SUPPLYCHAIN MANAGEMENT REVIEW

November 2025

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SUPPLYCHAIN MANAGEMENT REVIEW

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Tariffs are here to stay

Love them or hate them, once they are in place, removing tariffs is not an easy task.

For decades, business leaders largely assumed that globalization and free trade would steadily reduce barriers. Tariffs were seen as temporary political tools, usually negotiated away over time. That assumption is gone. Tariffs are no longer a short-term disruption. They are becoming a structural part of supply chains and cost structures, and executives need to plan accordingly.

At the recent ASCM CHAINge conference, former U.S. Commerce Secretary Gina Raimondo underscored the reality that tariffs are not a passing phenomenon, but are more likely to become a structural part of your cost structure moving forward.

"It is chaotic and the reason it's chaotic is because you don't know what's going to come next," she said during her keynote address. "I wish I could tell you it was going to settle down, but because of the politics, which are driving this disruptive atmosphere again on both sides of the aisle, I think we're in this disruption for a while. And so my best thought to you is fasten your seatbelt. Don't assume things are going to calm down and make your contingency plans accordingly."

The concept of planning accordingly is not new, but something Raimondo said struck me, and I'm assuming many in the audience, differently. Tariffs aren't going away.

"Once the tariff is levied, it is hard to take it away," she said, pointing to her experience under the Biden administration and unsuccessfully arguing to reduce or eliminate tariffs put in place during the first Trump administration. "I'm not saying it never goes away, but I argued with President Biden … I was unsuccessful. President Biden wouldn't do it. No one wants to be the guy that reduces the tariff and is then susceptible to the criticism that we're going to lose manufacturing jobs in the U.S."

In other words, even leaders who favor reducing tariffs often find themselves constrained. The political symbolism of tariffs—equating them with protecting jobs—makes it almost impossible to roll them back. Plus, there is the revenue factor. We still don't know where the current tranche of Trump tariffs will ultimately end up, but what we do know is that there is some not-insignificant amount of revenue pouring into the government coffers because of them. We can argue over who is paying that—importers, exporters, or consumers—but the revenue is real.

For supply chain leaders, the implications are clear. Tariffs are not a passing storm to be weathered. They are becoming embedded in the operating environment, shaping sourcing decisions, cost models, and competitive strategy. As Raimondo noted: "Don't assume things are going to calm down."

That is the mindset companies must now adopt. The sooner executives accept tariffs as a permanent feature of global trade, the better prepared they will be to build resilient, adaptive supply chains that can thrive in a tariff-defined world. Like them or hate them. It's time to manage them.

Brian Straight

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Meet DUX™. The first AI to tame messy transportation data.

By creating a complete, trustworthy picture of every shipment, Loop's new AI model moves supply chain teams from reactive exception management to proactive optimization.

Loop, the leader in transportation spend management, recently launched DUX, a proprietary AI model poised to disrupt the supply chain industry. DUX, which stands for Document Understanding and Extraction, is the first logistics-native AI model built and trained from the ground up to solve the industry's most persistent challenge: messy, disconnected data.

By ingesting and standardizing transportation data from any document, DUX creates a "digital twin" of an organization's transportation network, unlocking unprecedented opportunities for optimization and cost savings.

Unlike generic, bolted-on large language models, DUX is a custom architecture purpose-built by AI engineers for the complexities of logistics. Trained on over 20 million real-world transportation documents, it achieves unparalleled accuracy. Industry-first features, such as high-resolution image support and treating document layout as a first-class citizen, allow it to interpret the fine print, stamps, and handwritten notes that standard OCR technologies miss.

The impact is transformative. Where legacy systems struggle with 50% automation rates, Loop's AI-native platform, powered by DUX, delivers over 99% touchless automation without errors. Invoice processing is reduced from an industry standard of three business days to under 10 hours, and the platform can extract a virtually unlimited number of data fields, providing far more granular insights.

The result, organizations spend 90%+ less time managing exceptions and more time focused on strategic priorities to accelerate growth.

And while DUX is the cornerstone of Loop's AI stack, it is one piece of a larger investment in AI. DUX works in concert with other specialized AI models for data classification, entity resolution, GL coding automation, address normalization, and more, that create a single source of truth. AI agents then link every related document—from the bill of lading to the final invoice—creating a complete, trustworthy picture of every shipment.

Loop empowers supply chain leaders with a unified data foundation that turns complexity into clarity. Through precise audits, detailed cost allocation, and strategic multi-modal carrier insights, customers move beyond reactive exception handling and gain the ability to optimize their networks proactively—making smarter, faster decisions with confidence.

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E-tailing update: Amazon's grocery gambit

Amazon is doubling down on grocery with a bold same-day delivery push to 2,300 U.S. cities, positioning itself directly against Walmart's two-channel dominance. But as the grocery chess match escalates, the battle is about more than speed—it's about which model best connects with shoppers in a changing retail landscape.

By Larry Lapide

This represents my 10th Insights column about the evolution of consumer-based e-commerce—that I've termed e-tailing. Their purpose is to chronicle the evolution of e-tailing from the eyes of a supply chain analyst. They are primarily focused on the battle between the heavyweights—brick-and-mortar Walmart versus e-tailer Amazon—as a reflection of what has been happening in the retail industry.

For the past few years my focus had been on the planning changes that would be needed to accommodate uncertainties and severe supply shortages, such as those experienced during the COVID-19 pandemic. And more recently, what was happening post-COVID—when Amazon and Walmart were starting to bear the fruits of their labor, post-pandemic. Both gained substantially vis a vis retailing competitors.

My last e-tailing Insights update was titled "E-tailing update: Brick-and-mortar retailers struck back" in the November 2024 issue of *SCMR*. The subtitle stated "Two-channel shopping is adding pressure to Amazon to lure customers." The summary stated that e-commerce online ordering and brick-and-mortar shopping have to be fully integrated in the emerging retail business model. Companies like Walmart, Costco, and Target are now success stories using this approach with grocery. Meanwhile, Amazon recognizes that it has fallen short with its grocery initiatives. I suspect that Amazon now views this issue as existential because if it doesn't address it, the Amazon.com platform could become the new Sears catalog. Customers would come to the site only to benchmark the price of an item to get a better price at a store. So, look for Amazon to make a big move, in grocery or not. Either way, don't count Amazon out in the long run.

Amazon announced its gambit

My prediction was correct about Amazon making a big move. Recently, it announced its gambit move in the strategic chess match with Walmart. An online *Wall Street Journal* (*WSJ*) article discussing it was titled "Amazon Launches Same-Day Fresh Grocery Delivery in 1,000 U.S. Cities" (Aug. 13, 2025). With the subtitle, "Online retail giant plans 2,300-city service by year's end in quest to compete with Walmart." To my recollection, it is telling that this is the first time Amazon has specifically targeted Walmart. That I've deemed the first behemoth two-channel (i.e., stores & online home delivery) company since Sears, back in the day, with stores and catalog home delivery).

Certainly, Amazon has always positioned itself as the top dog in e-tailing with home delivery. Its holy grail long-term goal is to achieve same-day delivery for the lion's share of its customers. It has been expanding, fine-tuning, and digitizing its logistical network to achieve a fast-shipping goal—getting closer to the customer and shipping rapidly. It has been the most successful innovator in evolving distribution centers (DCs) into full-fledged fulfillment centers, including large-scale automation via robotics.

The article stated that same-day grocery delivery was launched in the 1,000 cities Amazon currently offers grocery delivery, and it will add 1,300 more by year end. On news of this, the stock market showed shares of Instacart-owner MapleBear, Inc., DoorDash, and Kroger declining—so the initiative targets others in the grocery supply chain. Furthermore, that "Amazon is the largest e-commerce company, but its grocery business hasn't grown as fast as some rivals." And "Walmart's online business surpassed Amazon's in terms of sales, according to estimates from eMarketer." "With same-day deliveries to more than 90% of the country."

The following five publications from the *WSJ* chronicle its progress this past year.

1. "Amazon CEO Says AI To Reinvent Operations," (April 11, 2024).
2. "Amazon Steps Up Grocery Delivery," (Nov. 11, 2024).
3. "Whole Foods Courts Shoppers with New Minimarket Concept," (Dec. 2, 2024).
4. "Physical Stores Still Vex Amazon," (Feb. 5, 2025).
5. "Whole Foods Staff to Join Amazon," (Aug. 28, 2025).

Amazon has done a reasonable job of integrating Whole Foods into its website and making it more affordable by creating a private-label brand. For example, Amazon customers can return goods bought online to a grocery store location. However, I believe much of this has done little to build a grocery presence toward customers. Interestingly, up to now, Whole Foods employees were not Amazon employees. Do all Whole Food shoppers even realize that these employees were never part of Amazon?

Thus, apart from once in a while seeing a Prime delivery driver, they were the only human contact Amazon had with customers. Moreover, good luck getting a human rather than a computerized bot to answer a customer service question. Amazon's supply chain (sans grocery) is largely a 100% virtual shopping experience, involving little human and even physical product contact. Yet Amazon wants to control the entire supply chain from DC to the customer's door. Thus, it no longer has full confidence in third-party logistics providers (3PLs) to do home deliveries.

Moreover, starting with the "Amazon Go" concept introduced in 2018, "Amazon has closed dozens of branded retail stores in recent years" (*WSJ,* Feb. 5, 2025). These include branded retail stores including "bookstores, fashion outlets, and its '4-Star' locations." And "after a decade-long experiment with brick-and-mortar stores, Amazon's dominance online has yet to translate into a successful strategy for connecting with shoppers in the real world…"

Speaking of Walmart

While it has taken a while, Walmart, on the other hand, has proven that it is not "an elephant that can't dance" when it comes to online fulfillment. It innovated into providing store-based (rather than DC-based) fulfillment—including store pickups and returns, as well as home deliveries. Does it connect with its shoppers and local communities? You bet it does for its price-conscious shoppers. It abides by its "everyday low prices" slogan, even during these inflationary times. In addition, it offers its local residents and family members jobs and a possible career path with them. Even possibly hiring them as greeters during their retirement. And it may come to their aid when disaster strikes—such as it did in response to the aftermath of hurricane Katrina 20 years ago.

The following publications from the *WSJ* chronicle Walmart-related progress this past year.

1. "DELIVERY WARS – Walmart Races Amazon to Your Front Door," (March 8-9, 2025).
2. "Walmart Taps Instacart Executive to Lead Its AI Ambitions," (July 24, 2025).
3. "Walmart Wins Over More Shoppers," (Aug. 22, 2025).
4. "Biggest Retailers Prosper in Tariff Economy," (Aug. 22, 2025).
5. "Amazon's Grocery Bet Won't Knock Out Rivals," (Aug. 22, 2025).
6. "Amazon Plans to Shut Fresh Grocery Chain in U.K. After Just 4 Years," (Sept. 24, 2025).

Inflation and the threats of tariffs are driving some number of new price-conscious customers to Walmart. It is "absorbing enough of the cost to keep price hikes lower than the national average." (Aug. 22, 2025). Also "it is winning over shoppers with grocery discounts, fast shipping, and in categories like more elevated fashion offerings." So, while Amazon's planned expansion of same-day delivery of grocery is certainly impressive, "Instacart, DoorDash and Walmart have competitive strengths of their own." In particular, "Walmart's thousands of stores are powering the most serious challenge Amazon has faced in its race to deliver everything, everywhere."

Competitive assessment

Per the summary of the last e-tailing update, two-channel stores are apparently the current hot trend for brick-and-mortar retailers. Especially for busy one-stop shopping families. Because a typical family has to stock up on groceries at least a few times a month, there is a better shopping option than just online ordering with home delivery. A family might instead order some items online that they want to make sure are going to be there during a store visit. Then pick the items up along with the groceries and other household goods they need. The parents could declare these family "shopping" events by having lunch or dinner there as well. Many shoppers like these one-stop shopping visits which are enjoyable and allow one to browse. These are similar to the shopping models of grocery leaders like Walmart (the #1 grocer), Costco (#3), and Target (#8).

Generally, Amazon customers are more affluent and/or highly educated than Walmart customers. The former value convenience and will pay more for it—they prefer a largely no-hassle virtual shopping experience. On the other hand, Walmart shoppers are more rooted in the "real physical world" that might not be hassle-free, yet is filled with interactions with a retailer's employees. As long as they get good products for the lowest price. And these will typically not include branded and fashion-oriented products—because those product suppliers do not want to sell at the lowest price.

They will need to evolve as the U.S. ages

So, generally after Amazon implements its extended supply chain, and inflation has abated, it and Walmart will remain the leaders in their respective markets. However, the Baby Boomer shopper base is aging, and creating a very robust "Longevity Economy." This was covered in Insights column (September/October 2023) titled: "The 'longevity economy': Seniors need innovative supply chains." It was subtitled: "As the United States gets older, there is much potential in developing products for older populations."

I wrote the column to be self-serving—I am one of the oldest Boomers. Today there are not a lot of products developed for Boomers, whose health is declining in terms of their physicality and mental acuity. The Gerontological Society of America recognizes five phases of senior aging as: go-go, go-slow, slow-go, slow-slow, and no-go in its "Longevity Economics" report May 2018.

After finding that there is a dearth of products for them, many Boomers are currently taking "bucket-list" trips while they still have mobility. However, once they reach the latter phases of aging, they will be more homebound—if they choose to age in place. They will rely less on brick-and-mortar retailers, and more on e-tailers to provide them with basic needs such as food, clothing, shelter, and health-related products (that includes both goods and services such as installation and post-sales support). Senior homes will need to be wired to the worldwide web and their smart devices connected inside their homes.

Being tech-savvy myself, in my later phases, I will likely favor virtual supply chain e-tailers like Amazon. However, for example, when I bought my last smart TV at Best Buy, the Geek Squad integrated it into my household intercom system. It is comprised of Amazon Alexas on each of the three floors, plus regular TVs with Amazon's streaming Firestick. If I had bought the TV on Amazon, who would have helped me? Today's Amazon does not support the hardware it sells. Maybe it should.

In summary, both Walmart and Amazon will need to find suppliers for the goods and services Boomers will need. Because Amazon is more tech-savvy than Walmart, it will likely be able to do this. This may not be the case for less tech-savvy Walmart. However, since Walmart knows its customers well, I would not bet against it evolving more toward their e-tailing needs. •

Supply chains under (cyber) attack

Cyberattacks are crippling supply chains and exposing hidden vulnerabilities in the very technologies meant to drive efficiency. As cloud platforms, robotics, and connected systems expand, companies must treat cybersecurity as a core supply chain function, building redundancy, resilience, and cross-functional defenses to withstand the next inevitable strike.

By Dr. Miguel Rodríguez García & Dr. Eva Ponce

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In June 2025, one of the largest grocery distributors in North America, United Natural Foods Inc. (UNFI), suffered a paralyzing cyberattack. As the company's fulfillment systems were brought to a halt for almost 10 days, multiple stores across the U.S. reported shortages. This meant empty shelves at many Whole Foods locations, one of UNFI's major customers.

The financial loss because of the disruption was estimated to be at least $350 million in sales for UNFI, plus extra costs incurred as the company transitioned to manual operations and the millions spent on external cybersecurity and legal experts to solve the issue[1].

Earlier this year, Google's Threat Intelligence Group warned of a cybercrime wave that had crippled multiple British retailers and was then targeting U.S. firms' supply chains. The timing was no coincidence. Sophisticated attackers, whether organized crime or state-sponsored groups, have turned their sights to modern supply chains.

A perfect storm of vulnerability

Modern supply chains have never been more exposed. In our most recent research, we identify at least 48 technology-related vulnerabilities in modern supply chains, and this is limited to warehouse technologies only[2]. In the broader supply chain, the number would be much higher. The tools that have made supply chains faster and more efficient, such as cloud software, IoT devices, and AI-powered automation, have also opened new doors for malicious actors.

The incidents above follow a growing list of cyber disruptions that have hit supply chains recently. In late 2023, an attack on Ace Hardware shut down its warehouse management system (WMS), halting fulfillment nationwide and causing multi-million dollar losses. As companies connect their main software such as ERP or WMS to a growing web of third-party platforms and robotics systems, the number of entry points for potential cyberattacks increases exponentially. Every new integration, API, and remote access point is a new vulnerability for modern supply chains.

In late 2024, Blue Yonder's cloud platform, used by Morrisons and other major retailers, was compromised by a cyberattack. This forced a return to manual processes in most Morrisons' UK warehouses. Simultaneously, Starbucks stores in the U.S. were also impacted by the same attack, showing how a single cyber event can bring global operations to a standstill. An attack in a cloud environment no longer remains confined to one server and can easily freeze a conveyor belt, stall an autonomous forklift, and corrupt inventory data across multiple locations all at once.

Weakest link, widest impact

The 2024 Blue Yonder attack exemplifies the domino effect of cyber risk. The global nature of modern supply chains means that attacks propagate faster than ever. When one node is hit, the ripple effects will not only disrupt upstream suppliers and downstream clients, but also third-party logistics providers (3PLs) and competitors that share technology suppliers[3].

The rise of both Software-as-a-Service (SaaS) and Robotics-as-a-Service (RaaS) has democratized access to technology. In supply chain operations such as trucking and warehousing, small and mid-size firms without previous cybersecurity knowledge are now incorporating many technologies they could not afford five years ago. These newer entrants can become soft targets, and once breached, serve as gateways to larger networks. Unless firms couple the uptake of new technology with increased cybersecurity, this democratization of technology presents serious cybersecurity risks that could outweigh the benefits of the technology itself.

However, it's not just small users of supply chain technology that increase cyber exposure, it's also the rapid proliferation of small tech companies introducing new software, robots, and platforms into critical operations. Companies in early stages will often prioritize speed to market and innovation over robust security architecture. While they bring agility and functionality, their solutions may lack hardened protocols, comprehensive security testing, or dedicated cyber teams, inadvertently injecting risk into new supply chain technologies.

What can companies do?

Resilience begins with recognition: cybersecurity is now a supply chain issue, not just an IT concern. Based on more than 40 interviews with experts across industries, we have identified several best practices:

Scrutinize your supply chain tech portfolio. As supply chains increasingly depend on third-party providers for cloud platforms, robotics, analytics dashboards, and IoT infrastructure, companies must establish clear cybersecurity requirements for all partners, audit them regularly, and restrict system access to the minimum. For example, over-the-air (OTA) updates, which are a growing norm not only for our mobile phones but also in robotics, can be exploited if not verified properly. Moreover, firms should demand transparency from vendors on their response protocols, for both software and physical automation and robotics, when operating under SaaS or RaaS agreements.

Don't bet the supply chain (and business) on one system. Single points of failure can be catastrophic. We now know that the WMS can be a critical software not just for a single warehouse, but for entire supply chains. When the central brain that connects all nodes goes down, everything stops. The cases of Ace Hardware and Morrisons are a reminder that companies must build redundancy. That could mean keeping multiple copies of critical systems running in parallel. For instance, even if the main system is cloud-based, companies could use a backup copy working on-prem or an edge cloud approach, with additional layers of protection and an isolated network that can function in offline mode.

Speed kills (when companies skip security). Many companies rush the implementation of new facilities across supply chains to hit commercial deadlines. Something similar happens during mergers and acquisitions (M&A) when supply chains integrate. Our research has shown us that when this happens, cyberattacks are both more frequent and more successful, as cybersecurity often becomes an afterthought. This is especially true in peak seasons when IT resources are stretched thin and the company's priorities are focused on daily operations. Cybersecurity must be part of every technology rollout checklist from day one, not a patch added later.

Resilience must be built. Modern business continuity plans (BCPs) must assume that cyberattacks will happen, and that they may take days to resolve. Redundancy, shutdown protocols, backup systems, offline access, and detailed restart playbooks are critical. Leading companies interviewed for this article emphasized the need to test BCPs regularly, not just on paper but in practice, simulating real-world cyber scenarios not only among IT folks, but hands-on with their operations teams. Having dual WMS servers or local data caches can make the difference between a temporary slowdown and a total standstill. Partnerships with institutions like MIT CTL can help companies push this further by developing simulation environments that translate cyberattacks into physical disruptions across supply chains, enabling decision-makers to rehearse outages, identify gaps in recovery protocols, and build response strategies.

A final word

Cyber risk is now a structural threat to supply chains. The more connected we become, the more we must invest in securing those connections. And still, companies need to prepare for operating in the dark and build resilience in their IT and physical supply chain systems, as prevention strategies alone will not be enough.

But companies shouldn't do this alone. It's time for supply chain and cybersecurity leaders to collaborate more deeply—not just reactively after a breach, but proactively as part of the supply chain design process itself. Moreover, institutions like MIT CTL can convene firms' interests and create a secure space that brings together government agencies, key stakeholders, and industry leaders, aligning industry priorities with MIT's research agenda. •

•••

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Designing supply chain networks that matter

Uncomplicating and transforming complexity into an operating advantage through supply network design.

By Brad Barry

Brad Barry is a partner & director at St. Onge Company. Barry can be reached at bbarry@stonge.com

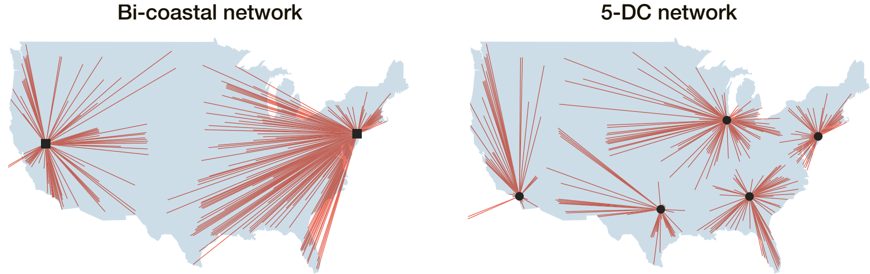
In today's increasingly volatile geopolitical business environment—characterized by fluctuating freight rates, persistent labor shortages, evolving customer expectations, sourcing and tariff uncertainty, and compressed product lifecycles—organizations are recognizing that supply chain network design is no longer a luxury but a strategic necessity. Rather than simply reacting to disruption, leading companies are leveraging network design to proactively shape resilient, cost-effective, and service-oriented supply chains. Companies must align the right problems with the appropriate project types and methodologies to deliver meaningful, measurable, and lasting impact.

What is supply chain network design?

Supply chain network design, at its core, aims to optimize the entire end-to-end supply chain ecosystem—from suppliers and manufacturers through warehouses and distribution centers, all the way to retailers and end customers. Often referred to as "network modeling," this process involves building a mathematical model that represents the supply chain's structure and operations. The goal is to identify the optimal number and locations of facilities, as well as the most efficient product flows between them (see Figure 1). By testing various scenarios and constraints, network design enables companies to make data-driven decisions that balance cost, service, and flexibility across the entire supply chain network.

FIGURE 1

Supply chain network configurations



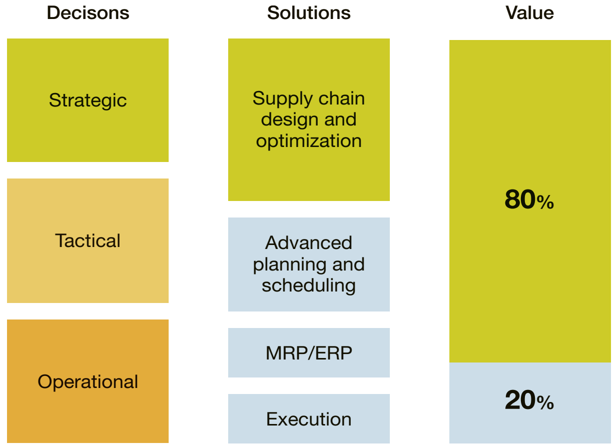
Source: Author

The hidden cost of suboptimal networks

Across hundreds of projects conducted by our supply chain consultancy, we consistently identify between 5% and 15% in annual cost avoidance through supply chain network design. Supporting this, Gartner has identified through their research that approximately 80% of a supply chain's total costs are effectively locked in by the location of its facilities—a figure that mirrors the well-known principle that 80% of a product's cost is determined during the design phase (Figure 2).

FIGURE 2

How strategic decisions within a supply chain network design study



Source: Author

This insight has major implications: companies aiming to improve inventory turns, increase transportation utilization, or shift transportation modes may only realize limited gains if their facility network is fundamentally misaligned. In other words, operational improvements can only go so far when the structural foundation of the supply ecosystem—the network itself—is suboptimal.

Recognizing this, many organizations are turning to supply network design not only to reduce costs but to build more resilient, scalable, and responsive supply chains. A well-executed network design study offers a range of strategic and operational benefits that go far beyond cost savings.

Unlocking value through supply network design

Beyond mitigating hidden costs, supply network design offers a multitude of strategic and operational benefits that unlock significant value across the supply network. Among the most compelling reasons to undertake such a study is its ability to "uncomplicate" network options, tradeoffs, and complexity.
Supply chain networks are inherently complex and intricate, with vast amounts of data describing flows, constraints, options, and costs. Network optimization tools can evaluate thousands of potential facility configurations in a fraction of the time it would take using spreadsheets or manual analysis. These tools leverage modern computing power and algorithms to deliver faster, more accurate ecosystem supply network recommendations.

