

# Global Trends in Hi-Tech Supply Chains

Electronics | Components | Materials | Logistics

2026

 White paper



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# Global Hi-Tech Supply Chain Outlook

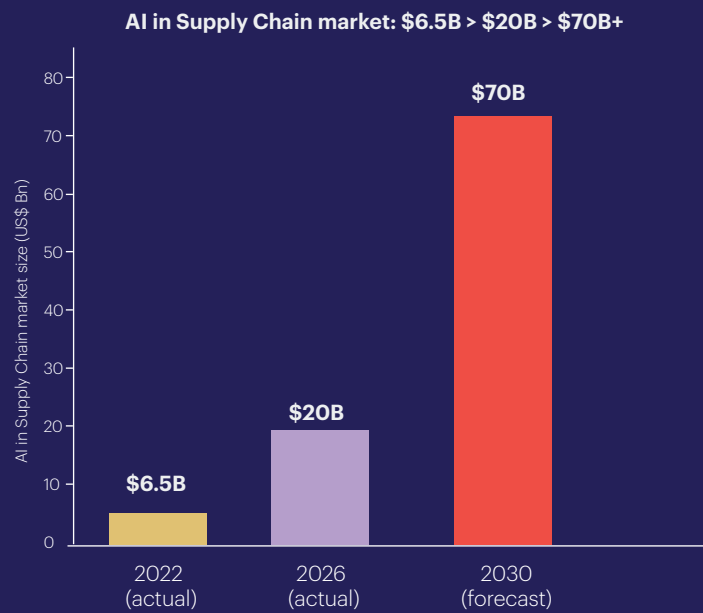
Two forces now define every supply-chain conversation in the hi-tech sector: AI is transforming both demand and operations, and the policy environment around tariffs, export controls, and critical minerals has become a permanent structural cost rather than an episodic shock.

01

AI in supply chain is moving from pilot to prerequisite.

The global AI-in-supply-chain market has grown from \$6.5 billion in 2022 to nearly \$20 billion in 2026, with Grand View Research projecting it will exceed \$70 billion by 2030. Gartner separately forecasts that spend on supply chain management software with agentic AI will reach \$53 billion by 2030. 72% of supply chain organizations have deployed generative AI, though only 23% have a formal AI strategy.

Sources: Grand View Research (cited in Supply Chain Management Review, April 2026). Gartner separately forecasts SCM software with agentic AI at \$53B by 2030.

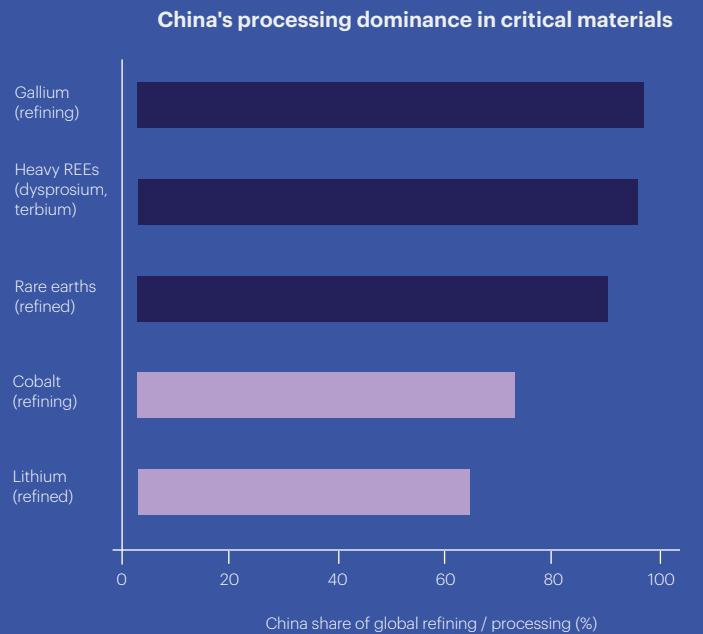


02

Critical materials are becoming the new sovereign asset

China is responsible for about 91% of global rare-earth refining (IEA, October 2025), between 98% and 99% of heavy rare-earth element processing for dysprosium and terbium, and nearly 99% of gallium refining. In April 2025, export controls expanded to require licensing for heavy rare-earth exports, including enforcement of re-exports by third countries.

Sources: IEA October 2025 (rare earths refining 91%); Global Policy Watch February 2026 (heavy REEs 98-99%); Z2Data January 2026 (gallium -99%); IEA critical minerals analysis..



## Hi-Tech Supply Chain Sector Overview

Eight key structural forces are simultaneously transforming high-tech supply chains, explaining why all major OEMs, EMS partners, distributors, and hyperscalers are redesigning their sourcing, planning, and risk management strategies simultaneously.

Tariffs have become a permanent structural expense. Section 301 tariffs on Chinese semiconductors increased from 25% to 50% through late 2024 and 2025. According to McKinsey, 82% of companies have felt the impact of tariffs and have taken action or put countermeasures in place. Current tariff rates are around 20-32% on China, 18% on India, and 25% on nations conducting business with Iran.

The idea of friend-shoring and the China+1 trend is emerging. By 2025, Vietnam is expected to surpass China as the leading supplier of laptops and gaming consoles to the United States. However, Bloomberg analysis shows that core production will remain in China, while less-skilled assembly will move to Vietnam. According to Capgemini, 73% of companies anticipate an increase in sourcing from friend-shoring, rising from the current 37% to 41% over the next three years.

The need for critical minerals has become increasingly pressing. China processes around 91% of rare earth elements, 98% — 99% of heavy rare earth elements such as dysprosium and terbium, and nearly 99% of gallium. In April 2025, export controls were expanded to include lutetium, yttrium, dysprosium, terbium, and advanced magnets, with extraterritorial enforcement concerning re-exports from third-party countries.

The shortage of memory and components is impacting the economics of devices. Counterpoint has reported that memory prices skyrocketed by approximately 50% in the fourth quarter of 2025; data centers are anticipated to account for around 70% of all memory chips produced in 2026. IDC has warned that the PC market could shrink by as much as 9% in 2026 due to memory pricing, while the automotive sector is gearing up for tighter supplies of memory chips as manufacturers shift wafers to more profitable HBM.

