How can chemical companies thrive amid semiconductor supply chain disruptions?

CAS

A division of the
American Chemical Society

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Semiconductor crisis:
When uncertainty is the only certainty

Global demand for semiconductors is rising, straining the specialized supply chains that power one of the world's most essential industries. For chemical companies, the stakes are especially high.

Semiconductor production relies on a narrow set of ultra-high-purity materials, many of which are derived from rare earth elements and specialty chemicals, with limited alternative sources and stringent handling requirements. Any disruption to the availability, quality, or flow of these materials can ripple across the supply chain, impacting downstream production. For manufacturers, the challenge is clear: seamless operations depend on adaptability and fast decision-making. With market volatility, siloed systems, and limited visibility, operational disruption has become the norm—not the exception.

Is your supply chain built to bend or break under pressure? The difference lies in your command of data.

Data-driven strategies offer a clear path to strengthening operations and ensuring continuity across those essential supply chains. This white paper explores three practical, data-driven strategies chemical companies can use to stay competitive amid semiconductor supply chain challenges:
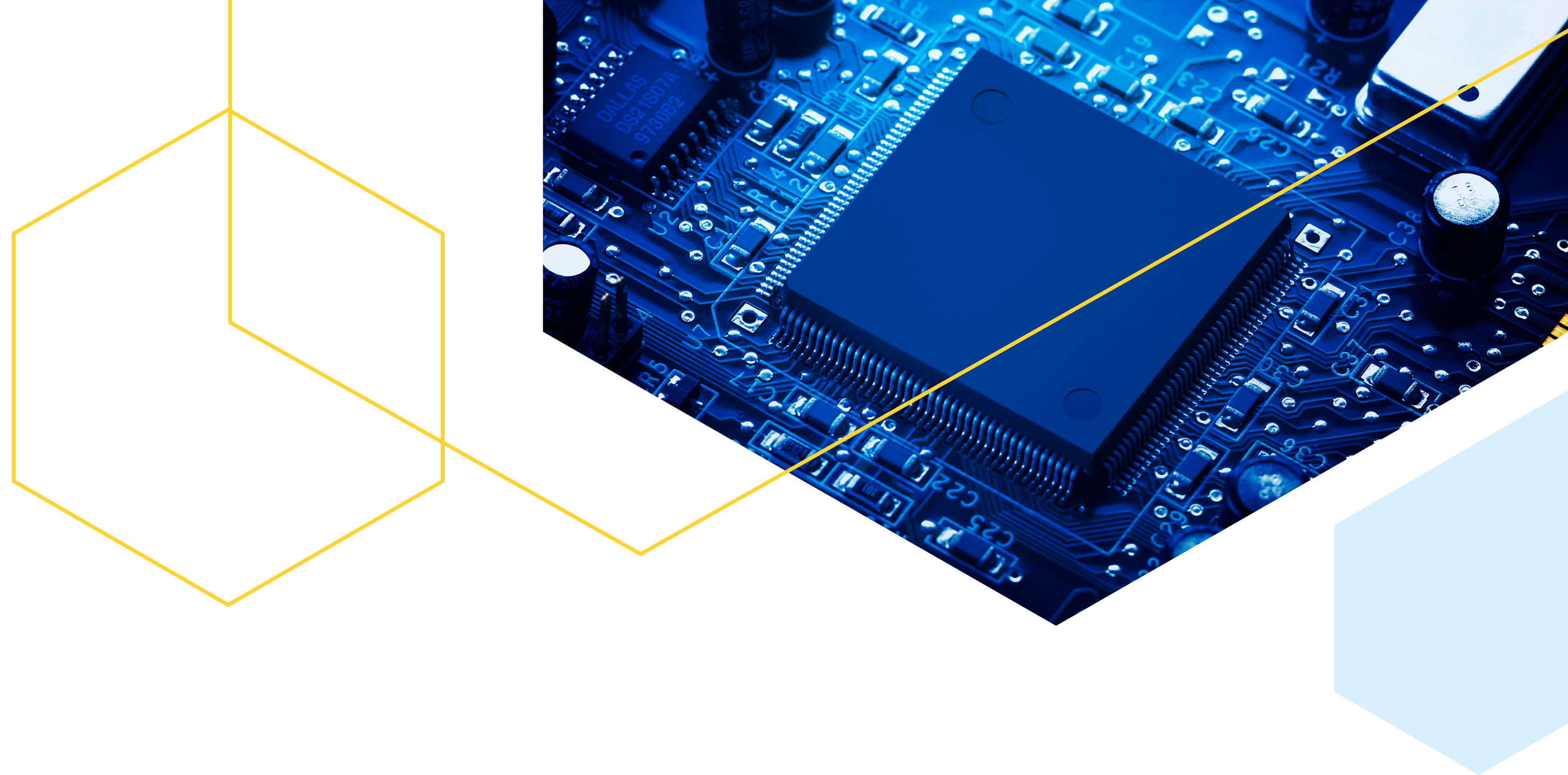
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Identify risk patterns through historical data.	**Make faster decisions using real-time insights.**	**Build long-term resilience with predictive analytics.**

