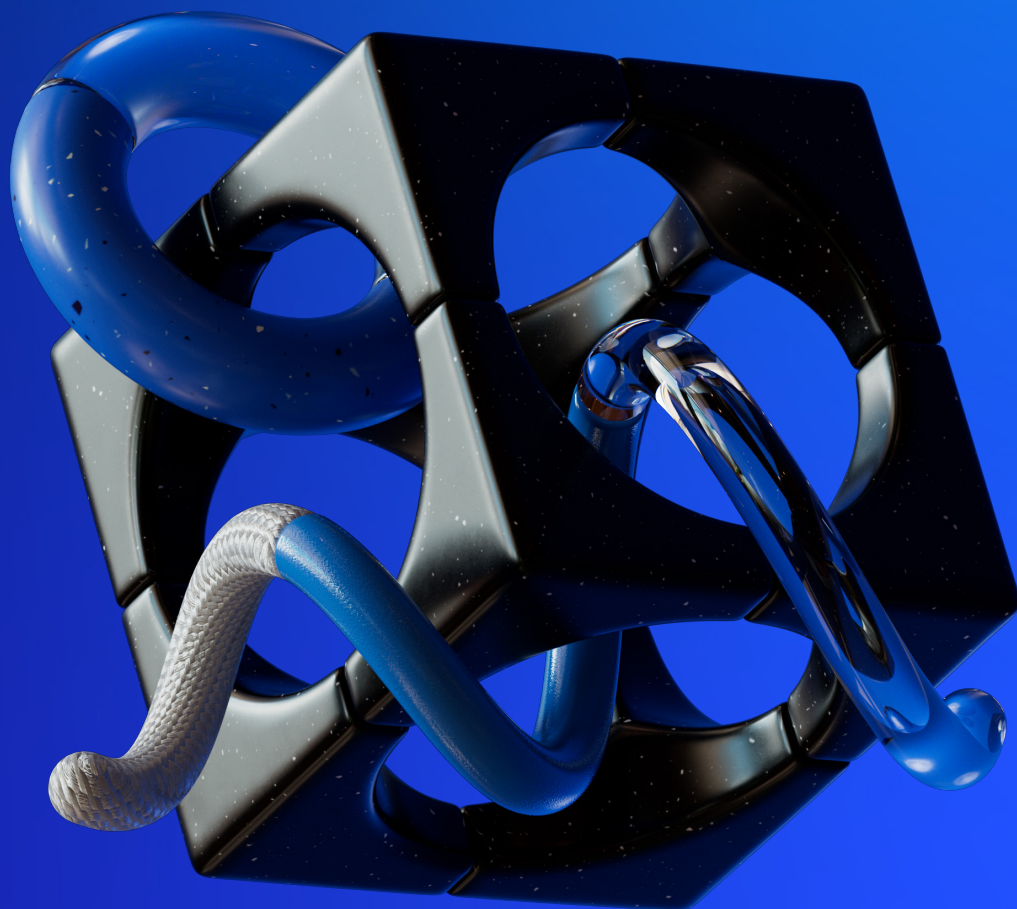


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# Creating an IT Partnership for Supply Chain Transformation

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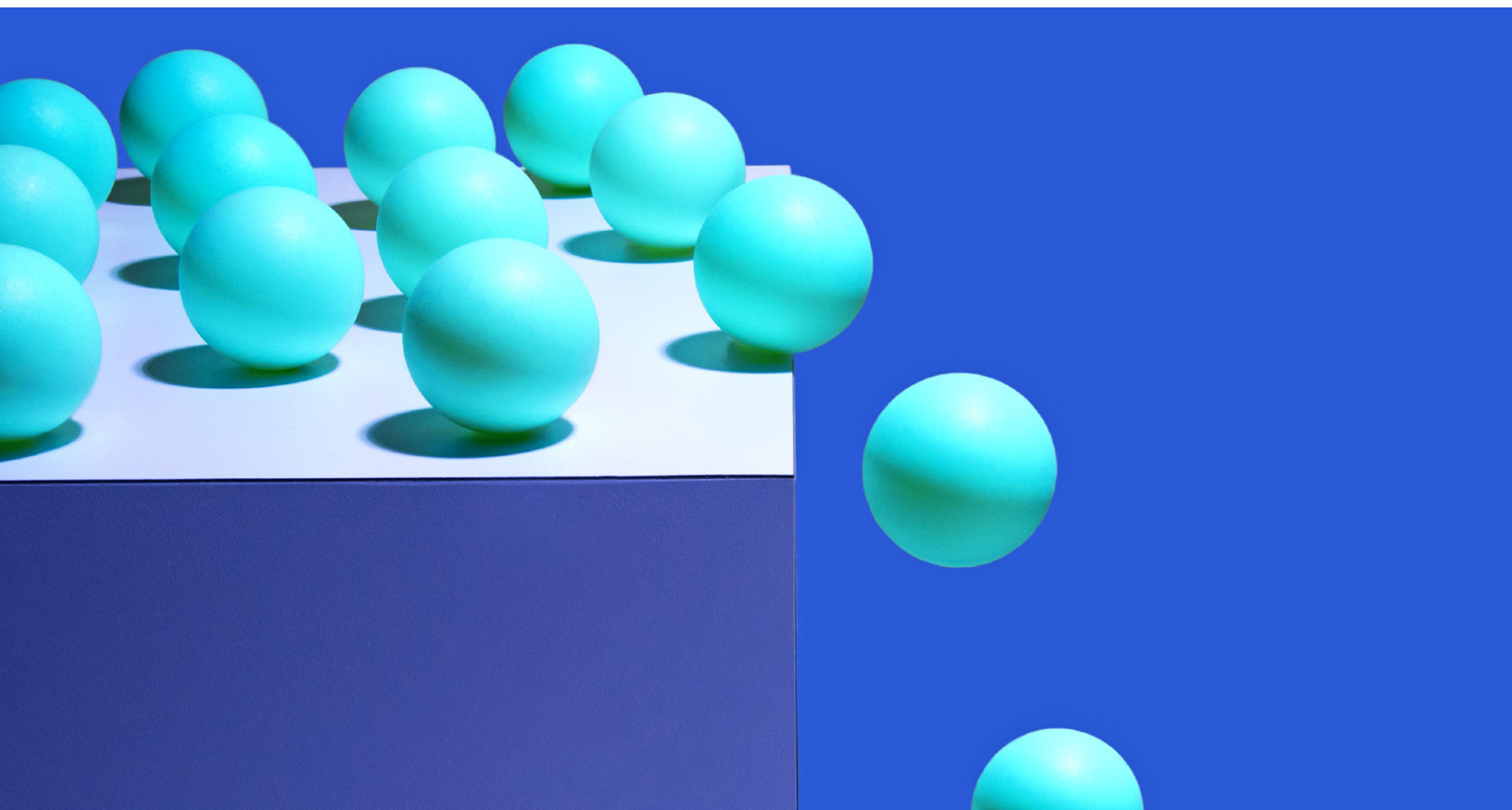


Operations Practice

# Supply chains: Still vulnerable

When it comes to supply chain resilience, have companies taken their eyes off the ball?

by *Knut Alicke* and *Tacy Foster*  
with *Vera Trautwein*



**Supply chain disruptions** keep on coming. From missile attacks on commercial shipping in the Red Sea to automotive production delays following floods in Europe, global supply chains continue to experience instability. Meanwhile, trade tensions are choking the movement of semiconductor products, manufacturing equipment, and critical materials.

The latest McKinsey Global Supply Chain Leader Survey suggests that problems like these remain the norm, not the exception, with nine in ten respondents saying they have encountered supply chain challenges in 2024 (see sidebar, “About the research”). More worryingly, there are signs that, when it comes to supply chain resilience, companies are taking their foot off the gas. The survey results identify considerable gaps in the ability of organizations to identify and mitigate supply chain risks, with few new initiatives aimed at addressing those weaknesses.

The biggest gap could be the one at the top of the organization. Few surveyed supply chain executives believe that their boards have an in-depth understanding of supply chain risk. Only a quarter have formal processes in place to discuss supply chain issues at board level. All this could leave companies dangerously exposed to future disruptions.

### **A brief history of turbulent times**

Since 2020, McKinsey has conducted annual surveys of supply chain leaders to ask about the performance of their supply chains, the impact of volatility and disruption on their supply chains, and their efforts to manage those challenges. The surveys occurred during a period of unprecedented supply chain turbulence that included the COVID-19 pandemic and its aftermath. This environment pushed supply chains to the top of the agenda, as companies took action to keep their businesses running in difficult conditions.

Those actions were initially rapid, tactical changes, with a focus on larger inventories and buffer stocks. But companies also took more strategic actions, accelerating projects to improve supply chain visibility, revamping their planning capabilities, and pursuing regionalization and dual-sourcing strategies to improve structural resilience.

