



Achieving supply chain visibility in multi-tier environments

Supply chain planning excellence across the extended supply chain

In today's multi-tier supply chains, achieving supply chain visibility and control are crucial to planning excellence. The key to success is implementing a holistic, end-to-end supply chain planning and response management system, where everyone can understand the consequences of decisions up and down the supply chain.

Vertical integration is the merging of two businesses that are at different stages of production of a product—for example, a semiconductor fabricator and a consumer electronics manufacturer.

Faced with shortages of raw materials and an immature motor industry's supplier network in the early part of the 20th century, Henry Ford decided he needed total control: owning the whole supply chain. By the 1920s his company ran coal and iron ore mines, timberlands, rubber plantations, a railroad, freighters, sawmills, blast furnaces, a glassworks, and more. In other words, total vertical integration.

But by the late 1990s, when outsourcing was prevalent in the West, particularly in the United States, McKinsey & Company wrote: ¹

“Whereas historically firms have vertically integrated in order to control access to scarce physical resources, modern firms are internally and externally disaggregated, participating in a variety of alliances and joint ventures and outsourcing even those activities normally regarded as core.”

Behind this statement, though not stated explicitly, is the loss of control, particularly of the supply chain, that is the result of outsourcing. When coupled with off-shoring to Asia, which greatly extended the supply chain and the associated lead times, many companies looked for ways to regain control.

In the 1990s, Dell developed a concept called “virtual integration” that combined largely outsourced manufacturing with relationships that are much closer than the traditional links between buyer and supplier. Michael Dell, the founder of Dell, called it “a tightly coordinated supply chain” achieved largely through exchanges of information between Dell and its suppliers.

Several events since 2000—such as Hurricane Katrina in 2005, the fuel price surge in 2007, the recession of 2008/2009, the Japanese earthquake and tsunami in 2011, and the flood in Thailand in 2011—have exposed the fragility of today's global, outsourced, and fragmented supply chains, often with major components, particularly in electronics, being sourced from a handful of supplier clusters in the same region. In some cases, components crisscross the globe several times before ending up in an end item sold to a customer or consumer.

While these events have caused some companies to reconsider their outsourcing strategies, few can argue against the obvious financial benefits and operational flexibility. The real question is how to balance the financial advantages of outsourcing against the associated supply chain risks.

An adapted form of vertical integration

However, as Dell has demonstrated, a company can gain some of the control of vertical integration without full ownership through virtual vertical integration.

The return of deep economic cycles and major natural disasters is making many companies reconsider vertical integration in an adapted form so that they can gain greater control of the supply chain in order to satisfy their customers' needs.

The loss of control of the supply chain resulting from outsourcing is discussed in a working report titled “Emerging Trends in Supply Chain Governance” from the MIT Sloan School of Management, in which the authors state: ²

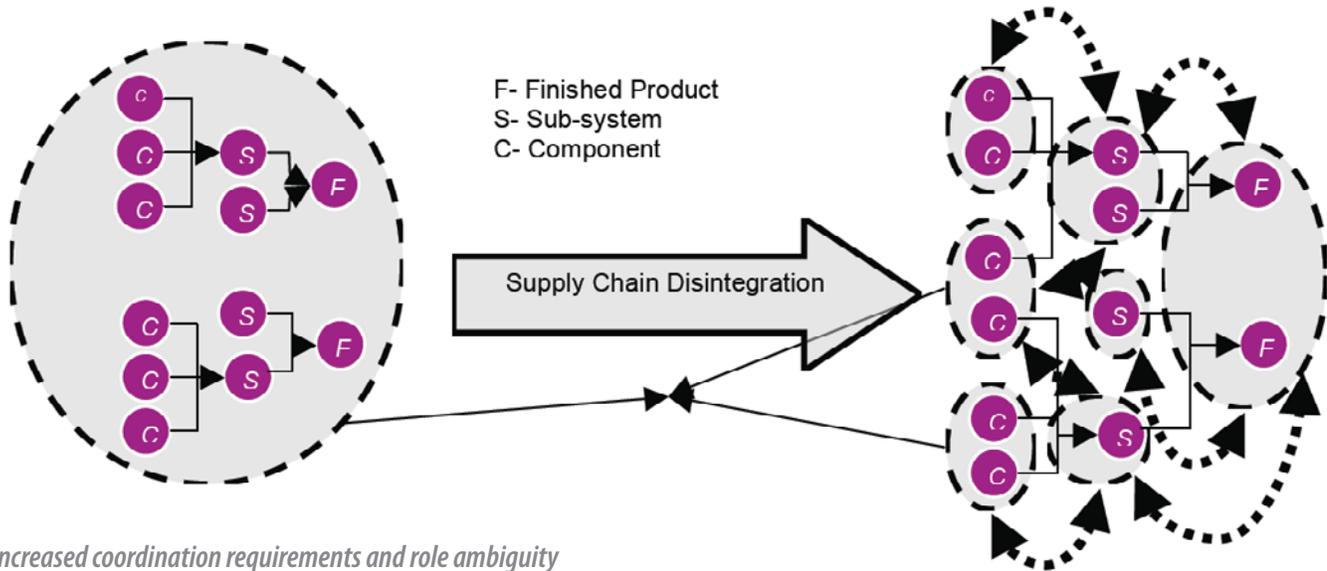
“As seen in [the figure below], the disintegration leads to a much more complicated network configuration. Even though the number of layers in the supply chain (from component to finished product) can remain the same, the level of interaction and coordination increases dramatically with the fragmented supply chain.”

