Top Trends in Supply Chain Technology for 2025

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By: Christian Titze, Simon Jacobson, Federica Stufano, Dwight Klappich, Leonard Ammerer, Simon Tunstall, Mark Atwood, Kevin Lawrence, Marta Muñoz

Initiatives:Digital Supply Chain Value Realization; Technology Buying Dynamics

> Gartner has identified the supply chain technology trends that will be the most impactful in the upcoming years — trends that are relevant to and span supply chain functions. Tracking them will help supply chain technology leaders shape the future of their organizations with responsible innovation.

Overview

Opportunities

- Advances in technology provide supply chain technology leaders the opportunity to support chief supply chain officer's (CSCO's) priorities, including digital and artificial intelligence (AI) value realization, workforce productivity, and employee to employee (E2E) operating model strategy development.
- Delivering the full potential of supply chain technology investments' past and future requires investments in "connectivity."
- Additional opportunities for competitive differentiation arise from technologies addressing the theme of "intelligence."
- Cybersecure supply chains and holistic sustainability are further trends to consider, because they address broader impacts across multiple dimensions in the ecosystem.

Recommendations

- Identify and evaluate innovative technologies, based on requirements and use cases that clearly map toward business outcomes.
- Solicit suggestions for using and prioritizing innovative technologies to improve and transform the supply chain by establishing a clear governance process that engages stakeholders and validates opportunities.
- Help expand connectivity by constantly evaluating and adopting digital technologies, such as ambient invisible intelligence, augmented connected workforce, multimodal user interface (UI) and polyfunctional robots.
- Identify opportunities to foster "intelligence," where there is significant demand for scale and efficiency and adaptability is required. This includes agentic AI, autonomous data collection, decision intelligence (DI) and intelligent simulation.
- Manage security and sustainability capabilities by default in each digital transformation initiative by using a disciplined governance approach, including risk management as part of the IT innovation process.

What You Need to Know

Supply chain technology leaders are in a unique position to devise a roadmap that shows how technology investments can help their businesses remain successful and drive competitive advantage, despite uncertainties and pressures. Both supply chain technology leaders and supply chain business leaders must evaluate the impacts and benefits of strategic technology trends. Given the increasing rate of technological innovation, this can be difficult.

Each year, Gartner identifies the most relevant, current and impactful technology trends for supply chain executives. This enables the ability to determine which single trends — or strategic combinations — will have the most significant impact on one's organization, and the ecosystem in which it operates.

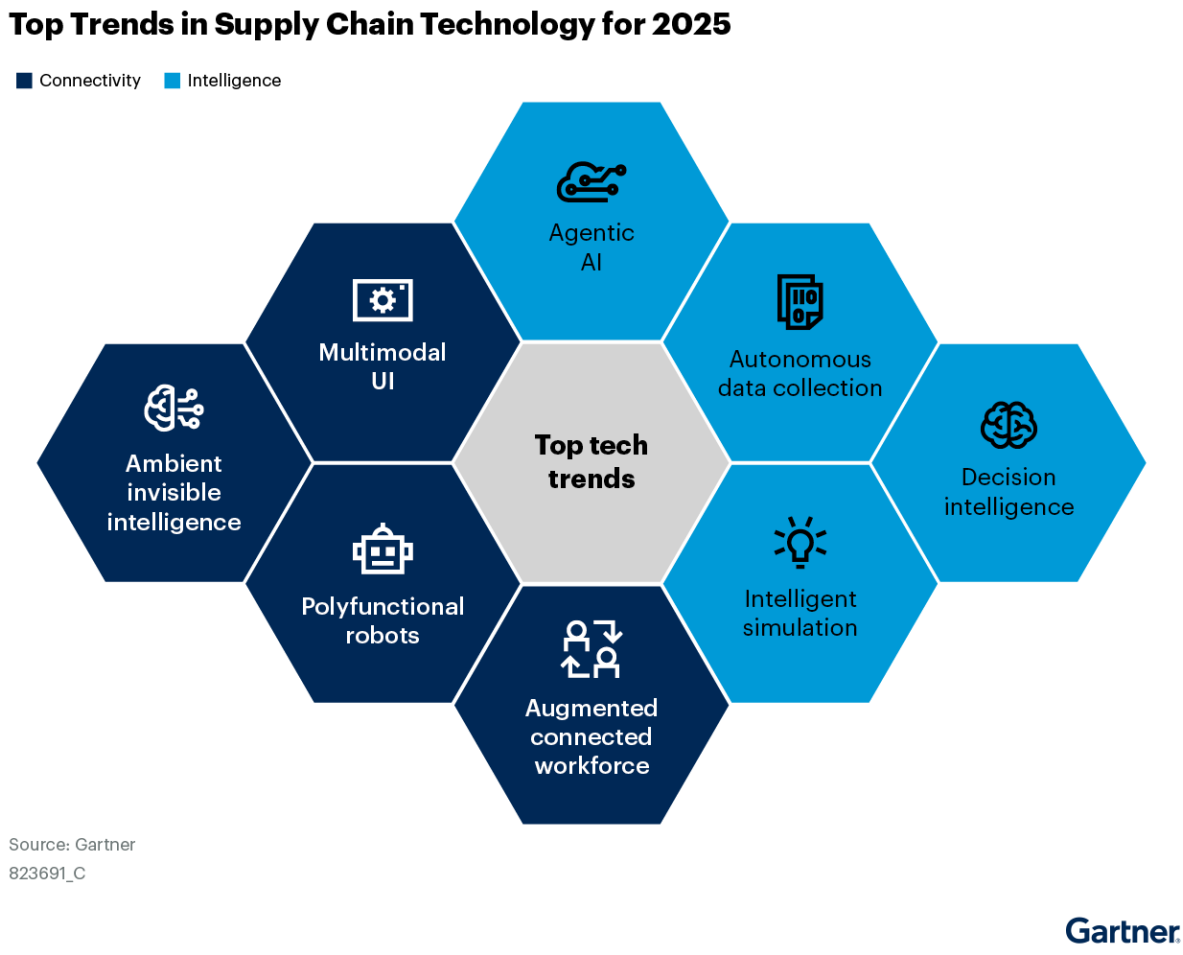
The top trends this year fall under two broad themes:

- Connectivity — Being pivotal across diverse sectors, driving innovation, efficiency, and human and machine interaction. Its significance is underpinned by the ongoing digital transformation and the increasing emphasis on integration and collaboration.

- **Intelligence** — Integrating advanced technologies to optimize processes, become more cost-effective, improve decision making, and create a more agile and adaptive supply chain in rapidly changing business environments.

Our description of the top strategic supply chain technology trends isn't a ranked list in which one trend is more important than the others (see Figure 1). Rather, trends are interconnected, and their importance differs not only by organizational maturity, but also by industry, business needs and previously devised strategic plans.

Figure 1: Top Trends in Supply Chain Technology for 2025



Examine the trends' potential relative to your organization's specific situation, including organizational maturity, industry sector and risk culture. Factor them into your strategic planning for the next few years and adjust your business models and operations accordingly. You can use some trends for a specific goal, while you can deploy others for multiple purposes. Given the connections among the trends themselves, the themes into which they fall overlap.

However, supply chain organizations that regularly evaluate technology trends will be better prepared to incorporate them into their business models and strategies over time, enabling them to seize competitive advantage at the right moment (see Table 1).

Table 1: Trend Profiles (Click the Links to Jump to the Profiles)

Connectivity ↓	*Intelligence* ↓
■ Ambient invisible intelligence ■ Augmented connected workforce ■ Multimodal UI ■ Polyfunctional robots	■ Agentic AI ■ Autonomous data collection ■ Decision intelligence ■ Intelligent simulation
AI- and Data-Driven, Sustainable Supply Chains Cybersecure Supply Chains	

Source: Gartner (February 2025)

Connectivity

Ambient Invisible Intelligence

Analysis by Christian Titze and Nick Jones

Strategic Planning Assumption (SPA): Through 2028, early examples of ambient invisible intelligence will focus on solving immediate problems by enabling low-cost tracking and sensing of items, reducing costs, and/or improving efficiency.

Description:

Ambient invisible intelligence is enabled by ultra-low-cost, small smart tags and sensors, which will deliver large-scale, affordable tracking and sensing. In the long term, this will enable a deeper integration of sensing and intelligence into supply chain operations. Ambient invisible intelligence is driven by three key technologies:

- Low-power wireless

- Energy harvesting (especially from ambient RF energy)
- Low-cost, low-energy electronics.

Why Trending:

The 2025 Gartner Supply Chain Technology User Wants and Needs Survey lists “digitizing, tracking and managing assets at the edge.” It also includes leveraging technology to support environmental, social and governance (ESG) and sustainability in the top 10 funded supply chain technology investments. In addition, due to improving product quality, safety awareness’s rise and the proliferation of governmental regulation in recent years, traceability has become increasingly important.

Smart tags and sensors will help get more real-time visibility into end-to-end supply chains, allowing a quicker response to possible deviations and the ability to avoid disruptions, thus enabling higher quality and more timely decisions. Deployments will provide trustworthy, embedded provenance and identity for product authentication, inventory and asset visibility, or shipment tracking — all at low price points. Furthermore, ambient invisible intelligence will provide a key new data source for analytics and AI to improve products and supply chain processes.

Implications:

- Through 2028, early examples of ambient invisible intelligence will focus on solving immediate supply chain problems by enabling low-cost tracking and sensing of products and assets, reducing costs and/orr improving efficiency.
- Short-term opportunities include automated stock checks in retail shops or warehouses, condition monitoring for perishable goods, real-time shipments tracking, or reusable packaging and transport items leveraging real-time infrastructure (RTI) — cloud-based secured and API-driven resource tracking systems with operational dashboards.
- Long term, we expect ultra-low-cost electronics to remain in items throughout their life cycles. Gateways to receive ambient messages will become standard features in the connected supply chain. New features, such as collaborations between related objects and devices, will evolve.

- However, the challenge of privacy will remain, with regulations affecting some use cases or smart sensing tags. Their infrastructures are likely to introduce new cybersecurity and resiliency challenges — for example, in regulated industries where it isn't acceptable for outsiders to know where things are.

Actions:

- Identify information shadows and early use cases in which ambient intelligence delivers return on investment (ROI) in 2025 to 2028, and pilot the most promising examples. Consider it as a potential replacement for some current or planned radio frequency identification (RFID) use cases.
- Look for new analytics opportunities enabled by real-time information (e.g., related to how objects are used, how and where they're stored, and where assets are located and used). This technology will accelerate the trend to "invisible analytics."
- Analyze the privacy, resiliency and data protection implications of any proposed use of this technology. Ensure that users can unambiguously disable it, if it becomes necessary.

