a respondent would have disagreed with all choices (0 responses). Half of the responses were in the middle of the spectrum (56%), with the highest individual count being on the positive side, with two-thirds of entries. This indicates an overall median level, and for top management, a mid-to-high level of support for the L5.0 constructs.

When assessing the details for the individual constructs, for *human-centric leadership and emotional intelligence* items, ten participants responded with a high score for all items, while four scored highest in the *well-being and development of team members* or the focus on *creation of a safe and supportive environment for team members* items. A quarter scored highest in the items to *remain calm and composed during challenging situations*, and a little more than a third (37.5%) scored highest in *emotional intelligence to inspire and motivate*. Only two scored highest in the item to *demonstrate empathy when addressing concerns of team members*. Overall, this indicates a slight emphasis towards the lower end, and an aggregate score of 4.62.

For construct 2, *future readiness, digital adaptability and digital mindset* had the strongest support. Half of the responses scored highest in *effectively integrating digital tools and technology*, followed by a little more than one-third (37.5%) in *ensuring that technology is used to enhance, rather than replace meaningful human interactions*, and a mere two respondents scored highest in the item for *encouraging the team to develop digital skills*. The aggregate score is the highest at 5.11, together with *innovation and experimentation*.

Scores for *sustainability and ethical leadership* were more evenly spread across the scale. Half of the respondents preferred *actively promoting ethical practices and integrity*. The same share of 12.5% of responses were given to *support for all statements, preference for encouragement of team to align goals with sustainability values and communicating importance of contribution to sustainable future*. Thus, *active promotion of ethical practices* was the overall strongest indicator within the construct. The aggregated response score is 4.9.

For the assessment of *inclusivity and collaboration*, a quarter of participants indicated support for all statements, and 37.5% of the respondents preferred *support for cross functional collaboration and knowledge-sharing*. Only two respondents each focused on *inclusive culture, ensuring that all team members have equal access and opportunities, and actively seeking input from underrepresented voices*. This makes *cross functional collaboration and knowledge-sharing* the leading indicator within the construct. To summarize, 4.97 is the aggregate value.

For the construct *innovation-driven mindset*, half of the respondents indicated *encouragement of experimentation* as the strongest focus, while four participants scored higher in *inspire the team to think creatively and explore problem solving*. *Full agreement on all statements and active implementation of innovative ideas and practices* were chosen by two respondents for each. The aggregate score is also one of the two highest scores, at 5.11.

For statistical analysis, a reliability calculation was conducted on a set of five items to evaluate the internal consistency. A Cronbach's Alpha was computed to assess the model (Tavakol & Dennick, 2011). This simplified formula in Figure 6 was used for the calculation:

$$\alpha = \frac{k}{k - 1} \left(1 - \frac{\sum s_i^2}{s_{total}^2} \right)$$

Figure 6. Formula for Cronbach's Alpha.

The Cronbach's Alpha calculation was conducted in two steps. In a first step, the two indicators of the first construct were assessed. Two data sets were used:

Item 1: 7 7 7 7 7 7 7 6 6 5 5 4 4 4 4

Item 2: 7 7 6 6 5 5 5 4 4 2 2 2 2 2 2

For *human-centric leadership and emotional intelligence* items, the calculation returned a Cronbach's Alpha of $\alpha = 0.86$. This indicates a high likelihood that both items measure the same concept.

To ensure comparability with the other four concepts, an aggregate value was used for *human-centric leadership and emotional intelligence*. This again gives us five datasets for the five L5.0 concepts:

Item 1: 7 7 6.5 6.5 6 6 6 6 5 5 3.5 3.5 3 3 3 3

Item 2: 6 6 6 6 6 6 6 5 5 4 4 4 4 4 4

Item 3: 7 7 5 5 5 5 5 5 5 5 4 4 3 3

Item 4: 7 7 7 7 6 6 5 5 4 4 4 4 4 3 3

Item 5: 7 7 6 6 6 6 5 5 5 5 5 5 2 2

First, computation was performed for Item 1 and Item 2, then indicators were added one at a time to observe how the score develops with more concepts added. This returned cumulative alphas between $\alpha = 0.906$ and $\alpha = 0.948$. This result in Figure 7 indicates a very high internal consistency of the data, i.e., the scale is measuring very homogeneously.

Subsequently, the model was tested by removing items. Cronbach's Alpha when items were deleted returned a lower score for every item removed. The result is shown in Figure 8.

