

The American Automotive Industry Supply Chain – In the Throes of a Rattling Revolution

Until the rude awakening of the 1973 oil embargo, the U.S. auto industry – vehicles and parts together – was a domestically focused business producing strictly for the home market with little in the way of foreign competition with which to contend. Ford and GM had extensive operations around the world, Chrysler had some small operations in Europe, American Motors had none. Their foreign holdings were run mostly at arms length, producing vehicles having little or nothing in common with those assembled in the United States. The industry imported very little, just \$5.7 billion for all vehicles, engines and parts in 1970. It exported even less, a total of \$3.9 billion.

The Auto Industry's Traditional Supply Chain

Into the 1970's the vehicle manufacturers (Original Equipment Manufacturers or OEM's) relied heavily upon their captive, in-house parts manufacturing operations for as much as 70% of their requirements, but were beginning to buy increasing quantities of products from outside suppliers. Even so, virtually all engineering and product design work, and all vehicle assembly was undertaken by the OEMs.

OEM engineers designed most of the bought-in components, developing all product parameters in the process. The OEMs would provide detailed blueprints to potential suppliers and invite them to bid against each other for a contract, employing an auction market model in which the two lowest price bidders usually won a "build to print" contract for an agreed fixed price, for an agreed quantity, supplied over a finite time period of generally not more than one year. OEMs frequently would pay for and retain legal ownership of any unique molds, tool sets, or stamping dies used to manufacture the products they engineered. Suppliers were expected to do little more than to determine how to actually manufacture the item for the lowest cost and a reasonable profit. Any cost reductions they managed to accomplish during the contract accrued for their own benefit. A third supplier frequently was selected for each item, held in reserve in case one of the primes fell out of favor. Price was the dominant factor in contract awards. Other key criteria included the prospective suppliers' manufacturing capability, capacity, reputation, and reliability. Product quality was another metric employed, but high rates of failure were tolerated, often with very little repercussion for the supplier other than to replace the rejected components at its own expense. This could be onerous, however, as the OEM's typically built large inventories of purchased parts, and could reject the entire stock, if the error rates were subsequently found to be too high.

Structurally, the OEM's supply chain was divided into three distinct, but sometimes overlapping layers. Those firms that sold finished components (such as a starter or generator) directly to the vehicle manufacturers were 'Tier 1' suppliers. Those that sold directly to the Tier 1s (copper wire or carbon brushes) were 'Tier 2.' Those that supplied raw materials to any of the above were usually characterized as 'Tier 3.' As the universe of domestic vehicle producers imploded, falling from more than 100 in the

1920's to just four in 1970,¹ competition among the parts suppliers to serve the survivors got stiffer, although the orders they won grew larger. Even so, the parts industry found that it could meet most requirements utilizing a limited number of facilities.

The Census Bureau reports that in 1985, firms identified to be primarily in automotive parts industry SIC categories (i.e., all Tier 1s, some Tier 2s, and probably few, if any, Tier 3s) generated shipments estimated to have a value of \$111 billion, nearly 5% of all factory shipments by all U.S. manufacturers that year. Employment in the sector averaged 796,700 for the year, 4% of the nation's total manufacturing employment. 1985 exports of U.S. automotive parts totaled approximately \$14.3 billion, compared with imports of \$15 billion, yielding a \$700 million deficit². Shipments to Canada and Mexico accounted for 81% of all exports, while imports from those countries amounted to 65% of that total. The United States had a \$2.2 billion surplus with Canada, a \$300 million deficit with Mexico. Trade with China yielded a \$17.8 million surplus on exports of \$18.6 million and imports of \$805,000. Shipments to Japan totaled just \$217 million, while imports reached \$2.8 billion, generating a bilateral deficit of \$2.6 billion.³

Impact of Global Trade Liberalization Upon the Auto Supply Chain

Several factors are bearing down simultaneously upon the U.S. supply chain, forcing it to undergo a major transformation – both in its composition and in its fortunes. These elements include:

- (1) *Globalization Without Liberalization – in Their Own Backyard:* From the late 1920's until the late 1970's, the U.S. auto industry had the home market mostly to itself. Prior to the 1973 oil embargo, in fact, imports were relatively insignificant, and foreign-affiliated manufacturing within the United States was nonexistent.⁴ That changed when Volkswagen (1979), Honda (1982), Nissan (1983,) and Toyota (1984) established large-scale assembly operations in the United States. Each new entrant followed the same pattern, at first importing most of its components; and if not the components, then the manufacturers of its purchased components; intending to rely upon their already established suppliers to provide all of their bought-in parts requirements – even though no local-content requirement was imposed upon them by the U.S. government.