Learn from the past: Identify risk patterns hidden in historical data

From hindsight to foresight

For companies navigating complex, high-risk supply chains, historical data offers more than hindsight; it holds the blueprint for operational resilience.

By analyzing historical data, organizations can surface disruption trends and spot patterns that reveal vulnerabilities across upstream suppliers and source materials. These evidence-based insights are essential to informing future decisions, yet without a clear data strategy, their value remains untapped.

When insights get locked away

Many organizations lack full visibility across the end-to-end value chain, making it difficult to detect where vulnerabilities lie or how disruptions unfold. Disjointed legacy systems further compound the problem, burying critical insights in handwritten notes, siloed spreadsheets, or outdated formats.

Without a clear, connected view of the supply chain, companies struggle to leverage legacy records that could prevent repeat disruptions and guide better decisions.

Connecting the dots: How CAS helps organizations illuminate supply chain risks

Turning scientific data into actionable, evidence-based insights takes structure, strategy, and deep knowledge management expertise. CAS helps organizations unlock the power of data through custom frameworks and supply chain mapping strategies designed to bring order to the information chaos.

The result is a robust foundation built to uncover hidden disruption patterns, expose root causes and transform scattered records into strategic signals—fueling smarter decisions and more adaptable supply chains.
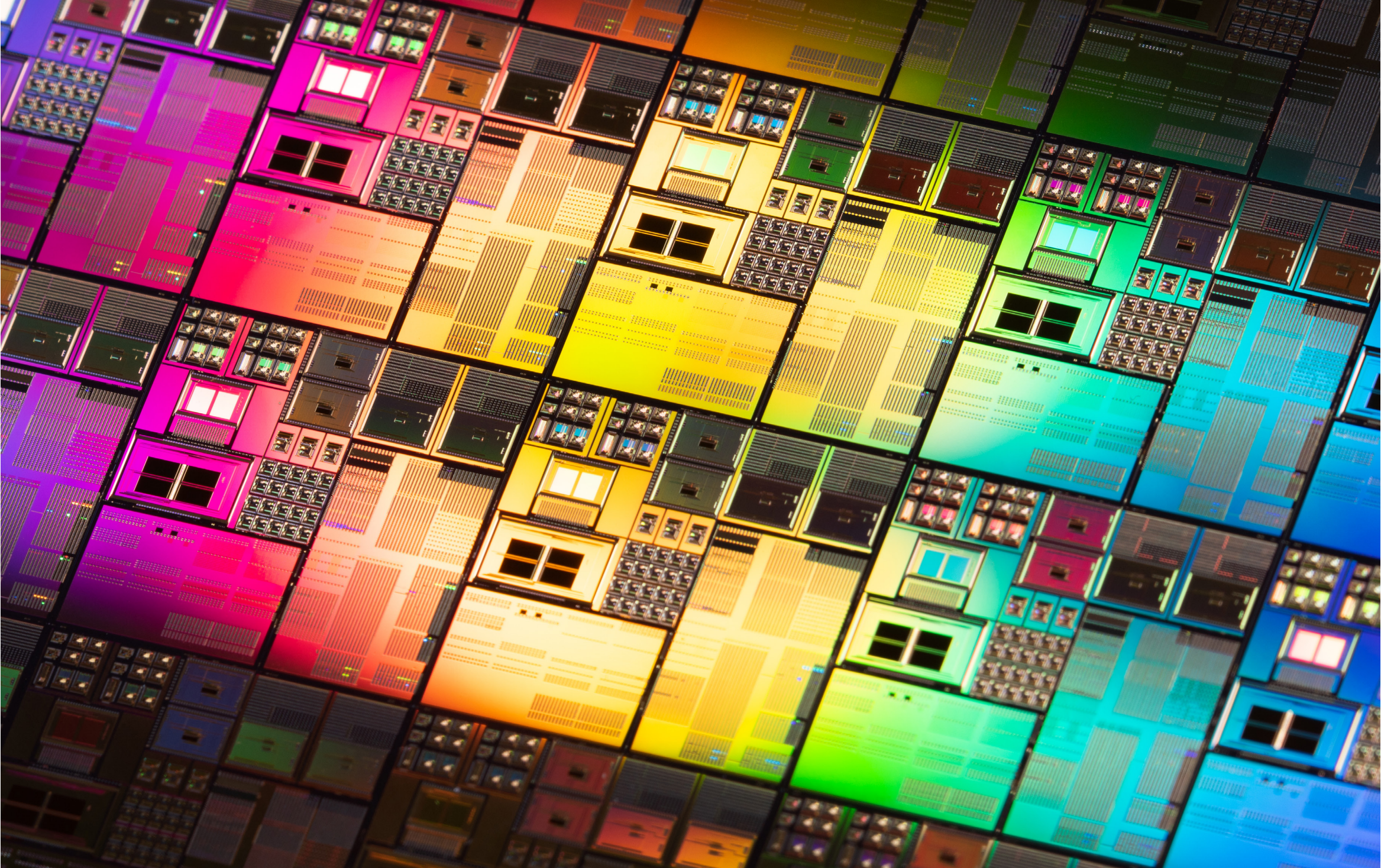
CASE STUDY: Overhauling data processes to unlock insights with CAS

