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Industry 4.0

Introduction

The integration of digital and physical technologies is accelerating, enhancing companies’ ability to increase operational excellence and grow in ways that may not have been possible just a couple of years ago. This phenomenon, known as Industry 4.0, suggests a new revolution that enables smart, connected technologies to transform organizations, operations, and the workforce by increasing information flow, creating new insights, and revolutionizing business models.

A key role of any board member is to provide strategic oversight in the form of forward-leaning perspectives to help the organization build and maintain competitive advantages in the face of increasingly rapid technological change. The purpose of this article is to help board members understand Industry 4.0 and its potential to create value for their organizations, while providing considerations for oversight.

What Is “Industry 4.0”?
The word “industry” and the term “industrial revolution” conjure up images of plants, machinery, and equipment. While these and other hard assets remain critical components of our economy, we are experiencing a new industrial revolution in which our economy is increasingly comprised of both physical technologies, such as sensors, robotics, 3-D printing, and wearables; and digital technologies, such as artificial intelligence (AI), analytics, and visualization.
How it works

While the technologies that power Industry 4.0 can seem impossibly complex, the process by which it works is really quite simple. In essence, the power and value of Industry 4.0 lies in flows of information, and the ability to integrate digital information from many different sources and locations to drive the physical act of doing business. In this way, information flows in an ongoing cycle, where data from one process informs the next.

Throughout this cycle, data flows continuously, providing digital information about actions taking place in the physical world. That information is then analyzed and used to drive new actions. This information flow occurs through an iterative series of three steps, referred to as the physical-to-digital-to-physical (PDP) loop (see figure 1). This ongoing loop incorporates the use of many physical and digital technologies, including analytics, additive manufacturing, robotics, high-performance computing, natural language processing, artificial intelligence and cognitive technologies, advanced materials, and augmented reality.

- Physical to digital: capture information from the physical world and create a digital record from physical data
- Digital to digital: share information and uncover insights using advanced analytics, scenario analysis, and AI
- Digital to physical—the essence of Industry 4.0: apply algorithms to translate digital-world decisions to effective data, to spur action and change in the physical world

Most organizations already have some part of the first two stages of the PDP loop—the physical-to-digital, in the form of connected assets, and the digital-to-digital, in the form of analytics—in place. However, it is the third stage—acting upon those digital insights back in the physical world—that can unlock the boundless possibilities of Industry 4.0. Indeed, it is the completion and continuation of this ongoing loop that enables organizations to be more responsive, flexible, and adaptive to the rapidly changing conditions around them; to make more informed decisions; and to better predict and respond to future scenarios.

Figure 1. The physical-digital-physical loop and the technologies used

1. Establish a digital record. Capture information from the physical world to create a digital record of the physical operation and supply network
2. Analyze and visualize. Machines talk to each other to share information, allowing for advanced analytics and visualizations of real-time data from multiple sources
3. Generate movement. Apply algorithms and automation to translate decisions and actions from the digital world into movements in the physical world

Source: Center for Integrated Research, Deloitte Insights | deloitte.com/insights

3. Deloitte Insights has published a broad series of perspectives on additive manufacturing in its 3D opportunity series; see https://www2.deloitte.com/insights/us/en/focus/3d-opportunity.html?icid=left_3d-opportunity
5. Deloitte Insights has published detailed analyses on a number of these technologies; see www.dupress.deloitte.com
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Opportunities and strategic considerations

The integration of physical and digital technologies has the possibility to open new doors and generate new opportunities for companies. The ability to combine data and learnings in new ways and make better, more informed decisions at a faster rate, can provide distinct advantages for those companies that are able to harness the power of Industry 4.0. Some of those opportunities may include the following:

- **New products and services** may be created with the combination of technologies like sensors, wearables, analytics, machine learning, and advanced manufacturing techniques. The use of insights generated through the feedback loop can also allow for improved designs of current products and services. In some cases, new business models may be created as companies amass data and are able to move into adjacent markets, markets that may not have been economically feasible before, such as small business banking or micro-lending in financial services, or provide services in addition to their physical products.

- **Improved productivity of supply chains, assets, and labor** is an area ripe with opportunity. Adapting to incorporate learnings from data in real time can reduce asset idling and maximize utilization. It also presents the opportunity to more effectively manage supply chains and material costs by reducing the potential for waste and making scheduling more reliable. Labor may become more efficient as technology makes tasks easier and frees workers for additional or new tasks.

