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Meeting the challenge of supply chain disruption

Deloitte, in collaboration with Manufacturers Alliance, examines how traditional manufacturing supply chains are evolving to balance costs, efficiency, and resilience.

Disruptions over the past few years have exposed vulnerabilities in manufacturers' existing supply chains. Conventional approaches may no longer be enough to achieve the desired level of supply chain assurance. For this study, Deloitte partnered with Manufacturers Alliance to understand the impact of supply chain disruptions on manufacturing and what manufacturers can do to achieve supply chain assurance. Read more on [Deloitte.com](https://www.deloitte.com).

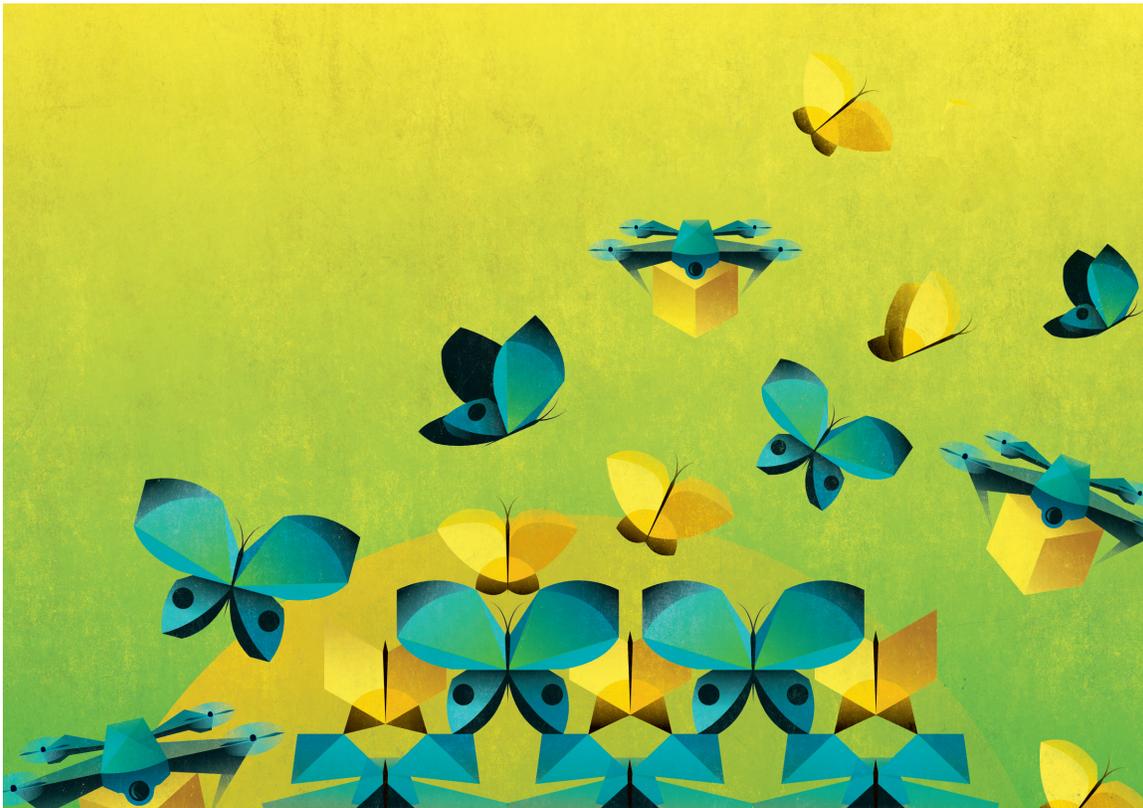
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Executive summary

THE PAST TWO years have demonstrated that the familiar formula of minimizing costs and maximizing efficiency in global supply chains is often no longer enough. Now, redundancy and resilience should be added to the equation to address increasing supply chain disruption.

To gauge the impact of recent disruptions and how supply chain executives are balancing this new equation, Deloitte and Manufacturers Alliance surveyed more than 200 manufacturing executives. Our study addresses the real impact executives have observed in their own businesses over the past 18 months. This paper highlights a range of new approaches and tools manufacturers are deploying as disruption becomes the norm. What emerges are four components important to a successful supplier management strategy: strengthening existing relationships, engaging multiple suppliers, deploying digital tools for increased visibility, and combining efficiency with resilience. These may be tried-and-tested tactics, but they are now being enhanced to meet new challenges head on.

