# MANUFACTURING THE NEXT INDUSTRIAL REVOLUTION

Abstract

Until recently, there was a clear route for success in manufacturing. The changes in the business environment today call for a 'Renew-New' approach – transform existing systems to meet current business needs and simultaneously, add new propositions that will make companies future-ready. In this paper, we present the possibilities awaiting the manufacturing industry.

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Renew and New: Manufacturing the Next Industrial Revolution
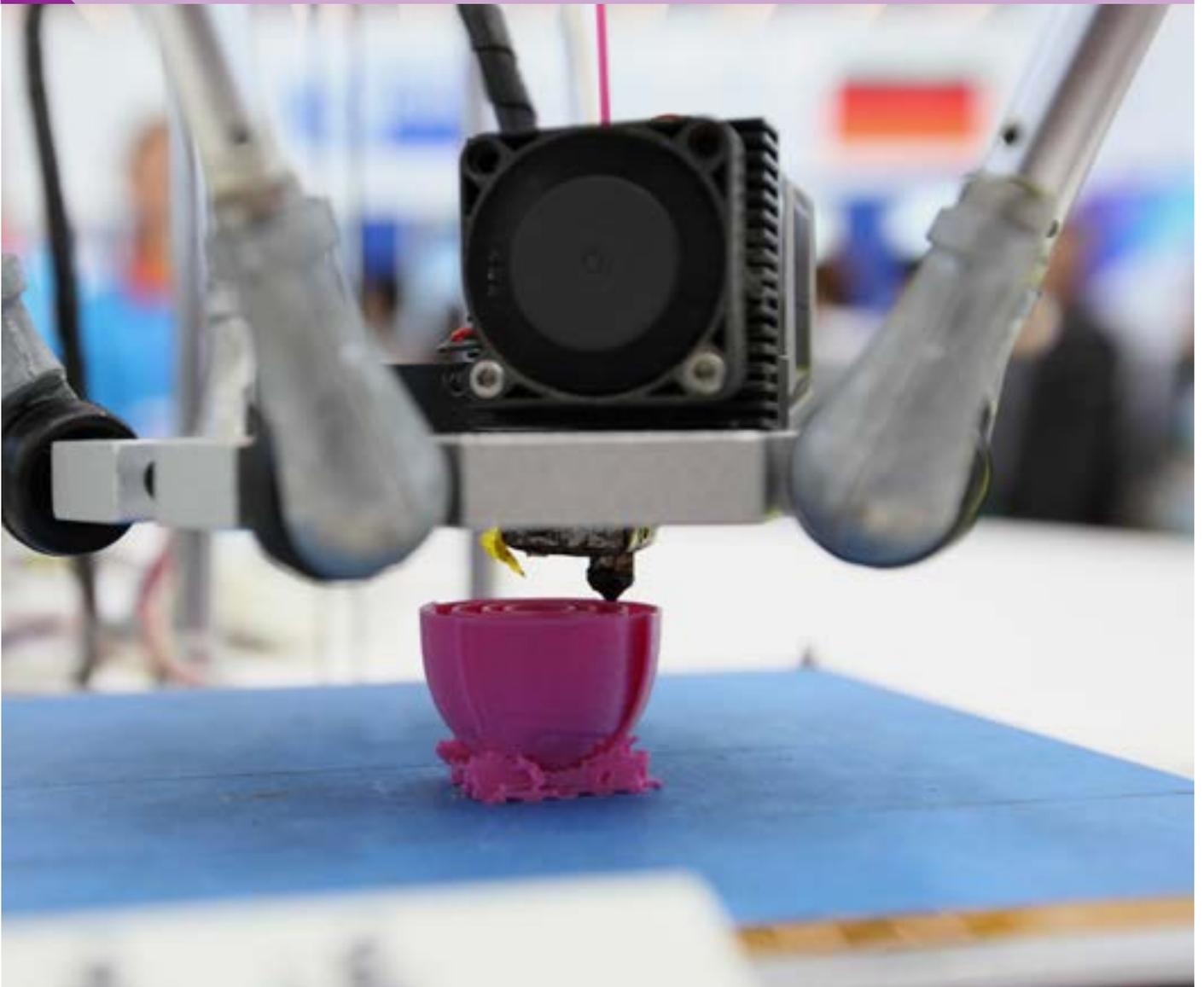
From mass production to mass customization, selling products to selling embedded services, operational excellence to continuous innovation, and efficient factories to intelligent ecosystems. This is how the plot will read for the next industrial revolution. It will be led by global shifts in macroeconomics and consumption, emphasis on value creation, experiential customers, and a convergent set of transformational technologies such as automation, Artificial Intelligence (AI), Internet of Things (IoT), and digital.

