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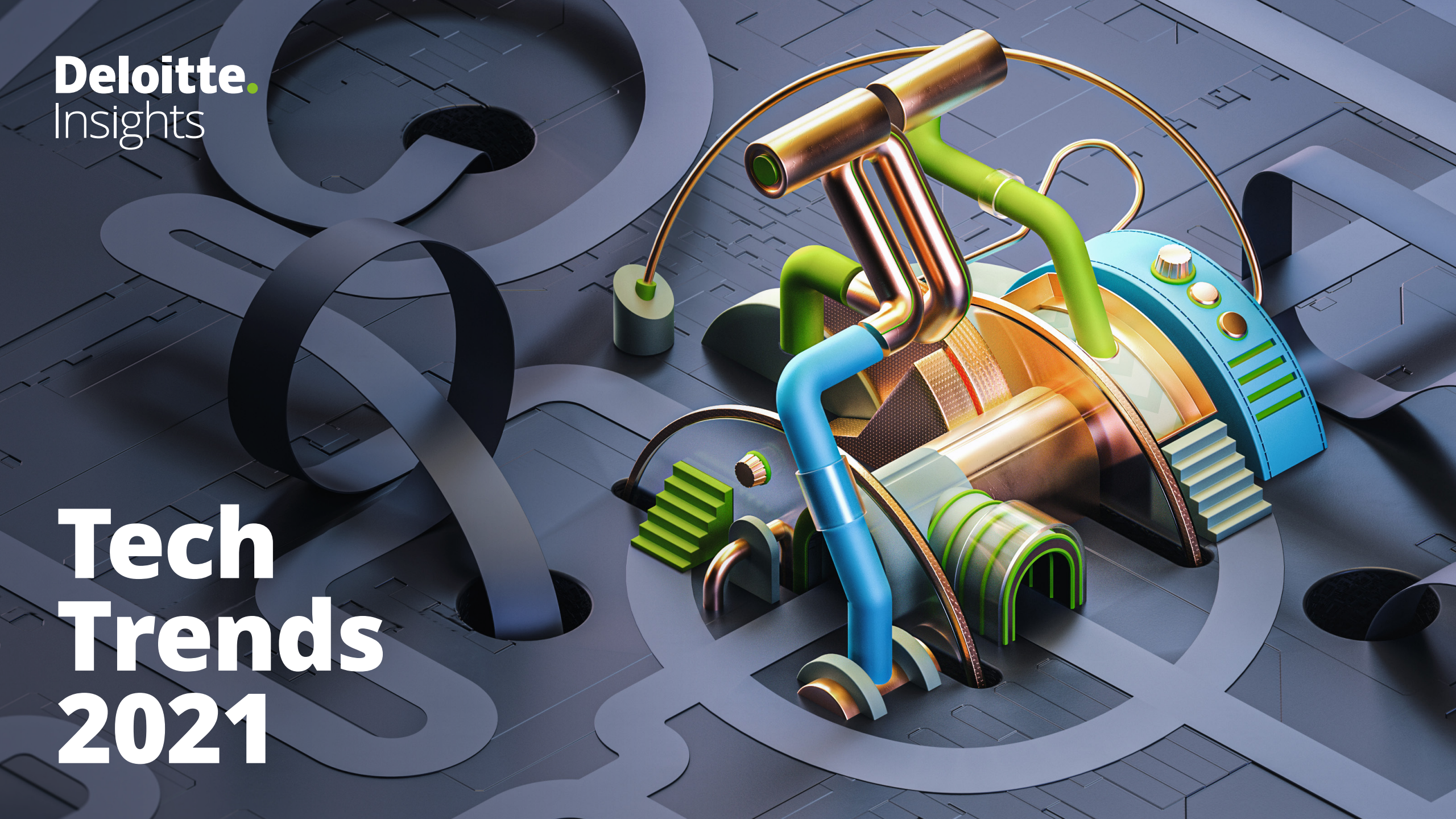
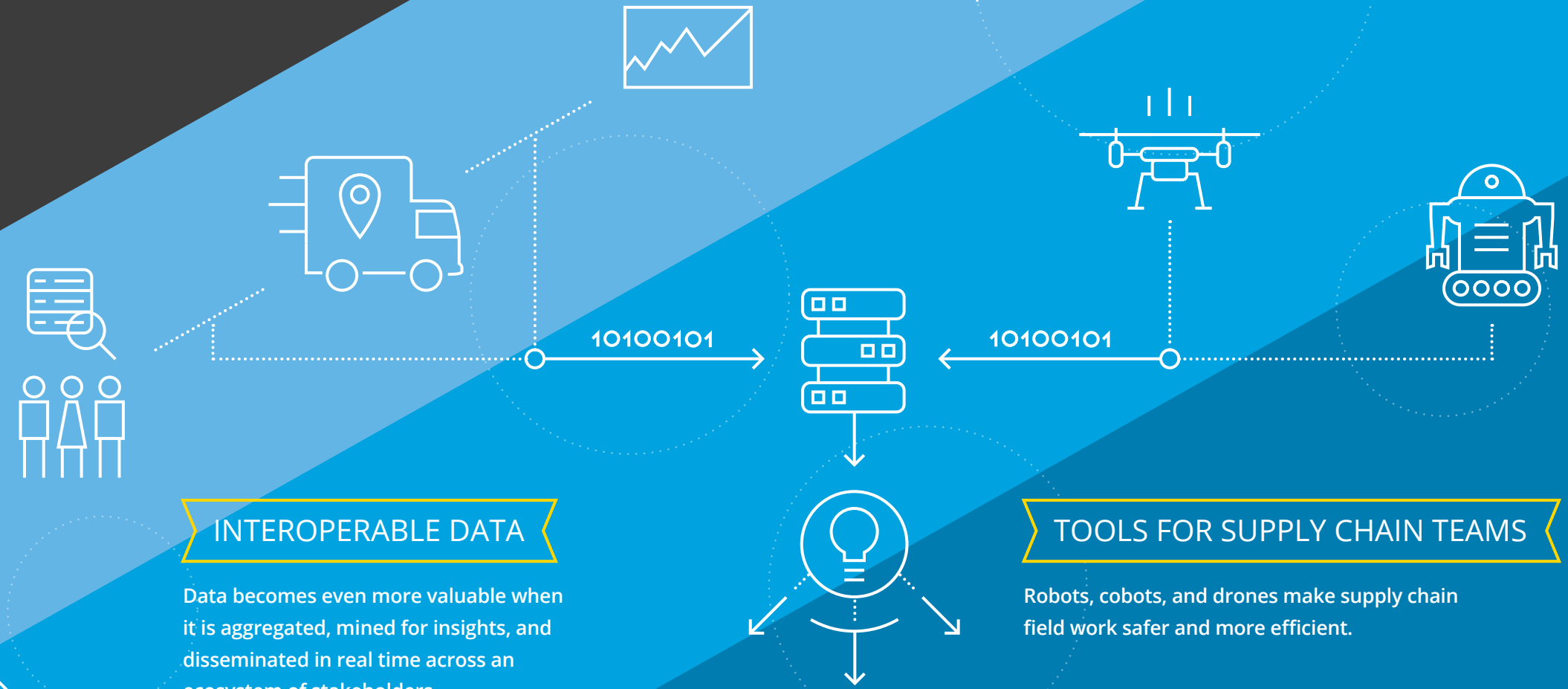