### **Progress made**

Our latest research shows that companies are now reaping the benefits of the strategic resilience projects they have implemented over the past three years. Supply chain footprints are evolving, with 73 percent of survey respondents reporting progress on dual-sourcing strategies. Additionally, 60 percent of respondents are acting to regionalize their supply chains.

Survey respondents also report good progress in their efforts to improve supply chain intelligence, planning, and risk management. The share of respondents with comprehensive visibility of their tier-one suppliers reached 60 percent, making this the second year in a row that this measure has increased by ten percentage points. More than three-quarters of companies believe they have sufficient internal capabilities to manage supply chain risk, along with effective decision-making structures.

Two-thirds of survey respondents say that they are making progress in the implementation of advanced-planning and -scheduling (APS) systems. These systems make up a key component of modern supply chain digitization. They enable companies to plan more accurately, respond to disruptions more rapidly, and improve their resilience by evaluating multiple supply chain scenarios.

Furthermore, companies are beginning to unwind the short-term measures that they put in place during and immediately after the COVID-19 pandemic. The number of survey respondents relying on bigger inventory buffers to manage disruptions has fallen sharply to 34 percent,

## About the research

The fifth annual McKinsey Global Supply Chain Leader Survey was conducted among senior supply executives from a range of industries and geographies

(exhibit). A total of 88 leaders completed the in-depth survey, which asked them about the status and evolution of their supply networks, planning, digitization,

and risk management processes. Responses were collected between April 26 and June 10, 2024.

Exhibit

### We surveyed 88 global supply chain leaders across seven industries about their networks, planning, digitization, and risk management.

Survey respondents, %



Source: McKinsey Global Supply Chain Leader Survey, April 26–June 10, 2024

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from 59 percent. Some of that drop was forced upon them, however: 6 percent of respondents report that they wanted to increase safety stocks but were prevented from doing so by cash or capacity constraints.

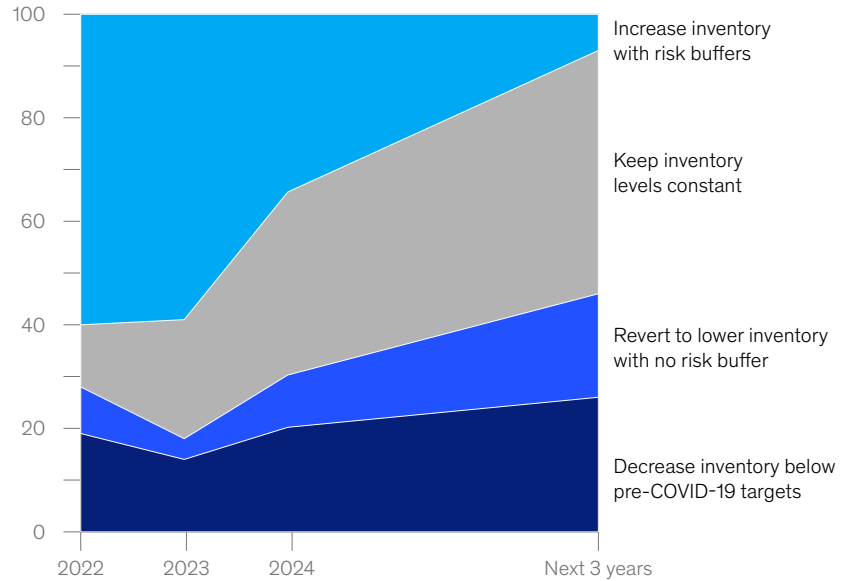
Perspectives on future inventory strategy are evenly split among survey respondents (Exhibit 1). A share

of 47 percent say that they plan to keep their overall inventories at current levels, with some planning changes in assortment or location across their networks. Meanwhile, 46 percent of respondents expect to reduce or eliminate risk buffers, with inventories falling back to or below prepandemic levels. Only 7 percent are planning further increases in network inventory.

Exhibit 1

## Inventory buffers are no longer the preferred way to mitigate supply chain risks.

**Inventory management approach over previous year and planned for next 3 years,<sup>1</sup>**  
% of respondents



<sup>1</sup>Question: How have your inventory levels evolved across your global network (raw materials to finished goods) in the last year?  
Source: McKinsey Global Supply Chain Leader Survey, April 26–June 10, 2024 (n = 88)

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### Progress slowing

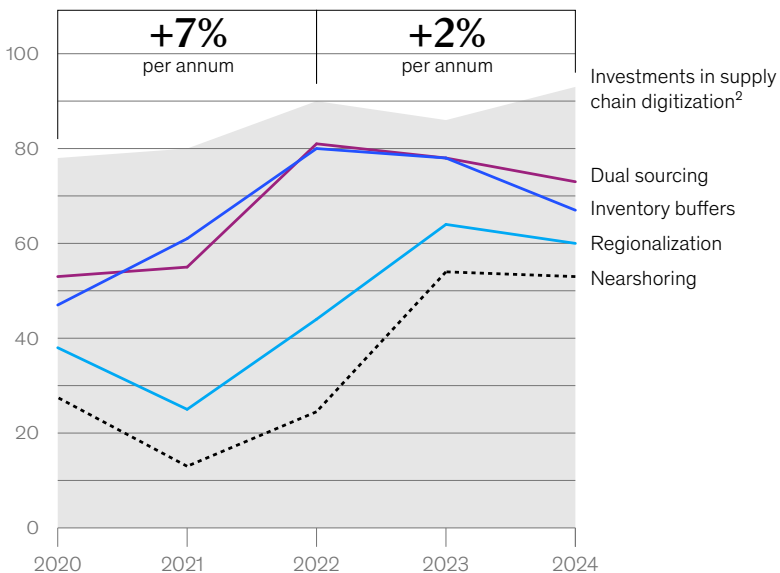
There are also plenty of signs that the revolution in supply chain resilience is losing momentum. The percentage of respondents pursuing dual-sourcing, regionalization, or nearshoring strategies has

remained flat over the past two years, for example (Exhibit 2). Overall investment in supply chain digitization is leveling off after rapid growth between 2020 and 2023.

Exhibit 2

**Companies are implementing fewer measures to improve supply chain resilience, and recent growth in digital spend is slowing.**

**Footprint resilience measures in implementation over previous year,<sup>1</sup> % of respondents**



<sup>1</sup>Question: Which of the following footprint resilience options (if any) have you already started or completed implementing in the last year?

<sup>2</sup>Question: To what extent have you increased investment in digital supply chain technologies in the last year?

Source: McKinsey Global Supply Chain Leader Survey, April 26–June 10, 2024 (n = 88)

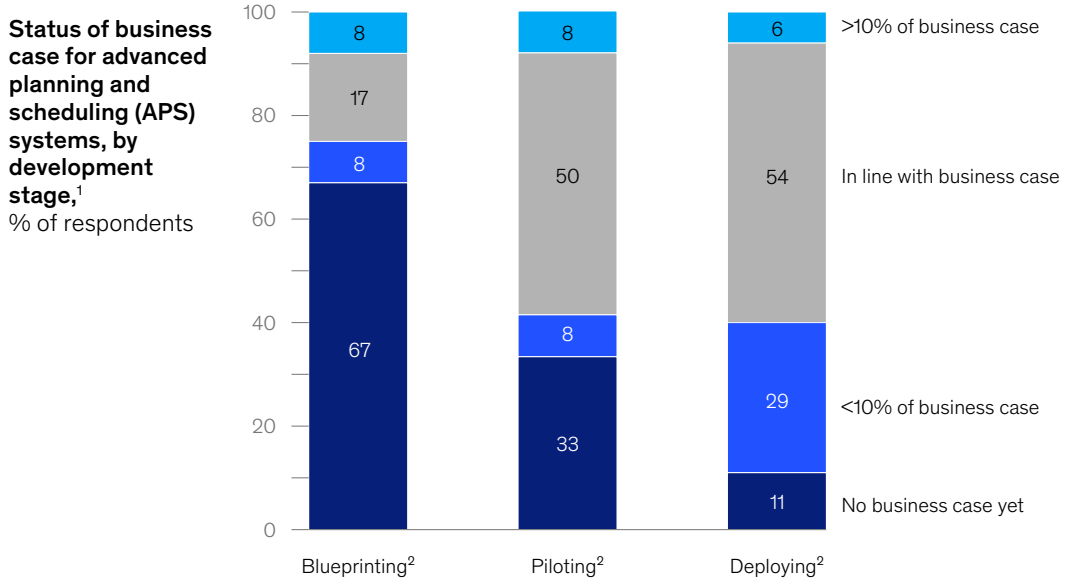
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While two-thirds of surveyed companies are investing in APS systems (up 14 percentage points from the previous year’s numbers), only 10 percent have completed their deployments. And companies are unclear about the value that these

systems deliver. One-third of respondents admit that they don’t have quantified business cases for APS systems, and 15 percent say that their implementations haven’t met business objectives (Exhibit 3).

