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The Fourth Industrial Revolution — Industry 4.0 and IoT

Securing the future of human society as we know it requires us to solve some grand challenges for which we must find long term solutions, such as reducing environmental pollution, providing better healthcare for an aging population, and finding new and sustainable energy and food resources. We now live in an age where there are enormous potentials to help solve some of these grand challenges—the fourth industrial revolution. We are being met with a tidal wave of new and disruptive technology as the digital revolution that underpins the fourth industrial revolution gathers momentum and enables us to make leaps forward that will transform the way we live and work with a scope to touch everyone in the world.

Three previous industrial revolutions of (1) water and steam power, (2) electricity and then (3) semiconductor technology each progressed over several decades. The most recent industrial revolution in semiconductor technology saw the birth of the transistor and integrated circuits, followed by mechanization and automation, all of which were developed and then adopted at a relatively slow pace. In contrast, the fourth industrial revolution that we are currently experiencing is progressing at an exponential rate and disrupting many existing systems and processes while creating totally new and innovative solutions.

Mass digitization and the Internet of Things (IoT) is set to transform many industries. Defined by Gartner as a network of physical objects that contain embedded technology to communicate, sense and interact with their internal states or the external environment, the possibilities of IoT are endless. Cisco predicts that 500 billion devices are expected to be connected to the internet by 2030. Such environments can be factories, autonomous vehicles, smart grids, robotics, etc.

Industry 4.0 was a phrase coined by the German government at the Hanover fair in 2011 that promoted the use of digitization in manufacturing. This has been an investment focus in Germany ever since, and they continue to be world leaders in automation. The proliferation of connected machines, M2M, augmented with smart software, secure networks and data analytics is helping to improve things like equipment utilization and preventing factory downtime, for example. According to IDC, manufacturers predict a 48% reduction in unplanned downtime from solutions such as the Connected Factory.

The benefits of Industry 4.0 and IoT require careful consideration of existing processes and infrastructure if a clear business case is to be made, as it is often a requirement to integrate existing and legacy systems with new sensors and networks. One of the fundamental considerations is to ask the questions: *What outcomes am I trying to achieve: Better throughput on the factory floor? Improvement in equipment utilization? Lower operational costs?* While this may seem an obvious starting point, it allows us to answer another fundamental question: *What critical decisions need to be made to achieve those outcomes?*

Many organizations will claim they have enough data, when in fact very often they already have too much data. The issue is that it is not providing any value at all. Far too often, an inordinate amount of data is a starting point and then we collect even more data to add to our "data lake." Then we spend a lot of time sifting through the data looking for insights, which is a traditional empirical analysis that we hope will drive some useful decisions. However, there is a danger in this approach, in that we may end up with erroneous or contradictory analysis which leads to wrong conclusions because we are unable to separate noise from useful data.

Furthermore, not all decisions or conclusions are useful or financially viable. Spending precious resources and time on broad inspection of data is not a sustainable business model. We can and should take a different approach as we gain access to new data sources that we can connect and augment in a smart way combined with advanced analytics. An effective process should start with the critical decisions needed, and go on to define the insights to make those decisions, ask what information is required to get those insights and finally, determine what type of data to collect in order to obtain the information.

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Data is available from a plethora of connected devices, from smart machines and sensors to robots and information systems, across factories and indeed supply chains. Careful consideration needs to be given to some fundamental requirements: number of sensors and the environment; what kind of data payloads need to be handled; network topology and redundancy; what response times are needed; what type of algorithms; whether we can add Artificial Intelligence (AI) and Machine Learning (ML); user interface requirements; and cloud versus mobile and desktop implementations. Importantly and in most situations, critically, we must ask: *What security measures are in place across the eco-system to avoid cyberattacks?* In many mission critical applications, the security overheads required to mitigate risks could well offset the cost-benefits of the data itself. Therefore, careful consideration must be given to decide who, what and how the system is constructed and how well it will perform to meet the desired outcomes.

Despite what might seem a daunting task, momentum is building and many organizations around the world are already planning to implement Industry 4.0 and IoT solutions. In an IDC survey in 2015, 58% of 2300 executives surveyed said IoT was strategic to their business, and 48% of enterprises have deployed IoT solutions today. The automotive industry is probably the most advanced and where it is estimated that 80% of vehicles are constructed by robots today. A new generation of cobots (cooperating robots) working together with humans are already being implemented together with IoT; therefore, we are set see the transformation of facilities across many industries.

Combining sensors in vehicles, factory floors, health monitoring and many other applications have given rise to the term *sensor fusion*. These devices typically are at the "edge" and our IT infrastructure is converging with this technology, thus bringing about high performance computer platforms that combine operating technology and traditional IT systems. This advancement has the capacity to integrate IoT on an extremely large scale and gives the option to deploy AI and ML solutions not only in the cloud but on smart devices or machines. These solutions provide a way to manage big data implementations without compromising performance and security.

A great example of an IoT device is in new emerging smart meters for households. The first generation of so-called smart meters included devices that were not intelligent at all and simply showed an overall energy consumption within your house. However, new smart meters are now capable of collecting much more data, disaggregating it in real time and showing energy usage per device connected to your supply. Combining AI and ML into the device, we can now identify not just the type of appliance but also the condition of the appliance. The consumer is empowered to save energy and is safer as result because the system will identify any faulty devices or appliances left powered on. The next generation of devices will add the capacity to buy and sell energy automatically for the consumer.

There is no doubt that mass digitization is set to transform the way we live and work. Industry 4.0 and IoT are enabling major new insights that will allow us to improve the world around us and help find solutions to the grand challenges. The scale of this transformation is nothing like we have seen before and is happening at a much faster pace than previous industrial revolutions. Furthermore, it has the scope to improve and sustain life for everyone on the planet.

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For Further Reading

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