- **Increased understanding of customer needs** and a stronger connection with the customer are by-products of Industry 4.0. Intelligent products and services gather information that can be added back into the feedback loop to enrich understanding of how products and services are used. A tailored user experience and customized marketing may encourage deeper loyalty and provide opportunities for follow-on sales.

- **Opportunities to develop the workforce of the future** are likely to arise as demands for talent with new skills are created by Industry 4.0. The integration of physical and digital technologies creates new types of jobs but also provides the opportunity to enhance existing jobs and make tasks easier. Training will inevitably be needed to empower the workforce to flex their skills to meet new demands and incorporate new technologies into tasks.

- **Risk reduction** is perhaps one of the most important opportunities presented through Industry 4.0. Gleaning insights from formerly disparate sources of data earlier and faster could provide opportunities to mitigate weaknesses in the supply chain, better evaluate vendors or manage material costs, or better analyze and secure transaction data.

However, with opportunity comes risk. When exercising oversight responsibilities, board members should consider the following strategic factors:

- Placing too much focus on the achievement of short-term metrics and not enough on investing in a longer-term, more strategic vision that responds to competitive disruption.

- Silos or a lack of coordination within the organization, particularly if it is multi-national, may inhibit the ability to embrace the power of Industry 4.0 and act on insights.

- If the organization examined the gaps between its existing capabilities and strategic objectives to determine where targeted investments should be made.

- How the organization is introducing change management efforts and continuous learning initiatives to counter trepidation in the workforce associated with new technology integration. Boards may also consider if the skill sets of senior leadership support and enable adoption of Industry 4.0 technologies in their organizations.

- If the organization has implemented a secure, vigilant, and resilient cybersecurity strategy to mitigate the potential for cyber incidents or data spills associated with the digitization of business and accumulation of sensitive data. Fully-connected organizations can be at a greater risk from cyber threats and the consequences of an attack could be far more extensive.

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7. Forces of change: Industry 4.0, p. 6, 10 [https://www2.deloitte.com/content/dam/insights/us/articles/4323_Forces-of-change/4323_Forces-of-change_Ind4_0.pdf](https://www2.deloitte.com/content/dam/insights/us/articles/4323_Forces-of-change/4323_Forces-of-change_Ind4_0.pdf).
12. The Fourth Industrial Revolution is here—are you ready?, p. 7 [https://www2.deloitte.com/content/dam/insights/us/articles/4364_Industry4-0_Are-you-ready/4364_Industry4-0_Are-you-ready_Report.pdf](https://www2.deloitte.com/content/dam/insights/us/articles/4364_Industry4-0_Are-you-ready/4364_Industry4-0_Are-you-ready_Report.pdf).
13. Industry 4.0 and cybersecurity: Managing risk in an age of connected production, p. 2 [https://www2.deloitte.com/content/dam/insights/us/articles/3749_Industry4-0_cybersecurity/3749_Industry4-0_cybersecurity_12.pdf](https://www2.deloitte.com/content/dam/insights/us/articles/3749_Industry4-0_cybersecurity/3749_Industry4-0_cybersecurity_12.pdf).
Conclusion

The increasing prevalence and influence of Industry 4.0, combined with the board’s fiduciary obligation to oversee company strategy and operations, suggests that directors need to understand Industry 4.0 and provide oversight for the company’s ventures into it. To effectively function in an Industry 4.0 environment, directors should consider the following actions:

• Understand the applications of various technologies (including what they can—and cannot—do) and potential impacts on the organization’s business and how they could complement strategy.

• Develop an awareness of how physical and digital technologies work together to drive value and translate decisions into the physical world.

• Challenge management to assess digital maturity and understand what can (and cannot) be done with resources already in place; consider engaging expert resources.

• Encourage the organization to start small, proving the concept and building a business case for further investment that may unlock further success and drive exponential growth.

• Help management achieve the right balance between short-term results and longer-term value creation/strategy.

• Understand—and help management to understand—that some failure is expected; encourage management to try new things while maintaining oversight.

• Encourage iteration—technology is evolving fast and there is room to apply learning and integrate it into strategic decision-making.

• Help the company recognize opportunities for innovation in its industry.

• Challenge management on where to invest in new technologies and what technologies best fit the company’s forward-looking strategy by tapping new sources of talent (while noting that talent can also be a risk), reaching underserved markets, using predictive tools to help improve processes and reduce risk, connecting supply chains, and creating new ecosystems.

• Remain vigilant over potential side effects and risks, such as talent shortages and cyber threats.

For more information about Industry 4.0 go to Forces of change: Industry 4.0.
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