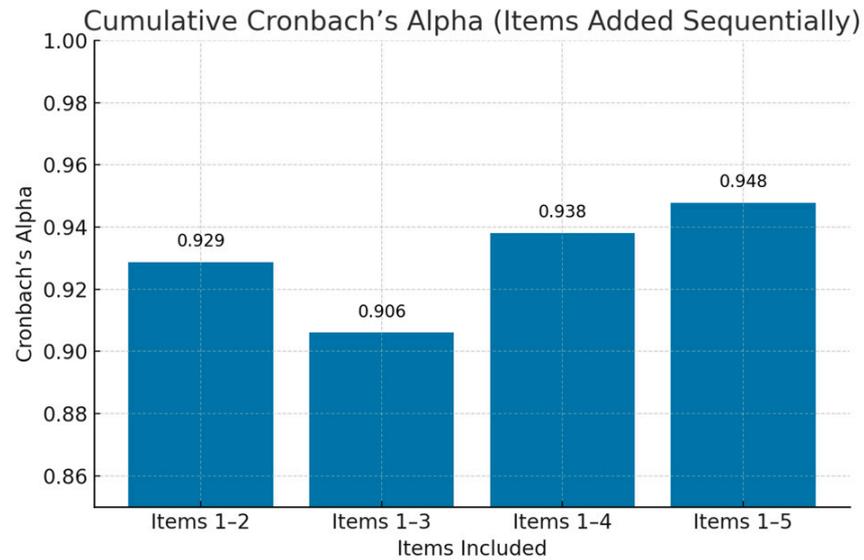


Figure 7. Cronbach's Alpha with Items added sequentially.

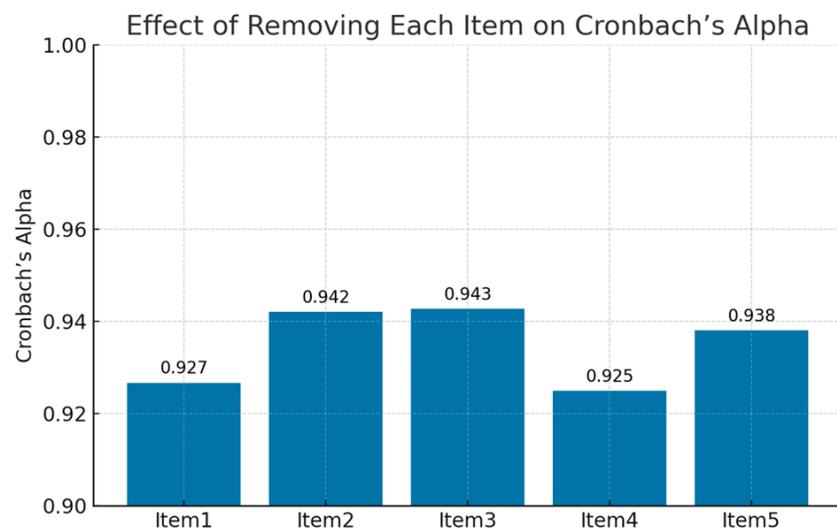


Figure 8. Cronbach's Alpha with Items removed.

The overall Cronbach's Alpha was $\alpha = 0.948$, indicating excellent reliability. Cumulative alpha values increased as more items were added, confirming consistent measurement of the same construct. Removing any item slightly decreased the alpha, suggesting that all items contributed positively to the scale. These results demonstrate that the questionnaire items are highly homogeneous and measure a common underlying dimension. Please see Appendices A–C for more details.

5. Discussion

The findings of this study suggest that although the L5.0 focus is growing globally in the business press, empirical studies are scarce. We help to fill the gap by offering a theoretical exploration of L5.0. We have proposed a comprehensive and actionable conceptual model for mapping L5.0. We have identified five key L5.0 pillars from the literature, which are human-centric leadership, future readiness and adaptability, a sustainability and ethics focus, collaboration and inclusion values, and an innovation and experimentation approach to leadership. We have developed a 30-item L5.0 survey instrument (plus pre-survey questions), which is anchored in the literature. Furthermore, we have conducted initial pilot testing for item clarification and face validity testing.

Comparing the aggregate scores of all the constructs shows *future readiness and adaptability*, along with *innovation and experimentation* standing out to have the highest overall aggregate scores of 5.11. The result is shown in Figure 9.

