

# SUPPLY $\times$ CHAIN connect™

June  
2024

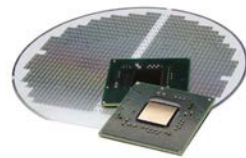
## Effective Inventory **MANAGEMENT STRATEGIES AND TECHNOLOGIES**





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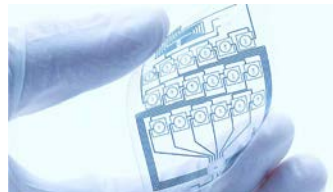
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# Top Supply Chain News for May 2024

Here's a roundup of the top supply chain-related stories and trends that took shape over the last month.

From the continued rise of tech-driven solutions to navigating geopolitical challenges to high demand for certain electronic components, supply chains were a busy place in May. As we head into June, here are some of the top trends and breaking news that shaped supply chains last month.

## Market Fluctuations Continue

In IPC's new *Global Sentiment of the Electronics Supply Chain Report*, the company says sentiment among electronics manufacturers fell after hitting a new high in April. Despite the decline, sentiment remains historically high.

The company says electronics manufacturers more likely expect PCB and EMS sales revenue to increase in the U.S. in 2024 when compared to other regions. "On average, electronics manufacturers anticipating a 2024 increase in either PCB or EMS sales revenue expect the percentage to range from 8 percent to 11 percent across all regions," IPC says, "while those anticipating a decrease in either PCB or EMS sales revenue believe the range will be between -8 percent and -12 percent year-over-year."

Some of the other key report findings included:

- Industry demand eased in May. Demand fundamentals weakened following a high in March, which was the highest level since July 2022.
- The Demand Index slipped 3% in May, with both the New Orders Index and the Shipments Index falling 5 points.
- The Backlog Index slipped back into contractionary territory, after a single month in expansionary territory.
- Cost pressures rose in May, after record low in April.
- The Labor Costs Index rose by three points in May and the Material Costs Index increased by 4 points.

## Apple's Supply Chain Comes Under Scrutiny

International lawyers representing the government of the Democratic Republic of Congo claim to have new evidence gathered from whistleblowers, and with a focus on Apple's possible sourcing of minerals from conflict areas in eastern Congo, Reuters reports.

The publication says Congo's lawyers notified Apple of a series of concerns about its supply chain, and also wrote to Apple subsidiaries in France. "The Amsterdam & Partners LLP law firm has been investigating allegations that minerals mined in Congo by several companies and armed groups are being smuggled out through Rwanda, Uganda and Burundi," the publication reports.

Apple has said in the past that it does not directly buy, procure or source primary minerals, and it has been auditing its suppliers for several years and publishing its findings. Reuters says that in 2023 Apple said that 100% of identified smelters and refiners in the supply chain for all applicable of its products manufactured in 2023 had participated in an independent third-party conflict minerals audit for tin, tantalum, and tungsten—known as 3T minerals—and gold (3TG).

## Disruptions are Easing, but Not Gone Yet

Supply chain disruptions became a major headache for businesses in the aftermath of the pandemic. In October 2021, *Liberty Street Economics* began asking businesses if supply availability had improved, remained unchanged, or worsened compared to the prior month, allowing us to derive diffusion indexes of supply availability for both service firms and manufacturers.

Fast-forward to May 2024 and Liberty Street Economics says that about 24% of service firms and 43% of manufacturers said supply chain disruptions impeded business activity last month. "Of note, the share of businesses reporting substantial supply disruptions has fallen considerably to just a small proportion," the company says. "All in all, while much progress has been made, supply chain disruptions remain significant and are restraining business activity for many firms in the region, though much less so than in 2021."

According to Liberty Street Economics, companies are responding to supply chain disruptions by focusing on changes to prices, output, employment and hours worked. For example, about 25% of service firms and nearly 40% of manufacturers increased their selling prices. "While such price adjustments were much less common than in October 2021," the company adds, "such high shares of firms raising prices in response to supply chain disruptions may well be contributing to inflationary pressures in the economy."