Further Reading:

Top Strategic Technology Trends for 2025: Ambient Invisible Intelligence

When and Why Enterprises Should Implement RFID to Track Critical Assets

Hype Cycle for Emerging Technologies, 2024

Augmented Connected Workforce

Analysis by Simon Jacobson

SPA: Through 2027, half of Fortune 500 manufacturers will create 15% of new positions through new engagement models enabled by augmented connected workforce (ACWF) strategies.

Description:

Connected factory workers leverage digital tools and data management techniques to improve and integrate their interactions with both physical and virtual surroundings. This improves decision accuracy, proliferates knowledge and reduces variability.

Why Trending:

There is a significant skills gap in today's workforce. Manufacturing-centric organizations' needs are rapidly changing. The trend of an augmented connected workforce is driven by six mutually reinforcing themes:

- Technology services, applications and devices have been treated separately, creating silos in the IT organization and friction for the workforce. Additionally, there are ongoing changes to platforms and services, with several solutions delivered to achieve similar ends.
- There has been an acceleration of new digital skills required for work across all job types; however, preparedness lags. Fifty-seven percent of respondents in Gartner's 2023 Smart Manufacturing Implementation Trends survey report that employees struggle to embed digital into day-to-day work. Nearly half report that they are constrained by a lack of skilled workers to support their organization's digitization plans.
- An opportunity has arisen for intelligent apps and digital tools to reduce new hires' time to competency.
- Advances in workplace automation and AI leave the workforce dealing with ever-more-complex issues.
- New workers may be tech-savvy with newer technology, but may lack subject matter expertise and access to best practices and know-how. Tenured workers have detailed process knowledge and might be digitally savvy outside the work environment; however, even as tools evolve, they struggle to fully adopt new technologies and use them to change how work gets done.
- Labor shortages are a top challenge for 60% of supply chain organizations, such as consumer goods manufacturers. Nonetheless, one-third of supply chain organizations lack an effective employee value proposition (EVP) to attract, retain and engage the needed talent through human-centric work design (see Supply Chain Executive Report: Future of Supply Chain 2023).

Implications:

ACWF initiatives can reduce time to competency, and increase multiskilling in operations and productivity. They could also provide career paths in the organization for entry-level personnel to grow without leaving to pursue additional schooling or training. Organizations with increased investment in automation or digitalization saw a significant positive impact in frontline workers progressing to more skilled jobs.

For example, as part of its smart manufacturing initiative, a consumer products manufacturer digitized critical standard operating procedures (SOPs) and work instructions for maintenance and quality across 21 factories. This represented a comprehensive shift from manual and paper-based processes to handheld and mobile devices for frontline workers and enhanced operational efficiency. Incorporating workflow automation and improved access to data and analytics homed in on targeted improvement opportunities.

This strongly emphasized change management, while upskilling more than 9,000 factory associates. As a result of improved efficiencies and data access, some sites have shortened onboarding time for new hires, while others have reported savings of upward of 100 labor hours per month.

Broadly successful ACWF initiatives are more than just technology. Organizations might start with a variety of technologies to enable the frontline workers to execute day-to-day operations better on a targeted basis. This will deliver financial ROI, but risk shortening the long-term value. Organizations that derive longer-term value from these initiatives use the technology enablement to catalyze broader initiatives that are more human-centric and reflect an evolved EVP.

Actions:

- Begin with simplification by taking a phased approach that eliminates offline processes and reduces human error. The measurable returns will stimulate demand for these initiatives and reveal short-term improvement opportunities, creating the path toward workforce transformation.
- Start a conversation with HR, functional and business leaders about simple ways to launch augmented connected workforce initiatives in your organization. Gather a current understanding of skills, roles, gaps in your approach and stakeholder priorities.

- Drive employee engagement and solutions ownership by engaging workers in designing their daily activities and enabling creativity and ingenuity. Start by asking, “How can technology improve a day in your life?”
- Begin building a better digital employee experience by using human-centric design disciplines, such as journey mapping and personas, within IT to identify role- and context-specific needs for augmentation at the work task level.

Further Reading:

- Top Strategic Technology Trends for 2024: Augmented Connected Workforce
- Innovation Insight: Connected Factory Workers Drive Smart Manufacturing
- Use 3 Levels of Value to Manage Connected Factory Worker Initiatives

Multimodal UI

Analysis by Federica Stufano

SPA: By 2028, three out of four companies will consider user experience (UX) the first criterion when selecting a new technology, behind functionality when selecting a new technology, forcing vendors to concentrate on UX that augments technical and functional capabilities.

Description:

A multimodal UI is an interface that enables users to interact with a system through multiple modes of communication simultaneously or interchangeably. These modes can include a combination of voice, touch, gesture, text, vision and other sensory inputs. The goal of a multimodal UI is to create a more natural, intuitive and efficient interaction experience by leveraging the strengths of different input methods and accommodating user preferences and contexts.