Tech Trends 2021

Supply unchained

COST CENTER TO VALUE DRIVER

Optimizing supply chain components to differentiate services provided to each customer can help companies find the sweet spot between cost and service.



INTEROPERABLE DATA

Data becomes even more valuable when it is aggregated, mined for insights, and disseminated in real time across an ecosystem of stakeholders.

TOOLS FOR SUPPLY CHAIN TEAMS

Robots, cobots, and drones make supply chain field work safer and more efficient.

TREND 3

Supply unchained

Transforming a traditional cost center into a value driver

Over the next 18 to 24 months, we expect to see manufacturers, retailers, and others take supply chain transformation to the next level by optimizing their supply chain ecosystems for resilience and risk. Moreover, they will begin transforming their supply chains from traditional back-office cost centers into value-driving operations. How? By following industry leaders' playbook for optimizing supply chains for customer segments:

- Trend participants can deploy an array of digital tools to hypersegment customers and capture demand signals from disparate parts of their *value chains*. They can then use this information to make supply chains more responsive to unique customer needs and to fluctuations in demand.

- They can explore ways to capture larger volumes of structured and unstructured data. By mining this data for operational insights, they can continuously optimize systems and processes throughout the organization. And by sharing the data more widely, they can look to optimize their entire supply ecosystem.

- Organizations may also pursue opportunities to use robots, drones, and other technologies to make supply chain teams more effective, efficient, productive, and safe.

While companies have been digitizing their supply chains for some time, recent shocks have provided fresh urgency for change. In Q1 2020, the world witnessed a decades-old supply chain model being disrupted, and it wasn't pretty. Driven by panic buying, consumer demand for paper products, cleaning supplies, and other nonperishable goods spiked dramatically.[1] Yet within domestic and global supply chains, these demand signals were not transmitted quickly to manufacturing floors and sourcing departments. After years of small-scope efforts to optimize and strengthen their supply networks, many leaders were confident that they had created robust, transparent supply networks. When COVID-19 hit, it quickly became clear that their efforts had been insufficient. Even the most flexible, resilient

supply chains proved to be only as strong as the weakest links of their suppliers' chains.

The ensuing disruption was widespread. In a recent survey of supply chain professionals, 97% of respondents said their organizations experienced COVID-19–related disruption.[2] Some of these organizations were caught off guard by the severity of the pandemic and the speed at which it unfolded. They shouldn't have been. The world has become ever more dependent on connectivity, vulnerable systems, and global supply chains, and this kind of high-impact disruptive event will likely occur with greater frequency.[3]

Against this backdrop, a growing number of leaders are realizing that their organization's supply chain optimizations may not suffice in an interdependent, unpredictable world. Indeed, in the same survey, 73% of respondents said their organizations are now planning major shifts in the way they approach supply chain management and procurement.[4] As a result, some are now taking a page from digital supply network pioneers. Using analytics to understand their customers more deeply and predict their behavior, a growing number of organizations are working to understand the sources of value for and buying behavior of those customers. By sharing information with their network of suppliers—and receiving information in return—they can better link supply and demand. And understanding their customers' value drivers makes it possible to optimize for deployment, logistics, procurement, and more in their new supply networks.

The work of turning a traditional cost center into a robust value driver will not happen overnight. Nor will building the flexibility, transparency, and resilience that complex supply networks need to weather disruption. But the time to start is now. COVID-19 portends a new, uncharted phase of globalization, interdependency, and—importantly—vulnerability.

Is your supply chain ready?

From cost center to value driver

The idea of transforming the supply chain from cost center to value driver is not new. Over the past two decades, leading companies have fine-tuned strategies for optimizing incentives and disincentives for online purchasing and delivery timing—strategies that manufacturing, retail, and other sectors may find helpful as they transform their supply chains. (See Lessons from the front lines "Pactiv Evergreen gets proactive with factory asset intelligence," on page 55).

Online retailers were among those pioneering the art of using predictive models to optimize the location and volume of

inventory, procurement, and replenishment. Using customer data, they developed highly detailed customer cost-to-serve profiles used to segment customers into groups based on location, preferences, and service expectations. These retailers found that in some cases, customers will pay premium prices for premium delivery services, while more price-sensitive customers will accept longer delivery time frames.

The work of turning a traditional cost center into a robust value driver will not happen overnight.

Developing nuanced insight into the complexities of demand and customer priorities helped these organizations pre-position products closer to demand, decrease transit time and risk, and increase delivery schedule reliability.[5] Meanwhile, they could maintain remote warehouses to supply nonurgent deliveries to the more price-sensitive. These insights transform supply chains into something new: a tool that encourages customers to make informed, personal buying decisions while simultaneously improving company profitability.

Hyperpersonalization and customer segmentation—made possible today by the systematic capture, aggregation, and analysis of vast volumes of unstructured data from increasingly nontraditional sources—have standardized across retail and are now poised to transform supply chains across industries. Some of these same approaches can help organizations in manufacturing, pharmaceuticals, energy, and other sectors better understand demand patterns and their impact on the supply chain, from point of sale to the manufacturing floor and all the way back to tier-three suppliers. Indeed, the extent to which customer information can be captured in real time to feed supply chain and manufacturing production decisions is already becoming a competitive differentiator.