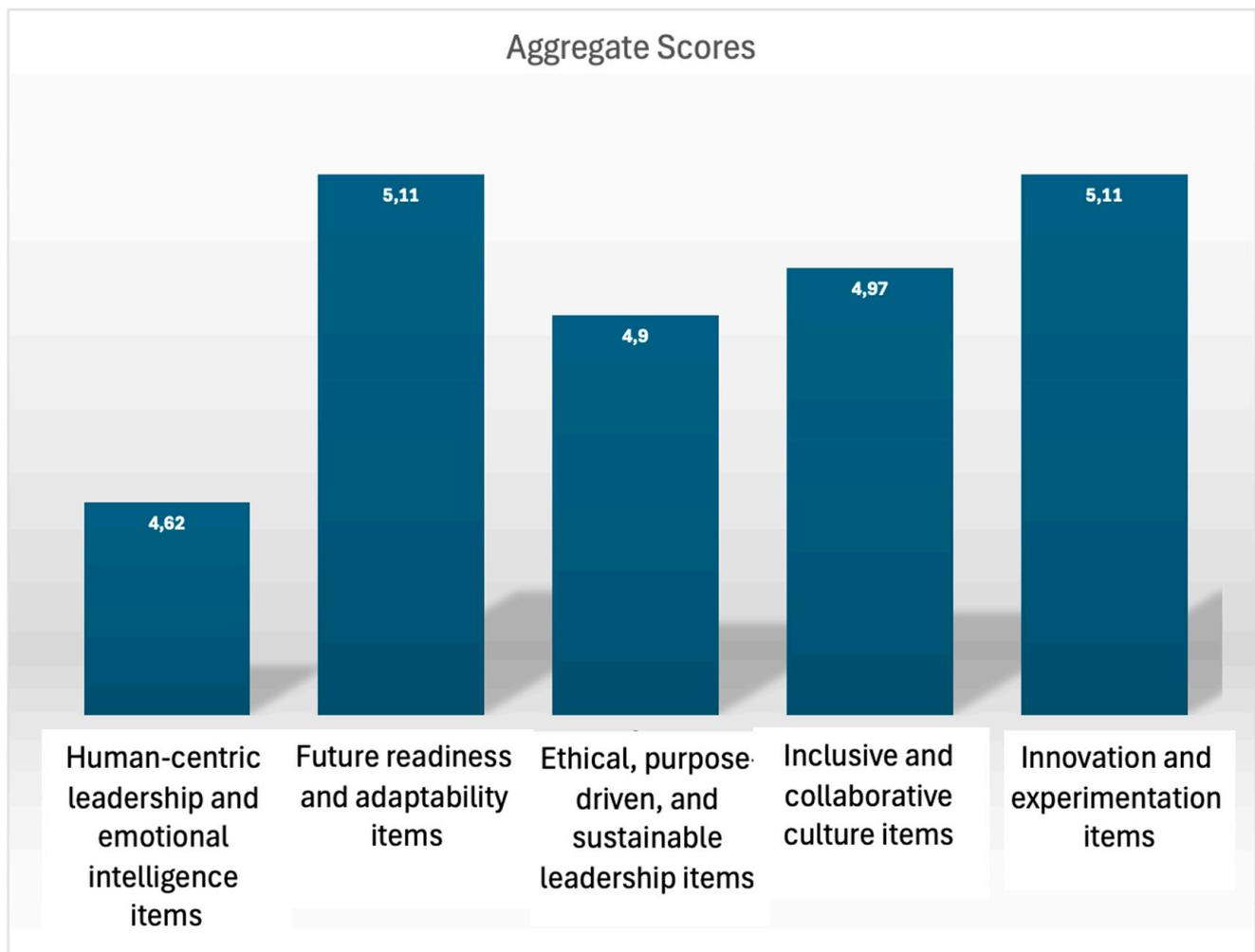


Figure 9. Aggregate scores for the five constructs.

From a management perspective, this indicates that future orientation and innovative leadership traits score highly in the survey results. Yet in comparison, human-centric leadership scores were the lowest overall in this pilot study. As human centricity is one of the five key pillars of L5.0, and a cornerstone of Industry 5.0, this result suggests that human-centric leadership and emotional intelligence might be areas to pay attention to for companies planning to implement Industry 5.0 models.

