



IDEAS MADE TO MATTER | SUPPLY CHAIN

# 5 supply chain technologies that deliver competitive advantage

by **Beth Stackpole** | Feb 14, 2020

## Why It Matters

*Innovation is upending every aspect of the supply chain. Here are the technologies to watch — and adopt — as the decade unfolds.*

Facing globalization, increased product complexity, and heightened customer demands, companies are taking up advanced technologies to transform their supply chain from a pure operations hub into the epicenter of business innovation.

Using sensors and ever-improving internet connectivity, forward-thinking companies are collecting data at every checkpoint, from the status of raw materials flow to the condition and location of finished goods.

Machine learning, artificial intelligence (AI), and advanced analytics help drive automation and deliver insights that promote efficiencies — making on-the-fly route changes to accelerate product delivery, for example, or swapping out materials to take advantage of better pricing or availability.

3D printing allows firms to localize production of goods closer to customers, allowing for faster turnaround, reduced transportation costs, and greater personalization. Additive manufacturing is also opening doors to easy production of spare parts, enabling companies to slash inventory, cut costs, and create supplementary revenue streams.

These advanced technologies are serving as a springboard for new business models — for example, many firms are piggybacking off the "internet of things" (IoT) to offer predictive maintenance services that guarantee product uptime while generating recurring revenue.

“Looking into the future, it’s about resiliency and an ability to adapt to changes in the marketplace and new business models,” said Simon Ellis, program vice president with IDC Manufacturing Insights, a market-research firm. “If a competitor comes along with a next-generation, digitally fueled capability, [companies] need to find a way to avoid being disrupted.”

Here are five of the top technologies poised to overhaul supply chain operations:

## The internet of things (IoT)

With IDC projecting double-digit annual growth for worldwide IoT spending through 2022, there is ample opportunity for connected and sensed “things”— think finished goods, shipping containers, or warehouse stations — to communicate information and deliver insights that will upend traditional supply chain practices.


IDC expects discrete manufacturers, process manufacturers, and transportation companies to spend the most on IoT deployments, primarily to support manufacturing operations and the management of production assets, and, in the transportation space, for freight monitoring and fleet management.

By tracking location, weather conditions, environmental status, traffic patterns, and more, suppliers can leverage AI and advanced analytics to determine, for example, if a shipment of refrigerated goods is at risk for equipment failure. Armed with such knowledge, suppliers can automatically reroute delivery to a closer distribution center or proactively dispatch a repair crew to prevent spoilage.



*Change, although good, always comes with risk. People have to go in with their eyes open.*

**Stuart Madnick** | Professor, MIT Sloan

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The ability to monitor assets throughout the logistics journey also helps eliminate misplaced inventory and lost shipments, further reducing risk and revenue loss.

“With just-in-time manufacturing, we care a lot about where a product is, when it’s going to arrive, and how it fits into the overall logistics flow,” said Stuart Madnick, an emeritus professor of information technologies at the MIT Sloan School of Management. “IoT devices, combined with the cloud and AI, make all that much more effective and comprehensive.”

On the downside, IoT opens the door to increased cybersecurity risks, and even worse, physical exposure, especially for large-scale, mission-critical industrial assets.

“The more IoT becomes a part of manufacturing and logistics systems, the risk isn’t just in data attacks, but physical dangers” like an oil rig or manufacturing line explosion, said Madnick, the founding director of the Interdisciplinary Consortium for Improving Critical Infrastructure Cybersecurity.

“Change, although good, always comes with risk. People have to go in with their eyes open,” Madnick said.

## Blockchain

While primarily associated with cryptocurrencies, blockchain, the distributed ledger technology, also ranks high on the list of technologies poised to bring improved visibility and transparency to supply chain processes.

Because blockchain creates an immutable record of transactions, the technology is well situated to track the provenance of goods and establish trust in shared supplier information, especially when the parties have competing agendas and don’t particularly engender trust.

“What blockchain brings to the table is the notion of immutability — nothing can ever be erased,” Madnick said. “It also goes back to the issue of trust — nothing is ever lost or altered.”

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Blockchain can establish an audit trail that is far more effective than traditional methods like email or simple electronic record keeping, proponents say.

As a result, blockchain’s biggest potential is for facilitating track-and-trace applications that help companies document the chain of custody of goods. Doing so can prevent leakage, help identify

counterfeit items and fraud, pinpoint at-risk suppliers, demonstrate that regulatory requirements are being met, and create transparency around sourcing.

IDC projects that a quarter of OEMs will leverage blockchain to source spare parts by 2023 — a move it predicts will improve accuracy of usable parts by 60% and lower costs by 45%.

A lot of early blockchain supply chain use cases are food related. For example, Walmart is running a pilot project with IBM's Food Trust Solution to track lettuce from its suppliers to Walmart shelves on the heels of recent E. coli outbreaks. SAP and Bumble Bee Foods are collaborating to use the SAP Cloud Platform Blockchain service to trace the journey of yellowfin tuna from the point of catch to the store shelf to address consumers' demands for safe and sustainably sourced food.

One of the biggest hurdles to leveraging blockchain is that it takes a village. In most cases, it's not one company implementing blockchain to garner traceability for its singular supply chain. Rather, to succeed, efforts will require an industry consortia-backed initiative that benefits a variety of competing partners.

## **AI, machine learning, and analytics**

Every modern supply chain has a vast treasure trove of data that can unlock insights into complex global supply networks.