But inasmuch as this renaissance opens up new possibilities for improved productivity, performance, and profitability for manufacturing, it also compels a transformation of the manufacturing enterprise in which traditional structures, systems, and strategies will be reimagined. To effect this transformation, manufacturers must adopt a dual strategy focusing on renewing core systems and functionalities for efficiency and performance, and embracing new capabilities that open up unprecedented possibilities.

We believe manufacturers will adopt the following strategies when they take the 'renew and new' route to enterprise transformation.

On the Renewal Agenda

The next big shift in the industrial manufacturing industry is not just about quality and numbers, but also about adapting to the digital age of technology and information.

It is now necessary to be in sync with the customers' requirements, as companies can no longer expect them to just consume what is manufactured.

This is making it even more imperative for manufacturing incumbents to explore the following opportunities for renewal.

- **Build smart factories:** When traditional manufacturing equipment and processes are amplified by technologies such as robotics, wireless sensors, Internet Protocol (IP)-based networking, and big data and analytics, the result is a fully integrated and connected production model that enables a quantum leap in efficiency and productivity. The shift to IP-based networks not only opens up communication channels between assets on the factory floor but also streamlines integration with mobile devices and back-end ERP systems.

  Real-time data from the factory equipment can not only improve operational efficiency but also enable better decisions on asset management, quality control, and safety and compliance. A connected factory floor enables real-time data generation, and the analysis required to optimize asset utilization and maintenance schedules, predict faults, streamline procurement, and enhance return on assets.

  While smart manufacturing is still in the pilot stage, demonstrations by several German companies and the German research center for Artificial Intelligence already point to its potential. A case in point is BASF's fully customized line of personal care products where RFID tags on empty bottles instruct the production equipment on the type of soap, fragrance, and labeling required as soon as an order reaches the system – potentially filling each bottle with a completely different order, if need be.

- **Build smarter supply chains:** A smart manufacturing setup without a smart supply chain makes for a suboptimal scenario. As technology erases the distinctions between the virtual and the physical, it gives rise to an opportunity to create intelligent, analytics-driven, next-generation supply chains that provide real-time and end-to-end visibility and control. From a central command center, companies can now monitor and manage virtually every parameter on the factory floor – at the point-of-sale, and anywhere in between – that has an impact on manufacturing operations. Companies such as Dell and Lockheed Martin, for instance, manage supply chain operations from such a command center.

  A smart supply chain, integrated across all business processes and systems can also leverage real-time data and analytics to enable more accurate forecasting, shorter response times, optimized supply chain processes, and faster decisions. And as technologies such as IoT and AI evolve, supply chains of the near future will become largely, if not completely, autonomous systems that will respond automatically and appropriately to changes anywhere in the supply chain.

- **Focus on product quality:** But before making the big leap to smart factories and supply chains, manufacturers must ensure that they are getting the basics right. While the automobile recalls in the U.S. last year garnered a lot of attention, a number of products from home appliances to bicycle helmets and children's toys have faced similar problems in recent years across the globe. Therefore, manufacturers should renew their focus on essential parameters such as product quality, even as they aspire to take their organizations to an industry 4.0 end-state or a 'fully connected way of making things'.

- **Increase investments:** The manufacturing sector is a key contributor to a nation's prosperity. The economies of emerging markets such as India, China, and Brazil have benefited greatly from the globalization of manufacturing and today, these countries are major hubs of production and innovation. Rising prosperity has created a huge customer demand in these markets and is accelerating the shift in manufacturing's center of gravity from the developed world to the developing world. Further, it helps that governments are directly investing or encouraging investment in manufacturing through programs such as 'Make in India' to develop their respective countries into global manufacturing hubs. As manufacturers follow their lead by making their own investments in technology, innovation, and business expansion, they will also have to invest in employee education, training, and skill development to renew their workforce.

- **Focus on security:** A highly connected world comes with an increasing risk of security breaches. While the recent attacks on large media corporations and retailers have sparked much debate, other incidents such as the hacking of a German steel mill which resulted in physical damage, have gone largely unnoticed.

  Such events serve as a warning for connected manufacturing whose practitioners will have to balance strategic opportunities with a clear focus on systems and data security. Security must be embedded into the design of manufacturing infrastructure and extended to every system, process, and device on the network. Besides implementing sophisticated security technologies, manufacturers must also lay down clear security policies, educate employees about endpoint safety, and establish an auditing and monitoring mechanism to ensure compliance.