In other words, while the financial benefits of outsourcing are difficult to resist, even though total landed cost is difficult to measure accurately, the impact of outsourcing on operational effectiveness has been a dramatic increase in supply chain volatility, uncertainty, complexity, and ambiguity.

In an effort to gain greater control, OEMs have attempted to implement simple, single-tier visibility and execution-level supplier collaboration solutions that rely on visibility of inventory and supply commits (essentially some level of vendor managed inventory, perhaps going as far as sharing transaction information such as advanced shipment notification (ASN) and goods receipt notification (GRN) via EDI messages). The drawback of these solutions is that they do not provide impact or consequence identification up and down the supply chain, or collaborative resolution of issues through “what-if” analysis. These supplier collaboration solutions simply provide methods to enforce plan conformance and do not provide a mechanism for a resolution to supply chain issues—typically a mismatch between demand requirements and supply capabilities.

¹Stuckey, J. and White, D., *When and When Not to Vertically Integrate* McKinsey Quarterly, No. 3, 1993.

²Bitran, G., Gurumurthu, S., and Sam, S., *Emerging Trends in Supply Chain Governance*, MIT Sloan School of Management, Working Report, June 2006.

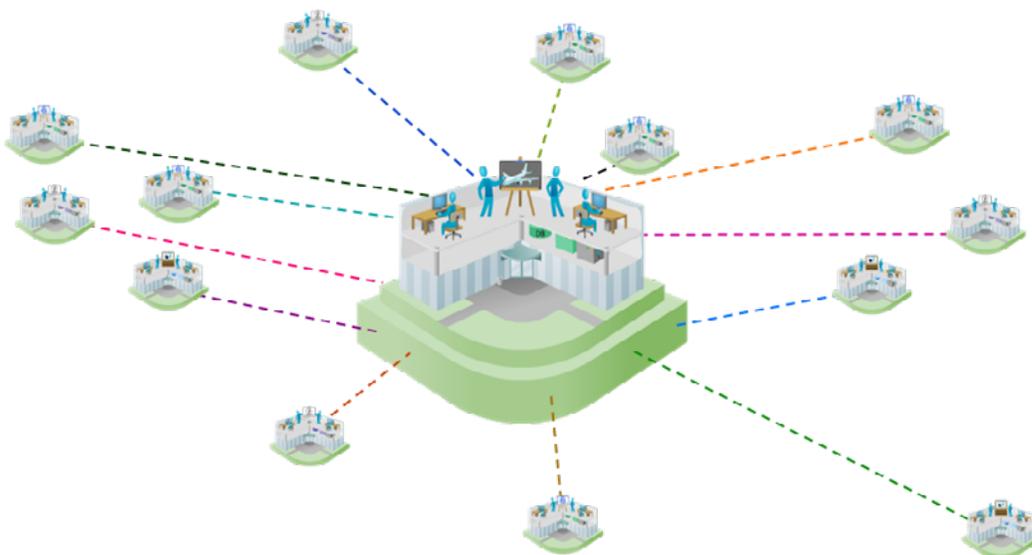


Increased coordination requirements and role ambiguity

The Gartner research report (Multitier Supply Chain Visibility Improves Supply Chain Relationships and Reduces Risk, Barger, R. Jr, North Rizza, M., and Kraus, B., 12 August 2011) states that:³

“Becoming demand-driven includes people, processes, and tools to sense and shape demand into an orchestrated, end-to-end, profitable response. Brand owners must move from single, tactical, supplier relationship engagement processes to a collaborative, multitier engagement process that spans the end-to-end value network — visibility is a critical first step to sense and shape demand.”