Further comparison of the aggregate scores in Figure 2, above, shows the constructs of *ethical leadership* and *inclusivity and collaboration* to have median results of 4.9 and 4.97, respectively. In comparison, *human-centric leadership and emotional intelligence* received the overall lowest aggregate score, with 4.62. These results indicate that within the respondent group, L5.0 *human-centric leadership and emotional intelligence* factors ranked overall lowest and the constructs focusing on *ethical, purpose-driven leadership and collaborative culture items* were in the middle, while *future readiness* and *innovation mindset* scored the highest. It could be argued that human-centric leadership skills are particularly important when AI-driven automation is already paving the way for job cuts in global technology companies. Similar effects are likely to be felt in less technical environments with some lag. But leadership needs to start making pre-emptive decisions today.

Overall, the survey results, as a road map to understand the maturity of L5.0 values in the respondent group, indicate a group of leaders who self-report high on the *future readiness* and *experimentation* values. For *ethical and purpose-driven leadership*, as well as an *inclusive and collaborative* mindset, survey results indicate good competences, yet less maturity in leaders for these elements of L5.0.

Summarizing the above, we can conclude that in line with intuition, no leaders in the pilot study showed low levels of L5.0 competences, as the lowest score was 4.62. Maybe expectedly, while none of the constructs indicated a low score in L5.0 leadership values, *ethical leadership* and *collaborative culture* values were lower than the *future readiness*, *digital adaptability and digital mindset*, and *experimentation* values. This raises the need for verification of the findings through a larger sample, where a higher number of responses should provide a clearer understanding of the Leadership 5.0 attitudes and preferences.

6. Conclusions, Limitations, Implications, and Future Research

The findings of this study have confirmed that although the L5.0 focus is growing globally in the business press, empirical studies are scarce: we help to fill the gap by offering a theoretical exploration of L5.0. We propose a comprehensive and actionable conceptual model for mapping L5.0. We have identified five key L5.0 pillars from the literature, which are human-centric leadership, future readiness and adaptability, a sustainability and ethics focus, collaboration and inclusion values, and an innovation and experimentation approach to leadership. We have developed a 30 -item L5.0 survey instrument, anchored in the literature, and we conducted initial pilot testing for item clarification and face validity testing. Besides theoretical contributions, as discussed above, our research also offers important practical managerial implications. Our research has identified and developed a survey instrument to measure the maturity levels of managers within the five key areas of being a future-ready leader: namely, human-centric leadership, future readiness and adaptability, sustainability and ethics, collaboration and inclusion values, and innovation and experimentation levels. By collecting data within organizations or industries, information can be used for mapping the development of global leaders. The survey instrument can be applied in the education and training of leaders for success in multiple countries and across a range of industries (Warner-Söderholm et al., 2024): an integral part of upskilling needs in both the public and private sectors. The practical implications include implications for policy makers and educational managers to identify needs in order to invest in capacity building. Periodical feedback to both individuals and departments on their levels of L5.0 maturity will strengthen company resilience.

In addition, our research addresses previous calls for a tool or ‘road map’ for helping organizations to measure L5.0 maturity in teams. Hence, an important managerial implication stemming from our findings is that the L5.0 tool can be applied as a validated online tool or an application for organizations to map different future readiness levels. Such a barometer can be utilized in management training to enhance self-awareness at all management levels, to prepare, educate, and develop new teams, and to strengthen the organization’s culture and future readiness reputation (Warner-Söderholm et al., 2024). Limitations of the study include the limited size of our pilot study respondent group. Future researchers now need to empirically test and validate the model and survey instrument. It is recommended to collect a large cross-national data set to explore the possible national difference in L5.0 maturity levels across regions. Future studies may include a larger set of demographic items to explore gender, age, and education level differences. Consequently, this study has important management and practical implications. Our mapping of the L5.0 existing literature yielded a clear support for the conceptual model and highlighted the appropriateness of the chosen survey items. The results of the pilot study indicate a

successful item clarification and face validity. The next steps will be to derive additional insights from larger samples and from comparisons of different groupings. Widening the L5.0 research scope to cover more geographies and surveying comparative samples of similar groupings bears the promise of deeper insights. Finally, our mapping of Leadership 5.0 underscores the critical management implications, by signaling a shift from efficiency-oriented leadership models to approaches that integrate human-centric values, ethical governance, and technological collaboration. Managers must foster adaptive, inclusive, resilient, and sustainable organizational cultures in order to thrive in the Leadership 5.0 era.

