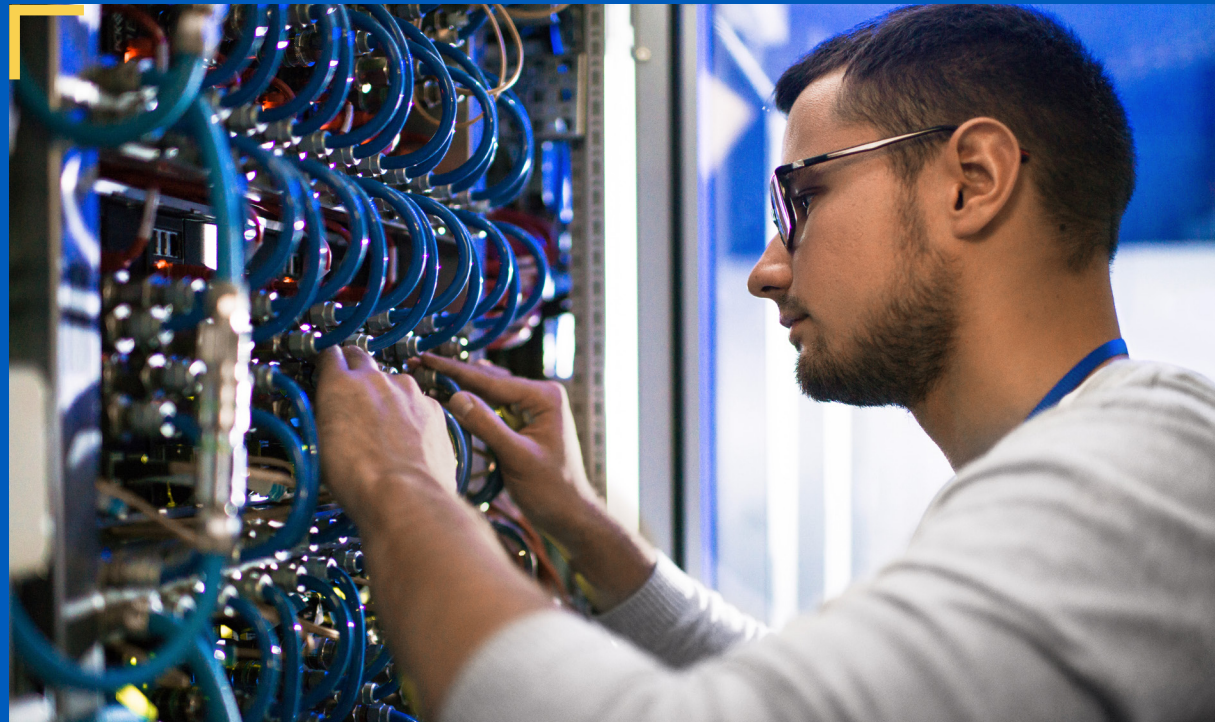


Connectivity:

Foundation of Digital-First Manufacturing



Today, manufacturers that embrace digitalization have a unique opportunity to surge ahead of their competition. Advanced digital technologies have become essential for any organization to navigate disruption — and the more severe the disruption, the bigger the potential benefits of digital tools.

Manufacturers are accustomed to modernizing to meet shifting conditions in their business, operational and regulatory environments. Typically, these upgrades have stopped short of full adoption of digital technologies. Overall, manufacturing has lagged behind other sectors on digital transformation. In a [Deloitte comparison](#) of 17 corporate sectors, manufacturing ranked near the bottom for digital maturity. This sector also had one of the shortest time horizons for enterprise digital strategy — representing a lack of adoption and of vision. Even before the major global recession sparked by the COVID-19 pandemic, Deloitte observed that “digital front-runner” manufacturers were gaining competitive advantage. The magnitude of this recent disruption has likely amplified that advantage.

Poor data connectivity is a common reason many manufacturers have yet to realize significant benefits from digitalization. This problem is not always obvious. Improvements to production automation and workflow require immediate access to rich data from several sources. The underlying network must be extremely fast, reliable and scalable to support advanced software and hardware. This increases agility, helping manufacturers respond immediately to supply chain fluctuations.