Take, for example, a consumer products company that manufactures and sells liquid laundry detergent in plastic bottles. Analysis of this manufacturer's value chain data clearly shows the difference in revenues from bulk sales to big-box wholesalers and smaller sales to mom-and-pop stores in rural areas. Armed with this insight, the detergent maker can segment its customers based on profitability and service expectation. It doesn't want to overserve its mom-and-pop customers who don't need regular deliveries, and it cannot afford to underserve the valuable big-box customers who expect much more. *This is where the supply chain can become a powerful*

tool for engaging customers. By optimizing the component parts of its supply chain to differentiate services provided to each customer, the company can find and maintain the sweet spot between cost and delivery service.

Tightly controlled, robust supply networks can offer another advantage as well. When faced with rapid, unexpected spikes in demand such as we saw in the early months of the COVID-19 pandemic, digitized, data-driven supply chains that provide high levels of transparency may be able to synchronize their planning, production, and fulfillment functions effectively and minimize—or even prevent—widespread disruption.

Share and share alike: Data becomes interoperable

As supply chains are transformed into value-providing supply networks, it is critical that organizations understand the value they provide customers, develop greater clarity into internal operations, and work to make supply more visible across their networks. Data—from internal supply chain operations and external partnerships alike—is the keystone for these efforts. Enhanced data visibility and speedier data processing can fuel efforts to align the supply and value chains.

Over the next 18 to 24 months, we expect to see organizations taking part in the *supply unchained* trend take the following steps to capture and analyze more data:

- **Leverage IT/OT convergence.** The same smart factory applications and Industrial Internet of Things (IIoT) sensor technologies that marry IT networking with operational technology software and machines on the factory floor are finding new applications in smart warehouses, logistics, and sourcing. Aggregating real-time operational data from these and other supply chain functions into a commonly shared data platform enhances end-to-end transparency, live metrics that support human and machine-based decision-making, and operational efficiency.[6] In addition to IIoT sensors, visual, acoustic, and temperature monitoring tools can generate unstructured and nontraditional data streams that, once digitized and analyzed, can help maintenance teams identify anomalies and perform predictive maintenance.

- **Boost data capabilities at the edge.** In the arena of data management, time is money. Time-sensitive data can become essentially valueless after it is generated, often within milliseconds. Therefore, the speed at which organizations can convert data into insights and then into action across their supply chains is often mission critical.[7] Edge computing can turbocharge

this process by moving processing and storage capacity closer to the source of data. In this distributed architecture model, data does not have to go to the core or cloud for processing, analysis, and dissemination. For example, digital data generated at the point of manufacture or sale can be analyzed in the moment, its insights then disseminated in real time from the edge directly to disparate pockets within the supply chain ecosystem that may not have their own analytics and compute capabilities.

Meanwhile, as organizations optimize their internal operations to serve clients and customers better, they are realizing that they need more visibility into their external sources of supply. Some are starting to explore the idea of creating common logistics platforms that can be used to share information across all the suppliers in the network in real time. When platforms become transparent, they offer visibility into every organization's supply chain, not just their own. The platforms may bring an AI and advanced analytics layer positioned on top of all the information to enrich the entire data corpus. Data, then, becomes *interoperable*.

Enhanced data visibility and speedier data processing can fuel efforts to align the supply and value chains.

The journey to full data interoperability will take time. As a first step, consider constructing a two-tiered data framework that incorporates elements of a shared-data future. On one level, data will be interoperable. Companies can create a native standard that allows users operating anywhere within a supply chain network to share information. This can help address a perennial challenge of one group in the chain building a product or data model that others inside an organization alone cannot easily replicate or support. There can be a second level in the data framework that individuals or groups within the supply chain can use to fast-track portable enhancements that the market demands.

New tools for supply chain teams

When we think of supply chain in its historic role as a cost center, we cannot overlook the cost, safety considerations, and inefficiencies associated with some non–value-added tasks performed by supply chain talent. For example, consider a traditional fulfillment model: When an order comes in, a coordinator hands a printed form to a forklift driver. The driver goes into a warehouse, lifts the

purchased product onto a palette, and then drives to an adjacent rail yard, where he loads the palette into a boxcar. Though an integral part of many supply chain operations, processes in which human workers operate heavy machinery in transit hubs and enclosed warehouses are often costly and inefficient. They may also carry a degree of safety risk. In the energy and utility industries, where field teams work with power lines and telecom towers in remote locations, the risks and the costs can be even higher.

