

Governing Supplier Parks: Implications for Firm Boundaries and Clusters

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Comments welcome.

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The aim of this paper is to analyze the causes and consequences of the emergence of supplier parks in the global automobile industry. They represent, for some, new experiments in production and logistics management; for others, they are a reversion back to the Rouge model of a highly vertically integrated factory, except that ownership is fragmented. Thinking more broadly about international trade and the political economy of regional development, supplier parks are subjected again to different interpretations. At one extreme, they may be regarded as clusters with all the goodness of a locally embedded production system, but at the other extreme they constitute an ultimate tool by multinational corporations to de-territorialize and control the 'global commodity chain'. How can we relate these different views with each other?

Starting with greenfield sites in emerging markets, especially Brazil, supplier parks have been spreading rapidly in Europe and North America in the recent past. This makes it particularly timely to examine the key drivers for creating supplier parks and the main challenges in the successful execution of supplier parks. A supplier park may be defined as a cluster of suppliers located adjacent to, or close to, a final assembly plant. It is used as a generic term to refer to the phenomena variously termed industrial parks, supplier campuses, modular consortia and condominiums. The paper develops a typology of supplier parks by identifying key attributes of their governance within the supplier park and its link to the region and beyond.

This paper is structured as follows. The first section reviews a broad literature that is relevant to supplier parks, around the issues of the disintegration of

large firms and the clustering of productive activities. The second section homes in on the automotive supplier park phenomenon, by describing specific cases of modular consortia and supplier parks. The third section then discusses the ambiguity in the incentives for creating supplier parks, from the viewpoints of OEMs and suppliers, by identifying four dilemmas or puzzles, before concluding the paper.

1. Firm Boundaries and Clustering in the Global Economy

In order to put the supplier park phenomenon in a broader theoretical context, it is necessary to trace how contemporary theories of the firm have interacted with international trade and economic geography. Different disciplines interpret a phenomenon through their own specific lens, attributing different causation and characteristics to the same phenomenon. Clustering is a good case in point, as it has grown into a popular academic research topic¹ and a public policy concern.² A conflation of positive and normative discussion in many of the writings in this field has led to implicit evaluation of the virtues and vices of various modes of organizing. Although this paper intends to focus on a positive analysis, it helps to make explicit the normative overtones of autonomy being better than dependence and exchange between equals being better than hierarchy, apart from the more explicit policy goals of long-term economic stability, dynamism through innovation, and good jobs. This section reviews the debate around the disintegration of large manufacturing firms and the rise of clusters, with a view to shedding light on why supplier parks are being created in the auto industry today.

1.1 *Dis-integration of Large Firms, but What is a Firm?*

Automakers – OEMs – are representative of the large manufacturing firm as described by Chandler (1977) and Penrose (1995). Their main task is to design, produce and distribute goods in large quantities for large markets. Economies of scale that arose out of the separation of planning from the execution of standardized tasks

¹ The way Porter (1998; also <http://www.isc.hbs.edu/econ-clusters.htm>) characterizes clustering as an extension of his four forces diamond is very different from conceptualization by those interested in the political economy of industrial districts and the socio-cultural aspect of the regions (e.g. Piore and Sabel 1984, Saxenian 1996).

² See, for example, the websites of COWS (<http://www.cows.org/>) for the USA, and of the UK Department of Trade and Industry (<http://www.dti.gov.uk/clusters/>) on

accounted for spectacular increases in productivity, consequential growth in markets, and further division of labour. The ultimate factory in this age of mass production was Ford's Rouge site built in 1927 to house its own steel mill, foundry, and machining shops (cf Toyota was not so different in its degree of vertical integration when it started making cars in the mid-1930s).

Vertical disintegration in the auto industry is normally recounted with reference to the challenge Japanese manufacturers posed with its lean production and supply in the 1980s. The story goes that the rigidities and coordination failure resulting from detailed specialization within large corporations were brought home to the likes of General Motors and Ford. They eventually sold their parts divisions (Delphi and Visteon respectively), and adopted flexible production based on problem-solving teams, in order to be as agile as the Japanese counterparts. The outsourcing of components, however, was a mixed model, of just-in-time (JIT) delivery by 'partnership' suppliers on the one hand, and of global sourcing from remote low-cost suppliers on the other hand. The 1980s saw the analysis of this phenomenon by using transaction cost economics (TCE) (Williamson 1985). Transaction costs explained the rise of vertical integration by referring to the hold-up problem caused by an opportunistic supplier – typified by GM's acquisition of Fisher Body in the academic folklore. But TCE was also invoked to explain vertical dis-integration when trust in supplier relations tempered opportunism and enhanced the optimality of relational contracting that lay between markets and hierarchies.

