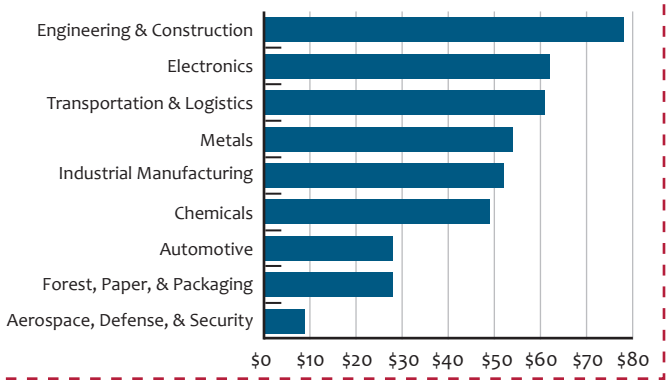
Industry 4.0

Financing the Revolution

Written by: Ela Malkovsky, Editor-in-Chief (Cambridge)

Annual Cost Reduction Until 2020

(in $ Billions USD)[1]



Within two short years since we published our manufacturing industry trends outlook for 2016, the discussion around implementing advanced digitized manufacturing technologies has shifted into action with the digital transformation of manufacturing as we have entered into the fourth industrial revolution, also known as Industry 4.0.

Global industry survey results indicate that industrial companies' average level of digitization is expected to soar from the current 33% to 72% within five years, with 2.9% (US$493B) revenue gains and 3.6% (US$421B) cost reductions annually[2]. Today, almost 40% of small and medium sized Canadian manufacturers say that they have achieved advanced levels of digitization, and first movers on the scene are already reaping the benefits. 40-60% of early Canadian adopters of Industry 4.0 projects report increased productivity, reduced operating costs, and improved product quality[3].

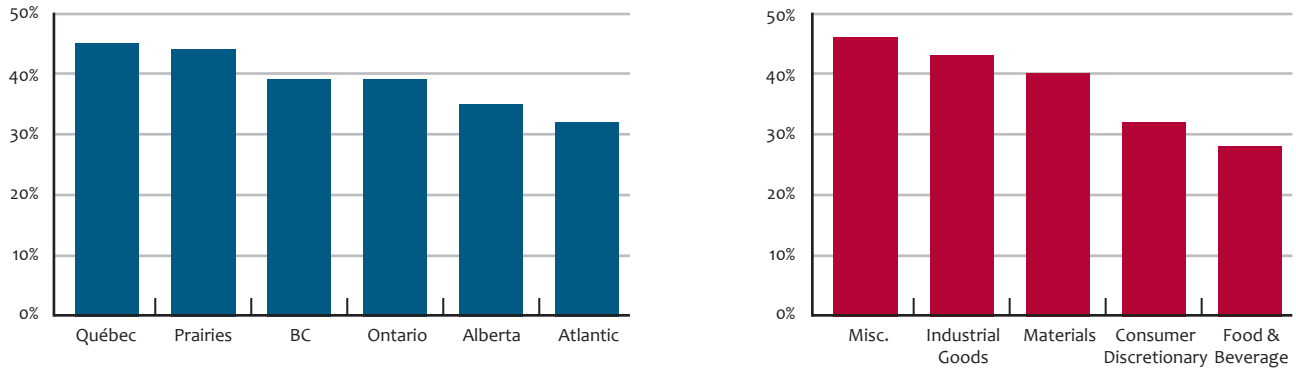
Industry 4.0 digital investments improve the top and bottom lines by enabling quantum leaps in performance with smart, digital factories that yield shorter operational lead times and increased efficiency, cost reduction and higher asset utilization, as well as improved quality assurance for maximum product quality. As a result, the integration of advanced technologies and the development of digital factories is creating profound opportunities for growth and is becoming increasingly vital to competitive survival.

In order to take advantage of these opportunities, companies must first overcome significant barriers related to the adoption of advanced technologies. Many companies delay investing in capital and workforce development during periods of slow global demand growth and uncertainty surrounding the free flow of goods. Companies investing in the digitization of their businesses are also contending with a skills shortage and a lack of digital culture in addition to excessive costs, along with unclear benefits of unproven technologies.

