

LEAN **AND** RESILIENT

THE NEW AUTOMOTIVE SUPPLY CHAIN HYBRID

June 2013

By Lisa Harrington, President, lharrington group LLC and
Associate Director, Supply Chain Management Center,
Robert H. Smith School of Business, University of Maryland



In 2011, when the unthinkable happened – the Fukushima tsunami and nuclear meltdown in Japan – the global automotive industry was already busy recovering from the U.S. financial crisis, dealing with a European market hobbled by the Eurozone debt crisis, and scrambling to meet demand in markets which are growing exponentially, like China and India.

Toyota's manufacturing was affected by the compound disaster in Japan. But some of its suppliers, including Renesas, were devastated. Renesas, explains Andrew Zolli, author of *Resilience: Why Things Bounce Back*,¹ makes about 40 percent of the chip controllers that power today's new cars. It had a just-in-time delivery mechanism, where it delivered chips to the Toyota supply chain with a six-minute gap.

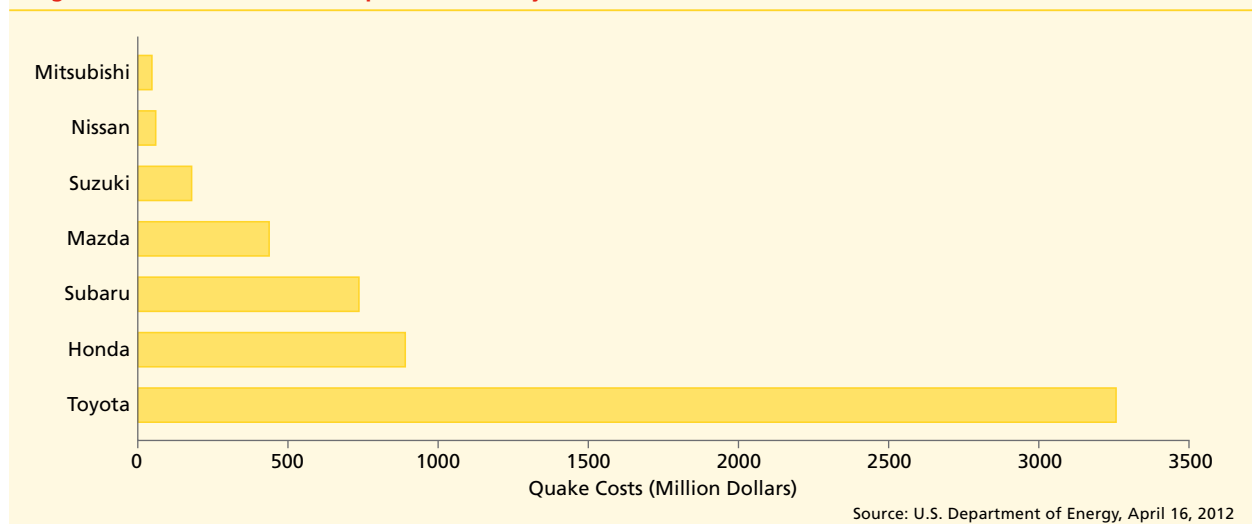
But at the time, Renesas only made the chips in one factory in Japan. And when that factory was decimated, manufacturing for Toyota shut down immediately all over the world. Toyota literally couldn't get its hands on the processing chips to run its new cars.

GM had a similar kind of exposure, with one critical difference, Zolli notes. GM had built sufficient redundancy into its supply chain so that it was able to dynamically reconfigure its supply and value network to ensure continued manufacturing of its most profitable vehicles.

The result: GM's CEO, in the third and fourth quarter of 2011, was able to report that the terrible disaster in Japan would have no impact on the company's earnings, even though it had roughly the same exposure, in terms of supply chain risk. By contrast, the quake cost Toyota nearly \$3,500 million (See Figure 1) and knocked the company from its position as the world's number one automotive manufacturer.

The automotive industry woke up to the fact that, while its just-in-time (JIT) business model and super lean, highly inter-dependent supply chains were wildly efficient, they also were brittle - susceptible to disruption on a potentially massive scale. Simply put, traditional just-in-time automotive supply chains were not resilient and, as a result, were at increasingly high risk of failure.