The pre-condition for disintegration, however, existed much earlier than in the 1980s in some parts of the industry. For example, when firms manufacture standard commodities or goods using standardized processes, vertical disintegration happened relatively quickly, as was the case with the machine tool sector. Although the skills associated with machining operations were often craft-based and tacit, their output could be codified and standardized. With increased specialization, markets for such common operations to service a variety of sectors (ranging from arms, aircraft, autos to other engineering products) were large enough to sustain a number of small specialized firms. Parts of Detroit, in the first decade of the twentieth century, before the rise of Ford and General Motors, certainly had a character resembling this situation.

its clusters policy.

This mode of decentralized cooperative production is typified by the industrial district in Baden-Wurttemberg or the Third Italy. Popularized as flexible specialization, Piore and Sabel (1984) brought to attention the existence of these industrial districts for their better-than-average growth of exports of innovative products. In their account, Piore and Sabel attributed this superior performance to the extensive intra-district trade among small firms which were locally owned, employed highly flexible workers in a local labour market, and shared locally provided services in technical expertise, finance, and marketing. The evolution of strong local cultural identity, combined with craft skills and know-how that were specific to the district as a whole, reinforced the community aspect of this sort of production system. But the boundary of the district was clear-cut and evident to everyone, as it was global on the outside (because of exports for international demand) but highly local on the inside. The question, relevant to understanding supplier parks, is whether or not branches of multinational companies can also become embedded in this way over time.

More recently, there is an increased awareness of how the dynamics of technology affects the boundary of the firm. This has pushed to the limit the notion that firms have boundaries at all.

In one variant that explores this link, Sturgeon (2002) attributes the rise of contract manufacturing in consumer electronics to the increased codifiability of knowledge required to assemble products such as the personal computer (PC). In the case of the PC, not only are components, subsystems and interfaces increasingly standardized; the practice of manufacturing and assembly operations are also becoming more codified with a steep reduction in the cost of storing, modifying and transmitting information using ICT. It is therefore not just the modularity in product design (Ulrich 1991), but also the codification of manufacturing operations that jointly promote the decoupling of product design from manufacturing. The most recent spate of disintegration in manufacturing is promoted by these technological conditions, creating firms that focus on systems integration and product design but outsource all manufacturing. Of course, a complete separation of product design from subsequent production may never be complete, but Pavitt (2002) predicts an increasing division of labour between system integrating firms in developed countries and contract manufacturers in developing countries. This is no more than the Taylorist principle of separating conception from execution, which is now paradoxically a source of flexibility than of rigidity. In one sense, this is also a vindication of Vernon (1966)'s product cycle

theory of trade, as he argued that relocations to developing countries would happen when products reach a mature stage in their cycle and techniques had stabilized.

System integrating design firms that outsource all manufacturing take to the logical extreme the notion that 'firms should know more than they make' (Brusoni et al 2001). Particularly in an environment of dynamic technological change and persistence of uncodified knowledge, contemporary theories of the firm that are based on resources (Penrose 1995), dynamic capabilities (Teece and Pisano 1994) or innovation (Lazonick 2002) caution against the outsourcing of technological knowledge. Nevertheless, the prevalence of alliances in R&D and collaborative project management suggests that the boundaries of the firm are becoming blurred as knowledge becomes increasingly specialized and any firm cannot source all from within but must access it from the outside (Pavitt 2001). Regardless of firm size, the network of agents tend to be more open than in traditional industrial districts, as they interact amongst themselves but often with resources which come from outside the core of the network. Silicon Valley, with a complex network of shifting alliances, relationships, intermediaries, firms and investors, is one manifestation of this phenomenon.

Another manifestation, more directly relevant to supplier parks, is the practice of involving key module and systems suppliers in the development of new automobile projects. Supplier engineers typically co-locate at the OEM's technical centre to engage in a highly integrated process of design. Helper, MacDuffie and Sabel refer to this as a 'non-standard firm' in which 'components or services crucial to the final product of one firm can be provided by independent companies and the firm's internal specialized producers can provide outsiders with crucial inputs' (Helper et al 2000 p.465). But can a productive arrangement carried out by a network of entities with separate ownership indeed be called a firm? If the answer could be yes, what binds the network into a firm is not unified ownership, but something else that gives a collective identity and a systematic property to the entity engaged in productive activities.