We believe this statement by Gartner articulates the benefit of virtual vertically integrated supply chains very clearly, namely a profitable response to changes in demand or supply across multiple tiers of the supply chain. In outsourced supply chains, this can often mean traversing several organizations across multiple ERP systems. And that presents a technology challenge.



³Barger, R. Jr, North Rizza, M., and Kraus, B., *Multitier Supply Chain Visibility Improves Supply Chain Relationships and Reduces Risk*, Gartner, Inc., 12 August 2011.

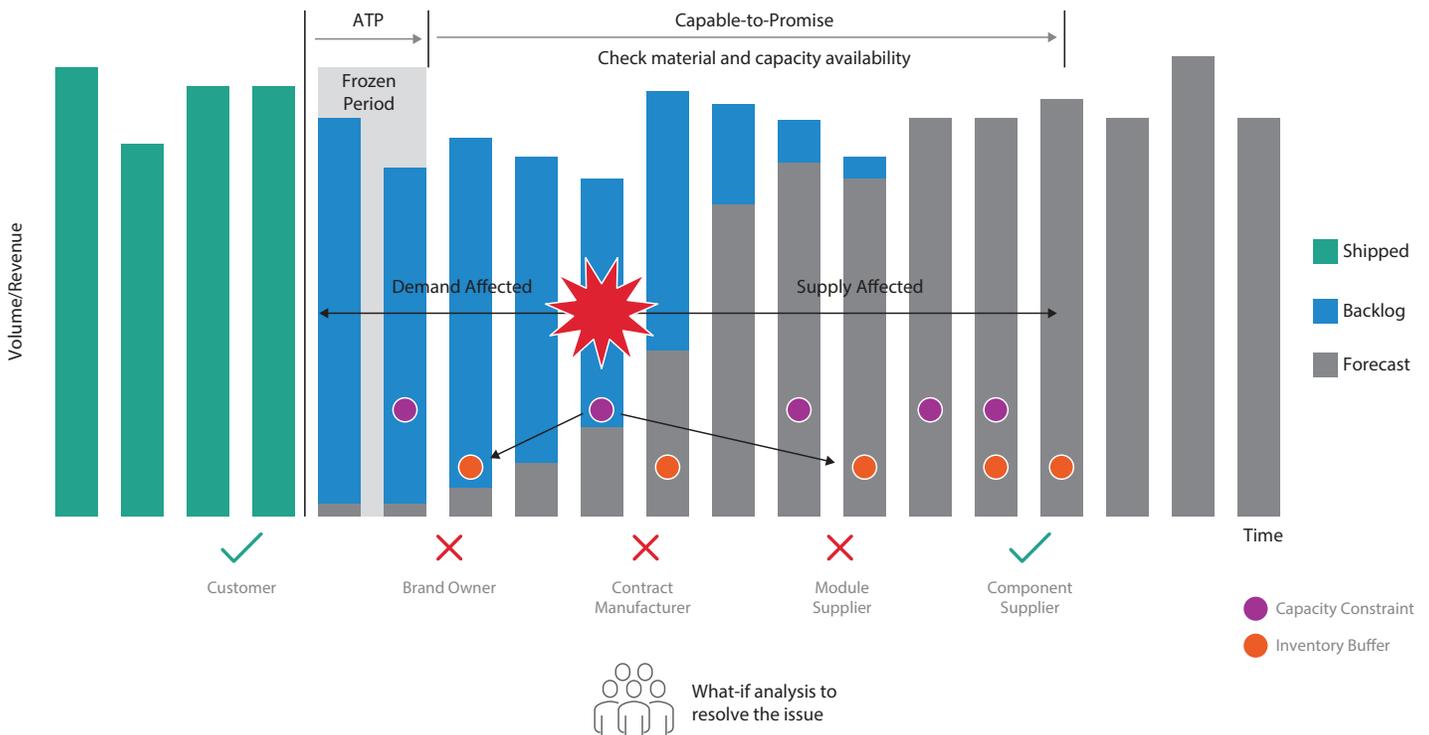
Firstly, ERP was designed to be used within the four walls of the enterprise. But with many companies outsourcing the majority of their production and, in many cases, even the delivery of the product to their customers' dock, most of today's supply chain exists outside of the confines of the ERP system. A "collaborative, multitier engagement process that spans the end-to-end value network" cannot be satisfied by a collection of disparate systems behind various enterprise firewalls.