In 1988, the VW plant in Pennsylvania was consolidated into its Mexican operations, having failed to generate sufficient volume to justify continuing in the United States. The Japanese affiliates grew stronger, adding additional participants and plants,⁵ and eventually (with some encouragement from the USG) purchasing significant quantities from U.S.-owned suppliers.⁶ Total “transplant” vehicle assembly increased steadily, reaching 3.1 million units in 2003 – 26% of all U.S. light vehicle production.⁷ On the other hand, Detroit 3 assembly volume (GM, Ford and DaimlerChrysler's Chrysler Group) has been decreasing, falling on average by 60,000 units a year between 1986 and 2002.⁸ In 2003 their production slipped by 500,000 units, and in 2004, another 470,000. The Detroit 3's share of all domestic light vehicle production was 96% in 1985, 25 points higher than in 2004. Many industry observers expect that the Detroit 3's

domestic (and global) share of production will continue to decline, inhibiting the prospects for any supplier that hasn't developed other customers.

- (2) *A Shift in the Industry's Business Model:* Many of the major new entrants in the U.S. auto industry employ a business model that combines collaboration between each assembler and its cadre of parts suppliers with a lean, flexible, just-in-time (JIT) assembly process. JIT is predicated upon short supply lines that can deliver small batches of components to the assembly line steadily and without interruption (often hourly, and sometimes synchronized to match a particular vehicle), coupled with the facility to immediately correct quality problems as they are discovered, and to make running changes in product specifications or volume requirements when needed. Buyers and sellers collaborate over time to drive costs down and share in the savings generated. This new business model appears to successfully lower the OEMs' input and assembly costs, improve product quality, and stimulate the development of new content.

On a long term basis the Detroit 3 are working to adopt JIT concepts and the collaborative, partnering approach to their own situations. Until they reach that point, however, they continue to seek price concessions while asking their suppliers to take on more design and manufacturing responsibilities and to absorb the suddenly higher costs for their steel and petroleum inputs. This situation is placing the supplier universe under great pressure. The Original Equipment Suppliers Association, OESA, cites separate studies in 2003 by Plante & Moran and by A.T.Kearney that found that only 20% of a surveyed universe of small, medium, and large North American suppliers were generating operating margins above 8%. 15% of each group were losing money.

- (3) *Trade Liberalization:* Declining tariffs, quota restrictions, and technical trade barriers in the emerging markets, coupled with fiercely competitive domestic and West European markets that will grow at most by 2% a year over the next 5-10 years – while some emerging markets are growing 15% a year,⁹ have encouraged U.S. OEMs to seek out new markets, many of which pressure foreign assemblers to rely on high levels of local content. Most OEMs, both U.S. and foreign, are usually more than willing to comply, particularly since their assembly techniques are all predicated upon local, JIT deliveries.
- (4) *Globalization of the Entire Auto Industry:* The global auto industry is shrinking, coalescing through both M&A efforts and via collaborative efforts, seeking to create manufacturing alliances focused on driving down costs and creating greater economies of scale than the competition enjoys. In the early 1960s there were some 100 independent vehicle manufacturers scattered around the globe. In 2004, six separate corporate clusters representing 25 large volume manufacturers produced 75% of the world's output.¹⁰ While these Global 6 will still be operating in 2010, and will still represent 75% of the world's output, where they produce those vehicles will have started to shift significantly.

PWC/Autofacts, for example, predicts that China's global share of vehicle production will rise

from 5% in 2003 to 8% in 2010, buoyed by a 90% increase in output to 5.3 million units. NAFTA's global share, on the other hand, could slip one point to 27%. (NAFTA will still retain top billing, however, having increased annual assemblies by 10% to a level of 17.5 million units.) A recent study by the Original Equipment Suppliers Association (OESA) and Roland Berger Consultants¹¹ estimates that the world market for original equipment (OE) auto parts (those used on the assembly line) will increase at a compound average growth rate (CAGR) of 3.4% per year between 2003 and 2010, reaching \$1.1 trillion. The U.S. market represented about 23% of total consumption in 2003, \$200 billion. U.S. consumption may grow at a CAGR of 2%, reaching \$220 billion, which would produce a 20% share of total world consumption in 2010. During this same period, China's OE parts consumption will have compounded at an annual rate of 10%, reaching a total of 8% of the world's consumption.