A new survey by Supply Chain Dive’s studioID and Comcast Business reveals that supply chain disruptions are the top challenge faced by a wide range of manufacturing businesses — ahead of cost control, efficiency, labor shortages and other serious concerns. A robust data network is the foundation of any technological solution to supply chain challenges, from 3D printing to real-time monitoring and analytics. It’s also needed to support solutions that involve artificial intelligence, machine learning and Internet of Things (IoT) technology. Therefore, the first step toward realizing the full advantages of digitalization is to assess and upgrade the manufacturer’s existing data network.

The window of opportunity to become a digital front-runner in manufacturing is beginning to narrow. Nearly every global manufacturer surveyed for the December 2020 [HP Digital Manufacturing Trends Report](#) said they believe that digital manufacturing technologies support economic growth. Furthermore, 90% reported they were already evaluating new supply chain models, including hybrid models (59%) and localized production (52%). Before these models become commonplace across the manufacturing sector, investments in modernized digital infrastructure are especially likely to strategically increase competitive advantage. Manufacturers that delay upgrading their data networks (as they wait for more sophisticated supply chain models to become the industry norm) will end up paying to catch up to competitors.

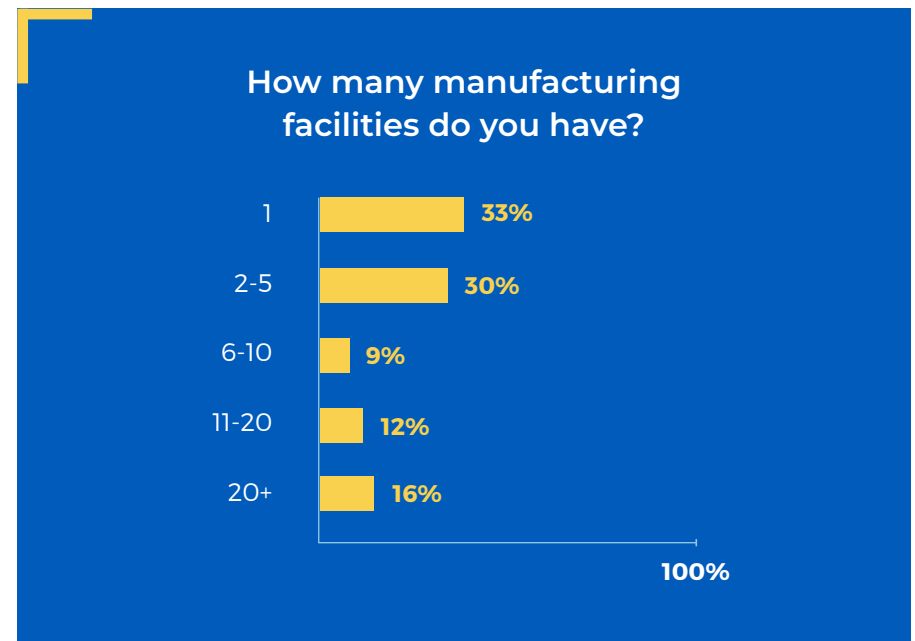
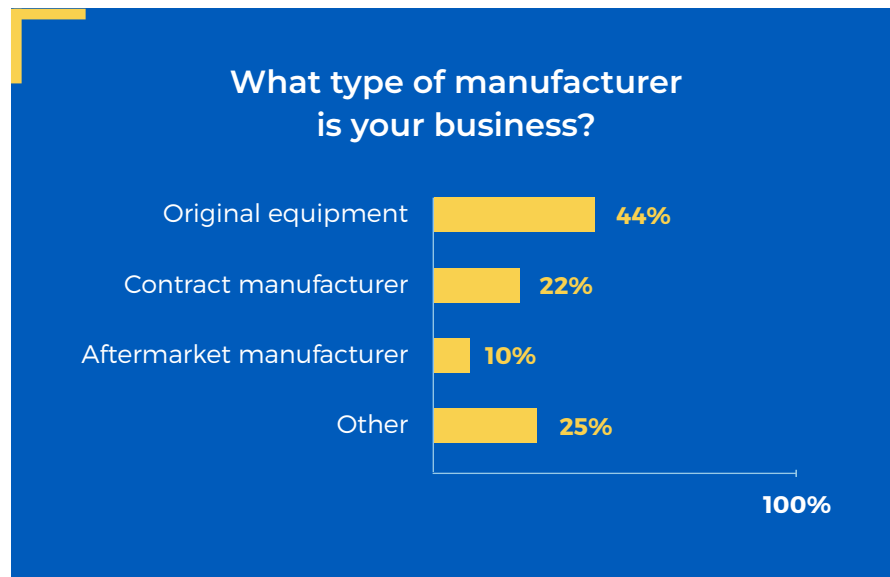
This playbook explores how manufacturers view their future needs for automation and agility. How do they evaluate data networks, and what are their strategies to maintain the flow of data needed to achieve business and operational goals?



