

MEMO

To: Claire Brown and Sloan Globalization Project

From: Advanced Manufacturing Project

May 16, 2002

Description of AMP and the Component Parts Sector:

The Advanced Manufacturing Project (AMP) is a research consortium dedicated to investigating the determinants and possible policy supports of improved performance in manufacturing, in what we take to be its key swing sector — component manufacturing. Participating institutions in the consortium are: the University of Chicago, the University of Wisconsin-Madison, Case Western Reserve University and the Michigan Manufacturing Technology Center in Ann Arbor. We also maintain collaborative ties with researchers in Germany (SOFI Institute), Denmark and Italy

Firms in the component parts sector fabricate and/or assemble molded, forged, formed, pressed, cast and machined goods in both metal and plastic, principally for sale to other manufacturers. The sector stands at the base of such industries as automobiles and other transportation equipment; industrial, farm, and construction machinery; electrical appliances; and, to a lesser but increasing extent, such electronic equipment as medical instruments. Producers in our industry constitute parts of the first tier of many contemporary manufacturing supply chains. The bulk of the industry, however, is located further down the supply chain, in the second and third tiers.

Given their identity as suppliers, component firm strategies are very much shaped by the strategies of their customers, the OEM's. And, changes in OEM sourcing strategies are transforming the component industry. The shift can be characterized as a move from capacity subcontracting (where suppliers supply product that the customer already produces in house) to specialized subcontracting (where component suppliers deliver inputs that the customer cannot produce). AMP'ers Jonathan Zeitlin and Josh Whitford have described the dynamic of the new form of subcontracting in the following way:

“In this model, subcontracting relationships with outside suppliers mitigate the difficulties of volatile and fragmented markets that grant little cost leeway even as they demand increasingly diversified products with ever shorter life cycles. As OEMs slim down by focusing on core activities and outsourcing some operations, long-term supply chain management becomes central to corporate strategy. Large firms that once held substantial quantities of inventory and work-in-progress rely instead on suppliers consistently to deliver high-quality parts just-in-time (JIT). They devolve day-to-day production and require substantial supplier assistance on

process and design improvements to turn new ideas into marketable products quickly, and must thus improve inter-firm cooperation and information transfer. OEMs give more business to fewer suppliers, and forge closer relationships with a core “strategic” group that they hope to align with their own goals. But these key suppliers are *not* envisioned as mere satellites orbiting a dominant but benevolent patron, dependent and beholden. Rather, in a practice somewhat in tension with the desire to extract priority treatment when needed, OEMs often push these same suppliers to become *more* independent, wanting them to work closely with other customers and other end-use industries. They share ideas, technology and fixed costs with these “partner” suppliers in ways they recognize may benefit competitors, but hope the smaller firms will learn from *other* customers, acquiring competencies that can transform the supply base into a vital source of new ideas and technology”¹

There are a variety of firm types in component manufacturing. On the one hand, the sector has a wide array of very large multinational producers. On the other hand, tremendous portions of the component sector are dominated by small and medium sized firms. In what follows we discuss the main types of firm found in the sector. All of the types of firm outlined below are ideal types (especially 2-4) and it is possible to find firms that pursue variants of one or several of the types simultaneously

- 1.) Large multinational firms. Most of these firms are part of the first tier of the automobile industry supply chain (Magna, Delphi, Visteon, ZF, Bosch, Johnson Controls, Eaton, Parker Hannifin, Arvin Meritor, etc). But there are also a number of very large conglomerate-type firms producing specialized components or groups of components which focus on the second and third tier of the auto supply chain (ITW) or which are active primarily in non-Auto areas of manufacturing components supply (Emerson Electric, Danaher, GKN and others). Units of these MNC firms can be very specialized and small (ITW has several units with fewer than 20 employees). But all these corporations are typically broadly diversified, multi component producers, capable of marshalling significant leverage in negotiations with their customers. All large MNC component firms have far flung national and international operations and significant internal training, research, and marketing infrastructures.

There are two kinds of diversification strategies here: Most first tier auto “mega suppliers” are pursuing vertical diversification strategies that will give them the capability of producing entire modules of the automobile (front end, drive train systems etc). Here they seek to acquire expertise in a coherent set of interlinked technologies within the automobile—effectively defining and capturing an entire zone of the value chain in the automobile. There is

¹ AMP paper by Jonathan Zeitlin and Josh Whitford, “Governing Decentralized Production: Institutions, Public Policy, and the Prospects for Inter-Firm Collaboration in US Manufacturing” March 2002, UW-Madison

considerable concentration occurring in this sector as OEM's seek to consolidate their supply base and source from fewer firms. Few mega-suppliers actually produce large modules at the moment, but they remain active as sellers of a broad array of discreet components and sub systems. MNC component firms in non auto areas where customer volumes tend to be lower follow an alternative strategy of diversification. Here firms tend to assemble a horizontal array of specialized technologies (ball bearing units, pumps, measuring devices-etc) that serve entirely different industries and sectors. This gives them great exposure to user know how and cross fertilization possibilities on the one hand and reduces their vulnerability to business cycle swings in particular industrial sectors.