Figure 1: Financial losses of Japan's seven major automakers, March 11, 2011 – March 31, 2012



¹ Andrew Zolli, *Resilience Strategies for a Volatile World*, Harvard Business Review Interview <http://blogs.hbr.org/ideacast>, 2012/07.

The resilience imperative

Acting on this knowledge, the industry and its supply chain partners have embarked on efforts to craft a revised operating model: Supply chains that are simultaneously lean *and* resilient. This model retains the principles of JIT and lean, but adds in controlled redundancy and contingent options to improve resiliency and protect against failure.

The evolution toward this hybrid supply chain model is ongoing. Automotive companies are re-balancing their supply chains to build in carefully managed tolerances for volatility. The goal is to build a supply chain that can tackle conditions of systemic volatility – good and bad – ranging from the ordinary to the unthinkable. And do so while preserving or enhancing profitability.

Zolli notes GM's CEO was able to report that the terrible disaster in Japan would have no impact on the company's earnings...

The new resilient automotive supply chain recognizes the need for collective, rather than sequential, risk management; and facilitates collaboration on the new scale that is necessary for survival.² It is built on true supply chain partnerships that create agility and contingent scale/capability, delivered in an “on-call” model. These partnerships span all players in the sector: OEMs, suppliers and supply chain service providers. They embody what Zolli refers to as the two defining aspects of resilience:

- The ability to maintain a core purpose, or
- The ability to restore core purpose in the face of a disruption.



² Lisa H. Harrington, Sandor Boyson and Thomas Corsi, X-SCM: The New Science of X-treme Supply Chain Management, Routledge, 2010.

Part 1: Current state and driving trends

An industry in flux

To understand this new hybrid automotive supply chain, let us first look at the industry's market dynamics. There are four major trends re-shaping the sector.

Trend #1: Global growth and emerging markets

Despite the drag effect of the debt crisis on the European market, global automotive production is forecast to hit record levels each year through 2017, with emerging markets driving the growth. This increased production is in direct response to demand caused by the rising affluence of emerging market populations, and their ability to spend on vehicles.

“For the first time in history, emerging market vehicle assembly exceeded established market assembly and is expected to do so in the future,” observes consulting firm PwC in a 2012 report on the automotive sector.

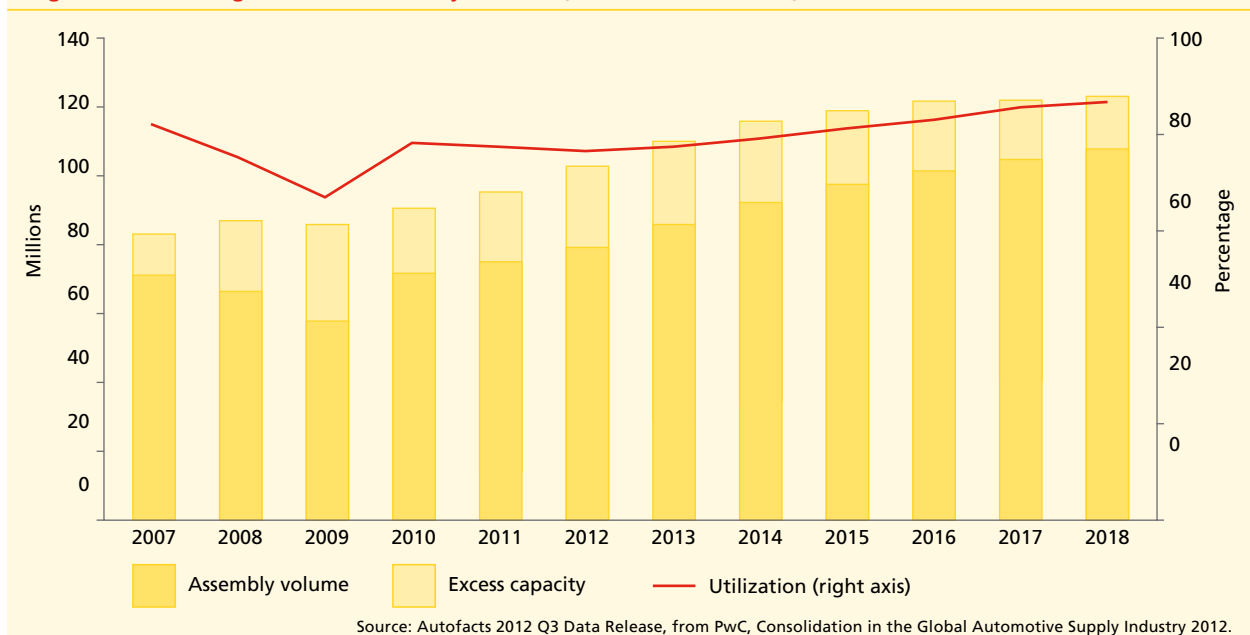
“Looking further out, vehicle assembly is expected to reach 100 million units around 2017 (see Figure 2)”³