Exhibit 3

**Companies are slow to create the business case for advanced planning and scheduling systems.**



Note: Figures may not sum to 100%, because of rounding.  
<sup>1</sup>What is the value captured from APS deployment?  
<sup>2</sup>What is the current status of your APS deployment?  
 Source: McKinsey Global Supply Chain Leader Survey, April 26–June 10, 2024 (n = 88)

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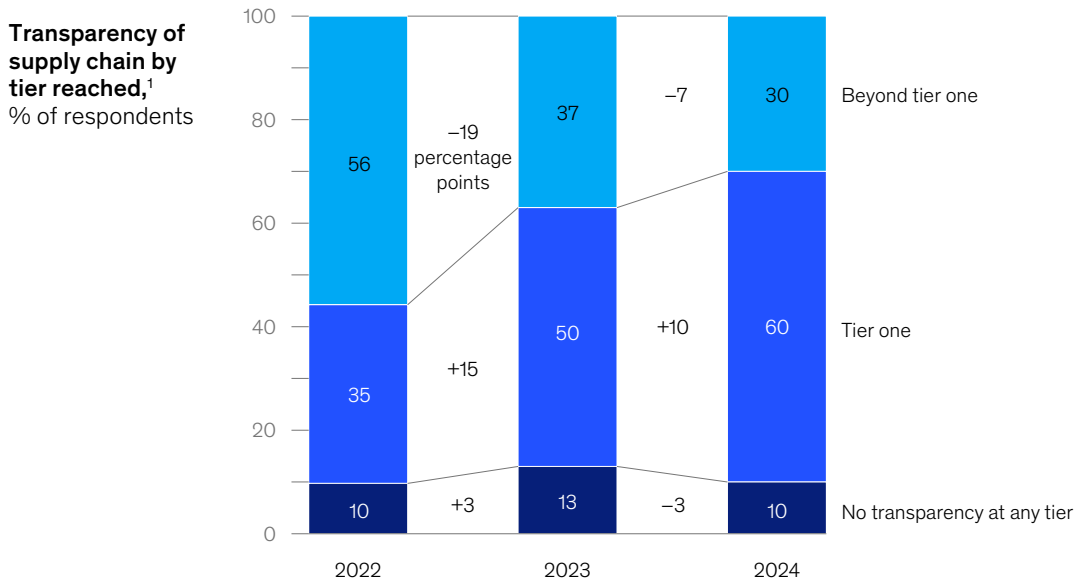
**Considerable gaps remaining**

This slowdown in resilience-boosting activity for supply chains would be understandable if organizations had completed the work that they set out to do. But survey respondents are all too aware of limitations in their supply-chain-management

systems. Companies continue to improve their understanding of direct suppliers, for example. The share of respondents who say that they have good visibility into deeper levels of the supply chain fell by seven percentage points, the second consecutive annual decline in this measure (Exhibit 4).

Exhibit 4

### Tier-one transparency continues to increase, but at the expense of deeper-tier analysis.



Note: Figures may not sum to 100%, because of rounding.  
<sup>1</sup>Question: How would you describe your multitier transparency today as a consequence of the supply chain disruptions of the past year(s)?  
 Source: McKinsey Global Supply Chain Leader Survey, April 26–June 10, 2024 (n = 88)

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This should be a concern because major disruptions often start deep in the supply chain. And once companies experience a supply chain disruption, it takes them an average of two weeks to plan and execute a response—much longer than the typical weekly cycle for sales and operations execution.

Meanwhile, pressure for better transparency in the deep-tier supply chain is rising. New supply chain laws increasingly require companies to ensure that all inputs are produced in compliance with environmental and human rights standards. The European Union’s Corporate Sustainability Due Diligence Directive is already in force for some companies, for example. Only 9 percent of survey respondents say that their supply chains are currently compliant with the new rules, with 30 percent admitting that they are behind or significantly behind in their compliance efforts.

A shortage of talent, particularly digital talent, continues to hamper supply chain transformation efforts. Of those surveyed, 90 percent say that their companies lack sufficient talent to meet their digitization goals. That number hasn’t changed in any meaningful way since the first survey in 2020.

Survey respondents also remain concerned that their senior management teams have a limited knowledge of supply chain issues. The share reporting that their boards have a deep understanding of supply chain risks increased this year but remains low at 30 percent. Perhaps more concerning is a steep drop in the frequency that supply chain risks are discussed at a senior-management level. In the 2023 survey, almost one-half of respondents said that their organizations had a regular reporting cadence for supply chain risk. This year, that share dropped to one-quarter, with most companies reverting to ad hoc reporting in response to disruptions or the emergence of major new risks.



## The way forward

To stay ahead of future supply chain challenges, companies must continue their ongoing efforts to build resilience and take new actions to address blind spots in their systems, processes, and capabilities. The data from our survey provide some insights into how this can be achieved.

### Don't let imperfect data be the enemy of good digitization

Data issues make up a major bottleneck for many ongoing digitization projects. While there is a correlation between data quality and the value achieved from digital efforts with supply chains, no survey respondents with deployed APS systems think that their data are perfect, yet many are satisfied with the performance of their new systems.

This suggests that companies might benefit from approaching data quality with the 80/20 rule by pressing on with the implementation of digital tools once most data are available, with processes in place to fix the gaps later.

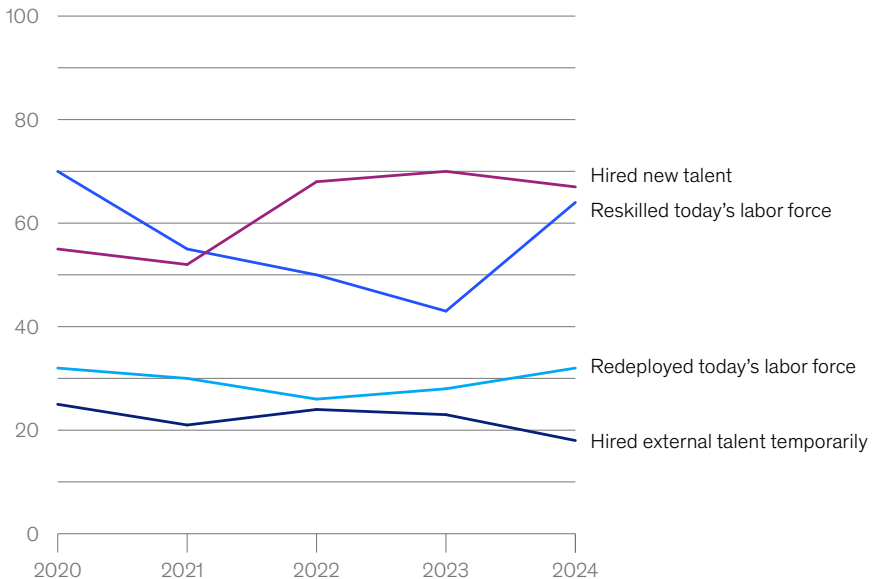
### Take on the talent-building challenge

The past three years have seen a dramatic shift in how companies approach digital-talent acquisition (Exhibit 5). After slightly favoring a homegrown approach in 2021, most respondents had turned to the market to fill talent gaps by 2023. This year, the pendulum has been swinging back again. Faced with an acute shortage of digital talent across all industries, company leaders are now revamping their internal training and talent development

Exhibit 5

## Supply chain leaders are pivoting back toward in-house training programs.

**Talent development actions taken over previous year,<sup>1</sup>**  
% of respondents



<sup>1</sup>Question: Which actions have you taken to get the right digital talent for your supply chain organization in the last year?  
Source: McKinsey Global Supply Chain Leader Survey, April 26–June 10, 2024 (n = 88)

capabilities. In the long run, this may be the most effective way to secure a sustainable supply of skills.

### Accelerate the adoption of AI

The rapid development of advanced digital tools is opening new opportunities in supply chain planning, operations, and risk management (Exhibit 6). These tools are already shaping organizations' digitization plans, as evidenced by a substantial increase in interest in demand-planning tools. In the coming years, we expect these technologies to provide additional functionality in other areas.

A major opportunity is in supply planning: AI systems can automate the analysis of multiple structured and unstructured data sources from multiple supplier tiers, logistics providers, shop

floor data systems, and in-house demand-forecasting systems. Another is in early-warning systems for potential supply chain risks that evaluate data from sources as diverse as supplier financial information, long-range weather forecasts, and social media traffic.