In an effort to meet OEM demands that they have the capability to design and build large chunks of products, these firms acquired a lot of other firms in the 1990s. For the most part, these firms have not recouped much of their investment, and several are facing bankruptcy, particularly in the auto industry. Reasons for their lack of success are both transitory (the sharp downturn in manufacturing demand in 2000) and more structural (firms that have made smaller investments have managed to compete with the megasuppliers, both because the megasuppliers have not managed to organize their capabilities efficiently and because their customers have not in practice been willing to pay extra for the mega-suppliers' new capabilities, which include advanced product development and managing global factories. If the mega suppliers' difficulties turn out to be more than transitional, it is possible that globalization of the supply chain will be slowed.

- 2.) Small and medium sized producers specialized on a particular product or process. This segment has grown as OEM's (and first tier mega suppliers) cast aside manufacturing operations in an effort to focus their operations on "core competences". The best of these suppliers have better equipment and can achieve better volumes in their specialty than any particular OEM—especially if that OEM is in the lower volume non automobile/consumer electronics areas of manufacturing. Josh Whitford and Jonathan Zeitlin describe such firms in the following way: "Rather than seeing just-in-time (JIT) production as a form of inventory shifting, such suppliers seek to reduce cycle times in an effort to drive stocks, work-in-progress, and thus costs out of the *entire* supply chain. These companies become the real experts in production, using this position to reduce costs from or add value to the product by focusing on process or design improvements in ways not possible before, when they simply built to specifications provided by OEM engineering departments so unconcerned with inter-firm collaboration that they did not even tell suppliers the end use of components."²

² *ibid.* See also AMP Memo, November 15, 2001: Report on Activities to Date" by Gary Herrigel

- 3.) Small and medium sized firms engaged in vertical diversification strategies. Here, following Whitford and Zeitlin, “firms bring additional process and/or design capability under a single roof, with the goal of becoming a “one-stop-shop” for OEM customers. They believe that as OEMs lurch towards the purchase of full modules and subsystem, suppliers with sufficient capacity to provide multiple services will be advantaged, as customers will not want to manage relationships with multiple specialists. In cost-competitive markets with thin margins, these firms also hope that they will be able to capture a larger portion of the value chain by encompassing multiple processes, and believe that having many operations in-house complements the OEMs’ need for ever shorter lead times.’ Distinctive about this strategy is that it is not a random acquisition of capacities. Rather ‘firms [focus] on a coherent set of core activities, revenue enhancement depends on capturing more of the *same* value chain, either by improving quality to move upmarket and adding design capabilities, or by adding complementary upstream and/or downstream operations, without encroaching too much on the core competencies of either their customers or suppliers..... Followed to its endpoint – though there is no reason suppliers cannot stop somewhere on this continuum – the logic of vertical diversification leads to a convergence of both product and process specialization strategies. The supplier becomes a full first-tier systems supplier, co-designing the product with the OEM, building those portions that fit its own core competencies and sourcing the rest to other process specialists (upon whom they perhaps also depend for some design help).³

- 4.) Small and medium sized firms engaged in horizontal diversification strategies. Again, Zeitlin and Whitford: “A horizontal diversification strategy resembles in certain respects that of the “capacity subcontractor” in that the supplier takes existing process capabilities and seeks to diversify the customer base, ideally expanding across multiple sectors. This strategy may complement aspects of vertical diversification (especially in terms of adding new process capabilities), but differs in its underlying logic by focusing primarily on spreading risk across supply chains, rather than enhancing value-added within them.⁴

Each of these strategies has benefits, but they also involve specific kinds of risks. Specialization makes producers vulnerable to down turns in their market area of expertise or to radical technological change that makes their specialty outdated. Vertical strategies

³ *ibid.* also Herrigel memo

⁴ *Ibid.* The authors also note that this strategy “also differs from a verticalization logic in that the supplier will utilize its varied capacities separately, rather than integrating them into a single product, thereby underscoring the point that we are dealing with a continuum of strategies.”

of diversification can be plagued by diseconomies of scope as well as excess capacity in various areas of specialty due to the slowness of OEM's to source in the integrated ways vertically diversified suppliers thought they would (a problem that is also felt at a much larger scale by megasuppliers in the automobile industry). Horizontal diversification runs the risk of fracturing the focus of the firm, making it difficult for the company to achieve systematic cost reduction for particular customers and also creating the possibility for overly complex process flows in plants.

