



e2open[®]

INDUSTRY BRIEF

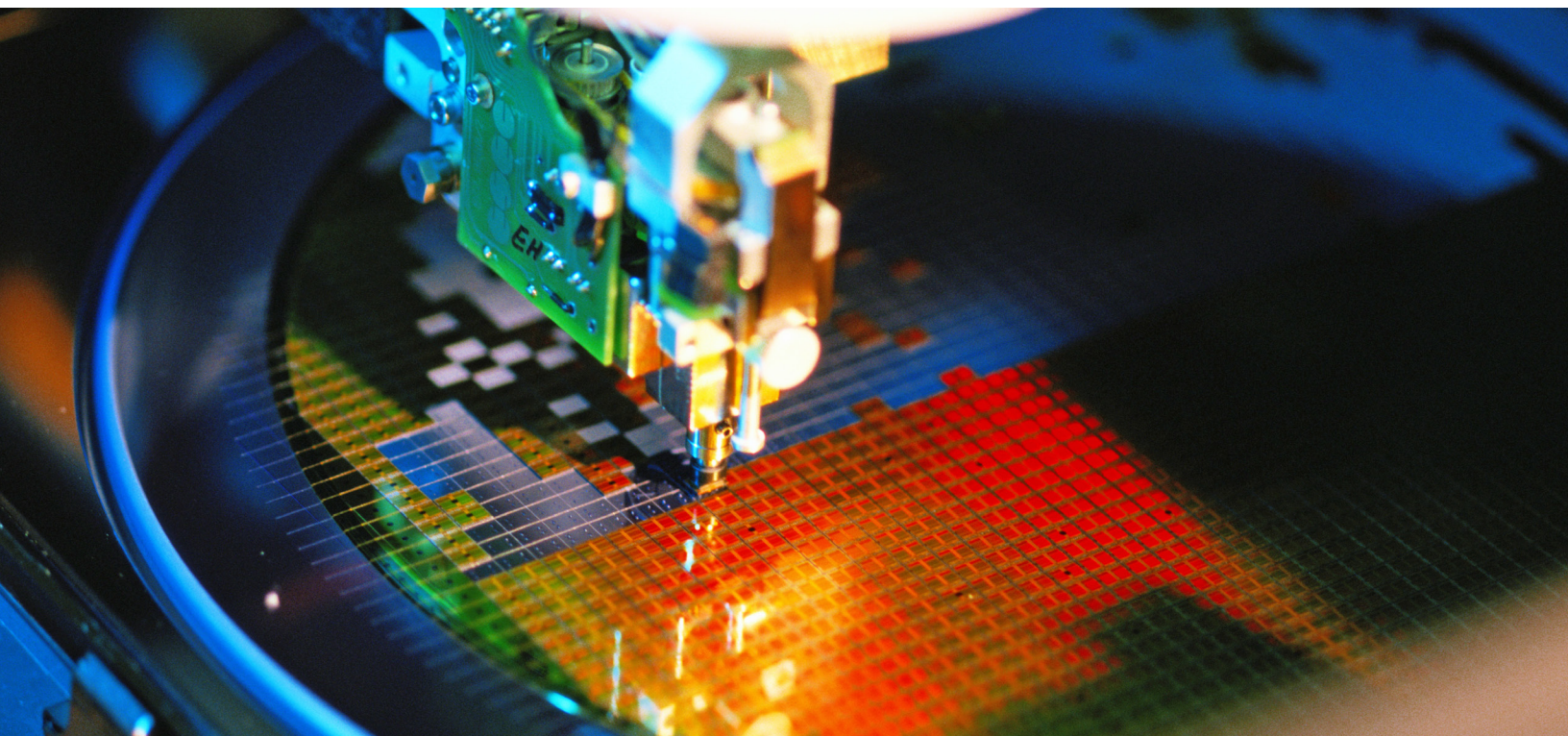
Semiconductor Manufacturing Industry

In an industry with the explosive demand for semiconductor chips, manufacturers are challenged to maximize the use of limited production capacity, keep quality and yields high, respond to both governmental investments in the industry and changing regulations, bring new products to market quickly, and reach potential profits.