Organizations are realizing that they need more visibility into their external sources of supply.

As the *supply unchained* trend gathers steam in the coming months, we expect to see more organizations address this challenge head-on with an array of technologies:

- **Autonomous robots and collaborative cobots.** Implementing autonomous robots can drive value by reducing direct and indirect operating costs and increasing revenue potential. They can lower labor costs and increase productivity by working around the clock.[8] Likewise, cobots work alongside human workers, augmenting their performance. Their movements are easily programmable, which enables them to perform specific, limited tasks such as sorting packages. In material transportation environments, cobots can zip past each other, humans, or moving objects in a warehouse or on a factory floor thanks to advanced collision avoidance capabilities.[9]

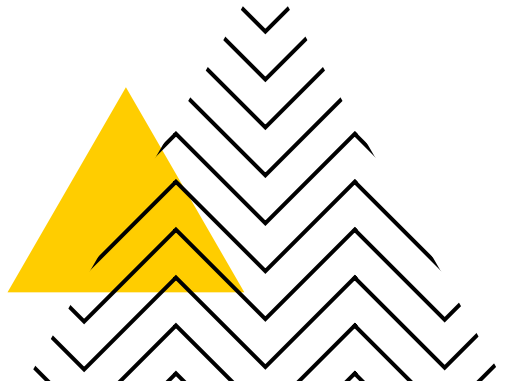
- **Aerial drones.** Companies can use unmanned drones for a variety of tasks, from providing inbound logistics in time-critical situations to carrying materials from storage to factory and transporting directly from receiving to shipping. Drones can also scan inventory efficiently and reduce labor costs.[10]

- **Computer vision.** Cameras are rapidly becoming ubiquitous and connected. Supply chain operators are placing them, in tandem with AI, throughout warehouses and freight yards to count stock. Companies are also using these computer-vision technologies on factory floors and in offices to monitor social distancing among employees, validate safety protocols, and help maintain procedural compliance. More advanced computer vision capabilities make it possible to visualize temperature radiation, detect subtle movements imperceptible to the human eye, and “ultra-zoom” in on individual parts of a complex whole.

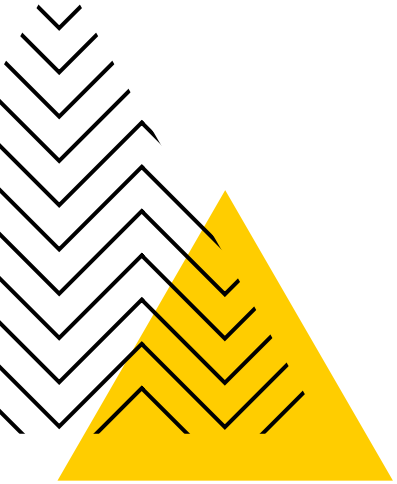
Interoperable data, AI, and machine learning also have a role to play. The ability to tie even the most remote supply chain functions into a seamless network with real-time data and, then, automate those functions or control them from a central location will be critical to lowering costs, while enhancing worker safety and efficiency.

The way forward

The list of promising tools and techniques in this field will continue to grow in the coming years as organizations work steadily to transform their supply chains from cost center to value driver and to prepare for the next big disruption. The time to begin this work is now. Digital tools and advanced techniques that seemed mildly interesting to supply chain leaders only a few years ago are mission critical. The COVID-19 pandemic has not only undermined many long-held assumptions about globalization and business-critical dependencies—it has laid bare the vulnerabilities of traditional supply chain models operating in a world where large-scale disruption may be no longer the exception but the rule.



LESSONS FROM THE FRONT LINES



Pactiv Evergreen gets proactive with factory asset intelligence

The factory floor is a critical component in a supply chain's overall flow from materials to finished products. Within this controlled environment, manufacturers not only create value but, to a degree, set the pace at which other supply network components such as sourcing and distribution operate. When factory machines malfunction, the impact can ripple across the entire supply chain, which is why a growing number of companies deploy an array of digital technologies on factory floors to generate the data they need to better understand machine efficiency and create a continuous machine optimization cycle.

