

## From Many to One: Managing the Multi-Sourced Supply Chain

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Even if a product is assembled in one place, its parts probably come from multiple locations. Here's how some companies are dealing with the complexities of truly global supply chains.



Here is one definition of outsourcing: a company shuts down its local factory, shifts production to China, makes the entire product there and ships it to the U.S. for sale.

If only it were that simple.

In reality, global supply chains consist of goods and components sourced from multiple locations. A product might indeed be made in China. But the parts that go into it are likely to come from half a dozen other countries. And that scenario poses massive challenges, as companies strive to synchronize the flow of parts into a central production site.

Apple's iPod is a prime example. The popular music player undergoes final assembly in China. But its hundreds of parts are said to come from China, Taiwan and the Philippines, among other countries. (Apple prefers to keep the details of its supply chain under wraps.) Portions of the newer iPhone reportedly are sourced from Singapore and even the U.S.

Automakers have been practicing this strategy for years, says Jane Barrett, a research director with AMR Research Inc. And they have gone far beyond the mere sourcing of individual parts from all over the world.

Toyota was among the pioneers of a system where suppliers in various countries make entire sub-assemblies for cars. The practice generates additional complexity, as original equipment manufacturers (OEMs) demand precise delivery of systems that must be merged into the assembly line within narrow windows of time. Because OEMs refuse to keep large inventories of parts on hand, suppliers must coordinate their shipments on a just-in-time basis. While they generally work from forecasts that span eight weeks, they might be required to respond to change orders within half a day, or even a matter of hours, says Barrett.

There's little room for error. At Toyota, "suppliers get told exactly which sequence [of parts] to put on the truck," she says. "It's extremely integrated."

A number of tools and management techniques are available to help coordinate a multi-sourced supply chain like Toyota's, including the kanban system of parts replenishment and Lean methods for eliminating waste from the organization. In addition, says Barrett, enlightened OEMs work with suppliers to create standardized platforms and components, so that a given part can go into multiple models from the same automaker.

That level of collaboration, which begins at the design stage, is still in its infancy, Barrett suggests. But it

takes on growing importance as companies diversify their sourcing. According to AMR, some 70 percent of a product's cost is locked in during the early design phase. To control that expense, OEMs need to involve suppliers at an earlier point than the purchase of parts or finished items.

Barrett cites one builder of jet engines that selected 20 key suppliers before proceeding with design of a new product. Together they came up with a more fuel-efficient engine, which has found success in the marketplace. More companies should embrace this philosophy of "open innovation," she says.

### **From Small to Large**

The concept of a widely distributed supply chain has gone from micro to macro. The latest convert is Boeing Co., whose 787 Dreamliner passenger jet is being assembled from sub-systems contributed by an army of suppliers from various countries. The task of coordinating all those vendors and their thousands of parts is a huge one. In fact, Boeing ran into supplier problems that pushed back flight testing and delivery of the new aircraft by many months. The company cited "ongoing challenges with out-of-sequence production work, including parts shortages, and remaining software and systems integration activities."

Exostar provided the software platform for collaboration between Boeing and its suppliers. Peter Scott, vice president of marketing and corporate development, dismisses the 787 delays as "growing pains." As companies globalize their supply chains and shift more responsibility to suppliers, he says, they go through an inevitable learning curve. Such "partner-based manufacturing models" involve the application of brand new technology and processes, which can lead to glitches along the way.

Scott says OEMs are beginning to understand the need for visibility that extends well beyond their Tier 1 suppliers, all the way back to the purchase of raw materials. That's especially vital for aerospace manufacturers, whose need for highly sophisticated parts often precludes the ability to draw on multiple suppliers for the same item. So when a major supplier goes down, the entire chain is likely to be disrupted.

Several OEMs use the Exostar platform to issue production forecasts to suppliers, receive commitments from those suppliers, then manage individual demand signals to orchestrate the shipping of parts from multiple locations. Scott says Exostar is working to tie logistics service providers (LSPs) into the platform as well, in order to track the physical flow of goods and optimize pickups within a given area. The technology allows for the constant trading of messages about the availability and status of orders, so the OEM knows exactly what it's getting and when.

Boeing has labored to incorporate design into its collaboration efforts with suppliers, Barrett says. All are required to utilize the same tools for computer-aided design (CAD) and management of a given product across its entire lifecycle. Increasingly, the development of new product involves a team of independent designers and engineers from several countries, constantly exchanging electronic messages and images to make up for the variation in time zones.

### **Role of Third Parties**

LSPs have a big role to play in coordinating the links of a complex supply chain. Germany's Schenker AG works with suppliers from around the world to translate OEM forecasts into actual moves, says Rob Walpole, senior vice president of logistics and supply chain development.