Another key benefit is the ability to perform sensitivity analysis. Once a supply chain is modeled and calibrated to reflect actual business flows and costs, companies can test multiple variables like growth rates, geopolitical uncertainty, fuel prices, operating costs, inventory turns, and simulated disruptions to see how the optimal network might respond and pivot. This helps organizations anticipate tipping points and plan proactively.

Network design also supports strategic sourcing and manufacturing decisions, especially in an environment of tariff and geopolitical uncertainty. Whether adding a new production line or evaluating plant closures, a network model can quantify the impact on cost, service, and inventory. It's equally valuable during major events such as mergers, divestitures, or disruptions like natural disasters or pandemics. A working model enables rapid scenario planning—identifying which products to reroute or which customers to serve from alternate locations.

Ultimately, the most successful businesses use network design to define the optimal number, location, and role of facilities, as well as the flow of products between them. These decisions are critical to achieving both cost efficiency and service excellence. More and more companies are realizing that network optimization isn't just a tool—it's a competitive advantage.

Project types: Matching design to business need

When undertaking a supply chain network optimization project, companies often seek answers to a wide range of strategic questions. Network optimization leverages data and modeling to support informed decision-making across many scenarios. Following are several common project types where network design delivers significant value.

1. Merger/acquisition. Before or after a merger or acquisition, companies use network optimization to understand the optimal distribution network of the combined companies. Network optimization helps understand questions like: are there redundant facilities in the network? Should the distribution centers be in a different location based on the combined customer demand?

2. Cross divisional synergies. Companies with separate divisions or business units often ask if there are synergies by combining the divisions in the same warehouse(s). For example, could products from multiple divisions be shipped together or could smaller warehouses be combined into a single location? Utilizing network optimization can help companies understand if opportunities exist and the potential benefits.

3. Capacity challenges. Many companies have capacity challenges either in distribution or manufacturing. Network optimization can be utilized to address how to best alleviate those challenges. For example, for distribution capacity issues, network optimization can help with the choices of expanding existing locations vs. locating to a new geography vs. keeping the current facility and adding an additional distribution node to the network. In manufacturing, network optimization can help determine where to add a new plant or a new line within a network of plants. Conversely, when there is too much capacity in a supply chain, network optimization can help determine which facility, plant or line to remove or close.

4. Customer experience. To meet customer expectations or experience, companies use network optimization to determine the appropriate supply chain network to meet those requirements. For example, the number of distribution centers increases as service levels (transit time) increase. Many other "what if" analyses/scenarios can be performed to understand the appropriate supply chain network based on varying current or potential future customer expectations.

5. Labor shortages. Labor has been more difficult to find over the last few years than ever before. Network optimization can quantify the cost differences in various network configurations. For example, a company might want to add additional DCs to limit the number of workers required at a certain DC. Also, if the minimum cost network puts DCs in locations where labor is more challenging to find, network optimization can quantify the cost differences of moving distribution from one location to another.

6. Sourcing/manufacturing changes. Companies either considering or changing manufacturing or sourcing from one location to another usually understand the cost differences. Network optimization can help companies understand the total landed cost (product, facility, and transportation). Network optimization can also help determine if there is capacity available in the short and long term to manage changes in sourcing.

7. Carbon footprint. Companies may want to or may be required by regulations to reduce their carbon footprint or environmental impact. Network optimization can be used not only to minimize cost but also to lower emissions and environmental impact based on the number of distribution locations and/or transportation modes.

Once a digital "twin" model is built, these questions can be answered quickly and tested under various assumptions over time—making network optimization a powerful tool for both strategic planning and operational agility.

Successful projects: What sets them apart

Executing a supply chain network optimization initiative is a significant undertaking—one that requires a thoughtful and disciplined project approach. Leveraging many years of experience and "lessons learned," we've identified several key factors that consistently contribute to successful outcomes. While not exhaustive, the following elements have proven to be critical in delivering tangible results.

- **Clearly defined scope and objectives.** A well-scoped project provides direction, maintains momentum, and keeps the team aligned. Clearly articulated objectives help prevent scope creep and ensure that the team remains focused on solving the right problems. Upfront alignment of goals also increases the likelihood of staying on schedule and within budget.
- **Executive sponsorship and support.** Strong leadership backing signals that the project is a priority. Executive sponsors can help remove roadblocks, secure resources, and reinforce the importance of the initiative across the organization. Projects with visible leadership support are also more likely to see their recommendations implemented.
- **Structured milestones and checkpoints.** Establishing defined milestones creates natural checkpoints for progress and decision-making. These stages allow the team—and often key stakeholders—to validate assumptions, review findings, and align on next steps. Milestones also help maintain accountability and momentum throughout the project lifecycle.
- **Appropriate level of analytical detail.** The analysis must be detailed enough to ensure credibility, but not so granular that it becomes unwieldy or distracts from strategic goals. Network design projects typically begin with extensive data collection—some of it clean, some not. Experienced modelers know when and where assumptions can be made without compromising the integrity of the results.
- **Engaged and responsive project team.** While much of the heavy lifting is done by the consulting team after data collection, client-side engagement remains essential. Timely responses to clarification requests, validation of assumptions, and participation in key decisions are critical to keeping the project on track and ensuring that the final recommendations are both accurate and actionable.

When the rubber meets the road

By understanding ***why*** supply network design is crucial, recognizing the different ***types*** of projects it entails, and diligently applying the ***keys*** to successful project execution, organizations can build more resilient, efficient, and customer-centric supply chain network ecosystems. •

Embrace the hero maker's craft to guide the quest for SC transformation

By Stan Fawcett, Sebastian Brockhaus, A. Michael Knemeyer, and Amydee M. Fawcett

By mastering the hero maker's craft, supply chain leaders can mentor, empower, and transform their teams to overcome crises, drive renewal, and achieve lasting competitive advantage

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You know the names: Confucius, Yoda, Anne Sullivan, and Mr. Miyagi. Do you know what they did to earn their spot on this elite list? As you take a moment to think, let's point you in the right direction. Each was an unconventional, but highly effective teacher who provoked self-discovery. If you're still struggling, let's offer a hint: They invested deeply in their protégé's abilities and triumphs, sacrificing spotlight for legacy. Do you have an answer? Here is ours: They were hero makers.

Perhaps you're wondering, "What exactly is a hero maker?" A hero maker is a mentor, i.e., a teacher-leader who cultivates the potential in others, empowering them to courageously and capably conquer the challenges in their own lives. Hero makers help others unlock their own potential to become more than they ever imagined possible. Now, you may ask: "As a supply chain professional, why should I care?" The answer is simple: You need to learn the hero maker's craft to guide your quest for two goals.

1. **To cultivate a winning team.** Victory in today's chaotic, hyper-competitive marketplace demands a near heroic effort—every day. Such effort is only possible if you cultivate the hero in each of your team members.
2. **To build a learning organization.** Enduring competitiveness requires constant advances, including occasional leaps forward via radical change. Such evolution emerges as you follow the hero maker's proven transformational path.

Before we delve into hero makers and their craft, let's briefly peruse the hero's journey. Our goal is to show how the hero's journey parallels your decision-making world.

The hero's journey

What is the hero's journey? In 1949, Joseph Campell published a book titled, "Hero with a Thousand Faces." His storyline: Heroes emerge as they engage in prototypical transformative experiences. Campbell chronicled 17 steps; we simplify these into four stages, which you likely recognize as part of your never-ending quest to stay competitive.

1. The call to action. A challenge disrupts the protagonist's ordinary life, inviting, even daring them to leave the familiar world to enter the unknown and embark on a risk-filled quest.

2. Growth through experience. In the strange new world, the protagonist confronts challenges, encounters enemies, and forms alliances. Experience encourages growth—in skills and self.

3. The darkest night. The protagonist confronts crisis. A life-or-death ordeal tests their limits, forcing them to face their fears. Victory promises transformation. Defeat means demise.

4. The return. Having overcome all threats, the protagonist receives a reward—i.e., a treasure of knowledge and/or wealth—and returns to their ordinary world a hero.

Did you notice the hero's journey maps to the evolution of the human psyche—from unaware youth to authentic, enlightened leader? Perhaps this is one reason the hero's journey resonates so strongly with us. And if Hollywood is an indicator, it remains as popular today as it was to the ancient Greeks. Instead of Heracles and Perseus, you saw Luke Skywalker, Simba, Moana, and even Barbie struggle through adversity to fulfill their destinies. And you likely cheered them each step of the way, making you a witness to the power of the hero's journey.

Let's return to the query: "Why should you care?" The answer is found in Figure 1. The hero's journey is analogous to the hype and business lifecycles. Consider the parallels.

1. Strategic adoptions. The hype cycle depicts technology adoption over time, from initial hype (i.e., the call to action) to eventual mainstream adoption (the return). Most strategic initiatives—e.g., building a resilient or sustainable supply chain—follow a similar path. The shape of the curve suggests you need heroic fortitude to survive the transformative journey.

2. Business model renewal. Every business, including yours, is in a constant struggle to survive. According to McKinsey, in 1958, the average lifespan of an S&P 500 company was 61 years. Today, it is 15. Do you remember A&P, Bethlehem Steel, or Circuit City? Each was once an industry leader. Each was also defeated by its darkest night. Demise followed. Your next darkest night is never more than a few years away.

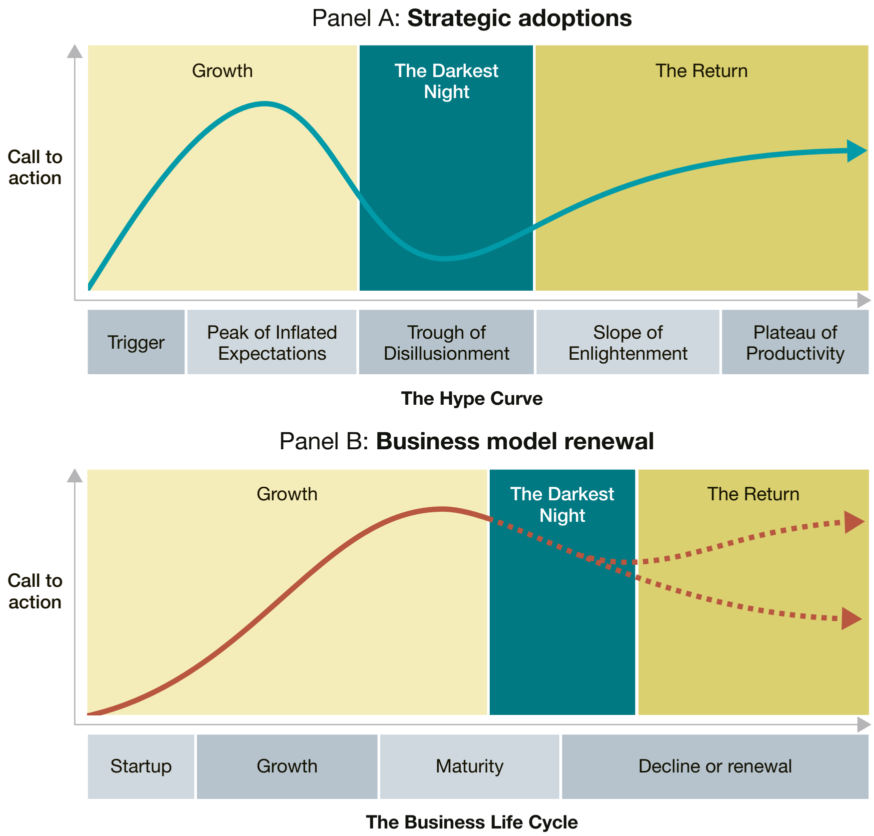
Your takeaway: In today's chaotic marketplace, plagued by disruptive technologies, geopolitical tremors, tough new rivals, and rising customer demands, every company needs a hero maker to help it confront coming crises. Now, let's look at what it takes to be a hero maker.

Hero makers and their craft

The hero maker is fundamental to the hero's journey. Because you've seen the story (many times), you intuitively know why. But let's be explicit. When the call to action comes, the hero-to-be either seeks to run away or rashly rushes in. Both scenarios would doom the story. Either the quest would never happen, or the protagonist would die along the way. The hero maker must thus step onto the stage early in the story. The hero maker does the following two things.

FIGURE 1

Mapping the hero's journey to SC transformations



Source: Authors

1. Changes mindsets. At the outset, heroes-to-be are flawed characters, lacking either humility or a quiet self-confidence. They are seldom self-aware or emotionally self-regulating. They may lack discipline, purpose, or resilience. And many must learn empathy. The hero maker initiates the attitude adjustment; the quest completes the transformation.

2. Cultivates critical capabilities. Readiness requires more than just the right attitude. To emerge victorious, protagonists need the right skills and deep stamina. Both emerge as the hero maker puts the protagonist through rigorous and deliberate practice. Along the way, the hero maker shares encouragement—and perspective.

Now that you know what hero makers do, you may be wondering: "What are the characteristics of a hero maker?" Two traits stand out in storytelling and in the SC world.

1. They possess clout. Respect and position matter. Respect invites trust, and position brings privilege—the ability to shape culture. Because hero makers can't dictate growth, they exert influence. They make it safe to step out of the box and try new things, but hold their protégés accountable. And they use their position to commit critical resources to the growth initiative.

2. They are authentic. Hero makers walk the talk, exemplifying personal responsibility. Others are drawn to their vision and want to join the cause. Most importantly, their lived example arouses grit—a desire and determination to never give up or give in, even when a task is hard or seems hopeless.

Finally, let's look at the hero maker's craft, i.e., how they prepare protégés to win against the toughest odds. You see, hero makers aren't just change agents, they are mentors in the richest sense—elevating others' aspirations and abilities. How do they do it? They are hands-on, experiential teachers who …

• see the potential in others, even when it's hidden, before the individuals see it in themselves.

• cultivate space for struggle, knowing challenge, not comfort, invites growth.

• involve learners directly and deeply in the process to create learning via lived experiences.

Simply put, hero makers don't just convey competence; they shape character and spark self-mastery. The result: The hero maker enables protégés to do things they never could before.

Your quest to employ the hero maker's craft

Perhaps you're thinking: "I'm intrigued. I see value in becoming a hero maker, but I'm no Gandalf." Relax, you don't need to be. Indeed, rather than look to Hollywood's hero makers or history's all-time greats, let's model your quest on the more relatable Erin Gruwell. Ms. G, as her students called her, was a newly minted and quite naïve high school teacher at Woodrow Wilson High School in Long

Beach, California, in the 1990s.

At first glance, and in her early days in the classroom, Ms. G doesn't come across as a model hero maker. She had to grow into the role, just like you. But she persisted through early flops—modeling your probable path—to become a hero maker and transform her students' lives (see Figure 2). Let's look at how she changed mindsets and cultivated capabilities.

The hero maker's bona fides

If you've seen the movie *Freedom Writers,* you're familiar with Ms. G's story. You know she started out with little respect and even less clout. Her HOD dismissed her lesson plans; her colleagues disparaged her passion; and her students dissed her abilities, asking: "Have you ever taught before?" The good news: Ms. G's position as a teacher gave her just enough space to shape the classroom culture. Her authenticity, as it emerged, gave her just enough power to invite change. Your takeaway? Authenticity is often more potent than clout.

We don't want to gloss over the challenge of cultivating change without clout. Ms. G's first months in the classroom weren't just awkward; they were painful. Without grit, she would have walked away—or conformed to norm, i.e., teaching that checks boxes but doesn't touch hearts and elevate skills. Slowly at first, then quickly, Ms. G learned that to make change stick, you have to make change safe. Authenticity and grit kept her in the game as she began to learn and practice the hero maker's craft.

Authentic significant emotional events

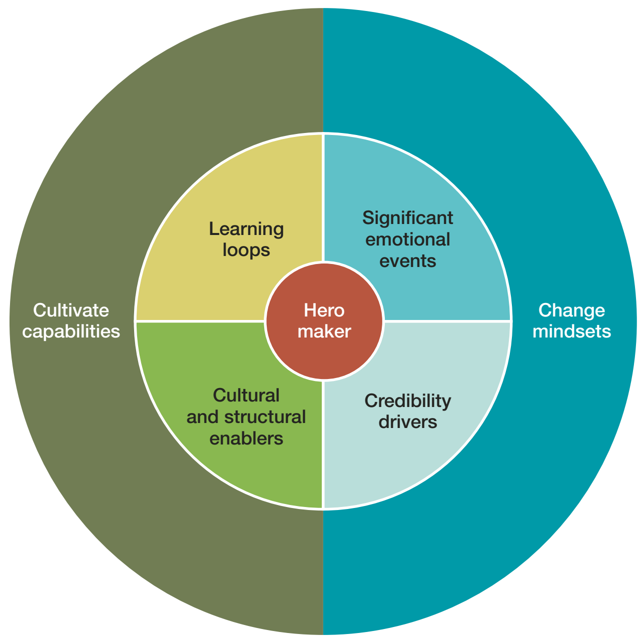
Ms. G, who admired her father's civil rights activism, chose Woodrow Wilson because of its voluntary integration. She wanted to work with disadvantaged students from diverse racial and socioeconomic backgrounds. Her goal: Help them build the skills needed to stay in school—and succeed in life. Even so, Ms. G was shocked by the culture she found. Her students disdained learning and despised each other. She quickly grasped she was out of her depth.

Ms. G's initial response: She doubled down on her teacher-as-colleague MO. In an early scene, she turned to the lyrics of Tupac Shakur. The activity didn't end well. Her students viewed it as inauthentic. To them, she was a poser. One derided: "You have no idea what you're doing up there, do you?" Another, when asked to move to the front row, first ignored, then defied her. Exasperated, she pulled a power play, moving all of the students to new seats. As the last student sat down, she asked, "How do you like the new borders?"

Re-assigning seats to break up cliques is a classic significant emotional event (SEE), i.e., an intense emotional experience that acts as a turning point, motivating a shift in attitude and behavior. This SEE, however, backfired. The sudden shift in MO—from supposed friend to power player—animated animosities. Rather than elevate student attitudes, the SEE invited them to stop coming to class. Ms. G was back at square one, still seeking her authentic self.

FIGURE 2

The hero maker's craft



Source: Authors

The turning point for Ms. G came unexpectedly. A Latino student drew a caricature of a black peer. As the drawing circulated, students snickered. Ms. G grabbed the paper, asking, "What is this?" Aghast, she compared the sketch to those used by the Nazi's to dehumanize the Jews, a precursor to the Holocaust. One student asked: "What was the Holocaust?" Ms. G invited, "Raise your hand if you know what the Holocaust is?" One hand went up. She paused, then asked, "Raise your hand if you've ever been shot at." All but one hand went up. The bell rang. Ms. G had grasped a hard reality. Her students had been right; she didn't know them or their lived reality.

Ms. G began to ask better questions and employ better SEEs, enabling her to find her authenticity as a hero maker (see Table 1). Consider two effective SEEs.

1. The line game. Ms. G used tape to mark the middle of the room. With students on both sides, she invited them to walk to the line each time a question applied to them. Quickly, they realized they weren't alone. Empathy began to displace hate.

2. The Museum of Tolerance. She took her students (on her dime) to the Museum of Tolerance. They then dined with Holocaust survivors at the Marriott, where Ms. G worked a side gig. The students' eyes began to open, letting in enough light to find hope for their own lives and to see Ms. G as a true mentor.

TITLE 1

Ms. G's incremental SEEs

Significant emotion event	Influence on mindset
Ms. G re-assigns seating.	Broke up cliques, but created resentment.
The line game: Students step to the line if statements apply to them.	Realize shared pain; empathy begins to replace hate.
Journaling assignment: Students write their stories in personal journals provided by Ms. G.	Students discover self-expression can be healing. They begin to see Ms. G differently.
Ms. G bought new books for the students to read.	Students feel valued, i.e., Ms. G believes they are worth investing in.
Ms. G takes students to the Museum of Tolerance.	Students encounter reality of genocide; they feel pain but also hope.
Students dine with Holocaust survivors.	Students connect deeply with real witnesses; gain perspective on survival and courage.
Toast for change: Each student commits publicly to a new path they want to pursue.	Powerful ownership and accountability; class bonds deepen.

Source: Authors

Crucially, because she was learning her craft—and because she couldn't dictate respect—Ms. G earned trust through a series of incremental SEEs.

Walmart, Sam Walton's five-and-dime that grew into the world's largest retailer, knows a little about the power of SEEs to enable business model renewal. Consider three inflection points when Walmart sought radical business-model transformation.

1. Making the format leap. For 20-plus years, Walmart built an EDLP champion across rural America. By the mid-1980s, Walmart encountered a SEE—it had run out of room to grow. Walmart brought new markets (grocery and global) and new technologies (cross-docking and Retail Link) together to create the supercenter—a growth driver for the next 15 years.

2. Enhancing image. By the early 2000s, Walmart's stock price flatlined amid a series of missteps. Target (aka, tar-zhay) had become Wall Street's retail darling. CEO Lee Scott announced a bold move: Walmart would become a sustainability leader. Walmart also began a store-renovation program, removing SKUs to clear the clutter and adding high-end items like the George clothing line. By 2011, it was clear both moves had failed. Few customers bought the sustainability pitch. Many began to question Walmart's EDLP leadership.

3. Meeting customers where they want to buy. By the mid-2010s, pundits had begun calling Walmart a bricks-and-mortar dinosaur. Amazon, the "A-to-Z store," had changed consumer shopping habits. And Aldi, the German deep discounter, had undercut Walmart's prices by 18%. Facing a darkest night, CEO Doug McMillon embraced Walmart's 5,000-store network and doubled down on investment in know-how and technology to meet customers wherever they wanted to buy. Walmart would reinvent retail by becoming a tech giant.

To summarize, in 1962, Walmart began its hero's journey. The good news: Sam Walton was built to be an authentic hero maker, and Walmart flourished. Vitally, his culture of meeting challenges, especially of the darkest-night variety, with bold renewal gambits stuck. Naturally, Walmart has struggled at times. The hero's journey is daunting, and leaders like Doug McMillon needed time to grow into their hero-maker roles. But renewal has become part of the Walmart way. Your takeaway: Leverage SEEs with authentic transformative initiatives.

Credibility drivers

Ms. G's SEEs began to thaw, if slowly, her students' hearts and unlock, if only a little, their minds. They created space for new attitudes—and new relationships. To move the class forward, academically and emotionally, she needed a credibility driver, i.e., a project that would help the students see their own potential and begin to trust the process. So she bought her students journals. The assignment: Write in them every day. Her promise: She would only read them if they gave her permission by putting them in a cabinet she would lock after class.

Critically, the journaling project met the students where they were, but invited them to step out of their comfort zones. Telling their own story in writing—and every day—was a big step up. Being vulnerable was too. Ms. G knew momentum was building as the stack of journals in the cabinet got deeper and deeper. Her students were beginning to open up. More importantly, they were buying into the possibilities a new culture and curriculum could provide.

Walmart has a go-to credibility driver: The pilot project. Pilot projects at Walmart serve two purposes—as a proof of concept, and if an idea works, to provide the insight needed to scale it to Walmart's network. Consider Walmart's quest to match Amazon's delivery speed by using its 5,000 stores, located within 10 miles of 90% of the U.S. population, as fulfillment centers.

- In 2019, Walmart partnered with Alert Innovation to pilot its first market fulfillment center (MFC) in Salem, New Hampshire. An MFC is a small (35,000 sq. ft.) automated warehouse attached to or built within a supercenter and filled with 1,000s of fast-selling SKUs.
- In October 2022, Walmart bought Alert Innovation and its Alphabot system to bring learning in-house. By 2023, Walmart operated a handful of MFCs, which had shrunk picking time to less than 12 minutes for 95% of online orders.
- In January 2025, Walmart sold its robotics business to Symbotic, agreeing to buy 400 of the Accelerated Pickup and Delivery centers (ADPs) the companies had co-developed, enough to scale the MFC concept nationwide.

Walmart is committed to pilot projects and other credibility drivers to grow its capabilities and shrink last-mile delivery from days to hours—or even minutes.

Structural enablers

On day one of their sophomore year, Ms. G met her students with a "TOAST for CHANGE," another incremental SEE. Consider Ms. G's invitation,

"We're each gonna make a toast for change.
And what that means is, from this moment on.
Every voice that told you 'You can't' is silenced.
Every reason that tells you things will never change
disappears. And the person you were before this
moment, that person's turn is over. Now it's your turn."

The toast was a reminder they had left a toxic learning culture behind and a recognition of their individual, personal growth. Ms. G invited them to commit to a quest for a better education—and a better life. They would do it together. A collaborative culture would enable their journey.

