

BEST PRACTICE GUIDE

Managing supply chain risk in aerospace and defense

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State of the industry today

Airworthiness issues, trade wars, and even “black swan” events such as the 2008 financial crisis, have caused significant turbulence for the aerospace and defense industry in recent years. Despite the impact these complex events have had on global business, Deloitte reported that **the commercial aerospace sector was expected to recover in 2020**—continuing a decade of solid growth that led to a large order backlog and steady work for aerospace and defense manufacturers and service providers.¹

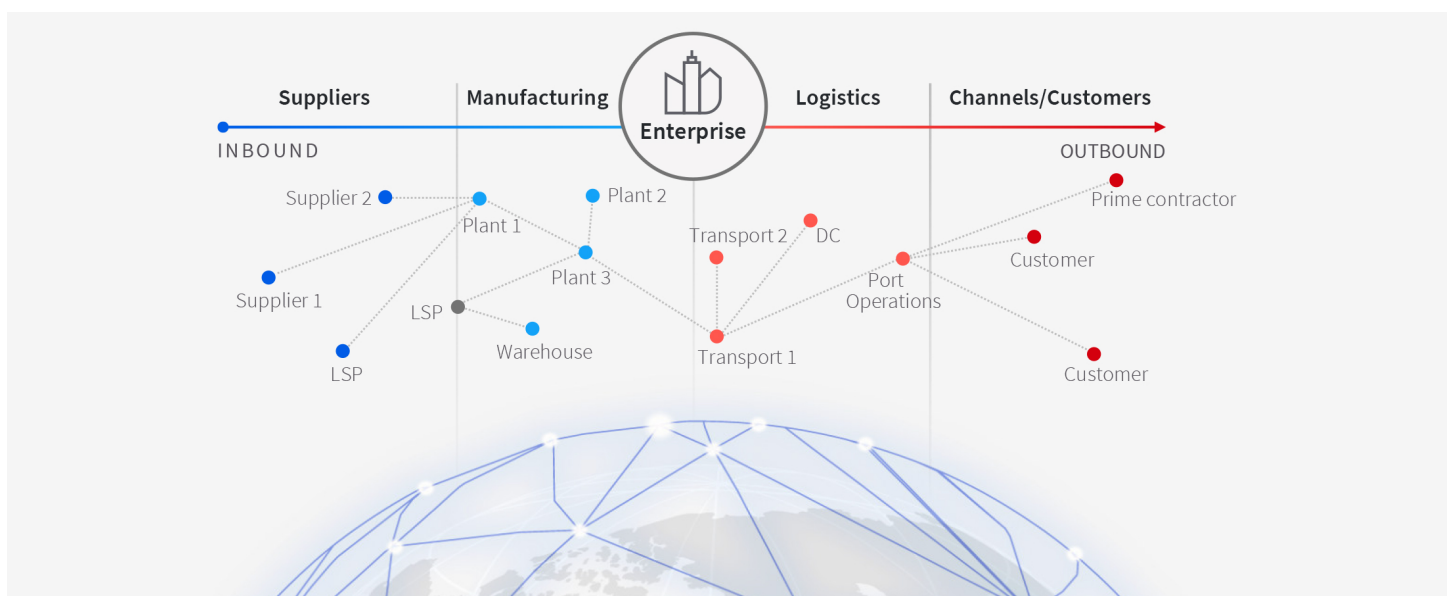
That 2020 financial recovery never happened. The COVID-19 pandemic caused a sudden and drastic decrease in passenger demand. And even though the commercial aerospace and air travel industries attempted to adjust to “the new normal,” **passenger demand was still expected to remain 30% below pre-pandemic levels into 2021**, according to Deloitte.² New safety measures and changing passenger preferences affected airline fleet mix and order books, causing **decreased supply chain demand and greater uncertainty**.³ Unfortunately, due to the unique and unexpected nature of the pandemic, many companies discovered their risk mitigation strategies were unresponsive and perhaps not even robust enough to weather a potentially slow recovery.

The overlap between commercial aviation and defense markets also presents a unique situation. For instance, the designation of defense manufacturing as critical infrastructure in the US provides some stability in the current commercial aviation downturn as the government seeks to provide additional financial support. But ongoing changes in demand and capacity may intensify already existing challenges in maintaining a healthy defense industrial base with a skilled workforce and continued investments in key advanced technologies.