Schenker is responsible for the timing of the shipments. It will take a manufacturer's forecast and

examine inventory on hand next to the plant, as well as items in transit from suppliers. Then it translates that information into a “pull” signal at the supplier’s location. The supplier who bears responsibility for holding inventory, although Schenker manages the task of balancing stocking levels based on actual demand. “At the end of day,” Walpole says, “if there’s more inventory than necessary, it raises costs.”

The need for just-in-time delivery, coupled with the sequencing of parts into the assembly line, make the job especially challenging. Not every supplier can maintain a stocking location close to the OEM’s plant, although automakers such as Toyota ask many of them to do exactly that. Others have to factor in the vagaries of long-distance transit in order to assure the timely arrival of their components, some of them complex sub-assemblies, at the plant.

The trend toward outsourcing of large pieces of a plane or automobile has given birth to another partner in the supply chain, and yet another level of complexity. According to Walpole, many suppliers lack the skills to create such units, so another entity might stand between them and the OEMs. Its job is to bring together many parts into a system that is then shipped out to the plant for final assembly. Such partners also handle the job of supplier inspection and approval.

In such cases, says Walpole, Schenker can act as logistics coordinator for multiple legs of the journey, in addition to recommending the best provider of a sub-assembly service in a low-cost production environment such as China. The LSP can also perform relatively simple tasks related to the customization of generic product to meet individual market needs, such as the packaging of peripherals into kits, and the inclusion of product literature in the local language.

The electronics sector, with its heavy dependence on outsourced manufacturing, can benefit greatly from such services, Walpole suggests. The biggest difference between that industry and many others, he says, “is the nimbleness that’s required.”

Oakland, Calif.-based APL Logistics, a long-time presence in Asia, plays a variety of intermediary roles within supply chains that draw on multiple sources of product. On the consumer-electronics side, it might merge speakers and stereo units into a single product, says Tony Zasimovich, vice president of international services. Or it might consolidate shipments from many locations into a single container. The company runs merging centers in Kaohsiung, Taiwan and Singapore, where it accepts parts from major Asia production centers and ships them out to overseas buyers.

Providers like APL Logistics benefit from the increasing reliance of retailers and manufacturers on postponement programs. In what amounts to a vendor-managed inventory service, it will store product arriving from various locations, then wait for orders from distributors. In general, the customer has already taken title to the inventory. APL has also managed other VMI vendors, providing information on order status and shipping into Supplier Logistics Centers in the U.S. In those cases, Zasimovich says, the customer might not take possession of the goods until they are landed.

Information can take the place of physical goods when a supply chain is stretched around the globe. Zasimovich says companies generally want to know when a shipment has passed through various key points in its journey, including transfers between handlers. Using the APL Logistics visibility tool known as SeeChange, they can go online and receive 20-minute status updates which reference specific purchase orders or even SKUs. When something goes wrong, exception messages are conveyed through management dashboards which allow for quick remedial action.

## The Holistic View

When it comes to streamlining multi-sourced supply chains, the biggest successes have been in mature industries such as high-tech and consumer electronics, says Alex Thompson, vice president of product management with San Mateo, Calif.-based TradeBeam, a vendor of global trade management software. Companies such as Apple and Dell Computer have achieved a holistic view of their networks, enabling them to deliver the right product to the right customer. In general, though, “most companies have not taken advantage of globalization opportunities that are out there.”

The main obstacles are organizational in nature, Thompson says. Many companies remain divided into functional silos that operate within narrow areas of responsibility. As a result, they can't reap the benefits to be had from merging physical and financial supply chains on a global scale. Information generated by shipments can't easily be reused for data reconciliation, financial processes and other purposes. Throw in multi-country sourcing, and the disjointed supply chain becomes even more difficult to manage.

One TradeBeam customer that has achieved some success in this area is the French automaker Renault. The company set out to build the Logan, a low-cost car with a target price of 5,000 euros. The goal was to win market share in middle-income economies such as Egypt, but Renault couldn't reach it without streamlining the global import and export process. The company drew on TradeBeam's software to create a single, centralized database of global trade data. The tool allowed it to work more closely with local suppliers and joint ventures, as well as logistics partners.

At the same time, Renault could make better use of free-trade agreements for globalized product design and sourcing. The company ended up shipping parts to Romania, then complete knockdown kits to Morocco, where it performed light assembly. That last step qualified the cars for shipment to Egypt at a lower duty rate, Thompson says.

Industries with a longer track record in outsourcing tend to do better when it comes to diversifying the supply base. The semiconductor industry is well along the path, having moved to an outsourced, “fabless” manufacturing model some years ago, says Ashok Santhanam, president and chief executive officer of Bristlecone Inc. in Milpitas, Calif. Such companies will buy silicon wafers from Asia, then conduct assembly and testing in other parts of the world, often relying on contract manufacturers for a large part of the process.