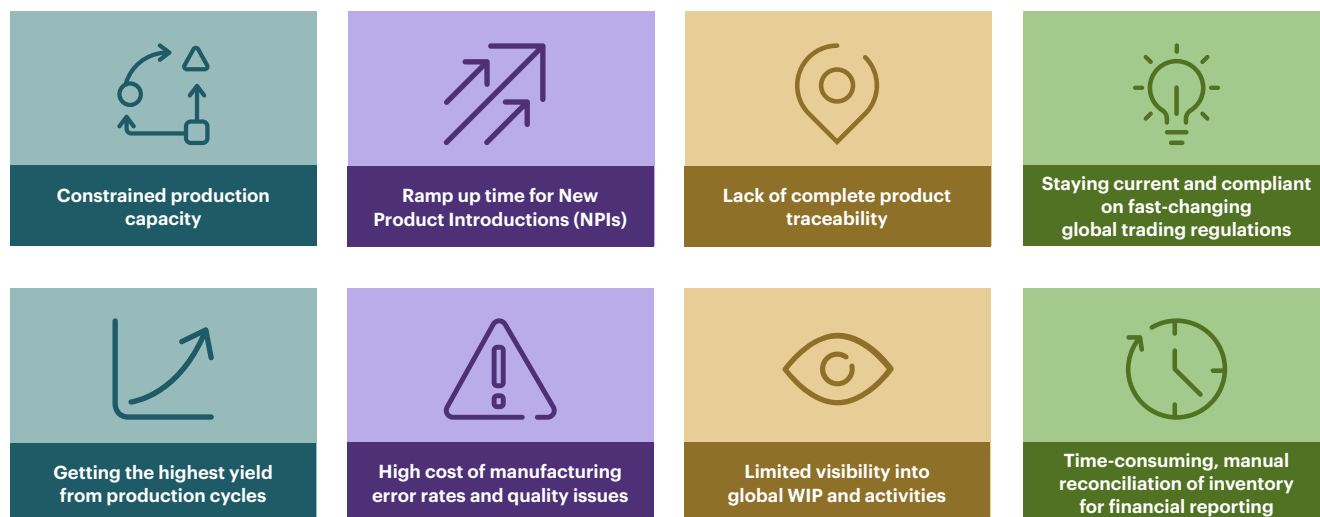


State of the semiconductor manufacturing industry: balancing extreme demand for chips and limited capacity

Semiconductor chips are growing more crucial every day. Yet despite unprecedented demand, there are shortages – across many industries that rely on these critical components. To respond to the combined opportunity and challenge, the semiconductor manufacturing industry must adapt in many ways. Industry leaders are already engaging in digital transformation and taking market share from companies that lag behind. Without an investment in this type of transformation, the growing demand for chips will not be met and shortages will become the norm—and your organization will miss out on potential profits.



