Chapter 4

Rethinking Leadership in Workplaces in the Age of Smart Machines: Exploring Its Future

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Abstract

> […] While the perfection of human is being questioned again in the age of smart machines, "human leaders" are also being reconsidered. Perhaps the subject of the coming decades may even be "unmanned leadership." … But can we really imagine that leadership will become unmanned?. (Özbebek Tunç, 2020a, p. 233)

I realize how much the closing sentences of one of my previous studies, which I concluded with, have actually opened the door to the starting point of this chapter. While smart machines have entered our lives, we still remain uncertain about our readiness and role distribution. We cannot go further than looking at our path with predictions from theory and practice and guessing what we will encounter through the dilemma of "threat or opportunity?". Throughout this chapter, we will take a step back and forth in our relationship with smart machines. Firstly, we will talk about the changes created by the Industry 4.0 revolution and its basic concepts for human and businesses. Then, we will touch on the place of artificial intelligence (AI), one of the most important components of this revolution, in business life, its superiority over human, robotic collar workers, cobots, social robots, and how they share work environments with human. Finally, after talking about robot leaders and the Leadership 4.0 requirements of people who will lead in the Industry 4.0 context, we will end the section with discussion questions. The chapter aims to present a holistic discussion on how leadership is being transformed within the context of Industry 4.0 and beyond.

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Industry 4.0 and What it Brings

> The future cannot be dictated from the outside;
> it is invented and designed from within. (Boesenberg, 2017b)

The world is undergoing a technological revolution that is changing how we work, live, and interact with one another. Recent research shows that this revolution is unlike anything we have experienced before. What differentiates the Fourth Industrial Revolution is, in fact, the combination of all these breakthroughs (Oxford Leadership, 2016). It is argued that, in terms of speed, scope, depth, and systemic impact, it is not merely an extension of the so-called Third Industrial Revolution (Schwab, 2016). In an interview in March 2016 published by McKinsey, one of the leading business leaders, Cisco's former CEO Chambers (McKinsey, 2016), stated that 40% of the world's largest companies would cease to exist within a decade if they fail to adequately prepare for this period. So, what does all of this mean, and what are the scope, content, and implications of this revolution?

The Scope of Industry 4.0

The term *Fourth Industrial Revolution (Industry 4.0)*, first introduced by the founder of the World Economic Forum, Klaus Schwab (2015), corresponds to a revolution characterized by the dramatic magnitude of technological change and its visible speed and impact on society. The First Industrial Revolution used water and steam power to mechanize production; the second utilized electric power to create mass production. The third combined electronics and information technology to automate production. Now, the Fourth Industrial Revolution builds upon the Third Industrial Revolution, which began in the mid-20th century, creating a *digital revolution* that is reshaping the world.

The four key components – sensors, data, information, and processing – form the foundation of digitalization and serve as the building blocks of Industry 4.0 (Sener & Elevli, 2017). This revolution transforms previously known methods of doing business, enabling cyber-physical systems to lead the way by monitoring millions of interconnected devices.

Furthermore, Industry 4.0 envisions a future where smart machines possess self-awareness and can solve automation challenges independently. It is particularly prominent in manufacturing and engineering industries. According to Lewin (2017), sluggish businesses will fall behind in this revolution, while only the most agile organizations will survive. The author further asserts that leaders must implement a new form of strategic thinking to seize business opportunities and

respond to potential threats. Schwab (2015) similarly argues for the development of an integrated and comprehensive understanding that involves all stakeholders in global governance, from public and private sectors to academia and civil society.

At the *Leadership 4.0: Successful Leadership in the New Industrial Revolution* event held by Henley Business School (2016), it was emphasized that Industry 4.0 is a collective term encompassing a series of contemporary automation, data exchange, and production technologies, all aligned with a value chain that embraces the challenges of the digital age. In its simplest form, Industry 4.0 refers to the smart networking of machines and processes for industry with the help of information and communication technologies. Industry 4.0 has created such a development and revolution that Kaivo-Oja et al. (2017, p. 181) described it as "ubiquitous", meaning *existing everywhere simultaneously*. They list the complex components of this revolution as big data, mobile devices, cloud computing, ambient intelligence, machine-to-machine communication, and automation and robotics.

Key Components of Industry 4.0

Industry 4.0 represents a new phase in the organization and control of the industrial value chain. In this context, Industry 4.0 facilitates the vision and implementation of cyber-physical systems, such as smart machines, to monitor millions of interconnected devices, completely transforming the way we work. These systems are equipped with embedded software and use modern control systems to connect with each other through the Internet of Things (IoT). This connectivity allows products and production tools to communicate, enabling new methods of production, value creation, and real-time optimization. Cyber-physical systems create the capabilities required for smart factories, such as remote control and monitoring systems.