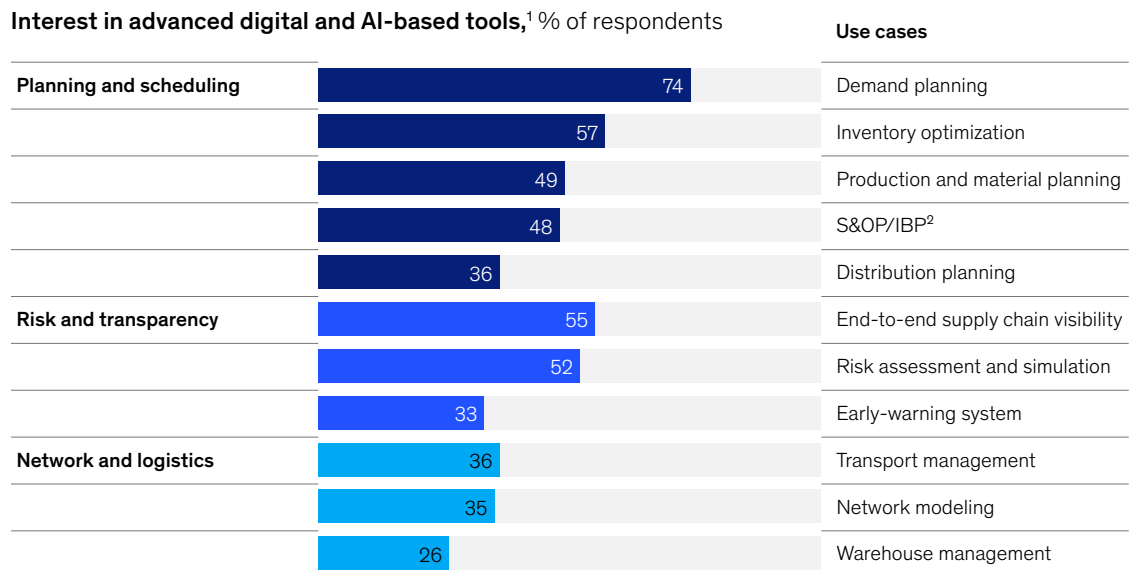
### Close the boardroom gap

Supply chain leaders failed to grab a seat at the top table when supply disruption was at the forefront of senior-management teams' agenda. Now they must find ways to educate and inform senior management about supply chain issues and challenges. Best practice here is still rare, but some survey respondents are taking proactive steps, including giving regular board updates on major risks, risk trends, and potentially disruptive events;

Exhibit 6

## Interest is rising in AI-based supply chain tools, especially for demand planning.

Interest in advanced digital and AI-based tools,<sup>1</sup> % of respondents



<sup>1</sup>Question: In which supply chain areas have you or are you planning to implement advanced analytics beyond your enterprise resource planning and advanced planning and scheduling systems (eg, optimization algorithms, machine/reinforcement learning, deep learning, predictive modeling, AI, gen AI, robotic process automation)?

<sup>2</sup>Sales and operations planning/integrated business planning.

Source: McKinsey Global Supply Chain Leader Survey, April 26–June 10, 2024 (n = 88)

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integrating risk analysis more explicitly into sale- and operation-planning processes; and publishing regular risk reports and quantitative risk indicators.

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While companies have made strides in strengthening their supply chains, the latest McKinsey Global Supply Chain Leader Survey shows that substantial vulnerabilities remain. A slowdown in resilience-building efforts, gaps in supply chain visibility, compliance challenges, and talent shortages leave many organizations exposed to future disruptions. To safeguard against these risks, businesses must prioritize ongoing digitization, talent development, and proactive risk management while ensuring that supply chain issues receive attention at the highest levels of leadership.

Is your organization paying enough attention to supply chain resilience? As a simple gauge, consider how many of these questions you can confidently answer with “yes”:

- Do you have a plan to build or acquire the digital talent your supply chain needs?
- Do you understand the risk status of your tier-two and tier-three suppliers?
- Do you have an effective early-warning system for internal and external supply chain risks?
- Does your supply planning use AI to evaluate risk scenarios quantitatively?
- Is your average time to recovery from supply chain disruptions less than one week?
- Does your board thoroughly understand supply chain risks?
- Is your board willing to budget for the mitigation of supply chain risks?

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Operations Practice

# The winning recipe for transforming advanced planning systems

Most supply chain leaders will overhaul their IT systems for planning in the coming years. This article shows how to increase the chances of success.

*by Valerio Dilda, Annouck Driesen, Pierluigi Fenelli, and Julian Fischer*



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**Last year**, McKinsey conducted a survey of a dozen global supply chain leaders across industry sectors to understand what changes could be expected in IT for supply chain planning over the next five years.<sup>1</sup> One of the survey's key findings was that 90 percent of respondents expected to overhaul their current planning IT.

In recent years, the COVID-19 pandemic and various destabilizing geopolitical events have made the need to strengthen global supply chains more urgent. Many companies have shifted from manual short-term solutions to longer-term solutions that incorporate advanced technologies, such as advanced prediction and optimization algorithms.

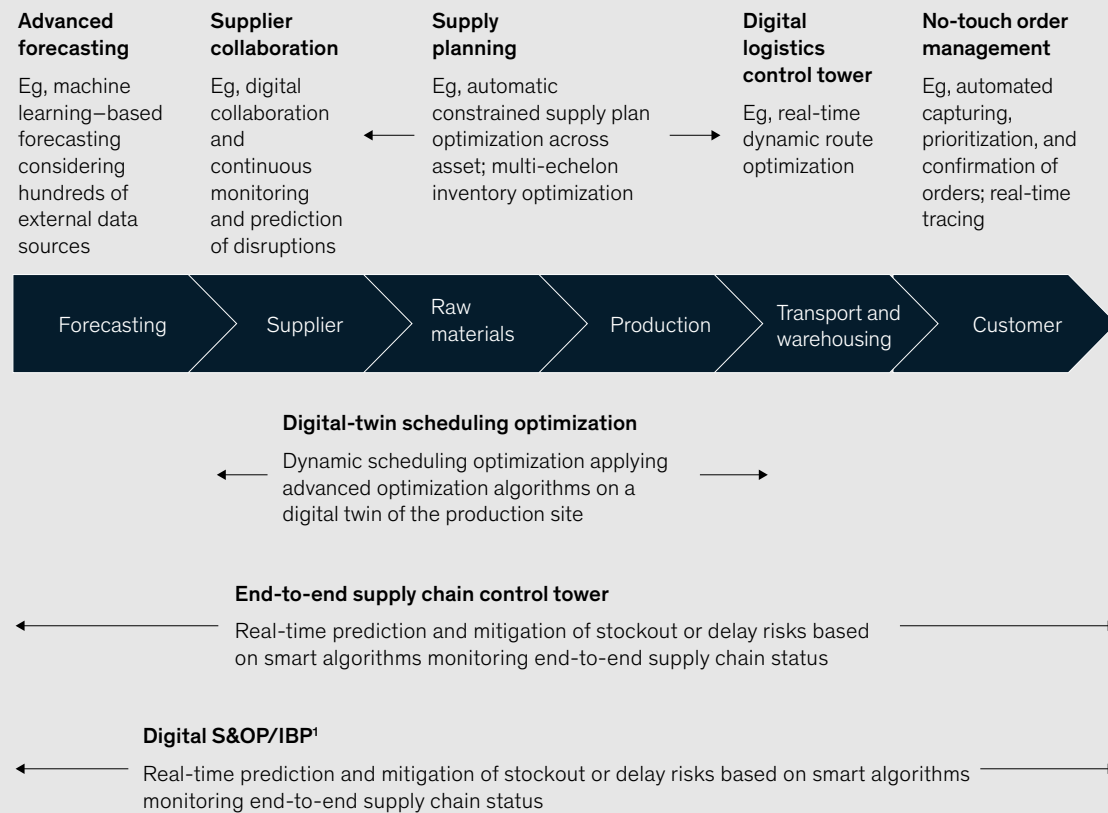
<sup>1</sup> Marilú Destino, Julian Fischer, Daniel Müllerklein, and Vera Trautwein, "To improve your supply chain, modernize your supply-chain IT," McKinsey, February 9, 2022.

## What are advanced planning systems?

Advanced planning systems (APs) are applications or software that enable industry leaders to plan the end-to-end supply chain and coordinate tasks such as advanced forecasting, demand planning, supplier collaboration, material planning, production planning, distribution planning, and order management (exhibit).

Exhibit

### Advanced planning systems can enable integrated business planning of the end-to-end supply chain.



<sup>1</sup>Sales and operations planning and integrated business planning.

Such technologies are not limited to monolithic architectures and are often the result of advanced planning systems (APSs) that combine bespoke advanced-analytics (AA) models for increased functionality (see sidebar “What are advanced planning systems?”).

In a follow-up survey we conducted with 80 companies involved in digital-planning transformations that focused on the deployment of an APS, we found a wide range of ROI across companies, with the most successful companies achieving returns four times higher than the median.

