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Leadership in the Fourth Industrial Revolution

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Introduction

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Dear Readers,

We are in the midst of a revolution. Industry 4.0, also known as the Fourth Industrial Revolution, has already moved past our doorstep and is making its way comfortably into our homes and workplaces. Industry 4.0, which integrates technological advances into every facet of life, will only continue to permeate the spaces which we inhabit.

At Stanton Chase, as experienced executive search consultants, we see the changing landscape and new expectations of leaders in all industries. We are now seeing a new leadership model emerge, and we have identified some of the relevant changes impacting and shaping today's leaders.

I am pleased to present this white paper on leadership in Industry 4.0 with you; we hope you gain new leadership insights from this article, and we look forward to partnering with you.

Sincerely,

Gert Herold
Managing Partner

Introduction

In May 2016, a 23-year-old woman drove onto a boat launch and landed in the icy waters of a lake in Ontario late at night.[1] She was a sober woman of sound mind. The problem? The woman relied on GPS technology to guide her driving route, and she followed the navigation voice directly into the water. Fortunately, she managed a swift escape through her car windows and lived to tell her story; a story of "too much technology". Other, often more unfortunate and morbid, examples of the increased reliance on technology abound. Whether for good or bad, it is undeniable this trend will continue into the foreseeable future. Technological advances are advancing at such profound speed that experts claim we are in the midst of the Fourth Industrial Revolution (FIR), also known as Industry 4.0.

Industry 4.0 comes right on the heels of The Internet of Things (IoT) phenomenon. In July 2015, Stanton Chase published "The Internet of Things: Adapting Corporate Culture to Reflect the Connectivity of IoT"[2]. IoT highlighted a shift in workplace culture by recognizing the exponential growth of devices has become normalized in today's society. This phenomenon has continued, and in today's world, IoT is just a small piece of the current FIR. The "Internet of Everything" has replaced the "Internet of Things" to encompass things, data, services, and people. The basic principle of Industry 4.0 is that entire value chains are interconnected by autonomous systems created by intelligent networks of machines and data. Cloud computing is a key feature of this revolution. This new environment includes four components: the internet of things, the internet of data, the internet of services, and the internet of people; these parts have come together in FIR and have witnessed growth and changes at an unparalleled pace.[3] The rapid rate of change has necessitated a reevaluation of corporate structure and workplace business practices, particularly within the leadership realm. At its core, FIR strives to reduce the need for human labor, and leaders are grappling with how this changes business dynamics, strategies, and their own roles. The effects of the FIR, and the paramount importance of the right leadership style during this pivotal time cannot be underestimated.

> *I think as a company, if you can get those two things right — having a clear direction on what you are trying to do and bringing in great people who can execute on the stuff — then you can do pretty well.*
>
> — Mark Zuckerberg

> *As we look ahead into the next century, leaders will be those who empower others.*
>
> —Bill Gates

> *My job is not to be easy on people. My job is to make them better.*
>
> —Steve Jobs

What is Industry 4.0?

In Industry 4.0, the ultimate goal is the creation of "Smart Factories", indicating that automated smart systems will be utilized for the entire production cycle from start to end in the value chain. This is made possible by advancements in data collection techniques that have grown and will continue to grow in the foreseeable future. The exponential growth of stored data, as displayed in the infographic below, illustrates the importance of data creation, collection, and manipulation that is happening in today's revolution.

In 2014 the amount of information stored worldwide exceeded 5 ZetaBytes.

By **2020** the total amount of stored data is expected to be...