Aerospace and defense and air travel are certainly not the only industries to be impacted by the pandemic; nor is this even the first time that supply chain vulnerabilities have hit high-value manufacturing industries. Automotive and high-tech and electronics have had their share of disruptions—original equipment manufacturers (OEMs) and large contractors in these industries have streamlined the supply base over the years to create greater economies of scale, as well as place greater responsibility for increasingly complex design and manufacturing tasks directly on lower tier suppliers.

But industry consolidation and increased reliance on suppliers creates greater supply chain risk, as the suppliers can become critical bottlenecks for design, manufacturing, and even aftermarket service. In addition, outsourcing to lower-cost countries has exposed companies to increased logistics and transportation challenges, along with greater global trade compliance requirements.

Figure 1: End-to-end supply chain visibility



To mitigate these risks, companies must modernize their supply chains to build more collaborative relationships, actively monitor leading risk indicators, and integrate supply chain metrics into program management and enterprise strategic planning processes. The impact of the pandemic has demonstrated how important it is for aerospace and defense companies to look to the supply chain as a source of competitive advantage and resilience through rapid innovation and agility, uncompromised quality and safety, and production efficiency gains.

Too often, collecting the information needed for supply chain risk management is a manual process, plagued by latency that significantly slows response time. The grim reality is that many aerospace and defense manufacturers and service providers operate in a reactive mode. Companies that embrace a 21st century supply chain will be better positioned to recover from current and future challenges, while establishing a sustainable competitive advantage.

“ Many A&D companies are leveraging their supplier network strength as research shows supplier relationships can play a major role in product development. These relationships could be of great significance when there is high technological complexity involved.”⁴

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This guide examines how supply chain visibility is a critical capability for supply chain risk management and should be a priority in digital transformation initiatives. The first section of this guide identifies many of the supply chain challenges aerospace and defense companies currently face; while the subsequent sections explore actions aerospace and defense companies can take to reduce supply chain risk.



Supply chain risk management

Commercial aviation suppliers were already in the midst of challenges surrounding the Boeing 737 MAX program before the pandemic started to have a negative impact on both commercial air travel and manufacturing operations. While the defense supplier industry was more stable prior to the pandemic, these suppliers also needed to find ways to return to work and keep employees safe to fulfill those contracts.

These suppliers are all dependent on each other to provide raw materials, components, and subassemblies—together creating a massive supplier ecosystem. According to [Deloitte](#): “Many A&D companies are leveraging their supplier network strength as research shows supplier relationships can play a major role in product development. These relationships could be of great significance when there is high technological complexity involved.”⁴

These differentiators are key to recovering after a crisis, and companies that invest strategically in digital transformation to secure their supply chains and anticipate demand will be best positioned to seize competitive advantage when the market returns.

A typical aerospace and defense supply chain can involve thousands of subcontractors. These relationships are multi-tier and multidimensional, with many participants involved in separate supply chains to support product line manufacturing, emerging product development, and aftermarket support.

A single company may participate in multiple roles and business models with its supply chain partners, and multiple points of interaction are required to maintain competitive cost and service levels. These complex relationships present some unique challenges that impact the efficiency and effectiveness of the aerospace and defense supply chain.

Figure 2: Ten risk archetypes threatening the aerospace and defense industry

RISK ARCHETYPE	DEFINITION
Sole source	Only one supplier is able to provide the required capability
Single source	Only one supplier is qualified to provide the required capability
Fragile supplier	A specific supplier is financially challenged/distressed
Fragile market	Structurally poor industry economics; potentially approaching domestic extinction
Capacity-constrained supply market	Capacity is unavailable in required quantities or time due to competing market demands
Foreign dependency	Domestic industry does not produce the product, or does not produce it in sufficient quantities
Diminishing manufacturing sources & material shortages (DMSMS)	Product or material obsolescence resulting from decline in relevant suppliers
Gap in domestic human capital	Industry is unable to hire or retain domestic workers with the necessary skill sets
Erosion of domestic infrastructure	Loss of specialized capital equipment needed to integrate, manufacture, or maintain capability
Product security	Lack of cyber and physical protection results in eroding integrity, confidence, and competitive advantage

Source: US Department of Defense⁶



The pandemic caused significant disruptions—perhaps most significantly because aerospace and defense suppliers were either directly or indirectly affected by facility shutdowns in China, a critical source of rare earth elements. With a dependence on sole-source suppliers—especially for the defense market—aerospace and defense companies have a vested interest in ensuring the viability of sole-source suppliers. A US Department of Defense (DoD) report identified ten risk archetypes threatening the US manufacturing and defense industrial base—five of which are related to limited sources of supply (see Figure 2).⁵

Single-source suppliers are similar to sole-source suppliers, with one critical distinction. A sole-source supplier is truly the only possible supplier available. With a single-source provider, multiple potential suppliers may exist, but only one meets the requirements of the commercial aviation industry or for government or military use.