Secondly, the requirements of multi-enterprise commerce are in direct contradiction to why ERP was created in the first place, namely to standardize processes and data. In an outsourced and/or off-shored environment, the full supply chain is represented in multiple ERP systems, and each node in the supply chain is likely participating in several other supply chains, each with its own planning cadence and business rules.

To regain control, the brand owners need to be able to plan and collaborate across multiple tiers. Demand and supply volatility and uncertainty require the supply chain to be rebalanced constantly. A sequential process that propagates, for example, demand changes through multiple ERP systems across multiple tiers of the supply chain may take weeks, only for the brand owner to realize that either the demand cannot be met or, even worse, that the demand picture has changed in the interim. A virtual vertically integrated supply chain represents the end-to-end supply chain and can propagate the demand across the multiple tiers in minutes, if not seconds, respecting the business rules at each node in the supply chain.

Going beyond visibility to multi-enterprise orchestration

In today's volatile business environment, collaboration among trading partners must go beyond the simple enforcement of a plan, which is all that visibility can provide. It is not enough to execute against a plan that is already out of date. Doing so only incurs additional cost while not satisfying true customer demand.



True collaboration and responsiveness between brand owners and suppliers can only be achieved if the impact of disruptions in either demand or supply can be determined across multiple tiers of the supply chain in minutes, not days and weeks. Visibility, while a key foundational capability, does not provide the impact evaluation across the extended supply chain. Cloud solutions are required that translate demand from an end customer to a profitable supply chain response through multiple tiers of the supply chain, crossing functional and organizational boundaries—always crossing multiple ERP instances.

Collaborative commerce is not only about generating a plan across multiple ERP systems, but also about being able to monitor the health of the plan to determine major deviations caused by demand or supply changes, and then to work as a team across functional and organizational boundaries to determine the most profitable response to the changes.

Agilent – Establishing a new view of the extended supply chain

The supplier network and business environment

Agilent is the world's premier test & measurement company, offering the broadest range of innovative measurement solutions in the Electronic Test, Life Science and Chemical Analysis markets.

The company operates in a high mix, low volume environment, which drives a lot of variability in its plans. Products are typically configure-to-order with many different options. Like other companies, outsourcing manufacturing operations is a key strategy for Agilent, which means it must navigate through volatility, while coordinating a virtual supply chain network comprised of multiple supplier and contract manufacturing (CM) partners.

In a simple supplier relationship, Agilent transmits information to suppliers through a forecast or PO, and then the supplier commits back to the PO. There is, however, a large contingency of more complicated supplier relationships to manage. Contract manufacturers (CMs), in particular, are viewed as an extension of manufacturing operations, and thus Agilent needs visibility from the CM on everything from demand and supply, to commit plans, and delivery status.

Depending on the product, Agilent has different CM models and different variations of buy-sell relationships (certain assemblies Agilent has kept in-house, which means they must sell those to its contract manufacturers in order for them to build the end item for Agilent).

Agilent collaborates with its CMs on both a planning and an execution front. From a planning perspective, the company will communicate its eighteen month forecast, and in the nearer term (2-3 months) it collaborates on more immediate operational activities and specific order requirements.

"Our goal is to plan effectively in the future, while ensuring that we can execute effectively in the interim."

Hock Seng Oh

Strategic Supply Chain Consultant, Agilent

The business challenges

Given that Agilent has a large part of its supply chain which is external to the company, there is an increased dependency on efficient and effective supplier collaboration and end to end supply chain (E2E) visibility to enable the company's success.

One of the most difficult parts of collaboration with CMs is in understanding the total complexity of the outsourcing model. Seeing and facilitating the information flow to and from suppliers, and getting the right information fast enough for Agilent to make decisions is no easy feat.

In cases where there is a buy-sell relationship, when Agilent wants to commit to an end item order for a customer, it has to know if and when it can commit its own internal part to the CM before the CM can commit to Agilent for the final product. It is this type of complicated information loop that poses the most challenges and drives the greatest requirement for:

- ▶ Getting the right information, when it is needed
- ▶ Ensuring the data is synchronized and
- ▶ Making sure everyone is looking at a common view of the information

Demand variability and market volatility add to this complexity. Because of the high variability, it is very challenging for Agilent to forecast configurations accurately so there is an urgent and continuous need to respond as fast as possible to the changing demand conditions.

