Smart manufacturing MORE THAN JUST ROBOTS

Automation in factories isn't new. Today, though, the disruptive force of digital transformation is taking manufacturing far beyond automation. Industry 4.0, mass customization, and advances in tech like 3D printing and nanomaterials have placed humanity at the cusp of several game changers when it comes to this US$11.6-trillion industry.

By Gary Maidment, Huawei

I, Robot

Automation began back in the 1800s with mechanized cotton spinners, steam power, and the arrival of the first industrial revolution. By the 1930s, the automotive industry was leading the second industrial revolution of mass production, paving the way for the digital control systems of the 70s. In the 1980s, car makers became intensive adopters of industrial robots, at which point computers and automation were embodying the third industrial revolution.

Jump forward to more recent milestones, and Foxconn in China was running up to 10 automated production lines in some of its factories at the end of 2016 in the second of its three-phase full automation plan. Also in 2016, Adidas unveiled its first fully robot-built sneaker, one of 500 planned prototypes for its new factory in Germany. Though we're not quite there yet, the arrival of lights-out manufacturing is a case of when, not if.

Automation is certainly not new, but digital transformation is so much more than robots assembling parts – it's destined to disrupt every link in the manufacturing value chain and virtually lead us into the fourth industrial revolution: the cyber-physical age. As data takes center stage, connectivity, cloud, big data, IoT, AI and virtualization will act in concert to create a new business paradigm.

But, there's a problem: Manufacturing enterprises have been sluggish when it comes to embracing digitalization.

Why the slow start?

One major issue is outdated legacy infrastructure. The complexity of virtualizing the production environment is exacerbated by IT systems that were developed before cloud, inexpensive storage, and ubiquitous connectivity came along. Going fully digital is also risky. Shutting down an assembly line to fix a software or network failure could be cripplingly expensive for a manufacturer. Connectivity requirements in smart manufacturing are also very high, often to the tune of sub-millisecond latency and data rates of 10 Gbps, as in the case of machine vision and cooperative

C-suite executives need to consider how maturing technologies like AI, virtualization, and 3D printing will shape the future alongside the connected manufacturing ecosystem of Industry 4.0 plus changing market dynamics.

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robots. Fortunately, that's what the latest wireless network solutions deliver: high-bandwidth, low-latency, and reliable connections that can cut costs by up to 50 percent and energy consumption by 10 percent.

Equally significant, though, is the skills gap that exists in data analytics, a central facet of manufacturing and the source of insight into processes, faults, consumer habits, and much more. Many companies aren't all that clear on how and where to deploy analytics solutions or how to use the huge volumes of data generated by sensors. And McKinsey estimates that there will soon be a shortage of around 1.5 million analytics experts in the US alone. While Forbes writer Meta S. Brown questions the McKinsey stats and analysis, she also identifies the human factor as an issue, "Managers who have trouble finding analytics talent have usually not given enough thought to their business goals."

Moreover, in a survey by Tata Consulting about big data analytics in manufacturing, the top problem identified by enterprises was building trust between data scientists and functional managers, which in turn creates a gap between data insights and how and which business strategies are executed. Of the 17 categories surveyed, the second biggest problem was determining what data to use for which business decisions, and the third was the inability to handle the volume and velocity of data generated by sensors. Simply put, manufacturers can't and aren't making the most out of the data they have access to.

The complexity of the manufacturing industry means that no coherent industry-wide digital transformation strategy exists, with individual enterprises digitalizing at different rates and in different directions. Moreover, many companies lack the agility to quickly shift from traditional goals like lean manufacturing. Indeed, the Tata Consulting survey found that the top three benefits of data analytics for manufacturers are still in line with the old-school aim of optimizing processes: tracking product defects and quality, supply planning, and identifying manufacturing process defects.

Reflecting the industry's commitment to lean processes, manufacturers have been relatively fast movers in analytics, smart sensors, and Industrial IoT (IIoT). That's all well and good, but the productivity gains from 6 Sigma and lean manufacturing have petered out over the last five or so years, because processes have

become as optimized as they can be.

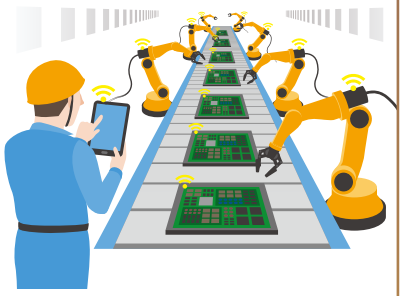
A change in mindset

Not all enterprises are benefiting from the new service-oriented business models that can arise from abundant sensors and data insights. In contrast, Denzil Samuels, Global Head of Channels & Alliances for GE Digital, gives an example of how his company benefits airline customers with the data, IoT, and service mix, "We can give the airline digital information in real time. That can help them with flight operations like scheduling crew and handling cargo. We can also provide data in a whole bunch of other areas by just selling them a jet engine." Thus, GE is acting as a manufacturer and also as a service provider based on hardware embedded with smart sensors.