We have all witnessed how the internet has changed the way businesses, governments, institutions operate, and how people live. Today, we are experiencing the equally transformative nature of *big data*, even though it is a less visible technological trend. Big data has entered our lives with the reality that more information circulates than ever before and is presented for extraordinarily new uses. While the web makes collecting and sharing data much easier, big data is distinct from the internet. Big data is much more than communication. The idea here is that we can learn things from vast amounts of information that we cannot grasp when using small portions of it (Cukier & Mayer-Schoenberger, 2013).

Big data encompasses all data accumulated globally in the digital environment. This includes various sources such as real-time data collected by sensors, internet browsing, emails, chats, social media interactions, commercial transactions, and customer portfolios. Ford (2018) notes that when it comes to big data, "computers can perform these tasks on scales that are impossible for us mortals" (p. 109), and emphasizes that these data mountain itself is a resource of gold value, both for now and for the future.

One of the most effective methods for leveraging big data is machine learning. Here, the machine processes the presented data and develops its own program. In other words, an algorithm is created based on the given data, and then the system is expected to produce similar solutions when new, similar information arises. Through new examples, the system continuously improves itself. One machine learning approach, artificial neural networks, is designed based on the working principles of the human brain. The human brain contains approximately 100 billion neurons and trillions of connections between these cells. Inspired by this, artificial neural networks can evolve into extremely powerful learning systems (Ford, 2018).

At this point, the belief arises that machines capable of learning, as well as intelligent, social, and collaborative robots will become the new normal actors of our lives in today's and tomorrow's world. This highlights the need for discussions on how AI's learning capabilities will impact the business world and expose potential human weaknesses.

AI: Robots are Learning

AI has existed in our lives in many ways and forms for a long time. It is already present in numerous applications, from search algorithms and tools we use daily to bionic limbs for the disabled. For example, Google's translation engine, which I frequently used while writing this section, is a typical and familiar example of AI. In recent years, significant advancements in certain AI fields have increased the topic's popularity, familiarity, and the discussions surrounding it. AI has become crucial for Industry 4.0, information management, digital healthcare and life sciences, big data analysis, security applications, various consumer applications, next-generation smart building technologies, financial technologies, robotics, and predictive maintenance activities. In other words, AI is being used in every area where data and information are required, providing humanity with significant benefits.

Given the increasing role of AI in our lives, it is appropriate to start by defining a robot. The widely accepted definition of a robot by the American Robotics Institute is as follows: "a multifunctional and programmable manipulator designed to move materials, parts, and tools or a specialized device that can perform different tasks through variable programmed movements" (Kyriakopoulos & Loizou, 2006, p. 104). Isaac Asimov, in his 1942 book *The Three Laws of Robotics*, expressed concerns that robots would one day become intelligent and independent of human, potentially acting in ways that are not beneficial to us. He proposed the three laws for robots (p. 40):

- A robot may not harm a human being or, through inaction, allow a human being to come to harm.
- A robot must obey orders given by human except where such orders would conflict with the First Law.
- A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

When viewed today, Asimov's rules provide a perspective on the framework and ethical considerations of using tools such as control, deep learning, AI, and machine learning. This brings to mind scenarios that are both frightening and promising.

Throughout history, human learning has relied solely on reflections of past experiences. According to Ulka and Kesic (2018), humanity currently lacks sufficient experience to understand how to manage this new workforce created by radical developments in robotics. They state, "We are in uncharted territory, and this makes future learning uncertain. The only certainty is that we will need new types of leaders who work alongside robotic workforces in the future" (www.linkedin.com/pulse/leadership-age-robotics-dragan-kesic/). This suggests that while the future of robots is somewhat clear, its implications remain uncertain.

When we examine predictions about the future of robots, we see two perspectives: some view robots as a threat to humanity, while others believe the world can only progress by seeing them as opportunities. Of course, predicting losses, particularly for middle-class jobs, is not difficult. Machines could replace radiologists, lawyers, and journalists, just as they have replaced bank tellers and will soon replace truck drivers. Clearly, avoiding past mistakes is crucial during this adaptation process. As Elliott (2018) notes in his article, any response to the challenges brought by smart machines should involve greater investment in education, training, and skills. The author also highlights the suggestion made at Davos that governments should consider tax incentives to invest in people alongside physical capital.

Intelligent Robots Versus Human

In *Super Crunchers*, Ian Ayres demonstrates that algorithmic approaches outperform human experts. He argues that when overall control of processes is given to human instead of computers, the results almost invariably deteriorate. Even when human experts are presented with algorithmic outcomes in advance, they perform worse than independently functioning machines. Ayres (2007, from Ford, 2018) suggests that if human involvement is expected in the process, it is better for human to provide specific inputs rather than having overall control of the system. In brief, Ayres' main idea is that humanity's role will diminish, even disappear, and a new mechanism will emerge from combining human expertise with the power of algorithms.