About the Survey

In Q3 2020, Supply Chain Dive's studioID and Comcast Business surveyed more than 100 manufacturing professionals about network connectivity and its effect on manufacturing growth. More than 40% worked for original equipment manufacturers.

More than one-fourth worked for large enterprises with more than 5,000 employees. About 20% work for midsize manufacturers (500 to 5,000 employees). The remainder worked for small manufacturers (under 500 employees).



One-third of participants worked for manufacturers that operated only one plant. Nearly 40% worked for companies with two to 10 plants. An additional 28% worked for manufacturers with 11 or more plants.


1 Solving Supply Chain Problems With Better Data and Networking



When the supply chain is disrupted, manufacturing operations slow or even cease – triggering a domino effect of delayed deliveries and unhappy customers. More than half of the manufacturers in our survey named supply chain disruptions as a major business challenge. Meanwhile, just over one in 10 said the same for network capacity and bandwidth limitations.

Which challenges is your manufacturing business currently struggling with?

Supply chain disruptions	53%
Cost control	48%
Efficiency	39%
Labor shortages	34%
Production speed	30%
Maintaining productivity	25%
Quality assurance	21%
Adherence to social distancing	15%
New equipment implementation	13%
Remote worker support	13%
Regulatory compliance	13%
Capital resources	11%
Network capacity/bandwidth	11%
Other	6%
Cybersecurity or privacy issues	4%



“All the technology in the world can’t help your company if you aren’t completely sure where your raw materials and products are in the supply chain, right now. **Having full visibility into your processes and supplies allows you to keep the line moving.**”

Amit Verma, vice president of solutions and technology
for Comcast Business

Maintaining comprehensive situational awareness can prevent many supply chain problems or solve them as soon as they emerge. This is fundamentally a data network issue.

“All the technology in the world can’t help your company if you aren’t completely sure where your raw materials and products are in the supply chain, right now,” said Amit Verma, vice president of solutions and technology for Comcast Business. “Having full visibility into your processes and supplies allows you to keep the line moving.”

On-premise data and networking infrastructure are quite common among manufacturers. Nearly half (47%) of the manufacturers we surveyed said their company relied at least partly on servers installed at the manufacturing plant. An additional 34% noted that their company manages its own data center in a separate location from the plant.

On-premise or internal data and networking infrastructure not only increases overhead costs and IT workload but can also reduce supply chain visibility.

Shifting these functions to the cloud (virtual networking and cloud-based data reporting) can yield immediate benefits. “By monitoring real-time data, plant operators can anticipate shortages or disruptions in real time (or near-real time) and pivot as needed,” Verma said.

Furthermore, artificial intelligence (AI) algorithms can automatically monitor supply chain data, alert personnel about emerging issues, and automatically place orders or adjust process schedules. A data network that supports real-time access to supply chain data also can support the significant computational needs of AI-augmented digital tools.

2

The Business Case for Upgrading Digital Infrastructure

“The main purpose of a manufacturing business is to produce high-quality products efficiently and cost-effectively,” said Julie Fraser, vice president of research for operations and manufacturing at Tech-Clarity, an independent research firm that focuses on how manufacturers use technology. “Once a manufacturer gets a process working to achieve that goal, they tend to adopt an attitude of, ‘If it ain’t broke, don’t fix it.’ But eventually, disruption happens, so that process no longer works as well as it once did. Digital transformation enhances a manufacturer’s ability to respond to inevitable change and disruption.”

Instant access to highly granular and current data, plus intelligent analytics, enable manufacturers to successfully balance the triad of essential manufacturing goals.

- **Efficiency**
- **Quality**
- **Cost control**

There is considerable business value in maintaining balance between these three manufacturing goals, despite disruption. That value supports a compelling business case for key strategic investments in advanced digital infrastructure: cloud resources, fast software-defined networking, software as a service (SaaS), monitoring and analytics, and digitalized hardware.

Delivering this message across the enterprise can be a challenge. Most manufacturing organizations are obsessed with controlling immediate costs. The triad concept of the business value of digitalization (quality, efficiency and cost control) respects this immediate economic pressure, while clarifying an expansive vision of a digital-first future. Demonstrating such strategic insight can help technology teams capture executive attention and gain support for digital infrastructure upgrades.