These requirements include standards such as the AS9000, AS9120, and ISO 9000 series certifications for quality management; the new Cybersecurity Maturity Model Certification® (CMMC) for US DoD contracts; and global trade compliance regulations for conflict materials and sanctioned countries. It takes time for manufacturers to obtain these certifications and to be qualified as “prime vendors.”

Working with sole-source suppliers

More than other manufacturing industries, aerospace and defense depends on a particularly high concentration of sole-source suppliers. Procurement managers must identify suppliers based on material specifications, costs, transportation modes, and delivery timelines—perhaps even planning out over the next 10 years. For trusted suppliers, this has the advantage of ensuring quality, minimizing production downtime, and optimizing costs. However, supply disruptions, such as delivery delays or quality issues, can lead to missed program milestones and cost overruns.

Aerospace and defense companies need to adopt digital technologies that enable greater collaboration, active monitoring of leading risk indicators for supplier performance and quality, and integration of supply chain risk factors into program management and enterprise strategic planning processes.

Weathering long lead times and large inventory

Long lead times is one of the biggest supply challenges for the aerospace and defense industry. It can impact performance metrics such as on-time delivery, and can even lead companies to carry large levels of inventory to avoid potential supply shortages. An OEM or tier-1 supplier must consider the cascading effect of lead times throughout the entire supplier network in order to meet their delivery schedules. Unanticipated disruption at any part of the supply chain can lead to order cancellations and performance penalties.

When manufacturers can rely on the stability of a large order backlog for production planning, this improves the reliability of the entire supply chain through investments in advanced technology, more efficient processes, and workforce development.

Figure 3: Supply chain challenges in aerospace and defense

	DESIGN AND ENGINEERING	PLANNING	PROCUREMENT	MANUFACTURING	AFTERMARKET
Key challenges	Dependence on a large number of sole-source suppliers				
	Long lead time				
	Financial challenges across the supply chain for new A&D programs				
		Large inventory for commercial aerospace and diversified A&D			
		Management of collaboration across a complex supply chain			
		Cyber threats			

Source: Ernst & Young (EY)⁹

In contrast, the pandemic has led to a sharp decrease in airline capacity, lower demand for spare parts, and unexpected shifts in aircraft fleet mix. The downstream impact on the aerospace and defense industry can make these long lead times even longer and delivery dates less predictable.

In a study by the **Boston Consulting Group (BCG)**, an aerospace and defense supplier described what happened to it at the beginning of the pandemic: “Change orders are coming in nonstop. We closed our facility for a week and a half to take a pause. Customers had no idea what they wanted or needed.”⁷

With defense acquisition, these long lead times can be even longer, with typical procurement cycles for weapons systems ranging from 4 to 30 years. National security priorities and program milestones don’t change because of a pandemic or supply chain challenges. As a result, **governmental budgetary pressures**, combined with the effects of COVID-19, exacerbate the aerospace and defense supply chain challenges that exist when it’s “business as usual.”⁸

Enabling supply chain collaboration

The impact of the pandemic forced aerospace and defense executives to adjust their companies’ cost structures to changes in labor, material, and production demand—a troubling adjustment for a capital-intensive industry.

Most companies that have both commercial and defense lines of business saw significant shifts in the ratio of work. But if companies expect to be able to meet the inevitable demand for new commercial aviation products and technologies, they need to preserve their commercial and research and development (R&D) capabilities.

An uncertain market led to unstable demand signals. In response, OEMs focused on shoring up critical suppliers with additional support and sought new suppliers—particularly domestic ones. New suppliers, however, need greater oversight, and they likely have a limited history of their performance and quality metrics.

The introduction of new suppliers may also increase a company’s risk when it comes to revenue-sharing partnerships for new technology development, or building value chains for specific aircraft and defense platforms. To help reduce risk, aerospace and defense companies should enable each stage of the supply chain to respond more effectively to changes in any other part of the network. Accomplishing this requires greater transparency, better information flow, and stronger collaboration capabilities.