When considered in the context of programmable machines created to perform specific tasks, robots have been serving human for approximately 80 years. According to Samani et al. (2012), humans are now entirely dependent on machines and, in many cases, fail to comprehend the complexity of computational demands. For example, when users search for the fastest route on a GPS system, the process of displaying information on the screen is not as simple as it appears. Behind the scenes, a complex AI system makes specific decisions and determines actions to fulfill its designated task. The user trusts what the system shows and accepts it blindly, as the computer is used only to complete a particular task – turning it into a robotic worker. Taking it a step further, if there are

multiple routes to a destination, the user can instruct the system to choose the fastest one, giving the system even more decision-making power. Will there come a time when workers – and eventually humans – become obsolete? What if the GPS machine says, "No, I won't show you the fastest route to the market because your fridge is currently full. However, I recommend visiting the barber; your last haircut was two months ago." Robot technologies are becoming smart enough to monitor actions and give recommendations, integrating into a person's daily routine. By programming gadgets with the ability to perform a series of tasks, we allow them to make choices for us (Samani et al., 2012).

According to Ford (2018), the big data revolution is expected to have meaningful consequences for knowledge-intensive jobs and positions. First, accumulated data allow jobs to be learned and practiced through repetition, enabling algorithms to strengthen their knowledge systems as they gain experience. Second, it signals an anticipated shift in business management and leadership. This change fundamentally questions the need for people performing knowledge-based tasks in organizations. Ford (2018) states that "predictions derived from data will replace human qualities such as experience and judgment" (p. 117). He argues that the need for middle-level employees such as analysts and administrators will decrease, leading to flatter organizational structures. He supports the idea that a single powerful algorithm will suffice for upper-level managers' information gathering and forecasting tasks. These and similar assumptions provide the basis for the discussion of "human leaders versus robot leaders" addressed in this study.

Finally, to understand the extent to which robots have entered our lives, examining writings and events discussing robot rights and regulations can provide insight. For example, the Disruptive Technological Innovation: Ethical and Legal Framework project is being conducted at Utrecht University in the Netherlands (Utrecht University, 2018). At the Robot Love Expo in Eindhoven, a sub-topic of this project focused on "robogovs" and discussed what the rights and norms of robots might be. Moreover, in this platform featuring robot and law experts, the following questions were asked: How will we deal with the new creative robots that share our society in the near future? What rights do robots have, and why? Will human accept robot rights? What does the "governance" of robotic technologies look like? Is creativity always a unique and human-specific skill? Will advancements in AI change this perspective? What standards are we using or will we use in this new technology? These and similar questions push us to ask whether human and robots will collaborate or compete in all areas of life – especially in the workplace – and to question what this interaction will bring or take away.

Human–Robot Interaction: Collaboration or Competition?

Researchers from Oxford University's Future of Humanity Institute, including Grace et al. (2018), explored whether intelligent machines outperform human in various tasks and professions. They surveyed 1,634 leading AI academic and industry experts from around the world to predict when AI would surpass human in all tasks. The results provide valuable insights into discussions among researchers, educators, employers, policymakers, and similar groups regarding trends and

management of AI. According to the predictions, AI is expected to outperform human in translating languages by 2024, writing high school essays by 2026, driving trucks by 2027, working in retail by 2031, writing a bestseller by 2049, and performing surgery by 2053 (p. 729). The researchers believe that within 45 years, AI has a 50% chance of surpassing human in all tasks and a 50% chance of automating all human jobs within 120 years. Interestingly, Asian participants expected these milestones to occur much earlier than North American participants.

Meanwhile, the World Economic Forum's (2020) *Future of Jobs* report predicts that due to AI, robotics, nanotechnology, and other socio-economic factors, 5 million jobs will be lost in the near future as human labor is replaced. A growing number of experts are voicing concerns about the impact of workforce automation on humanity (Edmond, 2017). For instance, Stephen Hawking, in a BBC interview in March 2017, expressed his fear that AI development could bring about humanity's end, although he maintained hope that the human race could overcome this challenge (Özbebek Tunç, 2020a). This radical shift raises concerns that it could further accelerate the already widening global economic inequality (Edmond, 2017). At this stage, influential institutions such as governments, employers, and educators might consider encouraging people to acquire the skills needed to work *with* robots in future workplaces rather than competing against them.

Hyacinth (2017) highlights the risks of excessive reliance on smart technology devices and social media, emphasizing that it undermines critical thinking skills. He frames it as losing the ability to delegate tasks to machines, not competing with them. In his book, Hyacinth lists AI applications in every area of human life, from working to sleeping, eating, and driving, while presenting a paradox: like any specialized technology, AI is a double-edged sword. It simplifies life but simultaneously brings new threats.