Semiconductor industry experiences challenges with new complexities

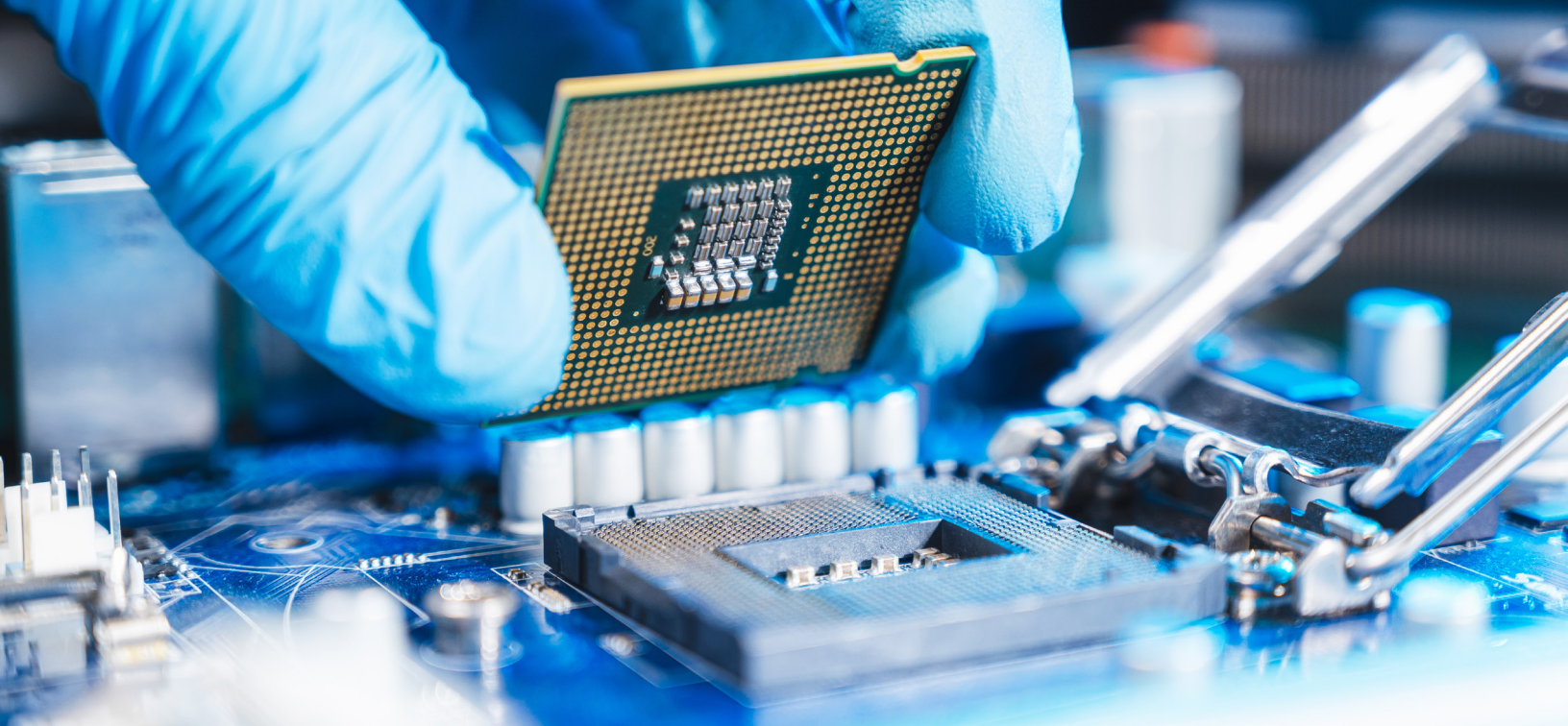


Urgent Needs: Securing Capacity and Speeding Time-to-Market

To meet growing demand, manufacturers must build or secure capacity for a manufacturing process that has many, many steps, requiring lot- and batch-level tracking and visibility into “work in process” from beginning to end. The time required to ramp up a manufacturing process is an added concern when new product introductions are rapidly increasing in volume. Time-to-market is the driver for realizing profits. Visibility and data-sharing across internal and external manufacturing are required to solve issues faster and minimize cost impacts when challenges arise, both of which can help companies realize margins sooner.

Fabless Production Model Growth

Many companies that have thrived with in-house manufacturing are moving toward a fabless, outsourced model, or leveraging a combination of the two. Along with the advantages of this transition come the challenges of establishing the same visibility and control with external systems as internal ones. Compliance and quality are just as important—and more difficult to attain—for outsourced operations as internal systems. The ideal scenario is to gain a holistic view of the entire multi-enterprise business with integrated operations, manufacturing, and quality systems, regardless of whether manufacturing takes place within or outside your four walls.



Leveraging Industry Investments and Managing Changing Regulations

Given the concentration of semiconductor chip production in the Asia-Pacific region, governments are making investments to create capacity and build resiliency in supply chains in their regions around the world. Over recent years, diversification has become a priority for semiconductor manufacturers, exploring options for adding new suppliers to lower risk. Realization of increased production from governmental funding for new production facilities will take time – it takes years to build these complex structures. Simultaneously, new global trade regulations add to the challenges for manufacturers, and keeping current and compliant with the ongoing changes adds to the overall business complexity.

If investment by capital markets is any indicator of expected growth, the semiconductor industry is certain to continue its growth trajectory, indicating collaboration is taking on greater meaning as companies prepare to address new markets and customers. More partnering across the value chain around opportunities such as application-specific solutions will advance the growth of the industry and even further necessitate connectivity with all supply chain trading partners.

Complexity issues call for a more connected supply chain



Structural Challenges of Today's Supply Chains

NOT Integrated	Disconnected processes, systems, applications, and data
Poor Data	Late, inaccurate, and incomplete data leading to indecision
Siloed Decisions	Misaligned priorities leading to disconnected and uninformed decision-making
Reactive	A series of hasty decisions and delayed responses resulting in poor outcomes



The Modern Supply Chain

Integrated	Unified supply chain technology platform and interconnected partner network
Harmonized	Timely, accurate, and complete data enabling decision grade insight and information
Connected Decisions	Real-time decision-making capabilities and automated responses
Proactive	Business transformation and a supply chain working together as one