Why Trending:

Insights from the 2025 Gartner Supply Chain Technology User Wants and Needs Survey indicate that, beyond functionality and meeting financial objectives, usability is the among the two top criteria influencing supply chain organizations' selection of new and emerging technologies. Multimodal UI tends to be the default interface for premium segments of supply chain software and hardware. Innovations in eye tracking, gesture, voice recognition and biosensing technologies — and their adoption into supply chain solutions — are accelerating the multimodal UI adoption.

Implications:

- The use of multimodal UI has garnered interest, and deployments indicate improvements in worker efficiency and motivating, versus the existing methods.
- Multimodal UI training can be provided for onboarding new workers in a more dynamic and attractive environment (e.g., for manufacturing, maintenance, warehouse operations or services). Engaging step-by-step instructions can also be given to workers through a pleasing UX.
- In logistics, there is the potential for solutions targeted at productivity, safety and ergonomics, such as a virtual AI assistant for truck and van drivers or multimodal voice, using scanning, text, transactional and conversational voice.

Actions:

- Prioritize the value of multimodal UI to provide safer, more secure and more pleasant working, training, onboarding and processing environments.
- Start by identifying specific use cases (e.g., field service, logistics, warehousing, manufacturing, maintenance or design) that can benefit from multimodal UI technologies.
- Deploy connecting and improving digital initiatives that drive user confidence, satisfaction, loyalty and advocacy.

Further Reading:

Predicts 2025: Cross-Functional Supply Chain Technology

Emerging Tech: Multimodal Generative AI Interfaces Transform User Experiences

Polyfunctional Robots

Analysis by Dwight Klappich

SPA: By 2030, 80% of humans will engage with smart robots on a daily basis, which is a significant increase from less than 10% today.

Description:

Polyfunctional robots are machines capable of taking on multiple tasks and following human instructions or examples without explicit programming or hardware modification.

Why Trending:

Although the allure and desire for multipurpose robots is not new, several barriers have kept them from viability; however, these obstacles are coming down. Some of the barriers and trends are:

- Hard coding versus adaptive intelligence. Traditional robots were costly and inflexible, and unable to adapt to new tasks. Advances in vision AI, AI/machine learning (ML) and new physical designs now enable greater adaptability in robotics.
- Multitask assignment, communication and integration. Traditional robots faced integration challenges that limited their task flexibility in workflows. Generative AI (GenAI) and ML now support new interaction models and bidirectional communication, enabling robots to adapt and respond to verbal commands from humans.
- Price and total cost of ownership (TCO). Polyfunctional robots are now competitively priced with human labor, due to significant cost reductions. Their growing flexibility and adaptability, combined with lower prices, make them viable alternatives to traditional labor.

Implications:

- Industrial robots are typically hard-coded for single tasks, requiring significant intervention for changes. This leads to companies maintaining large, heterogeneous fleets of robots, each designed for specific tasks, unlike humans who can be trained for multiple roles.

- Polyfunctional robots will even serve as a flexible workforce, autonomously adapting to various tasks. due to novel form factors and intelligent software. They can perform multiple roles throughout the day and will eventually self-learn new tasks beyond their initial programming.
- Polyfunctional robots must safely operate in human environments, navigating spaces not designed for traditional robots. This necessitates novel form factors and a focus on fail-safe operational safety to adapt to diverse environments, including those with humans.

Actions:

- Although the potential for polyfunctional robots is alluring, supply chain operations with high-volume, predictable and consistent processes should not delay investment in robots while waiting for this technology to mature.
- Companies need to begin mapping their functional processes to determine which, if any, of these processes can be addressed with the current generations of robots and which will benefit most from polyfunctional centered design.
- Identify processes that need high degrees of flexibility and adaptability and focus on learning how your human workforce performs these tasks to understand the capabilities a polyfunctional robot will need to support.
- Because fully capable polyfunctional robots are not yet available, companies must develop a structured methodology for conducting effective proofs of concept (POCs) when these capabilities evolve during the next several years.

Further Reading:

Hype Cycle for Supply Chain Execution Technologies, 2024

Hype Cycle for Mobile Robots and Drones, 2024

Top Trends in Supply Chain Technology for 2024

Intelligence

Agentic AI

Analysis by Leonard Ammerer and Tom Coshow

SPA: By 2030, 50% of cross-functional supply chain management (SCM) solutions will use intelligent agents to autonomously execute decisions in the ecosystem.

Description:

Agentic AI systems offer the promise of a virtual workforce of AI agents that can assist, offload and augment human work or traditional applications. Agentic AI systems promise to deliver more adaptable software, capable of completing a wide variety of tasks not explicitly programmed in a domain, rather than only those designed into the software (see AI and Generative AI Case Study Snapshots). These systems can plan, act and adapt based on their context to meet goals in complex environments, dramatically increasing AI's potential to execute against operational environments. This is based on recommended actions created in supply chain planning (SCP) or other SCM environments.

Why Trending:

Cross-functional SCM solutions designed to close the technology gap between planning and execution have thus far been disappointing (see Supply Chain Brief: Framework for Evolving Command Center Decision-Making Technologies). Traditional technologies implemented for this purpose, such as integration technologies and workflow engines, often mirror the complexity of the supply chain environment and work against maintaining the flexibility of the supply chain technology stack.

Agentic AI can address some of the unrealistic expectations of AI by being capable of closing the decision-to-execution gap. It can be empowered to take decisive actions, enabling it to solve problems that require action, rather than mere content generation. This advancement will increase the number of supply chain tasks and workflows that can be automated.

