Industry 4.0 and the IIoT: After COVID-19

Executives & Entrepreneurs

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- The coronavirus pandemic has accelerated some of the secular shifts we identified in our previous report “Industry 4.0 and the IIoT: Winners but also losers.”
- We believe the transformation of the industrials sector in the Fourth Industrial Revolution will have major implications for SME entrepreneurs, so we reiterate our conclusion and put it into context of the COVID-19 health crisis.
- The world will become more digital. Lockdown measures have forced many businesses to change fundamentally the way they buy and sell goods and services, which is accelerating digital adoption rates.
- US-China trade tensions had already demonstrated the interconnectivity of global supply chains and how vulnerable they are if even small parameters change. After COVID-19, we believe companies will start to reshore (localize) some of their production.
- Factories will need to be more digitalized and automated to produce smaller quantities efficiently with localized manufacturing. The Industrial Internet of Things (IIoT), 5G, and industrial software are all key enablers of the transformation to smart manufacturing.
- We discuss the opportunities that digital twins will bring in terms of flexibility to manufacture, time to market, and productivity improvements. We also look at the threats from preventive maintenance and the shift to digital services, and what they mean for firms. Whereas this report is intended for entrepreneurs, investors are urged to look at our related Automation and robotics as well as Enabling technologies’ themes.

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Industry 4.0: After COVID-19

The coronavirus crisis has triggered a new discussion about globalization versus localization. During the crisis it has been obvious that firms that have been able to take decisions country by country had an advantage in terms of production flexibility as well as from demand perspective. Also, the recent escalation in China-US trade tensions has highlighted again the vulnerability of supply chains. This and the pandemic experience has put the spotlight back on supply chain adjustments, given how many countries were forced to announce lockdowns with limited time to procure supply of essential goods. Therefore, we believe companies and governments will increasingly consider moving some production closer to home or to their customers after the crisis. This represents a paradigm shift in manufacturing from the cost focus over the last few decades which favored concentrated manufacturing hubs.

Another key conclusion is that the manufacturing sector will become more digital in the next few years. We expect an increasing focus on connected devices and their use of the Industrial Internet of Things (IIoT). Some key manufacturing hubs in Asian markets, including China, South Korea and Japan, have maintained uninterrupted production despite limited manpower availability thanks to use of sensors and IIoT to monitor production. With investment in 5G remaining on track, IIoT adoption should continue to rise. At present, the feedback from industrial companies is that their customers are showing strong interest in "remote-everything." Ultimately social distancing in factories means more automation equipment.

In sum, the current crisis has highlighted how companies cannot afford to have all their supply coming from one country, which could shut down its entire manufacturing footprint. Thus, reshoring is not just about avoiding costs and tariffs; it is also about diversification and reducing risk. This is especially true for companies involved in goods that are deemed critical to public health, such as manufacturers of medical protective equipment (PPE) and pharmaceutical treatments.

Localizing efforts could boost new factory construction, which could benefit companies exposed to general machinery and automation and robotics technologies that help improve new plant productivity. We would expect new plants to have a higher level of automation content due to a reduced desire for labor, which could be impacted by future pandemics. This will also include remote monitoring and Internet of Things (IoT—a network of connected devices that constantly send and receive data) capabilities. Automation also reduces labor costs, a consideration given high wage costs particularly in developed markets and some developing countries. Despite rapid growth in automation over recent years in China and other emerging markets, penetration is still much lower than in developed countries. But there are also gaps within developed markets. The US is still far behind Germany and Japan, for example. This shows the huge potential globally. And wherever robots are installed, so too normally is other automation equipment (see Fig. 1). We believe the coronavirus experience will prove to be a tailwind for the global automation industry, both for hardware and software firms. In particular, reshored factories will typically be smaller and require more automation equipment to run them as efficiently as possible.

Figure 1 - Robot density in manufacturing industry by country

In addition, the use cases for emerging technologies like commercial drones and 3D printing have surged during the pandemic. Drones have been used for contactless delivery of goods, and 3D printing adoption has also picked up. For instance, the US Food and Drug Administration partnered with public-private agencies to respond to the shortages in medical supplies using 3D printing to produce ventilator valves, ventilator parts face masks and plastic shields.

In our previous report (see "Industry 4.0 and the IIoT: Winners but also losers," published in October 2019) we highlighted that Industry 4.0, the Fourth Industrial Revolution, and smart manufacturing are terms that describe a new era of manufacturing characterized by increased connectivity and automation. Based on the scenario above, we are now more convinced that this transformation will play out even faster than previously expected. This will have a major impact on companies in
the manufacturing sector and suppliers of manufacturing equipment. In our last report we discussed the opportunities and challenges that market participants are facing in this new environment. On the following pages, we revisit our arguments in the light of recent developments. Our market estimates haven’t changed. As we are still in the early stages of this technological change, the range of estimates of how big this new market may become is broad. Various leading companies in this sector claim to improve productivity by up to 30%. The size of the IoT market is expected to reach USD 1.1tr by 2021, up from USD 600bn in 2016 (source: IDC, Bloomberg Intelligence). We estimate that the IIoT represents 15% of this revenue pool.