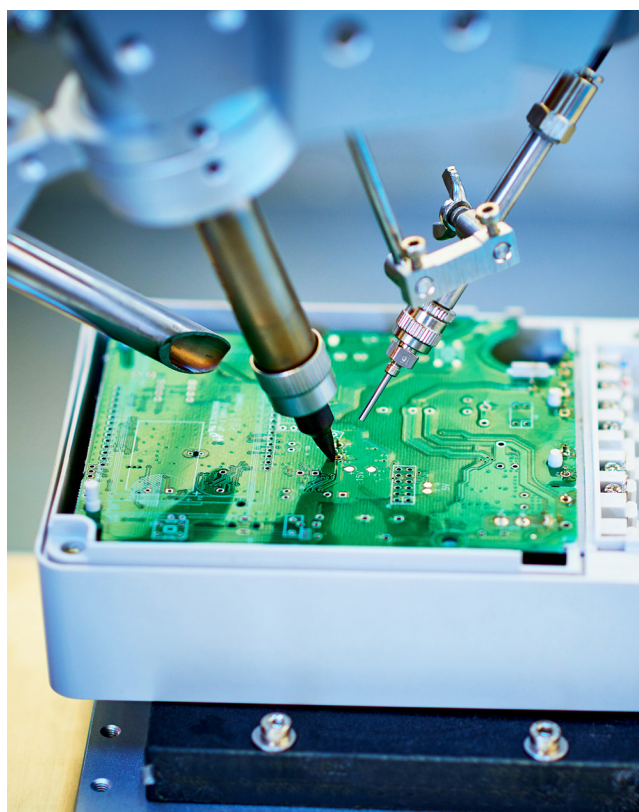
What if you had a
connected supply chain?



Agility to Adapt to Strategic Business Moves

Can your supply chain adapt quickly to support new strategic business decisions?

Many semiconductor manufacturers that have thrived with in-house manufacturing facilities are moving toward a fabless, outsourced model, or leveraging a combination of the two. Outsourcing brings the benefits of greater production flexibility and cost reductions. Along with the advantages of this transition, come the challenges of establishing the same visibility and control with external systems as internal ones. Compliance and quality are just as important—and more difficult to attain—for outsourced operations as internal systems.



Application-specific semiconductor chip production continues to provide growth areas for manufacturers who may partner with customers to co-invent new designs for integrated circuits. Consider the application-specific circuits that power autonomous driving in the newest era of vehicles from the automotive industry.

Merger and acquisitions (M&A) is another business growth strategy that brings another supplier ecosystem into the fold, requiring the complex integration of the acquired company's internal and external systems into your supply chain. M&A may advance a company's strength in a certain market or aid in branching out into adjacent markets. In a growth industry like semiconductor manufacturing, all these tactics will demand agility in your company's supply chain. The ideal scenario is to gain a holistic view of your entire multi-enterprise business with integrated operations, manufacturing, logistics, and quality.

Reinvent your supply chain now for new business growth and supply chain readiness.

A connected supply chain that can adapt quickly to changes requires a platform designed to manage data coming from disparate third parties – including both existing and newly acquired internal and external systems. It is inherently challenging to merge, index, and analyze data across disparate systems, yet e2open's canonical-based integrated data model is designed to normalize disparate data from across all partners and ecosystems. The data streams are harmonized using artificial intelligence (AI) and made decision-grade, providing a single source of truth for all parties and applications.

The ability to quickly onboard these new suppliers, outsourced manufacturers, and other trading partners is a factor that increases your supply chain agility. E2open's comprehensive integration capabilities minimize the time and effort to integrate with new entities up and down the supply chain, so semiconductor manufacturers can focus on the production of chips and bringing new product introductions to market faster.

Realize Profits Faster on New Product Introductions (NPIs)

How quickly do you ramp up your manufacturing production for NPIs?

Smartphones, tech devices, homes, appliances, automobiles – there is seemingly an endless list of “smart” products that need semiconductor chips – and they keep getting smarter which requires new, advanced designs for even better chips. Each of these cases, and many more, drive explosive industry growth and requires efficient processes to rapidly bring these NPIs to market.

The time required to ramp up a manufacturing process is critical for semiconductor manufacturers when NPIs are increasing in volume. Time-to-market is the driver for realizing profits. Manufacturers know that the highest margins for these chips are early in the product’s lifecycle – right at product launch. The new chips may be the leading edge for a short while – but only until others catch up, manufacture similar chips, and they become a commodity.

Reduce NPI cycle time and deliver high yields for the greatest profit.

Visibility and data-sharing across internal and external manufacturing are required to solve issues faster and minimize cost impacts when challenges arise in production, both of which can help companies realize margins sooner. With a fabless, outsourced model, manufacturing your new products relies on the processes of the contract manufacturer (CM). Producing semiconductor chips is like tweaking a recipe along the way to get it just right. It involves collaborating on initial specifications, monitoring production, correcting for errors, and refining the specification – all with the goal of fast time-to-market, quality product, and high yield.