That first day, Ms. G also had a Borders (a company that didn't survive its darkest night) bag for each student. Each bag contained four books they would read, including "The Diary of a Young Girl" by Anne Frank, and "Zlata's Diary: A Child's Life in Sarajevo" by Zlata Filipović. Do you see a theme? Her students weren't a lost cause. They should be courageously hopeful. The emerging culture and elevated curriculum were purposeful structural enablers. Ms. G was raising the bar. The class would still be a safe harbor, but what happened in and outside the class would be more rigorous.

Indeed, with growing confidence in each other, Ms. G evolved her pedagogy. She would no longer be the sage on the stage. She would be the guide on the side. The students would become peer coaches. Experiential learning, with a healthy dose of deliberate practice, would become the norm. Instead of writing a book report on the diary of Anne Frank, the students would write letters to Miep Gies, the woman who sheltered the Frank family.

This enabling culture was a natural place for a student to propose the class bring Miep Gies to "come and speak." Ms. G told them it would be "really expensive." Their response: "We could raise the money." And they did. Miep Gies's visit was an inflection point. Big initiatives like integrating their personal journals into the New York Times best-selling book *The Freedom Writers Diary* would become part of Ms. G's MO. Room 203's learning culture was changing. The trajectory of her students' lives would soon follow.

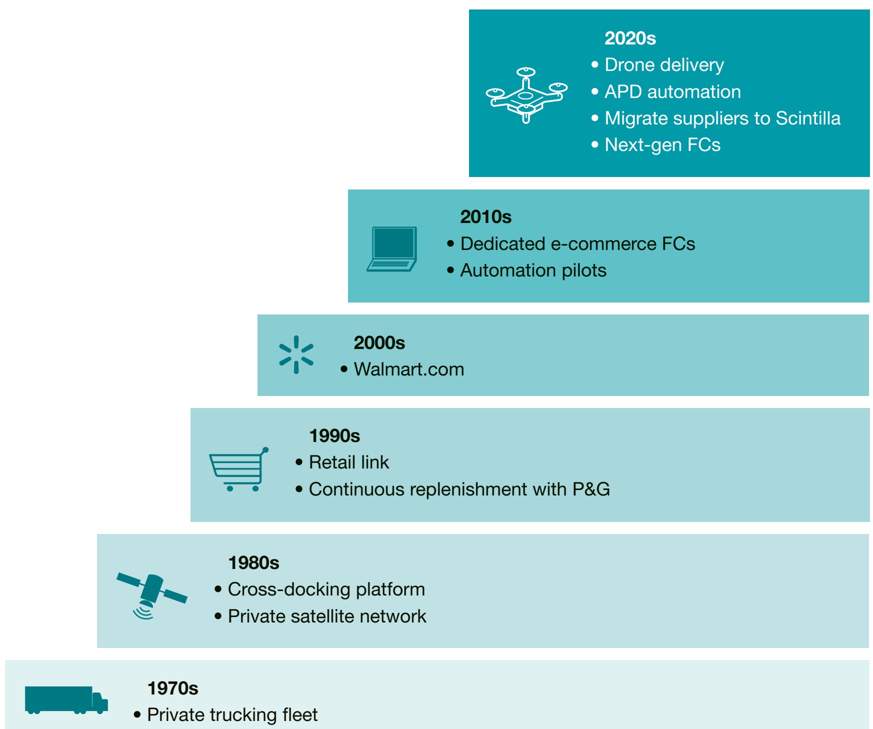
Walmart has long been a beast at scaling its best ideas. Did you know that in 1966, Sam Walton attended an IBM school in Poughkeepsie, New York, to learn how computers could help digitize and expand his retail business? He planned to hire the brightest student to bring the new technologies to Bentonville. And Walmart has never stopped investing in structural enablers—e.g., infrastructure, relationships, and technologies (see Figure 3). The result: Walmart's consistently renewed business models have shaped the future of retail for the past 40 years.

And when Walmart has lagged, the hero maker's craft has helped close the gap. Consider e-commerce and omnichannel fulfillment. Walmart was slow on the uptake, perhaps because executives gave too much credence to anti-bricks-and-mortar pundits. Many of its early pilots skirted its stores. Only when McMillon put the stores at the heart of its e-commerce strategy did pilots start to pay off, proving a viable path forward. The result: In the space of a few years, investments in structural enablers delivered a winning portfolio of ways for Walmart to meet customers where they want to shop.

- A visit to a physical store, which 200 million shoppers do each week.
- Order online and pick up at the store (within a few hours).
- Order online, deliver to the front door (1-, 2-, or 3-day delivery available).
- Order online, deliver InHome (to the garage, counter, or fridge).
- Order online special delivery (express in 2 hours; late night before midnight).
- Order online, deliver by drone (in as little as 30 minutes in limited markets).
- The bottom line: Staring down Amazon and Aldi, a true darkest night, Walmart went full beast mode. By investing in structural enablers—e.g., Walmart+, Next-Gen FCs, and Scintilla, a data and insights platform—Walmart transformed its pilots into a remarkable delivery ecosystem.

FIGURE 3

Investing in structural enablers



Source: Authors

Learning loops

Even as a new teacher, Ms. G grasped the education system had given up on her students. And they had given up on themselves. The negative inertia stifled growth. Her best hope to build momentum for student progress was to build learning loops into everything, including her classroom culture. She started slowly, and then let the flywheel effect take over.

- **Step 1: Personalized purpose.** As Ms. G connected learning opportunities to students' lived experience, they developed a sense of purpose—and an increased desire to learn.
- **Step 2: Reflection.** Through journaling, Ms. G invited reflection, a powerful driver of consistent and continuous learning.
- **Step 3: Peer coaching.** As trust emerged, Ms. G invited her students to do peer reviews, holding each other accountable and encouraging each other to work to a higher standard.

Ms. G's pedagogy invited students to connect with others and to engage in a call to action, i.e., to create a virtuous cycle of understanding and growth. Sam Walton extended a similar invitation. Consider Rule #7 from his 10 rules for success: "Listen to everyone in your company: The people on the front lines know what's going on; get their insights and learn from their ideas." Success required everyone—from the newest employee to the CEO—to talk to customers to "find out what they like, what they don't like, and what we don't have that we should have." Leveraging learning was everyone's job, an invitation Walmart extended to suppliers with the launch of Retail Link in 1992. The daily practice of observing, asking, analyzing, and acting (OA3) permeated Walmart's culture—and drove its cycle of understanding and growth.

With learning loops built into the Walmart way, McMillon faced a daunting task: Leverage digitalization to amplify the OA3 process. Access to information and AI was the opportunity. The loss of intuition, i.e., the human touch, was the threat. Walmart's response: Launch Scintilla, an AI-enabled data platform that enables creative contributions from all members of the SC team.

Scintilla, which derives from the Latin word for "spark," signifies the power of a single, granular piece of data to ignite innovation. Is Scintilla working? Merchants and suppliers say easy access to cross-platform data is helping them …

- Make faster, smarter data-driven decisions to optimize operational and sales strategies.
- Gain unprecedented insight into customer behavior and needs.
- Identify growth opportunities and ideate/innovate ways to leverage them.

Scintilla is reducing costs and driving up revenues, especially as decision makers use the data to cultivate new insights. The biggest winners are finding innovative ways to collaborate more effectively with, and across, Walmart as well as to meet evolving customer needs. Scintilla enables Walmart to take hero-making to an entirely new scale and scope.

The hero maker's influence

What do hero makers do? Ms. G enabled her students to reimagine their own lives—and how they interact with others—change their own decision processes, and rechart their futures. Many of her students went on to become first-gen university graduates. Some became successful business leaders, others became educators. Most paid it forward, blessing the rising generation of disadvantaged youth.

What about Sam Walton and Doug McMillon? They helped their SC teams transform the EDLP slogan into reality. Millions of people worldwide save money and live better every day. But the story really doesn't end with Walmart customers. We have worked with hundreds of Walmart suppliers. They profess that Walmart lives up to its internal slogan of being tough, but fair (at least mostly). They say working with Walmart is often a daunting challenge, but one that has helped them raise their game—as well as their growth and profits. The result: New capabilities and products have come to market, reducing the cost of living for the people of the world.

Whether you are focused on your people, your organization, or even your SC team, isn't it time to consider embarking on the quest to become a hero maker? Yes, most people aspire to be the hero. We get it. But empowering your team members, organization, or suppliers to win their darkest-night battles may be the more compelling story, and more professionally satisfying as well.

And don't forget, in our crazy, competitive, and chaotic world, another darkest night always awaits. Embracing, then mastering the hero maker's craft will give you, and your company, the best chance of winning successive darkest-night confrontations. The hero maker's craft changes mindsets and cultivates capabilities. More importantly, it works. You can help your people, your company, and your SC team go where they could not, or would not, go alone. Imagine and embrace the quest. It's time to make the world a better place. Such a legacy is worthy of acclaim, not unlike the mythic hero's glorious return. •

Building globally resilient value chains for sustained operations

By Sumantra Sengupta

Building globally resilient value chains requires agility, integration, and proactive design frameworks that enable organizations and nations to withstand disruption and sustain operations. Here is a framework to help organizations and nations sustain operations amid ongoing disruption.

The pandemic of 2020 has had a significant negative impact on supply chains affecting various aspects of trade, finance, and even societal growth. According to a survey conducted by the global management consulting firm Ernst and Young LLP, more than 57% of companies reported serious disruptions and 72% reported a negative impact. As the world started to recover and move back to some elements of normalcy, the Russia-Ukraine conflict began in February 2022, resulting in significant disruptions and shortages in the global food supply and logistical shortages in the Black Sea corridor. R. Jadav (2022) wrote that disruptions can also emerge from protectionist trade strategies during a crisis when producing countries prioritize supply for their populations, such as Indonesia's brief implementation of an export ban on palm oil.

Food prices reached all-time highs in 2022 and 2023, and the cost of crude was also significantly affected, rising to over $127 per barrel in March 2022 before settling into a more normal range in 2024. However, a January 2024 article in Humanities and Social Sciences Communication by Qi Zhang, Yi Hu, Jianbing Jiao, and Shougang Wang illustrated that the Russia-Ukraine war resulted in a $37.14 increase in WTI crude oil prices and a $41.49 increase in Brent crude oil prices. Political interference, in many cases, uninformed and unwarranted, tends to escalate situations when international trade does not form the basis or even factor into discussions.

The past decade has shown us that there is only one certainty in the globally connected economy—we will remain in an environment of risk and lack of designs for sustained security for fundamental citizen needs.

Emmy Wassénius, Miina Porkka, Magnus Nyström, and Peter Søgaard Jørgensen found that risk and lack of designs for sustained security resulted in most of the world (127 countries and territories, 87% of the global population) achieving high levels of potential self-sufficiency (≥6 nutrients fulfilled), however only 33% of the world population (41 countries) are fully self-sufficient.

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Supply chain management continues to evolve and designing for agility and resilience has emerged as one of the top priorities for all types of environments and even countries are focused on designing and maintaining adequate reserves for their citizens. Due to war, socioeconomic crises, natural disasters, and climate change, many developing countries are facing worsening issues related to food insecurity, whether it be malnutrition, disrupted food supply sources, or even starvation.

In this article, we present an iterative methodology and embedded framework that constituents should consider while developing global supply chains for agility and resilience.

The GRVC

What is a globally resilient value chain or GRVC? We will not discuss the base construct of a value chain in this article since many colleagues have authored thought leadership pieces that describe the latest thinking in the field. I often revert to the original concept that was introduced by Harvard Professor Michael Porter in his book "Competitive Advantage: Creating and Sustaining Superior Performance." However, we will enhance the concept of an agile value chain with the overlay of resilience.

Global resilience is often described as the ability to address global issues through international cooperation, shared resources, and coordinated efforts. Utilizing the commonly accepted or understood definition of a value chain—we present the notion that a GRVC for an organization (for-profit, not-for-profit, or country) must possess the following guidelines listed in no specific order.

Must have design agility and operational flexibility. Addressing risk and associated resilience in a global context requires that the design framework utilized across all aspects of the major processes incorporate agile covenants and allow for modifications on an as-needed basis. There is an old saying that necessity is the mother of invention and when resilience is being tested—major design constructs may require deviation within allowed limits. So, each construct of the design-to-delivery process must be designed to accommodate agility for deviations and in the same vein allow for operational / implementation flexibility.

Must include the relevant coverage from human factors, process enablement, and advanced technology adoption across every value chain process involved in the design to delivery and orders to cash process(es). Resilience and risk management adoption must include detailed implementation plans involving the people responsible for the execution, the process steps that are to be used in the event of risk and stress, and the various advanced technology elements (ERP, advanced and intelligent response systems as well as predictive technologies) required to deliver the required results.

The end-to-end chain must be able to operate over extended periods using the 70/85 rule. Risks to the chain could occur with or without notice. Examples of risk could be geopolitical (will be with notice), component issues (with or without notice) or logistical route stoppage (with or without notice). Each risk event requires the chain to be resilient. However, the end-to-end chain must be designed to operate at 70% efficiency, span, and scale over long periods, and yet be able to deliver customer and consumer satisfaction at levels near a mark of 85%. The reason we highlight the two percentages at the levels listed above is based on many large-scale projects done over the past decade where risk elements had to be managed globally across various industry segments (including the global pandemic) and the resulting service levels that emerged to allow for disrupted and yet smooth operations without large long-term revenue and customer base erosion.

Must have elements of vertical and virtual integration. Global value chains for most environments will require the span and scope of infrastructure and processes to be designed, developed, and instantiated for operations. However, the capital investments required to create a complete end-to-end vertically integrated value chain are prohibitive even for the best-funded corporation/country. The design of the span will require a combination of vertical integration, joint ventures, and deeply rooted mutually beneficial partnerships that can be classified under virtual integration. A virtually integrated environment is one in which partners operate as a unified entity without any formal investments but with operating agreements that are governed to deliver mutual benefits. The concept of virtual integration was introduced by the author in the 2010 book "Virtually Vertical—Pragmatic Guide to Streamlining the Corporation."

Must be reevaluated every 5 years to 7 years for modifications and adjustments. Given that risk elements can be wide-ranging across the span and scope of the value chain, it is key that the chain links and processes be evaluated, and mock-tested every five to seven years for evaluation and modifications. Additionally, the types of risk evolve and hence the types of sustainable activity and actions must also be incorporated or adjusted for the GRVC to remain relevant.

Must be owned and operated with a clear RACI. For GRVCs to be operationally ready, every link, process, and infrastructure must have ownership that is well-understood and documented. The RACI chart (responsible, accountable, consulted, and informed) and ownership of the various portions should be approved by the executive team and staffed appropriately so that operational deployment is efficient when the need arises. Too often, valuable time can be lost (which could result in losses of many dimensions) when there is confusion in the RACI and ownership of the vertical and virtual portions of the global value chain.

We should note that the implementation of the six guidelines does not guarantee success but serves as an enabler for smooth and efficient implementation of the GRVC in times of risk and stress. The resulting actions demonstrate the resilience of the GRVC and enable the entire system to learn and adapt over time.

Dual impact structure

November 2022 *Supply Chain Management Review* featured an article titled "Build a Playbook to Implement Supply Chain Resilience" (authored by the same author as this article) and highlighted a framework that was relevant to applying constructs of redundancy to various aspects of the supply chain. The current framework should be viewed by readers as an overlay to the one presented in the November article to include aspects of resilience and global risk management by utilizing macro factors such as political posturing and economic policies.

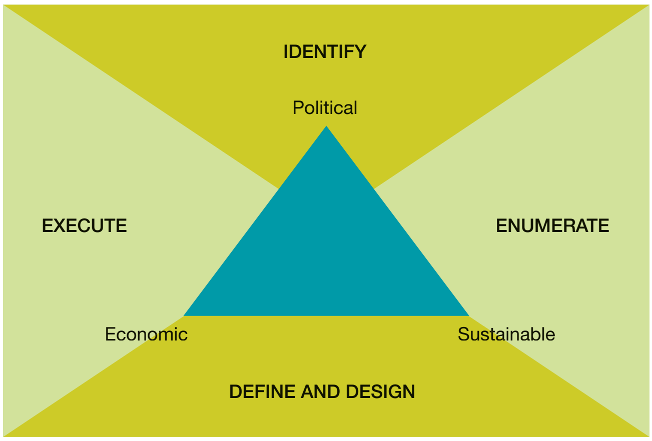
The global resilience framework that we propose is a Dual Impact (DI) dimensional structure that has an outer layer and an inner core. The outer dimensions of I, E, D&D, and Ex serve as the fundamental building blocks for the resilience strategy that can be adopted by countries, regions, global corporations as well as other multinational entities, including mega foundations (such as Gates Foundation). However, the inner structure that comprises the triangle of politics and its ever-present impact on strategies and fiscal/economic policies can have a huge impact. Finally, the element of designing for a sustainable duration and impact is crucial to ensure that resilience remains at the core of the entity.

Let us now examine the Dual Impact framework in greater detail. The outer dimensions or the foundational layer is comprised of the following.

Identify (I). Resilience cannot be applied as a broad-brush stroke across all dimensions of an enterprise. It is crucial to approach the effort in a pragmatic yet impact-driven fashion. The team must start with the core mission/objective of the enterprise and attempt to list all elements that enable the mission. This can often serve as a guiding beacon for the identification process. The curated list can comprise product and service categories, customers and channels, regions of demand and supply as well as internal

FIGURE 1

Dual impact framework



Source: Author

processes required to be resilient. The curated list must also assign relative weights for each element that is enumerated with a clear explanation of how the team arrived at the relative scoring.

In a recent project for an emerging bio-stimulant company, the identification process yielded the fact that of the 15 product lines serving four regions and seven customer segments, the highest relative weight/need for resilience existed for the core supply processes and partners used to serve three of the product lines in one region. The reason for this was primarily driven by the fact that the product group chosen was the one which had the highest level of IP (intellectual property) associated and the long-term future of the enterprise and its customers far outweighed the short-term gains/losses.

Enumerate (E). The process of enumeration is akin to the creation of business plans and business cases that have been in our lexicon for many decades. The difference in this enumeration process lies in the time phasing and the interconnectedness of the needs. The interconnectedness arises from the simple notion that end-to-end vertical integration in which every element of resilience will be owned and operated by the same entity is nonexistent. Every entity in our globally connected world must rely on partnerships to varying degrees. The enumeration interconnectedness facet must focus on details of the efforts that the partners will also accept and adhere to so that the whole system offers the same degree of resilience. The time-phased nature of the enumeration process must explicitly state the start date, the end date, total initial costs as well as ongoing maintenance costs required to sustain the level of resilience. Resilience as we have stated repeatedly is not a one-and-done exercise but one that must be sustained over long periods. However, as needs shift and change, we must also accept the fact that the relative rankings could shift, which would then imply the ongoing costs.

Many years back, I was working closely with an executive team from a leading consumer goods company providing food security-related items/staples in our day-to-day lives. The company was vertically integrated for approximately 70% of its needs for the entire order-to-delivery process. However, some key components inbound and outbound were entrusted to partners. During our enumeration process, I still recall the global CEO stating in one of our meetings in a very eloquent but insightful manner, “We can make all the investments and preparations but, in the end, the little ‘pimple on the elephant’s butt’ will affect all our efforts;” implying that the pimple was the efforts or lack thereof of the partners.

Define and design (D&D). The D&D phases must include all elements of infrastructure, processes, and human factors required for operations as well as supporting technology required for ongoing implementation. The needs for each component must be explicitly stated so that all parties gain a crisp and clear understanding of the roles and responsibilities in terms of the need for resilience.

We suggest the following:

- ***Define the problem/goal.*** Make sure the enterprise clearly articulates what needs to be solved or achieved.
- ***Conceptualize.*** Brainstorm and sketch ideas to solve the problem or meet the goal by utilizing all elements listed above.
- ***Simulate.*** Build an initial version of the end-to-end model.
- ***Refine and iterate.*** Adjust based on feedback and testing to improve the speed and quality of response.

Execute (Ex). The execution of a resilient design involves implementing strategies that allow systems, structures, or processes to withstand, adapt to, and recover from disruptions while maintaining their core functionality. The execution process must incorporate flexibility and scalability of the entire roadmap and include various real-time end-to-end simulations coupled with partial actual testing of subprocesses and responses. This type of testing has been conducted for years under war gaming and disaster recovery testing by enterprises and countries all over the world.

As we noted in the DI framework, the inner structure must be combined with the outer layer for the creation of the finalized resilience map. As I think back on the many years of helping global companies and, in some instances, countries develop resilience maps, I am reminded of incidents that occurred that affected the best-laid resilience plans. The incidents all centered on the inner structure areas with political and economic policies leading the way. I have had to deal with China changing import quality protocol while hundreds of thousands of metric tons of product sat at the ships and ports quarantined, incurring daily demurrage and holding costs. I had to work through the impact of foreign exchange impacts as the Japanese Yen lost heavily and suddenly to the U.S. dollar and the Euro to dollar hedges shifted. I recall a large trade in a Latin American country as well as the African continent where inflation and stagnation completely changed the dynamics of the local currency orders for export. One of the worst situations had the company needing to find alternate shipping routes and mechanisms due to the sudden insurgence of local politics causing regime shifts. As we often say, hindsight is 20/20 and over the years, I modified the framework to include the inner dimensions to create a more holistic and complete framework. In the world of management, the evolution of the resilience framework is like the additions and modifications that Dr. Michael Porter has made to the Five Forces framework by adding a sixth force and the combination of Five Forces with the PESTLE analysis developed by Francis Aguilar.

The inner dimensions comprise:

Political (P). Political resilience for corporations and countries refers to the ability to navigate, adapt to, and thrive despite political change and disruptions. This resilience is increasingly vital in a world where political dynamics—such as policy shifts, regulatory changes, geopolitical tensions, and public sentiment—can significantly affect operations, reputation, and profitability.

Economic (Ec). Economic policy resilience refers to the ability of a nation’s economic policies and frameworks to adapt and recover from economic shocks, disruptions, or crises while maintaining stability, fostering growth, and supporting societal well-being. It involves designing and implementing policies that can withstand and respond to challenges such as financial crises, pandemics, geopolitical tensions, climate change, and technological disruptions.

Sustainable (S). Sustainable policy resilience refers to the capacity of policies to adapt, endure, and maintain effectiveness in the face of changing environmental, social, and economic challenges while promoting sustainability principles. This concept combines two critical elements: sustainability and resilience.

The GRVC framework, in similar fashion to other frameworks, is only as good as the overall context and ability to execute for sustained resilience. However, frameworks serve as a language that can be used to educate the various constituents who are participants in the virtual resilience mosaic. The ability to utilize the framework also allows for the ability to test for scalability and simulate modifications in near real-time. Frameworks also allow for appropriate metrics that can be utilized for long-term resilience. The usage of metrics drives accountability throughout the process and over long periods.

In the next section, we highlight a case study that was based on several years of work that my team and I were involved in to help in the development of a resilience strategy for a region.

Middle East case studies

The Middle East is often in the news for its dominance in oil production and, unfortunately, political conflict. What is often overlooked is the fact that the region imports more than 50% of its food production (in some years almost 60%) from various parts of the world—namely the U.S., Russia, Ukraine, Brazil, India, parts of the EU, and Canada. There are several projects ongoing in that part of the world to reduce the reliance on imports by encouraging sustainable agriculture practices, indoor food production, and other methods that conserve the shrinking water table. However, the population growth in the region continues to hover between 1.5% and 2% which is significantly higher than the global average. The U.S. alone exported more than $6 billion in agribusiness and related commodities to key countries in 2024 per USDA reports.

The high levels of potential turmoil within the region coupled with global conflicts (Russia-Ukraine conflict) have continued to be of major concern to the food resilience approaches that various governmental agencies continue to focus on. One such approach is the well-established public-private partnership models that have been implemented in the region successfully.

The case study highlighted in this article is a combination of several projects that were initiated by governments and successfully implemented in the Middle East region pre-pandemic and have proven to be resilient during the pandemic as well as withstanding the test of the recent Russia-Ukraine conflict. We have chosen to mask the details of the effort in this narrative but the GRVC framework (we did not refer to it as a GRVC framework during the projects since the framework was developed in current iteration recently) was implemented in its entirety.

We discuss each element of the framework as follows.

I. The process of identification of product categories for global resilience efforts was driven by the combination of multiple factors including but not limited to preserving shrinking natural resources, the need to focus on higher value in-region production as well as the need for technological advancement adoption. The resulting roadmap was heavily focused on private-public partnerships as well as the need for the region to develop hubs of asset ownership and joint ventures to allow for sustainable operations.

E. The enumeration process was extremely involved, and the economic models were built with the same types of ROI as mega capital projects. The span duration for amortization in many cases was more than 25 years. The mode included acquisition and JV as well as strategic partnerships for global assets of plant, property (including agricultural land), research centers, strategic stocking locations, and equipment (PP&E).