Strategically leveraging various government funding solutions at different stages of your company's digital transformation can help offset the immediate costs of adapting digital technologies without imposing future debt, thereby mitigating the risk of investing in industry 4.0 projects such as hiring and training, new equipment/software purchases, and research & development (R&D), and thus enabling companies to compete in the new era of manufacturing.

Percentage (%) of Businesses that Have Implemented Digital Technologies[4]

By Province (blue) and Sector (red)



[1][2]PWC, 2016 Global Industry 4.0 Survey [3][4]BDC Study, Industry 4.0: The New Industrial Revolution; *Are Manufacturers Ready?*

The Technological Revolution

Written by: Nicolas DesRoches, Regional Practice Leader -- Eastern Ontario (Ottawa)

The advancement of global manufacturing through Industry 1.0, 2.0 and 3.0 with the advent of mechanization and water/steam power, the introduction of electricity and, more recently, IT systems, has now entered into the next paradigm shift: development of smart factories with end-to-end connectivity and automation through data collection and processing. This shift, one that promises to fundamentally change the way we look at manufacturing, has come to be known as Industry 4.0.

What is Industry 4.0?

Industry 4.0 is a focus on connecting systems and equipment to facilitate high product customization and automation, making mass production more flexible and efficient. By creating networks of "smart" machines that can autonomously resolve issues, adapt to new products or materials, and optimize their process, Industry 4.0 allows for increasing complex work through worker support rather than manual labour.

Key Industry 4.0 Terms

Internet of Things (IoT): Connectivity between devices to allow transferring, processing, and exchanging of data (either by sensing or controlling remotely) across network infrastructures. Gartner's January 2017 report shows an expected increase from 6,381.8 million IoT units in 2016 to 20,415.4 units in 2020.

Big Data: In regards to Industry 4.0, this means user behaviour analytics, predictive analysis, and other methods that use diverse data sets and types to produce meaningful metrics and outputs.

Cloud Computing: This is access to communal pools of configurable resources which can be quickly provisioned and managed with minimal interaction, using Internet infrastructures.

Cyber-Physical Systems: As per the National Science Foundation, these systems contain physical and software components that are intertwined, interacting with each other but operating on different scales and exhibiting multiple and distinct functions and outputs, depending on situational contexts.

Cognitive Computing: Signal processing and artificial intelligence systems such as natural language processing (NLP), speech recognition, human-computer interaction, and dialogue/ narrative generation.

Industry 4.0 is generally accepted as having four main concerns:

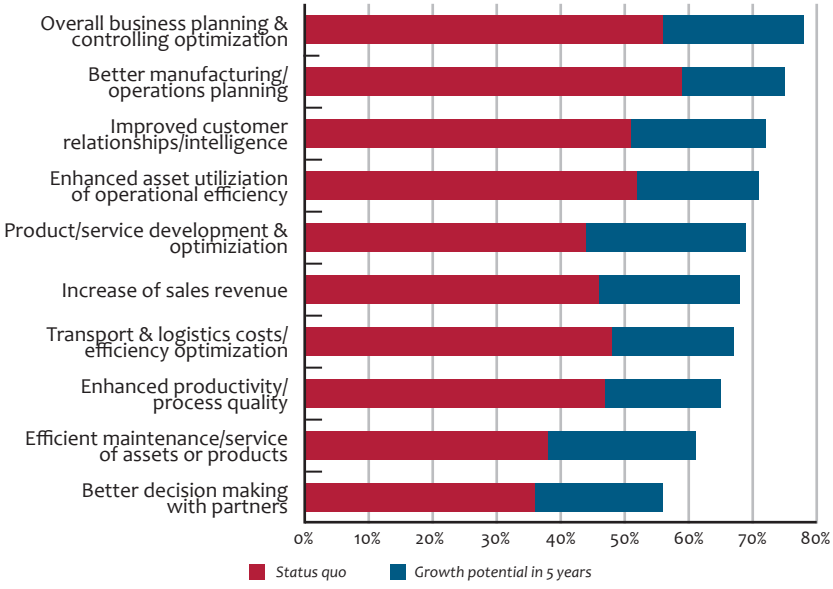
1. ***Interoperability*** – The ability to create seamless automation through same-channel digital communication between equipment and machinery; relies on the Internet of Things (IoT) and cloud computing.
2. ***Information Transparency*** – The ability to create virtual simulations and reproductions of the physical world and facilitating complex analytics and modelling; relies on "Big Data".
3. ***Technical Assistance*** – The ability of machines to make complex decisions and evaluate outcomes/repercussions, as well as creating autonomous systems to handle unsafe or undesirable tasks; relies on "Big Data", cyber-physical systems, and cognitive computing.
4. ***Decentralized Decisions*** – The ability to automate production and decision making, such as implementing automated QA processes using scanners and cameras; relies on cyber-physical systems and cognitive computing.