Each OEM cluster is struggling to gain the upper hand in a competitive arena that features closely matched teams fielding similar, essentially interchangeable product lines. The industry's battles are compounded by the existence of too much, too expensive, and too fixed investment in assembly capacity (often estimated to be on the order of 20 million – 25 million units globally over the past 10 years), coupled with a shift in the arena from the developed markets to the emerging economies that sport vehicle markets that are growing much more quickly. Every company is striving to maximize efficiencies, first by adopting JIT principles, secondly, by using just a few architectural platforms upon which they build multiple – but seemingly, unique – vehicle models and thirdly, by maximizing the utilization of common parts across brands, platforms, and affiliates.¹² U.S. parts suppliers (and their foreign competitors) once again face the prospect of fewer but more demanding customers, offering larger contracts, but spread over greater distances that necessitate more local, on- or near-site investment by each supplier.

- (5) *A New Tier Structure and Expanding Supplier Responsibilities:* Increasingly, the major OEMs are moving toward a “Vehicle Brand Owner” business model, in which each VBO eventually will be responsible primarily for managing, marketing, and maintaining a stable of nameplates, having surrendered more and more responsibility for content engineering and even for vehicle assembly to outside suppliers, and having transferred more and more costs, responsibilities, and product knowledge to them in the process. Some, including GM (Saab), DaimlerChrysler (Chrysler), and even Porsche, have already begun to subcontract production of complete low-volume “niche” vehicles to speciality assemblers. Suppliers now are being evaluated, not only on the basis of near-term price and long-term cost reduction programs, but also for their corporate stability, product design and production engineering capabilities, for down-stream management of their own supply chains, delivery reliability, willingness to locate plants in closer proximity to the OEM's – wherever they are located – and for participation in the assembly process.

The domestic parts industry is in the throes of responding to these new challenges. Some suppliers are

willingly taking on the new responsibilities offered to them by the OEMs–cum–VBOs, transforming themselves into “Tier One-Half systems integrators,” that engineer and build complete modules (for example, an entire interior, 4-corner suspension sets, an entire rolling chassis) and assume both product design and development responsibilities and down stream supply chain management functions previously undertaken by the OEMs. These suppliers are scrambling to add to their capabilities and product lines; building additional plants to satisfy JIT requirements and minimize inventory exposure, adopting global best manufacturing practices, investing in their own development of new technologies, or buying or merging with firms that can contribute new skills, complementary products, and new technologies.

Other firms, however, are choosing not to pursue this new role, consciously deciding to remain in the less demanding tiers. Studies by McKinsey suggest that they actually may be more profitable in the near term, but some eventually could find themselves in an exceedingly competitive environment of highly cost sensitive, commodity products – particularly if they are unable to differentiate their offerings. The OESA/RB study notes that only 14% of its surveyed participants managed to meet their cost reduction targets in 2000-2002. Unfortunately, producers don’t see this pressure slackening. In fact, 12% expect to be struggling with 20% reduction targets in 2003-2006, versus the 6% that faced this bogey in 2000-2002. It’s not surprising that many suppliers have exited the business, either through bankruptcy or by refocusing their efforts to serve other industries.

The Detroit 3 have shed most of their “captive” parts suppliers (and their high-rate labor contracts) as part of their struggle to reduce costs, spawning an active business in mergers and acquisitions that peaked at \$30 billion in 1999. Helped by these consolidations, 20 of the world’s top 50 global OEM suppliers are U.S. corporations that account for nearly half of the top 50’s total sales. A collection of firms spun off by GM became Delphi in 1999. Ford formed Visteon in the same way and for the same reasons in 2000. Both are at the forefront of the Tier One-Half revolution, ranking just ahead or just behind Robert Bosch as the worlds’ largest parts producers from one year to the next. Eventually every OEM may deal with no more than 50 or 60 Tier One-Half system integrators and no more than 300 Tier 1 firms, a considerable reduction from the 1970’s, when an OEM’s direct supplier list numbered several thousand.