A leader in chemical logistics manages billions of pounds of regulated materials each year. To maintain compliance across global supply chains, the company developed proprietary software. However, maintaining up-to-date information posed a serious challenge with evolving chemical regulations. The organization partnered with CAS to overhaul its data process and curate and verify regulatory data for more than 100,000 compounds to be integrated into its proprietary system.

The result: A reliable source of regulatory insights allowing the company to respond faster to changes, reduce compliance risk, and improve supply chain resilience.

Key takeaway:

Historical data is more than a record—it's an untapped source of insight that can expose repeat disruptions, supplier dependencies, and sourcing vulnerabilities specific to the high-purity materials required in semiconductor manufacturing.

With the right strategy, chemical companies can turn legacy records into fuel for more resilient, proactive supply chains.

With CAS data specialists, you can quickly:

Digitize	Standardize	Connect
Legacy documents and disparate data sources to streamline information integration and unlock critical insights.	Formats, scientific terminology, and language to ensure data interoperability and enable smarter analytics and scalable insight generation.	Disparate databases and siloed systems to establish a unified data foundation for confident analytics and reliable insights.

Decide with speed: Secure operational insights for confident action

In a global environment shaped by fast-moving market shifts and supply disruptions, responding quickly and confidently is critical. For chemical manufacturers, agility often determines whether operations continue smoothly or grind to a halt.