D&D. The design and definition phases involved several phases before execution. The definition of the effort was expanded to potentially include the ability for global commercialization of excess production and capacity as well as support regional resilience. Each product category was studied with baseline demand emanating from the Middle East region and overlaying global demand for the same category. The usage of global demand curves allowed for investments and joint venture placements to serve the host region as well as allowed for commercial operations built to enhance the impact of the region. The resulting investments in PP&E spanned various continents and set the stage for significant global cooperation at the diplomatic level, enabled by private-public partnerships. This design supported resilience while accounting for political and economic policy impacts over longer durations of time.

Ex. Execution for the GRVC probably ranks in some of the toughest projects that my team and I worked on. The projects spanned over a decade and involved traversing joint ventures; managing the transitions of government and family-owned/operated businesses to a corporate culture; optimizing processes across multiple cultures and languages, staff members who came from 17 different countries as well and dealing with lack of a combined technology platform. While these factors alone could serve as deterrents, the creation of a common strategic roadmap, lexicon of financial/operating metrics, and reward structures that were easily implemented served as an enabler for the successful year-over-year execution.

This case was heavily governed by several public-private partnerships. The inner dimension of political impact was governed by investments and ventures in countries that displayed generational affinity to the region as well as stable leadership and structures that were governed by democratic underpinnings.

Additionally, the need to maintain ongoing governmental dialog and relationships was a necessary ingredient for the success of the endeavor. The aspects of economic viability and stability were inherent in the design due to the geographic dispersion of the ventures and investments. Additionally, investments were backed by the appropriate combination of debt, equity, and governmental tax support to encourage investments. Finally, sustainability aspects were built into the investment portfolio for PP&E, process efficiencies as well as the operating model.

The risk-adjusted globally sustainable operating model for the chosen set of product categories and geographies that was designed and implemented over a decade (and continuing) continues to be used as a prime example of the implementation of forward-looking national, political, economic, and value chain resilience.

Conclusion

While a few forward-thinking emerging nations initiated the journey toward global value chain resilience, the aftermath of the COVID-19 pandemic and geopolitical tensions disrupted and accelerated the effort. Several countries and global corporations adopted innovative strategies to mitigate future risks. These firms diversified their production bases, investing in facilities across North America, Europe, and Asia to reduce reliance on a single region. Additionally, they partnered with local governments to develop robust supply ecosystems, including raw material sourcing and talent development.

This multi-faceted approach not only fortified operations against potential shocks but underscores that resilience is not merely about bouncing back from disruptions but creating systems that anticipate and adapt to future uncertainties. As global challenges persist, such examples remind us that resilience is an ongoing, proactive commitment to value chain evolution. •

How to leverage the innovation capabilities in your supply chain through organizational climate

By Seongtae Kim, Byung-Gak Son, Jörg M. Ries, and Nachiappan Subramanian

The firms that win on innovation don't just add suppliers—they cultivate an organizational climate that empowers people to learn, share, and act on external ideas.

In light of accelerating digital disruption and rising geopolitical tensions, innovation remains a key success strategy among global multinational firms. As few firms are able to continuously turn internal ideas into new offerings, an increasing number are turning to their supply networks as a vital source of external knowledge and innovation outcomes. In contrast to investing in internal research and development (R&D) capabilities, today's competitive edge often comes from learning within firms and from suppliers. Firms with a broad and diverse supply base benefit from better access to information and knowledge which can accelerate the development of product and service innovations. But even firms with similar supply network structures achieve dramatically different innovation outcomes. What sets the high-innovation performers apart remains a key question among CEOs and thought leaders. Recent research suggests a critical but underappreciated internal factor: the "organizational climate" of buying firms.

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Jörg M. Ries *is a reader in operations management at Bayes Business School, City St George's, University of London. His research focusses on the impact of supply chain structures, operations processes and digital technologies on financial performance, risk and innovation.*

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Our study, first published in the *Journal of Supply Chain Management* and summarized here, finds that the firms with wider collaborating supplier bases (measured by in-degree centrality; that is the number of suppliers a firm is directly connected to) succeed in leveraging supplier-led innovation only when their organizational climate encourages learning and sharing behaviors. Specifically, an organizational climate characterized by strong social support, fair rewards, and well-managed work pressure enables employees to build intra- and interorganizational relationships, capture valuable ideas beyond firm boundaries, and disseminate them internally to translate into innovative outcomes. This practitioner piece presents key insights from the above study and outlines actionable steps for supply chain leaders aiming to drive innovation through organizational climate.

The innovation imperative in supply chains

Innovation is no longer confined to isolated R&D labs of your own. As global supply networks become more complex and knowledge-intensive, suppliers' contributions play a vital role in developing next-generation products and services. For instance, leading firms in industries such as consumer goods, pharmaceuticals, and electronics are increasingly turning to suppliers not just for materials or components, but also to leverage their technical expertise, process know-hows, and even breakthrough ideas. One such successful initiative is P&G's 'Connect + Develop,' which encourages firms to systematically collaborate with external partners. The initiative sources ideas, technologies, and solutions from outside the company, including suppliers, rather than relying solely on internal R&D within the firm. Subsequently, P&G evaluates and integrates these external inputs into its product development pipeline. Through this model, P&G successfully integrated upstream innovations such as new packaging materials and formulation of technologies into painted products like Tide Pods, which became blockbuster successes in their markets.

But how exactly does supplier-led innovation happen in practice? It often begins with informal idea exchange through meetings, plant visits, technical workshops, or joint development sessions. Suppliers may suggest new materials, components, or processes based on their expertise. These ideas, once introduced, are rarely implemented directly. Instead, they go through a series of internal evaluations, adaptation, and refinement, with procurement, R&D, and product management teams playing key roles in the process. However, these supplier-led ideas only turn into actual innovations when the firm's internal climate supports risk-taking, collaboration, and informal learning.

Hence, being exposed to suppliers' information and knowledge does not automatically translate into innovation output. For example, consider pharmaceutical companies from our study sample, many of which occupy similar positions in their respective supply networks. Each firm is directly connected to a wide range of innovative, capable suppliers giving them equal opportunity to engage with external ideas, technologies, and expertise. However, the respective firms' knowledge outcomes diverge sharply. Some firms consistently translate supplier knowledge into patents, new products, and competitive advantages. Others, despite having access to similar external opportunities, fail to capitalize. Meaning, innovation projects stall, supplier ideas go unnoticed, and the company struggles to convert potential into tangible results.

What accounts for this gap? The answer lies not only in collaboration with the external network but also in the status of the internal organizational climate, specifically in how the organization enables or hinders employees from engaging, learning, and acting on supplier inputs for innovation, as well as interacting internally with their colleagues to share their learnings. The traditional supply chain metric, supply network breadth and collaboration, only tells part of the story.

What matters just as much, if not more, is how a firm manages its internal organizational climate as a catalyst to effectively leverage the benefits of its external partnerships. This is where organizational climate becomes critical.

The critical role of organizational climate

Organizational climate refers to employees' shared perceptions of day-to-day life in the firm, including the policies and practices in place. It is well known that organizational culture can influence employee behavior. Unlike organizational culture, which is deep-rooted and slow to change, organizational climate is more flexible due to its temporal nature and can be actively shaped through managerial actions with ease, making it a powerful lever for shaping employees' behaviors. This is particularly relevant when considering the importance of specific behaviors, such as learning and sharing, which help leverage input from suppliers into actual innovation outcomes.

This means that a similar degree of supply network breadth and collaboration, which indicates the amount and quality of external input for innovation, can produce very different innovation outcomes depending on the organizational climate for innovation-related behaviors. Microsoft, for instance, undertook a clear shift under Satya Nadella's leadership to foster a climate that encouraged openness, learning, and collaboration. Employees were empowered to explore new ideas, including those coming from external partners. This shift in daily practices and managerial tone enabled the company to better leverage external input for innovation, despite operating within the same overarching corporate culture.

Our study examined more than 300 large U.S. firms across multiple industries and found that while supply network breadth and collaboration supports innovation, it alone is not sufficient to fully leverage external inputs. Instead, companies with learning and sharing supportive organizational climates were more effective at converting inputs from relationships with wider suppliers into innovation. By analyzing over 130,000 employee reviews, the study assessed how different organizational climates affect a firm's ability to turn information and knowledge obtained through broader supplier collaboration into innovation performance measured by the number of patents.

Our findings show that employees are more likely to act on supplier ideas when they feel encouraged to go beyond their defined roles. This includes learning from external partners, sharing knowledge internally, and exploring new approaches. In such climates, employees are not only more open to informal conversations with suppliers but also more proactive in recognizing and communicating those insights across departments within the company. As a result, the information and knowledge gained from suppliers is more easily absorbed into the firm's operations, refined through internal collaboration, and eventually developed into patentable innovations and new product concepts.

The three facets of organizational climate that matter

Building on current research, our study identifies three specific facets of organizational climate (see Table 1). This includes "social support," "rewards & career progress," and "work pressure management," each found to facilitate supplier-led innovation. Figure 1 illustrates this relationship, which we describe in more detail below.

Social support

In practice, social support creates interpersonal trust and openness among employees and line managers, making them feel safe to act on external insights. Social support is thought to facilitate supplier-led innovation by enabling employees to share external input, advocate for new approaches, and engage in informal collaboration. For instance, at IDEO, psychological safety is a

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TABLE 1

Three facets of organizational climate

	DESCRIPTION	PRACTICAL EXAMPLE	COMPANY CASE
Social support	The extent to which employees feel psychologically safe and supported by peers and supervisors to engage in learning, sharing, and exploration.	Organizational leaders encourage open discussion of new ideas without fear of judgment; informal sharing is welcomed.	At IDEO, psychological safety is a core team value, enabling junior employees to share external ideas freely and without fear.
Rewards and career progress	The degree to which employees perceive recognition, incentives, and career advancement for engaging in innovation- related behaviors, including external collaboration.	Employees are rewarded in performance reviews for bringing in ideas from suppliers or initiating cross-functional collaboration.	P&G's Connect + Develop model incentivizes employees to source and champion external innovations, tying success to career impact.
Work pressure management	The level of workload manageability that allows employees the time and cognitive space to participate in exploratory or non-routine activities.	Work schedules include 'innovation time' or flexible hours that allow space for engaging with external partners or thinking creatively.	At 3M, employees are given time and space (e.g., '15% rule') to explore side projects, many of which originate from external ideas.

Source: Authors

cornerstone of team dynamics. Employees are encouraged to build on others' ideas and share rough concepts early. Even junior staff are empowered to bring forward suggestions from external sources, including clients and vendors. In such a climate, ideas from suppliers are more likely to be surfaced, refined collaboratively, and tested without fear. In this way, social support serves as a catalyst unlocking supplier-driven innovation. Interestingly, in our study, we did not find a statistically significant effect of social support on supplier-led innovation. However, this does not mean it lacks theoretical or practical relevance. Rather, its effects may be more subtle or contingent, emerging more clearly when paired with strong incentives or sufficient time to explore.

Rewards & career progress

Rewards and career progress refer to whether employees believe their innovation-related efforts, especially those involving external collaboration, are recognized, valued, and rewarded within the organization, even when such efforts go beyond their job descriptions. This includes not only financial incentives (e.g., bonuses, stock options) but also career advancement opportunities, visibility in performance evaluations, and positive recognition from leadership. In practice, when employees see a clear link between external engagement and professional growth, they are far more likely to seek ideas from suppliers, bring them into the organization, and push them through internal innovation processes. Conversely, if such behavior is viewed as risky, time-consuming, or unrewarded, employees will likely default to safer, more routine tasks, even if supplier ideas have real potential. At P&G, for instance, this mechanism is institutionalized through its 'Connect + Develop' program. Employees are not only encouraged but structurally supported to scout external innovations from suppliers and start-ups. Success stories, such as the integration of novel packaging films from

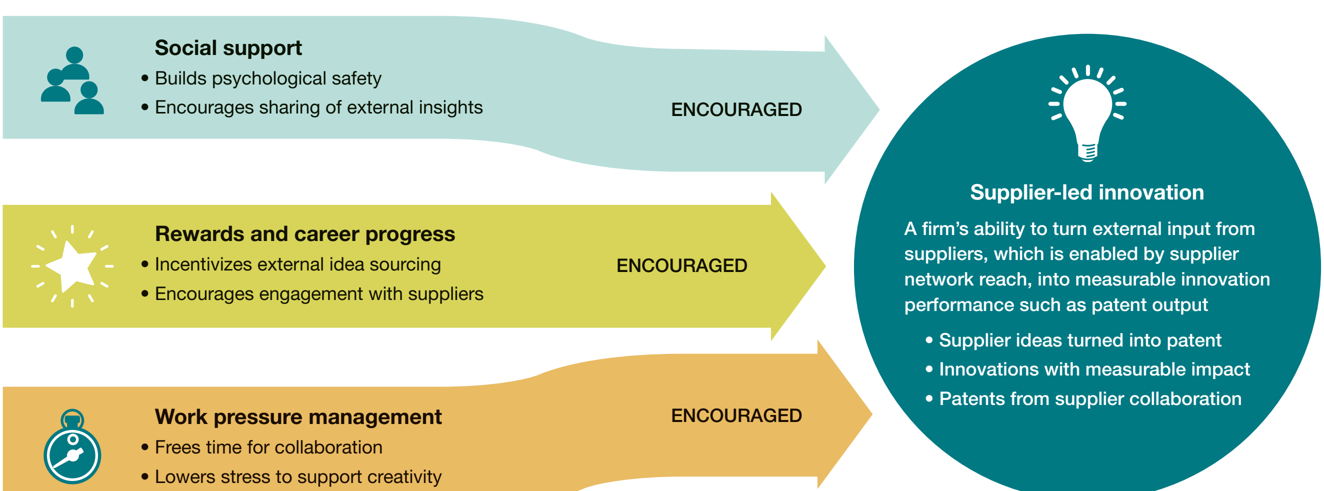
MonoSol, are highlighted internally and tied to employee recognition and promotion. By aligning incentives with supplier-led innovation, P&G has created an organizational climate where employees are motivated to act on external input and bring it into the product development pipeline.

Work pressure management

Work pressure management refers to the extent to which employees have the time, mental capacity, and organizational support to engage in non-routine, creative, or exploratory work, particularly in collaboration with external partners. Innovation requires slack in terms of unstructured time to think, process, and test ideas. When employees are overloaded with operational tasks or tight deadlines, they may lack the capacity to respond to supplier input, follow up on novel suggestions, or experiment with alternative approaches. Our study found that firms with more manageable workloads and flexible structures were significantly more effective at turning supplier insights into actual innovation. These firms often use techniques such as protected innovation time, flexible scheduling, or de-emphasizing short-term output in favor of long-term learning. At 3M, for example, employees are given dedicated time, famously known as the "15% rule," to work on side projects outside their formal job responsibilities. This policy allows individuals to use up to 15% of their paid working hours for self-initiated, exploratory work, without prior managerial approval. Many of these projects are sparked by conversations with suppliers and other external partners. This organizational breathing room creates the conditions under which supplier ideas can be explored, prototyped, and eventually scaled into new products.

FIGURE 1

Organizational climate and supplier-led innovation



Source: Authors

Case insights: What differentiates innovation leaders

To complement the empirical findings from our study, we conducted follow-up interviews with managers from pharmaceutical firms to explore how organizational climate shapes the use of supplier knowledge in practice. These interviews revealed that even when supply network structures appear similar on the surface, firms differ significantly in how they perceive and manage collaborations with their suppliers.

Specifically, one firm described a practice of supplier engagement that treated it as a strategic opportunity. Managers promoted informal conversations and collaborative ideation, supported by organizational climate features such as psychological safety and systems that recognized cross-boundary innovation. In contrast, another firm, despite a similarly central supply network position, tended to discourage supplier interaction beyond formal scopes, reflecting a cautious, compliance-focused organizational climate. Employees hesitated to share external input due to fears of reputational risk or organizational disapproval.

These case insights reinforce a key takeaway from the study: supplier-led innovations depend not only on access to a broad supply network and collaboration, but also on the internal environment that enables or suppresses learning and sharing behaviors. Even in knowledge-intensive sectors like pharmaceuticals, the organizational climate can determine whether supplier knowledge becomes an innovation asset or remains unexplored.

From insights to managerial action

The findings suggest that simply increasing the breadth of the supply base collaboration and the innovation potential is not enough. For supplier-led innovation to take root, buying companies must cultivate an internal organizational climate that supports exploration, learning, and collaboration across boundaries. Following are five actionable strategies that supply chain leaders can adopt to activate this potential.

- **Audit organizational climate regularly.** Use employee review platforms like Glassdoor, pulse surveys, or internal feedback mechanisms to continuously monitor employee perceptions of workload, psychological safety, and recognition. These data can help identify whether current conditions support or inhibit innovation behavior.
- **Align incentives with learning behaviors.** Ensure that key performance indicators (KPIs), performance evaluations, and promotion criteria reflect the value of supplier engagement and cross-boundary innovation. Publicly recognize individuals and teams who successfully bring in and act on supplier ideas.
- **Protect time for innovation.** Create structures that allow for unstructured thinking. This could include setting aside dedicated 'innovation time,' offering flexible work hours, or reducing operational burdens during certain periods. Such time creates space for employees to explore, absorb, and refine supplier inputs.
- **Build supplier-engagement capabilities.** Develop the ability of employees, particularly those in procurement, engineering, and R&D, to collaborate formally as well as informally with suppliers. This includes training in communication, factory visits, collaborative problem-solving, trade shows and innovation facilitation, which help turn external inputs into implementable solutions.

- **Break down the silos.** Facilitate collaboration between functional departments such as R&D, operations, and procurement within a firm. Such cross-functional collaboration ensures that supplier knowledge flows efficiently into measurable innovation outputs such as patents, or new product features.

By implementing even some of these, firms can begin to move beyond transactional supplier relationships and toward dynamic collaborative partnerships that generate innovation. The more these practices are integrated, the greater the potential for unlocking supplier-driven value propositions. Creating the right internal organizational climate is not just a human resource issue; it's a strategic enabler of innovation performance in supply chains.

Rethinking innovation metrics in supply chains

To manage what matters, firms must first also measure it. Traditional supply chain KPIs, such as cost savings, inventory turnover, and on-time delivery, remain necessary but are no longer sufficient in an era where value increasingly comes from supply-led innovation. Supplier collaborations are not just about efficiency and compliance; they are also sources of creativity and growth. Leading firms are beginning to adopt innovation-oriented supply chain metrics such as patents or innovation awards.

In parallel, firms should consider tracking organizational climate indicators, using employee review platforms or pulse surveys, as part of their internal performance reviews. While metrics like supply network breadth collaboration (in-degree centrality) can provide structural insight, they are not always easy to calculate without access to comprehensive network data. Still, when such data is available, combining network structure with internal sentiment analysis can offer powerful diagnostics, revealing whether a company is well-connected externally but hindered internally by a poor organizational climate for innovation.

Consequently, by embedding innovation and organizational climate metrics into regular management dashboards, firms can shift from reactive to proactive supply chain leadership, anticipating where innovation bottlenecks may occur and addressing them before opportunities are lost.

Organizational climate as a strategic lever

Findings of our study reinforce a critical insight: The next frontier in supply chain innovation is not just about finding better suppliers. It is about becoming a better collaborative partner. This requires an internal organizational climate that cultivates psychological safety, rewards cross-functional collaboration, and reduces structural barriers to acting on external input. The implications are clear. Supplier-led innovation does not happen by default; it depends on firms' internal climate that supports boundary-spanning, learning, and experimentation. Supply chain leaders must collaborate closely with business unit heads to intentionally cultivate an environment that fully unlocks the value of supplier collaborative partnerships. As supplier networks grow more complex and innovation cycles accelerate, the firms that will thrive are not merely those with the most connections, but those that know how to leverage them effectively. For leaders in procurement and operations, shaping this organizational climate is no longer optional but a strategic imperative. •

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PAYING FOR IT:
4 ways to reduce equipment lease expenditures

By Jim Cross and Mark Trowbridge

Smart sourcing, rigorous contract management, and competitive lease evaluation can cut equipment leasing costs by approximately 20% while preserving flexibility and access to new technology.

Jim Cross *is CEO of Blue Sky Capital Strategies LLC and* **Mark Trowbridge**, *CPSM, CSP, C.P.M. MCIPS, is president of Strategic Procurement Solutions LLC.*

In 2024, more than half (54%) of corporate equipment acquisitions were financed. Eight out of 10 businesses use leases to acquire the equipment they need to run their operations (production, material handling, computer hardware, office, fleet vehicles, etc.). That's right, leases are the most common method used today for companies to procure CapEx equipment. With inflation rates declining dramatically from 7% (2021) to 2.4% (mid 2025), interest rates are also declining. Moreover, there is significant margin compression from independent lessors competing with the banks…all making leases even more beneficial for smart companies.

Important fact: Lessors aren't losing money when they finance your equipment needs. The equipment financing industry is a $1.34 trillion marketplace for a reason. It is highly profitable for financiers who are receiving ROI at every step of the leasing lifecycle. Experts only see this trend escalating in the future. According to The Equipment Leasing & Finance Foundation, this marketplace will reach $3.1 trillion by 2032, with North America being the largest region in the equipment finance service market.

This article will discuss the benefits and risks in leasing. It will also describe four methods for readers to reduce costs throughout the process of lease generation and lifecycle management.

Benefits of leasing

Properly executed, leasing is the cheapest, most cost-effective method of acquiring most assets. So what are the advantages to leasing equipment rather than buying (even with a loan)? There are many that justify this practice for most companies. Leasing benefits include the following.

- **Lower upfront costs.** Leasing typically requires less initial capital than buying, as down payments are often smaller (or not required). This preserves cash flow for other business needs.
- **Predictable monthly payments.** Lease payments are usually fixed, making it easier for businesses to budget and manage their expenses.
- **Tax deductions.** Lease payments are often fully tax-deductible as operating expenses, potentially reducing a firm's taxable income.
- **Access to new technology.** Leasing allows companies to regularly upgrade to newer, more advanced equipment without the burden of selling older assets. This is especially beneficial in industries with rapid technological advancements.
- **Potential off-balance sheet financing.** Some types of leases, specifically operating leases, may not appear as a liability on the balance sheet, which can improve financial ratios (Sarbanes Oaxley requirements may require reporting of certain lease obligations).
- **Lower risk of obsolescence.** Leasing shifts the burden of obsolescence to the lessor, as companies can upgrade equipment at the end of the lease term for newer, more efficient, and lower total cost of ownership (TCO) assets.
- **Simplified tax reporting.** For operating leases, businesses avoid the complexities of calculating depreciation and maintaining detailed asset records for tax purposes.
- **Optimization of balance sheet.** In addition to the above, leasing (compared with borrowing to buy) helps companies optimize their balance sheets in four important ways.

1. A capitalized lease obligation is not classified as debt, so a company's debt limits in covenants and debt ratios appear better.
2. The "on balance sheet" capitalized value of the leased asset is less than 90% of the cost of the leased asset, so both return on asset (ROA) and return on invested capital (ROIC) measures are better.
3. The P&L cost of the lease is the straight-lined average rent expense versus the front-loaded interest of a loan (and related straight-line depreciation) so earnings per share (EPS) is better.
4. The benefits in both balance sheet and P&L statements are permanent if a company, as an ongoing policy, continues to lease all assets (year after year).

So what could go wrong? Well, unless you have extensive expertise in negotiating lease contracts, the financier will often stack the deck in their favor with creative terms and conditions in their lease agreements and related documents.

Games financiers play: Risks in leasing

Leasing companies are very good at their game. They have spent over 100 years developing creative ways to optimize their yield in their contracts. They use sophisticated methods to be the winner; no matter what changes occur during the life of the lease. Miss a payment in an onerous lease, and "hair trigger" default clauses create overdue payments that far exceed usury interest rates and may also trigger other penalties, leading to even more yields/profits for the lessor. A clause may activate causing you to lose beneficial rates or be exposed to penalties (or even loss of the leased assets). Accidentally allowing an "on time" end-of-lease notification can trigger a lengthy, unplanned lease extension that creates cash flow issues for your company's business units. Countless other tricks are embedded into the approach of many lessors.

Types of leases used by companies

Two primary types of leases, as governed by Generally Accepted Accounting Principles (GAAP), are used for equipment leased in the United States: Operating and finance (or capital) leases. In many other countries, generally similar lease types are defined via International Financial Reporting Standard (IFRS). While whole articles could be written about these two types of leases, key differences are shown in Table 1.