To get the highest percentage of non-defective chips – the yield – e2open provides semiconductor manufacturers the detailed history of the manufacturing process associated with every lot and batch, so they can see how and where the product was produced and tested at every step, the materials used, and the quality records for each lot. By proactively identifying issues early in the production cycle, they can reduce both scrap costs and delays while further addressing issues stemming from poor quality and less-than-optimal production.

Quickly ramping up the production of NPIs requires streamlining the entire process with continuous visibility into all production facilities, monitoring the process, and tuning the process along the way to shorten the production cycle time and drive down costs. In a fabless, outsourced model where you rely on contract manufacturers, a connected supply chain is critical to driving the needed collaboration and communication.

Clear Communication to Internal and External Production Sites

With manufacturing processes at multiple internal and external facilities, how do you keep everyone on the same course when changes to manufacturing instructions occur?

The increased complexity from the rapid expansion of the supply chain ecosystem through M&A or organic growth requires effective communication throughout the process to include the accurate and timely transfer of manufacturing, test, and quality instructions. The accurate transfer, tracking, and validation of manufacturing and testing instructions help you improve quality and significantly reduce product introduction cycle times.

Introduce new products faster with manufacturing and testing instructions accurately and immediately shared across all production facilities.

Efficient transfer of instructions from chip design to manufacturing streamlines the exchange, maintenance, and archiving of design documents, manufacturing instructions, and quality test specifications. Centralized management of manufacturing and testing instructions lets companies seamlessly transition from design to mass manufacturing for both internal and external production, improving quality and productivity while accelerating product ramp-ups.

Only on a connected supply chain does this clear, immediate communication exist with all internal and external partners that must stay aligned on instructions, processes, and changes. E2open provides semiconductor manufacturers with a platform for communication across a connected supply network.

End-to-End Quality, Traceability, and Orchestration

Do you have the processes and technology in place to respond quickly and precisely to quality defects?

In the semiconductor industry, many different suppliers have a role in the manufacturing of a single chip, and the complexity of maintaining quality is exacerbated by the insurgence of outsourcing production. Manufacturers must be able to see and manage any quality concerns quickly and efficiently, with pinpoint accuracy of all defected materials or components, so they can minimize the impact of the defect and keep yields high.

With semiconductor manufacturing, if you can't trace and control inventory at the lot and batch level, you can't reduce the overall cost of defects. And if you don't have the entire supply chain connected, you can't easily orchestrate the recalls you need to make throughout internal, external, and logistics networks.

Access complete, accurate genealogy data to trace the production process, collaborate on issue resolutions, improve quality, and minimize risk.

Semiconductor manufacturers can automatically capture all steps that occur during production across all stages and nodes, including manufacturing, assembly, test, packaging, and circuit integrations before it is sent for finished product assembly – be it computers, smartphones, automobiles, medical technology, home appliances, or smart home devices.

With a system that uses an underlying data model to translate these steps into traceable, digital representations, you can analyze the whole supply chain. When quality issues arise, you have data to determine the root cause, track any affected products, and efficiently orchestrate a recall across all suppliers. With this digital chain of custody, you have a complete multi-level lot genealogy tree, along with commonality analysis, enabling you to identify defective components from supplier to finished goods.



Accurate Inventory Valuations and Contract Payments

Is your process for summarizing and reconciling inventory values to feed your ERP system grueling, and time-consuming? Are you sure you are not overpaying invoices?

At any point in time, semiconductor manufacturers will have many production processes, at varying stages of completion, and at numerous internal and external facilities – around the globe. Semiconductor manufacturing is an extremely complex environment composed of thousands of steps. To meet financial reporting requirements, a true and accurate valuation of inventory must be calculated, taking a significant amount of time and manual process to trace work-in-process across all operations.

Additionally, when manufacturers attempt to accurately calculate service-based costs, they often experience invoicing errors and inappropriate expenses. Again, driving up the time and expense of a manual process to reconcile supplier invoices.

Automate the valuation process with an inventory 'system of record' and reduce supplier overpayment.

Companies are required to accurately report the value of their inventory. For semiconductor manufacturers, the challenge of tracking the activity of all chips being produced – a whirlwind of many process steps, tracking volumes of lots where the lots may split and then recombine – e2open tracks all this activity to produce an automated accurate value. And more importantly, track not only internal production, but that outsourced to contract manufacturers. It is critical to have accurate data to feed into your ERP system, and e2open is helping companies do just that, becoming the inventory 'system of record'.