Agentic AI is moving from trial programs to full production. Gartner forecasts that by 2026, 40% of enterprise applications will incorporate task-specific AI agents, a rise from less than 5% in 2025. It is anticipated that spending on supply chain management software featuring agentic AI will reach \$53 billion by 2030. However, Gartner also warns that 60% of digital supply chain adoption initiatives may fail to deliver the expected value by 2028 due to insufficient investment in change management.

Digital twins are evolving into hybrid AI twins. Gartner estimates that by 2026, 65% of supply chains will implement hybrid twin systems, combining conventional digital twins with AI-driven adaptive layers closely integrated with ERP and IoT. Leading implementations have reported a 14% reduction in costs for rerouted shipments and a decrease in stockout risks in West Coast port operations.

The new standard is multi-tier supplier visibility. According to Cleo (2025), more than two-thirds of companies will have diversified their supply chain partners by the end of 2025, with 57% of those partners based domestically. The visibility of two-tier supply chains has fallen back to 2022 levels, largely due to a slowdown in digitalization investments, creating a paradox in which diversification accelerates while visibility declines.

Sustainability disclosure has become a procurement criterion. Scope 3 emissions disclosures — covering supply chains and end use — are becoming material to customer procurement and capital-market access. Hyperscalers are increasingly requesting supply-chain emissions data as part of vendor selection, and EU CBAM and similar regimes are materially expanding the disclosure perimeter.

Sources: McKinsey & Company Supply Chain Pulse 2025; Bloomberg shipment-level customs data analysis March 2026; Capgemini Supply Chain 2025; Cleo Supply Chain Report 2025; IEA October 2025; Counterpoint Memory Pricing January 2026; Gartner press releases April–May 2026.



## Strategic Lens: From Resilience to Total Value

The eight structural forces above describe what is happening in 2026. The strategic question for hi-tech CXOs is how the supply chain operating model must evolve to capture value through them. KPMG's 2026 supply chain outlook frames this evolution around three shifts that complement the structural trends: a move from resilience to Total Value, the migration of supply chain into Global Business Services, and a new generation of metrics that reflect the supply chain's strategic role.

**From resilience to Total Value.** KPMG argues that leading supply chain operations in 2026 will move beyond a focus on resilience toward delivering Total Value -uniting Total Experience (customer-centric, data-driven, technology-enabled, employee-empowered) with Total Performance (financial, operational, people, innovation, sustainability). The objective shifts from navigating disruption to enterprise-wide value maximization.

**Supply chain joins Global Business Services.** KPMG identifies supply chain as the next function to migrate into Global Business Services, following finance, HR, and IT. The case is the volume of repeatable, transactional, scalable activity -and the benefit is centralized analytics, automation, and AI, plus elevated global end-to-end visibility, integrated logistics control towers, and dedicated planning capability.

**Connected Intelligence is the AI end-state.** KPMG describes the most mature destination as Connected Intelligence -enterprise-wide AI linking supply chain with procurement, finance, ESG, HR, and CRM into an intelligent, autonomous ecosystem. The path runs through AI embedded in Source-to-Pay, planning, and risk platforms, rather than standalone pilots.

**New metrics for a strategic asset.** KPMG identifies eight measurement areas that expand boardroom KPIs beyond cost-per-unit, DIFOT, and inventory turn: visibility and real-time data; resilience and Total Value; AI and automation decision accuracy; digital twin utilization; human-machine collaboration; cybersecurity and risk management; ESG; and multimodal supply chain orchestration. These reflect the supply chain's evolution into a strategic asset that underpins competitiveness, resilience, and sustainability.

Sources: KPMG. Key trends impacting supply chains in 2026 -Total Value, Global Business Services, Connected Intelligence, and the new metrics framework.

## Key Market Movers and Shakers

Across OEMs, EMS partners, distributors, software platforms, and equipment suppliers -these are the organizations defining the 2026 hi-tech supply chain.

### OEMs reshaping sourcing footprints

**Apple** -Since 2023, Apple has poured over \$1 billion into manufacturing facilities in India and plans to shift about 15% – 20% of its production to India and Vietnam by 2026 to reduce its exposure to US-China tariffs. This transition encountered delays in Vietnam, resulting in a roughly a 10% increase in lead times for certain products in late 2024.

**HP** Following the impact of tariffs on Chinese electronics, HP has increased sourcing from Taiwan and Thailand, achieving an 8% cost reduction. This diversification has required implementing more robust supplier management systems to handle the growing complexity.

**Foxconn** -Operating high-demand Vietnamese facilities, including in Bac Ninh province, where labor demand is so high that first-time factory workers are bused in from remote villages to fill 1000 advertised jobs since the Lunar New Year 2026.

### AI and SCM software platforms

**Oracle Supply Chain Planning** -Positioned as a leader in both 2026 Gartner Magic Quadrant reports for SCP Solutions (discrete and process industries). Reports double-digit forecast-accuracy gains and inventory-turn improvements for adopters, with S&OP cycles compressing from weeks to days.

**ChainSynth and AI logistics-twin platforms** -Industry reports indicate 20% – 40% faster response times to disruptions and double-digit reductions in inventory holding costs for organizations that move from forecasting to network orchestration.

**General Mills (as platform reference)** -Building a dynamic digital twin to automate 50 million decisions per year — significantly reducing product waste and lowering transportation costs.

## Critical-minerals investors and refiners

### **MP Materials, Lithium Americas, Trilogy Metals, USA Rare Earth, Vulcan Elements, ReElement Technologies, Korea Zinc:**

Recipients of US federal equity investments under the Trump administration's critical-minerals strategy; at least \$1 billion in total equity stakes announced as part of a broader strategy that also includes a \$12 billion strategic stockpile plan.