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Institutional Review Board Statement: Ethical review and approval were waived for this study. No specific ethics board application to start the study was required as we meet the ethical standards within the EU GDPR data protection requirements set by European Commission (europa.eu), as anonymity and confidentiality are assured. We confirm that we have not included medical trials or specific research on humans or animals in our study. In addition, we detail and confirm in our manuscript footnote, which co-author contributed to the development of each section, to secure that we meet the San Francisco protocol for ethical co-authorship (sfdora.org).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data available by contacting corresponding author.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

| Calculation tables for aggregate scores: | | | | | | | |
|--|-----|------------|------|---|------|------|--|
| Aggregate scores 1 | | | | | | | |
| 94 | 112 | 0.83928571 | 0.84 | 7 | 5.88 | 4.62 | |
| 54 | 112 | 0.48214286 | 0.48 | 7 | 3.36 | | |
| 82 | 112 | 0.73214286 | 0.73 | 7 | 5.11 | | |
| 78 | 112 | 0.69642857 | 0.7 | 7 | 4.9 | | |
| 80 | 112 | 0.71428571 | 0.71 | 7 | 4.97 | | |
| 82 | 112 | 0.73214286 | 0.73 | 7 | 5.11 | | |
| Aggregate scores 2 | | | | | | | |
| 74 | 112 | 0.66071429 | 0.66 | 7 | 4.62 | | |
| 82 | 112 | 0.73214286 | 0.73 | 7 | 5.11 | | |
| 78 | 112 | 0.69642857 | 0.7 | 7 | 4.9 | | |
| 80 | 112 | 0.71428571 | 0.71 | 7 | 4.97 | | |
| 82 | 112 | 0.73214286 | 0.73 | 7 | 5.11 | | |

Appendix B

Survey questionnaire.

1. Pre-survey questions for organizing data: (A) Organizational level. Required to answer. Single choice.

I hold a C-Suite position (CEO, CFO, COO, CTO, etc.).

I hold a senior management role (EVP, SVP, VP, etc.).

I hold another role at my organization (Head of, Director, Senior Manager, etc.).

2. Pre-survey questions for organizing data: (B) Function in organization. Required to answer. Single choice.

I work at a technology company (IT, SW, services, engineering).

I work in a technical department at a multipurpose company (R&D, engineering, IT).

I work in another function at a multipurpose company.

3. Pre-survey questionnaire for organizing data: (C) Gender. Required to answer. Single choice.

I am male.

I am female.

No selection.

4. Section 1a: Human-centric leadership and emotional intelligence items. Required to answer. Single choice.

I fully agree with all the statements.

I prioritize the well-being and development of my team members.

I actively listen to and value input from all members of my team, regardless of their roles.

I create a safe and supportive environment where team members feel comfortable sharing ideas and concerns.

I treat all team members fairly and equitably in decision-making processes.

I inspire my team to find purpose and meaning in their work.

I disagree with all the statements.

5. Section 1b, part 2: Human-centric leadership and emotional intelligence items. Required to answer. Single choice.

I fully agree with all the statements.

I am aware of my own emotions and how they affect my leadership decisions.

I remain calm and composed during challenging situations.

I demonstrate empathy when addressing the concerns or needs of my team members.

I handle conflicts within my team constructively and fairly.

I use emotional intelligence to inspire and motivate my team effectively.

I disagree with all the statements.

6. Section 2: Future readiness, digital adaptability and digital mindset. Required to answer. Single choice.

I fully agree with all the statements.

I effectively integrate digital tools and technology to improve team productivity and collaboration.

I encourage my team to develop digital skills and embrace technological advancements.

I ensure that technology is used to enhance, rather than replace, meaningful human interactions.

I am adaptable to changes brought about by digital transformation.

I empower my team to use technology creatively to solve problems and innovate.

I disagree with all the statements.

7. Section 3: Sustainability and ethical leadership. Required to answer. Single choice.

I fully agree with all the statements.

I consider the social and environmental impact of my leadership decisions.

I actively promote ethical practices and integrity in my team and organization.

I encourage my team to align their work with sustainability goals and values.

I communicate the importance of contributing to a sustainable and equitable future.

I prioritize projects and initiatives that align with ethical and environmental values.

I disagree with all the statements.

8. Section 4: Inclusivity and collaboration. Required to answer. Single choice.

I fully agree with all the statements.

I create an inclusive culture where diverse perspectives are valued and encouraged.

I ensure that all team members have equal access to opportunities and resources.

I encourage cross-functional collaboration and knowledge-sharing within and beyond my team.

I actively seek the input of underrepresented voices when making decisions.

I foster trust and unity among team members from different backgrounds.

I disagree with all the statements.

9. Section 5: Innovation-driven mindset. Required to answer. Single choice.

I fully agree with all the statements.