OESA estimates that there were 30,000 firms in the North American automotive supply chain tiers in 1990, but just 10,000 in 2000 and 8,000 in 2004. By 2010, their numbers may dwindle to no more than 5,000, each enjoying significantly higher sales volumes, but each likely to require significantly fewer employees.¹³ OESA/RB forecasts an 11% decline in auto parts production worker employment between 2003 and 2010, caused primarily by increased productivity paired with slowing growth in U.S. output. While some industry observers may question the precision of these estimates, none will disagree with the magnitude of the pressure the industry is experiencing.

The Census Bureau’s 5 Year Economic Census and Annual Survey of Manufacturers are now reported only on a NAICS basis. Data is available for 1997 through 2001, with 2002 data due to be released shortly. The 1997 Economic Census reports that firms placed in NAICS Codes 336211, *Motor vehicle bodies*, and 3363, *Motor vehicle parts*, (which would capture most Tier 1s, some Tier2s, but probably

few Tier 3s) totaled 5,823 companies operating 6,694 related establishments. Total employment was 822,700 in 1997. By the end of 2001, employment had dropped 5.5% to 777,800, in line with the overall national employment decline during this period. Production worker employment fell more steeply, falling 7% to 615,500, but this also was in line with the national trend. The industry's payroll, however, grew more slowly than the national average, rising 2% to \$32.8 billion, while the nation's manufacturing payroll increased by 4%. Production workers' wages fared even less well. While the national wage increase was 1.4%, wages for production workers in the automotive parts industry fell 1.3% to \$23.7 billion.

Census reports industry shipments at \$187.5 billion in 1997, 5% of the total for U.S. manufacturing industries. The 2001 Annual Survey recorded industry shipments of \$197.4 billion, which maintained the industry's share of the national total. It may be more significant, however, that while the industry's value-added ratio in 1997 was nearly 41%, that ratio slipped to 39.7% in 2001. This may suggest that suppliers are failing to improve their position in the auto industry's value chain, or it may reflect the intense price pressures they are facing. IRN Consulting reports that U.S. suppliers were asked to cut prices by an average of 3.8% in 1997 and by 5.4% in 2001. Requested cuts averaged 6.3% in 2003.

Exports of U.S. automotive parts in 2003 totaled \$48.5 billion, compared with imports of \$74.5 billion, yielding a \$26 billion deficit – a good bit higher than 1985's \$700 million shortfall.¹⁴ Shipments to Canada and Mexico accounted for 78% of all exports in 2003, while imports from those countries represented 53% of that total. The United States had an \$8.9 billion surplus with Canada, a \$10.7 billion deficit with Mexico.¹⁵ Trade with China yielded a \$2.3 billion deficit on exports of \$500 million and imports of \$2.8 billion. This was dwarfed by the deficit with Japan, which totaled \$11.7 billion on exports of \$2 billion and imports of \$13.7 billion.

New Capabilities and Resources are Needed to Improve Supplier Competitiveness

The primary change agents impacting firms in the automotive supply chain can be summed up as:

- (1) The maturation of an intensely competitive global industry – there are now far fewer, but far larger auto manufacturers, seeking greater economies of scale and requiring larger suppliers capable of delivering those economies;
- (2) The maturation of the established major markets – demand is virtually saturated in the United States, Canada, West Europe, and Japan – while the emerging markets are virtually untapped; and
- (3) The evolution of a new business model predicated upon localized vehicle assembly – requiring very short supply lines and increased supplier responsibilities and expenses.

Given these circumstances, what will help U.S. suppliers adjust to the new reality? How can governments help them to become more competitive at home and abroad? The OESA/RB study cites a litany of changes that suppliers believe will help improve their competitive position relative to other countries, among them: front-loaded investment tax incentives; more effective education and training programs; lower healthcare expenses; more vigorous enforcement of international fair trade practices; a rebalancing of union/employer rights.

These topics also were identified in the Department's *Manufacturing in America* report, which comes to the clear conclusion that government agencies should strive to assure that they provide the lowest-cost business environment, consistent with their obligations to the public welfare. OESA also draws attention to the need for a better coordinated regulatory process, perhaps via an Ombudsman, that anticipates and seeks to mitigate the often conflicting demands imposed by government agencies.