1.2 Embeddedness in Locality remain, but can Multinationals be a Force for Embedding?

Now, we must marry the contemporary theories of the firm with international trade and economic geography. As a starting point, globalization and locational

clustering are not necessarily opposites. Globalization, in the sense of the integration of the global economy through lower barriers to trade and reduced transportation costs, has led to greater international division of labour. It is precisely this increased specialization in certain skills and activities, enabled by globalization, rapid transportation, high speed communication and accessible markets, that leads to clustering (Porter 1998). A cluster is defined by Porter as a geographic concentration of interconnected companies and institutions in a particular field, and is an alternative way of organizing the value chain that lies between arms'-length markets and vertical integration. Clustering leads to high productivity and innovation because it gives good access to resources such as employees, suppliers, and specialized information, and also leads to face-to-face rivalry of a healthy sort amongst competitors. Proximity matters here because local rivalry among firms with known identity creates a better motivational force for competition (and cooperation) than faceless competition. This is quite a different basis for valuing proximity from one based on 'sticky knowledge' (see later discussion).

Moreover, clustering in the sense of having firms engage in similar activities physically concentrated in a particular locality is not in itself sufficient to gauge whether or not it functions or performs well. The evaluation of well-functioning may be merely outcome-based, e.g. whether the cluster grows and remains vibrant with innovation and well-paid jobs. But the process of arriving at these outcomes is just as important. In this context, 'territorialization', a specific case of embeddedness, is often considered a cause of desirable outcomes.

In economic geography, territorialization refers to a situation in which economic activity is dependent on territorially specific resources, i.e. relatively immobile factors that are tied to a specific region. As Storper (2000) notes, the increased specialization in activities through international trade may lead to the preservation or destruction of territorialization. This is an important point, as it is frequently assumed that international trade and investment de-territorialize more than territorialize productive activities, due to foot-loose branch plants of multinational corporations (MNCs). At one extreme, MNCs may indeed be a force for deterritorialization if they source components or final goods (such as clothing or footwear) from specific developing countries with little territorially specific assets apart from low-wage labour. Here, MNCs, particularly if they are brand-named merchandisers, are a powerful node in the 'global commodity chain' (Geraffi and

Korzeniewicz 1994) precisely because they can hedge one low-wage location for another in sourcing their merchandise. By contrast, specialized industrial clusters, such as the Italian industrial districts, depend equally highly on the export of outputs for international customers, but their production system is territorialized in the sense of drawing all the key resources from within the locality.

Even in some of these industrial districts, multinational companies have invaded to first de-regionalize (i.e. by abandoning old ways) and then to re-regionalize a certain locality by adopting a new productive arrangement linked to the MNCs (Herrigel 2000). Herrigel points to the practical difficulty of re-territorializing a de-territorialized region, particularly when local suppliers are excluded from the new cluster led by an MNC, predicting a dark future for some of the new MNC-led industrial districts. But is this pessimism warranted?

It seems to me that there are two strands to this pessimism that have to be dealt with separately. One strand is a moral case that objects to the imposition of a hierarchy from the outside in an otherwise self-governing 'centre-less' district. The opprobrium is cast against imposed hierarchy and undermined autonomy, and the prospect that people who contribute to production do not necessarily benefit fairly as MNCs expropriate the fruit of labour. An absolutist position on this is not subject to debate, as it cannot be put in a better light by pointing out trade-offs, for example, a better injection of capital and opportunity for skill upgrading by MNCs at the expense of the loss of local autonomy and identity.

The other strand is the logical difficulty of starting a re-territorializing process once de-territorialization has occurred. Here, I recommend moving from talking about territorialization to embeddedness (Granovetter 1985). Territorialization in the sense of dependence on territorially specific resources apply less and less to factors of production including labour. There is an essential difference between a reliance on locally based resources such as natural resources (e.g. mineral mines, climate, and water) that are totally immobile on the one hand, and a reliance on physical, financial, human and intellectual capital whose immobility in a world of greater mobility is as much about making commitments as about constraints on the other hand. Then, embeddedness of productive activities in a region or territory, depends much on commitments. This points to the possibility that some supplier parks can become more embedded, and others less so, depending on the nature of commitment being

made by key factors of production.