While the automotive sector is truly a global industry, it is also highly concentrated. The top 10 global automakers account for roughly 80 percent of the worldwide production. Toyota, General Motors and Volkswagen AG lead, with Toyota recapturing first place in 2012. Asia, especially China and India, will drive growth over the next five to seven years. It is expected to account for 40 percent of the sector's overall expansion.⁴

Despite the drag effect of the debt crisis on the European market, global automotive production is forecast to hit record levels each year through 2017...

The world's largest assembly market, China, will likely capture the biggest share of that growth. Analysts predict vehicle production will double during the next five to seven years, according to PwC. “The underlying reality in China is that wealthier households are expected to grow the fastest at over 20 percent compound average

Figure 2: Global light vehicle assembly outlook (2007–2018, millions)



³ PwC, Consolidation in the Global Automotive Supply Industry 2012, p. 1-3.

⁴ PwC, p. 1-3.

growth rate, tripling the number of potential automotive buyers every four to five years,” PwC states.

At the same time, China’s nascent domestic car-makers, typically joint ventures with global OEMs, are churning out growing volumes of low-cost vehicles designed for domestic-only consumption. This same trend is developing in India and, soon, Africa.

Trend #2: Mega-plants and multiple platforms

“Across the industry, companies are shifting to producing multiple models or platforms in a single plant to gain flexibility, reduce costs and better utilize production assets. These mega-plants, based on the concept of building to a common engineering platform, produce up to six different vehicles in one location. This improves capacity while reducing the need to build new plants”, comments Mike White, Senior Vice President - Global Automotive Sector, DHL Supply Chain.

Automakers are investing heavily in building these mega-plants in China, Mexico and elsewhere. For example, VW, along with its Chinese joint ventures, plans to invest almost \$80 billion in 10 new plants (including seven in China).

As OEMs build mega-plants in new geographies, they are asking component suppliers to follow them into supplier business parks - or clusters – in order to provide greater support.

At the same time, vehicle nameplate life cycles are shortening. Today, a vehicle model lasts four to five years vs. seven to eight years in the past. These shorter lifecycles have forced automakers and their suppliers to re-vamp their business methodology in order to design and produce new vehicles on the shortened cycle. Essentially, every process in the automotive supply chain has sped up.

To meet the need for speed, while at the same time reducing costs, VW is taking manufacturing flexibility one step beyond the mega-plant, multiple platform model. The German automaker is migrating to a new modular “tool-kit assembly” system that will allow it to build all of its vehicles using just four basic toolkits – one for small city cars, one for midsize cars, one for sports cars and one for large cars and SUVs, according to a profile in Forbes.⁵

VW believes its toolkit system will save at least 20 percent a year in per-vehicle costs and cut assembly time by 30 percent.



⁵ Joann Muller, How Volkswagen Will Rule the World, Forbes, 4/17/2013, p. 1-3.