However, the OESA/RB study also notes that even if government agencies were able to deliver every change requested, U.S. producers probably would still face a significant cost gap versus most of our major Asian trading partners. In short, governments can help, but cannot solve the industry's problems. Suppliers must adapt as well, making appropriate adjustments in their business plans and operating procedures to drive their costs lower and their standing on the value chain higher. As JIT principals become more pervasive in the assembly of vehicles, suppliers will need to follow their customers abroad or lose the business.

On the other hand, JIT principals also work against the wholesale transfer of parts production from the United States to other countries – with the possible exception of high labor/low technology content (i.e., commoditized) products. Producers can use that reality to their advantage by, perhaps, shifting their focus to the development and production of innovative products with proprietary technologies that help insulate them from price competition, or by restructuring their U.S. operations – completing low-tech high-labor manufacturing stages abroad, while maintaining higher value-added operations in their domestic plants. They must continually refine their business operations, and constantly improve their manufacturing processes. The Department's *Manufacturing in America* report proposes that governments assist in these efforts by revitalizing the Manufacturing Extension Partnership program (which helps SME firms develop more effective production practices), and by stimulating the development of new technologies and industries.¹⁶

The Department should evaluate the utility of organizing a series of exploratory trade missions to introduce small and medium American Tier 2 and 3 suppliers to the senior purchasing officers of all of the international vehicle manufacturers and upper tier partners. However, rather than visit these companies' individual plants in, for example, China or Brazil, the focus should be the global corporate purchasing offices, whether they are located in Tokyo or Seoul, Paris or Stuttgart. These missions would not attempt to generate immediate sales, but instead work to establish credentials and to seek opportunities for future business.

Note, however, that only those firms that possess proprietary technologies, or superior manufacturing processes and are prepared to compete on price, can expect to succeed with offers to supply these prospective customers via long-distance supply lines. Others must be prepared to invest in facilities in close proximity to their customers' plants, doing so to develop corporate-wide economies of scale that will help maintain the competitiveness of their existing U.S. plants. Many suppliers would have difficulty raising the capital needed for such investments, because of the relentlessly competitive global environment in which they operate. Therefore, governments also should explore creating WTO-compliant programs to improve U.S. supplier access to venture capital.

But more important than all of this, the small and medium-sized U.S. supplier community needs help in developing new manufacturing processes, and for adopting and adapting global best manufacturing practices to their operations. Without first regaining their international competitiveness, trade promotion assistance may not produce significant results. Moreover, because contract awards are slow to develop in the automotive industry, because they require an extensive proving period for the prospective supplier, and because the contracts may involve vehicles or components not scheduled for production for several years, it would be a mistake to expect that the recent devaluation of the dollar will provide a significant sales boost for the original equipment market (unless the realignment becomes permanent).¹⁷

At the end of the day, the domestic auto parts industry will require fewer employees. Thus, governments also should focus upon assisting displaced workers develop new skills and find new employment opportunities, not upon sheltering them from progress. Every such effort, however well intentioned, from Smoot-Hawley right up to the (recently relaxed) restrictions on some steel imports, has always generated unanticipated consequences that pop up unexpectedly somewhere else, place a burden on someone else, and succeed only in reducing the overall competitiveness of the American economy and in reducing our standard of living.