**EU 60 Strategic Projects:** The European Commission has selected 60 strategic projects targeting lithium, graphite, cobalt, nickel, and rare earths — 47 within the EU and 13 externally in partner countries, including Canada, Kazakhstan, Ukraine, and Zambia.

**US-Australia Critical Minerals Framework:** Committed \$1 billion to joint minerals production projects in 2025; further partnerships with Saudi Arabia, Cambodia, Malaysia, and Thailand have followed.

Sources: Supply Chain Management Review April 2026; Bloomberg March 2026; Oracle Magic Quadrant press release April 2026; Chemical & Engineering News February 2026; Council on Foreign Relations February 2026 critical minerals report.

## The Eight Trends Defining 2026

This paper examines each trend in turn — its drivers, its leading players, and the executive imperatives it creates. The eight have been selected based on strategic significance to hi-tech operators, breadth of impact across the supply-chain value chain, and the depth of verified data available to support the analysis.

**01 The Tariff Regime as a Permanent Structural Cost**

**02 Friend-Shoring and the China+1 Reality**

**03 Critical Minerals and Rare Earths Dependency**

**04 Memory, Components, and Materials Scarcity**

**05 Agentic AI Moves from Pilot to Production**

**06 Digital Twins Become Hybrid AI Twins**

**07 Multi-Tier Supplier Visibility and Risk**

**08 Sustainability, Scope 3 and Circular Electronics**



## 01

# The Tariff Regime as a Permanent Structural Cost

## At a glance

- Section 301 tariffs on Chinese semiconductors rose from 25% to 50% through late 2024 and 2025; PCB assemblies, electronic components, and electrical equipment have all been subject to increased duties. Current tariff levels include 20% — 32% on China, 18% on India, and 25% on countries conducting business with Iran.
- McKinsey (2025) reports 82% of companies were affected by tariffs and have prepared or implemented countermeasures. The Reshoring Institute survey of 18 executives shows most capital investments and hiring decisions are largely frozen pending tariff clarity -a holding pattern with material strategic cost.

## Key Market Trends

## 01

### Tariffs as a standing policy feature

- Tariffs have effectively become a standing feature of US trade policy across administrations.
- Companies are being forced to permanently redesign sourcing footprints rather than wait out a perceived cycle.

## 02

### Inventory build-up as primary response

- Inventory build-ups have served as the primary resilience response to tariffs (McKinsey, 2025) -ahead of structural nearshoring.
- An estimated 60% of US companies experienced logistics cost increases of 10-15% due to tariffs in the past year.

## 03

### Sectoral concentration of impact

- Tariffs have had the strongest impact on industries with globally distributed component supply -most notably automotive, electronics, and machinery.
- Supply-chain resilience has become a competitive differentiator as tariffs now function as a persistent structural cost layer.

## 04

### Policy unpredictability as the new constant

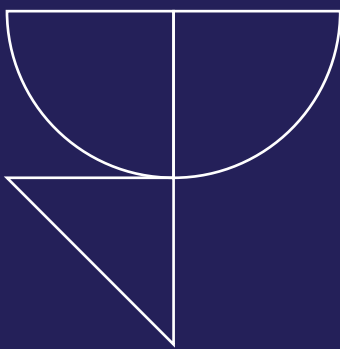
- Country-specific tariffs -such as those proposed in the Greenland case in early 2026 -are increasingly being used as political instruments.
- Companies are forced into reactive postures, with limited room for proactive anticipation or strategic planning.

## Initiatives by Major Players

**Walmart** -Reduced Chinese imports by 10% in 2024 in favor of Vietnam and Thailand sourcing, but reported a 5% rise in logistics costs due to longer shipping routes. Demonstrates the trade-off between tariff mitigation and operational complexity.

**Apple** -Investing \$1B+ in Indian manufacturing since 2023; shifting 15-20% of production to India and Vietnam by 2026. The transition has led to supply chain bottlenecks in Vietnam, resulting in approximately a 10% increase in lead times for some products.

**Foxconn Vietnam operations** -Operating high-demand Vietnamese facilities, including Bac Ninh province; recruiting agencies are running social-media livestreams to advertise vacancies -the labor market signal of how fast the shift is happening.



## Key Imperatives

### Treat tariffs as structural, not cyclical.

- Tariff volatility has persisted across multiple administrations and pricing tiers.
- Build supply chains, contracts, and pricing strategies on the assumption that today's tariff levels are the new baseline, not a deviation from it.

### Pair inventory builds with structural diversification.

- Inventory buffers are a tactical response; they do not change the structural exposure.
- Use the breathing room they create to fund actual sourcing diversification -most companies have not yet completed this step.

### Map sub-tier tariff exposure.

- Direct supplier tariff exposure is only the visible layer; sub-tier exposure is often larger and uncatalogued.
- Without sub-tier visibility, tariff-driven cost surprises will continue regardless of first-tier diversification.

### Stress-test under multiple tariff scenarios

- Scenario planning across 20%, 50%, and 100% tariff regimes is now routine for leading organizations.
- Sourcing decisions should be made with these scenarios explicit -not against a single base case.

Sources: McKinsey & Company Supply Chain Pulse 2025; KPMG Supply Chain Trends 2026 (tariff-management platforms and AI scenario simulators); Reshoring Institute Executive Survey 2025; Supply Chain Management Review May 2025; Lambda SCS February 2026; SupplyChainBrain April 2026; Ivalua Tariff Impact Report 2026.

## 02 Friend-Shoring and the China+1 Reality

### At a glance

- **Vietnam surpassed China** as the leading US supplier of laptops and game consoles for the first time in 2025. China's US shipments fell by \$51 billion last year, more or less offset by the US's cumulative \$49 billion rise in imports from Vietnam, India, and Mexico (Bloomberg analysis of shipment-level customs data, March 2026).
- **Capgemini** reports 73% of companies expect friend-shoring to account for a rising share of sourcing and production -increasing from 37% today to 41% within three years; 82% expect to reduce reliance on China, shifting activities toward the US, UK, Canada, Mexico, and Vietnam.