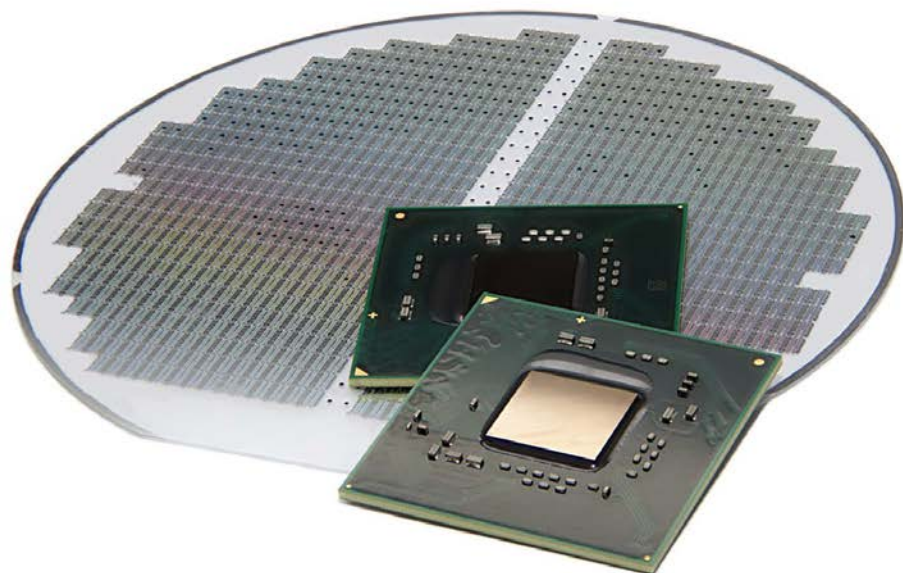
## Demand for AI Pumps Up the Electronics Supply Chain

Artificial intelligence (AI) is sending shockwaves through the global electronics industry, according to *Astute Group*, which says demand for high-performance computing, driven by advancements like ChatGPT, is outpacing even optimistic forecasts and fueling a scramble for specialized components.

The company expects demand for high-performance GPUs, FPGAs and HBM memory to continue to surge and says engineers and businesses must prepare for the ripple effects, including potential supply disruptions and the need to adapt designs.

"While AI's disruption challenges legacy supply chains, it ultimately represents a tremendous catalyst for growth within the electronics industry," Astute Group points out. "Proactive companies that invest in specialized solutions and embrace supply chain agility will be positioned to reap the rewards of this transformative technology."

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# High Demand for SiC and GaN Semiconductors for the Next 10 Years

**A new report predicts nearly 23% growth in the Silicon Carbide and Gallium Nitride power semiconductor market over the next 10 years.**

The wide bandgap semiconductors SiC (Silicon Carbide) and GaN (Gallium Nitride) have drawn a lot of attention in power applications. In fact, the unique properties of SiC and GaN materials have made them promising candidates for future high power, high frequency semiconductor devices, according to *ScienceDirect*.

These power semiconductors are widely used in motor drives, powertrains, lighting systems, LiDAR autonomous control, and other automotive applications, Future Market Insights reports.

There's also been a surge in demand for high-performance semiconductors as adoption of renewable energy systems such as solar and wind energy continues to increase. SiC and GaN power semiconductors can handle the high power requirements of these systems and improve their performance.

“The global GaN and SiC power semiconductor market has witnessed significant growth and innovation over the past decade,” *Skyquest* says. “These advanced materials have emerged as transformative options for power electronics, addressing limitations of traditional silicon-based semiconductors.”

## Major Market Acceleration Ahead

Based on these and other market trends, *Fact.MR* is now anticipating a major market acceleration for the SiC and GaN power semiconductor sector over the next 10 years. During that period, the market is expected to post a compound annual growth rate (CAGR) of nearly 23% before reaching \$11.08 billion in 2034—up significantly from a current \$1.41 billion. *Fact.MR* says SiC and GaN power semiconductors are transforming the electronics sector by overcoming the limited features offered by conventional silicon-based semiconductors. These semiconductors are energy efficient and have thermal tolerance, both of which make SiC and GaN ideal for high-temperature and high-frequency applications.

“These semiconductors are finding extensive use in the automotive, renewable energy, industrial, and consumer electronics sectors,” the research firm says. For example, in the automotive sector, SiC and GaN power semiconductors are used in the manufacturing of energy-efficient electric and hybrid vehicles.

The market for SiC and GaN power semiconductors vary by geography:

- The U.S. market is currently evaluated at \$149.9 million.
- Japan is set to hold 29.4% of the East Asia market share by 2034.
- The China market is approximated at \$154.4 million
- right now.

The market is also highly competitive. Industry giants are adopting product expansion strategies such as mergers and acquisitions, *Fact.MR* reports, while mergers and acquisitions help companies increase their product offerings and market reach. For instance, Infineon Technologies AG recently announced the acquisition of GaN Systems Inc., and Flosfia began offering next-gen power chips made from gallium oxide.

## Overall Outlook Remains Positive-But-Cautious

The broader semiconductor market has been through some ups and downs lately as the sector emerged from the pandemic, shook off the impacts of the global shortage and caught up with demand for certain products. According to *KPMG's Semiconductor Industry Confidence Index*, the current score of 54 is similar to that of 2023, with a value above 50 indicating a more positive outlook than negative.