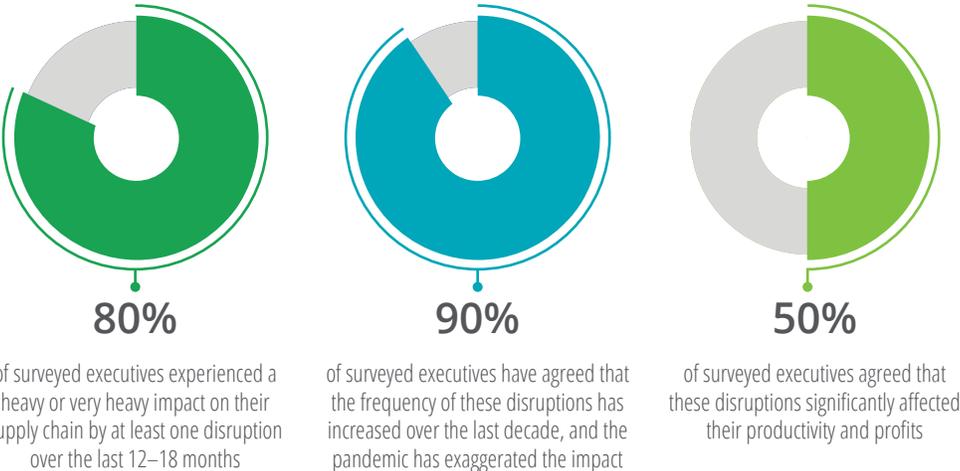


ABOUT THE 2022 MANUFACTURING SUPPLY CHAIN STUDY

Deloitte and Manufacturers Alliance jointly launched a study (hereafter referred to as “the study”) in June 2022 to understand the impact of disruptions on the manufacturing supply chain and gauge the response of manufacturers to these disruptions (figure 1). On behalf of Deloitte and Manufacturers Alliance, an independent research company conducted an online survey of more than 200 US-based manufacturing executives in July 2022. The survey findings were supplemented with a series of interviews with manufacturing and supply chain executives.

FIGURE 1

Over the last 12–18 months, 80% of survey respondents have experienced significant supply chain disruption



Source: Deloitte analysis of 2022 manufacturing supply chain study data.

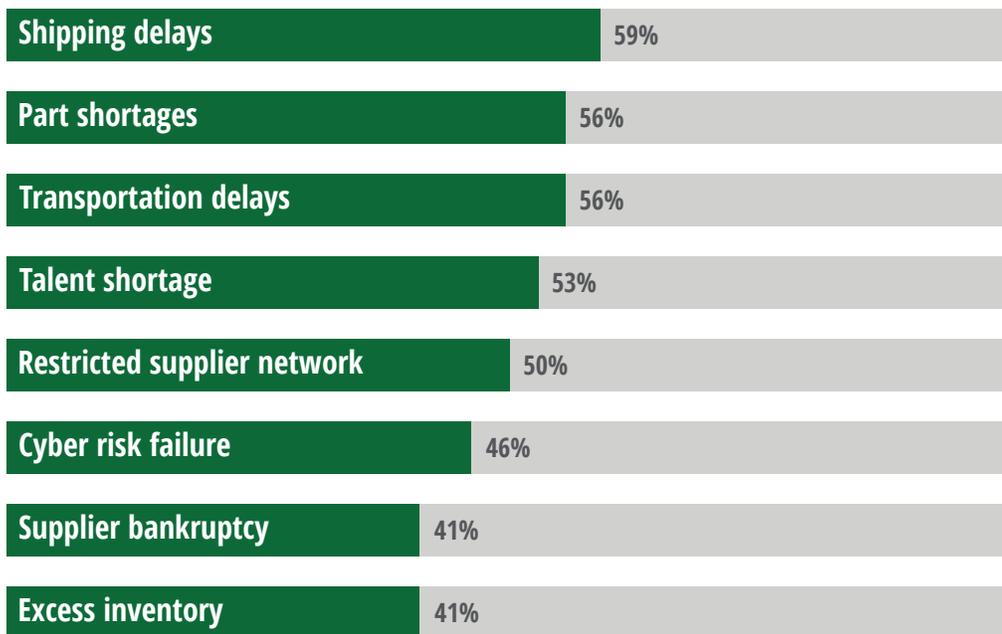
Spotlighting supply chain disruption

SHIPPING DELAYS, PARTS shortages, and transportation delays due to truck driver shortages and congested ports had the greatest impact on manufacturing companies in the past 12–18 months, according to survey respondents (figure 2). Production and profits are the two key areas where this impact has been felt, and a majority of respondents report negative impact to profits of up to 13%.

These factors suggest that supply chain executives are working to solve a new optimization problem with more stringent constraints: Costs still need to be minimized, yet resilience and redundancy should be built in to assure supply. This calculation is ever more challenging given the rising costs of energy and materials and labor, current workforce shortages, and ongoing logistics challenges resulting from two years of pandemic disruptions.¹

FIGURE 2

Shipping delays had the biggest impact on manufacturers' supply chains in the last 12–18 months