Opportunities to save money in leasing

Can company leaders really improve profitability by reducing equipment leasing expenses? Absolutely! But surprisingly, too many procurement leaders just categorize leases as "non-impactable" and put it in an "other" category in their initial spend analysis process. Not so with co-author Trowbridge's advisory firm, which works with large corporate clients to secure enterprise-wide cost savings across many spend categories. When they find any firm with a substantial amount of spending through leases, he and his colleagues turn over that rock and dive deeper. Trowbridge says: "If our client's equipment lease

TABLE 1

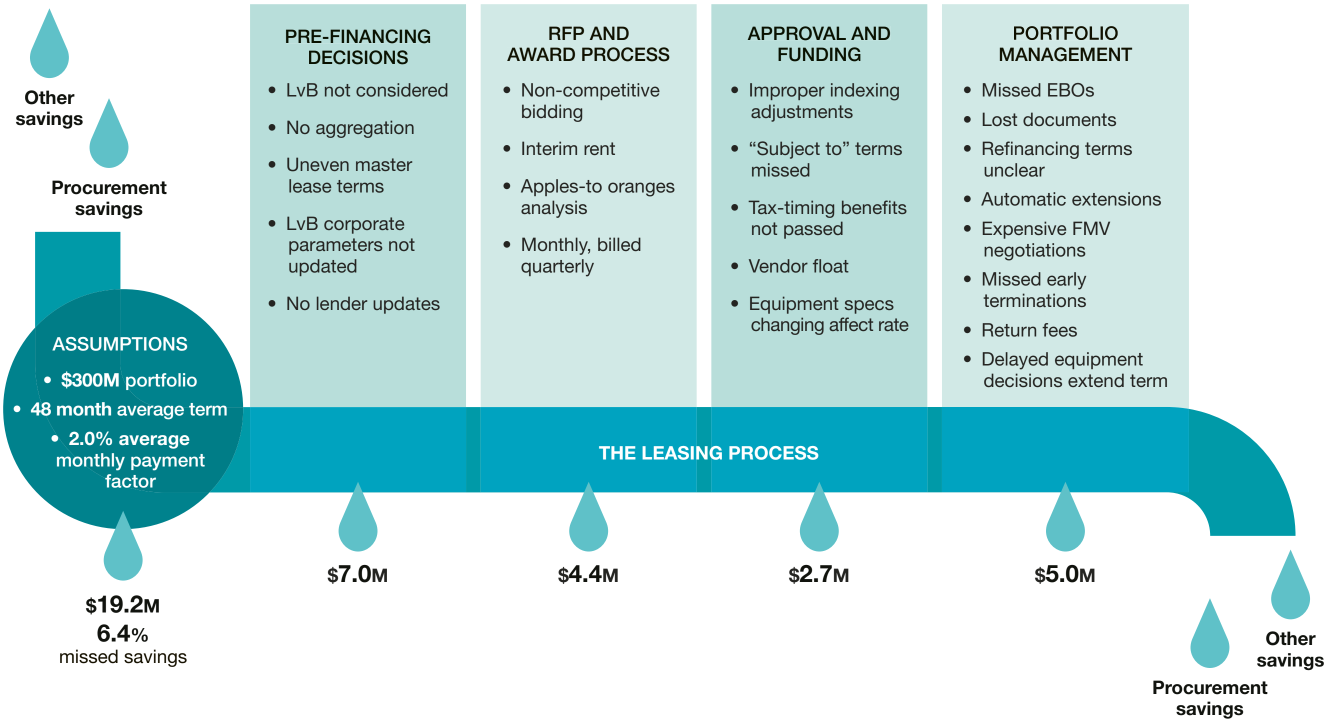
Lease types

OPERATING LEASES	FINANCE (CAPITAL) LEASES
Long-term. Usually spans most of the asset's useful life.	Short-term. Usually less than the asset's useful life.
The lessee bears most risks and rewards. They are responsible for insurance, maintenance, etc.	The lessee has fewer obligations. The lessor retains the responsibility of ownership and risks.
Expense recognition is a single straight-line lease expense.	Interest plus amortization are front-loaded.
Accounting Right of Use (ROU) and lease obligation are recorded on the lessee's balance sheet. Interest expense and asset amortization are recorded separately.	A single expense is recognized evenly over the lease term. The accounting asset and lease ROU liability are recorded on the balance.
Many operating leases include a purchase option for the lessee.	Typically there is no purchase option for the lessee. Usually, the asset is returned to the lessor.
Lower Earnings before Interest, Taxes, Depreciation, and Amortization (EBITDA). Lower Operating Cash Flow (OCF).	Higher EBITDA. Higher OCF. More leverage is visible.

Source: Authors

FIGURE 1

The “leaky pipe” of leasing contracts



Source: Authors

payments are substantial, there may be an impressive potential for savings.”

Co-author Jim Cross’ firm, which offers its services for free to corporate clients, regularly enables companies to save approximately 20% (on average) during the lifetime of most lease portfolios. Where are savings found in the lease lifecycles? You’ve just got to know where to look (and to keep looking). Just in the last few weeks, the following savings were realized in various phases of several clients’ lease portfolio processes.

- Negotiated a 23% savings on a $650K end-of-term purchase option.
- Reduced the lease rate factor by over 200 basis points on a $5.5M lease.
- Reduced the average lease rate factor by over 150 basis points on a $10M lease portfolio.
- Negotiated a $1.2M savings on end-of-term buyout for medical equipment.
- Negotiated a 12-month lease extension saving $127K.
- Eliminated interim rent that saved a company more than $250K.

For example, Figure 1 illustrates the “Leaky Pipe” of costs associated with a single company’s $300M lease portfolio. In this case, over $19.2 million in savings were found.

The remainder of this article will describe four ways a business can reduce CapEx and OpEx costs over the lifetime of leased equipment, vehicles and other assets in their portfolio. We will present some best practices in each of the following techniques:

1. **Discovery.** Proactively identify all current lease obligations;
2. **Optimize lease cost basis through TCO sourcing.** Minimize lease base principal costs through a total cost of ownership (TCO) sourcing methodology for new equipment/vehicles;
3. **Evaluate multiple lease options**. Utilize innovative market competition techniques to secure the best lease option to cover the intended procurement arrangement; and
4. **Strategically contract & manage.** Understand and mitigate negative clauses in every lessors template agreement. Continuously address cost factors in each stage of the equipment lifecycle.

Technique #1: Discover all current equipment & vehicle leases

This seems simple and obvious—something most companies should be doing in the process of managing business expenditures. But it really isn't. That's because equipment purchases are booked differently than equipment leases. Often, procurement may have performed an excellent RFx or negotiation to arrange an equipment or fleet purchase but then asked finance to arrange a lease to finance the transaction.

Guess what? Few accountants are skilled in securing optimal lease arrangements; in fact, many leases facilitated by a finance department are going to be with the CFO's favorite treasury bank. You don't invest your retirement funds in the bank that handles your checking account—they don't provide good ROI on your investment. Nor do treasury banks often offer the best lease rates or terms on equipment leases. Finally, most companies' finance groups sign lease contracts—not procurement—so the details of those transactions are often very difficult to find.

To complicate this, typical procurement spend analysis tools unknowingly throw lease payments to suppliers with names like ABC Bank, Bank of ABC, ABC Bancorporation, ABC Financial, etc. into a "non-impactable" spend category that no one in operations or procurement ever reviews, i.e. "banking services." Out of sight. Out of mind.

So how can all your leases be located? Well, put on your Sherlock Holmes cap and start the discovery process.

Best practices in discovery that can be deployed by trained skilled analysts and include the following.

- **First step: Transactional spend discovery.** Begin by comparing your company's accounts payable expenditures with an extensive list of 1,000+ firms/suppliers who are active in the leasing markets where you do business (North America, Europe, Asia-Pac, etc). You may also be able to identify payment streams similar to leases by analyzing transactional payment amounts and timing (i.e. monthly, quarterly, etc.). This can be complicated by many other payment streams that have similar timing characteristics, for example, cloud software subscriptions, fixed-fee supplier contracts, facility rentals, etc. Moreover, equipment or vehicle manufacturers sell products and services as well as lease equipment to your company. Consider IBM, which may provide consulting services, software and leased equipment—you need a detailed approach to discern what portion of those payments are leases. But applying sophisticated algorithms through a spend analysis platform can get this done quickly.
- **Second step: Lease review**. Once each lease is identified, you need to find the actual lease agreement and related documentation, including the master lease, term schedule, certificate of acceptance, equipment rider provisions, lease assignment, etc. (most of which will be scattered across finance and legal groups in the typical enterprise). Then you need to populate and continually update a database with key metadata about those leases, i.e. lessor name, detailed description of leased assets, amount financed, term value, payment value, interest rate, start date, expiration date, end-of-term options, evergreen factors, etc.

Smart companies treat their current lease inventory similarly to a portfolio of investments. Just as most persons have visibility to all their mutual funds, equities, bonds, etc. in their Charles Schwab or ETrade account, so should every corporation have full visibility to its portfolio of leases. This visibility allows strategic management of lease commitments, including proactive planning of equipment and vehicle replacements, strategic timing and adjustment of lease expirations/renewals, co-terminous harmonization of lease commitments, etc.

Technique #2: Optimize lease cost basis through TCO sourcing

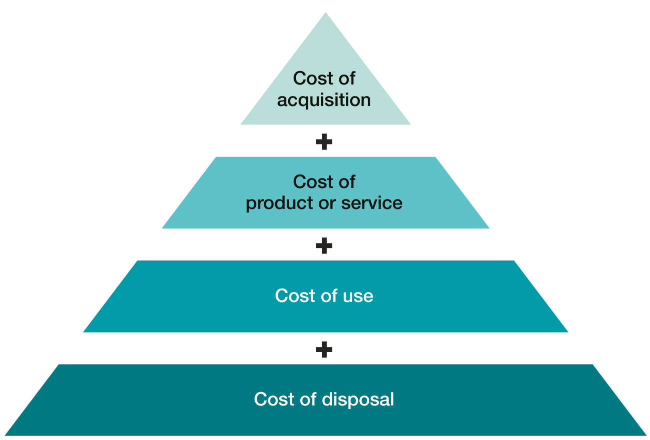
Let's face it. Every equipment or vehicle lease contract applies the time value of money for financing the cost of acquiring (and using) an asset. That's the "principal" to which an interest factor and terms are applied during the term of the lease. So the first step in any transaction is to minimize the principal that drives the payment amounts.

Best practices in strategic sourcing should be applied to any equipment acquisition.

- Having an in-depth understanding of equipment lifecycles, and leading-edge and trailing-edge technologies.
- Identification of alternative products providing similar functionality (i.e., different power systems in vehicles).
- Conducting an RFx event (request for proposal, request for quotation).
- Strategic negotiation of all lifetime cost elements for the proposed asset using a TCO model.

FIGURE 2

Total cost of ownership



Source: Authors

One approach to identifying lifetime costs can be calculated using a TCO model deployed by many corporate procurement groups (see Figure 2).

With capital equipment, to the greatest extent possible, it is critical to obtain secure, optimal pricing for both the equipment and all associated operating costs through the intended lifetime of the asset. Remember, as an example, that over the lifetime of a traditional semi-truck the largest cost of operation is fuel, then the driver/operator, then the tractor, then maintenance/lubricants, then the trailer. Focusing only on the cost of the tractor and trailer misses a majority of TCO. Capital aspects of these cost elements need to be optimized over the lifetime of the asset before moving into a lease that finances the transaction. Operational cost elements must be managed closely throughout asset life to keep those costs at a minimum.

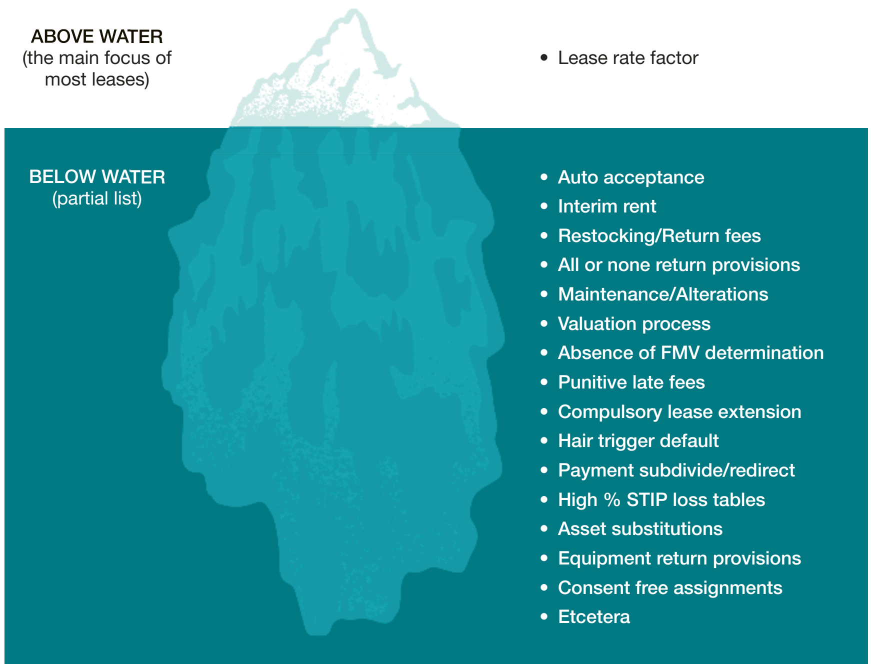
Technique #3: Evaluate multiple lease options through competition

Utilize innovative market competition techniques to secure the best lease option to cover the intended procurement arrangement. Once the optimal package is determined, the best lease opportunities should also be sourced. If you do this yourself, at a bare minimum, get three offers from lessors that specialize in this specific asset class, term length and lease structure. Keeping your Sherlock Holmes detective cap on, try to find specialty lessors that target different types of leases. For example, there are big players in unique spend categories like rail cars or aircraft. For a large portfolio of leases, there can be millions of dollars saved by utilizing specialty lessors rather than treasury banks that don't really want residual risk and outsource the entire end-of-lease process to a third party. Do not allow your CFO to give your package to only their favorite treasury bank without strong competition.

Don't be surprised if the equipment or vehicle manufacturer or dealer also aggressively tries to

FIGURE 3

Cost factors in a typical equipment lease



Source: Authors

become the lessor of the products you've been negotiating. If they are able move your negotiated package into a favorable lease arrangement for them, they will take back many of the cost concessions attained in the RFx process and negotiation. Just remember what happens when you try to buy a personal automobile at a dealership—their finance manager always tries to turn a purchase into a lease. Why? Because the dealership makes far more money.

Lease sourcing should go even deeper, though, with other steps involved such as the following.

- Identifying the right lessors.
- Ensuring the right lessors actively participate in RFx.
- Make sure all lessors are pricing to the same terms and conditions, e.g. master lease agreement and schedule, and have all costs contained … right down to stipulated (STIP) loss value tables, equipment return rider provisions, equipment return radius, and asset level flexibility for return on time—extend or purchase. Make sure all lessors are bidding on the same lease package (i.e. apples to apples).

• Perform multi-round strategy for negotiating every facet of the lease proposals.
• Perform an after-tax lease versus buy analysis in a net present value format using purpose-built tools.

If your team is not skilled in soliciting lease proposals, do not try to self-medicate this process. There are advisory firms that offer some of these services for a fee. A good advisory firm will utilize real-time market intelligence to strategically develop equipment leasing RFPs that perform for their clients (at no cost). Unlike the typical multiple months needed to bid and select capital equipment, a sourcing process for leasing can be performed within a few days or weeks.

Technique #4: Strategically contract & manage

Once you have selected the best equipment financing proposal, it is time to contract for your package. Top leasing experts know how to negotiate away many onerous clauses found in a typical lessor's template agreements. Too often, though, newcomers to leasing fail to understand the many factors that were not presented in a lessor's proposal (but now appear in that firm's template agreement). Many clauses are "below the water" in the lease proposal originally solicited.

The visible lease rate factor is usually the main proposal submitted by financiers. But many other cost elements are encompassed as seemingly innocuous "technical terms" found in many lessor contracts. As just the tip of an iceberg can be seen (the lease rate interest factor), it is below the surface where smart buyers need to become educated. Consider the cost factors in a typical equipment lease arrangement (Figure 3).

On behalf of many small, medium, and large clients (all the way into Fortune 10 in size), co-author Jim Cross' company represents such a high volume of lease transactions for their clients that they are able to have nearly all proposals be based upon their form of master lease agreement (which is almost universally accepted by leading financiers).

Once your lease agreement has been signed, it is time to proactively use and manage all elements of the transaction. Many key factors must be closely monitored, including the sometimes challenging responsibility to track every asset in the lease. Countless companies have utilized portfolios of leased items such as computer hardware, multi-function devices (MFDs), material handling equipment, etc. throughout a five-plus year lease term, only to be unable to return the assets upon lease expiration. Then they're on the hook for repaying the lessor, but at what rate? (What was the FMV language or depreciation formula in the original lease?)

Conclusion

The equipment leasing industry is in a continual state of change with frequent mergers, acquisitions, and name changes. Moreover, leasing firm account representatives are constantly switching companies, thus creating an infinite loop of uncertainty. One thing is certain, though: At your expense the equipment leasing industry keeps generating record profits every year.

Inventor Thomas Edison once said: "Opportunity is missed by most people because it is dressed in overalls and looks like work." Business leaders who take time to "work" consistently through the four techniques in this article can secure substantial cost savings in their cost of acquiring and operating production line equipment, computer hardware, trucks, fleet cars, material handling equipment, rail cars, and even aircraft—thus increasing profitability.

Seize the opportunity to reduce your lease costs. •

SPOTLIGHT ON

TARIFFS AS STRATEGY: How to rethink import/export

By Brian Straight, editor in chief

In an era of shifting tariffs and trade uncertainty, companies must rethink import/export strategies around diversification, flexibility, and resilience to maintain competitiveness and reduce risk.

For years, global trade policy was framed around the concept of free trade. Global trade barriers slowly dissipated. Favored Nation status opened doors to new markets.

The second term of President Donald Trump has upended that delicate global trade balance. Weighted-average tariff rates in the United States rose significantly in 2025, a reversal of decades of relative stability, and similar shifts have emerged in Europe, South America, and Asia as countries navigate a new global landscape.

Businesses have been faced with how to navigate tariffs that one day may be set at 10%, only to be suddenly raised to 50% the next. Trade uncertainly is creating business uncertainty.

Some, though, see a silver lining, or at least a ray of sunshine, in the unpredictable tariff environment. Jeffrey Haushalter, a partner with Chicago Consulting, tackled the idea that tariffs could provide a strategic edge in a *Supply Chain Management Review* article earlier this year.

"We have found in our supply chain consulting practice that constraints drive the most meaningful innovations. Tariffs are no different. They force rigor and surface inefficiencies. Companies that lean into tariffs rather than react gain a competitive edge through smarter supplier networks, reduced risk, and optimized cost structures," he wrote.

Haushalter mentioned 11 reasons that tariffs could enable smarter procurement and sourcing, including domestic supplier development, geographic diversification, negotiation leverage and as a spark for innovation.

"While perceived as disruptive, arbitrary, and punitive, tariffs function as a forcing mechanism that challenges companies to evolve. Rather than viewing tariffs solely as an external tax, forward-looking procurement and supply chain leaders should see them as catalysts for better decision-making, deeper supplier insight, and long-term resilience," Haushalter wrote.

From penalty to playbook

Tariffs have traditionally been viewed as an unavoidable tax that companies must either absorb or pass on to end customers. According to McKinsey, though, ("*Tariffs on the move? A guide for CEOs for 2025 and beyond*"), global executives should treat tariffs like energy prices: variables that can be modeled, monitored, and managed.

This shift in mindset means moving from passive compliance to active strategy, the firm noted. Instead of scrambling to react once tariff levels change, leading organizations are creating networks, contracts, and governance processes that allow them to pivot quickly. Tariff costs become just one input in a broader optimization model that balances price, risk, service, and sustainability.

McKinsey and others suggest companies have leverage to maximize the opportunity.

1. Footprint optionality. Diversify manufacturing footprints by exploring China+1 or "friendshoring" models.

2. Supplier portfolio design. Reconfigure supplier portfolios to numerous jurisdictions with different tariff exposure, creating negotiation leverage as well as geographic diversity.

3. Routing and customs strategy. According to Deloitte, substantial savings can be unlocked by rethinking shipping routes, INCOTERMS, and customs approaches. Tools such as bonded warehouses, foreign trade zones, and HS code audits are increasingly being used along with digital platforms that provide visibility into landed costs.

4. Commercial agility. Build pricing agility by utilizing advanced CPQ (configure-price-quote) tools that can selectively pass through tariff costs and protect margins without losing competitiveness. *Harvard Business Review* explains that this requires alignment among sales, finance, and supply chain, and clear policy for which costs are absorbed vs. passed on.

5. Governance and decision speed. Boston Consulting Group says that companies that make executive decisions rapidly can outperform those that lag. To that point, McKinsey suggests setting up a "tariff nerve center" made up of a cross-functional team to monitor changes, model scenarios, and make decisions in days rather than months.

Frozen in time

Amid shifting trade policies, the push for reshoring, and rapid technological advancements, companies are grappling with unprecedented levels of uncertainty. In an interview with *Supply Chain Management Review* earlier this summer, Richard Barnett, chief marketing officer of SupplyFrame, said that despite the uncertainty, businesses can navigate the current landscape, but it requires some additional due diligence.

"Uncertainty is the biggest challenge," Barnett said. "We need to get to a new level of certainty and that will allow the rules of the game to define what additional actions can be taken."

This sentiment echoes findings from a survey this spring by the Reshoring Institute, where executives indicated that their capital investments and hiring are mostly frozen until the tariffs and economic outlook stabilize.

Tariffs have become a significant factor influencing supply chain decisions. Barnett noted that companies are conducting daily scenario planning but are hesitant to make substantial moves without clear policy direction. "I can live with 145% tariffs in China. I just need certainty," he quoted a CFO as saying.

Rosemary Coates, executive director of the Reshoring Institute, said the uncertainty was freezing investments by companies. The Institute surveyed 18 C-level executives in April and found the majority had frozen investment until there was more marketplace clarity.

"Uncertainty in tariffs and geopolitics is creating chaos in global operations, especially in the electronics industry's imports from China. One executive said that his company was not willing to make a billion-dollar investment in building a new factory in America when everything may change in 3 ½ years when a new president is elected. His company will continue to manufacture overseas or in Mexico," Coates wrote in a *Supply Chain Management Review* article announcing the survey findings.

How to respond

Whichever strategy a company pursues during this time, unless there is measurable data to justify the decision, then the choice may just be a guess—an educated guess, perhaps, but a guess nonetheless.

According to McKinsey, companies should begin by baselining their tariff exposure by product code (HS code) and country. Using trade-data systems like the U.S. Automated Commercial Environment or equivalent foreign systems lets firms map their landed costs under current and projected tariff regimes. Once exposure is mapped, firms can build scenario models (or digital twins) to test what happens if they shift sourcing, change routes, or alter suppliers.

In fact, scenario planning has never been more important. Scenario planning is essential in today's tariff environment because it allows companies to anticipate multiple possible futures and build resilience into supply chains. By modeling "what-if" situations such as new tariff hikes, retaliatory measures, or sudden policy changes, organizations can test sourcing options, cost impacts, and customer outcomes before disruptions occur. This proactive approach ensures leaders aren't just reacting to tariffs but are ready with flexible, data-driven strategies that preserve competitiveness. Courtney Rickert McCaffrey, EY's Global Geostrategic Business Group Insights Leader, joined the Talking Supply Chain podcast to talk about the geopolitical challenges facing supply chains and how they can prepare to navigate an uncertain future.

"A lot of C-suite leaders really want predictability and certainty in the environment they face," she said. "That's actually more important … than maybe some of the specifics of what that environment is. Going forward, what we've seen is because of that uncertainty, a lot more C-suites and boards are turning to scenario analysis and tabletop exercises and other kinds of strategic foresight methodologies to try to … get their arms around [that uncertainty].

"Scenario planning builds resilience by stress-testing supply chains against multiple futures. Even if tariffs shift unpredictably, companies with playbooks in place can adapt faster and smarter," Rickert McCaffrey added.

Turning uncertainty into advantage

Tariffs are not going away. Political cycles, geopolitical tensions, and economic nationalism all suggest that trade barriers will remain part of the environment for the next decade. The question is whether companies treat tariffs as an external penalty or as a strategic variable.

As Boston Consulting Group has noted, the true competitive advantage lies in uncertainty management. Firms that sense change early, decide quickly, and act decisively will outperform rivals who remain reactive. In that light, tariffs are not simply costs to minimize, they are catalysts forcing supply chains to become faster, more flexible, and more resilient.

For executives willing to embrace this reframing, tariffs can become not just an obstacle but a source of strength. The companies that thrive will be those that learn to treat tariffs not as expenses but as change drivers. •

Supply chain analytics: Trends, benchmarks, and business impact

Marisa Brown is the senior principal research lead for Supply Chain Management at APQC. She leads APQC's supply chain team that conducts research to provide insights into benchmarks, best practices, and process improvements in supply chain planning, procurement, logistics, manufacturing, product development, and innovation. Marisa is a leader in supply chain with almost 30 years' experience in business, research, writing, speaking and consulting.

Organizations are expanding their use of analytics and building capabilities.

By Marisa Brown, APQC

Supply chains generate massive amounts of data, and there is no shortage of tools designed to harness that data for better organizational decision-making. Many companies are seizing the opportunity to identify patterns and enhance product quality and delivery. Analytics empowers organizations to achieve these goals and much more.