Implications:

- AI agents represent a different level of sophistication and functionality compared with robotic process automation (RPA), for example. An AI agent is a more advanced system that not only automates tasks, but also has a degree of "agency." This means it can operate autonomously, make decisions based on the data it processes and eventually learn from its experiences.

- With their diverse capabilities and adaptability, AI agents are poised to revolutionize a multitude of workflows in supply chain decision making. Their ability to learn, predict and autonomously make decisions will drive efficiency, innovation and transformation across domains, affecting the way we work and operate.
- By dealing with different adoption rates per function, reaping the benefits of AI agents responsibly and effectively will also require guardrails, including regulations, policies, traceability and governance, that guarantee explainability and proper risk management.

Actions:

- Identify opportunities to add agentic AI to workflows in which there is significant demand for scale and efficiency and for which adaptability is required. Rethink entire workflows across silos from an automation-only perspective and add humans back into new workflows at strategic points. Start small on use cases in which high-quality data is accessible, behavior is verifiable, and ROI is high or significant enough to justify the investment.
- Treat AI agents like Tier 1 digital co-workers to whom you delegate work. Rethink collaboration models, workflows and team strategies to maximize the benefit of AI agents that can uncover and act on derivative events that human teammates might not notice.
- Put guardrails in place to ensure that agentic AI is constrained to a defined role and set of capabilities. Do so to prevent it from taking incorrect actions that could cause damage.

Further Reading:

Innovation Insight: AI Agents

Build AI Agent Services to Revolutionize Client Operations

Augment D&A Workflows With Agentic Analytics

Autonomous Data Collection

Analysis by Simon Tunstall and Dwight Klappich

SPA: By 2027, 50% of warehouse operations will replace some human-centric data collection with autonomous data collection platforms.

Description: Autonomous data collection takes advantage of such technologies as indoor-flying drones and mobile robots to autonomously capture data. These solutions use technologies such as AI-enabled vision or radio frequency identification (RFID) to support such use cases as inventory management, inspection and surveillance. Solutions typically include a mobile platform, such as a flying drone or a mobile robot; onboard cameras or other sensors; and advanced AI-based software for navigation. Newer solutions are moving away from drones and using autonomous mobile platforms on which sensor arrays are mounted, offering longer battery life and more robust cameras and sensors, because there are few weight restrictions.

Why Trending: Supply chain operations, notably logistics and manufacturing, generate large amounts of data that must be captured and processed. Most companies have moved away from manually recording data on paper and now capture most data using some form of technology, such as mobile devices or scanners. However, although better than paper and pencil, these technologies still require humans in the loop and are often time-consuming and low-value-add functions.

Implications:

- Autonomous data collection platforms use technologies such as cameras, RFID readers and drones to capture data continuously, which enhances productivity and reduces labor. Advanced AI/ML enables intelligent interpretation of digital images, offering significant business benefits by lowering costs and improving process efficiency.
- Cycle counting in inventory management is time-consuming and poses safety risks, making it a prime area for automation. Mobile robots with mounted cameras are emerging as effective solutions, potentially accelerating adoption over flying drones.
- Inspection or surveillance using drones or other technologies could replace manual and often dangerous inspection or surveillance processes in warehouses and plants. Indoor drones are particularly valuable for inspections in dangerous areas or elevated heights. Unlike inventory management, these would be nonoperational and would be used periodically, as needed. However, these drone use cases could potentially integrate with other warehouse audit and inspection tools and mobile apps to facilitate inspection operations.

- Although mobile data collection platforms receive a lot of attention, there are also many strong examples of stationary data collection solutions. These range from ceiling-mounted cameras capturing safety events, to towers beside dock doors that can autonomously verify products as they're loaded onto a truck, to cameras monitoring the movement and condition of vehicles in a yard.

Actions:

- Pilot flying drones for inventory management and cycle counting, if your goods are palletized and, especially, if they are shrink-wrapped. Test in one site, and roll out rapidly to others if the business case has been proved.
- Approach drone use for inspections just as you might other inspection use cases by using the drones to supplement the skilled workforce already doing inspection in other ways.
- Focus on autonomous mobile robots for use cases in which battery life and other considerations are more important, for the foreseeable future.

Further Reading:

Hype Cycle for Supply Chain Execution Technologies, 2024

Predicts 2025: Supply Chain Operational Technology

Cool Vendors in Logistics and Robotics Technology

Critical Capabilities for Warehouse Management Systems

Technology Trends Transforming Warehousing — Part 2: Handling Volatility & Complexity

Decision Intelligence

Analysis by Christian Titze and David Pidsley

SPA: By 2028, 25% of chief data and analytics officer vision statements will become "decision-centric," surpassing "data-driven" slogans, with human decision-making behaviors explicitly addressed to improve data and analytics (D&A) value.

Description:

DI is a practical discipline that advances decision making by explicitly understanding and engineering how decisions are made, as well as how outcomes are evaluated, managed and improved via feedback. DI combines decision modeling, AI, analytics and related capabilities to support, augment and automate decision making and drive business outcomes. It is used to design decision-centric solutions, explicitly model decisions, orchestrate decision execution flows, evaluate and govern decisions, and audit their outcomes.

