Technology

Industry 4.0 Technologies: Tips for Developing Your Digital Strategy

Kip Hanson | Aug 10, 2021

Ready or not, the manufacturing world is changing. Here's a primer toward developing a digital strategy using Industry 4.0 technologies.

There's no need to rehash the First, Second or Third Industrial Revolutions.

Those interested in tracking the progress of manufacturing over the past two centuries can find plenty of information on the internet and elsewhere.

What's more important right now is to realize that a) we're in the early stages of a Fourth Industrial Revolution, one whose change potential far outstrips that of its predecessors, and b) mastering these new technologies is critical to our future success.

But what is this thing called Industry 4.0? And what makes it any different than the everyday technological advancements that have been occurring since humankind sharpened the first rock?

That's a deep question, but in simple terms, the current Industrial Revolution is one defined by data and digitalization. It's an environment where machine tools and factories are smart, where previously disparate systems communicate with one another, and decisions are made based on analysis, not conjecture.

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> Al Whatmough
> Autodesk

It's also an environment that manufacturers must strive to master. Just as steam power gave way to electricity, and mechanical control systems fell prey to those controlled by computers and software, so will virtualization and Big Data augment—and in some cases, replace—our current manufacturing

methodologies.

Adding Up the Benefits of Industry 4.0

Any digital manufacturing initiative requires two things: effort and investment.

Here are a few things to consider as you attempt to mentally and financially justify each:

- ***Yahoo Finance*** reported that the industrial control and factory automation market is expected to grow from its current value of $133 billion to $198 billion by 2026.
- ***Forbes*** recently indicated that "Industry 4.0 is now scaling fast," in large part due to the pandemic and resulting disruption.
- That same report referenced research by the ***McKinsey Global Institute***, which confirms "that manufacturing innovation is now accelerating and scaling at a pace we have not seen in a long time."
- It should be alarming to manufacturers not yet engaged in the Industry 4.0 initiative that ***Molex Corp.*** published a survey recently showing that 51 percent of respondents have a well-defined Industry 4.0 corporate priority with executive sponsorship.
- Similarly, ***Newark Electronics*** published its own survey, in which 48 percent of the respondents said that "productivity and manufacturing enhancements were their main target" for IoT data.

The takeaway should be clear: There's no shortage of reasons for implementing an Industry 4.0 strategy.

What are you waiting for?

Here are some of the key components of Industry 4.0 that machine shops, sheet metal fabricators and indeed anyone in the manufacturing industry should be familiar with if they're to succeed in this brave new digital world.

What Is the Industrial Internet of Things (IIoT) and What's the Benefit?

If you have an internet-capable smoke detector or smart thermostat at home, you're already familiar with the Internet of Things (IoT). Now apply that same technology to a CNC machine tool or other industrial equipment and—you guessed it—you're now a user of the IIoT, the source of countless bits of data about machine performance, production status, potential maintenance needs and much more.

In fact, the IIoT has the ability to collect so much information that it's considered the source of so-called Big Data, a veritable flood of information that should be kept to a necessary trickle for the greatest benefit. When properly implemented, however, the IIoT allows facilities to avoid "too much reliance on tribal knowledge" and reduce the risk that comes when skilled people will take their hard-earned experience elsewhere.

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That's according to Jeff Rizzie, the director of digital machining at Sandvik Coromant, who suggests that the IIoT, together with analytical software like the company's MachiningInsights, makes those same people ***far more effective***. He also says that, for shops not yet using the IIoT, it's a great time to get started.

Industrial Cloud Computing

In most but not all cases, the data streaming off IoT devices ends up in the cloud, which despite its lofty name is really nothing more than an uber-connected, server-filled data center in Atlanta, Reno or elsewhere. As with the IIoT, you might use the cloud each day and not even think about it. Your banking software is in the cloud, as is Facebook, Dropbox, Words with Friends and practically any computer-based service or mobile app in use today.

Why does this matter to manufacturers? Several answers come to mind. The first is as just described: interoperability with the IIoT, along with an opportunity to remotely monitor and manage production processes. This opens the door to unattended manufacturing and all its many benefits.

But there's also the increasing use of cloud-based software as a service (SaaS) offerings from the likes of Autodesk 360, MachiningCloud and many enterprise resource planning, or ERP, systems. These offer streamlined deployment along with greatly reduced investment costs, while giving even smaller manufacturers access to high-end software systems that were once out of reach. Cloud computing, says Epicor Software's Tom Bidinger, "has the power to ***completely transform*** the way we all do business."

What Are Digital Twins?

The cloud is closely associated with another principal Industry 4.0 development: the digital twin, aka the virtual twin. Whatever you call it, manufacturers use these digital replicas to verify product designs, simulate failure modes, predict performance in the field, and collect real-world, real-time usage data.

Al Whatmough, CAM product manager at Autodesk, notes that digital twins offer multiple ***opportunities for improvement***. "It could be something as simple as a toolpath simulation, where machining data can then be tied to the digital twin for performance analyses. On the other end of the spectrum, there's digital twinning of the factory floor, which gives industrial or manufacturing engineers greater ability to optimize their entire operation."

Additive Manufacturing

Then there's 3D printing. At first glance, it might be unclear why additive manufacturing (AM) is considered an Industry 4.0 technology, but have no doubt that it is. "The capability to print low volumes cost-effectively has brought ***mass customization*** within arm's reach for more manufacturers, not just industry giants."

That's the viewpoint of Nadav Goshen, CEO of MakerBot Industries, who pointed out that 3D printing has evolved well beyond its original use as a rapid prototyping technology. Facilities use it to make fixtures and other tooling. Aircraft manufacturers use it to produce critical engine components, HVAC ducting and structural parts. And automakers are beginning to see its value as an end-use manufacturing technology. The list goes on and on.

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But again, why does 3D printing fall under the Industry 4.0 umbrella? More importantly, why should

manufacturers adopt it? There are many reasons. First off, it is an inherently digital technology. It leverages the cloud for data exchange and collaboration. It is largely automated, promotes local manufacturing, and is far less wasteful than subtractive manufacturing processes. And although AM is not yet capable of machine learning and AI (artificial intelligence), rest assured: It's coming.

Speaking of AI, it is yet another piece of the Industry 4.0 puzzle. So are augmented and virtual reality (AR/VR), advanced robotics and automation, edge computing, cyber-physical systems (CPS), and more. It might seem like a lot to grapple with, and it is, but for those contemplating how to implement a digital manufacturing strategy, take Jeff Rizzie's advice: Think big, start small and move quickly.

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How are you leveraging automation and data to improve your manufacturing capabilities? Share your thoughts and insights in the comments below.