Additionally, efficient management of contracts and accurate calculation of service-based costs can help reduce both invoicing errors and inappropriate expenses. Automatically capture and digitize all service-based costs incurred by all suppliers, contract manufacturers, and logistics partners and validate them against the contracts to eliminate the payment of incorrect charges. Prevent overpayments, and leverage data-driven insights to improve negotiations with partners, while technology and automation reduce workloads and help ensure every invoice is correct before payment.

Automated Compliance to Mitigate Risk with Ongoing Regulations Changes

What's your plan for immediate compliance with ongoing changes to regulations that impact semiconductor manufacturers?

The regulations landscape is fluid. Today's landscape isn't like yesterday's, and it won't look the same tomorrow. Geo-politics are driving regulatory changes impacting the semiconductor industry significantly – even risks to national security may be at stake. Global trade isn't getting any easier. We expect changes to continue, so it is a matter of being prepared to know when and what the changes are, and ready to comply immediately.

It is a significant task to confirm each transaction is properly checked against the latest regulations. This process is often manual, time-consuming, and error-prone – increasing your chances of running afoul of regulations and incurring significant and costly consequences. Risks for semiconductor manufacturers go beyond the fines and penalties associated with non-compliance. Critical to your brand and reputation is staying out of the news as the company was cited for non-compliance.

Stay compliant with up-to-date regulations data and automation of all aspects of global trade to avoid fines and penalties, protect your reputation, and mitigate risk.

When regulations such as those restricting semiconductor chips and equipment for chip production from being shipped to specified regions around the world, compliance with these regulations is complex and requires immediate attention to fully understand and implement. Regulation changes may impact multiple trading lanes, increasing the potential risks when conducting international business.

E2open's global trade platform is backed by the world's most comprehensive database of regulations and business rules, covering 98% of world trade. A team of experts is updating the system daily and automatically applies these rules to all cross-border transactions, mitigating non-compliance risks such as fines, loss of trade privileges, and criminal liability.

The frequency and volume of regulations changes impacting the semiconductor industry demand automation and reliance on a dedicated knowledge source with up-to-the-minute updates. A global trade platform becomes your mission-critical system to lower your risk profile – and e2open helps you confidently manage trade compliance risk no matter where you do business.





Enhanced Logistics Visibility

How are you managing visibility and costs of logistics, whether shipping equipment to production facilities or semiconductors flowing through the numerous steps and moves throughout production?

Semiconductor manufacturers have relied extensively on air transport – often expediting shipments – to get chips through production, assembly, and into finished consumer products. Manufacturers, including contract manufacturers, ship equipment to production facilities that can utilize other modes that are less costly. Various risk events, such as weather events or port closures, were impossible for most manufacturers to predict, leaving them with ineffective or costly means of resolving the problems when these disruptions continued to occur.

With the right technology, providing visibility into transport options, costs, expected times of arrival, and updates for potential risk events, semiconductor companies could move shipments on the water when that lower-cost option is a viable choice, and leave

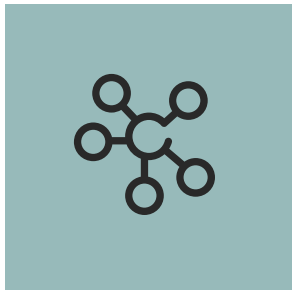
goods that need to be expedited or travel faster on air transport. Visibility across the supply chain must play into this scenario, bringing purchase order data and customer commitments into the decision-making process to make the best logistics business decisions.

Use real-time data and visibility with your logistics management to drive time-to-market and profitability goals.

Logistics visibility provides transportation management stakeholders with a reliable, real-time status of goods on the move for all modes, all regions, and all legs of a shipment – a means to accurately answer the question, “Where’s my stuff?” When powered by e2open’s network, which collects data from global logistics partner ecosystems and analyzes it using powerful, proprietary algorithms, you are informed and able to make optimal decisions in any scenario.

Visibility into risk events, the impacts, and the mitigation options are an integral part of a connected supply chain – and not just a fancy overlay with no actionable data. Dashboards are configured by role allowing individual users to view the information that matters most to them. Data from various applications are synthesized together to help users make the best decision for the entire supply chain, and not accidentally optimize one process at the expense of another.

Why e2open?