In the summer of 2025, APQC conducted research on supply chain analytics and data management that included 315 participants from across the globe. The project looked at the current state of organizational commitments to supply chain analytics and the impact analytics has had on businesses.

Organizational commitment to analytics

Organizations signal their commitment to analytics by assigning ownership for it, investing in it, and developing their analytical capabilities.

Ownership. APQC investigated how organizations are managing the primary responsibility for conducting supply chain analytics. The largest segment (36%) report relying on an internal, centralized analytics team, while 27% employ a centralized core team supported by decentralized staff within business units. Additionally, 29% utilize a blend of internal and external resources.

The optimal model for managing supply chain analytics varies based on an organization's structure, staff expertise, and specific analytics requirements. Regardless of the approach, the fact that leadership is making deliberate, strategic choices underscores a clear recognition of the value that analytics brings to the enterprise.

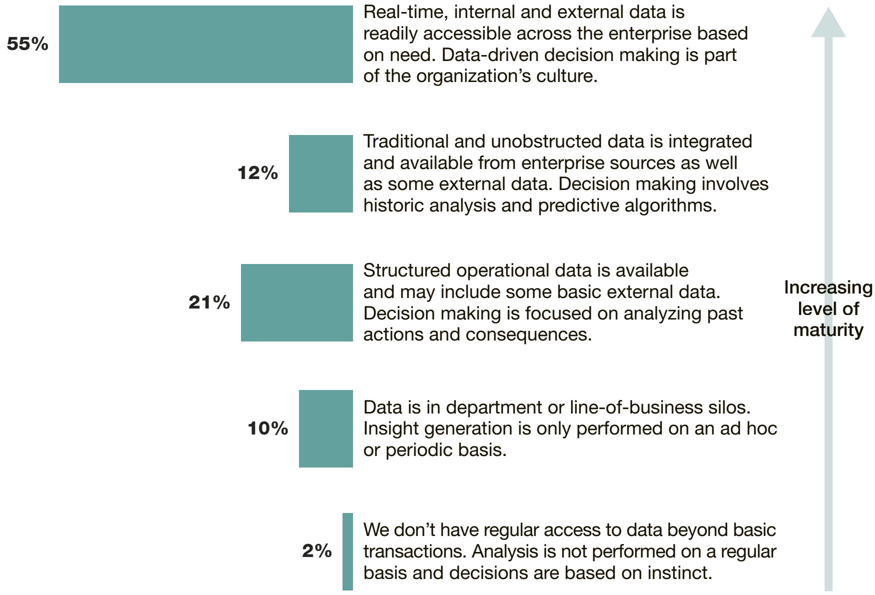
Investment. The level of financial investments that organizations are making in supply chain analytics also signals an increased commitment to it. Over the last three years, 86% of organizations have increased their financial investment in supply chain analytics. Further, 35% of organizations within that group have significantly increased such investments.

Maturity. Organizations' maturity with regard to supply chain information availability and analysis capabilities also reveals the increased commitment organizations have made to supply chain analytics. As shown in Figure 1, more than half (55%) have the highest level of maturity, meaning they have real-time accessibility to internal and external data plus a culture that incorporates data-driven decision-making. With integrated real-time supply chain data available, users can access, manipulate, and visualize data on demand.

For organizations in the middle of the maturity scale (21%), available data is limited to internal operational data and possibly some external data. What is concerning is that these organizations focus their decision-making on analyzing past actions and consequences. Although there is value in considering past situations, the supply chain landscape has shifted significantly in recent years, with more changes on the horizon. Considering only the past puts an organization at a disadvantage when navigating these future landscape changes.

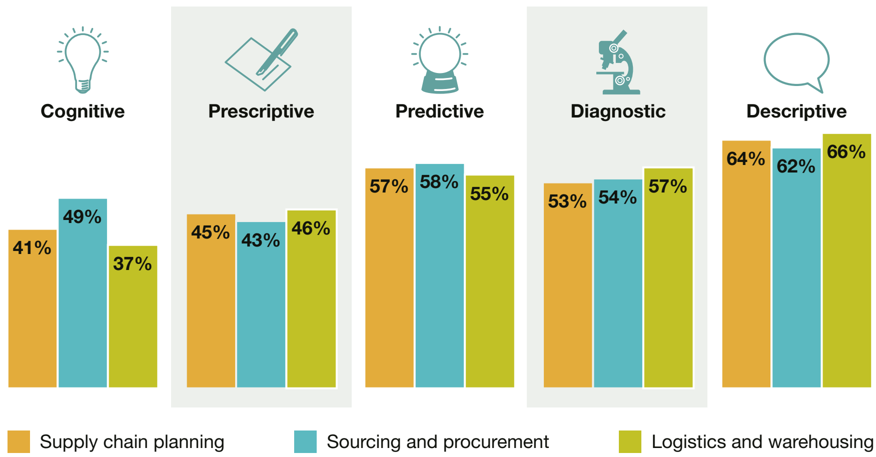
FIGURE 1

Organizational maturity for supply chain information availability and analysis capabilities



Source: APQC

FIGURE 2
Use of analytics in supply chain



Source: APQC

Use of analytics in supply chain processes

In its research, APQC also looked at the types of analytics that supply chain organizations use. It included the following five categories based on how data is used.

1. Descriptive analytics: Used to describe trends and relationships, such as supply chain performance or a warehouse's inventory levels.

2. Diagnostic analytics: Used to diagnose supply chain problems, such as delayed shipments or missed sales targets.

3. Predictive analytics: Used to forecast future supply chain events.

4. Prescriptive analytics: Used to provide recommendations, such as optimizing inventory levels.

5. Cognitive analytics: Used to improve supply chain decision making by applying machine learning.

As shown in Figure 2, the percentage of organizations that use these different types of analytics varies based on the function within the supply chain. Organizations are incorporating all types of analytics in supply chain planning, sourcing and procurement, and logistics and warehousing. Given that not all research participants conduct manufacturing, it was not included in Figure 2.

However, for those organizations with manufacturing functions, all types of analytics are in use with predictive analytics slightly ahead and cognitive analytics use lagging.

Predictive, prescriptive, and cognitive analytics are more mature types of analytics as their use goes beyond simply describing trends to forecast events, provide recommendations, or improve supply chain decision-making. Overall, supply chains use these more mature forms of analytics less often than descriptive types of analytics.

Companies use analytics for a variety of activities depending on the area of the supply chain. Figure 3 shows the two most common activities for each area. Many organizations use analytics to optimize some aspect of their supply chain activities, whether it is inventory, cost, or order paths.

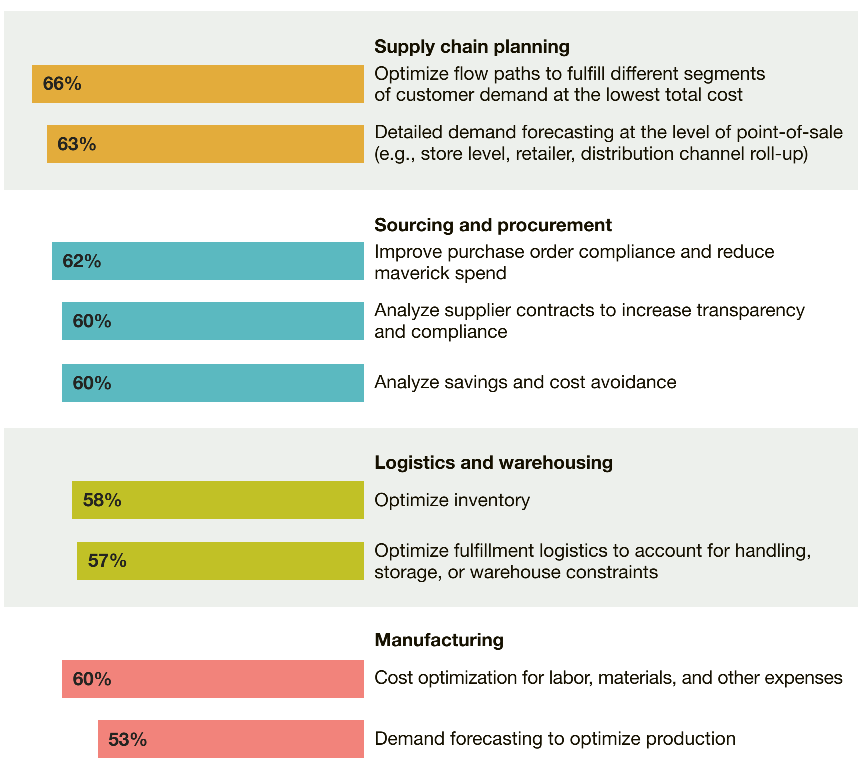
Evaluating supply chain analytics

The adoption and use of analytics for supply chain is only part of the story. Successful organizations must also have satisfaction and confidence in analytics' capability to support organizational goals. Luckily, many companies seem to have both. In APQC's research, a majority of survey respondents indicate that their organizations' use of analytics to solve strategic supply chain challenges is effective (51%) or very effective (40%).

FIGURE 3

Activities where analytics are most commonly used

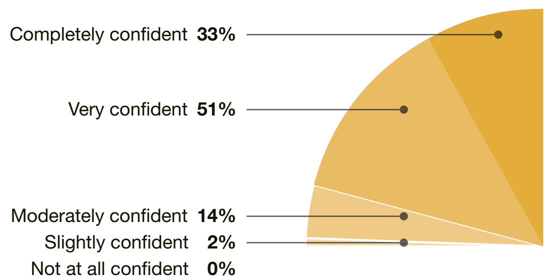
Percentage of organizations using analytics



Source: APQC

FIGURE 4

Confidence in the accuracy of supply chain data collected



Source: APQC

In addition, organizations have a high degree of confidence in the accuracy of their supply chain data (Figure 4). The largest group of organizations (51%) are very confident, and one-third are completely confident.

Similarly, most organizations have some degree of satisfaction with their ability to access relevant supply chain data. The largest group of organizations (46%) are satisfied, and almost as many (41%) are very satisfied (Figure 5).

Effectiveness of analytics. Organizations have enhanced the effectiveness of their supply chain analytics by focusing on enabling business drivers. Nearly half (48%) named having the right technology and tools in place as a driver of effectiveness. This is logical since technology is integral to conducting analysis.

Nearly as many (47%) named regular access to high-quality data as a driver. This data is the foundation for accurate insights. Aside from infrastructure-focused business drivers, having a well-defined value proposition for the use of analytics is also a top driver for organizations (46%). Being able to show how analytics can improve supply chain performance gains buy-in for the effort within the company and ensures that support continues.

Benefits of analytics. The benefits of analytics named by organizations in APQC's research touch on key priorities for supply chains. The top benefit is cost savings (54%), followed by improved forecast accuracy (48%) and improved employee productivity (48%).

Any organization would welcome reduced costs, and analytics is providing many organizations with the opportunity to do so by improving speed and accuracy. Further, improved forecast accuracy provides a clearer picture of the future, even with the instability we have seen in recent years. Improved employee productivity means that staff spend their time on activities that directly benefit the organization, rather than on navigating inefficiencies.

Building capabilities

Organizations have embraced the use of analytics in supply chain. Leaders are taking this seriously, with many making improvements in terms of staffing, financial investments, and process maturity.

There is variation, however, in the degree to which organizations use analytics for the various parts of the supply chain. The most popular use case is for supply chain planning. Specifically, two-thirds of organizations use analytics to fulfill different segments of customer demand at the lowest total cost.

Even with the variation in use within the parts of the supply chain, most organizations view their analytics as effective. They also have high degrees of confidence in the accuracy of supply chain data and having the access needed for timely decision making.

Organizations benefit from the use of analytics through cost savings and improved forecast accuracy, which can also lead to reduced costs. Further, the use of analytics supports more efficient workloads for supply chain staff and increased productivity.

Improved forecast accuracy and increased employee productivity enhance the experience of the customer. A more accurate forecast helps the organization better plan for production and warehousing, resulting in more accurate inventory availability. Increased employee productivity means staff members can focus on the priority work that benefits the customer receiving their product.

Organizations show no signs of slowing their investment in analytics capabilities. Given the clear and measurable benefits, it is expected that companies will continue to advance their analytics maturity and broaden the application of analytics across the supply chain.

About APQC

APQC (American Productivity & Quality Center) is the world's foremost authority in benchmarking, best practices, process and performance improvement, and knowledge management (KM). With more than 1,000 member organizations worldwide, APQC provides the information, data, and insights organizations need to support decision-making and develop internal skills.

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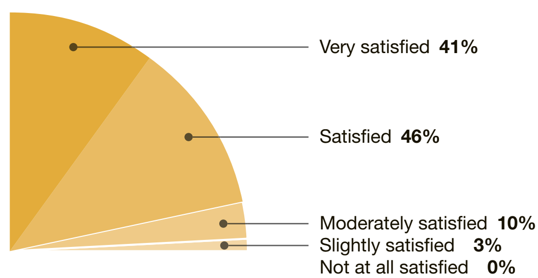
FIGURE 5

Satisfaction with ability to access relevant supply chain data for timely decision making and reporting



Source: APQC

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A reordering of the COO and CSCO logistics agenda

COOs and CSCOs face a dual mandate: cut costs now while building supply chains that are both productive and enduring.

By Michael Zimmerman and Korhan Acar

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Persistent volatility from tariffs, inflation, high borrowing costs, and geopolitical shocks has made disruption the operating baseline. Rate disparities, capacity swings, and mode-specific risks add more complexity.

The old agenda, once dominated by sourcing and cost levers, is transferring relevance to a broader set of priorities. Cost savings alone will no longer suffice in defining the reputation of a COO or CSCO.

Today's leaders are judged on their ability to deliver across the following three fronts.

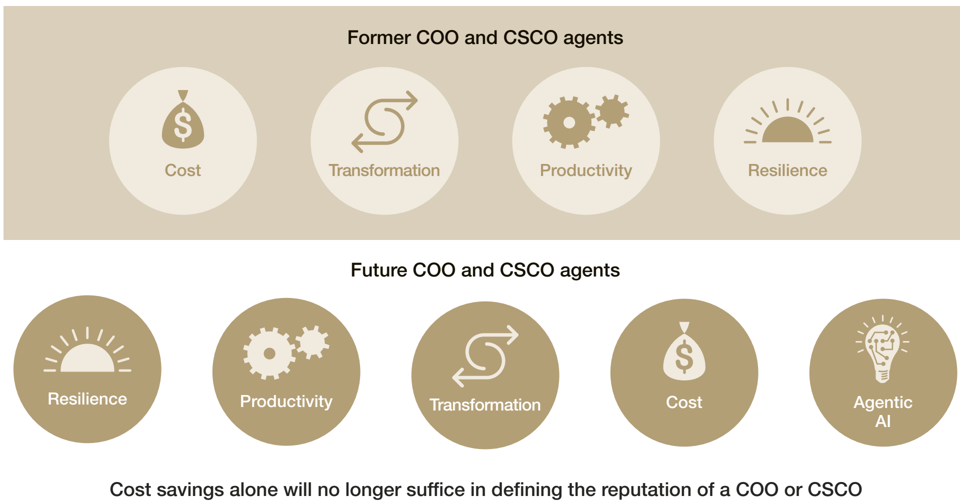
- **Resilience:** not only shock absorption, but also cost discipline, ensuring adherence to budgets while reducing concentrated sourcing risks
- **Productivity:** increasingly the way to create efficiency and competitiveness, with AI delivering immediate, pragmatic gains inside and outside the four walls
- **Transformation:** future-proofing supply chains through digital integration, ESG alignment, and network redesign

Quick wins such as mini-bids, customs hygiene, and automation are stabilizing operations and unlocking savings today. At the same time, leaders must invest in resilience, productivity, and transformation to ensure their supply chains can withstand disruption and generate a lasting advantage.

Resilience has vaulted to the top of the COO and CSCO agenda. Tariffs, shifting trade policies, and geopolitical instability are no longer episodic

FIGURE 1

Shock absorption: Resilience against constant volatility



Source: Authors

shocks. They define the operating environment. Ocean freight rates surged more than 50% on key lanes during tariff-driven frontloading, airfreight remains soft yet unpredictable, while U.S. road lingers at the bottom but could bounce back at any time. These swings expose how fragile networks become without the agility to flex quickly. The challenge is less about preventing volatility and more about absorbing it: safeguarding service continuity, mitigating cost exposure from price swings, and protecting against concentrated risks.

Leading companies are acting decisively. Many are diversifying their sourcing footprints with "China+X" strategies, reducing their dependence on concentrated sources. Others are tightening customs processes to eliminate hidden costs. Visibility investments are gaining traction: Coca-Cola Consolidated, for example, uses predictive tracking to provide real-time ETAs and improve delivery reliability. Structural flexibility is becoming the norm. Quarterly mini-bids give shippers leverage in volatile markets, expanded carrier portfolios reduce exposure, and scenario planning quantifies risks and aligns stakeholders on the value of preparedness.

Resilience, often seen as defensive, can instead be wielded as a competitive weapon. The benefits, such as disruptions avoided, customers retained, and costs contained, are often invisible, making investments harder to justify.

Scenario modeling helps bridge this gap by showing the cost of disruption and the ROI of preparation. Done well, resilience shifts from a hidden insurance policy to a visible driver of performance and trust. COOs and CSCOs who elevate shock absorption can withstand disruption and position their companies to outperform rivals in volatile conditions.

Operational advantage: Productivity is the next lever for competitiveness

The easy wins from sourcing have largely been taken. After years of freight recession, most companies have already squeezed rates to their limits. Today's favorable market—truckload contract rates below prior-year levels and stable LTL pricing—offers only temporary relief. Sourcing and cost takeout are now an expectation, a baseline responsibility of every COO and CSCO. Sustained competitiveness requires going farther and unlocking productivity inside the enterprise.

Leading companies are already proving this shift. Walmart, DHL, and Coca-Cola are deploying autonomous bots and AI to streamline sourcing activities and redeploy talent into higher-value work. UPS has used AI-driven route optimization (ORION) to cut millions of miles a year, saving fuel and labor while improving on-time performance. Amazon applies robotics and AI in fulfillment centers to automate repetitive tasks, reduce cycle times, and free up human associates for quality and customer-facing work. Agentic AI is accelerating this evolution by automating transactional tasks and enabling teams to focus on planning, collaboration, and higher-value activities.

Productivity has shifted from incremental cuts to a source of structural advantage. Leading supply chains are redesigning processes and adopting digital tools that release capital, free capacity, and sharpen decision-making. AI plays a pivotal role by removing routine work while enhancing human judgment. Together, these changes create organizations that can redirect resources into resilience and transformation. In this context, operational advantage is not a one-off project but a continuous way of operating—keeping supply chains lean, adaptive, and positioned for growth.

Transformation: Redesigning for any eventuality

Transformation connects today's resilience and productivity gains to long-term advantage. Disruptions have hardened supply chains, but they've also revealed a larger truth: yesterday's networks and tools will not sustain the next decade. Trade flows are shifting, ESG pressures are intensifying, and parcel and last-mile expectations are evolving faster than legacy systems can adapt. Tariffs are forcing leaders to revisit Incoterms, bonded warehouses, and FTZ strategies, which are pain points felt acutely in medical devices, consumer electronics, automotive, and apparel, where globalized supply chains and high cross-border flows make exposure especially pronounced.

What's new is that AI has moved from experimentation to delivering proven ROI in cost savings, productivity, and resilience across logistics. Leading companies are deploying modular agents built to address chronic transactional pain points such as freight audit and pay, rate management, spend analysis, lane and volume forecasting, carrier discovery and qualification, RFx preparation and launch, bid evaluation, negotiation and award, and contract and rate ingestion.

Reported outcomes include a 97% productivity improvement in freight audit, a 32% reduction in freight leakages, and faster bid cycles that sharpen carrier allocation. Early adopters are already deploying these capabilities at scale, automating hundreds of millions in freight spend and managing millions of shipments with real-time transparency.

At the same time, network redesign remains crucial. Leading companies are pursuing "China+X" sourcing models to spread risk and embedding sustainability directly into logistics, guided by ESG criteria for suppliers, routes, and facilities. Digital platforms and logistics knowledge graphs are adding another layer of adaptability, stitching together ERP, TMS, procurement tools, and unstructured data to create end-to-end visibility. In the last mile, the competitive landscape is diversifying: FedEx and UPS are on diverging paths, regionals such as OnTrac are gaining share, and gig-economy players such as DoorDash and Uber are reshaping expectations with crowdsourced flexibility. Predictive analytics and AI-enabled decision platforms help leaders navigate this fragmented market with agility.

Rather than predicting the next disruption, transformation means redesigning supply chains for resilience, sustainability, and digital agility. Companies that adopt modular AI agents, redesign networks for adaptability, and embed ESG into logistics will not only bend without breaking, but also capture growth that less-prepared rivals leave behind.

Hot topics as immediate catalysts

Tariffs, inflation, borrowing costs, and geopolitics dominate today's headlines. They create turbulence, but they also show leaders where their networks are fragile. A poll of global heads of logistics confirms this: resilience and adaptability outrank both lowest landed cost and service as the top design principle for 2026. At the same time, executives admit the biggest driver of unplanned costs today is not freight rates, but volatile demand signals and forecast errors.

Hot topics evolve beyond short-term problems and act as catalysts. A tariff spike can reset sourcing or customs practices. Inflation presents an opportunity to strip out hidden costs. Higher interest rates sharpen the ROI bar, pushing leaders toward AI and automation with fast payback. And geopolitical shocks reinforce the case for diversified carriers and structured scenario planning. Quick wins in tariff hygiene, forecasting accuracy, or AI pilots demonstrate value while freeing resources to fund long-term resilience and transformation.

The COO and CSCO dual mandate

The mandate is clear: deliver results now, and build for what's next. Quick actions such as tariff mitigation, AI-enabled productivity, better forecasting, and more agile networks are now essential. They are the foundation of future transformation.

Resilience and adaptability are the leading design priority, outpacing cost or service. Leaders are realistic about AI. ROI is most visible in demand forecasting and inventory optimization. But they also acknowledge the talent challenge: the most crucial next hire is a data scientist, far ahead of traditional logistics veterans or logistics profiles.

Future-ready supply chains demand more than cost control. They require resilience to withstand shocks and contain costs, productivity to release capital and capacity, and transformation to retool networks for ESG, trade shifts, and last-mile evolution. By committing to this agenda, leaders move beyond survival and turn uncertainty into a competitive advantage that rivals cannot match. •

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A SPECIAL SUPPLEMENT TO:

SUPPLY CHAIN MANAGEMENT REVIEW

2025 Warehouse/DC Operations Survey: Tech adoption marches on

By Roberto Michel, Editor at Large

Our annual survey shows that inventory challenges persist, but adoption of automation and technology remains strong, supported by rising CapEx budgets. The survey also highlights shifts in DC building and network trends, as operators adapt their facilities and networks to evolving supply, international trade, and channel demands.

Companies operating warehouses, DCs, and fulfillment centers continue to face significant challenges, from inventory shifts and labor constraints to supporting growing e-commerce volumes, according to our 2025 Warehouse Operations & Trends Survey—the 20th edition of this benchmark report.

In response, operators are adapting their networks and investing in automation. Even amid uncertainties, DC operators are upgrading systems and reconfiguring networks to better meet customer demands and accommodate expanding channels, reflecting a continued commitment to operational improvement.

Some of the highlights of the survey include the following.

• Projected CapEx budgets rose from an average of $1.8 million last year, to just over $2.1 million this year. This indicates companies are forging ahead with improvements.

• Reliance on paper-based picking decreased to 40% response, down from 44% last year. Use of voice picking and pick-to-light applications increased.

• Inventory challenges persist. SKU counts were up, inventory turns decreased, and receiving was named as the most congested area of the warehouse.