This article focuses on the recipe that supply chain leaders can use to overcome challenges and achieve the highest impact during their transformations. This winning recipe is designed

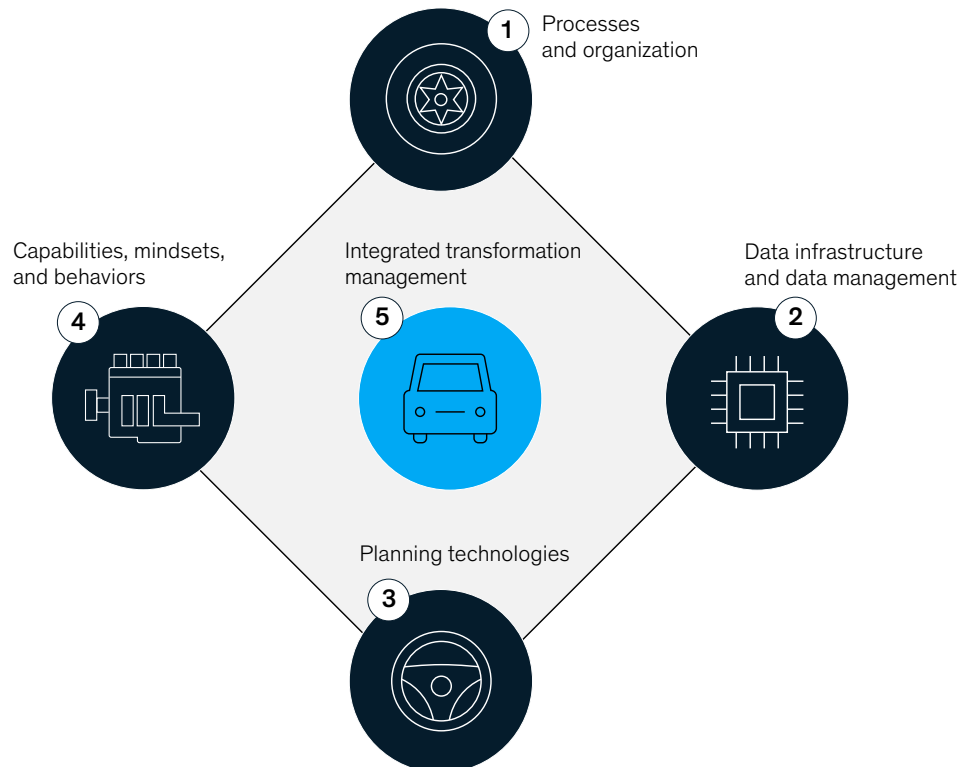
to support APS-centered digital-planning transformations and to make supply chains more resilient, effective, and efficient.

### The five ingredients of a successful APS transformation

According to our survey respondents, more than 60 percent of supply chain-planning IT transformations take more time or money than expected or don’t achieve anticipated business outcomes. The winning recipe for a successful transformation requires integrating five ingredients to deliver at-scale impact (Exhibit 1). Much as a vehicle needs all of its elements, if one part of the system is missing, the vehicle won’t function as intended.

Exhibit 1

### Integrated advanced planning systems transformations require five key ingredients.



Linking these five ingredients will require fundamental shifts in the ways of working for organizations undergoing APS transformations. Making these shifts can help organizations achieve their business goals on time and under budget.

### **1. Processes and organization: How to defeat the attitude that ‘things have always been done this way’**

A digital-planning transformation is not only an IT matter. It is first and foremost a redesign of planning processes, with a significantly higher degree of cross-functional integration. Simply laying new tech on top of old processes misses several opportunities for optimization, including offering value-added services to customers or driving profitability through the coordination of sales and operations.

Companies should understand “what good looks like” by getting a view of best-practice planning processes, which include demand, supply, logistics, and sales and operations planning—as well as the control tower, inventory management, scheduling, and collaboration with suppliers.

At the outset of the transformation, companies should invest the necessary amount of time into mapping every step of the process in conjunction with bottom-up impact analysis. This can help ensure that any newly implemented process supports the value drivers.

To address process and organization, companies should take the following actions (for an example, see sidebar “Example: Life sciences company”):

- Orchestrate processes and automate routine tasks, such as data updates, communication, and stakeholder input gathering.
- Design for critical executive decisions with readily available data and governance that facilitate alignment between commercial, logistics, production, and procurement.
- Enable comprehensive views of important risks and opportunities via root-cause analysis—for example, pegging orders to their raw materials.
- Embed process changes and improvements over several cycles, enabling incremental adoption of the new mindset and process.
- Create transparency for where new processes can be diverted by documenting process exceptions, such as when expediting orders creates supply chain inefficiencies.
- Monitor end-to-end supply chain performance and adherence with real-time dashboards to track system adoption and proper system decision making.<sup>2</sup>

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<sup>2</sup> For more on improving supply chain performance, see Jan Henrich, Jason Li, Carolina Mazuera, and Fernando Perez, “Future-proofing the supply chain,” McKinsey, June 14, 2022.

## **Example: Life sciences company**

A large global pharmaceutical manufacturer managed to achieve a major inventory reduction, top industry service levels, and improved efficiency through an advanced planning system (APS) transformation. This improvement was made possible by defining overarching standardized end-to-end processes and operating models that were both global and specific to the business units. In particular, the organization worked to change its planning capabilities, such as moving from fragmented to end-to-end planning. Instead of viewing the APS transformation as an IT project and appointing project managers from the business side and IT separately, the organization created a joint team that brought together IT, business leaders, and process consultants. In this way, the organization carried out the APS transformation in parallel with reengineering processes, resulting in agile three-way communication.

By the time the system is ready for transformation, companies should be ready to implement the designed process. Any divergence from the target design state should be monitored for both primary and secondary processes.

**2. Data infrastructure and data management: How to overcome insufficient data readiness**

Digital planning requires four system layers to integrate seamlessly: a system of innovation in which to use machine learning and other innovative solutions, APS as a core planning software (system of differentiation), a system of consolidation where multiple sources are harmonized and consolidated in the data lake, and a system of record where the company's enterprise resource planning (ERP)

systems typically have the majority of source data (Exhibit 2).

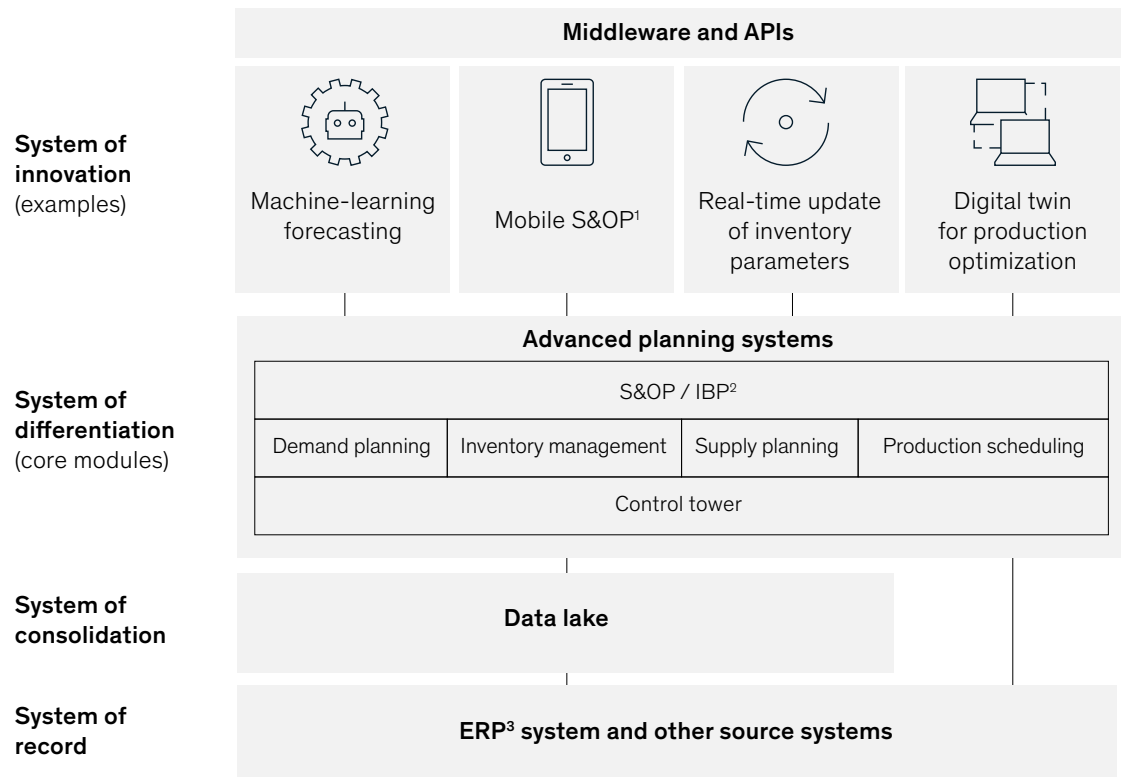
Automated data integration is challenging and should not be underestimated. What makes the difference in terms of impact is the timely availability and quality of the data with which the systems work. Even though most leaders are aware of this issue, we continue to see companies oversimplify the work, overestimate the capacity of their teams or their resources, and lack the necessary accountability for data preparation.

Treating data like a product can reduce the time and effort needed to implement new use cases by as much as 90 percent.<sup>3</sup> On this point, APSs often

<sup>3</sup> For more on what treating data like a product looks like, see Veeral Desai, Tim Fountaine, and Kayvaun Rowshankish, "How to unlock the full value of data? Manage it like a product," McKinsey, June 14, 2022.