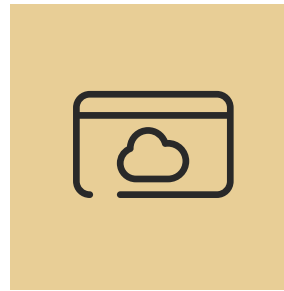
Network

All Ecosystems & Tiers
Always Connected
Trading Partners



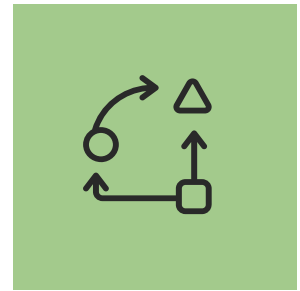
Data

Uniform Decision Grade
Harmonized, Timely,
and Complete



Applications

Unified & intelligent
Holistic Decision Making



Process

Multi-tier & Multi-Enterprise
End-to-End Process
Orchestration

End-to-end visibility and control have long been key challenges to making better business decisions. While the supply chain itself is inherently connected, the processes are inherently siloed. This is due to disparate data sources and disconnected processes and systems across vast supply chain networks.

Enter the pandemic. In a relatively short period of time, we've witnessed unprecedented disruptions in demand, supply and logistics. What was a fairly free-flowing, demand-driven process, became restricted and supply-constrained. Factory shutdowns. Supply disruptions.

E2open is a world-leading provider of networked, cloud-based supply chain technology and services focused on providing supply chain resiliency during supply and demand volatility.

The company's connected supply chain platform and multi-enterprise networking technologies represent a unifying and composable system — a system giving you the ability to see, forecast, act, and advance in the most informed and intelligent manner, optimizing making, moving and selling across the entire value chain when certainty isn't certain.

The combination of an integrated end-to-end platform, best-in-breed applications, and harmonized decision-grade data from a holistic network of four ecosystems comprised of over 400,000 enterprises provide a single source for real-time insight and actionable information across the entire supply chain.

Connected processes and systems provide a secure connection to this decision-grade network data, empowering companies with the visibility and capability to optimize efficiencies and manage supply chain volatility in real time. All of this enables suppliers, manufacturers, transporters, and fulfillment channels across the supply chain to operate as one, optimizing supply, demand, and delivery efficiently and sustainably while the world we live in is in constant motion.

E2open — the value is in our name — an open supply chain ecosystem of record, from planning to execution to sales and fulfillment, providing you next level supply chain efficiencies and a roadmap to business transformation at a pace that is right for you.

E2open. The Connected Supply Chain. Moving as one.™

Network Architecture

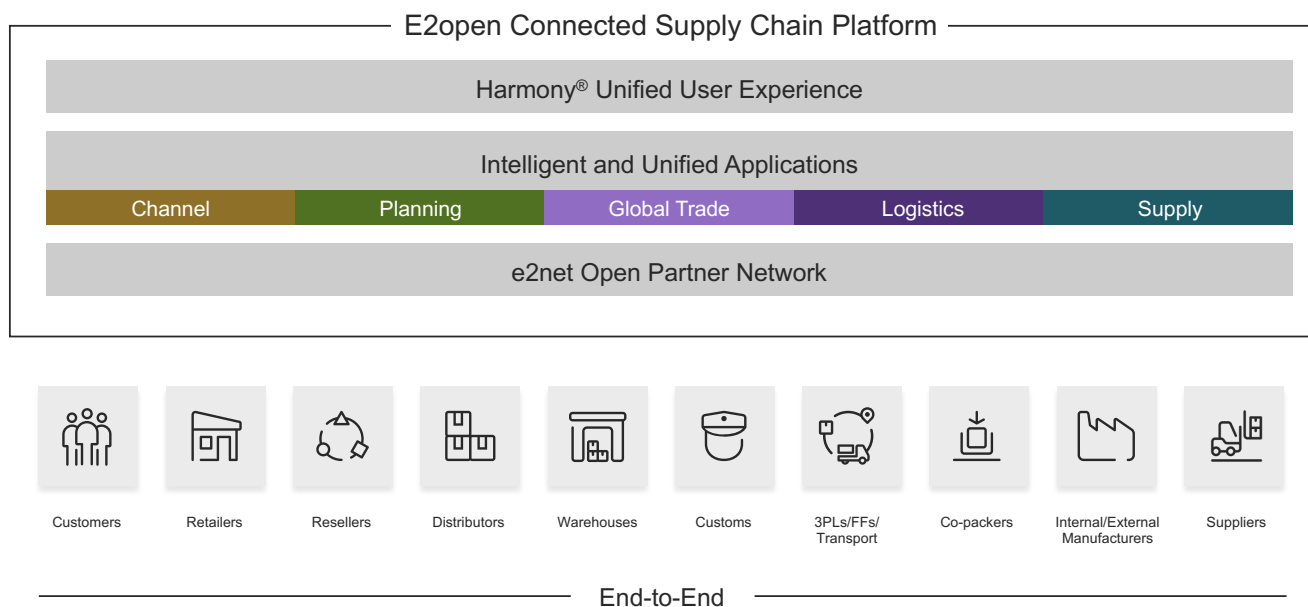
Supply chains are complex. They are global. And they are outsourced to hundreds, if not thousands, of partners to make, move and sell goods around the world. Consider the hundreds, thousands, even millions of hand-offs testing the integrity of a company's supply chain everyday — suppliers, manufacturers, transporters, and fulfillment channels.