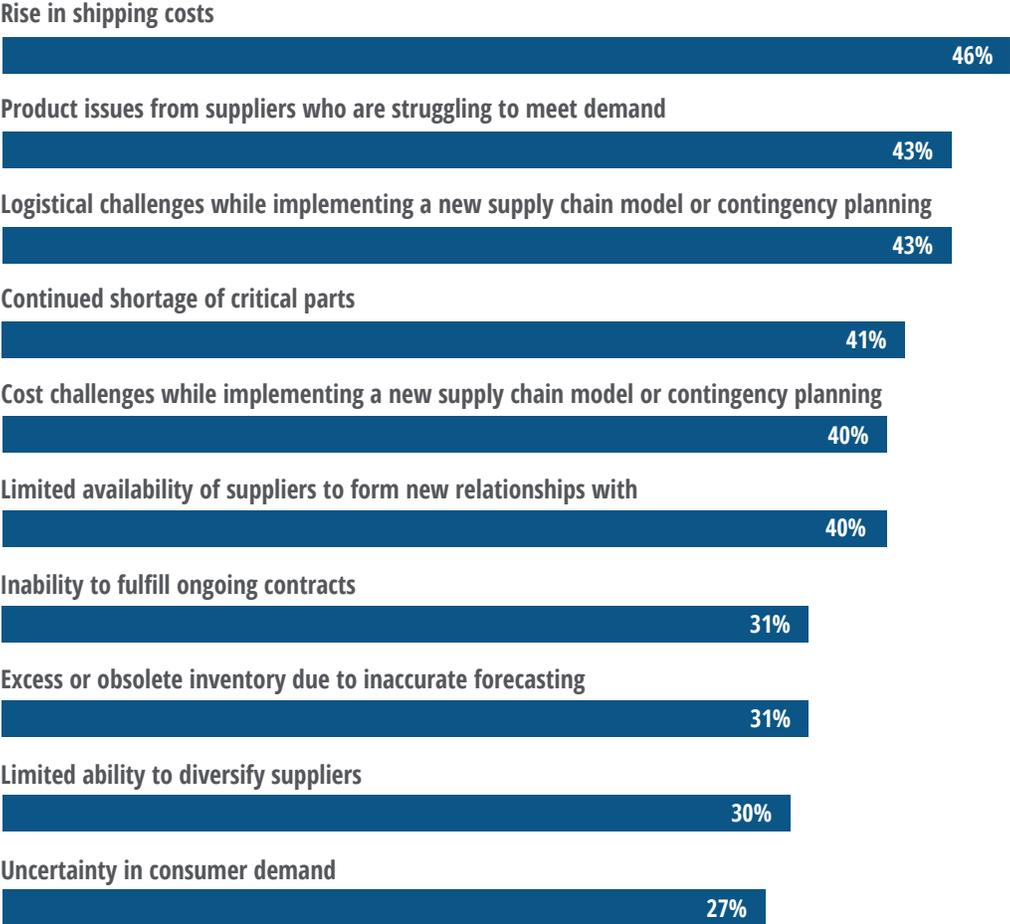
Source: Deloitte analysis of 2022 manufacturing supply chain study data.

The top operational concern (figure 3) among surveyed executives is rising shipping costs. Indeed, shipping costs rose by over 77% in August 2022 from January 2021 due to increased fuel costs, labor costs, and logistics challenges.² Underlying all these concerns is labor, where costs continue to rise. Indeed, total compensation cost per hour worked rose by 6.2% to US\$42 in the manufacturing industry in Q1 2022.³

The next category of operational concerns cited were those affecting inbound supply, characterized by suppliers struggling to meet demand and the continued shortage of critical parts. These problems in turn translate into outbound challenges: 31% of surveyed respondents mentioned the inability to fulfill ongoing contracts as one of their top operational concerns. Also high on the list were the challenges associated with implementing contingency plans such as switching suppliers.

FIGURE 3

Top operational concerns range from rising costs to logistical issues in inbound supply challenges, affecting manufacturers’ ability to fulfill ongoing contracts



Source: Deloitte analysis of 2022 manufacturing supply chain study data.

Key approaches for assurance of supply

MANY COMPANIES ARE pursuing four key risk mitigation strategies to address these operational concerns and reduce the disruption to their business: strengthening existing relationships, engaging multiple suppliers, implementing digital solutions for greater visibility, and returning to just-in-case approaches (figure 4). These strategies are familiar, but they are being deployed with enhanced tactics.

What additional tools are executives wielding to make these familiar strategies more effective in a world of continuous disruption and rising input costs? How are manufacturers addressing the new constraints of rising costs, labor shortages, and logistics bottlenecks in this supply chain optimization problem? The study uncovered some encouraging findings.

FIGURE 4

Key risk mitigation strategies companies are implementing over the next year



Source: Deloitte analysis of 2022 manufacturing supply chain study data.

Strengthening existing relationships

THE EXIGENCIES OF the current environment are bringing a new focus on time-tested skill sets. Several supply chain executives surveyed emphasized that in volatile environments, the familiar skill of supplier relationship management can become even more important to avoid disruption. However, junior employees may need to be taught these skills as most are used to working in a demand-driven environment.

The sudden shift to a supply-constrained business model meant not all employees were armed with the needed relationship management skills to work closely with suppliers as partners to manage

forecasts, lead times, inventory strategies, and costs. In many cases, this partnership has developed as quarterly supplier reviews turned into daily calls between senior supply chain executives and the CEOs or CFOs of their suppliers, sharing information and helping each other navigate the business environment (figure 5). For example, one company worked through its supplier as a partner to find an alternate source of chips during the chip shortage, thereby achieving greater flexibility and visibility. Another company worked closely with suppliers as shipping options from Asia were reduced and freight was moved to air cargo, which incurred higher costs.⁴

FIGURE 5

A four-pronged approach to strengthen existing supplier relationships



Source: Deloitte analysis of 2022 manufacturing supply chain study data.