### Key Market Trends

#### 01 China outside China

- Reshoring from China does not necessarily mean a loss of Chinese industrial influence -production capacity is being redistributed across Southeast Asia, India, and Mexico, often under Chinese ownership or strategic control.
- True diversification now requires visibility into ownership and control structures, not merely geographic location (GEP 2025).

#### 02 Vietnam as the assembly hub

- Bloomberg analysis shows that core electronics production shifted to Vietnam, but it is still happening in China; only low-skilled final assembly lines have moved across the border.
- Chinese manufacturers found a cost-effective workaround: assemble in Vietnam to escape tariffs while keeping component manufacturing in China.

#### 03 India as a strategic alternative

- Apple's investment in India has exceeded \$1 billion since 2023; India's tariff rate (18%) sits between Vietnam and China.
- India offers scale, English-language workforce, and growing component ecosystems — but infrastructure and logistics gaps remain real.

#### 04 Mexico as the North America anchor

- A 2025 Deloitte study predicted that 40% of US companies would relocate at least part of their supply chains to North America by 2026.
- Mexico offers proximity, USMCA preferences, and lower labor costs — but infrastructure gaps can delay nearshoring projects.

## Initiatives by major players

- **Apple:** Shifting 15% — 20% of production to India and Vietnam by 2026 to reduce US-China tariff exposure; \$1Bn+ invested in Indian manufacturing facilities since 2023.
- **Foxconn:** Scaling Vietnamese facilities aggressively; labor demand at northern Vietnam industrial parks has driven recruiters to source workers from remote villages, with bonuses signaling the urgency.
- **HP:** Expanded sourcing to Taiwan and Thailand after tariffs hit Chinese electronics, reducing costs by 8%.
- **Walmart:** Reduced Chinese imports by 10% in 2024 in favor of Vietnam and Thailand, though absorbed a 5% rise in logistics costs from longer routes.

## Key imperatives

### Look past geographic relocation to ownership control

- A Vietnamese factory owned by a Chinese company offers limited diversification.
- Track the corporate-control layer, not just the country of operation, when assessing concentration risk.

### Plan for a three-to-five-year build-out

- True industrial relocation — not just final assembly — takes years to scale.
- Companies starting now will not see meaningful structural diversification before 2028; budgets and milestones should reflect that timeline.

### Invest in supplier development

- Vietnamese, Indian, and Mexican supplier ecosystems are less mature than their Chinese counterparts in many high-tech categories.
- Supplier development — quality systems, capacity, financing support — is a precondition for diversification, not a follow-up to it.

### Recognize the cost premium

- Friend-shoring typically increases per-unit cost; the value is in resilience and tariff avoidance, not unit economics.
- Build the business case on total landed cost under tariff scenarios, not on the standalone unit price comparison.

Sources: Bloomberg March 2026 shipment-level customs analysis; Capgemini Supply Chain 2025; GEP 2025; SupplyChainBrain April 2026; Deloitte 2025 Supply Chain Study; Lambda SCS February 2026.

## 03

## Critical minerals and rare earths dependency

### At a glance

- China accounts for approximately 91% of global rare-earth refining (IEA October 2025), 98% — 99% of heavy rare-earth processing for dysprosium and terbium, and roughly 99% of gallium refining. For batteries, China dominates with shares of 80% or more across many key segments, and 95%+ in extraterritorial materials and LFP cathodes.
- In April 2025, export controls were widened to include alloys containing lutetium, yttrium, dysprosium, and terbium, with extraterritorial enforcement provisions requiring foreign purchasers of Chinese-origin commodities to obtain MOFCOM licenses for re-export to third countries.

## Key Market Trends

### 01 The processing chokepoint

- While mining is somewhat diversified geographically, China's dominance becomes overwhelming further down the value chain.
- Processing facilities in extraterritorial countries face higher operating costs due to environmental regulations, labor costs, and infrastructure requirements.

### 02 Export controls: Extraterritorial reach

- April 2025 MOFCOM controls cover all heavy REEs, as well as production equipment and services related to rare-earth extraction and refinement.
- Extraterritorial provisions extend Chinese control over HREE transactions that have minimal direct links to Chinana.

### 03 Long lead times for alternatives

- Most new heavy rare earth projects are not expected to achieve commercial viability until 2027 or later.
- Alternative supply chain development requires substantial capital across mining, processing, and manufacturing stages — and a decade-scale build-out for true rare-earth independence.

### 04 Innovation-led diversification

- The Council on Foreign Relations argues the US cannot out-mine or out-process China and should instead 'leapfrog' through innovation, recovery, and recycling.
- Materials engineering — designing chemistries that reduce or eliminate reliance on the scarcest minerals — is being treated as a tool of economic statecraft.

## Initiatives by major players

- **US federal equity stakes:** The Trump administration has taken at least \$1 billion in total equity stakes in Trilogy Metals, Lithium Americas, MP Materials, Vulcan Elements, ReElement Technologies, Korea Zinc, and USA Rare Earth as part of a \$12 billion strategic stockpile plan.
- **EU 60 Strategic Projects:** The European Commission has selected 60 strategic projects targeting lithium, graphite, cobalt, nickel, and rare earths — 47 within the EU and 13 externally, including in Canada, Kazakhstan, Ukraine, and Zambia.
- **US-Australia Critical Minerals Framework:** Committed \$1 billion to joint minerals production projects in 2025; further partnerships with Saudi Arabia, Cambodia, Malaysia, and Thailand have followed.
- **Minerals alliance (50+ nations):** More than 50 nations, including India, participate in a multilateral alliance aimed at securing critical mineral supply chains and reducing reliance on Chinese production.

## Key imperatives

### Map your critical minerals exposure

- Most hi-tech operators have not mapped which products depend on which materials, or where those materials are processed.
- A clean exposure map is the precondition for any meaningful mitigation strategy — and it usually surprises the operators who undertake it.

### Invest in substitution and recycling early

- Materials engineering reduces dependency more durably than mining diversification.
- Recycling and rare-earth-free designs are the longest-lead, highest-leverage hedges against ongoing weaponization.