Why Trending:

One of the two motivating factors to invest in supply chain technology for organizations this year (see 2025 Gartner Supply Chain Technology User Wants and Needs Survey) is the decision-making process becoming faster, more intelligent and higher in quality. Along with that, the current hype around automated decision making and augmented intelligence, fueled by a variety of AI techniques in decision making, including GenAI, is furthering interest in DI.

Recent crises have obviously revealed the brittleness of business processes. Re-engineering decisions to be more resilient, adaptable and flexible will require the discipline of methods and techniques. The fast-emerging DI platform market powered by AI-accelerated platforms is starting to provide resilient solutions for supply chain decision makers.

Implications:

- DI could enable better, more timely and optimized decision making by making the models of decisions explicit and transparent to the supply chain user. It reduces the unpredictability of decision outcomes by modeling the business context.
- DI reduces technical debt and increases visibility. It improves the impact of supply chain processes by materially enhancing the consistency of decision models, based on the power of their relevance and the quality of their transparency, making decisions transparent and auditable.
- Challenges remain, especially from an organizational standpoint. The inability to impartially reconsider critical decisions within and across departments diminishes the effectiveness of initial DI adoption efforts. An inadequate organizational structure regarding advanced techniques, such as the lack of an AI center of excellence (COE), could also impair DI progress.

- Many organizations still lack an understanding of decision modeling and AI techniques. Poor AI literacy could slow down the development of DI projects when AI is involved. In addition, in organizations that have focused almost exclusively on technical skills, the other critical parts of human decision making — the psychological, behavioral, social, economic and organizational factors — have gone unaddressed.

Actions:

- Develop DI skills and staff expertise in traditional and emerging decision augmentation and decision automation techniques, including applying predictive and prescriptive (i.e., optimization, simulation and business rule-based logic) analytics. Upskill business analysts to decision analysts, and develop new roles, such as decision engineer, decision scientist and decision steward.
- Tailor the composition of decision-making techniques to the specific requirements of each decision situation by including diverse stakeholders from IT and the business to foster collaboration on requirements for the use cases of different decision contexts in supply chain.
- Optimize DI solution effectiveness and implementation efficiency, and maximize business value by carefully choosing a buy, build or partner model for DI platforms that enable a range of styles from decision support augmentation to automation.
- Accelerate the development of a DI capability by encouraging experimentation with GenAI and expediting the deployment of composite AI solutions that bring rule-based logic guardrails.

Further Reading:

Hype Cycle for Analytics and Business Intelligence, 2024

Market Guide for Decision Intelligence Platforms

Supply Chain Brief: Framework for Evolving Command Center Decision-Making Technologies

Human-AI Delegation Framework for Decision Augmentation

Intelligent Simulation

Analysis by Simon Tunstall

SPA: By 2028, 15% of logistics and manufacturing organizations will embed intelligent simulation in their applications to help manage complexity in their operations.

Description:

Intelligent simulation refers to the integration of advanced technologies such as AI, ML and advanced analytics into traditional simulation models to enhance their accuracy, efficiency and predictive capabilities. This approach supports more sophisticated, dynamic and adaptive simulations that can better mimic real-world scenarios and provide deeper insights for decision making.

Why Trending:

More than half of participants in the 2025 Gartner Supply Chain Technology User Wants and Needs Survey stated that advanced analytics/simulation/ML are highly disruptive technologies, with 28% stating that they have at least one of these technologies live in production. Intelligent simulation is a confluence of these technologies.

Supply chain operations, notably logistics, manufacturing and transportation, deal with a large number of variables that can significantly affect their performance, operational costs and capital expenditures (capex). Intelligent simulation can optimize more traditional simulation and analysis, which is used to plan routes; select, test and deploy the right-fit material-handling equipment; and plan and reprioritize intralogistics workflows.

Implications:

- Intelligent simulation can aid the shift from reactive to proactive resource deployments, enabling operations to handle greater volume and volatility.
- Simulation and emulation solutions are already commonly used in warehouse control systems to enable planning and stress-testing of automated material-handling equipment prior to deployment and to enable monitoring and control of the equipment once deployed. Enhanced use of intelligent simulation may help optimize this use case.

- Some transportation providers are beginning to deploy simulation capabilities in areas previously neglected, such as multicarrier parcel management. These support routing and consolidation instructions across orders and fulfillment operations. They also support carrier/delivery decision making, based on probabilities, rather than conventional, deterministic feature sets.
- Robotics providers, especially for warehouse picking/manipulation robots, are using synthetic data to train their systems in object recognition. This is an early example of its use in this environment. Synthetic data can be an input to, as well as an output from simulation. This can speed up the training and adoption of robotics systems.
- Intelligent simulation aids the evolution of warehouse digital twins, progressing from 2D/3D visualization to algorithmic process simulation and virtual operation of resources.

Actions:

- Catalog the current use of simulation across operations, which applications are being used and for what scenarios. Identify where these use cases fall short and gauge the readiness to employ intelligent simulation to supplement these activities.
- Challenge vendors on their use of or roadmap for embedding or expanding intelligent simulation in their applications, measurable business outcomes or financial projections.
- Assess the current and near-term expected complexity of your operations to determine whether intelligent simulation may be required and when. Examine whether more traditional analysis and simulation may fit your current needs.
- For a more targeted approach, investigate specialist technologies, such as warehouse simulation and modeling, as well as warehouse resource planning and optimization.