“This modular approach will in large part determine whether VW can pass Toyota or GM. There’s big risk here: If something goes wrong with a shared component, the problem can quickly multiply across VW’s entire lineup.”⁶

As OEMs build mega-plants in new geographies, they are asking component suppliers to follow them into supplier business parks - or clusters - in order to provide greater support. This clustering concept delivers great benefits to the OEMs, including:

- Reduced time to produce, translating into shorter time to market

- Reduced inbound logistics costs
- Improved supply stability
- Reduced risk from long transit times, and
- Improved responsiveness to change

The supplier clustering model is well established in Mexico, for example, where there are 13 large clusters of suppliers and services for the automotive industry. These clusters serve both the passenger car and the commercial truck markets.

Government requirements for local content will fuel this clustering trend going forward. Governments of China, Brazil and other countries are passing regulations to require OEMs to use more local supply content in vehicles. This means supplier clusters will develop in the new manufacturing locations, but the process is likely to take years. Even in developed markets like the U.S., it took several years to build the regionalized supplier base to support production in the Southeast.

Despite this trend, experts estimate that eight to 15 percent of core components – like engines and transmissions - will continue to be sourced from strategic suppliers back in the OEM’s home country. “This may not sound like a lot of volume,” one automotive supplier acknowledges, “but these are critical components and the volume is significant enough to add complexity to the supply chain.”

Critical components sourced from afar also include an increasing percentage of electronics. As a result, automotive supply chains are now inextricably linked to supply chains outside the traditional automotive circle – e.g., consumer electronics. Their operating ability – and fortunes - are now intertwined. And competitive cost challenges dictate that most of the electronics in today’s vehicles are imported from the traditional electronics manufacturing spots around the world – e.g., Asia and Mexico.

⁶ Muller, p. 1-3.

Trend #3: Getting closer to the customer

OEMs are locating their new manufacturing plants closer to their end markets. Automakers have moved from manufacturing in their home countries and shipping finished vehicles to market, to a model of geographically regionalized production – i.e. manufacturing at, or near, the point of demand. “This means the industry is setting up regionalized manufacturing plants and supplier clusters in new locations all over the world”, explains Dennis Drinan, Vice President, Global Sector Products & Head of LLP Service, DHL Supply Chain.

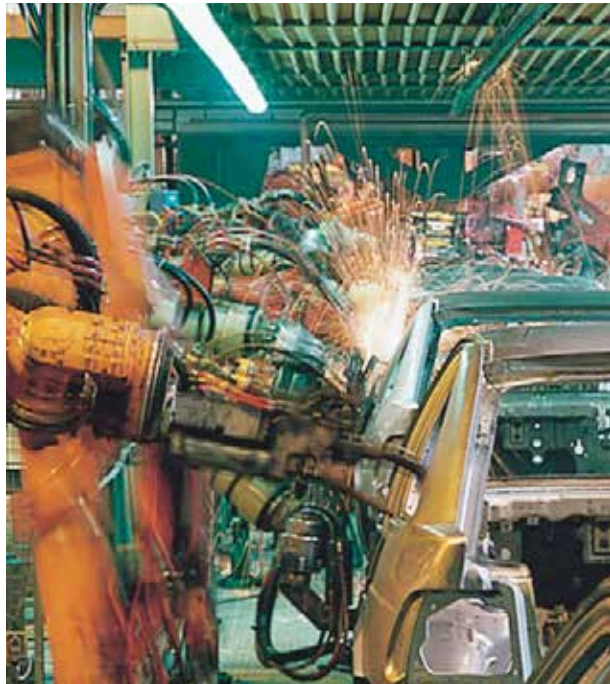
Automotive supply chains are now inextricably linked to supply chains outside the traditional automotive circle – for instance, consumer electronics.

Jaguar Land Rover, for example, which saw export sales in China rise dramatically in the last year, decided to set up production in China. The British car maker entered into a joint venture with China’s Chery Automobile Company to build up to 200,000 vehicles a year in a new \$1.65 billion manufacturing plant in Changshu, near Shanghai.



The allure of building plants in emerging markets is not necessarily to take advantage of lower labor rates. Instead, the primary drivers are reduced supply chain costs, speed to market, access to market in response to government requirements or tariffs, and support for local content. Once sales volumes reach a certain point, it no longer makes sense to ship finished vehicles across oceans.