From shifting material input to adjusting to meet new regulatory demands, pivoting quickly demands insight-driven intelligence to support decisions and ensure operational continuity. Too often, critical data is fragmented across systems, data sources, or outdated reports, slowing response time and increasing operational risk.

From fragmentation to resilience: What vulnerable supply chains truly need

Unified operational insight

Siloed data slows response time. A unified operational view of the upstream supply chain gives chemical companies the oversight needed to react quickly and confidently.

Through comprehensive data integration, organizations can connect critical substances —including high-purity solvents, etchants, photoresists, and specialty gases—to process requirements, regulatory considerations, and supplier information to gain deeper visibility into their operations and safety and sustainability risks.

Enhanced supply chain visibility

Speed is essential, but speed without clarity creates risks. Chemical companies need an accurate and continuous overview of their pipelines, supplier status, and regulatory changes to:

- Adjust sourcing strategies quickly to avoid critical material shortages and protect production schedules.

- Identify vulnerabilities across the supply chain, including critical minerals, substances with known environmental hazards, and materials being phased out.

- Pivot rapidly to stay compliant with the latest guidelines and avoid costly regulatory breaches.

- Identify disruption signals early to act fast and minimize operational downtime.

CASE STUDY: CAS Custom Services enables faster purchasing with a custom feedstock intelligence platform

A multinational consumer goods company needed a better way to forecast raw material pricing and support its purchasing teams with meaningful chemical insights. Managing more than 4 million tons of raw materials annually, the company struggled to trace substances to their feedstock origins - a task requiring months of manual work.
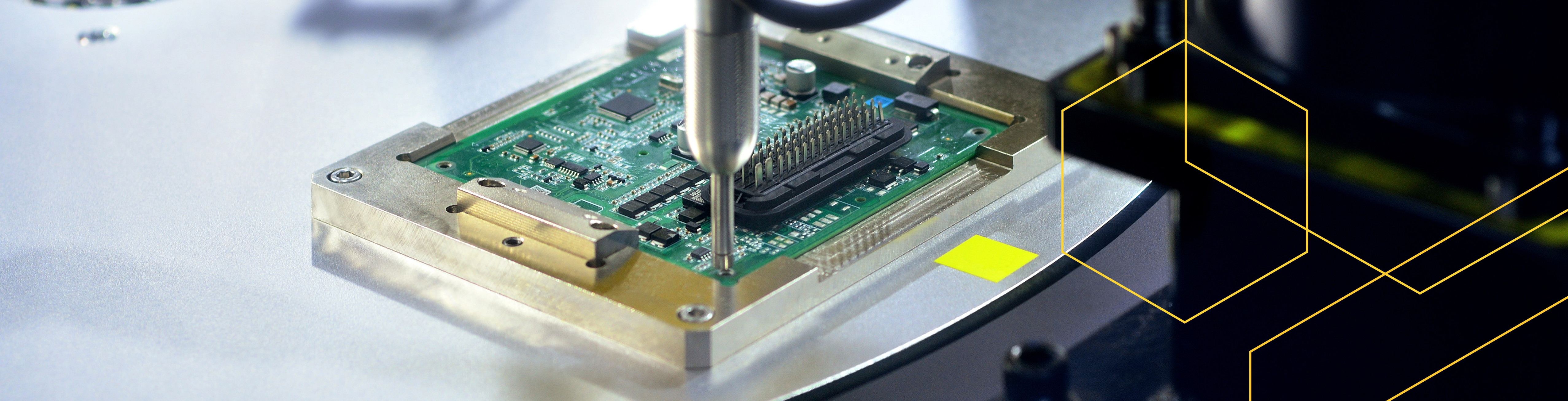
Partnering with CAS, they developed a custom feedstock intelligence platform. CAS data scientists mapped more than 6,000 substances and filled in critical synthesis routes, allowing the company to connect price trends with chemical composition. The solution was integrated into a digital tool for purchasing teams to use in real time.

The result: Faster decision-making, confident contract negotiations, and greater purchasing power across a complex global supply chain.