### Build strategic inventory deliberately

- Stockpiling decisions must balance material degradation, technological obsolescence, and the opportunity cost of capital.
- Public-sector stockpile programs are emerging as partners — engage early to secure participation.

### Engage with the policy framework

- EU CRMA Strategic Projects, US Defense Production Act mineral programs, and partner-country alliances are all open for engagement.
- Participate in the design phase rather than reacting to the implementation phase.

## 04

# Memory, components, and materials scarcity

## At a glance

- Memory prices rose roughly 50% in Q4 2025 (Counterpoint, January 2026), with the rally projected to continue through 2026. Data centers will consume approximately 70% of all memory chips made in 2026; IDC has warned that the PC market could shrink up to 9% in 2026 due to memory pricing.
- Beyond memory, the copper market faces a refined deficit of 330,000 metric tons in 2026 (J.P. Morgan Global Research), with average prices projected at \$12,075 per metric ton. Tungsten prices have rallied to historic levels, driven by Middle East energy disruptions and a Chinese export crunch.

## Key market trends

## 01

### Memory reallocation to HBM

- Samsung, SK Hynix, and Micron are reallocating wafer capacity toward higher-margin high-bandwidth memory.
- The auto industry is bracing for tighter memory chip availability as the highest-margin AI demand pulls supply away from traditional segments.

## 02

### Copper as the new bottleneck

- Copper demand is growing across AI infrastructure, data centers, and military systems.
- Trump has imposed 50% levies on semi-finished copper products; an additional 15% duty could take effect in January 2027, depending on a Commerce Department investigation.

## 03

### Tungsten and tactical materials

- Tungsten prices have rallied to historic levels, driven by an export crunch from China and the effects of the Middle East conflict on oil shipments.
- BMO analysts have forecast another supply deficit in 2026; production is highly geographically limited, and alternative supply chains are years away.

## 04

### Pricing apocalypse risk

- Industry coverage has described “a pricing apocalypse that could last a decade” if AI demand growth continues at the current pace.
- Consumer-electronics OEMs are absorbing pricing pressure that may not pass through cleanly to end consumers.

## Initiatives by major players

- Memory makers (Samsung, SK Hynix, Micron): Reallocating wafer capacity toward HBM — pre-allocated largely to NVIDIA and AMD. Memory pricing rally projected to continue through 2026 and into 2027.
- Auto OEMs: Bracing for tighter memory chip availability as suppliers reallocate to HBM. Long supplier qualification cycles in automotive make rapid pivots difficult.
- PC and smartphone OEMs: IDC has warned the PC market could shrink by up to 9% in 2026 due to skyrocketing RAM prices; TrendForce has revised its 2026 smartphone and notebook outlooks downward.
- Copper and tungsten miners: J.P. Morgan and Goldman Sachs flag tightening; copper price reaching \$12,075/MT average for 2026. Western mining and processing capacity expansion remains multi-year.

## Key imperatives

### Re-engineer for material efficiency

- Redesign products to use less of the materials whose prices have stepped up sharply.
- The fastest payback in 2026 capex programs is in reducing material intensity, not adding capacity.

### Invest in substitution and recycling early

- HBM3E and HBM4 supply is pre-allocated through 2026 and into 2027.
- Companies dependent on these components should secure multi-year contracts now rather than negotiate on the spot market.

### Build strategic inventory deliberately

- PC, smartphone, and consumer electronics demand may contract in 2026 due to memory pricing.
- Build demand scenarios that explicitly capture the downside path — and align inventory commitments accordingly.

### Engage with the policy framework

- Material substitution — copper alternatives, tungsten alternatives — is the most durable hedge against tactical-material shortages.
- Engineering teams should be brought into the supply-chain risk conversation, not consulted after sourcing decisions have been made.

Sources: Counterpoint Memory Pricing January 2026; J.P. Morgan Global Research; Supply Chain Dive January 2026; Sourceability April 2026; Tom's Hardware memory coverage; TrendForce November 2025; IDC PC market warning December 2025.

## 05

## Agentic AI moves from pilot to production

### At a glance

- Gartner forecasts that SCM software with agentic AI will reach \$53 billion in spend by 2030; Gartner also predicts that 40% of enterprise applications will embed task-specific AI agents by 2026, up from less than 5% in 2025. Grand View Research projects the AI-in-supply-chain market will exceed \$70 billion by 2030, up from approximately \$20 billion in 2026.
- Adoption is broad but uneven. 72% of supply chain organizations have deployed generative AI (Gartner). However, only 23% have a formal AI strategy, and Gartner warns 60% of supply chain digital adoption efforts will fail to deliver promised value by 2028 due to insufficient investment in change management.

## Key market trends

### 01

#### Adoption is incremental, not transformational

- Only 17% of supply chain organizations are pursuing immediate transformational redesign of processes and workflows (Gartner November 2025 survey of 140 senior supply chain leaders).
- 83% are either applying AI incrementally to specific use cases or gradually scaling it into integrated processes.

### 02

#### Demand forecasting and S&OP first

- Demand forecasting is the most mature AI use case in supply chain — adoption rates reach 87% among leading organizations.
- Companies embedding ML into S&OP processes are seeing forecast accuracy improvements of 20% — 40%, translating directly into working-capital release and reduced carrying costs.

## 03

### Autonomous procurement agents

- KPMG identifies agentic procurement as a defining 2026 shift — agents are now operating across source-to-pay, contract life cycle management, and third-party risk systems, autonomously issuing and managing RFPs, evaluating supplier responses, triggering onboarding, monitoring supplier risk, and identifying contract renewals.
- Agents can generate negotiation scripts and execute pre-approved contract playbooks; AI-powered spend analytics and supplier risk scoring enable procurement to identify savings that traditional category management misses.

## 04

### Connected Intelligence as the destination

- KPMG describes the mature end-state as Connected Intelligence — enterprise-wide AI linking supply chain with procurement, finance, ESG, HR, and CRM into an intelligent, autonomous ecosystem.
- Gartner predicts that by 2030, 50% of cross-functional SCM solutions will use intelligent agents to execute decisions autonomously. The control challenge is orchestrating thousands of agents without incurring technical debt due to decentralized tool sprawl.