One reason to deal with multiple suppliers is to play them off one another to obtain a lower price. But the real motivator is a need to create the most efficient and synchronized supply chains possible, Santhanam says. Different sources of parts and product might serve particular markets, based on capacity and access to logistics services. Local-content requirements within free-trade agreements can also drive decisions on sourcing.

Supply chain planning software allows a manufacturer to look at various constraints related to inventory, in order to balance the need for assured supply with the risk of obsolescence. The tool also determines how much a given supplier can contribute.

Meanwhile, on the factory floor, manufacturers must coordinate the inbound flow of parts with the ability of their machines to make certain types of product. One customer of Bristlecone, a printing plant, has to carefully plan production to allow for the time needed to clean equipment when it switches from one color to another, says Anil Gupta, vice president of marketing.

Companies attempting to build more complicated supplier bases are finding help from vendors of spend management software. Pat Furey, senior category manager for Sunnyvale, Calif.-based Ariba Inc., says his company can advise on the best place to site production and suppliers, based on considerations of logistics, cost and the competitive landscape. Category managers can track product price and availability in various locations. Ariba also takes into account the risks from sourcing in distant countries, or places where supply disruptions might be more likely. "We make sure our customers are sourcing in the right region," Furey says.

The tendency of manufacturers to outsource whole assemblies presents new challenges for certain sectors, Furey says. In adopting a process that is common in the computer industry, Boeing was treading on new ground. Some key suppliers weren't accustomed to assembly work and had to adjust their operations. The Boeing experiment, he says, "wasn't a bad idea. It's just going to take a while [to perfect]."

### **Multiple Supply Chains**

A multi-sourced supply chain actually consists of several chains that must be modeled and managed in a coherent manner, says Bob Anson, senior director for total supply management with i2 Technologies in Dallas. Step one is to perform high-level modeling of the entire network. "As companies have become more global," he says, "they have not necessarily had a centralized approach to supply chain network definition." Planning has tended to occur on a region-by-region basis.

Master planning has to take place across all supply chains in order to allow for efficient material flow to and from multiple regions. Only then can companies designate materials for the right region while making trade-offs that result in the best outcome from a global perspective. On the execution end, Web-based supplier portals can help to foster collaboration among an army of suppliers in various locations, not to mention better control by an OEM over its whole supplier base, Anson says.

The increase in supply lines and partners doesn't mean that companies can relinquish control over their networks. According to Anson, some OEMs are negotiating price or capacity with Tier 2 suppliers, then acting as a broker of those parts for Tier 1 producers. In the high-tech sector, a company might purchase key semiconductor components for use in sub-assemblies. The trend can be seen in electronics as well, where companies such as Hewlett-Packard and Dell are buying up raw materials and allocating them to suppliers as needed. In the process, they get a better price or ensure access to key commodities.

In such cases, it becomes essential for the manufacturer to keep close tabs on purchased raw materials as they move toward final assembly. That's the only way to ensure that suppliers are meeting their contractual obligations and not using the OEM's dedicated commodities or parts for another customer. "Visibility mechanisms allow you to make sure that you can connect the dots," says Exostar's Scott.

Andrew Kinder, director of supply chain product marketing with Infor in Atlanta, sees no reversal of the trend toward outsourced supply chains. On the contrary, he learned in a recent survey of 100 supply chain directors in the United Kingdom, companies are still planning to outsource their operations and China remains the number-one target.

"Elongated" supply chains require the management of multiple items from multiple sources, Kinder says, even if China is the focus for most finished-goods production. But companies won't accomplish that goal without a consolidated view of global customer demand. Only then can they plan their supply chains appropriately.

Each decision carries its own set of impacts related to cost, timing, service and product quality. Global network optimization tools can help companies make the proper trade-offs between capacity and inventory, based on good demand planning, Kinder says. Leaders in the field re-optimize their systems at least monthly. In the pharmaceutical industry, companies selling into Europe might adjust their sourcing patterns several times a year, based on the need to match supply with demand.

Kinder tells of one Infor client, a nautical engineering company, that relies on sole sourcing only when absolutely necessary, drawing on multiple suppliers for other types of product. The company is fully aware of the risks involved in each sourcing decision.

As complicated and risky as it might seem, the multi-source model offers advantages of cost and efficiency that will continue to entice companies with global supply chains. Santhanam suggests that many manufacturers are just beginning to understand the strategy's value. "There's a long way to go," he says. "But it's clear that the synchronization and inventory reduction mantra is on everyone's lips."