I inspire my team to think creatively and explore new ways of solving problems.

I encourage experimentation and allow team members to take calculated risks.

I create an environment where innovation is celebrated and rewarded.

I motivate my team to continuously learn and adapt to emerging challenges.

I actively implement innovative ideas and practices to improve processes and outcomes.

I disagree with all the statements.

Appendix C

Cronbach’s Alpha

Datasets for Cronbach’s Alpha

| | | | | | | | | | | | | | | | | | |
|---|---|---|-----|-----|---|---|---|---|---|---|---|-----|-----|---|---|---|---|
| Human-centric Leadership and EI (1) | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 |
| Human-centric Leadership and EI (2) | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 |
| Human-centric Leadership and EI Future Readiness and Digital Adaptability | 7 | 7 | 6,5 | 6,5 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 3,5 | 3,5 | 3 | 3 | 3 | 3 |
| Sustainability and Ethical Leadership | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 |
| Inclusivity and Collaboration | 7 | 7 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 3 | 3 |
| Innovation-driven Mindset | 7 | 7 | 7 | 7 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 |
| | 7 | 7 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 2 |

Step 1: Calculate item variances.

Step 1 – Calculate item variances

(variance across the 16 participants)

$$s_1^2 = 2.32, \quad s_2^2 = 0.89$$

(sum of item variances = 3.21)

Step 2: Calculate score per person.

Step 2 – Total score per person

(sum of Item 1 + Item 2):

e.g. person 1 = 13, person 3 = 12.5, person 11 = 7.5, etc.

Variance of total score $s_{total}^2 = 5.64$

Step 3: Use Cronbach’s Alpha.

Step 3 – Plug into Cronbach’s α formula

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum s_i^2}{s_{total}^2} \right)$$

with $k = 2$:

$$\alpha = \frac{2}{1} \left(1 - \frac{3.21}{5.64} \right) = 2 \times (1 - 0.57) = 2 \times 0.43 = 0.86$$

The analysis returns an overall Cronbach’s Alpha value of 0.948.

References

- Alban-Metcalf, J., & Alimo-Metcalf, B. (2007). Development of a private sector version of the (Engaging) Transformational Leadership Questionnaire. *Leadership & Organization Development Journal*, 28(2), 104–121. [\[CrossRef\]](#)
- Alshaibani, E., Bakir, A., & Al-Atwi, A. (2025). The impact of leadership behaviors on organizational innovative performance and learning in AI-driven Industry 5.0 environments. *Development and Learning in Organizations: An International Journal*, 39(3), 18–21. [\[CrossRef\]](#)