According to KPMG, 83% of semiconductor leaders project their company's revenue to grow in 2024, which is in line with last year's 81%. However, the rate-of-growth projections are slightly lower. This year, four in 10 leaders expect revenue growth of more than 10 percent. While still healthy, a full half of respondents (5 in 10) felt this way last year.

Automotive topped the survey as the most important application driving semiconductor company revenue, with wireless communications coming in second and cloud/data centers and the Internet of Things tied for third place on organizations' top list of revenue drivers in 2024.

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By SUPPLY CHAIN CONNECT STAFF



# Taking the Pulse of Digital Supply Chain Transformation

Here are the primary drivers and roadblocks that companies say are dictating their supply chain transformation initiatives this year.

As an authority in benchmarking, best practices, process and performance improvement, and knowledge management, American Productivity & Quality Center (APQC) periodically takes the pulse of the world's supply chain operators. Last month, APQC turned its focus to digital supply chain transformation with its latest *2024 Quick Poll Report*.

Based on input from 300+ respondents, the APQC report provides a cross-industry snapshot of the current state of digital transformation in supply chain, including its elements, key drivers, top barriers and the teams that are leading the transformation process. The group defines digital transformation as the “strategic integration of multiple technologies” in relation to the supply chain.

According to the survey, nearly two-thirds of respondents say their organizations are in the advanced stages of adopting digital transformation in their supply chains, including the achievement of full implementation with continuous improvement or in the process of a full-scale adoption. Only a small minority (16%) is still in the planning stage or conducting pilot projects, APQC reports.

## The Top 10 Drivers

Over half of the survey respondents (55%) consider data management to be a critical element of their organizations' supply chain digital transformation efforts. Other common elements of digital transformation include generative and algorithmic artificial intelligence (GenAI and AI), advanced

analytics, robotic process automation (RPA), enterprise resource planning (ERP) systems and the Internet of Things (IoT).

According to the APQC reports, the top drivers of supply chain digital transformation right now include the desire to improve quality (e.g., minimize errors); improve sales and operations planning; and enhance supplier/customer service and communications. Here's how the numbers break down:

- 33% of companies want to improve quality
- 30% are interested in improving sales and operations planning/integrated business planning
- 29% have their sights set on improving supplier/customer service and communications
- And, 28% want to be able to provide better real-time access to data

Other core concerns right now include cybersecurity/IT risk reduction, the need for connected systems to support better decision-making and the need to reduce costs. Other companies are focused on improving supply chain cycle times, information sharing and collaboration.

In contrast, the survey respondents say they're less focused on pursuing digital transformation in their supply chains in order to enable remote work, improve accessibility on devices and update their existing legacy systems.

## Barriers to Digital Transformation

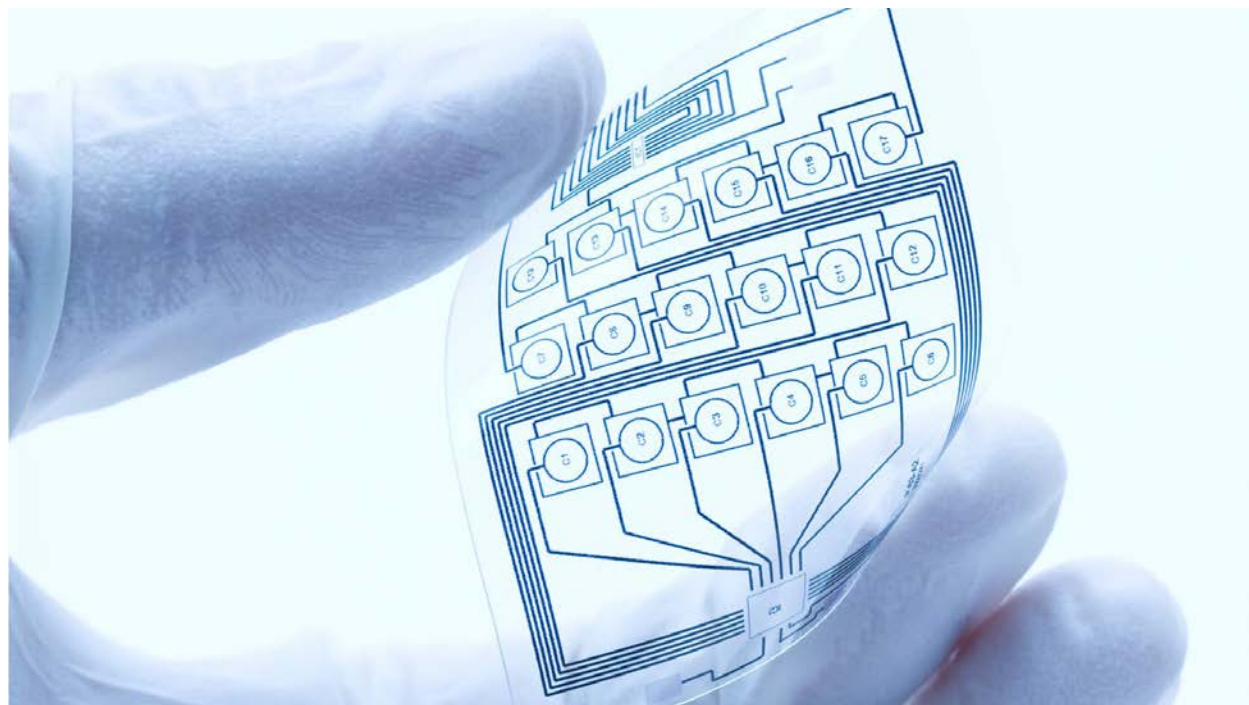
APQC says the common barriers to digital transformation also include integration challenges, security and governance concerns, technology capability limitations, and the lack of skills to use new systems and processes.