1.3 Mysteries of the Region, but are Mysteries Recreated or Destroyed in Globally Connected Firms?

The advent of the Internet with all the hype about virtual space has yet again raised the prospect of the death of distance (Cairncross 1997) and the consequential loss of any advantage in industrial localization. In some sense, clusters are held together by the limits of communications technologies. But why do we continue to see clusters more in some sectors than others? How do we explain the distribution of clusters that die and those that survive? These questions are raised and answered by Brown and Duguid (2000). They argue that the new communication technologies have not undermined clusters because the spreading of knowledge is not the same as the spreading of information. It is often through the sharing of practice, normally requiring face-to-face encounters, that knowledge becomes actionable. This is certainly the case with much of scientific knowledge, and also the implementation of certain techniques such as lean production.

Brown and Duguid's (2000) discussion of the well-known phrase by Alfred Marshall – 'The mysteries of the trade become no mysteries; but are as it were in the air' – is useful here. 'Mystery' denoted skills, crafts and implicit knowledge that they represent. It also was a term for the old Guilds, i.e. associations of craftsmen. Thus, 'mystery' was 'in the air' in the sense that without such formal organizations, the secrets of the trade were shared – as though they were public knowledge – in the locality. Thus if knowledge is difficult-to-codify and is comprehensible only within the context of shared practice, then it is best transmitted through proximate and repeated contact. Thus, the propensity to cluster depends on the nature of knowledge and activities involved, being higher where knowledge is difficult-to-codify, and when premium is attached to the speed of spreading such knowledge.

Tacit knowledge ('sticky knowledge') makes 'sticky places' advantageous (Markusen 1996). Without a shared practice, it's hard to get knowledge to move (Brown and Degruid 2000). But despite this, there has been a relentless move, not least by multinational corporations, to try and codify what had previously been considered uncodifiable, and to spread it to geographically dispersed places. Moreover, even within a firm or a cluster, benchmarking and continuous improvement are based on

identifying standardized (or standardizable) practices, which become an object for making improvements. Here, like in peer networks, clustering (proximity) is important not so much as a conduit of tacit knowledge, but for providing a psychological basis for staying ahead in innovation. Rivalry rather than cosy membership in a community is the focus of analysis here. In the automobile industry, productivity benchmarking relies on ranking and the identification of 'best practice' as a motivational force for improvement. Supplier associations (Sako 1996) and supplier development (Sako 1998) also rely as much on a sense of rivalry amongst suppliers as on sharing know-how amongst them.

The above discussion indicates that supplier parks for the same OEM, particularly if they are geographically apart, are likely to develop their own local practice as uncodified element of knowledge can be spread only through the implementation process. At the same time, each supplier park has the capacity to improve its overall performance by using benchmarking to fuel rivalry amongst suppliers.

To summarize this section, it was argued that large manufacturing firms may dis-integrate their supply chain, particularly if they have the following pre-conditions: (a) a modular product architecture with well-defined (if not standardized) interfaces between modules, (b) codification of manufacturing and assembly processes, and (c) a decoupling of product design from manufacturing. Vertical disintegration can happen without geographical proximity between firms when all these conditions hold. If some of these conditions are violated, as is likely with complex multi-technology products facing technical change, co-location is likely, in design and production, where proximity facilitates the transmission and sharing of knowledge in the context of shared practice. Clustering led by a multi-national firm is nevertheless subjected to various forces that may lead to the embedding or otherwise of its activity in a specific location. It was argued that embedding occurs due not so much to immobile territorially specific factors, but to commitments made by the firms and by factors of production. Such commitments may reinforce the 'mysteries in the air' of the locality, with uncodifiable knowledge. But attempts at codifying and formalizing are a basis for making improvements in practice.

2. Significance of Automotive Supplier Parks

This section describes the major examples of modular consortia – including Volkswagen Resende and MCC Smart in Hambach – and supplier parks which have opened in Europe and those being planned in North America. Key suppliers of modules (or subsystems) on supplier parks are also identified. Sources of information in this section, for the moment, are largely secondary, based on published materials supplemented by some interviews conducted by the author.

2.1 Modular Consortia

Perhaps the earliest example of the actual implementation of the idea of a modular consortium was by Volkswagen, which started assembling trucks and buses at Resende, Brazil, in November 1997. This innovative organization resulted in part from the ambition for a new factory concept by Lopez (who moved from GM to VW to find a receptive home), and in part from the failure of Autolatina, a joint venture with Ford, which left VW with no expertise in designing trucks and buses in-house. Nine suppliers (known as ‘partners’) are housed under the same roof to make seven modules and to fix those modules for final assembly.³ As such, Volkswagen does not employ any direct workers amongst the 1365 workers on site. More strikingly, all production workers are on a harmonized single human resource management system (with identical wage, benefits, hours, etc.) regardless of the company for which they work (Ramalho and Santana 2002, p.762). VW provided a total of US\$250 million investment in land, buildings and equipment, while a further US\$50 million were invested by the suppliers. VW, nevertheless, remains in charge of basic design, quality assurance, R&D, and coordination amongst suppliers through an Executive Committee and a Co-ordination Committee that meet regularly to define long-term strategy and manage shorter term issues respectively. VW may be said to control the supply chain through its ownership, not of factors of production (such as capital and labour), but of the VW brand name. Although ownership is dispersed, in all intents and purposes, the Resende site operates as if it were integrated as a single firm.