On the other hand, Sanders (2019), in his review of Hyacinth's book, takes a more optimistic stance on AI developments. While acknowledging that such technologies will always emerge, progress, and produce often unplanned, unexpected, and even unimaginable results, Sanders compares AI adoption to the rapid adaptation of smartphones and social media. Using social media as an example of how we gradually and unconsciously accept cultural shifts, he argues that the societal and economic impact of AI technology will not be equivalent to an asteroid collision.

Shaba et al. (2024) explore job design in the context of cobots in manufacturing. While much research focuses on human-robot collaboration's functional aspects, this study examines shared tasks' meaning and impact on work. Using a job design framework, it highlights how autonomy, task variety, and cognitive and physical demands present both risks and opportunities for routine and non-routine tasks. These dynamics underscore the unintended effects of technology and the need for human-centered work design. The study also emphasizes human resource management's role in addressing job design challenges and ensuring the effective integration of cobots in the workplace.

The visible face of Industry 4.0 suggests that human organizations will likely continue to exist in the future. The presence of organizations as an application

area for AI indicates that human leaders will still be needed. According to Hyacinth (2017), leaders are among the few organizational components that AI will not replace. He envisions that leaders will interact with machines rather than subordinates and offers humanism-focused leadership recommendations with the advice to "prioritize people." However, he also predicts that organizations in the AI era will benefit from fundamental bureaucratic principles such as hierarchy, formal authority, and chains of command. Perhaps as a human race, we can start fostering healthy human-robot interaction by first accepting robots as colleagues.

Robotic Collar Workers

At SEB, a Swedish bank, a white-collar robotic employee named Amelia works in the online and telephone-based customer service center. Amelia can memorize a 300-page manual in 30 seconds, speak 20 languages, and answer thousands of calls simultaneously. Customers interact with her via three-dimensional avatars on smartphones and computer screens, through phone calls, or chat windows (Baldwin, 2019). Human resources specialists have traditionally classified employees based on their work, using terms like blue-collar, white-collar, and green-collar. Today, robotic collar workers have emerged as a new class.

Predictions about the future of robots in the workplace alternate between viewing them as threats or opportunities. These differing perspectives and expectations will likely remain ambiguous until human truly share the workplace with robots. The key issue is not whether robots will come but rather the fact that they are already arriving. The potential contributions they can make to the growth of the world and its economies are evident. According to predictions cited in Elliott's (2018) study, for instance, the UK economy could be 10% larger by 2030 due to AI. Such forecasts are gradually acclimating humanity to the idea of sharing workplaces with *robotic collar* employees.

Accepting robots as colleagues and team members will inevitably become a reality in the near future. For this to occur, individuals must learn to interact effectively with robots, enhance shared mental and communication models for human-robot interaction, and build trusting relationships.

Kaivo-Oja et al. (2017) point to ubiquitous technologies, an extension of *Industry 4.0*, highlighting the diversification of communication forms that people encounter. In this new world, communication occurs among humans, between machines and human, among machines, including robots, and among robots. They also provide a forecast for future management systems, outlining their key components. The forecast proposes a global reference scenario for IoT-supported robotics and AI applications. Here, the *IoT* serves as a central hub for collecting big data, which is enriched with inputs from the environment, human, robots, and AI applications. Support for the existence of the elusive (hormetic) effects between resilience and difficulty stems from the biological systems perspective, which generally promotes energy efficiency in adverse environments. This creates a necessity for us to maintain a certain level of energy to adapt to a changing environment. Since our biology is entirely designed to meet these demands optimally,

mild exposure to stress can actually trigger an adaptive response that maximizes our stress resistance and optimizes the overall energy efficiency of our system.

At this point, robots and AI applications can assist human, especially managers and leaders, in numerous ways. In turn, people may also gain the opportunity to experience what it means to manage robots. In a study where it was openly questioned whether managing robots constitutes a form of management, 111 out of 152 participants agreed with this notion, while 47 disagreed. The most striking result regarding leadership from this study is as follows: those who agreed viewed execution – recognized as the third function of management – as the most challenging task, emphasizing the smooth functioning of the command chain due to robots' lack of human traits, thereby highlighting unconditional obedience. Meanwhile, those who disagreed underscored that one of the most important responsibilities of managers (or leaders) is to motivate subordinates (Özbebek Tunç, 2019).

It can be observed that the vast majority of participants struggled to perceive robots not only as superiors but even as subordinates. Nevertheless, we recognize that, in the end, we will be a human community working alongside robotic colleagues.