“Digital transformation enhances a manufacturer’s ability to respond to inevitable change and disruption.”

Julie Fraser, vice president of research for operations and manufacturing at Tech-Clarity

A man with a beard, wearing a blue long-sleeved shirt, is focused on working on a server rack. The server rack is filled with various components and has several glowing blue lights. The background is dark, and the overall lighting is a cool blue tone. A thin blue line with a small circle at the end is visible in the top left corner of the page.

Additionally, leveraging cloud resources for data storage, computing and networking provides responsive scaling as well as stronger cybersecurity. It also helps eliminate costs associated with owning and maintaining IT hardware. Cloud solutions especially help manufacturers expanding into new product lines or markets, or those strategically regionalizing operations – business changes that entail substantial supply chain changes.

This business case can succeed only when it includes hard numbers and specific recommendations. The first step on this path is to conduct a thorough audit of the manufacturer's digital infrastructure. Partnering with a solution provider that has deep expertise in manufacturing-sector applications for advanced networks can strengthen this cost/benefit analysis. A digital infrastructure audit can illuminate system gaps and highlight opportunities to fix costly business and operational problems with updated technology. This process also clarifies which parts of the infrastructure can be economically integrated with the new system, to help manage the project cost.

3

Supporting OT and IT With Advanced Digital Infrastructure



At manufacturing companies, operations technology (OT) and information technology (IT) have grown tightly intertwined. Process engineers, control engineers and other OT professionals are primarily concerned with machines, sensors and control systems installed at the plant. Gradually, IT technology and methods have crept into the realm of OT as plant equipment becomes more digitalized. Data collected from hundreds or thousands of key points in a production environment, such as IoT sensors, can predict a machine failure or improve the supply chain through enhanced insight into consumption. Today, a big part of OT's job is to ensure that IoT sensors, programmable logic controllers and other digitally connected equipment at the plant can communicate quickly, accurately and effectively.

The scope of OT is rapidly expanding beyond the facility, into the cloud. Innovations and advancements in cloud computing power, bandwidth, reliability, cybersecurity and scalability support more effective and efficient operation of plant equipment. They also readily accommodate exponentially greater quantities of data.

One of the first steps in shifting the digital side of OT into the cloud is to enhance the facility's digital connectivity – specifically, reconfiguring the existing LAN to support a WAN upgrade. Typically, LANs have been a high priority for manufacturer IT teams. LANs connect only to local servers, not to off-site data centers or cloud solutions. When manufacturers have made WAN upgrades, this usually is done to support changes to the LAN, such as routing sensor data to an off-site data center.


Upgrading a facility's on-premise networking from coaxial cable to fiber-rich, Ethernet-dedicated internet is only the first phase of updating a manufacturer's digital infrastructure. This high-speed connectivity must be expanded to encompass all facilities in the enterprise. WAN technology provides a far more reliable connection to cloud services and off-site data centers. Nearly half of our survey's participants said their manufacturing facility had a LAN, but only 11% had any kind of WAN – even though two-thirds of participants worked for companies that operate more than one manufacturing facility.

A newer WAN technology that can prove especially helpful for manufacturers is the software-defined WAN (SD-WAN). In our survey, only 9% of manufacturers used an SD-WAN. In an SD-WAN, networking hardware is decoupled from the control mechanism, routing data traffic with maximum efficiency and speed between locations or connected devices. This simplifies WAN management and improves application performance, while providing an opportunity to control costs by leveraging commercially available internet access.

Which types of digital communications infrastructures are currently used at your manufacturing business?

Local area network (LAN)	45%
Internet services	42%
Direct connections to cloud and data center suppliers	37%
Wi-Fi 5 or 6 (802.11ac)	32%
Ethernet services	26%
Wide area network (WAN)	11%
5G	7%





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Julie Fraser, vice president of research for operations and manufacturing at Tech-Clarity

“SD-WAN will intelligently route the information flow,” Fraser said. “It can handle data traffic from many places: the cloud, network edge, and data coming from the LAN.”

This yields important OT benefits. “In the OT world, you’re trying to keep a manufacturing process very efficient,” she explained. “SD-WAN can be configured to ensure really time-sensitive data doesn’t travel far, reducing latency real-time transactions and intelligence on the shop floor.”