³ The nine firms are Remon (Bridgestone) (supplying tyres and wheels), Iochpe-Maxion (chassis), Meritor (axles and shock absorbers), Powertrain (a joint venture between Cummins and MWM) (transmission units and engines), Delga (cabin construction), Carese/Eisenmann (painting), and VDO (steering and electrical work) (Ramalho and Santana 2002, p.759).

Brazil has been treated by many US and European OEMs as an experimental ground – a laboratory – for testing new manufacturing concepts. Specifically, General Motors' Blue Macaw project led to the opening of a new plant in Gravatai, in Rio Grande do Sul, to manufacture a subcompact Corsa derivative, with 17 suppliers.⁴ Similarly, Ford's Amazon Project resulted in the establishment of a plant in Bahia to build passenger cars on a platform remodeled on the Fiesta, with 18 module suppliers under one roof and further dozen suppliers nearby.⁵ Just as at Volkswagen Resende, all the suppliers are on an identical human resource system, in which Ford is responsible for recruiting and training all operators at the suppliers as well as for the Ford's main line.

Other examples include the Chrysler pickup plant in Campo Largo, Parna (closed only 2 years after opening in June 1999); the Mercedes A Class plant at Juiz de Fora (with a sister plant at Rastatt, Germany); the VW/Audi plant in Sao Jose dos Pinhais; and the Renault plant to manufacture the Scenic and Clio models at Curitiba, which spearheaded Renault to create supplier parks at brownfield sites in Sandouville, Douai and Palencia in Europe. Unlike the VW Resende plant, all these other investments deviate from a 'pure' modular consortium in that the OEM takes some part in the assembly process and that some suppliers are located close to, but not on, the consortium site (see Lung et al. (1999) and Salerno (2001) for details).

Another oft-cited example of the modular consortium is the SMART plant in

⁴ The Gravatai plant has 16 suppliers on site, and one in the surrounding area. They are: Polyprom (small stamped parts), Saint-Gobain (pe-assembled window glass), VDO (dashboards with pedals), Bosal-Gerobras (car tool kit), FSM (screws, mounting elements), TI Bundy (brake and fuel lines), Industria de Plasticos Automotivos/Soplast (fuel tanks), Delphi (front and rear suspensions), Sogefi (air filters), Lear (seats, headliners and door dressing), Arvin Meritor (exhaust systems), Arteb (lighting systems), Goodyear (assembled wheels and tyres), Pelzer (plastic injection parts like bumpers, internal trim, door lining), Inylbra (upholstery, carpeting, insulation), Valeo (cooling systems). The seventeenth company, Zamprognna, delivers steel sheets. (Salerno 2001, pp.100-101). GM's Brazil experiment is in a leading position, with an intent to apply lessons to the European operations, specifically the Vauxhall plant at Ellesmere Port, UK, assembling Astra, a GM plant in Antwerp, Belgium, and the Opel plant in Russelheim building cars on the so-called 'Epsilon' platform.

⁵ The Bahia plant uses 33 suppliers in total, of which the major ones are Visteon Corp. (instrument panels), Valeo SA (front-end modules with radiators), ArvinMeritor Inc. (exhaust systems), Dow Automotive (painted plastic doors, side panels and bumpers), Lear Corp. (seats), Benteler AG (front and rear suspension and brakes), SAS (door modules), BSB (large stampings), ThyssenKrupp Automotive AG (suspension stampings) and Kautex Textron (fuel tanks) (*Automotive News* May 27 2002).

Hambach, aka Smartville, in the north east of France. The idea of a two seater electric city car was conceived by Nicolas Hayek, the founder of Swatch, to offer consumers the same sort of variety, quality and affordability in cars as for the watches. A joint venture between Hayek's SMH and Mercedes-Benz, called Micro Compact Car (MCC), was formed in 1994. The project did not go as planned, as the idea of an electric car was superseded by the conventional gasoline-powered car, and the car had to be re-engineered at a late stage to avoid the same sort of instability problem that Mercedes was facing for its A Class cars. Consequently, the product launch was delayed, and when cars finally started rolling out in 1998, Hayek pulled out leaving all of MCC to Mercedes.