50x larger than today.
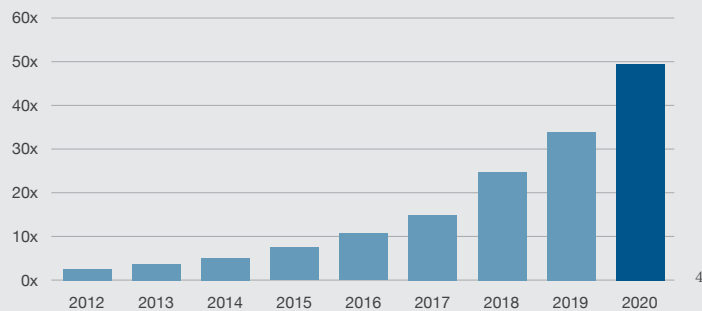
*Zetabyte = 35,000,000,000,000,000,000,000 bytes

4

There are four main characteristics of Industry 4.0: vertical integration, horizontal integration, through-engineering, and integration of technologies.[5] Vertical integration requires enhanced connectivity within the Smart Factory chain, allowing "...factories and manufacturing plants [to] react quickly and appropriately to variables, such as demand levels, stock levels, machine defects and unforeseen delays."[6] Horizontal integration facilitates networks that create and add value, such as business partners and customers around the globe. Through-engineering is a unique aspect of FIR that focuses on the entire value chain. In other words, businesses are no longer just looking at manufacturing or an isolated aspect of the production process, but rather they are looking at a product from its inception to the final output and delivery. This is achieved with new, advanced and enhanced data collection technology, which is the fourth and final characteristic of Industry 4.0.

Examples of each of the four characteristics include the following:

Vertical Integration
Smart Systems can predict when a machine malfunction will occur. Vertical integration provides a mechanism for a maintenance request to be submitted and the system to be fixed in anticipation of a problem.

Horizontal Integration
A shipment of goods is scheduled to fly out from a nearby airport. While the goods are being transported from the factory to the airport, the airport closes for an emergency shut down. Horizontal integration of the Smart system provides the technology to receive this information and immediately put "Plan B" into effect. The goods are quickly rerouted to the next closest airport and distributed in time.

Through-engineering
Prior to FIR, a company manufactured shoes and then sold them to a distribution company. In the wake of FIR, the same company now controls the process throughout the entire value chain and distributes the shoes to the final marketplace.

Technology Integration
The shoe company (referenced above) collects and analyzes consumer data to understand the consumer market, produce the number, quantity, and style of shoes accordingly. Latest results reflect a shift in the consumer market, indicating that girls' black ballet shoes are in high demand. The manufacturing machines automatically adjust production numbers accordingly.

Undoubtedly, technology plays a fundamental and pivotal role in how businesses are able to transform their practices to keep pace with the rapidly changing industrial landscape. Cyber-physical systems are a key component of the new Smart factories. "Cyber-Physical Systems (CPS) are integrations of computation, networking, and physical processes. Embedded computers and networks monitor and control the physical processes, with feedback loops where physical processes affect computations and vice versa." [7]