Aerospace and defense companies that rely on sole-source suppliers found themselves at even greater risk if the supplier was financially distressed. OEMs and tier-1 suppliers represent somewhat lower risk for aerospace and defense companies because the OEMs and tier-1 suppliers can spread their orders across multiple vendors to reduce procurement issues, but this can also mean higher costs for the aerospace and defense companies.

Gaining end-to-end visibility

Since 1996, the [supply chain operations reference \(SCOR\) model](#) has helped guide many companies' supply chain management processes by creating competitive advantage through planning, purchasing, manufacturing, and distributing products and services that provide value to customers.¹⁰

Driving efficiency is at the heart of creating these competitive advantages. Efficiency is a measure of performance (in terms of time and resources), and the SCOR methodology aligns these metrics into program management and strategic planning business processes.

The need for greater efficiency is a constant driving force—in both good times and bad. Aerospace and defense supply chains are continuously squeezed for incremental efficiency, often by reducing working capital and decreasing costs. Frequently asked questions include:

- How many days of on-hand or in-transit inventory can I reduce?
- How long are parts and finished goods sitting around collecting cost?
- How long does it take me to build a certain system?
- How long does it take me to quality check the system?

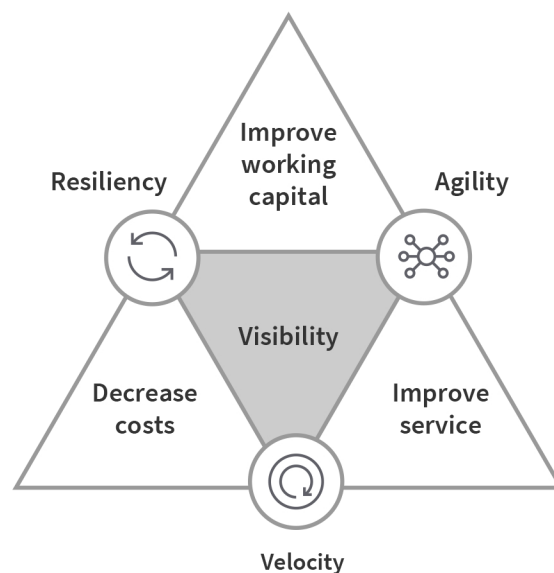
Unfortunately, efficiency often comes at the expense of resilience because efficiency is typically delivered by ruthless optimization of an existing environment, rather than by being adaptable to changes in that environment. For example, just-in-time (JIT) production techniques create very lean supply chains with minimal inventory, but JIT can also make businesses more vulnerable to disruptions.

According to Roger Martin in the [Harvard Business Review](#), “Resilient systems are typically characterized by the very features—diversity and redundancy, or slack—that efficiency seeks to destroy.”¹¹ The effect across an entire industry seeing greater efficiencies tends to be consolidation via mergers and acquisitions (M&A), reorganization for greater specialization, and fewer suppliers overall in a more fragile supply chain.

Figure 4: Key objectives of a best-in-class supply chain

Key objectives of a best-in-class supply chain

- Simultaneously optimize service levels and working capital
- Improve the resilience, agility, and velocity of the supply chain
- Increase visibility across the end-to-end supply network



Successfully striking a balance between efficiency and resiliency to reduce supply chain risk requires greater data visibility within the supply network. By connecting supply chain parties, collecting data, and using sensing signals in real time, companies can detect, coordinate, and resolve issues much more quickly.

This requires a platform for network connectivity and data visibility—a supply chain digital twin—that integrates with other business systems to automate common business processes. This can help free up supply chain experts for more complex tasks, such as scenario analysis and business continuity planning.

Multi-enterprise supply chain business networks

The key to end-to-end visibility is to have all trading partners connected with each other via a multi-enterprise supply chain business network (MESCBN). An MESCBN is much more than just a data transmission network for EDI messages, an enterprise resource planning (ERP) system, or a stand-alone supply chain tower.

An MESCBN connects with many other networks, provides a centralized source of shared information across enterprises, enables network-wide collaboration, and more. According to [Gartner](#), MESCBNs “are an essential technology component to a successful high-maturity, digital transformation.”¹²

“Multienterprise supply chain business networks (MESCBNs) are an essential technology component to a successful high-maturity, digital transformation.”¹²

GARTNER

Once a centralized information hub is established for data visibility and transparency, aerospace and defense companies can reap significant value from applying analytics and artificial intelligence (AI) to create new insights and instant responses across a supply chain.