In the near term, at least, regionalization of production immediately elongated and complicated the supply chain. For German automakers like BMW producing in their home country, all suppliers were nearby and things were relatively simple. Changes could be made in production schedules at short notice. “Now, companies are building cars in the U.S. or China, with German or other foreign components. This approach requires a lot more discipline in the supply chain”, Drinan says.



BENEFITS OF USING AN LLP

What are the potential benefits of partnering with a global lead logistics provider (LLP) with deep expertise in the automotive industry?

- 1 Agile, adaptive supply chain execution
- 2 Supply chain event mitigation and contingency solutions
- 3 In-country and global supply chain expertise and relationships
- 4 End-to-end supply chain visibility
- 5 Established continuous improvement cost management
- 6 Consistent, reliable, cost-effective transportation and delivery
- 7 Demonstrated supply chain best practices
- 8 Supply chain risk assessment and management

Trend #4: Relentless cost pressure

Finally, there is one industry dynamic that permeates every facet of automotive industry operations worldwide: Relentless pressure to reduce costs. Logistics costs typically represent five to 10 percent of manufacturing revenues in automotive. To be more competitive, companies must use every trick in the book to reduce costs and improve market share. This brings the discussion full circle – right back to risk and resiliency.

There is tremendous pressure to be leaner – to hold less and less inventory, while at the same time guaranteeing reliability *and* resiliency. Those two objectives are often in direct conflict. “If you wanted to be safe,” observes an auto industry executive, “the first thing you’d do is keep a lot of inventory nearby. But your other goal is to be lean, so that means taking away most or all of the safety stock.”

PRODUCING IN CHINA: TACKLING SUPPLY BASICS

In China's newly emerging domestic auto production sector, supply chain resiliency carries a different definition than that of the global OEM world. Supply chain resiliency is more basic – ensuring production supply, trying to create at least some visibility into inventory and flows, and trying to cut down on the amount of inventory “buffering” going on all across the supply chain. SGMW, the three-shareholder joint venture between two domestic Chinese partners – SAIC Motor Corp. Ltd. and Liuzhou Wuling Motors Co. Ltd. – and GM China, struggles with these issues every day.

Launched in 2002, SGMW manufactures vehicles geared to the low-end, inexpensive domestic Chinese market. The company's first product line was micro-vans. Then in 2010, it began making passenger cars. “Ten years ago,” says Steve Montague, Supply Chain Director, SGMW, “we were making 150,000 micro vans; today we're making 1.5 million.”

All sourcing is domestic, meaning SGMW doesn't have to worry about managing a global supply chain. In fact, most parts come from within a 30-mile radius of the factory sites. But the company's rapid growth has caused a myriad of supply problems, ranging from too much inventory to unpredictable deliveries. “Our local suppliers have grown up from mom and pop businesses,” Montague says. “They still are very immature in their manufacturing and supply chain processes, which are still manual.”

Generally, SGMW suppliers deliver parts directly to the production lines. The automaker sends them a production schedule spreadsheet, and the suppliers manage the parts inventories and delivery to the plants.

“Our biggest challenge right now,” reports Montague, “is we have an overly complex supply chain footprint in the sense that our suppliers use a lot of local 3PLs and transient warehouses, where they store material, but we don't have good visibility into the inbound flows coming from those sites. Our suppliers are focused on keeping up with our production growth. They're not focused on the supply chain, so they cover us with a lot of factory inventory. There's a lot of inventory buffering going on because we lack information.”

The joint venture partners are working hard to resolve these issues, implementing a number of improvements. In one such improvement for its passenger car plant in Liuzhou, Guangxi, SGMW partnered with DHL Supply Chain to manage a 60,000 sq. meter on-site logistics optimization center. The center consolidates deliveries from Chinese suppliers and their 3PLs from outside the local radius, manages the inventory and supplies the production line on a just-in-time basis.

“Before we set up this optimization center,” Montague explains, “we had problems with inventory management and downtime because the 3PLs in Liuzhou couldn't manage those inventories or meet our requirements for JIT delivery. We selected DHL to run the on-site optimization center because we knew it had experience doing this in Thailand.