> *"Cyber-Physical Systems (CPS) are integrations of computation, networking, and physical processes. Embedded computers and networks monitor and control the physical processes, with feedback loops where physical processes affect computations and vice versa."*
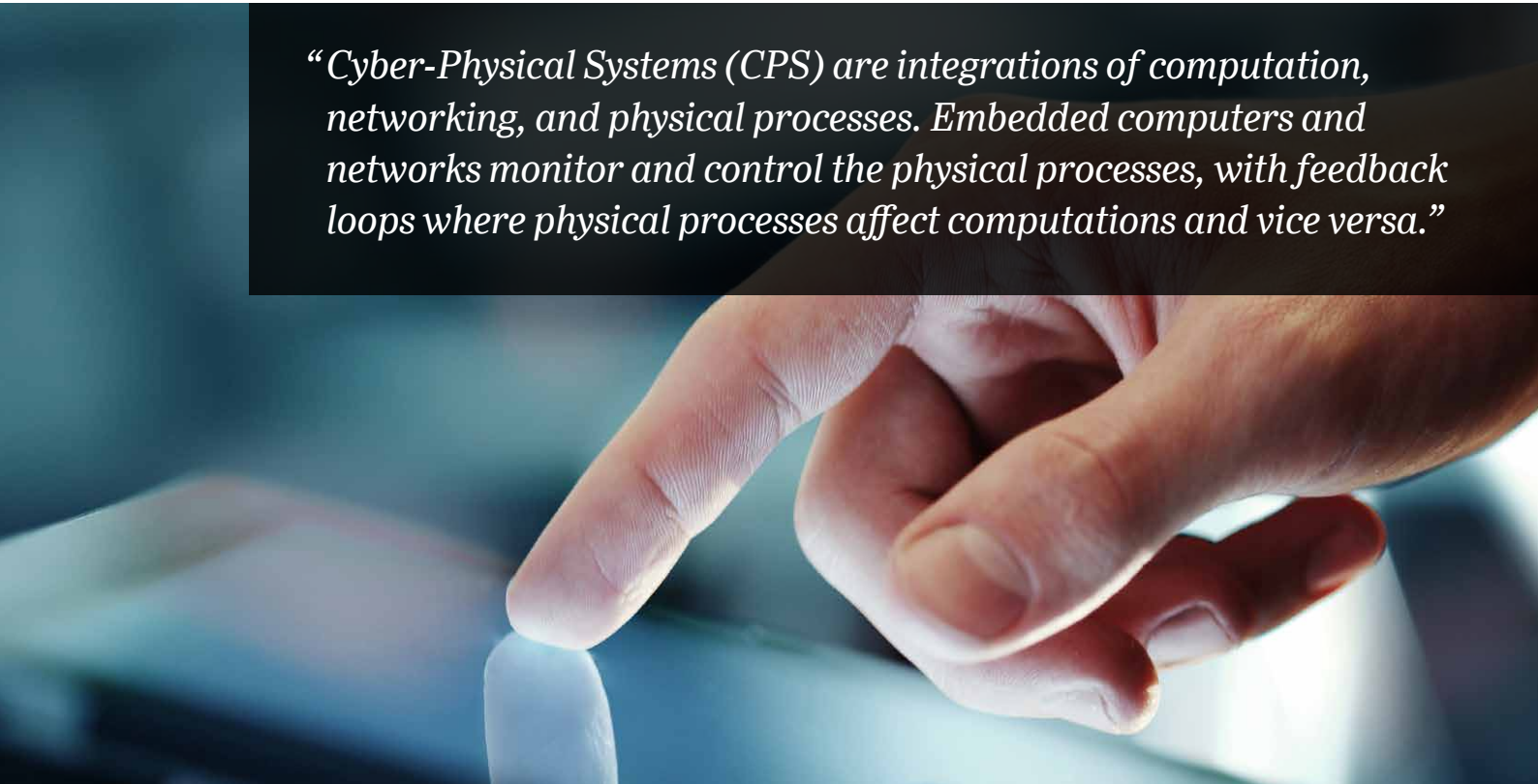
These systems must have the capability to collect data that can be used by producers. It is also essential for these data collection systems to have analytical skills to process large sets of data, make decisions, and act on these insights quickly. Data collection methods must not only be powerful, but they need to remain secure and confidential. Smart factories are at the heart of this transformation, and "[i]t means machines using self-optimisation, self-configuration and even artificial intelligence to complete complex tasks in order to deliver vastly superior cost efficiencies and better quality goods or services." [8]

In Industry 4.0, technical assistance and cyber physical systems are designed to enhance the performance of autonomous tasks. This minimizes the role of human involvement from everything from product production to decision-making. With the decentralization and automization of decision-making comes a fundamental shift in hierarchical roles. Leadership is changing. Industry 4.0 is blurring the boundaries between humans and technology as a new landscape emerges, and leaders need to be on the forefront of adapting to these changes.

The Global Impact of Industry 4.0

"You cannot wait until a house burns down to buy fire insurance on it. We cannot wait until there are massive dislocations in our society to prepare for the Fourth Industrial Revolution," proclaimed Robert J. Shiller, 2013 Nobel laureate in economics, Professor of Economics, Yale University.[9] Industry 4.0 is not an imagined future; it is happening now. The world is investing in Industry 4.0, and businesses that do not integrate 4.0 principles will be left behind.