- 38% say cost of implementation keeps them from investing in new digital supply chain technology solutions
- 42% blame integration challenges
- 38% say security and governance concerns keep them from making this move
- 38% say technology capability limitations are their biggest concern
- And 37% say lack of skills needed to be able to use new systems and processes is a primary roadblock

The group also identified some consensus among the respondents, with nearly half (48%) perceiving the “cost of implementation” to be a top barrier to the success of their organization's supply chain's digital transformation. In this

high interest rate and inflationary economic environment, such concerns could be keeping companies on the supply chain digital transformation sidelines this year.

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## New Funding Source for Flexible Electronics Manufacturers

The NextFlex consortium announces a new \$5.3 million funding opportunity for the commercialization of hybrid electronics.

Formed in 2015 through a cooperative agreement between the U.S. Department of Defense (DoD) and FlexTech Alliance, NextFlex is a consortium of companies; academic institutions; non-profits; and state, local and federal governments with a shared goal of advancing U.S. manufacturing of flexible hybrid electronics (FHE).

Flexible Hybrid Electronics are printed electronics combined with silicon-based integrated (active) circuits on a conformable substrate. Examples of key active components from Si CMOS processes include microcontrollers, digital signal processors, high density memories and radiofrequency (RF) chips.

According to NextFlex, flexible and additive hybrid electronics give everyday products the power of silicon ICs by combining them with new and unique low-cost and environmentally friendly additive printing processes and new materials, including structural and conformal electronics and additive packaging solutions using novel materials. The result is fast time to market, lightweight, low-cost and highly efficient smart products that can be flexible, conformable and stretchable with innumerable uses for commercial and defense applications.

### Project Call 9.0

Over the last eight years, NextFlex's team of thought leaders, educators, problem solvers and manufacturers have collectively facilitated innovation, narrowed the manufacturing workforce gap and promoted sustainable manufacturing ecosystems. Now, the organization has launched a \$5.3 million funding opportunity focused on strengthening the U.S. electronics manufacturing sector. The funding will also be used to promote the commercialization of hybrid electronics.

In May, NextFlex released Project Call 9.0 (PC 9.0), its latest call for proposals that seek to fund projects that further the development and adoption of hybrid electronics while addressing key challenges in advanced manufacturing. The total PC 9.0 project value is expected to exceed \$11 million (including NextFlex investment and performer cost-share), bringing the total anticipated investment in advancing hybrid electronics since NextFlex's formation to \$143 million.

PC 9.0 focuses on areas where hybrid electronics can impact high priority U.S. manufacturing opportunities and areas of emerging importance within the electronics manufacturing community. It emphasizes projects that address critical hybrid electronics manufacturing challenges, enabling the transition of hybrid electronics devices into applications that require superior performance, assured reliability and improved environmental sustainability.

"NextFlex Project Calls advance the state of the art of hybrid electronics technology and have proven to push the field in new directions, with each marking development milestones that have been collectively achieved by the NextFlex consortium," said Scott Miller, Ph.D., director of technology, in a [press release](#).

"As hybrid electronics technologies increasingly find their way into products and manufacturing," he continued, "these developments will expand the range of applications in aerospace, automotive, structural health monitoring, and medical wearables."

### Developing Roadmaps, Prioritizing Technical Gaps

Also last month, NextFlex released its latest public [Hybrid Electronics Technology Roadmaps](#). Developed by subject matter experts from industry, academia and government,

the public roadmaps summarize the detailed information on the current state of the art, market opportunities and needs, key stakeholders, a five-year forward-looking development roadmap and prioritized technical gaps.

In its roadmaps, NextFlex has identified 11 different technical areas of influence, with device integration and packaging being one of those areas. The specific opportunity areas identified by NextFlex in that category include printed passives using ink-jet, aerosol-jet and direct-write; semiconductor packaging and heterogenous integration; and fully- and semi-additive PCB manufacturing, among others. To date, NextFlex has funded 39 projects that align to its Device Integration & Packaging Working Group.