New business models are not just prompted by technology. Consumer expectations are leaning towards personalization and faster delivery, both of which require a shift towards mass customization, strong digital infrastructure and, more recently, drone delivery. However, many traditional manufacturers are slow to embrace the mindset of markets of one.

The manufacturing industry is worth

US$11.6 TRILLION



Modern manufacturing requirements demand

< 1 MS LATENCY

and data rates of

10 GBPS

Cyber security breaches cost manufacturing

US$400 BILLION

per year

Mass customization in action: unmade.com

Fashion startup Unmade enables customers to customize garments before they're made, so customized designs can be produced at the same unit cost as mass-produced goods. Designed to avoid over-production and waste, the three elements of Unmade's business model are personalization, ecommerce, and on-demand manufacturing. An online personalization editor allows customers to change colors, patterns, and logos on garments; the ecommerce model lets existing stock and customized pieces to be sold together; and on-demand manufacturing sends orders to partnering knitwear factories to be made. A press evaluation describes this model as, "Making the tools of factory production available at the click of a mouse, with no penalty for short productions runs."

Smart robotics and machine learning will help achieve advances in mass customization. ABB, a leader in digital tech and robotics, is working with Huawei to combine wireless tech, smart sensors, and smart components to solve manufacturing challenges. According to Joni Rautavuori, president

of ABB Robotics and Applications, "The development that is happening on smart components and sensors makes it possible to use machine learning to develop new ways of programming robots." This increases the potential for adaptive programming, which in turn helps enable mass customization.

Despite the flexibility and agility of companies like Unmade, mass customization isn't high on most manufacturers' agendas. In fact, it comes in last in the Tata Consulting survey. However, given shifting consumer expectations, it's quite probable that this will change for many products.

The security issue

In March 2017, the tech mag Manufacturing Business Technology reported that manufacturing is the second most hacked industry after healthcare, in large part because of inadequate investment in security. Although cyber attacks cost businesses US$400 billion every year, cyber security – like data analytics – lacks experts. Forbes cites the non-profit information security advocacy group, ISACA, which "predicts there will be a global shortage of two million cyber security professionals by 2019."

The transition to Industry 4.0 is creating larger attack surfaces due to more complex networks, a vast number of connected IIoT devices, and big data processed in the cloud. Many companies lack a robust E2E Information Security Solution that protects against attacks from a hacker's armory, including server, client, web, software, and DDoS. Equally, on the R&D link of the chain, IPR and sensitive data requires a network solution that separates the R&D intranet from the office extranet, provides secure connections, and encourages collaboration.

Transitioning into the future

Germany's Industry 4.0 might still draw a blank-face response from some business leaders, but it represents the next phase in manufacturing in Europe. Equivalents are the Industrial Internet in the US and Made in China 2025. All involve the convergence of a range of technological enablers and accelerators, the result of which will be connected, smart factories and smart manufacturing.

Smart manufacturing goes beyond computing and automation. It creates a cyber-physical system, or digital twin, as a virtual model of a process, product, or service. Underpinned by ubiquitous, low-latency connectivity in the shape of 5G, smart sensors transmit data to the cloud where it's processed and analyzed to give contextual and predictive data.

Pairing a physical and virtual world has several advantages. GE Digital's Denzil Samuel's explains one advantage using the example of a

jet engine on which smart sensors constantly transmit enough data to build a cyber copy, "The engine that's now being simulated can take over the pain of major aircraft engine maintenance by replacing a single blade that's worn as soon as we know about it. Or better still, predicting when it'll get worn to the point when it needs replacing, so we can minimize the amount of time that the engine is actually out of commission."

Moreover, the connectivity afforded by smart manufacturing links all processes from R&D, sourcing materials, and production to QA, sales, distribution, and logistics.

Manufacturing 2025

Over the next decade, smart manufacturing will extend past individual factories to connect groups of factories and the manufacturing industry with other verticals.

The convergence of manufacturing and services will continue with the XaaS model based on IoT and data insights. Thus, the services that manufacturers will require and deliver as a result of the products they make will increase, many of which will be driven by data insights and consumer demand.

In the B2C space, consumers in emerging economies will become a dominant market presence, while demand in developed countries will fragment. However, customization – both in products and after-sales services – is likely to increase.

3D printing will evolve from prototyping to a viable means of mass production in the 2020s. Advances in raw materials will enhance parts design, manufacturing processes, and printing technology. At the same time, the use of nanomaterials, which we're seeing today in products like clothing, sports goods, and electronics, will expand into an industry worth US$170 billion a year. Coupled with improvements in robotics and AI, new areas of demand will emerge.

Back to 2017, and C-suite executives need to consider how maturing technologies like AI, virtualization, and 3D printing will shape the future alongside the connected manufacturing ecosystem of Industry 4.0 plus changing market dynamics.

Despite advances in technology, we live in uncertain times. Strategic investment in digital infrastructure, skilled staff, and partnerships are the tools to make things happen in the next decade of smart disruption.

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