"You cannot wait until a house burns down to buy fire insurance on it. We cannot wait until there are massive dislocations in our society to prepare for the Fourth Industrial Revolution."

Robert J. Shiller

The new landscape of FIR can be seen around the globe and is far-reaching into every industry and sector. In January 2016, the topic of the World Economic Forum in Davos, Switzerland was "Mastering the Fourth Industrial Revolution". Engineer and economist Klaus Schwab, founder and executive chairman of the World Economic Forum, noted that the transformation from the revolution will be unlike anything humankind has experienced. "The challenges are as daunting as the opportunities are compelling," Schwab said of the FIR. "We must have a comprehensive and globally shared understanding of how technology is changing our lives and that of future generations, transforming the economic, social, ecological and cultural contexts in which we live..."[10]

Germany led the startup of the FIR with its first mention of the term "Industrie 4.0" in a 2013 memo.[11] Subsequently, Germany has poured millions of dollars into research and projects to encourage cross-disciplinary collaboration in pursuit of the new industrial era. Specifically, there has been a focus on uniting government agencies with universities and businesses. Initiatives have also been seen in other parts of the world. For example, in the United States, a non-profit organization entitled "Smart Manufacturing Leadership Coalition" (SMLC) supports "the manufacturing industry through pursuing a comprehensive technology that no one company can undertake. Activities are built around...shared infrastructure that will achieve transformational economic-wide impact, manufacturing innovation and global competitiveness." [12] SMLC was founded because leaders understood that manufacturers needed an avenue to pursue the development of smart manufacturing systems without independently taking costly risks. Initiatives like SMLC benefit all stakeholders because they provide a collaborative, low-stakes environment to develop in a high-stakes future.

A report from Cornell University indicates the countries currently leading the FIR: Finland, Switzerland, Sweden, Israel, Singapore, the Netherlands, and the United States.[13] Specifically, these countries are recognized for "generating economic impact from investments in information and communications technologies (ICT)." The author indicates the importance and prominence of these countries because "it demonstrates that adoption of ICTs — coupled with a supportive enabling environment characterized by sound regulation, quality infrastructure and ready skills supply among other factors — can pave the way to wider benefits." Not surprisingly, a robust infrastructure is essential to the development of ICT. At present, social benefits, such as online access to healthcare and other services, are being seen the most in high-income countries.

> *"...With precision land-based or container agriculture, powered by solar energy and other renewable energy systems, farming can become very efficient, high yielding and hence remunerative."*
>
> Anil K. Rajvanshi, Director of Nimbkar Agricultural Research Institute

While positive and immediate effects of the FIR are being seen in higher income countries, Industry 4.0 also offers hope for improving conditions in developing nations. Anil K. Rajvanshi, Director of Nimbkar Agricultural Research Institute in Phaltan, Maharashtra, India, notes, "Today the biggest crisis in farming in India is the lack of labor, low prices of produce, shortage of water and very poor soils. With precision land-based or container agriculture, powered by solar energy and other renewable energy systems, farming can become very efficient, high yielding and hence remunerative." Rajvanshi goes on to indicate how FIR would change the hierarchical structure of society: "The FIR can usher in a decentralized and democratic society since the control of the means of production and usage will be in the hands of locals."[14] Rajvanshi's claim suggests that all nations and societies are redefining leadership roles in the new industrial age.