Proactively managing multiple tiers

Supply chain executives have been drawn into management not just of their primary suppliers, but increasingly of secondary and tertiary suppliers also. Several executives interviewed noted that previously they did not get involved beyond Tier 1, but the dynamics of the current environment drove a need to increase visibility. For example, if Tier 3 suppliers were unable to give firm dates for shipping, often this potential weak point wasn't visible to primary suppliers or to the company itself, and potential delays were not flagged early enough. To address this risk, one company interviewed has begun working closely with its own suppliers to apply transparent decision-making based on metrics and benchmarking to that supplier's suppliers. This can provide the company more visibility and clarity in terms of the companies with whom its suppliers are contracting.

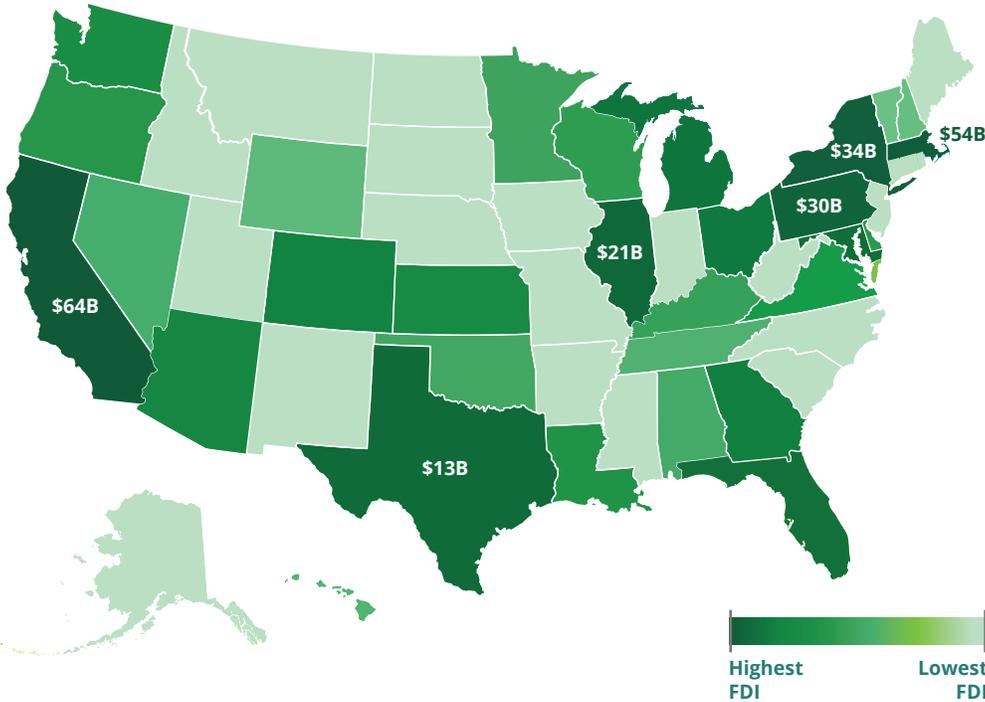
Boosting local production capacity

Boosting local capacity is a real and important strategy for today's manufacturers. US companies are increasing domestic sourcing. For the semiconductor industry, as other global industries, supply chain and logistics challenges are pushing manufacturers to build more local capacity. The solar energy industry, for instance, offers a case for using buyer power to increase production capacity. The US Solar Buyer Consortium was established to boost the domestic production of solar components. The group is focused on the procurement of US\$6 billion of solar panels but is also enlisting manufacturers who can increase production to meet the growing demand for solar modules.⁵

LED BY MANUFACTURING, FOREIGN DIRECT INVESTMENT IN THE UNITED STATES INCREASED IN 2021

Expenditures by foreign direct investors into new US businesses totaled US\$334 billion in 2021, more than twice 2020 levels and above the annual average of US\$290 billion from 2014 to 2020 (figure 6). Manufacturing accounted for 36% of this figure, at US\$121 billion.⁶ Moreover, manufacturing accounted for 20% of employment associated with this investment (47,400 new jobs).⁷ California received the most investment, totaling US\$64 billion, followed by Massachusetts, New York, Pennsylvania, Illinois, and Texas.

FIGURE 6
California received the highest manufacturing-led foreign direct investment in 2021



Note: All dollar values are in US dollars.
Source: Deloitte analysis of Bureau of Economic Analysis (BEA) data.