While supply chains are connected in theory, oftentimes the processes and data for true connection are not. Organizations are often siloed, and supply chain technology purchases frequently follow this fragmentation. This lack of coordination creates the environment for disconnect and therein incomplete and inaccurate data and information. Time and again, the structural challenges of today's supply chains lead to indecision or uninformed decision-making. These hasty decisions and delayed responses often lead to inadequate business outcomes.

What if you had a single source for real-time insight and actionable information enabling automated response and better decision making across the entire value chain? What if you had a solution that brought together all aspects of the extended supply chain while addressing supply chain volatility, disruption, excess cost, and waste?

Imagine an open, end-to-end cloud-native platform, with best-in-breed supply chain applications, and harmonized, decision-grade data from the world's largest multi-enterprise network. A multi-tier network of suppliers, manufacturers, transporters, and fulfillment channels all connected through business processes and uniform data.

The following architecture visual represents the connected supply chain platform from e2open.



Moving as one.™

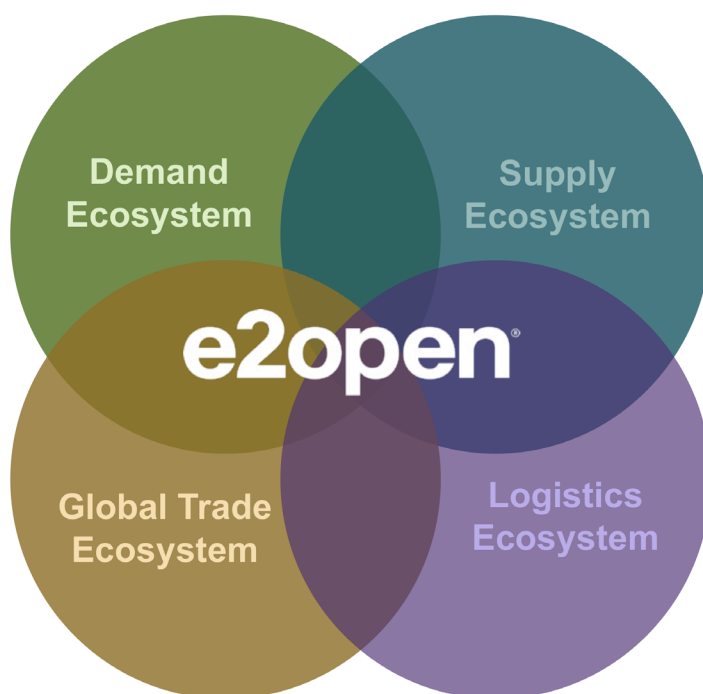
The world's largest network

Clients oftentimes expand the capability of their supply chain technologies one point solution at a time. E2open embraces that mindset, but advocates for the progression to include complete connectedness through an open platform. The connected supply chain platform from e2open provides access to hundreds of thousands of trading partners across four ecosystems (demand, supply, global trade, and logistics).

The value of access is only as good as the data that is traded. Harmony® from e2open, normalizes this vast amount of data into a single source of truth, guiding the supply chain through potential volatility.

Intelligent applications, informed through field-proven AI, provide a unifying capability across the entire value chain — Channel, Planning, Global Trade, Logistics and Supply. All applications and data are exposed through a single pane providing visibility across the entire supply chain.

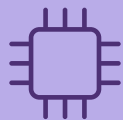
The world's largest network of interconnected partners



Key Benefits

- Unified supply chain technology platform and interconnected partner network
- Timely, accurate, and complete data establishing decision-grade information
- Real-time decision-making capabilities and automated responses
- Business transformation through a supply chain working together as one

With e2open, semiconductor supply chain professionals gain better visibility, collaboration, and control supporting a connected supply chain, moving as one.



e2open[®]

Moving as one.[™]

Learn more at www.e2open.com/industries/semiconductor-manufacturing/

E2open and the e2open logo are registered trademarks of e2open, LLC. Moving as one. is a trademark of e2open, LLC. All other trademarks, registered trademarks, or service marks are the property of their respective owners.

© e2open, LLC 2022 All Rights Reserved.

9600 Great Hills Trail, Suite 300E, Austin, TX 78759 | Tel. 1.512.425.3500 | e2open.com

IBSEMI2201