AMP is only one year into its study of these firms. We are still in the data gathering stage and all of the above should be considered preliminary. To date we have produced only 2 major papers and a number of very detailed and analytical research reports (in particular the memo by Herrigel). Two members of the consortium, Helper and Luria, are currently preparing a major survey of component firms in the Midwest.

All of this said, below we go through the question's posed by the conference organizers and provide answers based on the qualitative interviewing we have conducted to date:

Framework for Discussion

- 1.) **Proximity:** When do firms need to place personnel and activities in global locations to secure access to technologies or markets? How do firms simultaneously allow adequate authority to managers in remote locations yet maintain control over critical know-how?

Component manufacturers, in particular the small and medium sized ones, often live in fear that their customers will begin to source their products from distant markets with lower structural costs (lower wages or lower costs due to currency differences) and stop sourcing locally. On the whole, it is not possible to identify a single trend in the character of OEM component sourcing. Massive amounts of components continue to be purchased by OEM's in the home market or region in which the OEM itself has production and assembly operations. Reasons for this have to do with quality, familiarity with supplier, transportation costs, timing and the willingness of local suppliers to collaborate on the issue of cost reduction.

At the same time, OEM's are clearly seeking to globalize their component procurement, for reasons of cost and for reasons of risk diversification. Many kinds of components, despite high transportation costs and uncertainties, can be much more cheaply sourced in a developing country market (Mexico, China). This is especially true of high volume normed or standardized parts that involve little co-development or supplier design input and can be reliably sourced with significant lead times. However, as component producers in those markets become more sophisticated, OEM's can attempt to source higher quality components in these markets as well (e.g. tool and die components). In the

latter case, the logic can have just as much to do with the desire to diversify risk by creating a broad base of quality suppliers globally as it does to achieve structural cost advantages. OEM's also will source the same component in a variety of regions if it has assembly or production facilities in a variety of regions—here the logic would be one of maintaining a variety of specific localities. AMP research in the globalization project would focus on making these dynamics more precise and empirically tractable.

The amount of 'skill' embodied in the product seems to have surprisingly little effect on where it is sourced. On the one hand, we have looked in detail at a firm that makes electronic actuators and switches for cars, production of which requires only moderately sophisticated assembly skills. This firm has no intention of moving much production outside the US (they have one plant in Mexico whose quality management is unhappy with), since labor costs are well under 10% of total cost, and defects are very expensive to find. On the other hand, some tool and die work is moving from Michigan to China. The Chinese firms' cheaper labor allows them also to offer a 96 hour lead time (in contrast to several weeks for a Michigan supplier)

Most MNC component producers have actively followed their OEM's around the world, building or acquiring capacity near major OEM assembly or production plant to be able to supply locally. This is typical of Megasupplier strategies in the European automobile supply market. MNC component suppliers have also sought to build production plant in lower cost markets to supply higher cost ones—though here they often will seek to complement or coordinate production with home market production facilities.

Some components cannot be sourced from foreign markets—e.g., heavy steel axels for farm equipment or off highway construction machinery. Transport costs alone would be prohibitive. In such cases, if there is internationalization, it is to serve customers producing in a far off market.

Small and medium sized firms are limited in their ability to follow their customers to foreign production locations. They are also constrained in their ability to source their own product in foreign locations for sale to customers in their home market. They lack the personnel and the capital to do these things. In rare, but not negligible, cases, small firms will shut operations down in the US and set them up in a lower cost environment—classically Mexico, but also China and elsewhere. Most small and medium sized component producers seek to stay competitive in their own markets by improving the quality of their product and achieving successes in cost reduction (including, unfortunately, pressing labor costs). This would also be an area of research that could be deepend in the rubric of the globalization project.

- 2.) **International Strategic Alliances:** When are short-term partnerships or long-term collaborations with global suppliers and customers superior to arm's-length relationships? How can firms gain advantage from co-development and co-production alliances with potential global rivals?

Component manufacturers gain from collaborations in both technological and cost reduction areas. In the technology area, as OEM's concentrate on core competencies, they are reliant on suppliers for design input on crucial components. From a global perspective, this can involve integration of the component producer into a development team located in a very far off customer home market. Increasingly, however, OEM's in autos and machinery building are shifting development and design infrastructure to the markets of end sale in order (among other things) to more easily and cheaply integrate local component producers into the development process (German firms in the US//US Auto OEM's and Megasuppliers in Europe are examples; also John Deere in the US and Germany). Research into how manufacturing OEM's locate their product development operations globally will be an important part of AMP 's global interest.