China has also begun to benefit from new smart systems of manufacturing, particularly with the increased labor shortage resulting from the One Child policy. In May 2015, results of a global study on asset efficiency were released, indicating that China was leading the way as an early adopter of technologies and far surpassing Western countries.[15] Another interesting finding from the study was that while an overwhelming percentage of manufacturers recognized the potential value and importance of new technologies, very few of them had implemented them. This evidence also points to a challenge in leadership; who will bring companies into the next era?
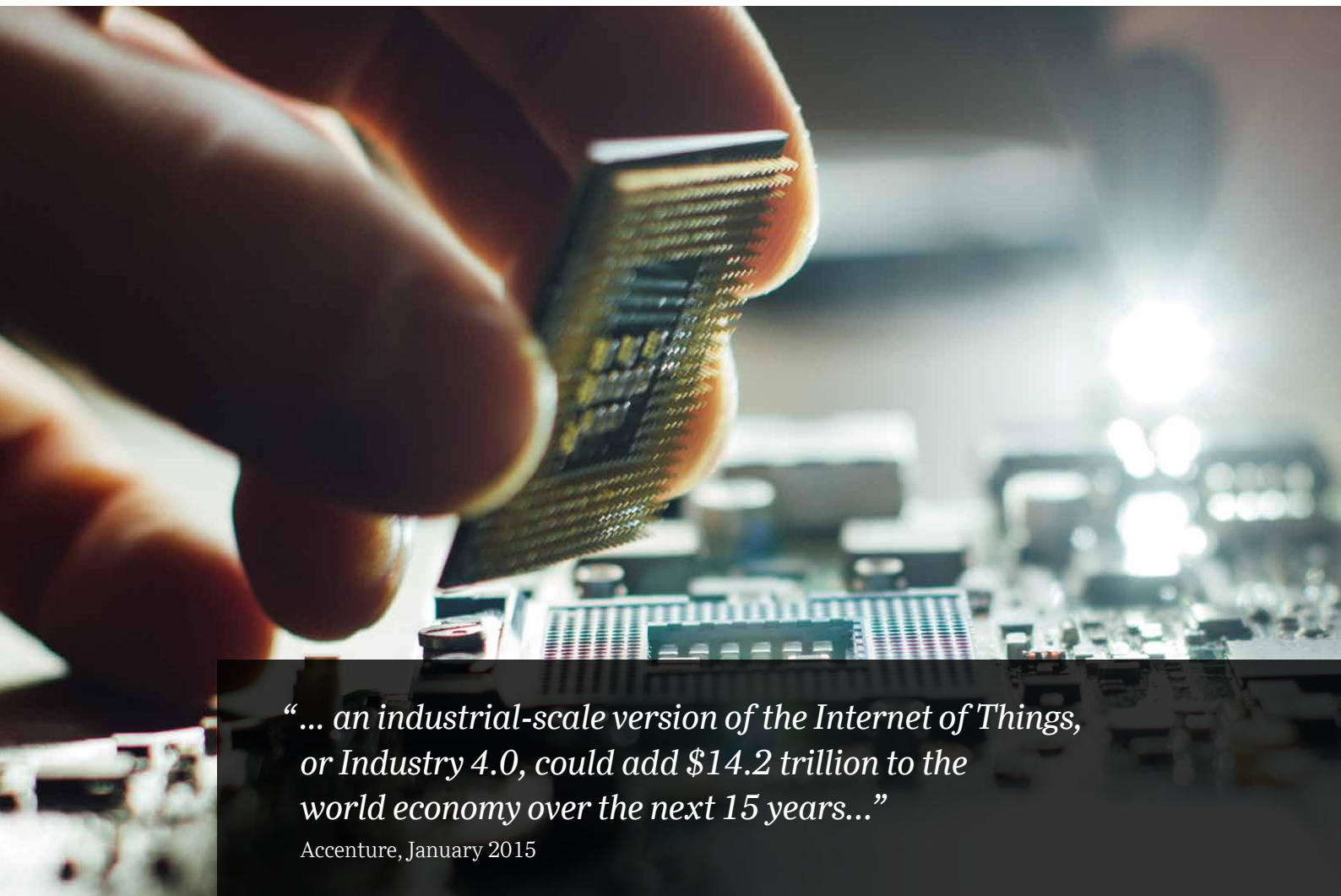
"... an industrial-scale version of the Internet of Things, or Industry 4.0, could add $14.2 trillion to the world economy over the next 15 years..."
Accenture, January 2015

Industry 4.0 is worth a lot of money. In January 2015, Accenture released a report "which concluded that an industrial-scale version of the Internet of Things, or Industry 4.0, could add $14.2 trillion to the world economy over the next 15 years..."[16] The report goes on to highlight the huge economic growth potential of Industry 4.0, going so far as to state that the value added would not only include financial benefits, but would be "enhancing worker safety."[17] The importance of worker safety with regard to leadership is explored more fully below.