Thus SD-WAN can be an essential tool for monitoring plant equipment. Also, SD-WAN expedites transaction processing between connected devices in multiple facilities by intelligently prioritizing key data.

Verma agrees that SD-WAN can prove especially useful for manufacturers seeking to become digital-first organizations. “SD-WAN delivers the bandwidth capacity and network agility that manufacturers need through centralized software-driven controls,” he said.

Legacy networks require individual hardware-based networking components, which can be costly, labor-intensive and less flexible. Software-defined networking enables multiple networking functions to be performed virtually on a single universal customer premise equipment platform (uCPE). A uCPE supports computing power, storage and networking on a conventional server that any company can buy off the shelf. This supports network services (including SD-WAN) as virtual functions to any site on the network.

“This means you may not need a truck roll to scale your connectivity or update your cybersecurity,” Verma said. “Virtualized network functions free IT staff and resources from labor-intensive hardware-support responsibilities and allows them to be redirected to functions that more directly support the organization’s core business.”

4


Benefits of Fully Digitally Connected Manufacturing



For many years, lean operation methodologies have largely driven strategy and practice in the manufacturing sector. Such a singular focus on controlling costs made it challenging for IT managers to gain support for technology improvements, which often were perceived as an expense, not an investment. In our survey, only 13% of participants said their company had implemented IoT sensors in their operation, while less than one-third reported that data analytics informed their process or business decisions. More than half of participants worked for small or midsize manufacturers, which typically do not have the luxury of large technology budgets.

Which connected technologies are currently used in your production operations?

Data analytics	32%
IoT sensors	13%
Computer-Aided Design (CAD)	10%
Robotics	9%
Computer-Aided Manufacturing (CAM)	7%
Predictive maintenance	6%
Artificial intelligence (AI)	5%
Computer Numerical Control (CNC) machinery	3%
Automated Guided Vehicles (AGVs)	3%
Programmable logic controllers (PLCs)	3%
Machine learning	3%
Vision systems	2%



“Automation demands bandwidth.
A manufacturing operation might have millions of transactional data points, transmitted in seconds or less. In process automation, every step of the process must be accounted for, no matter how small.”

Amit Verma, vice president of solutions and technology
for Comcast Business

In recent years (and especially in 2020), as big disruption became the “new normal” for supply chains, technology adoption has become a higher priority for manufacturers of all sizes. More manufacturing IT managers are getting C-suite support for digital adoption. Executives are turning to their internal technology experts for ideas to enhance the organization’s resilience and competitiveness. Many of these ideas focus on connectivity.

Our survey asked manufacturers how they might leverage better connectivity. By far, their top priority was automation of manual processes.

“Automation demands bandwidth,” Verma said. “A manufacturing operation might have millions of transactional data points, transmitted in seconds or less. In process automation, every step of the process must be accounted for, no matter how small.”

If your company improved its data connectivity, what would be your top goals to leverage this resource?

Automate more manual processes	52%
Collaborate better with vendors and customers	34%
Communication improvements	32%
Centralize control of data and assets	25%
IoT system performance enhancement	18%
Reliability improvements for remote workers	16%
Remote control/management of processes	14%
Lights-out manufacturing	9%

Verma likened this to road traffic: When more vehicles attempt to use a road than can fit on the road, traffic jams result. Similarly, when data networks are overloaded, the flow of information can slow down. Furthermore, many manufacturing facilities are in “digital deserts” — regions with limited options for high-speed connectivity. SD-WAN is transport-agnostic: It can use whichever form of transport, and whichever connectivity provider, is best for each location in the network, without adding network complexity.

Process automation offers additional operational benefits. For instance, it can help manufacturers limit the number of employees on the production floor at any given time. Workforce optimization helps manufacturers meet productivity goals while meeting other requirements.

Other popular uses for enhanced connectivity reported in our survey were improved collaboration with partners and vendors (34%), enhanced communication (32%), and centralized control of data and assets (25%). These findings suggest that manufacturers believe that increased trust and communication support improvements in the resilience of supply chains and operations.

“Whether the topic is smart factories or analytics or digital transformation, over and over again the conversation always comes back to communications infrastructure,” Fraser noted. “It’s the plumbing for all these technologies. It doesn’t matter how fancy your bathroom looks — you still can’t use it without the right plumbing.” Embracing a digital future is key for manufacturing growth. As these businesses seek to automate processes, implement SaaS and cloud-based solutions, and streamline workflow management, reliable connectivity can help pave the way toward the strategic gains.

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