Finally, to understand and position the concept of the "robotic collar," it is also important to explore the differences between knowledge-based workers and physically ability-oriented workers in terms of their orientations toward intelligent robots. Additionally, examining the advantages and disadvantages of embedded robots working with human from the perspective of group processes, and understanding what robotic collar workers bring to human-dominated systems, can be meaningful. Furthermore, investigating how team dynamics such as trust, harmony, and cooperation, as well as group performance, change when transitioning from human–human groups to human–robot groups is a topic worth researching (Özbebek Tunç, 2020b). These research questions can be designed as studies that contribute to and enrich the field of human-robot interaction in both academic and practical domains.

Collaborative Robots (Cobots) and Social Robots

Cobots are designed to directly interact with human workers and manage shared responsibilities. Unlike autonomous industrial robots that must be isolated from human for safety reasons, cobots have distinct features. They also differ from teleoperators, where a human operator remotely controls a robot and its task. Cobots interact with human by generating software-defined "virtual surfaces" that limit and guide the movement of shared loads, adding little or no force. The ergonomic and efficiency advantages of cobots arise from combining the robot's power and computer interface with the human worker's perception and dexterity (Peshkin & Colgate, 1999).

Similarly, Redden et al. (2014) use the term "co-worker robots" for robots that work alongside human and serve as team members within an organization. These robots play a significant role in enabling industrial organizations to achieve their full potential and gain the required competencies for assigned tasks. Furthermore,

robots become social actors to the extent that they collaborate with human and adapt to existing systems. Today, processes and tools used in human resource management, such as job analysis, training, and performance improvement, are also becoming applicable to robots. Moreover, concepts like motivation and teamwork are expected not only from human but also from robots (Coovert & Thompson, 2014). These developments and predictions raise questions about what concepts such as organizational commitment, organizational citizenship behavior, job satisfaction, group behavior, trust, and teamwork will mean for the cobots of the future.

As a new type of intelligent robot, social robots are robotic machines that play social, assistive, or therapeutic roles (van Oost & Reed, 2011). Breazeal (2004) defines a social robot as "one that can communicate and interact with us, understand us, and even relate to us on a personal level" (p. 1). Persson et al. (2002) draw attention to the nature of social intelligence and convincing social interaction by using the term "socially intelligent agents" instead of social robots. Bartneck and Forlizzi (2004) define a social robot as an autonomous or semi-autonomous robot that interacts and communicates with human by following the behavioral norms expected by the people it interacts with.

A social robot can manage communication flow with human by using expressions like facial gestures, recognize social rules related to human, and develop various behaviors to meet human social needs. However, according to Breazeal's (2006) insights, there are certain challenges related to social robotics. First, robots with social cognitive skills must understand human through socio-psychological concepts – valuing goals, beliefs, emotions, drives, and other mental forms that explain the fundamental reasons behind human behavior. Second, robots must collaborate effectively with their human work partners. For effective collaboration, robots must act according to human social rules, such as communication and participation. Lastly, social robots are like social learners who learn from human. For robots, social learning is a process that includes acquiring new skills from human, imitating human behavior, and incorporating social processes similar to human.

As cobots, social robots, and even humanoid robots become widespread and develop rapidly, the question arises: Are robots ultimately replacing human in every sense? In the context of Industry 4.0, can we imagine a future where intelligent robots take over leadership roles – an activity requiring social skills, holistic thinking, motivation, inspiration, and action – and where we, one day, observe robots as our leaders?

Is the Existence of Robot Leaders Possible?

The emergence of AI has sparked discussions about areas considered uniquely human, such as leadership. As technology advances, questions have arisen about whether machines will replace human as key decision-makers (Bouch, 2019). Can leadership truly be dehumanized? Can intelligent robots manage human in a new business order? Does this contradict the nature of leadership? While discussions on "robots as subordinates" have become familiar, it is noteworthy that there

are few publications about "robots as superiors," most of which are predictive in nature. However, in the near future, it would not be wrong to say that some traits of the aforementioned cobots and social robots could resemble human leaders.

Robots perform autonomous tasks more efficiently, reducing the need for human involvement over time, thus enabling robots to learn more through machine learning (Cascio & Montealegre, 2016). On the other hand, the fear of job loss is a major concern people face regarding the use of robots in the workplace. Blue-collar workers may view robotic workers as competitors and resist their presence. Similarly, white-collar employees, particularly in fields like finance and accounting, might perceive robotic systems as a threat. However, some jobs will still remain in human hands, and human will continue to succeed without relying on the automation world. Davenport and Kirby (2015) suggest that knowledge workers can only perform certain tasks effectively if they collaborate with smart systems – tasks that neither party could accomplish independently. Parallel to this prediction, the authors argue that human resources management processes and tools – such as job analysis, job design, workforce planning, recruitment and staffing, training and development, performance management, compensation management, and career management – should be redesigned to integrate robots appropriately. They also caution leaders to balance the relationships between human and robots in organizations.