“DHL is performing very well for us,” Montague reports. SGMW plans to set up similar optimization sites at all plants in the future.

Part 2: Building the lean *and* resilient supply chain

Building a supply chain that is both lean and resilient means creating a new hybrid that balances the need to reduce costs with effective use of redundancy, contingent scale and capacity. This is no easy task, and the solutions are dependent on multiple variables. They differ by customer, by geography and by provider.

In the automotive sector, however, certain attributes are emerging as the hallmarks of this lean-resilient supply chain hybrid.

Globally agile execution

Supporting the globally regional automotive supply chain – with its need for leanness and responsiveness – requires a new level of tactical logistics agility across a global footprint. The days of knowing what is going to happen 30 days out are gone. Third-party logistics providers (3PLs) that support the automotive industry have to build supply chains that can switch gears at a moment's notice, but not break the bank in doing so.

As the entities charged with executing the automotive supply chain day-to-day, the global lead logistics provider (LLP) must have a portfolio of solutions, alternatives, expertise and systems at the ready to deliver this tactical logistics agility. By way of illustration, consider automotive manufacturers' strategy to build cars to actual demand rather than to stock. This pleases the consumer, providing exactly the vehicle he or she wants, and also dramatically reduces finished goods inventory.

There is tremendous pressure to be leaner – to hold less and less inventory, and at the same time guarantee reliability and resiliency. Those two objectives often are in direct conflict.

Delivering this strategy means setting up a postponement system capable of feeding the production line with the right parts, even though the production schedule timeline is shortened and may change at a day's notice. Thus, a manufacturing plant sends out a five-day production plan to its suppliers to build a certain



number of cars over a certain number of days. It is the LLP's job to manage the plant's inbound-to-production material flow and coordinate all inbound movements.

The day prior to – or even the day of – the start of that schedule, the plant revises the plan based on new customer demand data. The LLP immediately redesigns the inbound route and supply chain solution based on the new signal. To do this, it re-calibrates the information from the master strategic plan, as well as the revised actual demand for the day of pick up, and reengineers to fulfill the new need. In the process, the LLP must optimize the revised inbound delivery flow to make sure the manufacturer does not incur higher transportation cost.

This kind of agility means LLPs have to be a lot closer to all of the supply chain data than they did in the past – data from their customers, their suppliers and their network. LLPs must be 100 percent aware of what is going on at all times. This visibility enables tactical agility.

Plan for the unknown

It is impossible to plan for every specific natural disaster or major supply chain event. What companies can do is develop contingency plans around types of supply chain deficiencies.

To build these contingent solutions, best practice 3PLs perform extensive *what if* scenario modeling on a broad range of events and situations. Using such modeling scenarios, the LLP can test different solutions geared to specific customers, see what works, and learn how to best respond to minimize impact. Thus, when something does happen, like a major supply disruption from a disaster, or if something seems likely to occur such as a port strike, the 3PL network has the processes in place to react quickly and move material around to eliminate or mitigate impact on the customer.

RESILIENCY CASE POINT: PORT SHUT-DOWN

When labor disruptions threatened to shut down certain U.S. East Coast ports, the potential work stoppages also threatened auto production. As the labor contract talks proceeded, some work stoppages happened and some did not. In anticipation of port shut-downs, one lead logistics provider (LLP) set up contingency service arrangements with the steamship lines well in advance to move materials through alternative ports. The LLP also identified alternate supplier sources in other parts of the U.S. for critical materials so it could shift sourcing, if needed. The contingency system worked and the automotive company suffered zero impact from the work slowdowns that did occur.

The LLP applied the same system to divert automotive customers' freight flows to southeastern ports in advance of Hurricane Sandy, which ravaged the U.S. Northeast, thereby avoiding any disruption.

Real-time, multi-tier visibility

As noted, supply chain resiliency is impossible without accurate real-time supply chain condition information. Visibility improves resiliency in a number of ways, as Martin Christopher, of the Cranfield School of Management explains. "It reduces uncertainty and enables the goal of a demand-driven supply chain to be achieved. Second, it reduces supply chain risk through shared information, both upstream and downstream of the firm's operations."