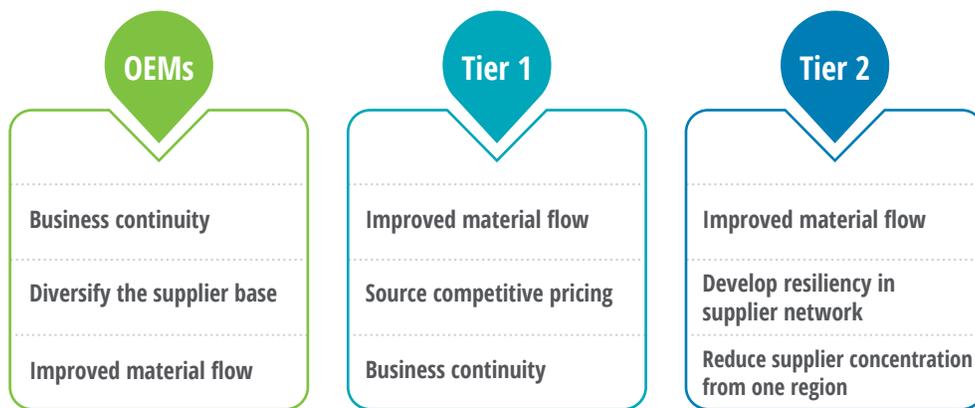
Engaging multiple and regionally diverse suppliers

THE BENEFITS OF engaging multiple suppliers are well known but may vary according to company type—OEM or supplier (figure 7). Nine out of 10 survey respondents have multiple suppliers, but only 44% have regional diversification of suppliers. The study highlights that companies with regional diversification were less affected by recent supply chain disruptions than companies with suppliers concentrated in one region. However, dual sourcing may increase costs: 43% of survey respondents noted cost as the top constraint in having multiple suppliers.

MITIGATING SUPPLY CHAIN DISRUPTION THROUGH SUPPLIER DIVERSIFICATION

Companies are actively trying to have a diverse mix of suppliers to tackle supply chain disruptions. For example, GM recently announced a deal with lithium supplier Livent and a separate cathode material deal with LG Chem. These contacts can provide GM with the battery materials it needs to help with its goal of building 1 million electric vehicles annually by the end of 2025.⁸ In another example, Tesla recently signed a long-term supply agreement with Vale for the supply of nickel for its batteries. With this agreement in place, Tesla has a total of seven nickel suppliers, spread across multiple regions.⁹

FIGURE 7
Key considerations when selecting multiple suppliers



Source: Deloitte analysis of 2022 manufacturing supply chain study data.

Building “bench strength” in suppliers

The semiconductor shortage, which has affected industries from automotive to handheld electronics, raises the question of how to achieve resilience when the market is highly concentrated. In the semiconductor supply chain, some suppliers are unique—for example, worldwide, there’s only one epoxy supplier and two suppliers of cutting-edge chips.¹⁰ Moreover, the global semiconductor industry has been running at over 95% utilization since December 2020, which is well over the 80% utilization rate normally considered full capacity, suggesting additional production capacity is needed.¹¹

The passage of the CHIPS Act in 2022 has helped jump start investment in additional production capacity in the United States. For example, a semiconductor manufacturer is considering four semiconductor chip fabrication plants (fabs) at a cost totaling nearly US\$30 billion. Intel announced plans for an initial investment of more than US\$20 billion to construct two new fabs in Ohio, a new region for chip-making.¹² And it isn’t just US-based companies considering adding capacity in the country: South Korean headquartered Samsung has proposed a US\$17 billion fab in Taylor, Texas, and has also recently submitted an application with the Texas comptroller outlining a long-term plan to build up to 11 chip-making plants in Texas and invest over US\$192 billion in the coming decade. Arizona is also poised to receive investment for chip manufacturing.

Supplier risk considerations

As supply chains elongate and supply bases increase with new sources created, procurement teams are becoming more central to enterprise risk management. Procurement and supplier risk management functions should work more closely

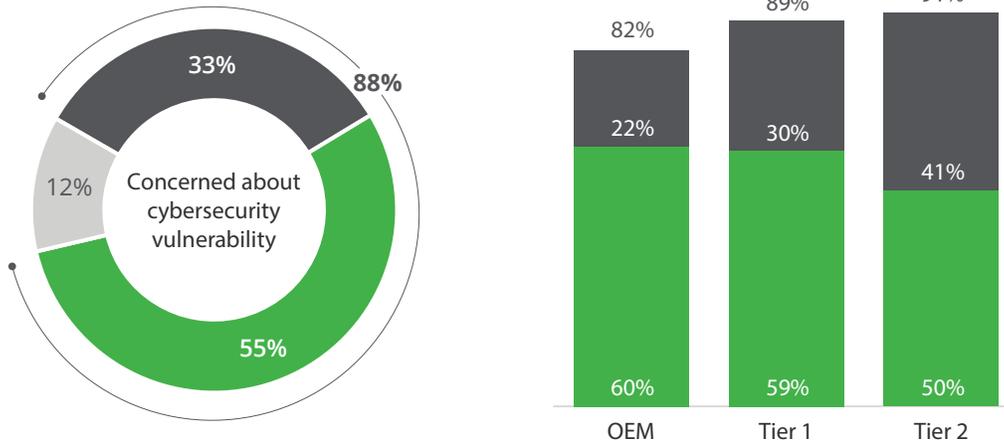
with suppliers and their compliance and risk management departments. Executives interviewed for the study are engaging more often and earlier with third-party risk management protocols. The historic approach of a point-in-time assessment, even if done annually, may no longer be sufficient for organizational risk management objectives. Companies must sense, monitor, and be ready to take action as needed.