### Initiatives by major players

- **Oracle Supply Chain Planning:** Leader in 2026 Gartner Magic Quadrant for both discrete and process industries. Reports double-digit forecast-accuracy gains and inventory-turn improvements; S&OP cycles compressed from weeks to days.
- **General Mills:** Building a dynamic digital twin to automate 50 million decisions per year — productivity gains include significantly reduced product waste and lower transportation costs.
- **ChainSynth and AI logistics-twin platforms:** Industry reports indicate 20% — 40% faster response times to disruptions and double-digit reductions in inventory holding costs for organizations moving from forecasting to network orchestration.
- **Maine Pointe (consultancy analysis):** Identifies that companies investing as much in people, processes, and change management as they do in technology consistently outperform those that lead with tools.

### Key imperatives

#### Define ROI before deployment

- Gartner reports 60% of supply chain digital adoption efforts will fail to deliver promised value by 2028 — largely due to insufficient change management.
- Treat AI as a measurable investment with defined cycle-time targets, documented cost savings, and CFO-trusted impact metrics.

#### Master data is the precondition

- Data quality and silos remain the primary constraint on AI value capture.
- Foundational master data alignment is technology-independent, and most organizations have not done it.

#### Start narrow, then scale

- Demand forecasting, supplier risk scoring, and procurement spend analytics are the high-leverage starting points.
- Bounded scope, measurable outcomes, and low operational risk allow the organization to learn before scaling further.

#### Govern agent orchestration explicitly

- Orchestration challenges grow non-linearly as agents multiply across functions.
- Centralize governance for high-stakes flows and let citizen developers innovate on lower-stakes ones -but plan the governance layer before, not after, scale.

Sources: Gartner Press Release April 2026 (Agentic AI in SCM \$53B); Gartner Press Release May 2026 (CSCO survey); KPMG Supply Chain Trends 2026 (agentic procurement and Connected Intelligence); Supply Chain Management Review April 2026; Grand View Research; Oracle blog post April 2026; Maine Pointe analysis.

## 06

# Digital twins become hybrid AI twins

## At a glance

- Gartner forecasts 65% of supply chains will use hybrid twin systems by 2026 — combining traditional digital twins with AI-driven adaptive layers, tightly integrated with ERP and IoT systems. AI-powered digital twins simulate disruptions, demand spikes, and supplier risks, allowing companies to test responses before real-world impact.
- Leading deployments report measurable returns. A US retailer using AI logistics twins predicted West Coast port container delays weeks in advance, automatically rerouted shipments through alternative hubs, and reduced costs by 14% while cutting stockout risks.

## Key Market Trends

## 01

### Scenario simulation at scale

- AI-powered digital twins generate and test millions of 'what-if' scenarios — far beyond what traditional planning could evaluate.
- Scenario exercises (What if Suez closes? What if Taiwan faces a blockade? What if tariffs increase to 50%?) are now central to executive decision-making.

## 02

### End-to-end visibility through generative AI

- Generative models synthesize data from ERP systems, IoT sensors, logistics feeds, and external sources into a unified, real-time view.
- Twins are increasingly tightly integrated with ERP and IoT systems — the integration layer is now where most value gets unlocked.

## 03

### The self-evolving feedback loop

- AI/ML models detect inefficiencies, forecast demand shifts, and simulate alternative routes; action layers automate responses such as rerouting, inventory adjustments, or supplier renegotiations.
- This self-evolving loop can reduce costs and improve resilience faster than human planners alone — but requires unified data and clear governance.

## 04

### The data-quality bottleneck

- Many enterprises struggle to unify supply chain data scattered across outdated systems — data quality and silos remain the primary constraint on twin value.
- Foundational master data alignment is the precondition; technology investment alone cannot fix it.

## Initiatives by major players

- **Oracle AI Supply Network:** Hybrid twin platform integrated with Oracle Cloud SCM; reports compression of S&OP cycles from weeks to days for adopters.
- **ChainSynth:** AI logistics-twin platform creating virtual replicas of supply chains and using LLMs to generate and test millions of 'what-if' scenarios.
- **General Mills:** Building a dynamic digital twin to automate 50 million decisions per year — productivity gains include reduced product waste and lower transportation costs.
- **Retail AI logistics-twin adopter (cited industry example):** Predicted West Coast port container delays weeks in advance; automatically rerouted shipments through alternative hubs, reducing costs by 14% and cutting stockout risks significantly.

## Key imperatives

### Start with a focused twin, not a network twin

- Boil-the-ocean twin programs typically fail; bounded twin scope succeeds.
- Pick the supply chain segment with the highest disruption cost and start there.

### Fix master data before scaling

- Twin accuracy is bounded by the quality of the underlying data.
- Invest in master data management as a precondition — not a side project — to twin deployment.

### Pair the twin with action automation

- A twin that produces insight without driving action delivers only a fraction of its potential value.
- Build the action layer — automated routing, inventory adjustment, supplier renegotiation — alongside the simulation layer.

### Treat the twin as a governance object

- Multi-agent orchestration and decision authority become harder as twins scale.
- Set clear human-in-the-loop boundaries early — particularly for high-stakes flows like supplier selection and major rerouting.

Sources: Gartner Hybrid Twin Forecast 2026; Tech Daily Shot Generative AI in Supply Chain March 2026; Oracle blog April 2026; Medium analysis on Digital Twins vs AI Logistics Twins; Gartner CSCO Survey May 2026.

## 07 Multi-tier supplier visibility and risk

### At a glance

- Cleo (2025) reports that by the end of 2025, over two-thirds of companies had diversified their supply chain partners — 57% of those partners located domestically. But two-tier supply chain visibility has returned to 2022 levels, creating a paradox in which diversification accelerates while visibility regresses.
- Ivalua (April 2026) and others emphasize that deep supplier visibility, including sub-tier mapping, is now essential to understanding tariff exposure and anticipating upstream disruptions. The power lies in supplier data — knowing who suppliers are, where facilities are located, and how exposed each is to tariffs.