- Antonakis, J., Avolio, B. J., & Sivasubramaniam, N. (2003). Context and leadership: An examination of the nine-factor full-range leadership theory using the Multifactor Leadership Questionnaire. *The Leadership Quarterly*, 14(3), 261–295. [\[CrossRef\]](#)
- Avolio, B. J., & Kahai, S. S. (2003). Adding the “E” to E-leadership: How it may impact your leadership. *Organizational Dynamics*, 31(4), 325–338. [\[CrossRef\]](#)
- Bakir, A., & Dahlan, M. (2023). Higher education leadership and curricular design in Industry 5.0 environment: A cursory glance. *Development and Learning in Organizations: An International Journal*, 37(3), 15–17. [\[CrossRef\]](#)
- Balcerzyk, D., & Czainska, K. (2024). Trust in artificial intelligence and the 5.0 leadership. In *Digital synergy* (pp. 94–100). CRC Press.
- Bansal, P., & Song, H. C. (2017). Similar but not the same: Differentiating corporate sustainability from corporate responsibility. *Academy of Management Annals*, 11(1), 105–149. [\[CrossRef\]](#)
- Barata, J., & Kayser, I. (2023). Industry 5.0—past, present, and near future. *Procedia Computer Science*, 219, 778–788. [\[CrossRef\]](#)
- Basham, L. M. (2012). Transformational leadership characteristics necessary for today’s leaders in higher education. *Journal of International Education Research*, 8(4), 343.
- Bos-Nehles, A., Renkema, M., & Janssen, M. (2017). HRM and innovative work behaviour: A systematic literature review. *Personnel Review*, 46(7), 1228–1253. [\[CrossRef\]](#)
- Breque, M., De Nul, L., & Petridis, A. (2021). *Industry 5.0: Towards a sustainable, human-centric, and resilient European industry* (No. KI-BD-20-021-EN-N). Directorate General for Research and Innovation (DG RTD) of the European Commission.
- Brown, M. E., Treviño, L. K., & Harrison, D. A. (2005). Ethical leadership: A social learning perspective for construct development and testing. *Organizational Behavior and Human Decision Processes*, 97(2), 117–134. [\[CrossRef\]](#)
- Carroll, A. B. (1991). The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders. *Business Horizons*, 34(4), 39–48. [\[CrossRef\]](#)
- Colgate, M. (2025). The importance and application of a coaching leadership style in businesses. *Businesses*, 5(3), 32. [\[CrossRef\]](#)
- Cox, T. H., & Blake, S. (1991). Managing cultural diversity: Implications for organizational competitiveness. *Academy of Management Perspectives*, 5(3), 45–56. [\[CrossRef\]](#)
- Damanpour, F., & Schneider, M. (2006). Phases of the adoption of innovation in organizations: Effects of environment, organization, and top managers. *British Journal of Management*, 17(3), 215–236. [\[CrossRef\]](#)
- Davies, K. A., Lane, A. M., Devonport, T. J., & Scott, J. A. (2010). Validity and reliability of a brief emotional intelligence scale (BEIS-10). *Journal of Individual Differences*, 31(4). [\[CrossRef\]](#)
- Demir, K. A., Döven, G., & Sezen, B. (2019). Industry 5.0 and human-robot co-working. *Procedia Computer Science*, 158, 688–695. [\[CrossRef\]](#)
- Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, 44(2), 350–383. [\[CrossRef\]](#)
- George, J. M. (2007). 9 Creativity in organizations. *Academy of Management Annals*, 1(1), 439–477. [\[CrossRef\]](#)
- Goleman, D. (1998). The emotional intelligence of leaders. *Leader to Leader*, 1998(10), 20–26. [\[CrossRef\]](#)
- Hendrikz, K., & Engelbrecht, A. S. (2019). The principled leadership scale: An integration of value-based leadership. *SA Journal of Industrial Psychology*, 45(1), 1–10. [\[CrossRef\]](#)
- Holroyd, C. (2022). Technological innovation and building a ‘super smart’ society: Japan’s vision of society 5.0. *Journal of Asian Public Policy*, 15(1), 18–31. [\[CrossRef\]](#)
- House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., & Gupta, V. (Eds.). (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. Sage Publications.
- Javaid, M., Haleem, A., Singh, R. P., & Suman, R. (2021). Substantial capabilities of robotics in enhancing industry 4.0 implementation. *Cognitive Robotics*, 1, 58–75. [\[CrossRef\]](#)
- Jiang, T., & Ali, D. (2024). The impact of leadership styles on employee relations performance. *International Journal of Social Sciences and Public Administration*, 3(3), 120–127. [\[CrossRef\]](#)
- Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2015, July 14). Strategy, not technology, drives digital transformation. *MIT Sloan Management Review*.
- Konno, N., & Schillaci, C. E. (2021). Intellectual capital in Society 5.0 by the lens of the knowledge creation theory. *Journal of Intellectual Capital*, 22(3), 478–505. [\[CrossRef\]](#)
- Murari, K., & Gupta, K. S. (2012). Impact of servant leadership on employee empowerment. *Journal of Strategic Human Resource Management*, 1(1), 28.
- Müller, J. (2020). *Enabling technologies for Industry 5.0: Results of a workshop with Europe’s technology leaders*. Directorate-General for Research and Innovation.