By impacting nearly all aspects of a business' operations and output, Industry 4.0 presents a revolution that surpasses all others in terms of complexity of implementation, and scope and scale of impact.

Getting Industry 4.0 Ready

Implementing Industry 4.0 systems can lead to increased productivity, output, safety, and reliability, which can in turn lead to increased profits, revenues, and market share. This fusion of process data and physical systems will undoubtedly lead to a digital transformation for many businesses, but there is also increased risk associated with data management and cybersecurity. Likewise, our workforce is not yet fully aware of or trained to address the opportunities and challenges Industry 4.0 will bring, such as how to implement and create such systems in different industries. With Industry 4.0 quickly becoming the reality of today rather than tomorrow, businesses will need to revolutionize to stay ahead of the pack in the already competitive global marketplace; those that do will be well poised to become the leaders and front-runners of the next global technological revolution.

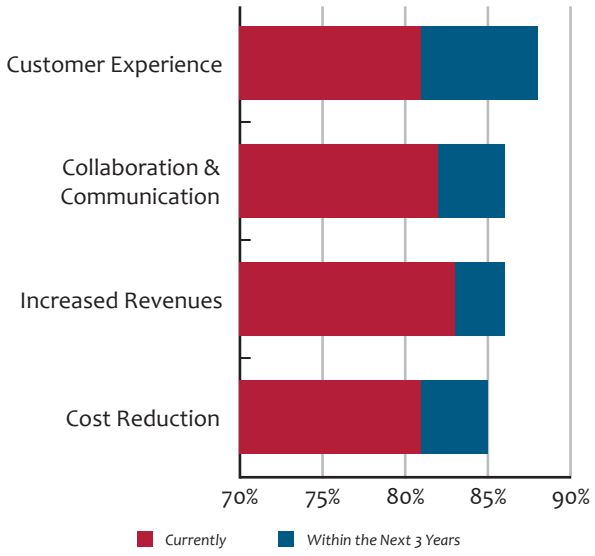
Use of Data Analytics Today and in Five Years (%)*[5]



***Percent of respondants who identified use of big data analytics in specific area, today and in five years**

[5]PWC, 2016 Global Industry 4.0 Survey

Industries Adopting Digital Transformation Initiatives See Enterprise-Wide Benefits[+6]



[+]Percent of respondants who, in the July 2017 Economist Intelligence Unit (EIU) survey, indicated at least "moderate" improvement after implementing transformation initiatives

The New Digital Factory

Written by: Philip Finkelstein, Technical Writer (Vancouver)

From the outset of the Industrial Age, the manufacturing floor has been an ever-changing landscape as advances in technology serve to streamline plant processes for improved efficiencies. Now well into the Digital Age, the revolution surges on with highly interconnected and flexible smart digital factories providing the building blocks for the new era of technological advancement—Industry 4.0—which has already begun to change the way we produce and consume with the advancement of smart manufacturing, robotics, artificial intelligence (AI) and the Internet of Things (IoT).

Four distinct trends have emerged as a means of advancing manufacturing capabilities: big data, advanced analytics, human-machine interfaces, and digital-to-physical transfer[7]. These trends will undoubtedly disrupt the status quo of production as cyber-physical systems are established to communicate and cooperate with other machines and humans in real time over IoT by way of cloud computing. Interestingly, top performing companies will see more contribution in cloud and mobile technology, IoT, and big data over the next three years, while the rest of industry will see more value in advanced manufacturing methods[8].

With the event of cloud manufacturing, companies have the option of moving to integrated planning and scheduling, allowing systems to combine internal data with information from horizontal value chain partners for precise inventory level control, while also facilitating predictive maintenance of key assets. These improvements in advanced analytics will be bolstered by developments in automation, driven by increased proficiency of big data technologies and the full-scale implementation of robotics into the assembly line.