Despite these problems, the MCC plant retained a key feature of the initial project, which became a potential blueprint for other OEMs with similar plans of their own. This was the concept of delayed differentiation, in which consumers could choose a variation – in reality only the choice of body colours -- at a dealership that committed to delivery with a short leadtime. The design principle that made this commitment possible was the modular consortium, in which ten key suppliers, called 'system partners', were involved in the project from the start to develop the modules, which are then manufactured by them and assembled into a final car. Eight of the ten are integrated into the site, namely Magna (body-in-white assembly), Eisenmann (body painting), Dynamit Nobel (plastic body panels), Ymos or Magna (doors), Mannesmann VDO (cockpit), Krupp-Hoesch (engine mounting and mechanical parts), and Bosch (front end module). The other two, Faurecia (seats) and Continental (wheels), operate in the immediate vicinity of the MCC plant. Of the total investment of 400 million Euros, 40% were undertaken by the suppliers. MCC employs around 600 employees and the system partners a further 900, but all employees are treated identically on the same human resource system, symbolized by the common canteen situated above the centre of a cross-shaped building that houses the assembly processes. A major difference from the VW Resende practice is that MCC retains control over the final assembly.

2.2 Supplier Parks in Europe

Perhaps the earliest move towards supplier parks in Europe was made by the Volkswagen group, which began introducing the so-called platform strategy, transforming its methods of production and supplier relationships after the acquisition

of the Spanish carmaker Seat in 1986 and the Czech Skoda in 1991. An industrial estate was built close to the Seat plant to bring together about 15 suppliers. The Skoda plant assembling Octavia in Mlada Boleslav, Czech Republic, was reorganised to incorporate about a dozen suppliers who assemble and deliver modules to the main line.

In the 1990s, Ford in Europe also played a pioneering role in bringing industrial parks or supplier campuses to the region, starting with Valencia, Spain, and Saarlouis in Germany, in 1996, both to produce the Focus. Ford Valencia has 13 suppliers on the park, whereas Saarlouis has 12 suppliers. Both sites have received local government incentives. Interestingly, although the same product was launched at the same time in the two sites, variations exist in the arrangement of supplier parks, manifesting the power of plant-level manufacturing staff and local circumstances. For example, JCI assembles and sequences seats on the park at Valencia, but this is done from a nearby pre-existing operation off the park at Saarlouis. Some major modules are made by different suppliers at the two sites; in particular, instrument panels are assembled by IPV at Valencia but by Visteon (teaming up with a logistics supplier, Anterist & Schneider) at Saarlouis.

After the Focus, two other major platforms were subjected to Ford's modularity study that incorporated the idea of industrial parks. One was a C/D platform, with the new Mondeo that was launched in 2000 at Genk, where a total of 10 suppliers are located on the supplier parks. Ford Genk, after some debate, decided to ask the suppliers to own the land and the buildings, in order to foster long-term relationships. (The companies are Conix, Illbruck, Magna, Pelzer, Rieter, Terberg, Lear, Textron, SML, and TDS-Essers). At Jaguar, the X-Type, which shares some parts with the new Mondeo, began production in 2001 at Halewood, where two suppliers (Sekurit, Pirreli) are housed within the final assembly area and a further five (Lear, Conix, Visteon, Studco, Infast) are located on a supplier park. The park land, previously owned by Jaguar, was first sold to English Partnership, which leases the land but requires suppliers to build their own buildings.

The second major platform is the B platform, on which the new Fiesta was developed and produced at Cologne. This is the platform at the heart of the Amazon project that resulted in the Bahia plant in Brazil discussed earlier in the paper. A major investment of \$645 million was made by Ford at Cologne to replace old

production equipment to enable flexible production. At the same time Cologne opened its supplier park providing space for 12 suppliers to deliver modules directly to the assembly line through a tunnel, on an in-sequence basis ('Ford gets rid of the bottlenecks in Cologne' *Automotive News* October 7 2002).