Best-in-class global LLPs can provide what amounts to an on-the-ground sensor grid in their countries of operations, geared to monitoring supply chain condition continuously. Their supply chain software solutions deliver visibility into supplier production, inventory and in-transit goods. Using this information, the LLP develops a supply logistics plan for every part all the way

to the production line. This plan incorporates cost per unit, which the LLP uses to understand two things:

- 1 The cost impact to the customer of a given supply chain deficiency, and
- 2 The cost for alternate supply chain solutions and how that expense impacts the overall supply chain cost structure for the customer.

If, for instance, the supply chain lost three days out of a 10-day lead time due to flooding, the LLP could ask the supplier to run a three-day level quantity increase, which the LLP would move by air freight over the next three-day period. While the solution increases transport costs, it prevents a production line shut-down – well worth the incremental transportation cost increase.

Partners in innovation

In the automotive sector, resilient supply chain management is based on partnerships, particularly with the LLPs that implement the on-the-ground solutions. These are not the transactional buyer-vendor relationships of old. They are more akin to a marriage.

Manufacturers have recognized that the old approach of squeezing vendors on price does not support their objectives. Instead, it is more about partnering to develop an innovative continuous improvement plan, which is backed up with the cost trade-off business case for that plan.

An important component of this partnership is a mutual understanding of value at risk on a bigger



enterprise-wide scale. Under this approach, the LLP and automotive company can assess supply chain risk in the context of what value is at risk if some or all of an organization's capabilities were destroyed and it had to start from scratch. In other words, which market and product or service it would focus on first, and how the supply chain network should be shaped to operate in a way that supports the company's priorities.

The up-side of resiliency

The automotive industry's journey toward creating supply chains that are simultaneously lean *and* resilient is still in its early stages. The lessons learned over the past few years from disasters, disruptions and high levels of volatility make several points clear. "The increasing vulnerability of supply chains requires a new focus on managing and mitigating risk which extends beyond the four walls of the single firm."⁷ Supply chain vulnerability is a network-wide issue, and must be addressed on a network-wide basis. This requires higher levels of information sharing across the supply chain, particularly with the LLPs charged with executing the collective 3PL supply chain operations.

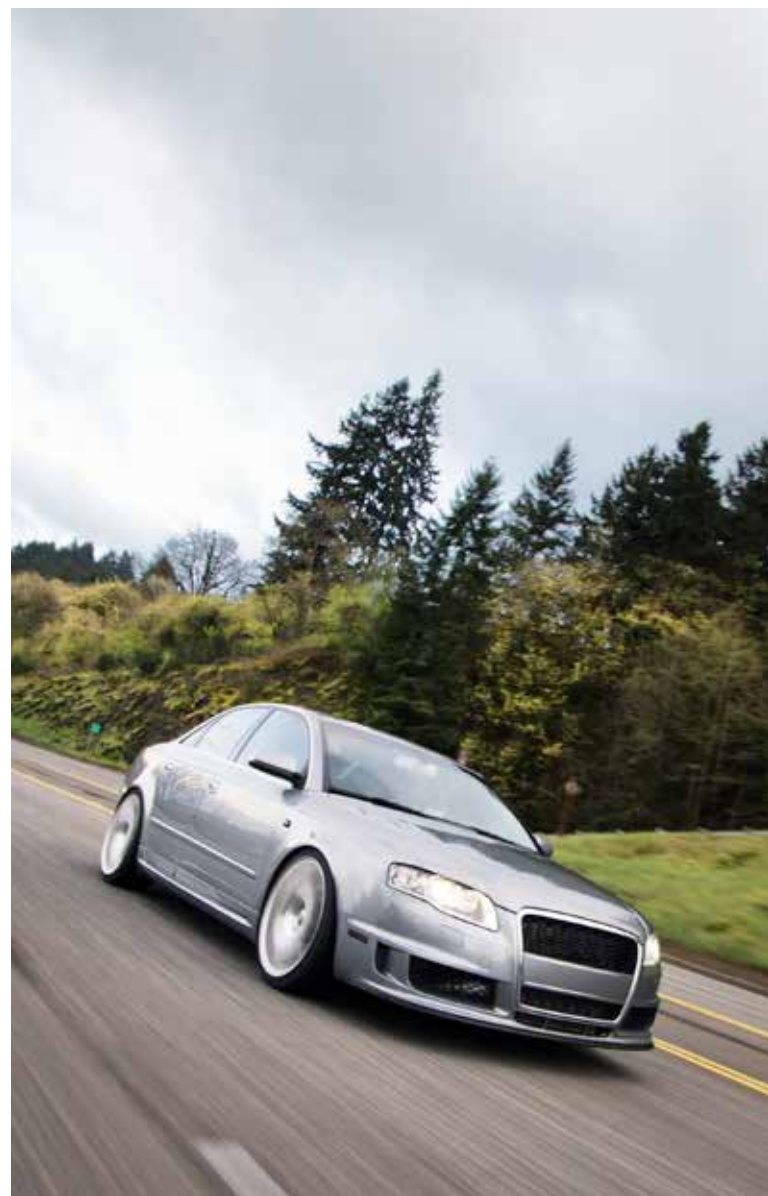
Best practice companies are partnering with global LLPs to re-balance the automotive supply chain, enabling it to flex and flux in response to volatility of any kind – be it an unexpected sales spike or a fire at a major supplier. This means building out capabilities, strategies, and tactics that:

- Deliver agility, appropriate redundancy, contingent capacity that can be "switched on" at a moment's notice
- Develop cost-effective alternative solutions and scenarios to market or operating developments – e.g., the port strike re-routing scenario
- Relentlessly improve visibility across the supply chain via robust IT architecture and close linkages into supply chain participants' systems to enable a "control tower" view of what is going on in the supply chain,

complete with proactive alerts on existing or potential problems, and

- Partner for mutual benefits by collaboratively focusing on metrics and continuous improvement

The LLP's job is to understand the unknown and engineer a portfolio of fully costed alternatives and solutions that can be rapidly deployed across all parties in the automotive supply chain. This means having the people, systems, processes, capacity and tools in place to deal effectively with volatility.



⁷ Martin Christopher and Helen Peck, Logistics Europe, February 2004, p. 17-21.

Those companies that embrace the ‘new normal’ of continuous – and sometimes radical – supply chain volatility and risk, and put the processes and systems in place to better manage both, regularly outperform their competitors. Companies that ignore or lag behind in addressing supply chain volatility do so at the peril of their bottom lines and their shareholder confidence.

As the lessons of Toyota, GM and the Fukushima disaster teach us, “Market volatility is a tremendous source of opportunity for companies that have developed the capabilities to not only manage risk but also respond to it more effectively than their competitors.”⁸

⁸ Accenture, Corporate Agility: Six Ways to Make Volatility Your Friend, Walt Shill, John F. Engel, David Mann and Olaf Schatteman, 2012, No.3 issue of Outlook, p. 4.

About the author

Strategic consultant, academic and co-author of three books, **Lisa Harrington** offers a global supply chain perspective.

At the Robert H. Smith School of Business, University of Maryland, Lisa is Associate Director of the Supply Chain Management Center and Faculty Lecturer on Supply Chain Management. She also is President of the lharrington group LLC, a firm providing strategic consulting services across global supply chain strategy, operations and best practice.

Lisa’s articles have appeared in Fortune, Industry Week, The Economist, Inbound Logistics, The European Business Review and many other publications.

DHL – The Logistics company for the world

DHL is the global market leader in the logistics industry and “The Logistics company for the world”. DHL commits its expertise in international express, air and ocean freight, road and rail transportation, contract logistics and international mail services to its customers. A global network composed of more than 220 countries and territories and about 285,000 employees worldwide offers customers superior service quality and local knowledge to satisfy their supply chain requirements. DHL accepts its social responsibility by supporting environmental protection, disaster management and education.

DHL is part of Deutsche Post DHL. The Group generated revenue of more than 55 billion euros in 2012.

www.dhl.com/automotive