- **Sensing:** Leading companies are beginning to use intelligent sensing of data, including social media, in combination with assessments and investigations, to enhance the effectiveness of their suppliers in managing third-party risk.
- **Monitoring:** As companies identify their critical risk domains, from financial health to geopolitics to cybersecurity, they can develop technology-enabled processes to proactively monitor their third-party ecosystem and identify the early warning signs that could trigger action.
- **Taking action:** For quick action, such as switching to a new supplier, having a preapproved response plan can be critical. One company requested all its vendors participate in response planning, outlining COVID-19 contingencies, such as if parts weren’t received and trucks stopped delivering. Similarly, additional suppliers need to be “prequalified,” such that the contracting work could be done already, shortening lead times.
- **Scenario planning:** Management teams can also identify potential scenarios in advance, along with subcriteria that help indicate the best response plan in a given situation. Executives should decide in advance who has decision-making power in each scenario and how to reduce downtime, address breach of contract incidents, etc.

FIGURE 8

Among survey respondents, 88% are concerned about legal, financial, privacy, IP theft, or cybersecurity

■ Yes, and have no strategy in place ■ Yes, but have a comprehensive strategy ■ No concerns



Source: Deloitte analysis of 2022 manufacturing supply chain study data.

Digital technologies are a key enabler to risk mitigation and assessing external risks in terms of components or materials. Survey results showed that 88% of respondents have concerns about legal, financial, privacy, IP theft, or cybersecurity due to

the supply chain ecosystem; however, 55% have a comprehensive cybersecurity strategy in place for such concerns. According to our study, OEMs feel better prepared than suppliers on IP and cybersecurity (figure 8).

VERTICAL INTEGRATION AS A TOOL FOR ACHIEVING SUPPLY ASSURANCE

Merger and acquisition deal activity in manufacturing continues to be strong, having increased substantially over the last three years; the industry recorded 52% year-on-year growth in such deals in 2021.¹³ Some of these transactions represent vertical integration along the supply chain, suggesting a possible trend. One example of such integration is Tesla's recent acquisition of ATW Assembly and Test Europe GmbH to enhance its battery cell manufacturing capacity, which highlights the integration to develop capabilities in-house.¹⁴ In an example from the aerospace and defense industry, Safran bought Aubert & Duval, a French supplier of metal powders for additive manufacturing and other powder-based part production technologies, from mining firm Eramet. The acquisition, jointly carried out with Airbus and investment firm Tikehau Ace Capital, was completed earlier this year.¹⁵

Enabling agility with digital capabilities

MOST COMPANIES ARE turning to digital capabilities for greater supply chain agility and visibility. Armed with real-time market intelligence and predictive technologies, manufacturing executives can better navigate current market volatility and pivot more quickly to their plan B. Most executives surveyed are implementing digital technologies for enhanced risk mitigation, such as increased illumination of the supply chain (figure 9).

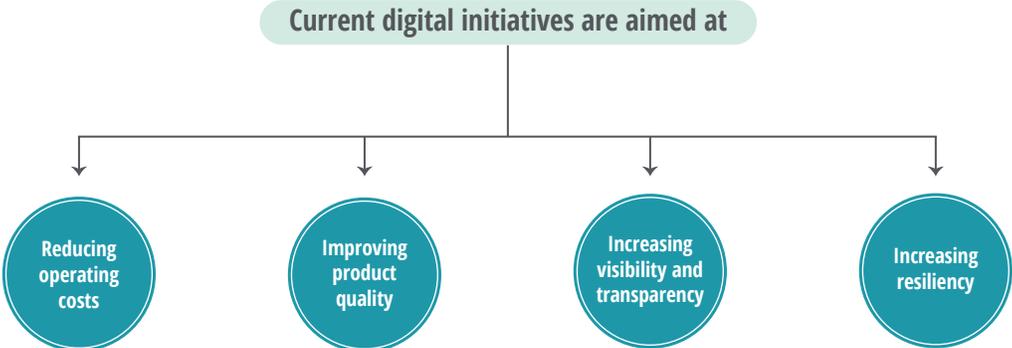
Increasing visibility with technology

Gaining supply chain visibility is one of the top use cases for ongoing digital initiatives, and 78% of surveyed respondents agreed using digital solutions and/or monitoring tools would enhance visibility and transparency throughout the supply

network. For most survey respondents, the lines of visibility start to blur beyond Tier 2+ of their supply network. However, there is a strong correlation between visibility beyond Tier 2 and implementation of digital solutions—73% of respondents with visibility beyond Tier 2 reported they had already implemented digital solutions. One executive mentioned launching a control tower that enhanced visibility into suppliers but also integrated different parts of the supply chain. Others are using Industry 4.0 tools such as AI and bots to integrate the supply network, as part of a larger digitization strategy for manufacturing. Several supply chain executives interviewed said that the early months of the pandemic helped them realize they needed to enhance their digital capabilities to weather the disruptions, and their spending on digital technology has continued to increase over the past three years.