## Key Market Trends

### 01 Sub-tier as the new battleground

- If a direct supplier sources raw materials from a country affected by tariffs, procurement teams may experience unexpected cost increases or delays —visibility beyond immediate suppliers is essential.
- Sub-tier mapping enables procurement to spot risks further upstream and pivot or prepare for cost impacts before they ripple down.

### 02 Real-time risk monitoring

- Robust supplier management technology enables real-time risk monitoring, scenario planning, and data-driven mitigation strategies.
- This level of visibility also enables more informed supplier negotiations, with procurement teams approaching discussions with a clear understanding of each supplier's challenges and risks.

## 03

## Ownership control vs geographic location

- A Vietnamese factory owned by a Chinese company offers limited diversification.
- True visibility now requires ownership and control mapping, not just geographic location — particularly across Southeast Asia and Mexico, where 'China outside China' is a real phenomenon.

## 04

## The visibility regression paradox

- Two-tier visibility has declined back to 2022 levels (Cleo, 2025) — partly due to a slowdown in digitalization investments.
- Companies are diversifying supplier portfolios faster than they are upgrading their visibility systems, creating new, uncatalogued exposure.

## Initiatives by major players

- **Ivalua:** Named a Leader in the 2026 Gartner Magic Quadrant for Source-to-Pay Suites; emphasizes sub-tier mapping and real-time risk monitoring as core procurement capabilities.
- **Procurement teams across industries:** Cleo reports over two-thirds of companies had diversified supply chain partners by the end of 2025, with 57% of partners located domestically — but visibility has not kept pace.
- **GEP analysis:** Identifies that reshoring from China often does not eliminate Chinese industrial influence — production has been redistributed under Chinese ownership or strategic control across Southeast Asia, India, and Mexico.

## Key imperatives

## Map sub-tier exposure as a discipline

- Most operators have limited first-tier visibility and almost none in the sub-tier — and the gap widens as supplier portfolios diversify.
- Build sub-tier mapping into procurement workflow, not as a one-time exercise.

## Track ownership, not just geography

- A Mexican supplier under Chinese ownership delivers limited diversification, and many recent moves have this character.
- Add corporate-control fields to supplier master data; mandate ownership disclosure in supplier qualification.

## Invest in visibility technology proportionate to portfolio change

- Diversification without visibility creates new and uncatalogued risk.
- Visibility investment should scale alongside supplier portfolio expansion — not lag behind it.

## Use visibility for negotiation, not just risk

- Real-time supplier intelligence is a procurement leverage tool, not just a defensive one.
- Teams that approach negotiations armed with supplier-specific risk data consistently capture better terms.

Sources: Cleo Supply Chain Report 2025; Ivalua Tariff Impact Report 2026; Gartner Magic Quadrant Source-to-Pay 2026; GEP 2025 Supplier Strategy Analysis; Thomson Reuters Global Trade Report 2026.

## 08

## Sustainability, Scope 3, and circular electronics

### At a glance

- Sustainability disclosure has shifted from a corporate-affairs add-on to a procurement and capital-markets criterion. Scope 3 emissions disclosures — covering supply chains and end use — are becoming material to customer procurement and capital-market access, and hyperscalers are increasingly requesting supply-chain emissions data as part of vendor selection.
- Critical materials also have a sustainability dimension. The Council on Foreign Relations argues that materials engineering — designing chemistries that reduce or eliminate reliance on scarce minerals — is now a tool of both sustainability and economic statecraft.

### Key market trends

## 01

#### Scope 3 is the next disclosure boundary

- Supply chain, capital goods, employee travel, and end-use of sold products are the largest and least measured emissions categories for most high-tech operators.
- Most companies cannot yet measure Scope 3 with audit-grade reliability — and the gap is becoming commercially material as disclosure rules tighten.

## 02

#### Customer procurement is the enforcement layer

- Hyperscaler customers are increasingly asking for supply-chain emissions data as part of vendor selection.
- EU CBAM, SEC climate disclosure rules, and similar regimes are extending the disclosure perimeter — making Scope 3 transparency a precondition for market access, not just a reputational matter.

## 03

#### Circular electronics and materials recovery

- Recycling and rare-earth-free designs are the longest-lead, highest-leverage hedges against materials weaponization.
- Investing in rare-earth-free technologies, new extraction and processing technologies, and recycling and waste recovery is recommended by the CFR and the IEA as the durable path forward.

## 04

#### Sustainability and resilience converge

- Materials substitution that reduces emissions also reduces dependency on concentrated supply chains.
- The sustainability and supply-chain-resilience programs that used to compete for funding are increasingly the same program, and should be governed accordingly.

### Initiatives by major players

- **Major European OEMs (Iberdrola, Enel, Ørsted) in adjacent sectors as benchmarks:** Sector-leading ESG disclosure and green bond issuance set the maturity benchmark that hi-tech operators are being evaluated against.
- **Hyperscaler customers (Microsoft, Amazon, Google, Meta):** Increasingly requesting supply-chain emissions data as part of vendor selection — making Scope 3 transparency a customer-acquisition variable for hi-tech suppliers.
- **EU Critical Raw Materials Act:** The 60 Strategic Projects framework explicitly couples sustainability with strategic materials development — emphasizing circular economy and processing within the EU.

## Key imperatives

### Build Scope 3 measurement now

- Scope 3 is the next disclosure boundary; firms still building it in 2026 will face cost-of-capital and procurement penalties through 2027 — 2028.
- Those who move early gain access to transition finance and preferred customer relationships.

### Treat materials substitution as both a sustainability and a resilience lever

- Rare-earth-free designs, recycled content, and material efficiency reduce both emissions and concentration risk.
- Don't budget these as separate programs — combine the funding and the governance.

### Make supplier ESG a procurement criterion

- Supply-chain ESG performance is increasingly a determinant of customer-facing ESG performance.
- Embed ESG criteria in supplier qualification and ongoing scoring, not just in annual reports.