On the Reinvention or New Solutions Agenda

Manufacturers need to leverage emerging technologies such as the Internet of things (IoT), analytics, sensing, and 3D printing to increase operational efficiency and reduce equipment downtime. Producing classy and efficient products is not enough; they should be clubbed with performance-based services that bind customers into a sustained relationship. These services must be tightly integrated with the product along with a robust support ecosystem to create a success story. Here are some of the opportunities that await them:

- **Servitization of products:** In the traditional manufacturing context, value creation commenced on the factory floor and consummated when the product reached the customer. Take the auto sector where the post-sale ecosystem is predominated by a mostly independent network of third-party service providers.

  In contrast, servitization shifts the emphasis from mere sale of products to the cultivation of customer relationships through a product's lifetime. Going back to the auto example, connected cars today link back to the manufacturer through a continuous stream of performance data to set the stage for a strategic, proprietary, and commercial relationship between the manufacturer and the customer extending into the support and service phase. And let us not forget the potential to add more services to the existing pipeline which can open up additional revenue streams for the manufacturer.

  Servitization, therefore, is not just about improving customer relationship and intimacy but also about enabling manufacturers to leverage it to deliver additional services that the customer is willing to pay for.

- **Internet of Things:** IoT is a key building block that enables the concepts of smart manufacturing and industry 4.0. It makes the manufacturing enterprise more efficient, productive, and innovative by enabling an architecture that spans operations and business systems, and allows real-time visibility into a range of KPIs that ultimately define performance and profitability. GM, for instance, uses sensors to determine if existing humidity levels are favorable to automobile painting. If not, the system automatically moves the car to some other process, saving time and mitigating the risk of a deficient paint job.

Though sensors and automation are not really new to the manufacturing ecosystem, IoT extends the same utility to a broad range of systems, processes, and devices, and even beyond corporate and geographic boundaries. In the industry 4.0 paradigm, big data and analytics technologies will convert a constant real-time stream of data from a range of cyber-physical systems into actionable insights that will contribute to enterprise efficiency and business growth.

- **3D printing:** As a technology, 3D printing is still nascent, but as it evolves in terms of economy, efficiency, and versatility, it is finding increasing application on the factory floor. Even in its current state of evolutionary development, 3D printing is beginning to help manufacturers bring down the cost, time, and resources needed to prototype, develop, and test new products. As the technology matures, it could help address the demand for mass customization without the expenditure of retooling. It could also help manufacturers streamline spare parts inventory by printing out rather than storing parts with infrequent demand. Take the example of Nike which is using 3D printing to create custom-made shoes in-store with great results and is planning to use this technology for other products in future.

  As the technology matures further, 3D printing will become a critical component of the manufacturing enterprise, both for its potential to bring down the complexity, time, and cost of certain processes as well as its promise to create new business opportunities.

- **Uberization:** Once in a while, there comes along a business model innovation that upends traditionally held notions of business structures.

Uberization is the result of one such model which takes a software or app-driven approach to instantaneously, and efficiently align supply and demand and deliver a quantum leap in efficiency and convenience.

Since the model went mainstream and profitable, predictions have been flying about how it could disrupt everything from the way we work to the way we buy products and services and the way we live. In the manufacturing context, uberization will probably create new business models and opportunities in the areas of product design (crowdsourcing of ideas), product sales and service (marketplaces and other channels), and the manufacturing supply chain (crowdsourcing of input components and transportation services).

- **Designing product experiences:** When customers today are looking for game-changing experiences, serving up a product, even one that is a generation ahead in terms of technology components or utility, will simply not suffice. As software and AI become integral components of the manufactured product, there is a huge opportunity to deliver an individualized and comprehensive experience that differentiates a product from its competition.

  Likewise, an approach that focuses on designing a compelling, bespoke experience, rather than just a physical product, will differ greatly from the traditional approach to product design. With the added capabilities provided by sensors, AI, and big data technologies, the product experience is no longer about just the UI or industrial design. Increasingly, it is about a product's ability to intuit a customer need, and call up the service that fulfills it.

Conclusion

The ability of manufacturers to harness the principles of smart manufacturing, industry 4.0, and servitization will be determined by how they drive systematic transformation across their existing structures, systems, processes, and strategies. An approach that prioritizes renewal of existing systems over the opportunity presented by new technologies or vice-versa, will deliver results that are suboptimal at best. To create the manufacturing setup of the future, enterprises will need to evolve existing systems to meet current business dynamics while simultaneously adding new functionality that will be critical to their competitive advantage and profitability in the near future. Most importantly, these new technologies have immense potential to empower various stakeholders in the manufacturing ecosystem to provide a quantum leap in value and experience to customers, leading to new business models and profitable growth.

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