Advancements in robotics with human-machine interfaces like voice and image recognition have made it easier to program and use robots for replicating complex human tasks. Advanced automation increases output efficiency and worker safety while enabling increased product customization capabilities through real-time self-optimization.

Technologies like 3D printing are revolutionizing prototyping and eliminating the need for complex assembly. AI technologies are continuing to expedite time to market as computers solve manufacturing challenges. And with the comprehensive structure of smart manufacturing guiding logistics, seamless flow from planning to production has never been more attainable.

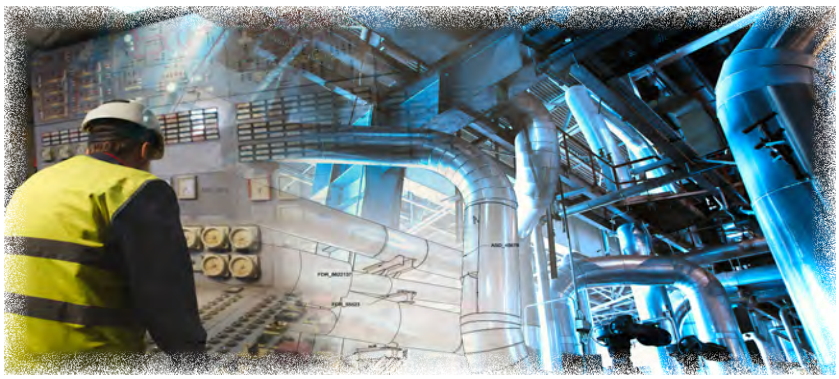
Transitioning a business to accommodate these new technologies will require that measures are taken to, support visibility into supply chains, find talent adept at industrial software programming and analytics, and build strategic partnerships, as well as organize and standardize protocols for IT system communication across numerous pieces of in-field equipment. The digital factory may be a new undertaking, but monumental shifts in manufacturing have always been accompanied by significant upticks in production efficiency, and thus lead to profitable boons for companies willing to make the leap into the next frontier.

[6,8]Prudential, Manufacturing in Motion: Transforming for a new Industrial Era, 2017

[7]McKinsey, Manufacturing's Next Act

Funding Opportunities for Advanced Manufacturing

Written by: Kyle Alkema, Technical Writer (Cambridge)



With the technological revolution well on its way, manufacturers find themselves at a critical juncture; to risk investing in unproven technology during uncertain political and economic times, or risk falling behind and perishing while the industry shifts into a new era of advanced automation, customization and value chain integration. At this juncture, government funding will be more critical than ever in supporting the digital transformation of businesses by reducing the risk of industry 4.0 investments in skill development, equipment/facility upgrades, and R&D projects.

Bridging the Skills Gap: The lack of technically skilled labour is the biggest challenge that companies face when developing and implementing digital technologies[9]. Therefore, transitioning to Industry 4.0 will require investment in advancing the training of existing employees as well as hiring and training new employees with the relevant skills, such as those needed for human-robot collaboration, industrial software programming and analytics, or digital performance management. Since a prime objective of the government is the creation of jobs, several programs exist for incentivizing and supporting the hiring or training of skilled employees. By contributing a portion of eligible costs, emphasis is placed on employer-driven training where incentives are supplied for the company to develop its workforce.

Upgrading Equipment and Facilities: For those companies willing to undertake the development of the digital factory, while also trying to maintain their bottom line, applying for government grants/loans that support facility expansion or the purchase of new machinery and support infrastructure can significantly reduce the risk of investing in disruptive and rapidly changing technologies. Strategically funded plant and equipment investments can enable your company to stay ahead of the competition by advancing your technological baseline, and thereby increasing production efficiency, without compromising the bottom line.

Financing Research & Development: The transition to advanced manufacturing will depend on, and be fueled by, intensive product and process development projects, of which a significant portion of labour and overhead costs can be claimed through innovation tax credits. Not only do these tax credits offset the costs of undertaking R&D projects at their onset but they also can be reinvested back into your business in the form of purchasing new equipment, acquiring new hires, expanding your facilities, taking on more challenging projects, or paying down debts.

While adopting advanced technologies will not be an easy undertaking, procuring government funding will enable businesses to reduce the risk of transforming their business by investing in workforce development, equipment and facility upgrades, and innovation and product/process development to stay ahead of the competition as we enter the new era of manufacturing.

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