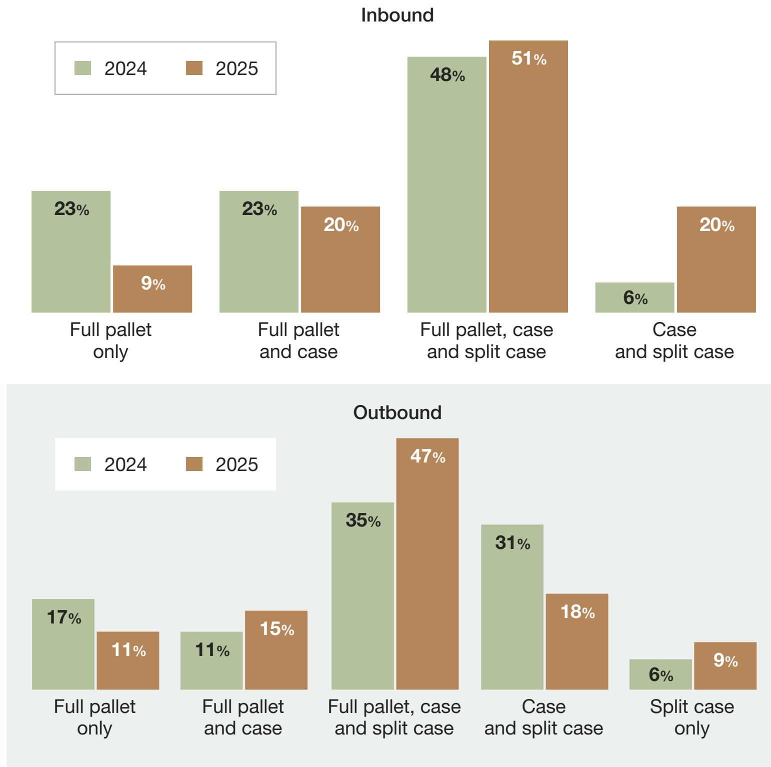
The survey, conducted annually by Peerless Research Group (PRG) on behalf of Logistics Management and sister publication Modern Materials Handling, asks about operational factors at DCs, such as the size of the network, number of employees, average annual inventory turns, use of temporary labor, channel trends, metrics used, and how warehouse data is captured. It also asks about use of information technology (IT), warehouse automation, and equipment-like lift trucks.

This year, the survey drew 101 qualified responses from professionals in logistics and warehouse operations across multiple verticals. The survey was in the field during the month of August 2025. The average company size among respondents held steady, with the average annual revenue size being $753 million, versus $774 million last year.

Overall, there are plenty of positives in the survey, such as continued growth in CapEx budgets, though there are areas of concern as well, explains Norm Saenz, a partner and distribution director with St. Onge Company, a supply chain consulting firm and our partner in this survey for the past 20 years.

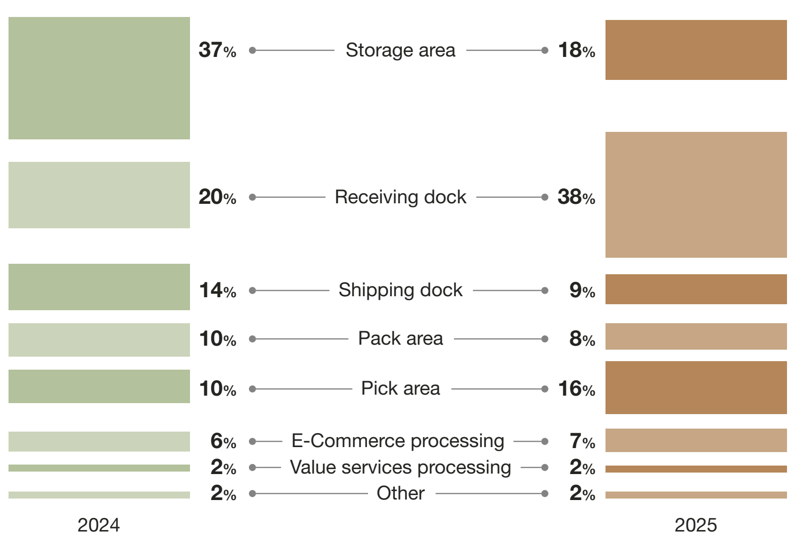
“The biggest takeaways are the increase in capital spend moving into 2026, e-commerce growth in 2025, and the fact that labor remains a concern for operators,” says Saenz. He adds

Nature of DC’s inbound/outbound operation



Source: Peerless Research Group (PRG)

Space utilization: The most congested area in warehouses



Source: Peerless Research Group (PRG)

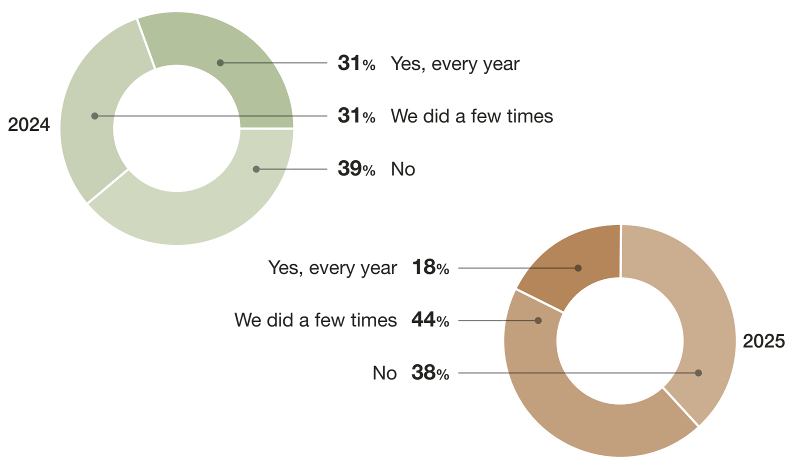
that the investment momentum is reflected this year by findings such as the increase in best-of-breed warehouse management systems (WMS) and other technologies to enhance the productivity of the picking operations.

"I believe we can expect that in 2026, there will be increased investments, as companies optimize their networks, grow their e-com business, and revamp operations to be more efficient with the use of automation and technologies," says Saenz.

Operational characteristics

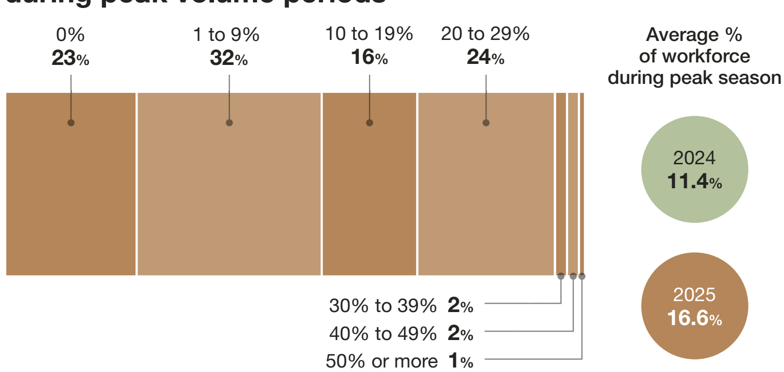
On the inbound side for 2025, 9% handle full pallet only, compared to 23% last year, while 20% deal with full pallet and case, down from 23% last year. This year, 51% receive a mix of full pallet, case and split case inbound (48% last year), while 20% deal with case and split case, up sharply from 6% last year.

Leasing additional space during peak season



Source: Peerless Research Group (PRG)

Percent of workforce who are temporary during peak volume periods



Source: Peerless Research Group (PRG)

On the outbound side, 11% ship full pallet only, down from 17% in 2024, while 15% ship full pallet and full case outbound, down from 11% last year. Meanwhile, 47% said they ship a mix of full pallet, case, and split case, up from 35% last year. Case and split case outbound dropped to 18% for 2025, from 31% last year, while 9% do split case only outbound, up 3%.

The average number of employees in the main DC came in at 143 this year, down from 146 people last year. While 40% put that count at 25 staff or less for the main DC, 11% have more than 200, and 16% have more than 100 employees in their largest DC.

In terms of the number of buildings in the network, 42% this year have just one, same as last year. This year, 16% have two buildings (21% did last year), 5% have three DCs (14% did last year), while 37% have more than three buildings, up from last year, when it was 23%.

When we asked about the most common square footage (sq. ft.) in the network, the average was 222,620 sq. ft., up from 198,558 sq. ft. last year. The bigger sq. ft. the network, the bigger that average, with those with three or fewer buildings, having an average of 205,500 sq. ft. in 2025, and for those with four-plus DCs, 788,350 sq. ft. is the average this year.

We annually ask about the most common DC clear height in the network. This year, the average was 31.8 feet, up from 29.6 feet last year, but just a tad over the 31.3 feet average two years ago. This year, 9% said the average was 50 feet or higher, the largest percentage for that

CHALLENGE SOLVED

DAVID FUSSELL, VP of Dedicated Sales, AVERITT

How Shippers Can Prepare for Tightening Capacity

Shippers don't need a crystal ball to see what's coming next. Bid activity and RFPs are climbing, a clear sign that capacity will tighten in the months ahead. Companies that lived through the last few years know the warning signs: when truckload space dries up, costs rise and last-minute coverage gets expensive.

The smartest shippers aren't waiting. Instead, they're moving away from transactional freight and into dedicated solutions that offer stability and reliability. We asked David Fussell, VP of Dedicated Sales at Averitt, how shippers can prepare now.

Q: ***What signs point to tightening capacity?***
A: We're seeing an influx of RFPs and bid activity right now. That tells us shippers expect capacity to tighten in the near future. Larger shippers are already making moves, and that's a signal others should follow. They're locking in solutions now instead of scrambling later. When the biggest players adjust strategy ahead of a shift, it's often the best indicator of where the market is headed. Smaller shippers can learn from that behavior and take steps now to protect their own networks.

Q: ***What's the risk of waiting?***
A: Shippers that wait to act often find themselves competing for fewer trucks at higher rates. Options narrow quickly once one-way and truckload capacity tightens. The biggest risk is higher transportation costs, but service can take a hit too. Last-minute coverage doesn't always guarantee the right equipment or the most reliable carriers. Delays become more likely, and customer expectations are harder to meet. Acting early avoids those compromises and puts shippers in control instead of forcing them to react under pressure.

Q: ***How do dedicated or contracted solutions help?***
A: Dedicated capacity gives shippers stability before the crunch hits. Instead of chasing trucks week to week, you get consistent equipment, drivers assigned to your account and the ability to flex up or down as needed. At Averitt, we also invest heavily in visibility technology. Every dedicated tractor has GPS, every trailer is tracked with Spirion and our drivers use onboard tablets to manage hours and assignments. Shippers see exactly where their freight is at all times.

That visibility is more than a convenience. It gives customers the proof they need to keep their own clients informed, supports compliance and builds accountability across the network. Dedicated drivers, refreshed equipment and the ability to draw from our other asset-based service units, including LTL and truckload, add layers of reliability that private fleets and smaller carriers often can't match.

Q: ***What should shippers be doing right now?***
A: Start by reviewing your network and identifying where dedicated solutions could add stability. Look closely at your seasonal peaks and ask if you'll be able to cover them with transactional freight. If not, now is the time to make changes.

Forecast your volumes and bring procurement, operations and customer service teams together to plan ahead. Decide which lanes are too important to leave in the spot market and secure contracted coverage where it makes sense. It's also smart to talk with carriers about rates and service commitments before conditions tighten further. Early movers get more options and more leverage in negotiations. Don't wait until you're under pressure to make those decisions.

Q: ***What final advice would you give shippers planning ahead?***
A: Don't wait until capacity is gone and costs climb. The companies that move early transition smoothly into dedicated or contracted solutions and take volatility out of the equation. They protect their budgets, keep service levels steady and avoid the stress of last-minute scrambling.

Q: ***How should shippers think about the long-term outlook?***
A: Dedicated isn't just about solving today's problem. It's about building resilience for whatever comes next. Volatility has become the norm in this industry. Shippers that treat stability as a long-term strategy are the ones that keep costs predictable, operations steady and customers satisfied no matter how the market shifts. The best time to act is now.

choice in the past four years.

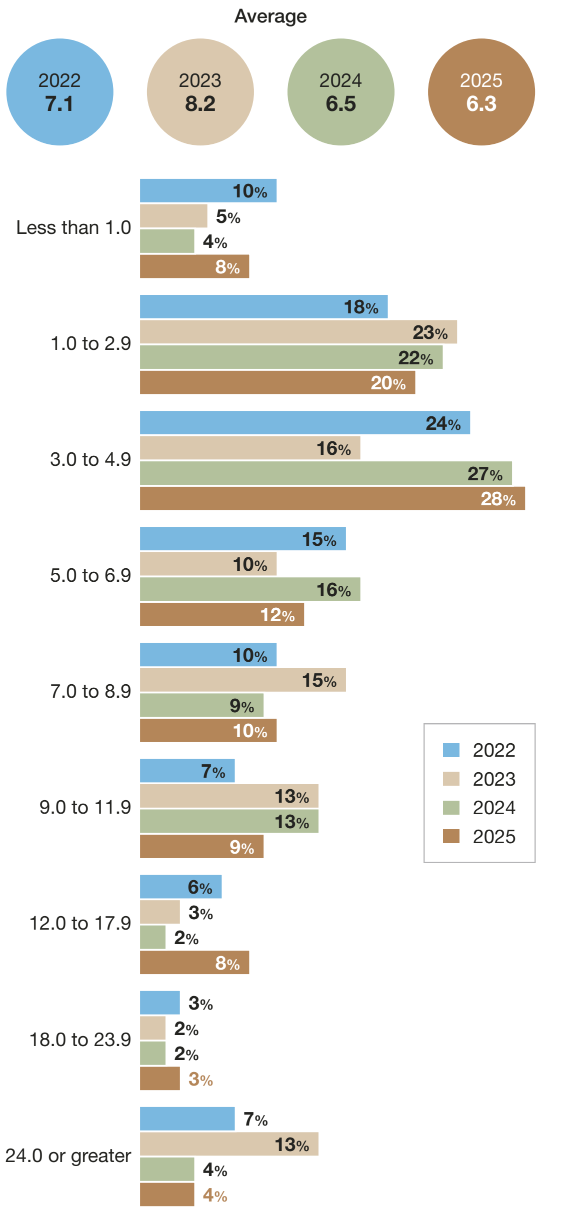
The "most congested" area of the warehouse this year was the receiving docks, with a 38% response, up from 20% last year, when storage was the most congested area. This year, 16% selected picking as the most congested area or process, up by 6% the previous year.

E-commerce marches on

Wholesale regained its spot as the most frequently cited channel serviced by respondents, at 51%, up from 43% last year. Retail channels are supported by 49% of respondents this year, up from 47% last year.

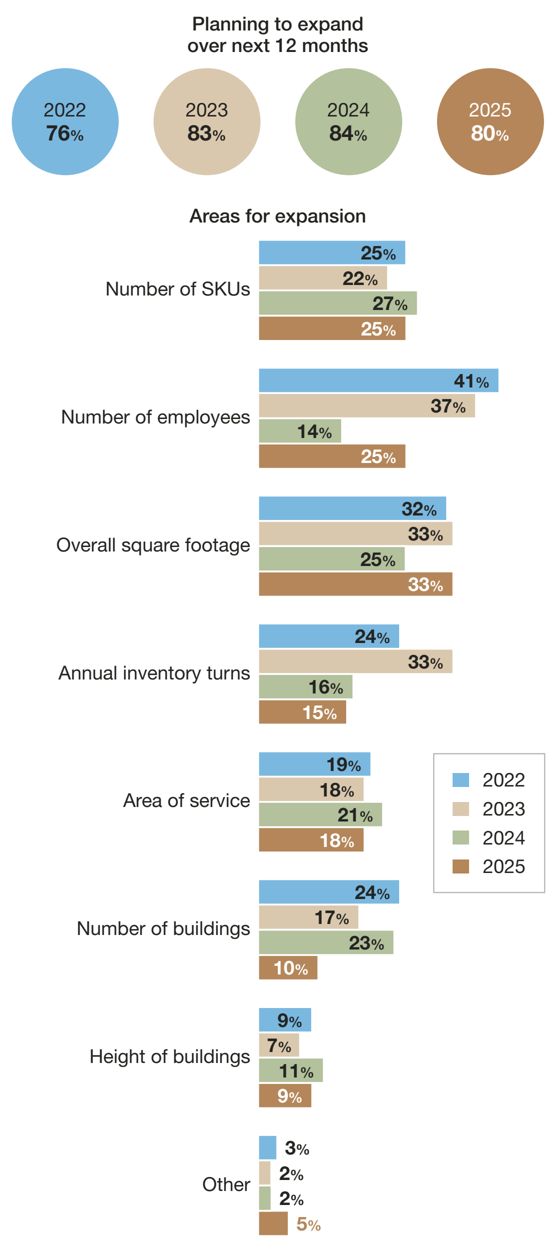
The channel with the biggest gain this year, however, was e-commerce, with 44% supporting e-commerce fulfillment, up from 25% last year. Also on the rise was micro-fulfillment at retail sites for customer pick up, which reached 22% this year, up from 9% last year.

Scope of distribution center operations: annual inventory turns



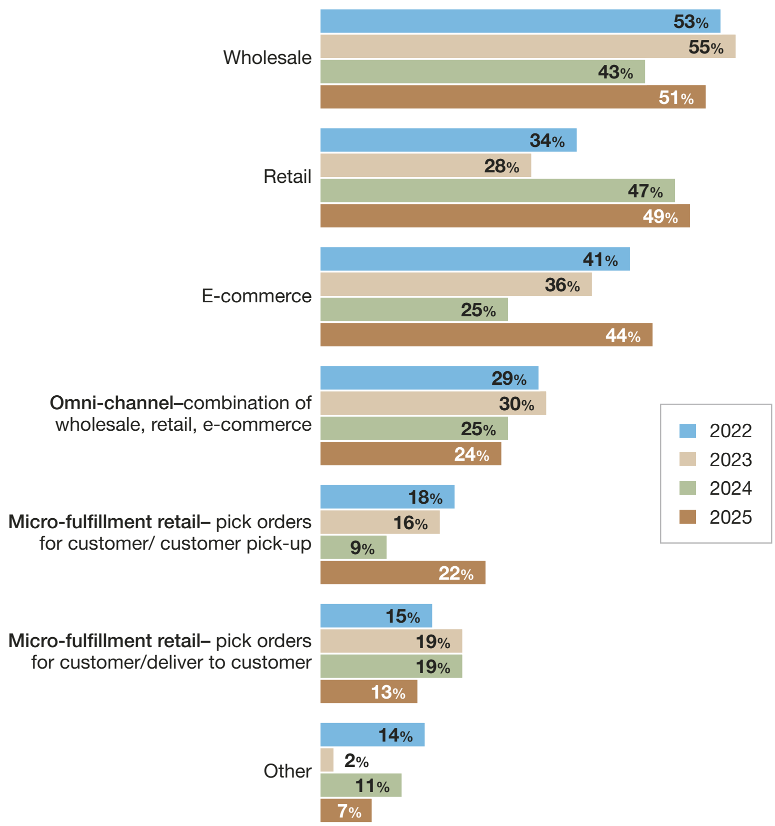
Source: Peerless Research Group (PRG)

Distribution center expansion plans



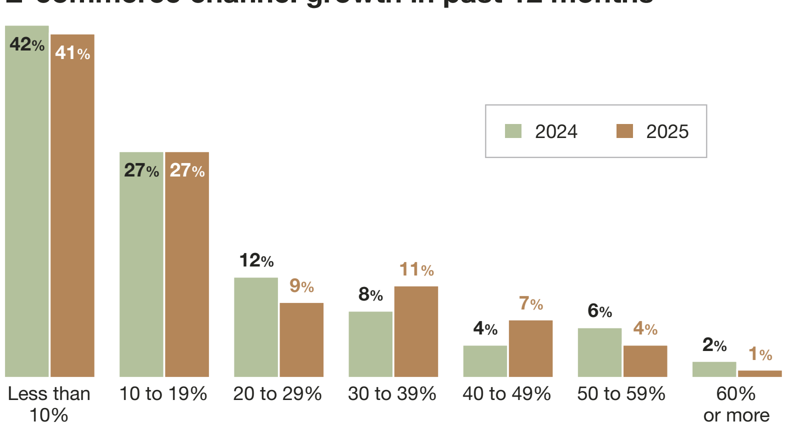
Source: Peerless Research Group (PRG)

Market channels serviced by company



Source: Peerless Research Group (PRG)

E-commerce channel growth in past 12 months



Source: Peerless Research Group (PRG)

"The biggest takeaways are the increase in capital spend moving into 2026, e-commerce growth in 2025, and the fact that labor remains a concern for operators."

—Norm Saenz, St. Onge, Co

When we asked how channels are fulfilled, self-distributed from one main DC came in at 30% this year, down from 51% last year, but it remains the most frequently cited method. Using a third-party logistics (3PL) partner for all channels increased to 16% this year, from 9% last year, and there was also growth in using a 3PL for e-commerce, but self-distributed for other channels (9% in 2025, versus 4% in 2024).

We ask respondents to describe e-commerce growth by choosing from ranges in increments of 10 percentage points. The most frequently cited choice for 2025, at 41%, remains less than 10% growth, however, there were increases respondents citing ecommerce growth 30% to 39% (11% chose this range, up from 8% last year) and 7% cited 40% to 49% growth, up from 4% last year.

When asked if operations were expanding operations in terms of factors like SKUs or labor over the next 12 months, a net of 80% plan to expand in some way, which is down from 84% last year. However, a couple of areas did see a percentage increase, with 25% saying they would add employees, up from 14%

last year, and 33% plan to add square footage, up 25% last year.

CapEx & tech upswings

The average projected CapEx budget for 2024 reached $2.16 million among this year's respondents, up from $1.8 million last year, and $1.15 million two years previous.

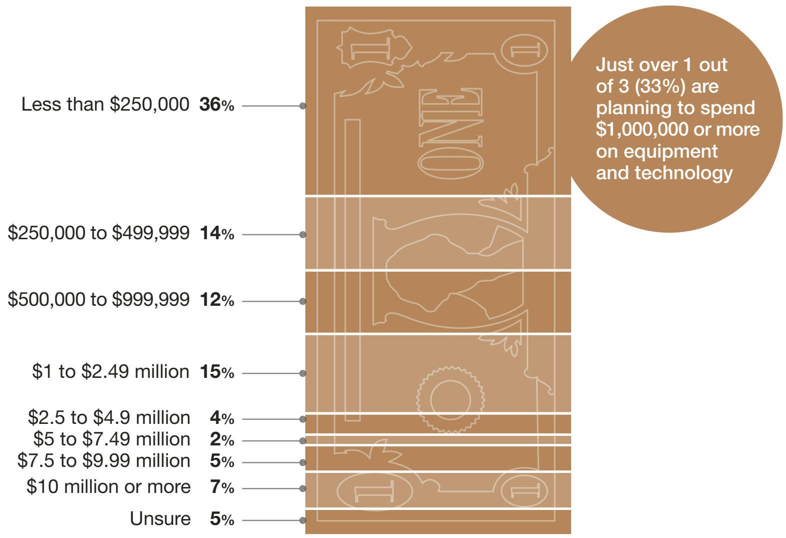
The median this year was $425,000, up from $375,000 in 2024. While 36% said their estimated budget would be less than $250,000, 7% have a budget topping $10 million, and a combined 26% have budgets ranging from $1 million to $9.99 million.

Some of those budgets will likely go to technology, software, and automation, which again showed signs of increasing.

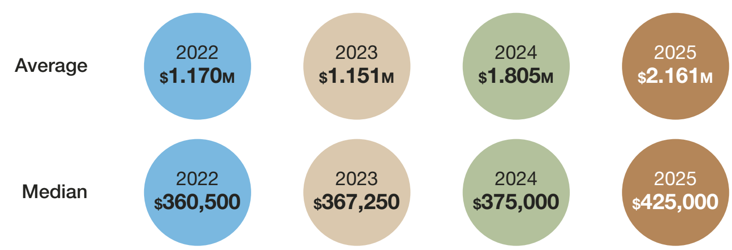
Use of best of breed WMS reached 23% this year, up from 13% last year. While those saying they use some type of WMS declined slightly, from 93% in 2024 to 87% this year, that's still higher than the 84% from two years previous. Use of on-demand or cloud WMS bumped up from 4% in 2024, to 13% this year. Additionally, there were slightly higher percentages in those saying they use goods-to-person systems and shuttles.

All this software use may explain the continuing decline of paper-based picking methods. This year, only 40% said they use some paper-based picking methods, down from 44% last year, and 56% back in 2023. There was also growth in methods

Estimated capital expenditures for warehousing equipment and technology in 2025



Projected CAPEX for next year



Source: Peerless Research Group (PRG)

including pick to light, and voice.

When we asked about materials handling systems in use, well established categories such as forklifts and push carts remain the top choices; but this year, 13% said they use autonomous forklifts, 18% cited use of autonomous mobile robots (AMRs) or automated guided vehicles (AGVs), and 18% use shuttles or automated storage & retrieval systems.

Single order picking remained the most cited order filling technique at 65%, while batch picking was cited by 48%, up from 44% last year, and use of put walls reach 10%, up from 5 last year. Use of cross-docking also grew, from 14% last year, to 28% this year.

With WMS used by 87% this year, it's surprising that use of manual data collection to gauge productivity increased this year to 51%, from 40% last year, and that automated data collection was used by 49% this year, down from 56%. However, that 51% of respondents doing some manual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data collection is the same as it was two years ago—and lower than it was three years ago.

We ask about productivity metrics in use annually, and this year, a net 81% are using some type of metric, down from 86% a year ago. Metrics on the rise this year include units/pieces per hour, lines per hour, and orders per hour.