Exhibit 2

**Digital planning requires seamless integration of what is typically four system layers.**



<sup>1</sup>Sales and operations planning.  
<sup>2</sup>Integrated business planning.  
<sup>3</sup>Enterprise resource planning.



have a well-defined data model, which is critical to scale the system. Today, companies are capable of preparing 70 percent of the necessary data tables in their own data lake well before the start of the actual transformation.

Typically, companies build a view or data tables that map to the APS vendor data model. Doing so can derisk future data pipeline issues. Data engineering inside the APS application is not easily accessible by users and can be considered a black box, and data changes upstream will likely cause data pipeline issues in the APS system. Companies therefore will need a hotline to an APS support organization to help them resolve the issues.

To address data integration and architecture, companies should take the following actions (for an example, see sidebar “Example: Large global agricultural company”):

- Integrate, contextualize, and harmonize necessary data inside the company’s cloud. Build well in advance a view or data tables that map to the APS vendor data model. ERP systems will be the main source of information; however, many companies are running with different ERP systems, and some critical data will likely not reside in the ERP system.
- Set up a system and data architecture to support real-time decision making and optimize load times between local data updates and the APS user system.

- Institute the management of master data. Planning systems are built on master data, and even though old processes might not surface problems, the newer process will almost certainly suffer.
- Review transactional-data accuracy and timeliness. Transactional-data updates should be real time (at the inventory level, for example) and synchronized. In addition, companies should review the accuracy of data related to details such as arrival times and product weights.

### **3. Planning technologies: How to avoid paying for something that isn’t used to its full potential**

Companies often select an APS vendor based on its industry experience or the number of installations the vendor has done. In a second stage, companies create a checklist of planning functionalities, such as pegging, scenario analysis, and debottlenecking. However, we recommend getting a deeper understanding of the quality of these functionalities and reviewing nonfunctional criteria—including ease of use, quality of delivery services, future flexibility, and risk—before selecting an APS vendor.

Because so many APS transformations are considered IT projects, many companies adopt off-the-shelf APS solutions. Instead, companies should assess how to build a two-level architecture that combines APS technology with AA solutions, such as advanced prediction and optimization algorithms.

## **Example: Large global agricultural company**

An agricultural company undertook a supply chain transparency project a year before its advanced planning system (APS) implementation. As part of this project, the company integrated data from various sources into its data lake and built best-practice supply chain dashboards to monitor the data quality. Although project leaders struggled with data issues during the dashboarding project, the company was ultimately able to deliver the APS project ahead of time because it could benefit from the work done before. The company was already using the data via the supply chain dashboards, which improved data quality and timeliness. The time gained could then be invested in improving processes and user interface (UI) design.

## Example: Global metals producer

A metals company went through a supply-planning transformation at scale, leveraging advanced planning system (APS) technology. In the design phase, the company concluded that the APS vendor's off-the-shelf algorithm would not suffice to achieve the maximum impact for its future-state process because the company's processes were bespoke. The APS vendor had an open architecture that allowed the company to integrate a bespoke optimization algorithm, which serves as the brain behind the supply plan, while all data structures, user interfaces, data flows, and user interactions were supported by the more standard APS solution. As a result, the company achieved maximum impact by integrating its unique operational constraints, as well as its objectives, while leveraging strong APS standardization and automation of planning processes.

Regarding AA solutions, a higher level of customization—and, in some cases, bespoke solutions—is needed. Our experience shows that approximately 50 percent of the value from APS transformations comes from the use of customized AA models in combination with APS systems. This allows for maximum flexibility and predictive accuracy and helps optimization models to best fit planning trade-offs and constraints.

To address planning technologies, companies should take the following actions (for an example, see sidebar “Example: Global metals producer”):

- Undergo a thorough vendor selection based on a set of functional and nonfunctional selection criteria, including industry use cases, installs, and product deep-dive sessions.
- Select the right systems integration partner, particularly one that can handle the complexity and customization necessary to fit the company's needs.
- Get an unbiased, high-level view of the envisioned result and map it against the off-the-shelf APS solution. Align on the customization and list requirements that can't be fulfilled.
- Create the mechanism to achieve impact during solution blueprinting and put extra focus on AA solutions. Because these are often the main value drivers, review applicability and customize as needed.

- Synchronize the rollout of the APS and the relevant AA solutions by region or business unit, thus maximizing value creation along the journey, potentially self-funding the entire transformation, and boosting its overall net present value.
- As early as the build phase, test that the technology and its various features are functioning correctly. Company product owners should be the final gate to declaring a feature as complete.
- Take the time to complete system integration testing, user acceptance testing, and hyper-care (the period immediately following a system change that requires elevated levels of support). This will make your system more robust in the long term.

### 4. Capabilities, mindset, and behaviors: How to avoid the return of old habits

Best-practice processes are typically designed at the start of a project, but once a company reaches the implementation stage of an APS transformation, the target processes are adjusted and people tend to fall back to old ways of working.<sup>4</sup>

This usually occurs when organizations underestimate the importance of establishing the right internal capabilities to drive an enhanced supply chain or when companies have not established processes for adapting mindsets and behaviors to new ways of working.<sup>5</sup>

<sup>4</sup> Knut Alicke, Elena Dumitrescu, Markus Leopoldseder, and Ali Sankur, “Digital supply chains: Do you have the skills to run them?,” McKinsey, July 6, 2017.

<sup>5</sup> Knut Alicke, Elena Dumitrescu, and Margarita Protopappa-Sieke, “Transforming supply chains: Do you have the skills to accelerate your capabilities?,” McKinsey, March 18, 2022.

To develop talent with more-complex skill profiles, companies can create two new types of capabilities: one with a combination of functional, technical, and leadership competencies to drive performance and another with technical competencies to build, maintain, and develop core AA-model archetypes.

Next to talent development and capability building, there are three other core elements that embed change into the organization: role modeling management (such as the presence of supply chain and IT directors in key project meetings), embedding change in formal mechanisms (such as disabling old systems), and providing intense support to adopt new ways of working (such as setting up a network of superusers).

To address capabilities, mindset, and behaviors, companies should take the following actions (for an example, see sidebar “Example: Semiconductor producer”):

- Set up a company-wide communications strategy across multiple channels. As part of change management, strive to create understanding and model best practices.
- Be a role model of top management by being present in crucial project governance meetings, leading company communication, and regularly discussing capabilities in executive meetings.
- Develop tailored capability-building programs focused on the specific skills needed. Focus on best practices around planning as well as leadership skills and specific APS software skills.

- Blend new competencies, such as data science or data engineering, with training in supply chain management or support from “translators” who blend functional and digital knowledge.
- Develop a performance management structure that rewards top performers and takes corrective action when performance drops below expectations.
- Combine specific trainings based on learning material from the APS vendor with in-person classroom trainings for a set of superusers.
- Facilitate change management in which process improvements will be made over several cycles, enabling incremental adoption of the new mindset and process.

Finally, this type of transformation can have a twofold impact on performance: in addition to the overall improvement of systems and ways of working, the investment in people could generate a substantial return because of increased motivation. Shaping and building solutions that help employees make more effective business decisions in a more efficient way will enable employees to work smarter—rather than working harder to manually run routine tasks and failing to address complex economic optimization trade-offs in planning.

### **5. Integrated transformation management: How to avoid project delays and working in silos**

Whether a tech-related transformation is for the supply chain or another business function, such transformations are notoriously difficult to get right.

## **Example: Semiconductor producer**

A leading global semiconductor player embarked on a two-year transformation of its supply chain, upgrading the skills of more than 1,000 employees, many of whom had been working in the organization for 20 to 30 years. The company had no systematic capability-building program in place for experienced staff, and the effort in external hiring had not been able to meet the requirements for the transformation. As the company embarked on a comprehensive supply chain transformation, its leaders suspected that success would depend on a significant shift in the skills and mindsets of its staff. By running a detailed assessment of the company’s workforce capabilities, the company was able to set up a two-year capability-building road map segmented by target population, functional knowledge, and level of expertise. In doing so, workforce capabilities dramatically increased, and the gap to initial state was closed, ensuring the success of the transformation program.

## Example: A metal company

The advanced planning system (APS) implementation for a metal company involved a collaboration among three organizations: the metal company itself, the APS, and the value assurance or integration partner. To ensure that all three companies were working as one team, the collaboration established a single project governance with one overall project manager and one overall project steering committee (with combined business and IT functions). This avoided siloed ways of working and misaligned priorities. The project manager worked hand in hand with the APS technical lead to set the priorities and define business requirements, while the technical lead defined technical requirements, ensured solution quality, and gave input on workload. As a result, the team was able to work in a synchronized way and deliver the project on time.