Key business issues

- ▶ Highly configurable products and business model of high mix, low volume results in significant plan variations
- ▶ Deep supply chain and complex sourcing relationship with internal and external partners
- ▶ Contract manufacturing supply chain information is not in internal ERP since outsourcing. This causes “gaps” in system information flow and limits visibility and flexibility to respond faster to changes in demand and supply
- ▶ Information is transmitted between CM systems and Agilent systems via internal tools and file transfers resulting in information latency
- ▶ Exception handling processes are required to manage the latency and gaps in supply chain linkages to ensure high customer fulfillment, efficient processes and optimized inventory levels

A tactical exchange of data node-by-node through the supply chain is no longer sufficient to achieve a breakthrough in performance. What is required is a holistic, end-to-end planning and response system, where everyone can understand the consequences of decisions up and down the supply chain.

The traditional process

1. Agilent runs its weekly plan, generates its end-item requirements and provides a forecast to a specific CM.
2. CM loads forecast into its system (runs reports over the weekend) and comes back to Agilent for the buy-sell requirement the subsequent week.
3. Agilent loads requirement back into its system to see the result and communicates back to CM.
4. CM receives and processes this information and then provides commit date for end-item.

This process takes several weeks depending on how complex the relationship is.

Anytime there is a change, that change needs to flow through the same process; therefore, it takes several weeks before the lowest level of the supply chain receives it. And by the time they respond, things have changed again, especially considering they would be into a new monthly planning cycle.

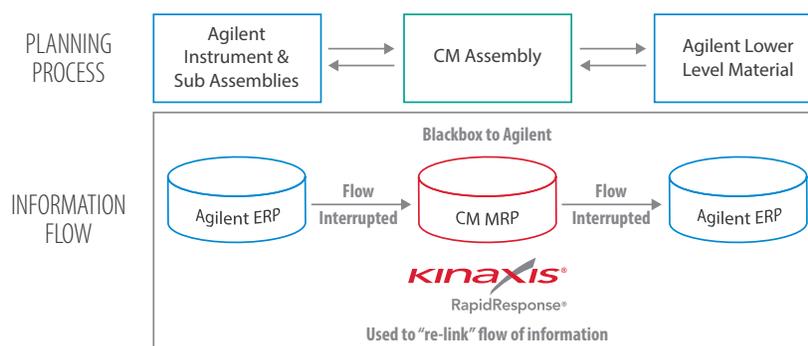
The challenge:

How do you flow information down fast enough so that everyone can respond to the appropriate signal as quickly as possible?

The RapidResponse solution

At the end of 2010, Agilent began a supply chain improvement program which included the creation of a vertically integrated planning process that would consolidate all of its different MRP and those of its CMs, to create a single plan (via BOM integration) with minimal data latency. RapidResponse is the foundational platform that merges all the information systems and provides the supporting capabilities to create and manage a single vertical supply chain. The program, which is an ongoing effort, has already produced significant advantages for Agilent.

Agilent is able to create a vertically integrated plan within RapidResponse that extends all the way from the top instrument level demand, explodes through the BOM and through all the sourcing, so the company can see the demand going through to the CM (and back through Agilent for any inter-sourcing arrangements). Agilent has created one common view where it can trace and facilitate information flow from top to bottom of the multi-enterprise supply chain — and all from within one single system.



Critical to this result was the fact that RapidResponse can model the behavior of the MRP from various CMs, because ultimately, the way a CM plans will be different depending on their process and technology. It is necessary to mimic what the CM does because the information and calculations that Agilent is working with must be consistent with what the CM's ERP is showing them.

With the vertically integrated plan in place, it becomes the backbone for all supply chain operational activities. It is, or will be, used in a variety of fashions:

- ▶ Common tool for CM management, which includes CM demand management, supply commits and performance management
- ▶ Fast and efficient way to view and simulate supply and demand balancing scenarios to facilitate decision-making. Supports various business scenario assessments such as:
 - Impact of demand change coming down and impact of supply change going up.
 - Changes in attributes; for example, if certain commodities are constrained and lead time has been stretched, what is the impact?
 - New product introduction planning. Assists planners to get the supply chains set up and make sure that demand is propagating through the BOM and then through to the contract manufacturer to ensure that the CM is ready to build the product when it is transferred to them.