Case in point: Pactiv Evergreen, one of the world's largest producers of food and beverage plastic, paper, and foam containers, wanted to explore opportunities to use digital capabilities including IoT, visualization tools, and advanced analytics to increase overall equipment effectiveness (OEE) to drive increased revenues without a significant investment in additional factory equipment. Leaders also wanted to reduce operating costs by making the company's existing industrial assets more efficient.

The company embarked on a factory asset intelligence program to merge the physical and digital worlds by investing in IoT technology, artificial intelligence, and advanced analytics to drive both asset and people performance improvements.

First, Pactiv Evergreen had to "light up" the dark data that already existed within plant assets and ingest it into a platform for both real-time and historical analyses. Because much of the equipment used within the processes was decades old, none of the machines communicated with one another or with operations personnel beyond the control panels. Project teams defined high-value use cases and then added secondary sensors across production lines to monitor and predict material flow issues from the silos to the hopper train cars, as well as specific asset health including vibration, temperature, and amperage. The teams also harvested data from other sources—including downtime, quality, and production—that, upon analysis, provided a holistic view of plant activity.

Pactiv Evergreen wanted to transition from reactive maintenance to condition-based monitoring, as a precursor to building up sufficient data history to become predictive. By utilizing edge processing technologies to capture critical data points such as vibration, temperature, and pressure, leaders were able to predict downtime and failures based on anomalies in real time. This information fed a library of proprietary condition-based monitoring applications, which were customized for different user groups. These apps pushed actionable insights to the right people, who could then address potential problems before production disruptions occurred.

As part of the initial plant deployment, project teams also experimented with signal analysis and video analytics to understand asset health throughout the production process. For example, the grinder is the most unintelligent asset on the production line, but if it goes down, the entire production line goes down. Using acoustic signal analysis, Pactiv Evergreen developed an algorithm based on machine learning that would predict grinder blade wear and alert maintenance to replace the blades during the next changeover, thus preventing unplanned downtime.

Finally, Pactiv Evergreen developed a factory control tower to allow plant leadership to monitor line asset performance as well as the OEE for each line and the entire plant. The control tower also provides insights on raw material consumption (blend insights) to control quality and material usage variances, machine and human performance insights (activity insights), and overall production health (production insights).

Pactiv Evergreen's factory asset intelligence initiative has transformed the company's entire approach to operational monitoring and maintenance, resulting in a 9% boost in OEE and a positive impact on the bottom line. "The results so far have been excellent," says CFO Mike Ragen. "We have seen a lift of about 19% in output, and that that equates on one line to about US$2 million of profitability. Extrapolating that across the 18 lines, we should see a US$36 million lift."[11]

MY TAKE

John Tomblin, PhD

Senior vice president for industry and defense programs and executive director, NIAR, Wichita State University

Every week, a squadron of B1-B Lancer bombers takes off from Ellsworth Air Force Base in South Dakota on routine missions over North America.

These venerable aircraft were designed and manufactured during the Cold War yet continue to serve as workhorses in America's strategic air wing. Their longevity can be attributed, in part, to a complex supply chain that provides maintenance crews and engineers with hard-to-find parts needed to keep B1-Bs running at peak performance. This is not a supply chain in the classical sense—rather, it is an interconnected ecosystem of digital tools and capabilities that monitor wear and tear on aircraft parts, enable predictive maintenance, and optimize inventory and fulfillment functions to help keep costs down. In other words, next-generation digital supply chain technologies are helping taxpayers extract more value from legacy assets.

My team at Wichita State University's National Institute for Aviation Research (NIAR) collaborates with the US Air Force to develop digital tools and predictive models for the B1-B airframe. For example, we have engineered digital-twin capabilities that offer maintenance teams an unprecedented 3D view into how particular aircraft parts will stand up to use over time. In the coming years, this capability will help aviation mechanics perform predictive maintenance on the B1-B and other legacy aircraft when—and only when—needed. What's more, using digital-twin data, they will be able to 3D-print long-obsolete replacement parts, extending the fleet's usefulness for the lowest possible cost.

Digital technology's ability to generate this degree of visibility—not only into the status of objects, but into operational processes and contextual environments—is poised to disrupt longstanding manufacturing and supply chain models. There is a digital transformation movement underway in which organizations are integrating design, manufacturing and other components within larger supply chains. Entire ecosystems connected by a digital thread increasingly share the same high-quality data in real time from end to end. A part supplier is now connected to designers and engineers who are, in turn, sharing data with workers and machines on the factory floor, and on through to warehousing and fulfillment. Every aspect of the product life cycle is integrated into a unified, data-driven, digital process that optimizes costs and efficiency over time.