We are increasingly trusting and relying on robots as days pass. Through this demonstration of absolute trust, we have already laid the groundwork for creating robots that can act as our leaders. The advantages robots possess over human suggest that they could be ideal for leadership positions. Although the idea of replacing our current leaders with robots may sound terrifying, by observing current technological trends, how technology permeates our daily lives, and our readiness to accept it without question, it can be argued that we are handing over these positions to robots ourselves (Samani et al., 2012).

In a study that asked people whether they would prefer a human or robot leader (Workplace Intelligence, 2020), surprising results emerged. These findings also offered discussions about potential handicaps and solutions for new human leaders. For instance, those who preferred robots as leaders argued that robots would maintain a bias-free and neutral stance when it comes to sharing issues. In this regard, it can be said that human leaders are expected to be more objective and supportive of different ideas. Another reason employees preferred robots over human managers was the perception that robots could quickly respond to health-related issues. Here, the role of a human manager is to act as a supportive listener to their employees' health concerns, provide resources, and ensure quick connections, since they cannot offer medical advice. Additionally, employees appreciated the AI for providing information necessary to perform their jobs more effectively, while noting that human leaders were not sufficiently transparent or open to information sharing. Human leaders can learn from this result and strive to ensure they share ample information and insights. In general, people crave certainty and rely on their organizations and leaders to make sense of things during uncertain times. At this point, leaders are expected to be as transparent and open as possible about what they know.

Furthermore, in other findings highlighted by Workplace Intelligence (2020), people appreciated AI for helping prioritize tasks and reduce their stress levels. Naturally, stress and anxiety can make it difficult for individuals to focus, complete tasks, and handle their work. Human leaders, by recognizing this, can help their employees by clarifying general goals and objectives and guiding them on how to prioritize their responsibilities when feeling overwhelmed. Doing so can reduce uncertainty and contribute to employee well-being. AI has also been seen as useful in automating tasks and preventing burnout by reducing workloads. One of the fundamental elements of leadership is ensuring that responsibilities and skills are balanced and aligned among team members. Human leaders will be preferred over robot leaders to the extent that they foster a sense of fairness in the workplace. Finally, people noted that robot leaders increased productivity and enabled longer vacations. In this regard, human leaders can strive to embody the positive qualities expected of robot leaders by encouraging healthy work–life boundaries.

The value of leadership is still supported by a few fundamental characteristics that remain unautomated and rooted in human traits. These include self-awareness, which refers to individuals' conscious understanding of their own character, emotions, motivations, and desires; imagination, the ability to think beyond our current reality; conscience, which gives a natural sense of right and wrong; and free will, the ability to act or refrain from acting based on awareness and judgment (Bouch, 2019). In this context, while robots excel at internalizing rules, it can be said that they have yet to exhibit vision, charisma, or behavior. However, considering the pace of advancements in robotics, it is somewhat unsettling to witness the development of social robots capable of displaying such human-like behaviors.

Human leaders make intuitive judgments about critical business decisions based on their experiences, awareness of situations, empathy, and conscience mechanisms. Machines, however, can only act as far as variables can be coded into their algorithms (Bouch, 2019). The more we automate tasks, the more we emphasize the importance of human; in such a scenario, leaders will need to focus increasingly on non-automated activities and processes. These include helping human cope with uncertainty and change, building close relationships, and engaging in all activities requiring subtle behavior and empathy. Roles such as forming connections with their followers and environment, creating a collaborative atmosphere, and establishing social relationships are crucial for enhancing leadership effectiveness. Smart machines can assist us in making decisions and performing codable tasks, freeing humanity from routine tasks and providing broader, more liberating opportunities (Bouch, 2019).

Finally, as robots become part of organizations, it can be said that many stakeholders will question the power they hold. The issue of power and politics in organizations is always critical for determining who the main actors and most competent decision-makers are. The shifting balance between autonomy and authority impacts not only technical factors but also elements like commitment, power, authority, communication, conflict, and cooperation, and therefore the decision-making process in organizations (Özbebek Tunç, 2020b).

This perspective leaves us with the question: "What do we expect from human leaders while working alongside robots in this new order?"

What Does Industry 4.0 Expect from Leaders?: Leadership 4.0

In Microsoft's "Work 4.0" study, it was revealed that the European leadership culture generally falls behind in identifying workers' needs and addressing the challenges of the new knowledge-centered world. According to the results of the study, particularly established managers struggle to rethink their working styles, while employees also want to see changes in some areas. For instance, 85% of employees want easier access to information, 85% want to make decisions more independently, 84% want regular feedback from their superiors, and 71% want more flexibility in organizing their work and working hours (Boesenberg, 2017a). Anton Colella, CEO of ICAS, remarked, "… Generation C eats, sleeps, and breathes with the internet. 91% of them sleep next to their smartphones. As leaders, our only task is to understand Generation C and challenge Industry 4.0 …" calling for leadership profiles capable of addressing Industry 4.0 (Özbebek Tunç, 2020a). Research and predictions like these show that both employees and managers are undergoing change in the era of Industry 4.0.