For this reason, value assurance has emerged as a solution for ensuring on-time, on-budget, and on-vision delivery as well as supporting rapid value capture and long-term sustainable impact. Leaders can focus on value-led transformations by implementing guardianship around three distinct, equally important, and mutually reinforcing pillars of responsibility: design, delivery, and value.<sup>6</sup>

- **Design.** Creating a blueprint for success is crucial to effectively managing ingredients of success, such as process and organization, data infrastructure and management, planning technologies, and integrated transformation.
- **Delivery.** Ensuring that system and organizational readiness ultimately stacks up to initial design blueprints, delivery also helps resolve tough design choices regarding customization versus standard system design, enabling rapid end-to-end implementation of the solution across the value chain.
- **Value.** Driving successful change management can help establish a value-focused transformation office to ensure cross-functional stakeholder alignment and prioritize actions.

With these points in mind, a necessary component of value assurance is building a multidisciplinary team. When it comes to managing the deployment of a wave itself—for example, planning the blueprint, build, testing, or hyper-care for a certain geography and business unit—leaders should set up a strong hands-

on team, led by someone who can steer a diverse group of people.

Typically, an advanced planning transformation requires collaboration among at least three to four different companies—for instance, a planning software company, a systems integrator, an operating-model consultancy, and a middleware company. It is important that together these companies bring the necessary expertise on all different layers of a digital-planning system. This requires a diverse team set up with more than ten different roles, including industry experts, supply chain planners, solution architects, integration architects, solution configurators, data lake engineers, source system IT, middleware experts, and others.

Several factors make this level of collaboration challenging. To begin, it requires a change in mindsets among buyers and suppliers that may be used to more transactional or even adversarial relationships. And most collaborative efforts need intensive, cross-functional involvement from all sides—a marked change to the normal working methods at many companies.

To address integrated transformation management, companies should take the following actions (for an example, see sidebar “Example: A metal company”):

- Set up a project management and project steering committee headed by both IT and the business. Final decision makers, such as the COO and chief technological officer (CTO), can lead the

<sup>6</sup> These three principles will be covered in greater detail in a forthcoming article.

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steering committee, removing roadblocks and providing clear direction; project managers can drive top-quality content because of their deep supply chain and ERP expertise.

- Take the time to become one team and carve out time to have fun. Have an in-person kickoff to align on roles and responsibilities, deliverables of blueprinting, and ways of working.
- Establish a project management cadence that involves all parties. Key stakeholders of all companies and departments should be present for daily project check-ins, weekly progress reviews, and monthly steering committees.
- Create clearly defined roles and responsibilities. Summarize team roles and their descriptions on one page and the deliverables per role and project phase on another. Buy-in from senior leaders of each company involved can also help hold everyone accountable.
- Use one project management tool that captures the entire workload—including user requirements, user acceptance testing (UAT) or system-integration-testing cases, issues, and change requests—and projects along the implementation timeline. Track progress rigorously and reprioritize when needed.
- Tailor the meeting cadence to what is needed per phase of the project—for example, blueprinting meetings can vary week by week, while testing meetings can be held daily at predefined times

and with a consistent agenda. That said, some phases, such as blueprinting and testing, benefit from face-to-face interaction, while others, such as building, are more remote.

Improving cross-functional engagement is a leadership issue. Organizations with the most successful collaboration programs often use a formal approach to managing cross-functional teams, with clearly defined roles and responsibilities. This is necessary because a formal approach not only helps ensure that the business does not see the transformation as an IT project but also helps the APS vendor feel accountable for the outcome in terms of its impact on performance and not merely its execution.

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Old playbooks for transforming supply chain systems are no longer useful, so companies need to think APS transformations through across a broad range of areas. To succeed, it is vital that companies look beyond IT to the transformation process itself: the desired data pipeline, which APS system works best for them, what cultural changes the organization needs, and how collaboration across organizations will work now and in the future.

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Operations Practice

# A more resilient supply chain from optimized operations planning

To combat greater complexity and prepare for rapid demand shifts, resilient companies can integrate prescriptive analytics into their supply chain planning.

*This article is a collaborative effort by Hossein Aghai-Khozani, Simon Bull, Valerio Dilda, Lapo Mori, and Sebastian Reiter, representing views from McKinsey's Metals & Mining and Operations Practices.*



**Across industries,** companies that rely on transported materials for their operations have gained hard-earned knowledge from major disruptions over the past couple of decades, most notably the financial crisis of 2008, the COVID-19 pandemic, and geopolitical developments. During times of sudden upheaval, companies must quickly ramp down operations and then ramp up again once demand bounces back, adapt their execution, and revisit long-term plans. The supply chain has a special role to play, as companies rapidly shift their focus from cost-effectiveness to maximized throughput—all with the same assets and infrastructure.

A poor response can have cascading effects, such as facility shutdowns or missed delivery obligations. In recent years, approaches that use data and analytics to identify answers and make recommendations to specific business problems have proved to be particularly relevant in bringing clarity to operations planning and thus improving supply chain resilience. However, the vast majority of companies have yet to implement such approaches in their supply chain, leaving a serious gap in their planning capabilities.

A recent McKinsey article<sup>1</sup> examined three value chain approaches that can address this supply chain gap—simulations of reality, optimization of plans, and real-time control-tower monitoring (see sidebar, “How analytics supports different planning approaches”). Here, we examine the second approach in more detail, as it ranks among the most powerful tools businesses can use to navigate complex and changing environments, especially disruptions.

Organizations that want to get the most out of this powerful approach design their associated optimization tools and processes along five best practices: improve information flows between teams, elevate customer centricity, bridge the gap between long-term planning and day-to-

day operations, understand true operational constraints, and use scenario analysis to ask critical “what if” questions.

As companies in manufacturing industries have discovered, following these design practices can increase supply chain throughput by 10 to 15 percent in the short term, with no change in assets or overall configuration. Organizations can also reduce costs by 5 to 10 percent and CO<sub>2</sub> emissions by 10 to 15 percent over the long term while increasing operational flexibility and resilience toward disruptions. This article details the design best practices that support this effort and how companies can get started integrating the necessary capabilities into their business.

## Optimization in sales and operations planning

Optimization in operations planning involves determining the optimal choices for a set of decisions in a given business environment and business target. This type of optimization generally works best with prescriptive models that provide the ideal set of decisions as an output. The elegance of optimization is its ability to adapt to not only changing business environments but also shifts in the business target—for example, from minimum cost to maximum throughput, highest yield, zero environmental impact, or a combination of multiple factors.

For these reasons, optimization is the ideal approach to readjust a company’s operations as outside factors or strategic priorities change. For example, an agricultural company recently experienced dramatic rises in production costs combined with limited transport capacity, creating significant gaps in its ability to manage existing resource constraints. The company was able to respond by shifting its operations planning to an optimization approach that almost completely closed this gap.

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<sup>1</sup> “Building value-chain resilience with AI,” McKinsey, November 26, 2021.

## How analytics supports different planning approaches

**Supply chain analytics** can support planning efforts that broadly fall into three types. While optimization has been at the center of this article, two other tools are simulation and monitoring. All three require expert knowledge of the system, but simulation also relies on large historic data sets (exhibit).

Optimization models are prescriptive analytics tools. The main output is an optimal plan for the current environment. Optimization is most useful when an organization must create an ideal plan from scratch that factors in complex rules and constraints. A typical use case for optimization is building a monthly plan for operational production as part of the sales and operations planning process.

Simulations are descriptive analytics tools. In a simulation, a digital twin is constructed with uncertainty measures and operational inputs. Simulation is more appropriate for comparing or modifying existing plans in the face of uncertainty. Whereas optimization is more of a “black box” process, simulation produces explainable KPI-driven reports. A typical simulation use case involves examining an existing material network with uncertain production quantities, demand, and transit times to identify first- and second-order bottlenecks.

The third analytics approach is real-time monitoring. Most companies have a control tower serving as an operating nerve center. However, fully digital end-to-end control towers can increase

resilience by expanding the scope of real-time monitoring to anticipate and respond to upcoming or potential supply chain disruption. Real-time monitoring is the most useful when seamless communication between various functions and integrated decision making are critical.

A combined approach is often best. For example, consider detailed railway scheduling. The complex rules and interactions require optimization methods to create valid plans, while simulation can then validate the performance and robustness of plans and determine the most effective delay-mitigation policies. Real-time monitoring ensures seamless communication between individual hubs in case of unexpected disruptions.

Exhibit

### In supply chain analytics, optimization, simulation, and monitoring can work together but have important differences.