Latest related thematic publications
- Automation and robotics, published on 26 February 2020
- Enabling Technologies, published on 14 January 2020

Why is this report relevant for small and medium-sized enterprises (SME) in the manufacturing sector?
We believe an inflection point is imminent in terms of: a) the connectivity of manufacturing equipment; b) the use of industrial software; and c) data analysis in the manufacturing process. All components will permanently change how companies run their factories and influence the business models of equipment suppliers. We discuss how more efficiency (e.g., preventive maintenance) and new business models may hurt the firms that don’t have the management resources, IT knowledge, and funding to prepare for the IIoT environment. But there is clearly upside for companies that integrate their IT and software expertise into their offering. We think SME entrepreneurs in the industrials sector must act now to digitalize their equipment; it could be too late in a few years’ time. The experience from the current pandemic has made it even more important that SME companies act immediately.

The large capital goods companies worldwide have already started to adapt their product portfolios to the changing environment. We advise managers of SMEs to review their digital offering and consider how well their products will connect to IIoT platforms. Given the large number of the platforms that either already exist or are being developed, entrepreneurs may opt not to develop their own platforms and focus instead on making their product offerings compatible with existing ones.

What is a digital twin?
In our previous report we defined a digital twin based on the description from Siemens, as a virtual representation of a product, production process, or performance. Modern factories no longer exist just in the physical world. As the consumer industry experienced with the launch of smartphones, the industrials sector is undergoing a fundamental IoT-driven structural change. Industrial equipment is becoming increasingly interconnected and linked, enabling people to collaborate better and enhancing productivity. In this digital transformation, companies will need to sense, analyze, and act based on data. So major industrial companies are in the process of expanding their software offerings or acquiring specialist IT companies that both provide new product optimization opportunities for their customers and create new incremental revenue opportunities for themselves.

One key enabler of digital twins is the IIoT, which describes a network of connected devices in the industrial world. Modern robots, warehouse equipment, devices that automate refineries, heating and cooling systems in buildings, and even modern airplane engines: all generate data. This enables the owner of the asset to operate much more efficiently (see Fig. 2). IIoT technology and the related industrial software are also becoming tools for asset optimization (cost savings) through remote monitoring and predictive maintenance. As the life-cycle maintenance cost of an aircraft engine, for example, is a multiple of its selling price, the potential savings from predicting unscheduled outages could be significant.
Buildings, too, benefit from this technology, through improved energy efficiency. They can be visualized before construction starts. Their owners, using this data, can optimize their energy supplies. Along with productivity and operational improvements, IIoT tech provides companies with new revenue opportunities and real-time product support. The data collection during the life cycle of products, buildings, and other applications delivers valuable insights about the parts that failed or weaknesses during periods of stress. We believe that, for major industrial companies, use of digital twins will become commonplace. It offers such companies an opportunity to sell new digital services and interact with customers more often through continuous monitoring of the installed base.

The IIoT will be key to the success of digital twin technology. It includes, among other applications, the use of sensor data, machine-to-machine communication, and big data technology (cloud-based platforms) to better monitor equipment and analyze data. Digital twins and IIoT technology eliminate inefficiencies and save time and money through better management of production processes and predictive maintenance. New technologies, in particular the coming 5G network, will accelerate adoption of the IIoT. We have seen countries that have used the fiscal stimulus due to the health crisis to increase spending on the 5G network. 5G goes beyond the applications of 4G with its focus on machine-type communication. It will have 10 times more bandwidth than 4G. Even more important for industrial applications is its low latency, high reliability, and IoT connectivity. Latency defines reaction time: Low latency is a prerequisite for real-time applications. For LTE (4G) technology, latency is around 50ms. It will drop in the 5G network to around 1ms (source: Deutsche Telekom). 5G reliability and availability is 99.999%, also an important feature. All these attributes will make it the standard wireless technology most companies use to communicate from the factory directly to the cloud. So 5G will be a pillar of smart manufacturing (Industry 4.0), improving efficiency, flexibility, and product diversity in the manufacturing process.

**Market players—a crowded space**

IIoT development is still in its infancy. There are many IIoT players in this “proof-of-concept” period that are trying to create a new offering. They include traditional US and European software companies as well as global industrial giants. We believe it is not sensible for those companies that missed the boat to start developing their own platform; it simply takes too long and prices for firms with this expertise have become so expensive in the meantime that it will be hard for companies that haven’t acted yet to acquire something at a reasonable price.

In our view, companies should instead focus on the connectivity of their products, ensuring they can plug into the existing platforms of industrial or IT firms. The situation is comparable to smartphone apps. If you develop the right one, you can make a profit without owning the platform. Many traditional software companies leverage their existing technologies to service the industrial world. Some industrial companies use the basic architecture of the software players to build their platforms in cooperation with them.