FIGURE 9

Three in four survey respondents have started utilizing digital solutions and tech automation in the supply chain as a risk mitigation strategy



Source: Deloitte analysis of 2022 manufacturing supply chain study data.

Using technology to “design out” niche suppliers

Companies have been undertaking value stream mapping of their supply chains for many years to determine where their raw materials come from and identify any potential points of failure in their supply chain. One executive explained that his company had developed a “scorecard” of its contracts, organizing them by age of contract, importance of the input to the final product, and history with the supplier. With this value mapping and contract prioritization, it becomes possible to “design out” reliance on niche suppliers in certain cases.

Emerging technologies such as digital twins can develop capabilities to run various simulations and assess multiple variables to determine where and how alternative materials or suppliers could be utilized. As companies continue to diversify their supplier base, the optimization process could become increasingly complex. The digital twin can help to identify underlying inefficiencies and bottlenecks and could assist in making an informed decision on selecting the desired supplier, right facilities, and transportation capabilities to achieve supply assurance.

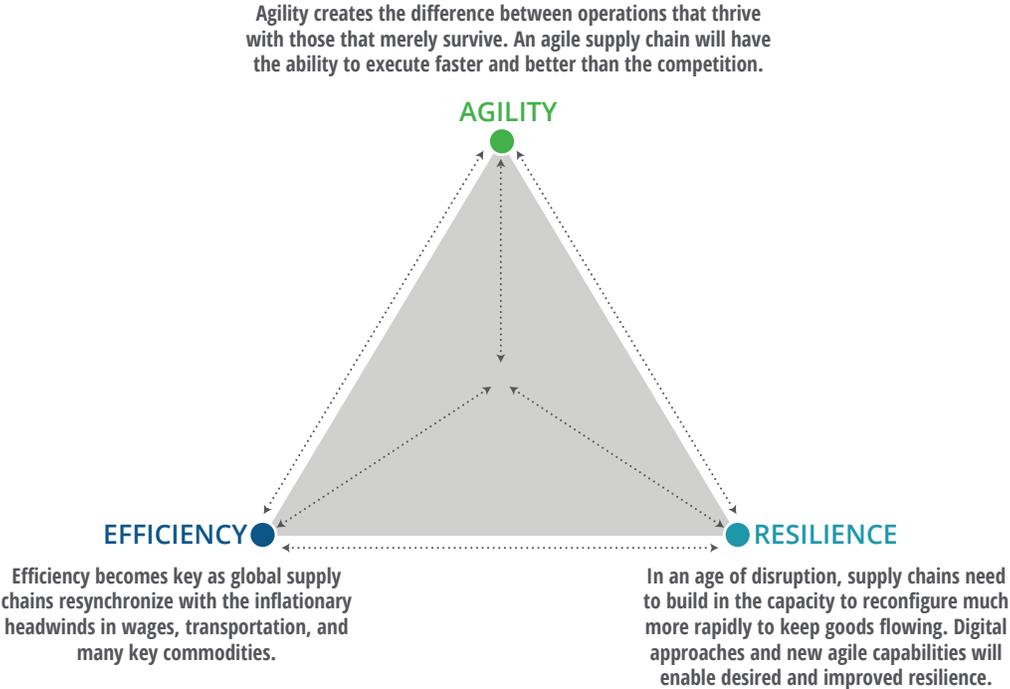


Moving away from just-in-time approaches

MANUFACTURERS SEEM TO be drifting away—maybe only temporarily—from just-in-time approaches to help manage the constraints of higher labor and materials costs, logistics bottlenecks, and labor shortages. One executive explained that in early 2021 his team decided they needed to move away from the focus on cost and orient increasingly on business continuity and customer satisfaction. Executives

draw a distinction between operational challenges, which can be solved through improved supplier relationships and visibility, and logistics and external challenges, which are out of the supplier’s or company’s control. However, to manage external challenges, supply chain leaders need to be well-equipped and strike the right balance between agility, resilience, and efficiency (figure 10).¹⁶

FIGURE 10
The agility-efficiency-resilience framework



Source: Jim Kilpatrick, Paul Delesalle, and Adam Mussomeli, *The new supply chain equilibrium*, Deloitte Insights, April 1, 2022.

Building out agile processes

Agility and flexibility are potential game changers. Flexibility of design could be used to standardize product-specific parts, allowing a standardized part to be used across products that would require minimal customization. For example, Tesla uses a number of chips in its vehicles for various control and infotainment systems, and its self-driving software. During the ongoing semiconductor shortage, Tesla swiftly changed to new microcontrollers, while simultaneously developing firmware for new chips produced by new suppliers.¹⁷

Mitigating transportation challenges

The persistent labor shortage in manufacturing, which has been exacerbated by the pandemic, has contributed to port delays, slower warehouse processing, and a truck driver shortage. As one executive explained, no matter how reliable your supplier, a labor shortage at a port can still cause a shipping delay. To address this disruption, building redundancy or resilience is needed. One company shared that it is looking at diversifying supply routes on the West Coast, possibly adding a Canadian port.