Analytics that can support supply chain planning efforts broadly fall into three types			
	1 Optimization	2 Simulation	3 Monitoring
Analytics type	<ul style="list-style-type: none"> <li>• Prescriptive</li> </ul>	<ul style="list-style-type: none"> <li>• Descriptive</li> </ul>	<ul style="list-style-type: none"> <li>• Descriptive</li> </ul>
Addressed business problem	<ul style="list-style-type: none"> <li>• Optimal execution plan for the current business environment in alignment with strategic direction</li> </ul>	<ul style="list-style-type: none"> <li>• Identification and analysis of root causes and bottlenecks for long-term resource allocation</li> </ul>	<ul style="list-style-type: none"> <li>• Real-time visibility of operations and financials for decision support</li> </ul>
End delivery	<ul style="list-style-type: none"> <li>• Productionized tool that can build and refine operational plans</li> <li>• Is executed on a regular basis</li> </ul>	<ul style="list-style-type: none"> <li>• One-off analysis providing insights on bottlenecks</li> <li>• Productionized plan assessor that can analyze plans and calculate precise KPIs</li> </ul>	<ul style="list-style-type: none"> <li>• Continuously running data stream and visualization</li> </ul>
Technical requirement	<ul style="list-style-type: none"> <li>• Current live snapshot of plant/process</li> <li>• Insights and operational information obtained through expert interview</li> </ul>	<ul style="list-style-type: none"> <li>• Extensive historical data to build relationships, distributions</li> <li>• Expert-provided insight into the decision environment</li> </ul>	<ul style="list-style-type: none"> <li>• Continuous data stream of live operational and financial data</li> </ul>



In essence, organizations can embrace optimization to support better, faster planning and thus increase value capture and resilience. Five best practices can sustainably improve supply chain decision making across the full coordination process (exhibit). To do so, the design of the corresponding optimization tools and processes must address all decision layers—from strategic orientation to operational execution. The best practices for optimization design explicitly address distinct layers and can thus enhance transparency and planning effectiveness.

**1. Elevate customer centricity by enabling a pull principle for demand-driven operations**

Customer-centric thinking is a foundational element for any type of operations planning. Tools and processes must be able to quickly translate demand into sequence and volume of production units and share this information with individual production sites. Optimization tools and processes can make these decisions rapidly and objectively, enabling both automated plan adjustments based on changing customer demand and faster responses by contact center agents to customer requests. Satisfying those requests can have a significant impact on operations. A commodity metals company was able to accelerate its decision-making process

and thus more quickly react to urgent customer requests resulting from demand fluctuations caused by rapidly changing spot prices.

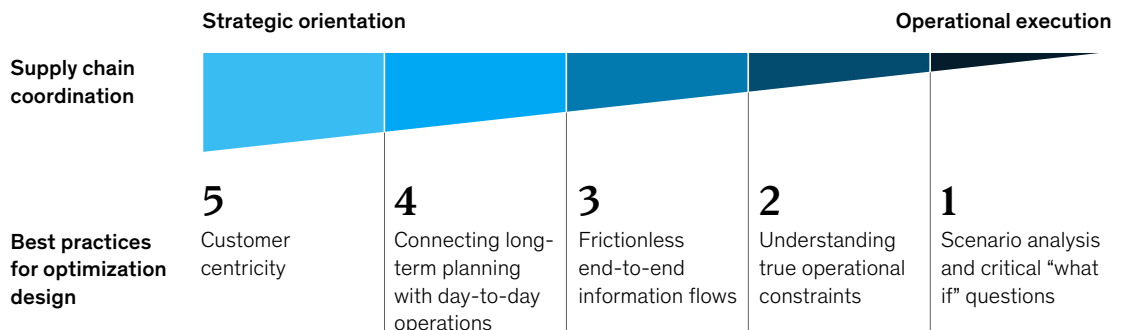
**2. Bridge the gap between long-term planning and day-to-day operations**

Short-term plans are typically shaped by current constraints, while long-term plans depend on outside factors that are likely to change. Effective operations planning addresses the in-between period, in which value can be lost in the gap between tactical vision and concrete implementation. Optimization tools and processes can translate mid- and long-term plans into detailed operational schedules, automatically accounting for dynamic conditions and complex operational constraints while allowing users to refine and explore possibilities. The gap is bridged in the other direction by feeding information on actual operations and deviations from control-tower monitoring back to optimization or simulation tools to continually minimize any loss in value. The agricultural company mentioned above was able to ensure its day-to-day operations remained in line with the long-term strategic goals and tactical monthly plans despite significant changes in the overall business environment.

Exhibit

**Adopting five best practices can help improve supply chain visibility and coordination at all levels.**

**Tool and process design must address all decision layers**



### **3. Improve information flows between operations and marketing and sales**

Organizations need to enable a consistent flow of information among stakeholders. Integrated supply chain planning tools already bring together information from multiple systems and business functions, creating transparency and empowering decision makers while enabling analytics tools. Optimization tools and processes can be added to improve decision making. A tangible example of this interplay can be a sudden change in production capacity due to an unforeseen dumper breakdown. Integrated planning tools ensure all relevant stakeholders are aware of this change, but only optimization tools will actively steer and synchronize the decisions of the entire organization toward the ideal target in this new environment. Actions could include modified marketing and pricing of the respective products or the realignment of the supply chain. Comprehensive control-tower dashboards are then used by teams from various functions to support real-time decision making.

For instance, a mining company was able to quickly and regularly make updates to its product portfolio based on recommendations from the marketing and sales team. This coordinated rapid response enabled the company to keep its portfolio closely aligned with market demand at all times.

### **4. Understand true operational constraints by dissecting the infeasible plans**

The exercise of identifying and avoiding infeasible plans often leads planners to review and adjust their operations. This infeasibility can come in the form of forced stoppages when operators are tasked with following an impossible plan or situations in which plans are unable to meet all known operational constraints. Control-tower dashboards can aid in understanding these constraints and providing feedback. Optimization tools can then progressively integrate all these constraints into actual operations planning, thus providing consistently feasible solutions. In this way, the impact of optimization tools results in higher adoption, as they reduce the overall frustration level across the organization associated with these infeasible solutions. For

one automotive company facing a shortage of semiconductor chips, a control-tower tool in combination with optimization-based processes generated more than \$100 million in margin improvement.

### **5. Use scenario analysis to ask critical what-if questions**

Planners must have an operational process that can run, understand, and evaluate scenarios for planning and scheduling. This process produces what-if questions that can inform discussions with sales, customers, and third parties and support better decision making. Optimization tools allow decision makers to focus on the “what if?” and receive immediate and risk-free feedback on the consequences, thus streamlining and lowering the barriers to asking insightful questions. Recently, a pharmaceutical company was able to improve overall throughput and on-time delivery by using optimization tools that enabled asking what-if questions regarding rush orders, staffing shortfalls, and capital expenditure investments.

### **Get started with an appropriate business opportunity**

Many companies have yet to make significant investments in optimization for their operations planning. Often, organizations have not even undertaken the analysis to select the business opportunity. In addition, discussions around optimal business targets that cover the most relevant trade-offs are often ignored, as they reside between functions and are thus considered “off limits.” Picking the wrong operations element or business target for optimization diverts finite resources from what truly matters and represents the biggest risk of failure.

The key is to identify a process that satisfies three criteria: first, the overall decision space must be so large that an individual planner can't explore and understand all the possibilities at once; second, the quality of outcomes must be objectively measured and assessed according to a well-defined and accepted target; and third, the

potential for improvement must be measurable and ideally quantifiable—for example, costs, throughput, CO<sub>2</sub> emissions, profit, or a combination of multiple factors. The mining company focused on profit by adjusting the supply chain in line with the optimal product portfolio, and the agriculture company emphasized the marginal costs of incremental production. The metals company selected a combination of throughput and yield while maintaining high customer satisfaction. The automotive company minimized lost revenue coming from supply chain disruptions. And the pharmaceutical maximized on-time, in-full delivery.

Companies must ensure their optimization program identifies business opportunities and associated targets that are not properly covered by the existing manual processes. However, any optimization-based approach must retain an adequate level of human judgment and expertise to account for unexpected situations and outliers. Optimization should aim to augment and empower human decision makers but not replace them.

## Common pitfalls in data gathering and infrastructure

Companies should avoid directing time and resources to elements that aren't necessary for high-functioning operations planning. For example, contrary to conventional wisdom, large longitudinal data sets are not required. Optimization for supply chain planning can typically be built by drawing on knowledge gained through expert interviews as well as snapshots using a small amount of the latest business data. Both elements are present today, as organizations need access to this information to monitor supply chain performance in the first place.

Similarly, companies should avoid focusing on building new data-centric infrastructure as an initial enabler for operations planning—either to capture and ingest data more frequently or to host new, complex analytics solutions. Instead, operations planning solutions can run infrequently, use small-scale data, and typically be implemented alongside and connected to existing tools and systems. In this way, these solutions are complementary to common end-to-end planning cloud solutions and maximize the value organizations can extract from existing resources.

In a recent case study, the large mining player developed an optimization-based process to improve the supply chain of its trains, vessels, and mine operations over short- and medium-term horizons. The process was aligned with the company's strategic target regarding customer specifications and overall production goals. Embedding the optimization process into overall decision making allowed the company to improve operations significantly. This move alone captured many millions of dollars in cost savings.

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In a world characterized by increasing volatility and major disruptions, the maturity of operations planning has the potential to increase the performance spread between first movers and laggards. So far, bigger corporations have taken the lead in implementing approaches to optimize their operations planning, given the resources and capabilities required. Whether optimization is within the reach of all companies is still an open question.

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