Key takeaway:

In a rapidly evolving semiconductor industry, connected data empowers chemical companies with real-time operational insight, enabling them to adapt quickly to safeguard critical material sourcing, maintain compliance, and mitigate disruption risks.

Closing the visibility gap: How CAS helps organizations act fast and confidently

Comprehensive data integration

From tracing raw material inputs to downstream products, we help you integrate internal and external data to gain reliable operational insights that support end-to-end visibility across your supply chain.

Custom supply chain analysis and risk management

We help you uncover emerging supply chain risks to reduce disruption, improve agility, and maintain business continuity.

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Anticipate what's next:
Master predictive analytics for long-term resilience

In the volatile semiconductor market, success requires more than fast thinking: it relies on forward-looking strategies, scenario planning, and proactive risk mitigation to anticipate what's next and act before disruption strikes.

Predictive analytics enables companies to simulate risk scenarios, forecast material constraints, and test response plans before issues arise. Without accurate, structured, and representative inputs, models can distort insights and lead to poor decisions.

It all comes down to data

Predictive models are only as reliable as the data used to build them. Without quality input, even the most advanced analytics can lead decision-makers astray.

The wrong data can quickly turn powerful tools into liabilities:

– **If trained on biased or unrepresentative data,** predictive models can generate skewed insights that fail to deliver accurate scenario modeling or guide strategic decisions.

– **If fueled by poorly structured data,** algorithms may miss critical insights, fail to anticipate supply chain disruptions, and undermine proactive risk management strategies.

Built for success: How CAS powers smarter models and reliable outputs

To build accurate and reliable predictive models, organizations need more than off-the-shelf data—they need the right data. We help organizations strengthen their forecasting capabilities by providing data solutions tailored to their needs.

We support advanced data analytics with:

- **Scientist-curated resources from the CAS Content Collection™** to help you expand your internal datasets, improve pattern recognition, and enhance prediction accuracy.

- **Custom-curated datasets designed to help you reduce information noise,** eliminate selection bias, and focus on company-relevant insights.

CASE STUDY: Overhauling data processes to unlock insights with CAS

A diversified chemical company set out to enhance its R&D workflows with AI models. While the ambition was clear, the data wasn't. Internal datasets lacked the specificity to train accurate predictive models, and standard external sources were too broad to support targeted innovation.

The company partnered with CAS to build custom training datasets, drawing from expertly curated scientific literature and patents to fuel more precise and reliable predictions.

The result: A validated predictive model that accurately generates precise company-specific recommendations, cutting R&D workflow timelines in half.

Key takeaway:

Predictive analytics powered by high-quality data allows companies to anticipate market fluctuations, logistics challenges, and disruptions in critical material sourcing to proactively adjust risk management strategies and minimize supply chain disruptions.

Data-driven resilience:
The competitive edge in the
semiconductor industry

Resilience isn't just about responding to today's disruptions. It's about building the infrastructure to navigate tomorrow's market volatility and inherent supply chain challenges. Nowhere is this more critical than in the semiconductor industry, where demand is high, complexity is deep, and vulnerabilities are constant.

At CAS, we help organizations transform unstructured data into actionable intelligence. Whether understanding historical patterns, connecting siloed management systems, or training high-accuracy predictive models, we provide chemical companies with custom data-driven solutions to turn information into insights and insights into action.