The group has also funded four projects that align with its Automotive Working Group, whose areas of opportunity include (but aren't limited to) HMI controls on steering wheels, interior and exterior goods; integrated heaters; lidar/camera heaters for startup warming; and integrated health sensors for EV batteries.

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# Electronics Supply Chain has Room to Grow on the Digital Maturity Scale

A new survey finds that three-quarters of electronics industry professionals are still using some type of ad hoc spreadsheets when sourcing products.

Organizations compare and benchmark themselves against many different metrics, with “digital maturity” being one of the newer comparisons being made both across companies and entire industries. Defined as the measure of an organization’s ability to use technologies to achieve its business goals, digital maturity is typically broken down into four levels: nascent, emerging, established and advanced.

Where nascent companies may lack the budgets, skillsets and cultural components needed to execute on their digital initiatives, for example, advanced organizations make con-

tinued investments in digital business strategies (regardless of economic indicators) and are already using advanced/emerging technologies like artificial intelligence (AI) and generative AI, among others.

So where does the typical electronics supply chain stand on this hierarchy of digital adopters, and what else needs to be done to help it advance? According to a new Supplyframe report, there is current “ample opportunity” for the electronics industry to enhance its digital maturity levels.

## 75% Still Use Spreadsheets

For [The 2024 Digital Maturity Model & Report for the Electronics Industry](#), the company surveyed electronics industry professionals and learned that about 75% of them are still using some type of ad hoc spreadsheets for sourcing goods. Nearly as many (70%) manually-validate and optimize their bills of materials (BOMs) without access to real-time intelligence.

Also, close to half (43%) said that their sourcing teams are reactive and follow the lead of the engineering departments. Supplyframe says its research uncovers “persistent challenges and opportunities for elevating digital maturity across new product introduction and procurement processes.”

For example, just 16% of those surveyed reported having some level of collaboration and alignment between engineering and sourcing during design. Less than 10% said that they use a third-party solution that is purpose-built for the electronics industry, and only 1% said they can accurately identify upcoming critical events before they impact their business.

“Investments in digital transformation are rising, and some of the turmoil in the global manufacturing and supply chain arena has stabilized,” said Supplyframe CEO and founder Steve Flagg in a press release. “But this research – which shows companies across sectors rate their digital maturity between one and two on a five-level scale – uncovers persistent challenges and opportunities for elevating digital maturity across new product introduction and procurement processes.”

## Industry-Specific Insights

Breaking the results down by industry—and using a scale of 1-5—Supplyframe says the digital maturity scores of companies in the automotive and transportation industry and the component manufacturing arena were just 1.0. Averages for the high-tech and OEM sector and the industrial equipment space were only slightly higher at 1.3. The average for companies in the life science industry registered a bit north of that at 1.6. And although the aerospace and defense industry fared a bit better, it only landed at 2.1 on the five-level scale.

Moving the needle on digital maturity in electronics may take some work. Supplyframe says more than a third (36%) of electronics industry professionals consider cost, supply,

quality, new product introduction sourcing and technology as significant challenges. “This points both to the broad scope of the challenges facing global manufacturers,” the company says, “and to the dire need for transformation within the entire design-to-source journey.”

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# 7 Things to Know About the EU's Corporate Sustainability Due Diligence Directive

The CSDDD went into effect in May and impacts companies in and out of the European Union. Here are seven important things to know about it.

Any organization that does business in the European Union (EU) is facing some new supply chain-related requirement this year. The **Corporate Sustainability Due Diligence Directive (CSDDD)** went into effect in May, with the goal of raising the bar for environmental and human rights practices in global supply chains.

The ambitious directive represents the most robust attempt to date to manage the risks and impacts of corporate value chains across all supplier tiers. “This feels like a sizable shift from how 99 percent of corporate sustainability teams are operating,” BSR’s Diana Wilkinson told *Greenbiz*.

Here are seven things to know about the new directive and the impacts that it may have on your organization:

**1) What the rules are about:** The new rules will ensure that companies that must comply with those rules identify and address adverse human rights and environmental impacts of their actions inside and outside Europe.

**2) The CSDDD establishes a corporate due diligence duty:** The core elements of this duty are identifying and addressing potential and actual adverse human rights and environmental impacts in the company’s own operations, their subsidiaries and, where related to their value chain(s), those of their business partners.

**3) The focus is on climate neutrality:** In addition, the new rule sets out an obligation for large companies to adopt and put into effect, through best efforts, a transition plan for climate change mitigation aligned with the 2050 climate neutrality objective of the Paris Agreement, as well as intermediate targets under the European Climate Law.