Further Reading:

Emerging Tech Impact Radar: Intelligent Simulation

Hype Cycle for Supply Chain Execution

Hype Cycle for Advanced Technologies for Manufacturing, 2024

Critical Capabilities for Transportation Management Systems

Critical Capabilities for Warehouse Management Systems

Technology Trends Transforming Warehousing Part 2: Handling Volatility & Complexity

Notable Mentions

Cybersecure Supply Chains

Analysis by Mark Atwood

Cyberattacks continue to present an ongoing, ever-evolving threat to businesses across all sectors. The supply chain, with its multiple functional hand-offs in the organization, as well as its vast partner ecosystem, represents a large and attractive target to bad actors. The greater the digitalization of the supply chain, the more the cyberthreat increases. Our research continues to identify cyber attack as a top challenge faced by heads of supply chains. In our 2024 “Geopolitical Risks Impacting the Supply Chain” survey, 59% of respondents said that a cyber attack had had a moderate, high or very high impact on their supply chain performance during the past 12 months.

The scope of cybersecurity risk to the supply chain is significant, given the breadth of supply chain IT and cyber-physical system deployment that is in need of protection in the enterprise. The breadth and multitiered nature of the partner ecosystem greatly adds to this complexity. Within many organizations, there is a lack of clarity associated with ownership and budget for identification and management of supply chain cybersecurity risks. The pace of threat expansion makes it harder for cybersecurity and supply chain teams to keep up with the protection of systems, products and third-party relationships.

In creating cybersecure supply chains, organizations are:

- Collaborating with chief information security officers (CISOs) to include the supply chain within overall corporate cybersecurity governance. This includes establishing key points of contact with the CISO and enterprise risk teams and developing a liaison role in the supply chain to become the main point of contact.
- Building cyber risk into their overall supply chain risk management framework, since many approaches, such as business continuity management (BCM), heatmapping, segmentation, visibility and scorecarding — can also be used to help manage cyber risk.

- Demanding third party cyber-risk validations through assessments and audits and tools, and applying this to the end-to-end supply chain, including upstream suppliers, contract manufacturing partners and logistics partners. Such activities should be done before, during and after the completion/renewal of contracts. They should heavily depend on the business impact and cybersecurity criticality.
- Becoming a part of the team protecting cyber-physical assets, especially with respect to operational technology (OT), the Internet of Things (IoT) and other automation in manufacturing and logistics.
- Building cybersecurity talent in the supply chain — in many cases, looking outside manufacturing industries in such areas as financial services and the public sector.

AI and Data-Driven Sustainable Supply Chains

Analysis by Kevin Lawrence and Martha Munoz

Supply chains do not have the information, skills and capabilities needed to respond to increasingly complex and demanding sustainability regulations. Data fidelity, availability and quality are pain points that can cause an over-reliance on assumption-based calculations. However, they do not always meet regulatory demands — e.g., the European Union Carbon Border Adjustment Mechanism (EU CBAM) requires actual data from 2025. Accuracy demands increase, with regulatory expectations for assurance and financial implications tied to measurements.

Leading organizations are getting ahead by implementing data-driven sustainability strategies that enable them to monitor and embed sustainability into their decision-making and operational processes. Regulations are accelerating sustainability data maturity, while AI is being deployed to improve data management and calculation activities.

Mandatory disclosures are becoming increasingly granular and growing significantly in scope: the EU Corporate Sustainability Reporting Directive (EU CSRD) has more than 1,000 parameters (qualitative and quantitative). Mandates such as EU CBAM will require actual values for carbon emissions at product level from 2025. Due diligence regulations, such as the U.S. Uyghur Forced Labor Prevention Act (UFLPA), demand transparency on suppliers' practices regarding forced labor.

Many companies are not ready for this level of granularity. Data traceability and audits are a requirement across many of these regulations, and selected methodologies apply to the way in which certain indicators need to be calculated and reported for specific regulations. All of these factors are driving companies' willingness to invest in solutions to achieve more accurate measurements for sustainability parameters.

To meet the growing demand for fidelity and efficiency, SaaS solution providers are starting to apply AI and improved data management capabilities. Examples include:

- Using AI to automatically identify and assign emission factors to operational activities to calculate a product carbon footprint
- Producing data confidence ratings in-app to easily monitor hot spots
- Accessing various public and paid-for databases to calculate inherent risk levels for supply chain partners, as part of due diligence assessments
- Migrating from spend-based calculations toward activity and primary data to drastically improve accuracy for carbon emission calculations informing strategic targets

Contributors

Nick Jones, David Pidsley, Tom Coshow

Evidence

2025 Gartner Supply Chain Technology User Wants and Needs Survey. This survey was designed to investigate the roles of digital and technology in supply chains. It also looked to assist supply chain technology leaders in their efforts to modernize legacy application landscapes and create credible business cases for their digital transformations. In addition, it examined how supply chain organizations are structuring themselves to support digital initiatives and their evolving perspectives on effectively leveraging emerging technologies in their supply chain organizations. The survey was conducted online from 16 October through 6 December 2024 among 506 respondents from North America (n = 153), Western Europe (n = 162), the Asia/Pacific (APAC) region (n = 111) and Latin America (n = 80).