What does RapidResponse offer?

- ▶ Provides common platform to integrate supply chain information from various sites to produce a vertically integrated MRP plan which has minimal information latency
- ▶ Enables flexibility in modeling the behavior of MRP from various CMs in the same plan
- ▶ Gives visibility into Agilent supply chain information at CM, such as on-hand, BOM, WIP, suppliers
- ▶ Supports various business scenarios assessments such as impact of demand changes, supply constraints, and attributes changes in BOM
- ▶ Confirms supply chain setups and demand propagation for NPIs
- ▶ Provides reporting type capabilities to extract information fast and easily. Able to analyze the results to make conclusions for next steps

Ultimately, Agilent needed to have end to end supply chain visibility to understand the risks, coupled with flexible and fast simulation capabilities to understand all the constraints deep in the extended supply chain. This enables Agilent to make quicker decisions to ensure continued customer satisfaction.

The gains

Process efficiency

- ▶ Integrated information with minimal latency, improves information flow and decision making times

Process effectiveness

- ▶ Complete information in an easily consumable view, fast and deep simulation capabilities, and a clear understanding of all the interdependencies enables better decisions

Improved customer responsiveness and service

- ▶ Confident answers provided to customer faster

Improved business performance

- ▶ Maximize business opportunities, and minimize risks
- ▶ Profitable decisions
- ▶ Actions aligned with corporate targets

For example, able to reduce new (big) order assessment and commit process which ranges from 3 to 14 days to make a decision based on manually reconciled information, to immediately assessing the order and going back to the customer with a confident commit date and production plan within a day or two.

Lessons learned and next steps

Establishing a vertically integrated plan (and facilitating the collaboration that ensues) is a combined technology, process, and governance challenge.

The company learned that it has to have people who could trace the vertical supply chain, as opposed to the traditional way of looking at the supply chain node-by-node.

When Agilent started the integration, one of the key requirements was to have an end-state in mind. The vertical integration team did a great job linking things, providing the basic backbone of how the information should be integrated and presented. That provides the foundational starting point but efforts are ongoing to fine tune the modeling to accurately represent variations in the supply chain. Now that the plan is modeled in RapidResponse, the implementation team is integrating the results and understanding how it impacts the process to see where either process or technology adjustments make sense.

While the willingness on the part of the CM to share key information required for MRP hasn't been an issue, there has been an information challenge in ensuring that what they share reflects operations accurately. When you link all these different operations together, there is significant work to be done in reconciling things such as part numbers, sourcing rules and the like. From a technology perspective, it isn't a roadblock, but it does require time and effort to ensure the proper linkages and conversions.

“This is a very significant paradigm shift, and organization-wise and skill-wise we are still learning and figuring out how to incorporate and change our process so that people think about and manage things vertically, versus layer by layer.”

Hock Seng Oh

Strategic Supply Chain Consultant, Agilent

Key challenges in implementation

- ▶ Understanding of CM planning processes to ensure accurate MRP modelling
- ▶ CM data management (e.g. part number matching, BOM linkages, sourcing rule linkages)
- ▶ Interpretation of vertical MRP and understanding of the differences from execution plan
- ▶ Modelling of processes to support the vertical plan
- ▶ Continued governance process with contract manufacturing to ensure data accuracy

In summary, enabling E2E supply chain visibility provides Agilent with the backbone for continued efficiency and effectiveness gains. While much of the work is done on the vertical integration, continued focus will be given to fine tuning the model and expanding capabilities in the following areas:

- ▶ Expanded CM management
- ▶ Constrained scenarios assessment (capacity and materials)
- ▶ Collaborative end-of-life planning with CM

This will propel Agilent one step further to the next level of supply chain excellence.



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About Kinaxis Inc.

Offering the industry's only concurrent planning solution, Kinaxis helps organizations around the world revolutionize their supply chain planning. Kinaxis RapidResponse, our cloud-based supply chain management software, connects your data, processes and people into a single harmonious environment. With a consolidated view of the entire supply chain, you can plan expected performance, monitor progress and respond to disconnects when reality hits. RapidResponse lets you know sooner and act faster, leading to reduced decision latency, and improved operational and financial performance. We can prove it. From implementation to expansion, we're here to help our customers with every step of their supply chain journey.

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