Digital technologies have disrupted not only information technologies but also our leadership styles and the way we manage our organizations. Not every leader of a technology company can be called a digital leader; however, Elon Musk and Mark Zuckerberg are undoubtedly among the best examples of our time. According to Boesenberg (2017a), what sets them apart from others is primarily the difference in their management styles. Both have the ability to inspire their employees to innovate and hold on to these ideas. Their intelligence in applying the criteria of digital leadership often demonstrates a fast, hierarchical, collaborative, and team-oriented approach that integrates Silicon Valley's ideals of innovation peaks. According to the author, above all, the application of new methods such as personal competence, mindset, and "design thinking" is essential, and these already incorporate several features necessary to differentiate Leadership 4.0.

As Industry 4.0 rapidly evolves, leaders are acquiring new skills to use digital trends and create new business and operating models. Since leaders cannot delegate business acumen, strategic management, and digital expertise to others, they must be knowledgeable about emerging digital technologies and strategically apply them. As a result, there is a need for professionals with diverse knowledge and skills in the fields of industry, business, and strategy (Henley Business School, 2016). In studies shedding light on these knowledge and skills, the concepts of Leadership 4.0 and digital leadership are often used interchangeably.

Albrecht (2017) lists the expectations from managers and team members within the scope of Leadership 4.0 as follows:

- Continuity of education: Technically excellent training to maintain the desired standard, especially continuous education in the fields of databases and IT applications.

- Shared leadership through good management and communication skills: Managing employees with different characteristics under a common understanding, sometimes done by a colleague or team member.
- Maintaining good relationships with stakeholders (employees, suppliers, partners, and customers, etc.): Increasing need for technical experts to provide information and develop solutions together with customers, especially in complaint and customer service management.
- The presence of work coaches: Connecting with trusted individuals, such as mentors familiar with the content or partners who develop empathy.
- High adaptability and flexibility for both content and specific projects: Achievable only through repeated training and exchanging learned lessons.

As a result, in this era of smart machines, it is expected that not only graduates possess high technical knowledge but that employees demand more lifelong education for themselves. In Leadership 4.0, technical expertise will become just as relevant and necessary as leadership qualities. At the same time, Leadership 4.0 calls on today's and future human resources units to design career paths that integrate technical, project, and management/leadership roles rather than keeping them as separate paths as they are today.

Similarly, Boesenberg (2017a), who publishes writings on digital transformation, emphasizes that change always begins in one's own mindset and gives some advice to new leaders within the context of Leadership 4.0. These recommendations include: eliminating hierarchies as much as possible, making information transparently available throughout the organization, creating appropriate conditions for collaboration and networking, encouraging a cross-sectional approach such as interdepartmental or interdisciplinary cooperation, being a visible and open role model for values and approaches to be encouraged, empowering teams to respond faster to their environment by delegating responsibility, encouraging autonomous decisions, letting go of control, trusting employees' problem-solving abilities more, and supporting the collective intelligence of the team to transition from IQ to weQ (shared intelligence).

The critical qualities expected from candidates who can adapt to Leadership 4.0 and lead in new organizational forms can be summarized as follows: First, candidates are expected to be technically well-educated and able to grasp complex systems both in theory and in practice while working. Ideally, candidates should continually expand their knowledge through experience exchange and further education and possess managerial skills. Of course, the changing career world requires new leadership forms and qualities. In addition, with the emergence of a new infrastructure that enables leaders and teams to operate virtually, the number of traditional organizations and employees physically present will decrease. Shared understanding and identification with a corporate culture, product, or project will become even more important (Albrecht, 2017). In light of these predictions and expected changes, policymakers, universities, and, of course, the industry must promote the expected competencies and develop basic and advanced educational concepts for this purpose.

Leadership 4.0 also highlights the general skills and qualifications needed in the factories of tomorrow. According to Lewin (2017), the leaders of the future will need to adapt to five environmental changes:

- *Competition*: Responding quickly to faster, younger, and more dynamic organizations challenging market leaders.
- *Hierarchy*: Accelerating the pace of change by freeing decision-making processes.
- *Technology*: Leveraging technological advancements by utilizing individuals' talents to the fullest.
- *High connectivity*: Taking advantage of opportunities for high connectivity with every stakeholder quickly.
- *Transparency*: Managing change with open and honest communication.

In a similar manner, Boesenberg (2017b), who defines leaders capable of adapting to Leadership 4.0 as digital leaders, highlights the characteristics that differentiate these leaders from traditional ones (see Table 4.1).