With this European track record, Ford plans to open its first supplier park in the US in 2004, a 155 acre area less than a mile from its Chicago assembly plant, costing \$250 million, plus incentives worth \$110 million from the state of Illinois, city of Chicago. Nine suppliers have already signed long-term leases (9 years for some), and several more are expected to join. Those already committed are: Sanderson (stampings), Tower Automotive Inc. (stampings), ZF-Lemforder (suspensions), Visteon Corp. (instrument panels, fuel tanks, engine coolant components), S-Y Systems (wiring), Summit Polymers Inc. (console-injected plastics), Plastech Engineered Products (injected and blow-molded plastics), Broser Technik fur Automobile (door components), and Pico (manufacturing equipment) ('Betting on Ford' *Ward's Auto World* Vol.38 Issue 7, July 2002, pp.14).

Unlike Ford, that began establishing supplier parks in Europe before implementing them in the US, some European OEMs treated greenfield sites in the US as experimental grounds. In particular, Mercedes' M-Class at Tuscaloosa, Alabama, was built with help of ten suppliers, and was also later built in Austria. Similarly, BMW's plant in Spartanburg, North Carolina, has 15 suppliers in the vicinity, and is a test bed for applying similar principles for BMW's plants in Germany.

2.3 Suppliers' Perspectives

A cursory look at which suppliers have located on supplier parks around the world leads to a striking discovery, that it is more or less the same company names that crop up again and again. They include Benteler for axles; Tenneco for exhausts; Faurecia, Lear and Johnson Controls for seats; Textron, Sommer Allibert, VDO and Visteon for cockpits; and other major names such as Delphi, Magna, and Bosch. Some of them are indeed global mega-suppliers that have grown through M&A. In this process, many of the smaller locally based companies, be they German private companies or Brazilian firms, have been absorbed. Module suppliers have also engaged in both horizontal and vertical integration to arrive at this position. JCI is a good case in point, most recently acquiring Prince, an interior trim manufacturer, to

grow from being a seats manufacturer to a design manufacturer of the entire interior.

There is a division of labour also between assembly of modules and the manufacturing of components that go into modules. The latter, component manufacturing, may be undertaken away from OEMs' final assembly if economies of scale can be exploited by consolidating production for several OEMs, or if product variety for any specific customer is quite low. The pattern of moving the sequencing and assembly operations only to supplier parks, whilst keeping component manufacture away, is common in Europe and elsewhere. Even in remote locations like Bahia in Brazil, some suppliers are assembling on campus, but taking delivery of components to be assembled from a few thousand kilometers south, in the industrial region around Sao Paolo.

The separation of module assembly from component manufacturing also makes the barrier to entry into the assembly work much lower. Assembly of modules is a semi-skilled operation, in which much of the efficiency gains come from good sequencing of parts and well-managed logistics as well as management know-how in plant layout and supervision. Opinions are divided on whether or not logistics suppliers that may manage the movement of components and modules on supplier parks can compete head on with module suppliers for assembly work.

Summary

To summarize this section, supplier parks have been a 1990s phenomenon, which had concentrated in regions such as Brazil and Europe, but is set to spread to North America and also to other emerging markets such as Central and Eastern Europe. Apart from the clustering of suppliers adjacent to, or close to, the OEM's final assembly line, and the idea of suppliers sharing in the upfront investment costs, they vary substantially along the following dimensions.

- (a) The physical layout (suppliers under the same roof or in separate buildings).
- (b) Extent of synchronization between the OEM's final line and suppliers' operations, as manifested by the presence or absence of conveyor links and the amount of buffers in the assembly process.
- (c) Who invests and owns capital, especially land and buildings, owned by suppliers in some cases and leased to them in other cases.
- (d) Whether or not employment governance is unified or diversified, with modular consortia opting for a uniform human resource system more than other types of

supplier parks.

- (e) Whether or not suppliers on supplier parks get involved in design, or whether they undertake manufacturing and assembly only.

It is unclear, at this stage, how these dimensions correlate to each other.

3. Four Dilemmas at Automotive Supplier Parks

There are at least four areas in which automotive supplier parks face a challenge, when deciding on the principles upon which they are constructed. In reviewing each area, there appears to be differing views, one that points to a wide gap -- a world of difference -- between modular consortia and more dispersed types of supplier parks, and another that may position these differing modes along a continuous spectrum.

3.1 *Modularity and Outsourcing Dilemma*

It is a peculiarity of supplier park discussions that modularity goes hand-in-hand with the proximity of supplier location. In theory, with modular product architecture, the supply chain architecture can also be modular, reducing the need for proximate location of suppliers. This is certainly the case in electronic contract assembly (Sturgeon 2002). Moreover, engines and transmissions have been made and shipped over some distance by many OEMs for a long time. So what is going on in the automobile industry recently? If proximity is not required by the intended product architecture, what is the role of proximity in this context?