Taking a networked approach

The supply chain for many organizations is multitier and multidimensional; but most organizations just use point-to-point connections between partners and their various enterprise systems.

The supply chain of a large enterprise can easily change 50 times per second, and most current supply chain structures can’t handle this massive amount of highly dynamic data.¹³ Visibility is often poor and incomplete, forcing organizations to operate in a reactive mode. This lack of visibility and agility is the result of organizations taking an enterprise-centric approach to solve what is actually a multi-enterprise problem.



The only way to overcome these limitations is to take a networked approach. A single-network execution approach enables all parties to share common processes, data, and information—in real time—to determine the optimal courses of action and better serve the customer.

Best-in-class supply chain solutions should enable organizations to:

- Identify key suppliers and build collaborative risk-sharing relationships
- Map out the supply chain at multiple levels to identify key risk points and relationships for proactive management
- Monitor and manage multiple supply chain tiers and dimensions using analytics to quickly identify and address problems
- Support unique EDI requirements of trading partners
- Incorporate global trade compliance requirements in a secure end-to-end supply chain

Engaging smart logistics

Smart logistics leverages end-to-end visibility with connected devices and asset tracking tools to improve the way that companies manage inventory, design their warehouses, transport items, and provide more seamless customer support. This focuses on the operational aspects of the supply chain and involves stakeholders from across the value chain—from raw material suppliers to manufacturers, third-party logistics (3PL) providers, freight forwarders, and distribution centers.

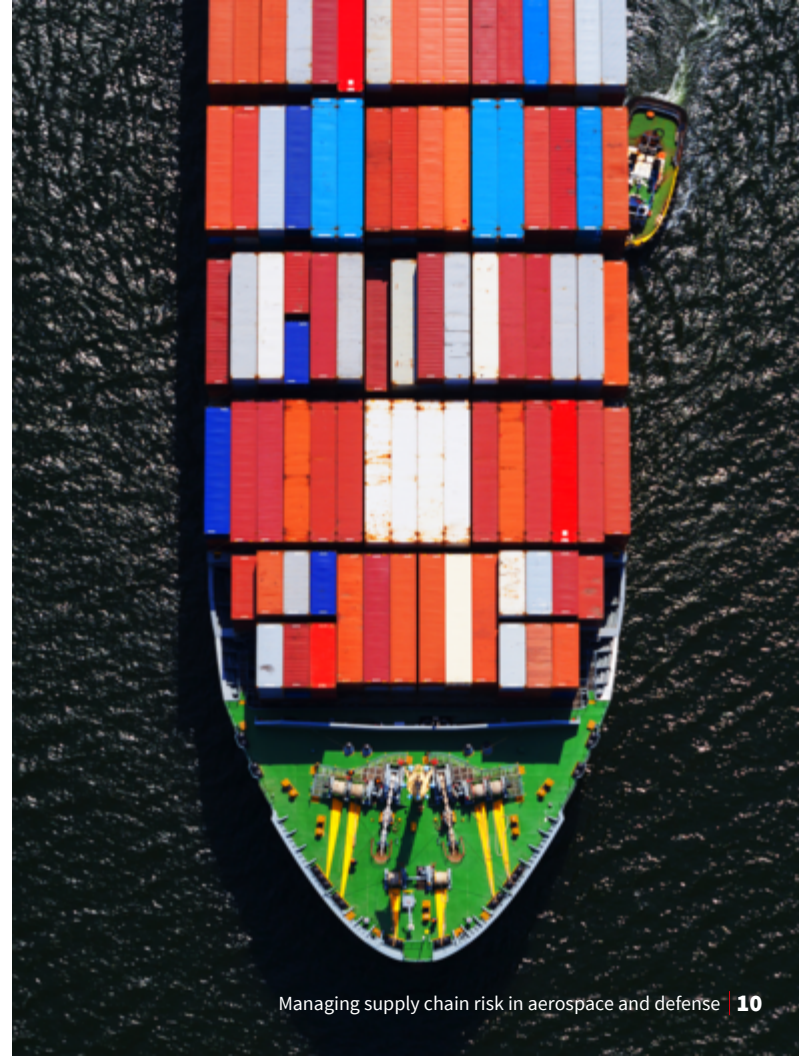
New technologies can enable built-in traceability features as part of manufacturing and distribution processes, reducing the risk of counterfeit parts in mission-critical systems. OEMs can incorporate onboard equipment sensors and use a centralized analytics platform to consolidate data from many owner-operators to more accurately predict maintenance requirements from a much larger pool of data.