**4) It’s targeted at large organizations:** In its final version, CSDDD will apply to European companies with at least 1,000 employees and \$489 million in annual revenues, which includes about 5,400 companies. It also covers businesses based outside of the EU that generate at least \$489 million in sales in the European market, *Greenbiz* reports.

**5) For now, at least, small companies won’t be impacted:** Micro-companies and small to mid-sized businesses aren’t covered by the proposed rules. However, the directive provides supporting and protective measures for SMEs, which could be indirectly affected as business partners in value chains.

**6) Compliance won’t be cheap:** The costs of establishing and operating the due diligence process may include (but aren’t limited to) transition costs, including expenditure and investments to adapt a company’s own operations and value chains to comply with the due diligence obligation, if needed.

**7) Enforcement strategies vary:** Following the rules on corporate sustainability, due diligence will be enforced through administrative supervision, with member states designating an authority to supervise and enforce the rules, including through injunctive orders and effective, proportionate and dissuasive penalties (in particular fines). Member

states will also ensure that victims get compensation for damages resulting from an intentional or negligent failure to carry out due diligence.

## Leveling the Playing Field

These new EU rules are expected to provide a uniform legal framework and ensure a “level playing field” for companies across the EU single market. Such rules will also foster international competitiveness, increase innovation and ensure legal certainty for companies addressing sustainability impacts. “The CSDDD will steer businesses towards responsible behavior and could become a new global standard with regard to mandatory environmental and human rights due diligence,” the European Commission points out.

The Commission also says that one-third of companies recognized the need to act and are taking measures to address adverse effects of their actions on human rights or the environment, but progress is slow and uneven. “The increasing complexity and global nature of value chains makes it challenging for companies to get reliable information on business partners’ operations,” it adds. “The fragmentation of national rules on corporate, sustainability-related due diligence obligations further slows down the take-up of good practices.”

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BRIDGET MCCREA | Contributor



# U.S. Solar Power Manufacturing Boom is Going Strong

Nearly 12 gigawatts of new solar module manufacturing came online domestically during the first quarter of the year.

The nation's solar industry installed 11.8 gigawatts-direct current (GWdc) of capacity in the first quarter of 2024, according to *U.S. Solar Market Insight Q2 2024*. Created by the Solar Energy Industries Association (SEIA) and Wood Mackenzie, the report estimates that total U.S. solar module manufacturing capacity now exceeds 26 gigawatts annually.

According to SEIA, the utility-scale segment had a “remarkable quarter,” putting 9.8 GWdc of projects in the ground—more than the annual total for this segment as recently as 2019.

Overall, photovoltaic (PV) solar accounted for 75% of all new electricity-generating capacity additions in the first quarter of 2024, remaining the dominant form of new generating capacity in the U.S.

The distributed solar segments posted mixed results. For example, residential solar shrank by 25% year-over-year as the segment continued to struggle with high interest rates and the transition to net billing in California. With 1.3 GWdc installed, it was the segment's lowest quarter since Q1 2022, the report explains.

The commercial and community sectors were relatively flat year-over-year, installing 434 MWdc and 279 MWdc, respectively. “The commercial sector is diversifying – newer states are growing but are offset by declines in mature markets,” SEIA says. “Community solar relies heavily on the creation of new state programs and policies to generate growth in new markets.”

While there's been progress on legislation in several states, SEIA says new policies have been “slow to cross the finish line.” Furthermore, the promise of future market growth in California was impacted by a recent decision by the California Public Service Commission (CPUC) to reject a proposed new program.

## Off to a Running Start

According to [Wood Mackenzie](#), the first quarter of the year was the second-best quarter ever for the industry, other than the last quarter of 2023.

“After achieving record installation growth in 2023, we expect the US solar industry to add a similar amount of capacity in 2024,” the company states. “While we do not expect growth this year compared to 2023, the US solar industry will add nearly 40 GWdc of installed capacity, double the market size from just two years ago. Our 2024 outlook reflects mixed trends across segments.”

For example, it expects the residential solar market to shrink 14% year-over-year as California residential volumes decline by nearly 40% due to the net billing transition. While solar-plus-storage installations are on the rise, it adds, this doesn't compensate for the declines in standalone solar. “Overall residential sector growth outside of California is expected to be flat as higher financing rates continue to challenge residential solar sales,” Wood Mackenzie predicts.

## What's Coming Next?

After 23% growth in 2023, commercial solar is expected to increase by 14% this year, primarily driven by growth in California and Illinois. “While this might seem counter to the declines in residential solar installations in California,” the company explains, “commercial solar is experiencing the same dynamics but on a delayed timeline due to longer development cycles.”

Wood Mackenzie says community solar growth will slow to 4% this year after increasing 10% last year. States like Illinois and Virginia are expanding on the community solar front, it adds, but “growth has slowed in more mature markets, and new state programs have been slow to form.”