Respondents were from organizations with $250 million or more in 2023 enterprisewide annual revenue. Industries surveyed included manufacturing (e.g., consumer products, industrial, high-tech, life sciences and healthcare); retail, transportation and logistics; and wholesale trade. Qualifying respondents had job roles tied to supply chain functions and were involved in decision making regarding SCM processes or operations.

Disclaimer: The results of this survey do not represent global findings or the market as a whole; rather, they reflect the sentiments of the respondents and companies surveyed.

2022 Gartner Future of Supply Chain Survey. This research draws on analysis of our 2022 Future of Supply Chain Survey fielded from August 2022 through October 2022, which surveyed 676 supply chain leaders at Gartner client organizations across 13 major industries and four regions. Respondents were asked to rate their supply chain's progress on current capabilities and expectations and plans for future capabilities. Capabilities and expected challenges to meeting these were measured across four sections (commercial innovation, authentic achievement of sustainability, human-centric work design and real-time decision execution), as well as the understood timelines for the organizations to make these shifts.

High- and low-performing organizations were segmented based on the question: How would you characterize the overall performance of your supply chain organization in supporting corporate goals and objectives during the past 12 months? The question measured respondents' perceptions of their organizations' overall performance across eight categories. These are customer lead time, customer satisfaction, employee engagement and satisfaction, ESG goals, on-time, in-full (OTIF) performance, overall revenue and growth, return on capital investment, and time to market for new products and services. Performance for each of these categories was self-rated on a five-point scale from "Significantly below expectations" to "Significantly above expectations," with "Meeting expectations" as the midpoint for the scale.

The data followed an approximately normal distribution (i.e., it was not skewed toward self-rated high performance or low performance), and an analysis of internal consistency found that the eight categories strongly represented one construct. Therefore, the average score across the eight items (removing items when respondents answered, "Don't Know/Not Applicable") was used as a proxy for overall organizational performance.

2023 Gartner Smart Manufacturing Strategy and Implementation Trends Survey. This survey looked to investigate the state of smart manufacturing strategies, the benefits and challenges experienced, and assess deployment initiatives that would help develop and ratify roadmaps. The survey was conducted online from 24 August through 4 October 2023. In total, 459 respondents were surveyed in their native language across North America (n = 231; the U.S. and Canada) and Western Europe (n = 228; the U.K., France, Germany and Sweden).

Qualifying organizations operate in the manufacturing industries and reported enterprisewide annual revenue for FY22 of at least $500 million (at least $1 billion in the U.S.) or the equivalent. The qualified respondents had a role tied to a supply chain function and were in director or above roles. All respondents were involved in their company's decisions regarding manufacturing operations and/or overall manufacturing strategy.

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2024 Gartner Geopolitical Risks Impacting the Supply Chain Survey. This survey was conducted to explore the complex geopolitical risks that supply chains are facing and the strategic decisions supply chain leaders have made to address the impact of these risks. This research was fielded online from 14 December 2023 through 18 January 2024. In total, 258 respondents were surveyed across North America (n = 130), EMEA (n = 107), Latin America (n = 3) and the APAC region (n = 18). Of the respondents, 161 were from organizations with more than 10,000 employees.

Respondents were asked about the extent to which certain geopolitical risks have affected their supply chain, the extent to which various supply chain processes contribute to overall supply chain performance and their current/future plans to transform the supply chain. They also responded to questions on supply chain performance, as well as the potential costs and criteria involved in various strategies to address geopolitical risks.

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2023 Gartner Future of Supply Chain Survey. This survey sought to understand how the supply chain is adapting to changes in economic values, fostering sustainable growth, harnessing digital assets' potential to enhance productivity, and revitalizing the workforce and network of people. Gartner surveyed clients online, along with community members and a wider group of supply chain practitioners globally, and received 818 complete responses from 29 August through 25 October 2023.

Respondents were spread across multiple industries. These included healthcare and life sciences (n = 155), industrial manufacturing (n = 154), consumer goods manufacturing (n = 139), technology and telecom (n = 125), food and beverage manufacturing (n = 105), retail (n = 48), other manufacturing (n = 30), energy and utilities (n = 27), transportation (n = 10), government (n = 9), services (n = 9), education (n = 6) and miscellaneous (n = 1). There were 542 organizations with headquarters located in the U.S., whereas 276 organizations had their headquarters located elsewhere.

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Document Revision History

Top Trends in Supply Chain Technology for 2024 - 10 January 2024

Top Trends in Strategic Supply Chain Technology 2023 - 9 March 2023

The 2022 Strategic Supply Chain Technology Themes - 25 March 2022

The 2021 Supply Chain Technology Themes - 27 May 2021

The 2020 Strategic Supply Chain Technology Trends - 8 May 2020

The 2019 Top Supply Chain Technology Trends You Can't Ignore - 11 March 2019

The 2018 Top 8 Supply Chain Technology Trends You Can't Ignore - 9 January 2018

Table 1: Trend Profiles (Click the Links to Jump to the Profiles)

Connectivity ↓	*Intelligence* ↓
■ Ambient invisible intelligence	■ Agentic AI
■ Augmented connected workforce	■ Autonomous data collection
■ Multimodal UI	■ Decision intelligence
■ Polyfunctional robots	■ Intelligent simulation
AI- and Data-Driven, Sustainable Supply Chains Cybersecure Supply Chains	

Source: Gartner (February 2025)