“The vision for autonomous planning is one in which big data and advanced analytics are used in every step of the supply chain planning process, enabling faster and better decision making with minimal manual intervention.”¹⁵

MCKINSEY

A smart logistics solution integrates a company’s supply chain with other business processes such as transportation management and customer service to improve key performance metrics. This can potentially create new sources of revenue, such as:

- Asset and parts traceability
- Global in-transit tracking
- Predictive ETA and transportation management
- Asset condition monitoring
- Predictive maintenance and logistics



Practicing smart procurement

Smart procurement technologies enable more strategic decision-making by automating repetitive tasks related to selecting goods and services, enforcing compliance, receiving and reconciliation, and invoicing and payment. While many organizations use a procurement module integrated with their ERP systems or accounting software, it's not always the best tool to deliver business benefits such as more strategic sourcing, better supplier engagement, and optimized payment cycle management. Spend analysis, contract summaries, and scenario planning are still often manually conducted outside an ERP system using reporting tools that are not integrated back into executable business processes.

Data-driven, decision-making tools and process automation can help organization move towards an "autonomous planning" approach that's more efficient, more agile, and more embedded into the enterprise. According to [McKinsey](#), "The vision for autonomous planning is one in which big data and advanced analytics are used in every step of the supply chain planning process, enabling faster and better decision making with minimal manual intervention."¹⁴

Supply chain solutions for today's aerospace and defense companies should include these capabilities:

- Automated procure-to-pay processes
- Supplier performance tracking, due diligence, and risk profiling
- Improved category management
- Smart contracts based on compliance and policy flowdowns
- Digitized demand sensing and planning

Building supply chain resilience

Supply chain resilience is important any time, but it's especially critical during times of disruption, such as the 2020 global pandemic. Even as the impact of the pandemic fades, another crisis could be on the horizon. In fact, [McKinsey](#) reports that companies with global value **chains can expect supply chain disruptions lasting a month or longer to occur an average of every 3.7 years.**¹⁵

The best way for aerospace and defense companies to increase supply chain resilience is through a digital ecosystem that creates value for all stakeholders by sharing data, collaborating on business processes, and broadcasting clear and stable demand signals across the supplier network. Increased visibility and transparency will improve supplier relationships and enable more efficient production planning. It may even prevent companies from exiting the market and creating critical gaps in the supply chain. Multi-enterprise supply chain business networks deliver on many of the capabilities needed to build a more resilient 21st century supply chain and transform aerospace and defense companies.

¹ Deloitte, [Midyear outlook: 2020 aerospace and defense industry outlook](#), July 2020, p. 3.

² Deloitte, [Midyear outlook](#), p. 4.

³ Deloitte, [Midyear outlook](#), p. 4.

⁴ Deloitte, [What makes high performing A&D companies tick?](#), 2018, p. 11.

⁵ US Department of Defense, [Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States](#), September 2018, p. 45.

⁶ US Department of Defense, [Assessing](#), p. 46.

⁷ By Greg Mallory, Thomas Peddicord, Lacy Ketzner, and Joshua Brenner, "Fixing the Vulnerabilities in the A&D Supply Chain," Boston Consulting Group (BCG), July 31, 2020.

⁸ McKinsey & Company, [Modernizing military acquisition and sustainment for the 21st century](#), September 2020, p. 2.

⁹ Ernst & Young (EY), [A&D Edge: Supply chain management in aerospace and defense](#), February 2018, p. 2.

¹⁰ Sarah K. White, "What is SCOR? A model for improving supply chain management," CIO, October 10, 2018.

¹¹ Roger L. Martin, "The High Price of Efficiency," Harvard Business Review, January 2019.

¹² Christian Titze, William McNeill, Bart De Muynck, "Magic Quadrant for Multienterprise Supply Chain Business Networks," Gartner, May 4, 2020.

¹³ Derek du Preez, "Can Infor solve the autonomous supply chain problem for the enterprise?," Diginomica, July 1, 2019.

¹⁴ Christoph Kuntze, Shruti Lal, and Karl Seibert, "Launching the journey to autonomous supply chain planning," McKinsey & Company, June 3, 2020.

¹⁵ [Risk, resilience, and rebalancing in global value chains](#), McKinsey Global Institute, August 2020, p. iv.

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