Every aspect of the product life cycle is integrated into a unified, data-driven, digital process that optimizes costs and efficiency over time.

In our work with smart factory technology at Wichita State, I see how some of the digital advances we are making with smart factories can help transform other components in a digital supply network. A smart factory is a highly digitized and connected production facility that uses technologies such as artificial intelligence, IoT, and robotics to manufacture products; it can self-adapt and autonomously optimize manufacturing operations. Machines on a smart factory floor can automatically boost production based on demand signals or slow down production based on supply signals. Likewise, with smart factories acting as the beating heart of digital supply networks, timing and production change signals can ripple out across a network in real time, thus maintaining operational coordination.

We are also exploring ways to use digital-twin technology to design smart factories, and to depict the most detailed aspects of their operations digitally. Companies can review

the designs, see them in operation, and make needed design adjustments long before pouring concrete and laying bricks. If design changes are needed during construction, they can be made much more quickly to minimize unnecessary delays and costs. Likewise, we can reengineer existing factories for the digital world. We make a digital twin of the legacy factory and then generate a virtual world overlay that illustrates changes needed to a single production line—or to an entire factory.

Ultimately, a factory is merely a process for taking input and turning it into output. In fact, we're using factory principles to assemble a high-volume COVID-19 testing lab in Wichita, Kansas. Whether the process keeps a plane in the air, manages virus testing, or delivers a smart phone, data drives it. Data—along with digital tools—can deliver the unprecedented insight customers need to innovate, optimize, and keep their operations soaring, like the B1-B, for years to come.

EXECUTIVE PERSPECTIVES

STRATEGY // Transforming an organization's supply chain from cost center to profit driver can have a significant impact on overall business strategy. While CEOs may not dive too deeply into the minutiae of data interoperability and demand signal capture, they should focus on the potential value that data-driven customer segmentation, digital optimization, and ecosystem transparency can help create. Taken together or individually, these opportunities are relevant to business and financial planning, risk management, and organizational efficiency. Notably, they can also help organizations optimize their supply chains for resilience and flexibility, which in the current global economic environment should be on every CEO's priority list.

FINANCE // To manage current supply chain disruptions, and to make supply chains more resilient for the future, CFOs can explore opportunities to invest in new technologies for greater integration. Case in point: blockchain.[12] The CFO, along with the broader C-suite, may be interested in the possibilities of increasing blockchain adoption for greater supply chain resilience in the postpandemic world. In fact, 40% of CFOs in a recent Deloitte survey expected their supply chains to be more diversified after the effect of coronavirus.[13] To achieve this diversification—and stay profitable—CFOs may need to dive deep into tactical items such as supplier payment terms, vendor assessments, and interest rate negotiations. No technology or reassessment should be out of bounds in the transformation from supply chain to network.

RISK // Global supply chains have faced acute disruption and increased regulatory scrutiny as a result of the pandemic; risk leaders today may not even be aware of all the points of risk in their supply chains. Even so, they may be able to respond effectively to future disruptions by learning more about vulnerabilities in their supply chain. Technology now makes it possible for organizations to understand the risk profile of their vendor landscape, share data in real time, protect IP, and track contractual terms. More disruptions are inevitable in increasingly complex supply networks, but forward-thinking CROs can take steps today to reduce potential points of failure throughout all parts of their supply chains.

ARE YOU READY?

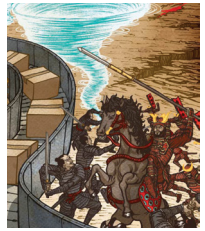
KEY QUESTIONS

1. What technologies and techniques can you deploy to capture and analyze more internal and external data from across the supply and value chains?

2. How could you benefit from sharing information more freely across your supply network?

3. Which nonrepetitive supply chain tasks carry elevated safety risks? Which of these tasks could be performed by robots, cameras, or other technologies?

LEARN MORE



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Our insights can help you take advantage of emerging trends. If you're looking for fresh ideas to address your challenges, let's talk.

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