Developing resiliency

To build resiliency, in some cases manufacturers are actively partnering with other manufacturers or are investing in their suppliers to support building more production capacity. Executives interviewed described a continuum of collaboration ranging from buying capacity in advance from suppliers to actually taking equity stakes in certain critical suppliers.

There have been several examples in which industrial manufacturers are expanding their activities into adjacent areas. Our study highlights that Tier 1/Tier 2 suppliers are likely to coinvest or partner with other Tier 1/Tier 2 suppliers in emerging technologies to develop new capabilities and advance through logistics and transportation challenges. For instance, the recent acquisition of Pleatco LLC by Pentair Plc allows Pentair to expand its presence through existing distribution channels, and also to expand in the aftermarket filtration space. In addition, including complementary air filtration products into Pentair's portfolio should serve the needs of existing industrial customers.¹⁸

In other cases, investment is focused on fostering more competition in a given market, ultimately to build more choice among existing producers. These additional investments could clearly have an impact on the industry's cost structure, but that reduction in margin could be worth the resilience ultimately provided through developing a deeper market with more producers.

The road ahead: Optimizing for agility considerations

As manufacturing executives solve the current supply chain optimization problem, they are leveraging four familiar mitigation strategies to balance resilience with efficiency. But they are also wielding new skill sets and tools to manage the tougher constraints of rising costs, labor shortages, and logistics bottlenecks to achieve agility.

Strengthening existing supplier relationships to increase resilience:

- Work closely with suppliers to help them apply metrics to their Tier 2, 3, 4 suppliers
- Agree on mutually beneficial KPIs so that all parties know what to expect from one another
- Help suppliers maintain data on their suppliers' throughput to boost transparency and assurance
- Train newer employees on relationship management

Engaging with multiple suppliers to balance efficiency and resilience:

- Correctly calculate the benefits of engaging multiple suppliers with the costs of lower margins and reduced control
- Use dual sourcing to achieve some cost control where possible, evaluating investing in development of additional suppliers in a niche market

- Have scenarios in place and alternative suppliers preapproved, conducting practice drills to make contingency plans more effective
- Locate additional production or alternate suppliers close to markets to reduce transportation costs and exposure to shipping delays

Employing digital solutions to boost efficiency and resilience:

- Implement warehouse automation in response to workforce shortages
- Move to digital solutions that increase visibility beyond Tier 2 suppliers
- Boost collaboration by initiating high-level information-sharing between all parties with the help of easy-to-use technologies
- Track potential sources of logistical disruption such as restricted routes and workforce shortages

Manufacturing executives are acutely aware of causes for both internal and external disruption and are taking steps to build redundancy into supply chains to assure business continuity. Though these efforts may lower margins, they can increase agility, reflecting the new balance that manufacturers are achieving between efficiency and resilience.

Endnotes

1. Stanley Porter and Kate Hardin, "Energy and commodities outlook: Disruptions from the Russian invasion of Ukraine," *Wall Street Journal*, June 3, 2022.
2. Freightos Ltd, "Freightos Baltic Index (FBX): Global Container Freight Index," accessed August 16, 2022.
3. US Bureau of Labor Statistics, "Table 4. Employer costs for employee compensation for private industry workers by occupational and industry group," accessed August 16, 2022.
4. Insights gleaned from manufacturing executives' interviews conducted in July 2022.
5. Zacks Equity Research, "AES sets up US Solar Buyer Consortium to promote solar industry," *Yahoo! Finance*, June 22, 2022.
6. US Bureau of Economic Analysis, "New foreign direct investment in the United States, 2021," news release, accessed August 16, 2022.
7. Ibid.
8. General Motors, "General Motors and Livent enter long-term lithium hydroxide supply agreement," news release, July 26, 2022; General Motors, "LG Chem and General Motors reach agreement for long-term supply of cathode active material to support EV growth," news release, July 26, 2022.
9. Fred Lambert, "Tesla releases list of battery material suppliers, confirms long-term nickel deal with Vale," *Electrek*, May 6, 2022.
10. Deloitte, *Anchor of global semiconductor: Asia Pacific takes off*, 2021, p. 9.
11. Semiconductor Industry Association, *Increasing chip production: Industry shouldering in to addressing shortages*, 2022, p. 1.
12. Intel Corporation, "Intel announces initial investment of over €33 billion for R&D and manufacturing in EU," news release, March 15, 2022.
13. Deloitte analysis of the data from Mergermarket.
14. Edward Taylor, "Tesla to acquire German battery assembly maker: source," Reuters, October 2, 2020.
15. Airbus, "Airbus, Safran and Tikehau Ace Capital sign an agreement with Eramet for the joint acquisition of Aubert & Duval," press release, February 22, 2022.
16. Jim Kilpatrick, Paul Delesalle, and Adam Mussomeli, *The new supply chain equilibrium*, Deloitte Insights, April 1, 2022.
17. Lambert, "How Tesla pivoted to avoid the global chip shortage that could last years," *Electrek*, May 3, 2021.
18. Pentair plc, "Pentair completes transaction to acquire Pleatco," news release, October 18, 2021.

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