In the area of cost reduction, collaboration is increasingly necessary as both OEM and supplier work together to discover ways to achieve cost reduction targets (through alterations in product and component design; through marshalling of leverage among several suppliers; through the negotiation of component life cycles in a product (radical reduction in an outgoing component in exchange for further business in a new product). These kinds of negotiations are not crucially shaped by proximity, but more precision in the way in which leverage and cost collaboration is coordinated globally is plainly needed. This is a very significant growth area in the components sector.

Arms length relations in component areas are abundant and are shaped primarily by considerations of design complexity, volume and cost. Low, high and low yields arms length and also is possible through off shore arrangements.

- 3.) **Outsourcing:** When should a firm accept a foreign supplier in an arm's-length global relationship for all or part of an activity such as design, production, marketing, or distribution?

OEM's will accept foreign component suppliers at arms length in production when they have a clearly delimited already designed product that is required at a low cost that cannot be supplied domestically. In some cases, OEM's may be reluctant to commit themselves entirely to an off shore supplier in this way for fear of supply line disruption, or moral hazards and as a result source some capacity in a home market or in an alternative low cost market (E.g. Delphi supplies the same Daimler Benz assembly line with wire harnesses assembled in both Portugal AND Rumania). Our knowledge of the range and variety of these arrangements is completely anecdotal at this point.

- 4.) **Acquisitions and Spin-Offs:** How do firms evaluate the possible purchase of, or investment in, strategic assets around the world? How do they decide to spin off certain operations? How do acquisitions contribute to market knowledge and technology knowledge?

Those Component manufacturers who can follow their customers and their markets overseas do so. In large part, this is a question relevant only to the first tier auto megasuppliers. As noted above, because they believed that the Auto companies were interested in radically reducing the number of direct suppliers, acquiring more technologically complicated modules and in sourcing their global operations in a global manner, mega suppliers radically expanded the diversity of their product and technological palettes and the location of their operations. Firms bought component producers up and down the value chain and they often did so redundantly in the US and Europe. Interesting questions in this area involve 1.) how do auto and non auto suppliers cope with difficulties involved in expanding operations in regions with relatively little or underdeveloped pre-existing components infrastructure. How much can they acquire; how much build up from scratch. What are the costs in terms of training, development, infrastructure etc

Spin offs in the component world occur primarily for cost reduction reasons. Operations that are not performing well within a conglomerate are sold or rationalized. Operations generating costs within a vertically or horizontally diversified firm will be shut down or rationalized. In unusual cases, such as the 80/20 metric of evaluation at ITW⁵, firms will spin off particularly efficient parts of the production process or the product palette, to make them more efficient

- 5.) **Time:** How do firms adapt to shrinking product cycles in global markets? How have firms adapted just-in-time and other logistical innovations on a global scale, and how has the use of the Internet, and IT more generally, changed supply chain management?

Time is a key resource for home market component suppliers. They can leverage proximity and speed against higher costs in other areas. Even so, many producers, especially in the high volume auto industry, have established global JIT networks for standardized high volume, labor intensive or lower tech components. Disc brakes manufactured by Continental Teves, for example, are cast in Portugal, ground in the Ukraine and assembled in Germany for delivery just in time in auto assembly processes

The internet can promote both auctions and collaboration across supply chains. Internet auctions have made it possible to identify firms that are outside of normal channels; often these firms are outside the US. However, these firms have sometimes failed to meet quality and delivery criteria, so use of auctions is more circumscribed than proponents' original (highly hyped) expectations. Still, Covisint (the auto industry e-market place) has done a significant number of auctions (greater in value than all the other e-business sites

⁵ The mantra at ITW is that 20% of your operations generate 80% of your revenues and the goal should be to concentrate production on that twenty percent and eliminate the rest. This results in a dynamic of constant spin off production.

put together). In addition, an industry of firms that certify suppliers as capable is springing up.

The internet and other IT that doesn't require the huge partner-specific investments of EDI also has the possibility of promoting collaborative design and scheduling.

According to our interviews at a couple of mega suppliers, use of video-conferencing has made it possible to for sites in the US and Europe to co-develop complex products. However, face-to-face meetings are still necessary. One function of the face to face meeting is that it allows for hallway conversations—unstructured interactions that can lead to unanticipated combinations of knowledge, or that build trust among participants in ways that formal meetings do not.