Finally, the company expects utility-scale solar growth to remain flat in 2024 and 2025. “The pipeline is strong,” it points out, “but buildout is being suppressed by a lack of labor availability, high voltage equipment constraints, and continued trade policy uncertainty, among other headwinds.”

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By SUPPLY CHAIN CONNECT STAFF



# Creating More Resilient Supply Chains

**New industry report highlights the role that diversity plays in today's most resilient supply chains.**

**R**esilience has always played an important role in supply chain management, but it's becoming more important than ever in today's volatile business environment. The global pandemic, subsequent disruptions, labor shortage and ongoing geopolitical turbulence are just some of the high-level issues that have forced companies to increase their focus on supply chain resilience.

A new DHL report shines a light on diversification as a strategy that more chief supply chain officers (CSCOs) should be using in the current environment. In [Supply Chain Diversification](#), the global transportation provider says companies that take a "proactive approach to redefining industry standards" will stand the best odds of reaching their supply chain resiliency goals.

By DHL's definition, supply chain diversification is a proactive approach that finds companies incorporating one or several dimensions into their supply chains to minimize risk. This includes multi-shored supply networks, multi-sourcing, parallel modes of transportation, and concurrent or redundant logistics operations.

"The events of the last years have shown us the importance of resilient supply chains and companies adapting their global supply networks accordingly," DHL's Katja Busch said in a [press release](#). "At DHL we are committed to supporting our customers in staying resilient in a sustainable way by providing tailored solutions, sharing best practices, and facilitating collaborative initiatives."

## Steps to Better Resiliency

Supply chain diversification has already become a popular theme in supply chain management, and for good reason. It's an essential strategic lever for building resilience, enhancing customer centricity, driving profitability, improving sustainability and gaining a competitive advantage.

"Supply chain resilience holds utmost importance in ensuring the attractiveness and viability of global trade," DHL's Yin Zou said in the report. "For businesses, the diversification of supply chains to adapt to the evolving global economic landscape, mitigate disruptions, and maintain seamless operations is a cornerstone of sustainable long-term economic success. Key areas include sourcing locations, partners, transportation mode shifts and additional logistics infrastructure."

Here are four approaches that DHL advises companies to use when working to diversify and shore up their global supply chains:

- **Leverage the power of multi-shoring.** Spread manufacturing and supplier locations across different regions or countries to mitigate risks. This includes duplicating manufacturing capabilities and using the same supplier in different locations.
- **Expand your manufacturing and supplier networks.** Expand the network to include redundant suppliers and manufacturing capacities to address financial and operational risks.
- **Don't limit your transportation modes.** Utilize multiple transportation modes simultaneously, covering all stages of transport—including first mile, long haul and last mile—to diversify routes and reduce risk.
- **Broaden your logistics operations.** Expand logistics infrastructure to include additional functions like hubs, warehouses and distribution centers. This may involve adding redundant capacity nearby and outsourcing certain logistics activities for diversification.

## Continuous Management and Improvement

In its report, DHL also provides some action steps that companies can take on their path to better supply chain resiliency. For example, it tells organizations to start with a comprehensive map of their existing supply chain to ensure a high level of transparency. Then, conduct an analysis of the "level of diversification" based on the four points outlined in the previous section.

The next step is to chart all supplier locations, including company-owned manufacturing facilities and ideally down to tier 3 suppliers. "Identify key customer locations and evaluate the company's current capacity to supply main markets," DHL advises in its report. Identify and assess key suppliers, partners and manufacturing facilities. Analyze the company's dependency on each and its ability to supply essential parts, products and services.

To best determine a desired level of supply chain diversification, define the objective in terms of diversification in alignment with the company's overall strategic goals. For example, consider the most common benefits of diversification, including customer-centricity, agility, sustainability, resilience and profitability. "It's also imperative to remember that supply chain diversification is not a 'set-and-forget' endeavor," the company adds, "[and that it] demands continuous management and improvement."

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# Effective Inventory Management Strategies and Technologies

Efficient inventory management is vital for any business, as it offers reduced costs, minimized stockouts, better cash flow management, higher customer satisfaction and improved decision-making processes.

The products stored in your warehouses and fulfillment centers are essential to keeping businesses thriving, but this only makes smart financial sense if you have what you need—not much more. Otherwise, products will go to waste, and you will spend too much on warehousing space.

Inventory management is all about finding the right balance. It can be the key to juggling supply and demand and getting what you need from your working capital. Let's explore some challenges inventory managers face today and tips for managing stocked items to meet consumer demand while limiting excess stock and preventing stockouts through technology-based tools.