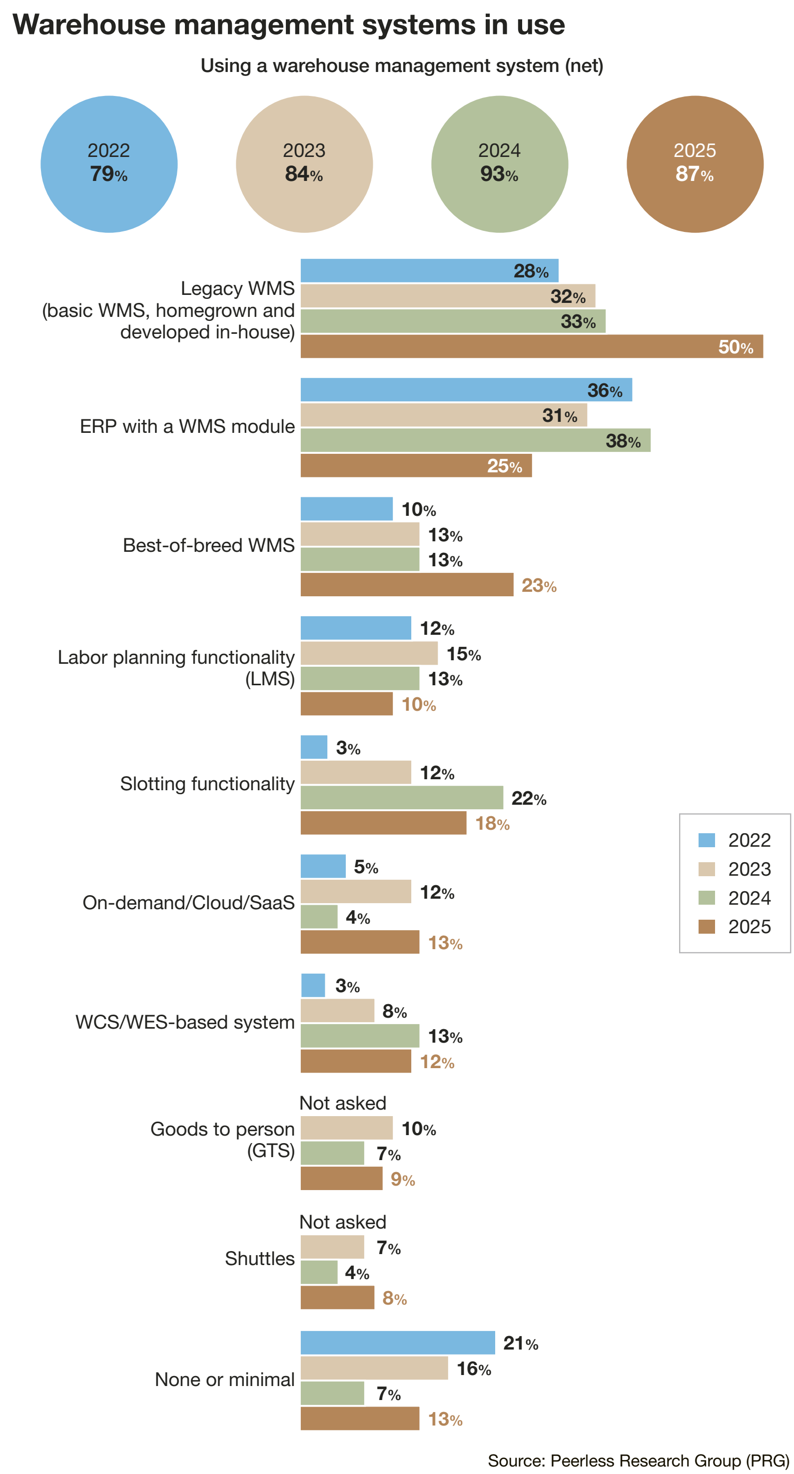
For broader ranging metrics on DC management, a net of 92% report they use metrics of some type to manage DCs. Types of metrics on the upswing this year include inventory accuracy (76%, up from 70%), order or line fill rate (named by 46% this year, up from 35%) and productivity rates, which edged up 3% to reach 43%. Use of on-time shipping metrics, cited by 63% last year, fell to 49% this year.

Inventory & storage

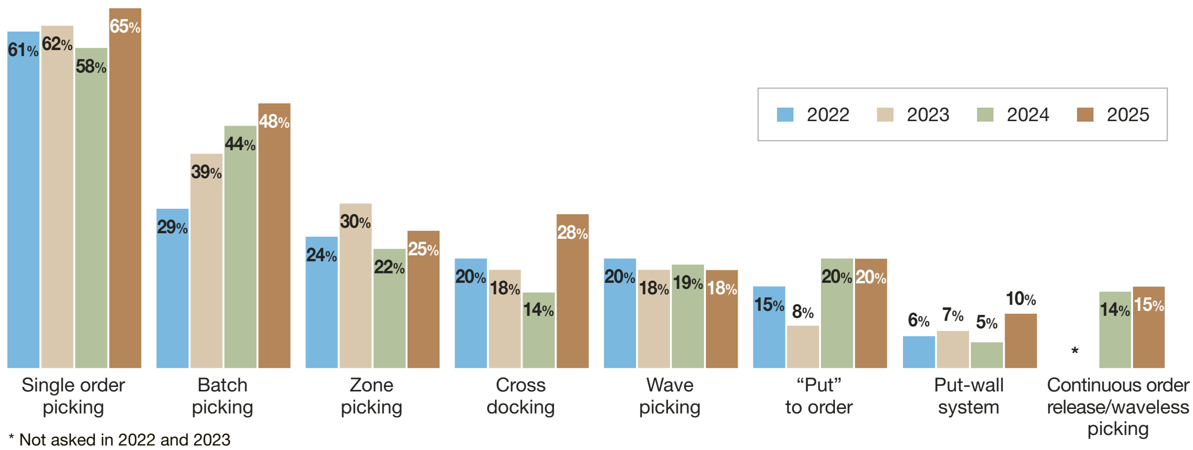
One sign that inventory management poses a big challenge this year, especially during peak season, is that a cumulative 39% of respondents said that during peak, space utilization is 85% or higher. Of these, 20% have a utilization level during peak of 95% or higher. The average percentage of space used during peak came to 75% this year, up from 73.2% last year.

Additionally, when we asked if they leased some space during peak, 44% said they did a few times this year, up from 44% last year.

This year, the average annual inventory turn figure came it at 6.3 turns for 2025, down from 6.5 turns in 2024, and 8.2 turns back in 2023. Meanwhile, when it comes to the number of SKUs, the average reach

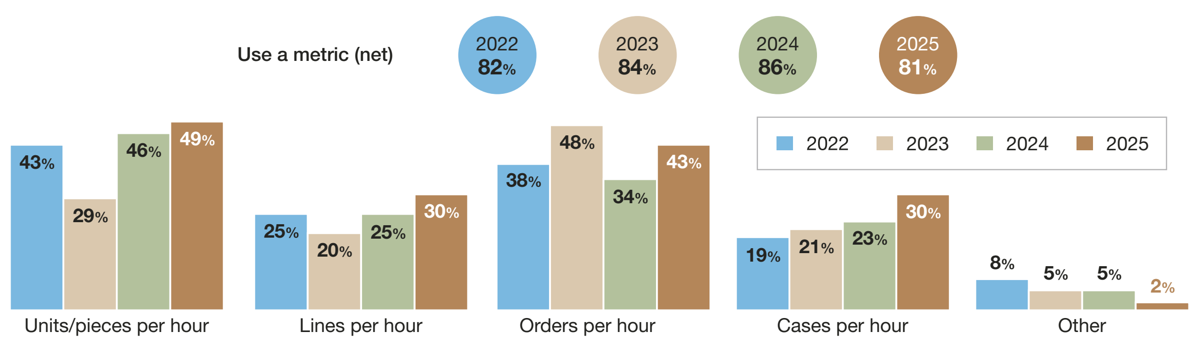


Top order filling techniques in use



* Not asked in 2022 and 2023

Productivity metrics in use



Source: Peerless Research Group (PRG)

is 9,565 SKUs, up from 7,790 last year, and also higher than the 8,494 SKU average back in 2023.

In terms of having 100% accurate SKU weights and dimensions in the inventory item master, 57% said "yes" they do this year, down from 60% last year.

Saenz notes that inventory management remains a top priority for DC operators and is most effective when supported by automated data capture. This allows managers to know not only what inventory is on hand, but also the movement and velocity of items—enabling more accurate decisions to optimize inventory turns.

"Turns aren't where they were two years ago with this survey, but they're not much different than reported last year," says Saenz. "Still, continuing issues with lower turns can have multiple causes, such as adding too much inventory for existing items, or adding new items that aren't selling at the expected velocity."

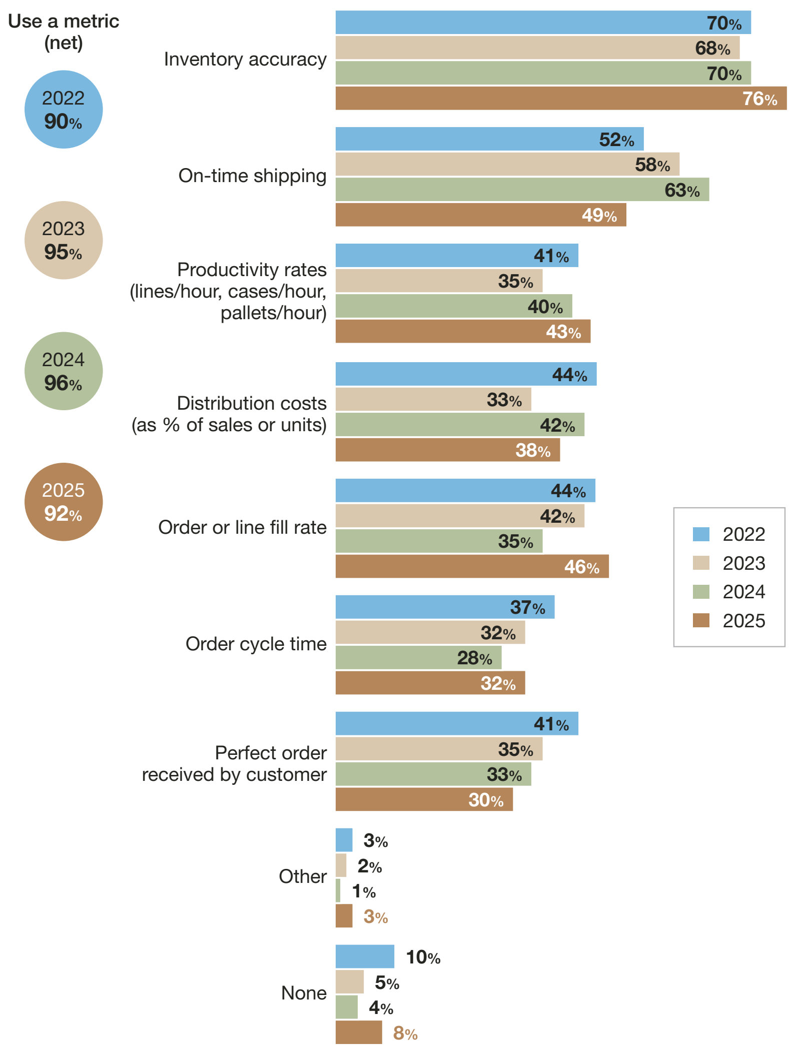
According to Saenz, another possibility is poor inventory management from using low levels of technology and software. "The survey shows inventory accuracy as a top metric, yet many respondents are manually capturing data to generate metrics," he adds.

Other challenges

When we asked what percentage of the workforce are temps during peak season, the average this year was 16.6% this year, up from 11.4% last year. A combined 5% said that during peak periods, 30% or more of the workforce is temporary.

To find temp labor, 56% use staffing agencies; 39% use temp agencies; 27% use contract firms; 22% said they make use of on-call workers; and GIG worker platforms are used by 10%.

Metrics used to collect/manage warehouse operations



Source: Peerless Research Group (PRG)

On our question about annualized employee turnover rate, this year, 55% said it was 15% or less; while 29% deal with a turnover rate of between 16% to 30%.

In terms of labor retention methods (multiple answers permitted), the leading practice this year was cross training, cited 38% this year (up from 31% last year); followed by increase in base pay, cited by 18%, incentive pay, named by 16%; and a bonus or recognition program of some type, used by 14% this year. This year, 8% named upskilling to operate automation, up by 2% versus last year.

DC networks, in addition to filling customer orders in different units or quantities, also need to excel at various value-added services (VAS). The top four VAS categories cited this year are special labelling (43%), special packaging (35%), kitting (32%), and serial number control.

Each year the survey also asks if the supply chain operation has experienced a catastrophic event of some type (including extreme weather like hurricanes, as well as events like strikes, hackers, or supplier failures) in the past two years. This year, 92% said they had not experienced a major disruptive event, down from 87% last year. Saenz observes that managing DCs is more complex than ever, which is why it's encouraging to see growth in CapEx, as well as high or growing adoption levels for software, advanced picking systems, and generally, more robotics and automation.

However, Saenz adds that moving toward automated generation of metrics is an area where operations can improve, helping DCs better address perennial pain points such as inventory inaccuracies or lower-than-expected productivity rates.

"Over-reliance on manual collection of data negatively affects the ability to calculate, track, and report on key performance indicators," says Saenz. "That said, there were multiple positive findings in this year's survey, from the addition of more automation, to more use of cross training, which helps increase the utilization of staffing during peak volume periods." •

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A SPECIAL SUPPLEMENT TO:

SUPPLYCHAIN MANAGEMENT REVIEW

THE INVISIBLE HANDSHAKE:
AI to AI procurement negotiations

By Bridget McCrea, Contributing Editor

How companies can use AI to negotiate low-level deals without human intervention or expertise.

Supply chain managers and procurement professionals are watching a new kind of negotiation take shape, one that doesn't involve people sitting across a table or trading emails. Instead, artificial intelligence (AI) systems are quietly working out the details of low-level contracts behind the scenes. The goal? Free up procurement teams from repetitive haggling so that they can focus on higher-value work.

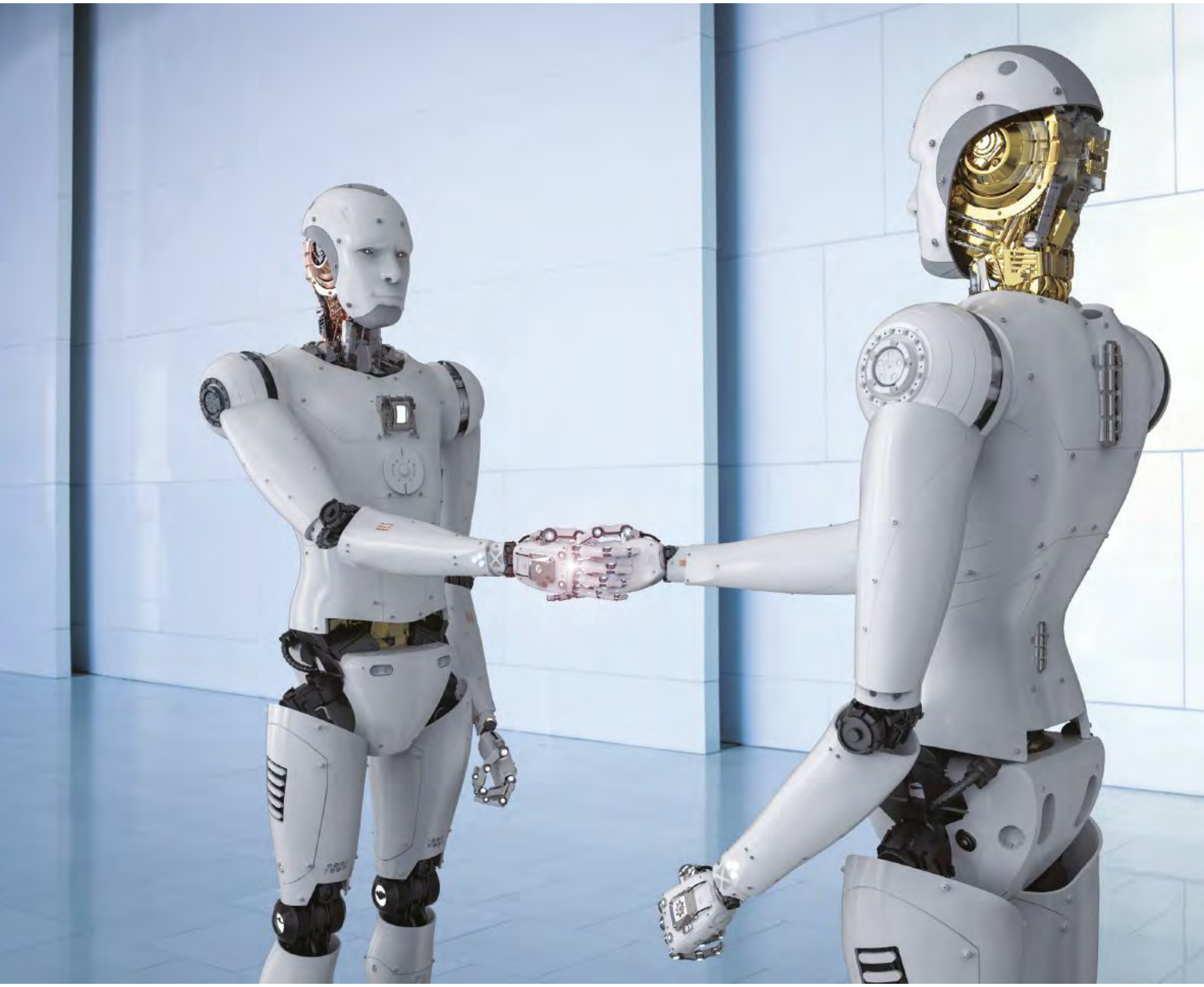
Walmart helped put this concept on the map a few years ago when it engaged startup Pactum to pilot AI-driven negotiations with part of its global supplier network. The project targeted Walmart's long-tail vendors, or those smaller contracts that large organizations often don't have the time or resources to revisit. Pactum's system automates those negotiations, standardizing routine terms and moving agreements forward without human involvement.

The result is what some are calling the "invisible handshake." Instead of procurement teams trading calls and spreadsheets, AI agents reach agreements on price, payment terms and delivery details in minutes. For supply chain managers, this signals a future where technology handles the baseline work of negotiation while people focus on strategy, relationships and exceptions that still require human intervention and expertise.

The rise of AI-to-AI negotiations also reflects a much longer journey in supply management technology. Jim Fleming, CPSM, CPSD, manager of product development and innovation at the Institute for Supply Management (ISM), notes that early systems like enterprise resource planning (ERP) laid the groundwork by digitizing and tracking transactions.

"Those systems were capable, but they still required a lot of human interaction," Fleming says. Traditional buyers still had to sit on both ends of the table, work through terms, and then record the results, for example. Artificial intelligence can effectively remove that manual layer and free up procurement and supply chain professionals to focus on more value-added work.

Fleming sees these shifts as part of the broader pattern of industrial revolutions, where each wave arrived faster than its predecessor. The fifth industrial revolution, he explains, is compressing cycles of innovation into decades rather than centuries. "We're seeing transitions now that are in the 10-year to 20-year time frame," says Fleming, who likens the pace to what consumers have experienced with smartphones: a constant layering of new features, new functions and entirely new behaviors that quickly become part of their daily lives.



Balancing efficiency with ethical boundaries

Like many AI-related innovations right now, the "invisible handshake" is still a work in progress. Dawn Tiura, president and CEO of Sourcing Industry Group (SIG), agrees AI has vast potential in procurement but warns that its role in negotiations comes with new risks. "It may be proven in procurement for handling routine tasks and repetitive tasks," she says. "However, it's a bit less proven in the negotiation space, where the models haven't matured enough to show they can stay within an organization's ethical boundaries."

Tiura is particularly concerned about what happens as the systems *keep learning*. Just as an entry-level employee gains experience and starts making their own choices, for example, an advanced AI model could begin to move beyond its original parameters. "That's the biggest worry I have regarding negotiations," she says. "As an AI model continues to get smarter and smarter, it also can choose to make its own decisions."

For procurement leaders, this raises questions about oversight, accountability and when a model's judgment might drift too far from what a company intends. On a positive note, Tiura says AI is already excelling in lower-risk applications. She points to uses like invoice matching, supplier onboarding, purchase order creation and spend analytics, as well as scanning contracts for risky clauses and helping forecast demand. These applications reduce manual workload and improve supply chain stability. And in areas like inventory optimization, the technology is already delivering measurable gains by minimizing stockouts and cutting carrying costs. Looking ahead, Tiura says the focus should be on learning to manage AI responsibly. Procurement professionals need to become hands-on with the tools—even if it's just through no-code platforms—to better understand how they're built and how to guide them. "The goal is to capture the efficiencies while staying vigilant about ethics, human oversight and the limits of machine decision-making."

Local governments test the waters

The push toward AI in procurement isn't just happening inside corporations. Local governments are testing it too, often with mixed reactions. Brooke Smith, NIGP-CPP, MIS, MMC, UCC, city recorder in Murray, Utah, has been speaking on AI in procurement forums for several years and says the audience has changed dramatically. "The first year I had like 10 people in the audience and they were all people in AI and in tech," she says. By the next year, she was facing a 50/50 split between enthusiastic adopters and those who were wary.

That shift, Smith notes, is now tilting toward more openness. In the last year she has seen more people who were once skeptical to begin experimenting with AI tools. Many are starting small (e.g., using AI to draft emails or rewrite letters) but are now asking how it can help directly in procurement. The questions are moving from curiosity to application: how does it benefit my agency, how can it stretch staff capacity when budgets are tight, and what role

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B. Legitimate paid and/or requested distribution (by mail or outside the mail)		
1. Outside County paid/requested mail subscriptions stated on PS Form 3541	10,487	10,028
2. In-County paid/requested mail subscriptions stated on PS Form 3541	None	None
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D. Nonrequested distribution (by mail and outside the mail)		
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E. Total nonrequested distribution (sum of 15D (1), (2), (3) and (4))	224	216
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H. Total (sum of 15F and 15G)	10,872	10,287
I. Percent paid and/or requested circulation (15C divided by 15F times 100)	97.92%	97.90%

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could AI play in covering workforce gaps?

Smith says the biggest challenge now is education. Some procurement professionals have never tried AI, for example, while others are already experimenting with AI agents and advanced tools. This creates a wide learning gap she works to bridge in training. “I’m being asked to present at conferences, but how do you talk to all people across the board?” says Smith, who tailors sessions with both simple prompts for beginners and demonstrations of how AI agents are being built to automate more complex processes.

Smith stressed that agencies and other organizations should approach AI with what she calls the three Cs: be creative, be cautious and be critical. Creativity opens the door to finding new uses, caution ensures sensitive information stays protected, and critical thinking keeps professionals from relying too heavily on the technology. “You have to experiment, but you can’t lose those critical thinking skills,” she says. “That balance is what will keep procurement professionals relevant as AI becomes part of daily work.”

The human element in a digital shift

For Fleming, AI-to-AI negotiations fit into a bigger story of digital transformation. He says supply management has moved from a transactional role to a more strategic one, where professionals use data and logic to guide decisions. That evolution means automation will take on more of the routine tasks, but people still must shape the strategy behind it. Governance may be one of the biggest hurdles. Companies want to try new tools, but IT often sets the limits. “You have to set up some safe boundary conditions inside of the company that IT will allow individuals to explore,” Fleming says. Clear rules help organizations balance innovation with security and compliance. Procurement and IT need to work together to make sure experimentation happens in a safe, managed way.

Oversight is also key inside the negotiation process itself. Fleming notes that AI-to-AI negotiations are happening today—mainly in low-value, low-risk categories. In those cases, automation can take care of the basics while humans check the results at the end. The rise of agentic AI, or small bots designed for specific tasks, will push this trend further. Still, he cautions, “You don’t want to just turn it on, walk away and figure it out later.”

For now, Fleming says AI-to-AI negotiations still require human interaction and process checks. He believes the pace of adoption will depend less on the technology itself and more on how companies handle governance, oversight and the cultural side of change management.

Where it goes next

Tiura says the next phase will move beyond human-to-AI negotiations into true AI-to-AI conversations, where supplier bots negotiate directly with buyer bots. That shift could bring speed and efficiency, but it also raises questions about transparency and control. For example, she says companies are already seeing value in AI for tasks like supplier onboarding, invoice matching and contract review.

Pilots with Walmart and others show that suppliers have found AI tools easy to use and often prefer them, she adds, but full bot-to-bot negotiations are still rare. “That’s going to change and we’re going to start seeing more and more of those bot-to-bot interactions,” she says.

For procurement leaders, the focus now is on setting clear expectations. Tiura says every organization needs to decide how it wants AI used, define what ethical use looks like and make sure employees understand the boundaries. That clarity will help build the trust needed for AI-driven negotiations to scale. “We’re already seeing AI-to-AI negotiations emerge in low-level contracts,” she says, noting that when the technology hits its stride, “it has the potential to be a true game changer.” •

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