**Cannibalization—who will lose?**

As with most innovations, the IoT represents not just an opportunity, but also a threat to existing business models. In particular, digitalization and predictive maintenance could cut into aftermarket and service sales. Think about a scenario in which a machine tells you its next service is due before anything in it breaks. Automatically, you’ll need fewer spare parts, and spare parts are attractive, high margin products for many firms. Some businesses can also sell their new products at breakeven costs and earn profits via spare parts and maintenance contracts. The subsequent lower maintenance costs could be material; estimates range from a 10% to 40% drop. The spending for new equipment will also decline due to the longer average life of the equipment, with downtime for maintenance reduced. So, companies with high service contracts and a major spare part business might lose out as customers better understand how to manage and care for their machines via preventive maintenance. The improvements in efficiency might result in lower sales for the overall sector. On top of that, software companies will likely be grabbing a piece of the pie.
Monetizing investments in platforms will thus be crucial. The key question is how much of the savings the manufacturer can keep and how much will go directly to customers. There is not yet enough data to offer an estimate with any certainty. The environment could be difficult for many companies unable to capture a big part of the value added and compensate for missing maintenance revenues and profits.

Another risk, in particular for SMEs, result from new business models. As highlighted above, the IIoT enables companies to control machines remotely, which provides opportunities for preventive maintenance and data analysis. But instead of selling machines to their customers, industrial companies could just sell a service, producing products for them (see description of PaaS below). Let’s assume you as a customer need a machine that manufactures 10,000 items of a certain product. But instead of buying the machine, you have the option merely to buy the capacity to produce these 10,000 items. In this case, the manufacturer remains the owner of the machine and sells not the equipment itself but the service (capacity) to produce 10,000 pieces for you. In the past, this would have been difficult as the equipment manufacturer would need your factory employees to run the machine properly. Now it is much easier as the manufacturer can control the machine remotely via the IIoT.

The customer saves by having to invest less, reducing capital expenditure, and the manufacturer can run the machine in the most efficient way. Although this sounds like a win-win situation for all involved parties, a problem could arise for smaller machine-building firms, which don’t have the financial wherewithal to use their own balance sheets to fund construction of machine parks. Bigger players could use their financial strength and management capacity to squeeze them out of the market. So smaller companies will have to initially make their equipment IIoT compatible and perhaps consider other, subsequent solutions like teaming up with financial institutions to create a similar offering.

Description of product-as-a-service (PaaS)
Normally, customers buy products as a onetime transaction, potentially followed by a guarantee and later a service contract. PaaS has a different business model: the user normally does not own the machine that makes its product, but rents it as a service. In the broadest sense, it is a bit comparable to a car leasing business. The supplier is responsible for servicing and maintenance, which the IIoT makes much easier as the supplier can access and control the machine from its headquarters and offer ad-hoc services.

Market opportunity
We have left our estimates unchanged since last year with respect to the amounts that companies will invest in the IoT and IIoT market. The short-term uncertainty around COVID-19 and the corresponding cyclical downturn makes it hard to update these forecasts currently, but we believe that over the long term spending in this market will accelerate yet further. We estimate the IIoT share of the total IoT market at 15% (see Fig. 3). Based on IDC and Bloomberg Intelligence, the IoT market is expected to reach USD 1.1tr by 2021, growing 13% annually from 2016 to 2021. The growth opportunity shows that it is important to participate, but as highlighted above to not underestimate the potential costs involved (forfeited spare part sales, etc.).

Figure 3 - IoT and IIoT spending in the year 2021

Source: IDC, Bloomberg Intelligence, UBS

Conclusion
In the report we have presented how we see the manufacturing world post the coronavirus crisis. As in the consumer sector, it will most likely accelerate the transformation of the sector, and the IIoT and 5G are key enablers of Industry 4.0.

Increased trade concerns and supply chain issues as a result of the pandemic have increased reshoring parts of their operations. This possibility was highlighted by the recent announcement by Taiwan Semiconductor that it would build a new plant in the US at a cost of USD 12 billion. Reshoring has been an evolving theme over the last few years, which started with the rapid increase in wages in China. As a result, some companies started to shift operations to other countries around the globe. Focus on this theme has increased further in the past year due to the increased trade frictions between the US and China, and now COVID-19’s impact on the supply chain. Companies have commented on how the transition of supply chains out of China last year has helped them to weather the current crisis. Thus, we expect the pandemic to push companies to continue to explore shifting some operations back to the US or Europe.
or areas closer to home such as Mexico or Eastern Europe in an effort to diversify their supply chains.

We believe smart manufacturing offers suppliers and customers opportunities to improve their efficiency. Investments in a digital offering will make more products connectable and enable better asset management and preventive maintenance. Monetization will be a key issue in this new era of manufacturing. A falloff in service revenue and spare parts sales needs to be compensated for by digital offerings (e.g. data analysis). At present, we are not sure whether companies have found the right way to address this issue. New business models like PaaS could also make it difficult for smaller firms that can’t afford this approach, exposing them to pressure from larger competitors.

In our last report we closed with the words: "It may take several years until we see full IIoT penetration, but companies have to invest now to create the digital twin of their products to participate in this market in the future." This message is even more relevant now, and we expect the time available could be even shorter for certain applications in the more digitalized post-COVID-19 world.
Appendix

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