## Ongoing Challenges with Inventory Management

As warehouses and fulfillment centers continue to confront widespread supply chain obstacles, many of these create various challenges with inventory management. Some of these include:

- **Inventory Tracking and Accuracy:** One of many persistent inventory control issues is smooth tracking combined with inventory accuracy. Tracking inventory in real-time is challenging, particularly for businesses with extensive inventories. Inconsistencies between physical stock and inventory records can also cause problems.
- **Managing Inventory Levels and Costs:** Inventory management issues involve balancing inventory quantities against costs. Understocking or overstocking can result in either lost sales opportunities or higher costs.
- **Keeping Up with Market Trends:** Inventory management solutions must align with market trends and consumer needs. For example, fast-changing consumer preferences can impact demand levels for current inventory.
- **Integrating Multi-Channel Solutions:** Integrating inventory has become challenging as consumer preferences change and businesses expand across multiple channels. Cross-channel inventory management (i.e., keeping track of inventory in stores, warehouses, etc.) can be complex.

- **Implementing Sustainable Practices:** More and more consumers want to support businesses with sustainable practices. The challenge for warehouses and distribution centers is reducing waste in the inventory process and finding other ways to minimize environmental damage.

## Mastering Effective Inventory Management in 2024

Efficient inventory management is vital for any business that sells products. It offers a variety of benefits that can impact the bottom line, including reduced costs, minimized stockouts, better cash flow management, higher customer satisfaction and improved decision-making processes. Here are some ways businesses can master effective inventory management in 2024 and beyond:

- **Review and Update Inventory Policies:** Most warehouses and businesses have inventory policies, which might specify how much stock to hold, how items should be stored and methods for re-ordering. These policies should be reviewed and updated frequently to stay in step with the ever-changing market so the business can address challenges and take advantage of new opportunities.
- **Embrace Technology:** One of the biggest trends in inventory management in 2024 is the continued implementation of digital transformation in the warehouse. Examples include:
  - ◇ Warehouse Management Systems (WMS): Serve as the foundation for running a more data-driven and automated warehouse. A WMS can track inventory, predict demand fluctuations, enhance supply chain visibility and personalize the customer experience.
  - ◇ RFID Tags: While many warehouses still use barcode technology, RFID tags are expanding due to the benefits of the solution. RFID tags can reduce errors, lower costs and improve efficiency in inventory management.
  - ◇ Robots and Automated Guided Vehicles (AGVs): These solutions are increasingly used in warehouse operations, particularly for repetitive tasks like storing and retrieving inventory.
- **More Data Sharing:** One lesson learned from global supply chain challenges over recent years is that siloed data creates more confusion and bottlenecks. To improve inventory management efficiency, many companies are now sharing data, eliminating these siloes internally, as well as sharing data with business partners more openly. You can make more informed inventory management decisions when you can see what's happening with a manufacturing or shipping partner.
- **Use Distributed Inventory Management:** With the pandemic, many businesses have discarded the idea of

just-in-time inventory management, even though it can be the most cost-effective and efficient when it works as designed. Instead of stockpiling massive amounts of inventory, some businesses embrace a different strategy—distributed inventory management. By storing inventory at smaller, distributed local warehouses and some brick-and-mortar stores, sellers can fulfill orders at locations closer to their customers. This can reduce inventory management costs and improve customer experience via faster shipping times.

- **Encourage Sustainability Initiatives:** With growing environmental concerns and changing consumer preferences, warehouses are beginning to prioritize sustainable practices. In the coming years, expect to see an increase in more energy-efficient solutions, like eco-friendly packaging, solar panels, LED lighting and waste reduction strategies. Many warehouses and logistics providers will also use more EVs to help reduce carbon emissions.
- **Measure Key Performance Indicators (KPIs):** Supply chain troubles may not be as severe as they were a few years ago, but there are still challenges related to efficient inventory management. The best way for businesses to manage these issues is to establish and use inventory KPIs to properly plan and organize inventory. A few examples include:
  - ◇ **Holding costs:** how much it costs to store unsold inventory
  - ◇ **Lead time:** how long it takes to receive inventory from your supplier
  - ◇ **Stockouts:** products you have that are currently “out of stock”
  - ◇ **Deadstock:** inventory on hand that isn't selling
  - ◇ **Inventory accuracy:** how your actual inventory levels match up with your inventory records
  - ◇ **Inventory days on hand:** the average time it takes to use up inventory on hand
- **Implement Staff Training:** While automation has become increasingly important for warehouses, we're many years away from robots replacing workers. Automation allows businesses to level up their workforce by increasing their knowledge about various business challenges so they can be empowered to use technology to impact overall results significantly.

Effective inventory management is essential to balancing supply and demand and unlocking working capital. It also helps a business deliver a positive customer experience, crucial for business results and success. As we head into the second half of this year, companies will seek more sophisticated inventory management solutions to improve efficiency, transparency and profitability.

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