Threats to the Revolution

"Is Google Making Us Stupid?", an article published by The Atlantic in 2008, has become a seminal article about the advancements in the technological age and the effects on human intelligence.[18] The author, Nicholas Carr, details the fundamental shift in learning, reading, and memorization that has taken place in recent years as a result of the digital proliferation. While Carr does not offer a final conclusion, he does suggest that the shifting landscape of modern times is resulting in a dumbing-down of society because of the over-reliance on technology. Similarly, the movie Idiocracy depicts a society 500 years into the future where "advances" in technology have completely obliterated human intelligence. Although the movie presents an extremely hyperbolic scenario, the pretext for the film's script is within the realm of believability and raises questions about the true benefits of an enhanced technological age.

"Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000."

In addition to the questionable effect of technology on human intelligence, the overall success of the Fourth Industrial Revolution hinges on some of its current challenges. Not surprisingly, Information Technology plays a critical role in the establishment and maintenance of many current initiatives. Highly skilled information technology personnel must always be on the forefront of implementing and troubleshooting the latest technology. At present, there simply are not enough highly specialized technical workers available for the existing vacancies and needs, and even businesses with ample tech support experience difficulties keep up with the exponential growth in demand. Pierre Nanterme, CEO of Accenture, recognized this gap when he stated, "Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000."[19]

There is also a need to protect industrial know-how; when algorithms go wrong, it is ironically now the human role to be the back-up source of intelligence. At the same time, Industry 4.0 creates the challenge of vast job cut-backs; when systems become automated, people lose their jobs. This may be offset by the creation of new jobs, but they are different and often highly specialized. Generational gaps also pose challenges as the older generation struggles to survive in a modern digital society. Finally, there remain unknown challenges. Industry 4.0 is just beginning, and experts have only recently begun to see the ramifications of these developments.

Leadership Trailblazers

Identifying and recruiting skilled leaders is a primary concern in the FIR. But where are these leaders, and what are the requisite qualifications? Digital skills and industrial know-how remain essential, but the soft skills are also of paramount importance. At Stanton Chase, we have over two decades of experience identifying, recruiting, and assessing top talent. Our depth and range of experience has given us critical insight into the four skill areas that top leaders in the digital age possess.

There's something fundamentally broken about the CEO model...
— Peter Grauer [20]

The New Networked Leader
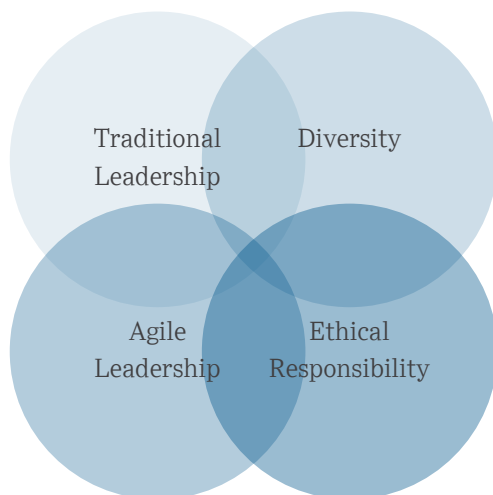
1. Traditional Leadership

First, we consider traditional leadership skills. While the focus of recent publications reveals the need for a "new" leadership style and approach, this does not mean that the previous leadership skills are no longer necessary. Quite the contrary: traditional leadership skills — such as the ability to effectively lead, manage, and inspire others — are now considered a bare minimum requirement.