### Treat the disclosure system as a competitive asset

- Operators with auditable, real-time emissions data will outpace those with annual self-reports as customer and regulatory expectations rise.
- Invest in continuous monitoring and verification infrastructure now — the cost is below the cost of contested disclosures.

Sources: Cleo Supply Chain Report 2025; Ivalua Tariff Impact Report 2026; Gartner Magic Quadrant Source-to-Pay 2026; GEP 2025 Supplier Strategy Analysis; Thomson Reuters Global Trade Report 2026.

## Looking Ahead: A 2030 Perspective

By 2030, hi-tech supply chains will look fundamentally different. Five shifts will be visible across every operator from OEM to distributor.

1. **Tariffs and export controls will be a permanent design constraint.** Today's structural tariff regime and licensing volatility will be normal operating conditions, not exceptional disruptions. Companies will have redesigned sourcing strategies, contracts, and pricing models around this assumption.
2. **Friend-shoring will have settled into a mature multi-polar network.** Vietnam, India, Mexico, and Eastern Europe will each have well-developed roles as 'China+1' alternatives — though the 'China outside China' phenomenon will persist, requiring ownership-control mapping as standard practice.
3. **Critical minerals will have measurable Western alternatives** — but still not enough. US, EU, Australian, and partner-country investments will produce material volumes of refined critical minerals by 2030. China's processing dominance will be reduced, but not eliminated.
4. **AI and agentic orchestration will be the default operating model.** Gartner forecasts that SCM software with agentic AI will reach \$53 billion by 2030, and that 50% of cross-functional SCM solutions will use intelligent agents. The competitive question will be governance and integration quality, not whether to adopt.
5. **Sustainability disclosure will be inseparable from supply chain performance.** Scope 3 measurement, materials substitution, and circular electronics will be procurement and capital-market criteria — and the same investments will deliver both sustainability and resilience benefits.

The policy environment is structural, the technology platforms are maturing, and the talent demands are rising. Operators that move decisively on the eight trends in this paper will define the next generation of hi-tech supply chain leadership.

# Glossary

**SCM** – Supply Chain Management

**S&OP** – Sales and Operations Planning

**ERP** – Enterprise Resource Planning

**CRM** – Customer Relationship Management

**SCP** – Supply Chain Planning

**S2P** – Source-to-Pay

**OEM** – Original Equipment Manufacturer

**EMS** – Electronics Manufacturing Services

**ODM** – Original Design Manufacturer

**OSAT** – Outsourced Semiconductor Assembly and Test

**PCB** – Printed Circuit Board

**HBM** – High Bandwidth Memory

**DRAM** – Dynamic Random Access Memory

**NAND** – NAND Flash Memory

**SSD** – Solid-State Drive

**LFP** – Lithium Iron Phosphate (battery cathode)

**REE** – Rare Earth Element

**HREE** – Heavy Rare Earth Element

**MT** – Metric Ton

**ESG** – Environmental, Social, and Governance

**Scope 3** – Value-chain (indirect) emissions category, covering supply chain and end-use

**GHG** – Greenhouse Gas

**CBAM** – Carbon Border Adjustment Mechanism (EU)

**CRMA** – Critical Raw Materials Act (EU)

**DPA** – Defense Production Act (US)

**USMCA** – United States-Mexico-Canada Agreement

**BIS** – Bureau of Industry and Security (US Department of Commerce)

**MOFCOM** – Ministry of Commerce of the People's Republic of China

**SEC** – Securities and Exchange Commission (US)

**IEA** – International Energy Agency

**CFR** – Council on Foreign Relations

**GBS** – Global Business Services

**DIFOT** – Delivery In Full On Time

**RFP** – Request for Proposal

**CSCO** – Chief Supply Chain Officer

**CFO** – Chief Financial Officer

**P&L** – Profit and Loss

**CAGR** – Compound Annual Growth Rate

**TMT** – Technology, Media, and Telecommunications

**ISG** – Industry Solutions Group

**PRC** – People's Republic of China

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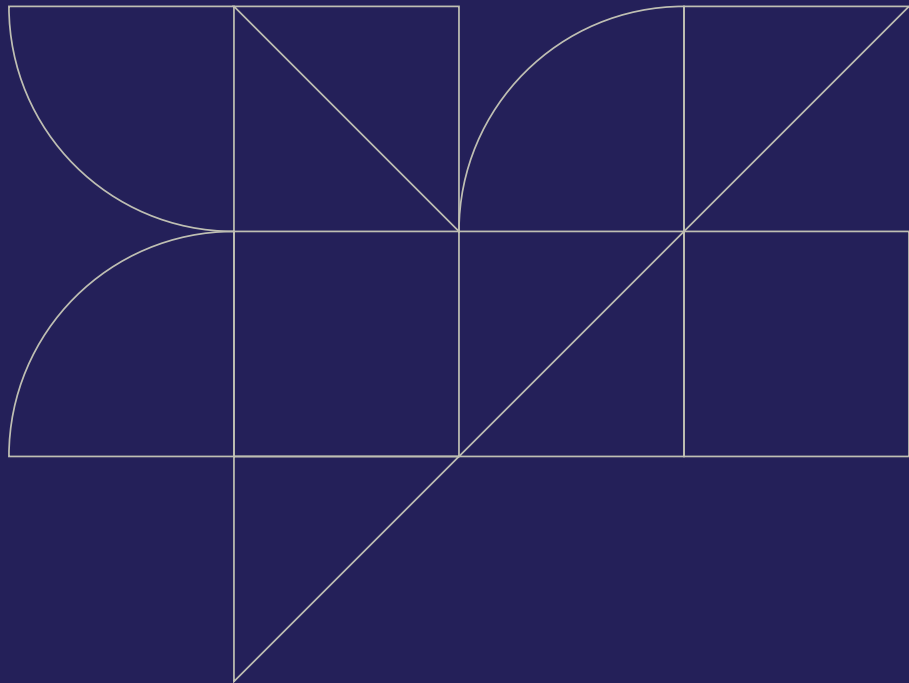
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