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Endnotes

1. Controlling interest in AMC/Jeep passed to Renault in 1980, which sold it to Chrysler in 1987. Chrysler was acquired by Daimler-Benz in 1998, forming DaimlerChrysler.
2. Using the OAAI/Automotive Industries Team's definition of auto parts, which is more precise than that used by Census. The industry recorded its first deficit in 1983, \$976 million, followed by \$1 billion in 1984.
3. The following year imports from Japan more than doubled, reaching \$5.7 billion. During this period, Congress considered and eventually rejected several proposals to establish import restrictions and local content legislation for vehicles assembled in the United States, including two bills introduced in the House in 1982 and 1983.
4. Imported vehicles didn't break above 10% U.S. market share until 1969. By 1975, they had reached 16%.
5. Mazda established a JV with Ford (1987), Mitsubishi with Chrysler (1988), and Subaru with Isuzu (1989). Toyota's 1984 effort was a JV with GM. Its first stand-alone plant was opened in 1988. Two German producers have also joined the ranks, BMW in 1995, and Mercedes-Benz (now DaimlerChrysler) in 1997. Honda, Nissan, and Toyota recently have added and expanded their U.S. plants. The Korean producer, Hyundai, is rapidly completing a large assembly plant in Alabama, due on line in 2005.
6. Purchases by the Japanese affiliates from U.S. suppliers totaled \$1.7 billion in JFY 1985, \$37.3 billion in JFY 2002, according to the Japan Automobile Manufacturers Association. 90% of their 2002 purchases were used in their U.S. assembly operations. Note that "U.S. suppliers" includes many affiliates of Japanese manufacturers. Between 1980 and 1989, about 260 foreign (mostly Japanese) affiliated parts manufacturers set up operations in the United States, employing 31,000. They had sufficient capacity to satisfy their original customers, and to serve the Detroit 3. BEA reports 534 foreign-affiliated auto parts suppliers in the U.S. in 2001, employing more than 170,000.
7. Between 2002 and 2004, Japanese-affiliated vehicle assembly plants will add nearly a million units of capacity, reaching 3.4 million units, according to estimates prepared by Ward's Automotive Reports.
8. Over the past two years, the Detroit 3 have closed four N.A. plants, refurbished at least that many others, closed two, opened two, and have announced plans for another two. Harbour & Associates estimates the Detroit 3's N.A. capacity at 13.5 million units in 2002, about the same as in 1999. Capacity utilization, however, fell from 99% to 91%.
9. J.D. Power estimates China's average annual growth rate at 15%. Others: Argentina, 8%; Brazil, 5%; India, 5%; Korea, 5%; Malaysia, 7%; Russia, 6%; Thailand, 14%; Turkey, 13%.
10. GM, Ford, Toyota, Renault-Nissan, DaimlerChrysler, VW
11. "Odyssey of the Auto Industry," presented before the SAE World Congress, March 8, 2004. Hereafter referred to as the OESA/RB study.
12. CSM Worldwide Consultants estimates that global vehicle platforms underpinned 59% of the world's total production in 1997, 65% in 2002, and may reach over 72% by 2007.

13. The next – and more profitable – wave of consolidations, consultant McKinsey & Company suggests, will find its locus among Tier 2 and 3 suppliers. The focus will shift from growing horizontally large to growing vertically smart, producing partnerships that yield more efficient entities that enjoy better margins within a narrowly focused group of products and components needed by Tier 1 suppliers and the system integrators. McKinsey notes that on average during the 1996-2000 period, Tier 2 firms generated a 7% return on sales, compared with 4.3% for Tier 1 firms. Their return on invested capital also was better, 12.2%, compared with Tier 1's 8.7%

14. 11-month 2004 data shows total automotive parts exports reached \$48.8 billion, up 8.6%. Imports gained 12%, reaching a total of \$76.8 billion. The result, so far, is a 19% increase in the 2004 deficit to \$28 billion. It already exceeds full year 2003's deficit by \$2 billion.

15. Unfortunately, most of the industry's shipments to these two countries are returned shortly thereafter, wrapped in shiny metal packages called cars and trucks. Thus, the surplus with Canada is not as significant as it seems, while the deficit with Mexico is even more significant.

16. However, the Administration's FY 2006 budget proposal includes a 60% reduction in Technology Administration's Manufacturing Extension Partnership program from FY 2005. The program, which helps firms improve their manufacturing processes, would be funded at \$47 million. The Administration also proposes to terminate TA's Advanced Technology Program, which provides assistance in developing practical applications from new scientific findings.

17. Near term opportunities for suppliers to the independent automotive aftermarket, on the other hand, can expect the dollar's slide to significantly boost their sales, if only for as long as the decline lasts. In the case of Western Europe, the window may have opened even farther, due to the EU's planned 2010 liberalization of its vehicle market to broaden the definition of "original" spare parts – those previously supplied to the aftermarket only through the vehicle manufacturer – to include parts produced by unaffiliated manufacturers that match the original equipment specifications. This will allowing independent producers access to vehicle dealers and to "insurance repairs." Sales through the aftermarket channel, however, is an entirely different game and is not further addressed in this paper.