2. Diversity

Second, creating a diverse environment is critical to successful leadership in the digital age. Diversity does not simply mean filling the work space with different skin colors; it means welcoming and embracing a wide array of opinions, perspectives, and backgrounds. Great leaders intentionally surround themselves with those who disagree and can offer new and varied insights. This approach to diversity enhances a leader's knowledge and understanding of the issues at stake.

3. Agile Leadership

Third, agile leadership is essential in leading today's revolution. Agile leadership comes from the concept of "learning agility" coined by a set of researchers at Columbia University's Teacher's College.[21] The authors note, "Adapting to new business strategies, working across cultures, dealing with temporary virtual teams, and taking on new assignments all demand that leaders be flexible and agile." They delineate five facets of agility: innovating, performing, reflecting, risking, and defending, all of which play an important role in the leader's success. Agile leadership also includes the ability to manage a multi-generational workplace. The new generation of millennials tends to expect flexible working arrangements and a more cooperative and communicative structure. Successful leaders must recognize and adapt to the varying needs of the changing workforce.

4. Ethical Responsibility

Finally, ethical responsibility is an increasingly key factor in determining a leader's success. At Stanton Chase, we have seen ethical challenges permeate the search industry. Many companies focus on the soft skills and experience that individuals bring to an organization. An explicit examination of ethics is not often seen as a fundamental feature of the hiring process. Nonetheless, our experience shows that considerations of leadership ethics can make or break the career of C-suite leaders.

A quintessential example of ethical questions in the modern world of smart technology can be found in the Tunnel Problem:

You are travelling along a single-lane mountain road in an autonomous car that is fast approaching a narrow tunnel. Just before entering the tunnel a child errantly runs into the road and trips in the centre of the lane, effectively blocking the entrance to the tunnel. The car is unable to brake in time to avoid a crash. It has but two options: hit and kill the child, or swerve into the wall on either side of the tunnel, thus killing you.[22]

Who should make the decision in this case, and what is the leader's role? Leadership questions of ethics and values permeate FIR. In June 2016, authors of a World Economic Forum article entitled "Leadership Challenges of the Fourth Industrial Revolution" asked "What if human enhancements become essential to compete for top grades and top jobs?"[23] Is it ethical for humans to be engineered? How will this affect society? Technological advancements in human genetic engineering are no longer a thing of the past, and leaders must tackle such controversies and draw boundaries that will shape the future.

Leaders can also leverage new technologies to protect humans, which is ironic in a revolution that aims to reduce the human role. "At Marathon Oil refineries, for example, employees wear a wireless device that tracks harmful gas exposure during a worker's shift and allows managers to monitor the location and safety of all staff members on shift."[24] Investments in such safety developments are central to leadership decisions in the new era. How much money should be spent on human and/or machine safety and protections?

Hierarchical structures are challenged and redefined in Industry 4.0. As previously noted, a change in farming technology and production processes in India could likely transform the underlying societal structure. Bernard Heuchmer, Vice President of Motion Control, Siemens Industry, also highlights a leadership challenge in the current industrial age: "One factor holding back Industry 4.0 is the mindset of management. That needs to change—they must be more proactive in supporting the changes among market leaders."[25] Leaders are tasked with walking a fine line between taking great risks to leap into the future without entirely compromising themselves or the company.

Conclusion

All Industrial Revolutions have had a profound impact on global society, and Industry 4.0 is no exception. Workplaces are experiencing dramatic transformations unlike anything before, and companies are challenged with recognizing and adapting to these changes. FIR is particularly unique in the way it challenges current notions of hierarchy and leadership. Industry 4.0 affects all societies around the globe — from the United States to Zimbabwe to North Korea, nations are confronting the realities of the new digital world. It is important for leaders and aspiring leaders to stay abreast of the changing landscape and maintain an enlightened and flexible approach to guide businesses into the future.

Industry 4.0 affects all societies around the globe — from the United States to Zimbabwe to North Korea, nations are confronting the realities of the new digital world.

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