- Mwita, M. M., & Joanthan, J. (2019). Digital leadership for digital transformation. *Electronic Scientific Journal*, 10(4), 2082–2677.
- Nahavandi, S. (2019). Industry 5.0—A human-centric solution. *Sustainability*, 11(16), 4371. [\[CrossRef\]](#)
- Northouse, P. G. (2023). *Introduction to leadership: Concepts and practice*. Sage Publications.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. [\[CrossRef\]](#)
- Podsakoff, P. M., MacKenzie, S. B., Moorman, R. H., & Fetter, R. (1990). Transformational leader behaviors and their effects on followers' trust in leader, satisfaction, and organizational citizenship behaviors. *The Leadership Quarterly*, 1(2), 107–142. [\[CrossRef\]](#)
- Posner, B. Z., & Kouzes, J. M. (1988). Development and validation of the leadership practices inventory. *Educational and Psychological Measurement*, 48(2), 483–496. [\[CrossRef\]](#)
- Salvetti, F., & Bertagni, B. (2020). Leadership 5.0: An agile mindset for a digital future. *International Journal of Advanced Corporate Learning*, 13(2), 57. [\[CrossRef\]](#)
- Sarişik, G., & Demir, S. (2025). Industry 5.0: A Human-centric paradigm for sustainable and resilient industrial transformation. *Journal of Social Perspective Studies*, 2(2), 50–66.
- Schnell, P., Haag, P., & Jünger, H. C. (2022). Implementation of digital technologies in construction companies: Establishing a holistic process which addresses current barriers. *Businesses*, 3(1), 1–18. [\[CrossRef\]](#)
- Serrano, C. G., & Mosquera-Bolaños, J. A. (2022). Leadership 5.0. a new approach in higher education. *IEEE Revista Iberoamericana de Tecnologías del Aprendizaje*, 17(4), 393–400. [\[CrossRef\]](#)
- Shore, L. M., Cleveland, J. N., & Sanchez, D. (2018). Inclusive workplaces: A review and model. *Human Resource Management Review*, 28(2), 176–189. [\[CrossRef\]](#)
- Spears, L. C. (2010). Character and servant leadership: Ten characteristics of effective, caring leaders. *The Journal of Virtues & Leadership*, 1(1), 25–30.
- Sun, X., & Song, Y. (2025). Unlocking the Synergy: Increasing productivity through Human-AI collaboration in the Industry 5.0 Era. *Computers & Industrial Engineering*, 200, 110657.
- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2, 53. [\[CrossRef\]](#)
- Thomas, A., Chawla, Y., Varma, A., & Szleter, P. (2023). The role of business leaders in Industry 5.0. In *The International Research & Innovation Forum* (pp. 629–640). Springer International Publishing.
- Van Dick, R., Lemoine, J. E., Steffens, N. K., Kerschreiter, R., Akfirat, S. A., Avanzi, L., Dumont, K., Epitropaki, O., Fransen, K., Giessner, S., González, R., Kark, R., Lipponen, J., Markovits, Y., Monzani, L., Orosz, G., Pandey, D., Roland-Lévy, C., Schuh, S., & Haslam, S. A. (2018). Identity leadership going global: Validation of the identity leadership inventory across 20 countries. *Journal of Occupational and Organizational Psychology*, 91(4), 697–728. [\[CrossRef\]](#)
- Van Dierendonck, D. (2011). Servant leadership: A review and synthesis. *Journal of Management*, 37(4), 1228–1261. [\[CrossRef\]](#)
- Vogel-Heuser, B., & Hess, D. (2016). Guest editorial Industry 4.0—prerequisites and visions. *IEEE Transactions on automation Science and Engineering*, 13(2), 411–413. [\[CrossRef\]](#)
- Wahlster, W. (2014, February 24–27). *Multiadaptive interfaces to cyber-physical environments*. Proceedings of the 19th International Conference on Intelligent User Interfaces (pp. 1–2), Haifa, Israel.
- Warner-Søderholm, G. (2013). Beyond a literature review of hall's context dimension: Scale development, validation & empirical findings within a norwegian study. *International Journal of Business and Management*, 8, 2. [\[CrossRef\]](#)
- Warner-Søderholm, G., Čepėnas, S., Minelgaite, I., & Akstinaitė, V. (2024). Sustainability-oriented leader, please! Effects of industry on followers' preferences. *Administrative Sciences*, 14(3), 46. [\[CrossRef\]](#)
- Weill, P., & Ross, J. W. (2009). *IT savvy: What top executives must know to go from pain to gain*. Harvard Business Press.
- Weill, P., & Woerner, S. L. (2018). Is your company ready for a digital future? *MIT Sloan Management Review*, 59(2), 21–25.
- Whitehead, J., Mohamed Hashim, M. A., Tlemsani, I., & Majid Gilani, S. A. (2025). Strategic Leadership 5.0: Reality or illusion? *Journal of the Knowledge Economy*, 1–29. [\[CrossRef\]](#)
- Xu, L. D., Xu, E. L., & Li, L. (2018). Industry 4.0: State of the art and future trends. *International Journal of Production Research*, 56(8), 2941–2962. [\[CrossRef\]](#)
- Xu, X., Lu, Y., Vogel-Heuser, B., & Wang, L. (2021). Industry 4.0 and Industry 5.0—Inception, conception, and perception. *Journal of Manufacturing Systems*, 61, 530–535. [\[CrossRef\]](#)

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