By harnessing a combination of technologies like AI, machine learning, and predictive analytics, companies can automate warehouse operations, improve delivery times, proactively manage inventory, optimize strategic sourcing relationships, and create new customer experiences that increase satisfaction and boost sales.

"In the past, the problem was we didn't have enough data — now we have massive amounts of data, and the problem relates to what can we do with it," said Sergio Caballero, a research scientist at the MIT Center for Transportation and Logistics.

That's where AI and machine learning come into play. Using algorithms and predictive methods, companies can parse through larger data sets and garner insights at a granular level — all with little to no human intervention. According to IDC, half of all manufacturing supply chains will invest in AI by the end of 2021, garnering a 15% productivity spike.

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Consider the logistics nightmare of coming up with a transportation plan for thousands of product SKUs needing to ship out to hundreds of warehouses and distribution centers scattered across the globe. “You need a way to automate the collection and analysis of data [other than] manually,” Caballero explained. Using machine learning to optimize the SKU data, “you can come up with a master shipping plan that’s truly optimized.”

Predictive analytics are also a high priority. Deloitte’s 2019 Supply Chain Digital and Analytics Survey found that surveyed companies are investing in predictive analytics primarily to drive cost reduction (cited by 81% of respondents) and improve customer experience (60%). The most promising use cases for supply chain analytics cited by respondents: Inventory visibility and optimization (32%), strategic sourcing and optimization (26%), and real-time product intelligence (22%).

While most understand the big-picture potential of the technology trio, supply chain managers tend to underestimate what’s required in terms of skills and boosting data quality to deliver real business value, Cabellero said. “Many companies still don’t have a clear business case for the technology or understand how it can be beneficial,” he said.

## Robots and automation

Robots have long played a role in the supply chain, used to move goods and materials throughout a warehouse, during transport, and as part of the fulfillment process. But as AI technologies push robots to higher levels of sophistication, machines will be assigned many manual tasks now owned by humans, from picking and packing orders to automating heavy loading tasks.

AI, machine learning, and IoT connectivity are helping to significantly improve the precision and mobility of industrial robots while aiding in safety, allowing for a new generation of cobots (collaborative robots) that can work alongside humans as opposed to being cordoned off in a separate safety zone.

[COBOTS, DEFINED](#) 

The potential for human-robot collaboration is fueling large-scale deployments throughout the supply chain. According to IDC, by 2023 some 65% of warehouse activities will employ robots and situational data analytics to help with storage optimization, increasing warehouse capacity by over 20% and cutting work order processing time in half.

That same research predicts that over 60% of global manufacturers will invest in AI-enabled robotic process automation by 2023, resulting in increased productivity and helping to close the ongoing talent gap for supply chain skills.

Amazon, the poster child for logistics and fulfillment, has bet big on warehouse robots, as showcased by its 2012 acquisition of Kiva Systems.



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**Stephen Graves** | Professor, MIT Sloan

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Kiva robots, used to transport inventory pallets from one place to another, are designed to work with human warehouse workers — not replace them. The robots bring heavy pallets to human workers for unpacking, with workers no longer having to log significant warehouse miles to get their job done. “This eliminates a tremendous amount of waste in a traditional warehouse that is associated with people walking,” said Stephen Graves, a professor of management science at MIT Sloan.

The e-commerce giant has expanded its use of robots with cobots that help pick, sort, transport, and store packages, and it recently introduced robots that scan and box items for shipment into some facilities this year, touting an ability to pack at four to five times the rate of the average human worker. Amazon also claims robots make it possible to store 40% more inventory, allowing it to meet Prime delivery promises.

While inching closer, even Amazon is still years away from “lights out” operations that require little or no human intervention, and experts like Graves question whether that’s ultimately the right goal.

“This is somewhat of an open question, but to the extent you have hardware and software running facilities, you still need people to maintain, monitor, and operate them,” Graves said, while adding, “of course, there will be some exceptions.”

## 3D printing

Consumers' appetite for personalized products, coupled with a push for made-to-order and localized production, is focusing attention on 3D printing.

Thanks to new materials, metal additive manufacturing technologies, and less expensive hardware, supply chain players are ramping up investment in the technologies, allowing them to decentralize production and make product and parts in local assembly hubs.

Making products closer to where there is demand allows companies to cut back on logistics and transportation costs, reduce their carbon footprint, sidestep geopolitical risks and tariffs associated with offshore outsourcing, and get products to consumers faster — a competitive upside in today's instant-gratification society.

The ability for on-demand production of parts, and in some cases, full product, has great appeal to lots of players in the supply chain, from OEMs to dealers. Moreover, with advances in materials, less expensive hardware, and new AI-driven software design tools, companies can produce fully functional parts, not just prototypes, that are lighter with less material waste than was possible with traditional technologies.

“On-demand production avoids tremendous investments in warehouses and inventory and allows companies to provide better customer service,” said MIT Sloan's Graves.

## A high-stakes makeover

While there's still a huge learning curve with some of the more advanced technologies, there's no question that the supply chain is in the midst of a high-stakes makeover.

That said, IDC Manufacturing Insights' Ellis reiterated the cautionary tale of focusing too much on technology at the expense of what's good for the business.

“Technology is the bright shiny object, but at the end of the day, it must either solve a business problem or put the company in a possible to seize on new opportunity,” Ellis said. “It all goes back to the goal of

resiliency and pursuing new business models.”



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