Resilience is about building ahead, and it starts with the right data in the right hands.
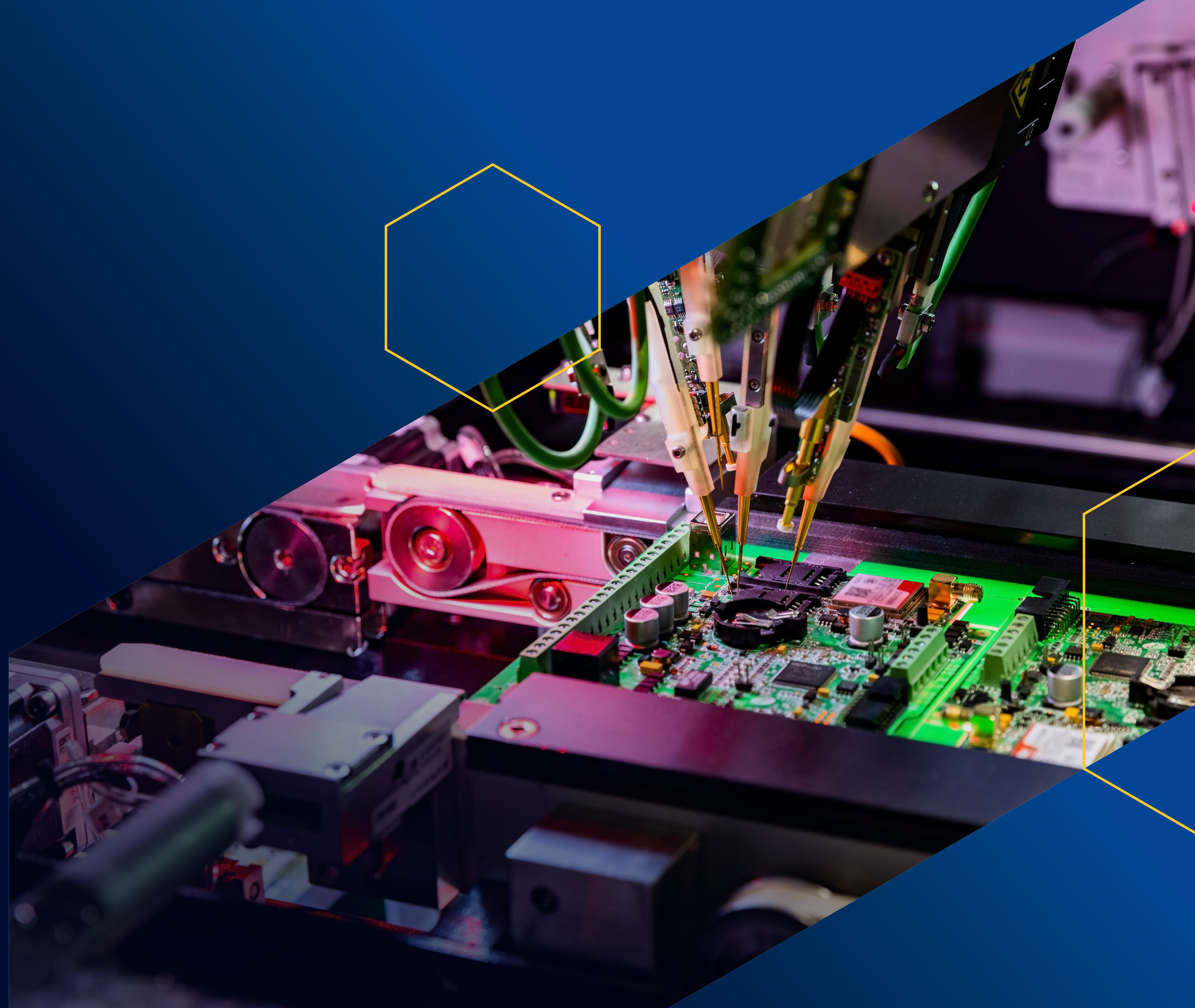
CAS connects the world's scientific knowledge to accelerate breakthroughs that improve lives. We empower global innovators to efficiently navigate today's complex data landscape and make confident decisions in each phase of the innovation journey. As a specialist in scientific knowledge management, our team builds the largest authoritative collection of human-curated scientific data in the world and provides essential information solutions, services, and expertise. Scientists, patent professionals, and business leaders across industries rely on CAS to help them uncover opportunities, mitigate risks, and unlock shared knowledge so they can get from inspiration to innovation faster. CAS is a division of the American Chemical Society.

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