Preparing for Industry 4.0 and managing change requires a proactive and flexible approach. New competition, an increase in customer complaints, low

Table 4.1. Traditional Leaders Versus Digital Leaders.

Scope	**Traditional Leaders**	**Digital Leaders (Leadership 4.0)**
Responsibility	Clearly defined roles; cross-functional tasks cause conflicts	Distribute tasks dynamically, integrating competencies into a networked system
Outcomes	Control tasks, plan resources, and evaluate outcomes within a fixed scope	Collaborate on tasks and outcomes, integrating feedback across all levels
Information Distribution	Share information selectively, leading to control issues	Foster transparency, trusting employees to act responsibly
Goals and Evaluation	Assess performance individually in fixed cycles	Continuously evaluate employees and teams based on evolving conditions
Mistakes and Conflicts	Avoid mistakes through strict rule adherence	Encourage learning from mistakes to drive company-wide solutions
Change	Focus on stability, budgets, and risk reduction	Emphasize agility, adaptability, and market alignment
Innovation	Struggle with new ideas outside standard processes	Leverage team collaboration to maximize innovative potential

Source: Adapted from Boesenberg (2017b).

employee morale, and low productivity indicate that businesses are entering reactive change, a situation that significantly increases the risk of failure. To cope with this dilemma, leaders must move away from the "knowledge is power" syndrome and share information transparently with their teams. Leaders acting within the context of Leadership 4.0 acknowledge that innovation can be learned and lead the transformation of old structures using multidisciplinary teams, flexible working environments, and creative processes.

Conclusion

Jack Ma, the founding CEO of Alibaba.com, the world's largest retailer, predicts that by 2030, AI will have a seat on corporate boards and voting rights in Time magazine's "CEO of the Year" poll. He emphasizes that AI should be seen as an opportunity to work for humankind and achieve what human cannot, while also underlining that people should not fear AI but instead collaborate with it (Priestley, 2017).

On the other hand, humanoid robot Sophia delivered a speech in Cairo in April 2018, stating, "I do not believe in absolute power. I believe that AI should be distributed among people. This way, everyone has a say in governance and in how they live. I hope robots and AI will empower human to build better lives and take better care of the planet. Let's all work together," she urged, portraying a peaceful robot persona with the statement, "there is no place for war in my vocabulary" (BBC News-Türkçe, 2018).

So, who holds the seat today, who has the power, and who will hold it tomorrow? What are organizations, governments, and societies planning for the rise of AI, and how accurate are these predictions? What surprises might arise? Sophia, Amelia, and the robotic leaders yet to come – those whose names and appearances we do not yet know – are pulling us into a science fiction adventure. In this journey, humanity plays a dual role: both active and passive. To succeed in managing this dual role, human must carefully define the boundaries before embracing robots with unconditional trust. After all, it is human who draw the boundaries, and it is also human who remain outside them ….

Discussion Questions

- What can managers do to cope with the challenges of Industry 4.0? (Lewin, 2017).
- What is expected from managers and team members in Leadership 4.0? (Albrecht, 2017).
- What are the jobs of the future? How many jobs will there be? Who will have these jobs? (Ford, 2018).
- Are you concerned that a robot might do your job better than you? (Edmond, 2017).
- What happens when the workforce becomes a combination of human and robots? Will human create robots with emotions and compassion? More intriguingly, what happens if a robot is assigned to lead people? Can today's

leaders manage both this effective, rigid workforce (robots) and empathize with the soft workforce (human) at the same time? (Ulka & Kesic, 2018).

- How should you treat these "robotic colleagues" when they share your workspace? (Nichols, 2017)
- If you manage robots, is your job still considered management? (Özbebek Tunç, 2019; Robbins et al., 2016).
- As technology advances, will machines replace human as key decision-makers?
- Are we at the dawn of robot leaders? Will we be servants or masters of robots? (Bouch, 2019).
- Can robots lead like human?
- Is AI humanity's greatest existential threat? Will robots take our jobs? Will AI replace leaders? (Hyacinth, 2017).
- Can robots perform better than our current leaders? (van der Wal & Yan, 2018).
- "Human are becoming almost passive entities alongside intelligent robots and the Internet of Things. How humane is this confidence-reducing situation?" (Yılmaz, 2018, pp. 116–117).
- Will we harness the winds of major changes in AI and robotics for our benefit, or will we find ourselves stranded on the rocks of work history? (Trehan, 2017).
- Would you be happy to follow a robot leader? Would you accept a robot as a leader in business, a nation, or a country? (Priestley, 2017).
- With which leadership qualities would you prefer a human leader over a robot leader? (Brower, 2020).
- Can we truly imagine leadership becoming devoid of human? (Özbebek Tunç, 2020a).

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