The main efficiency gain from modularity-in-production (as much as for modularity-in-design) comes from the ability to produce the modules independently of each other. Thus, tasks in each module can be carried out in parallel to one another, reducing the total throughput time of assembling a car. In the case of VW Resende, the throughput time was 8 hours, as compared to 28 hours for Ford's Ipiranga/Sao Paulo plant that assembled essentially the same truck but without a modular consortium (Lung et al 1999). Similarly, the assembly time for the new Fiesta at Ford's Cologne plant is reduced to 16-17 hours, as compared to 20 hours for the old Fiesta (*Automotive News* October 7, 2002).

But modularity in the product architecture that enables the parallel processing of modules also negates the importance of proximity. If modules have well-defined interfaces, and each module sub-assembly can be pre-tested before shipment, then there is little need for coordination between the OEM and suppliers. There is supposedly minimal amount of tacit knowledge or informal know-how exchange, as compared to a situation with more integral product architecture. Thus, it appears to be an oxymoron to have modular product architecture and yet an integral supply chain architecture.

Of course, one could argue that the car is not truly modular, that its product architecture in most cases is still quite integral, requiring close coordination of activities not just in design but also in production. This might explain why the sub-assembly of cockpits and doors, containing multiple systems and whose module boundaries are not so well defined, has to take place more close to the final assembly line than the sub-assembly of engines or seats. Also if this were the case, we would expect some variation in the incidence of supplier clusters, concentrated more for OEMs with more integral product architecture. In personal computers, we may contrast the practice at Dell, for whom proximity of suppliers does not matter due to its modular product architecture, and Apple for whom proximity of suppliers is highly valued given its relatively integral product architecture.

But in the automobile industry, the association between product architecture and supply chain architecture is quite different. Automakers are indeed divided on supplier parks (*Automotive News* October 7, 2002), but the divide is between those with supplier parks that also have relatively modular product architecture, like MCC Smart, and those without supplier parks that have a relatively integral product architecture, like Honda. This suggests that clustering in supplier parks has a function that is quite different from the tacit knowledge communication of the sort emphasized by Marshall's notion of the 'mysteries of the region'.

Indeed, we need to delve deeper into some aspects of operations management and logistics to understand why proximity is considered necessary. A key characteristic of sub-assemblies located on supplier parks is the high degree of product variant/options that make the sequencing of parts an important part of the operations. Particularly if a low inventory system is subjected to late configuration but also last-minute revisions in the sequencing to cope with planning failures, the proximity

acts like a buffer to cope with failure in order-to-delivery sequencing. As one OEM interviewee quipped: 'We can stay somewhat undisciplined with proximity of suppliers in the park'. In this view, proximity leads to a loss of discipline, whereas distance forces OEMs and suppliers to invest in accurate production planning.

Nevertheless, complete synchronization of production between OEMs and suppliers, if they are connected with a conveyor belt, without a large sequencing centre, contributes towards the rapid exposure of problems and the need for rapid reaction to rectification of those problems, as in the normal just-in-time set-up. The face-to-face communication, and the fact that OEM and supplier personnel can wander around in their respective areas of operations without barriers, facilitates quick feedback and joint problem-solving. Thus, we could argue that extreme proximity, as manifested by modular consortia, has beneficial consequences, whereas intermediate proximity for some supplier parks (which may be some kilometers away from the final assembly line) may not be adding much value.

This leads to a view that whereas modular consortia with a tightly knit supplier network under a single roof have a clear *raison d'être*, more dispersed forms of supplier parks are an uncomfortable compromise or a temporary phenomena that may either dissolve or converge towards tighter modular consortia.

3.2 Voice vs Exit Trade-off

The second dilemma lies in the familiar notion of both OEMs and suppliers wishing to get the best of both worlds of commitment and flexibility in their trading relationships. OEMs, in creating supplier parks, have increased their degree of outsourcing, reducing significantly the number of first-tier suppliers that deliver much larger chunks of the car – in the form of modular sub-assemblies – than previously. These suppliers have made location-specific investments and other commitments which are tied to a specific client. Thus, by asking suppliers to share in the investment project, OEMs have become more exposed to suppliers with committed investments, potentially undermining OEMs' wish to retain flexibility.

Supplier relations may be considered to lie on a spectrum, ranging from market-mediated arms-length exchanges which offer much flexibility in switching trading partners as markets dictate, and obligational trading based on trust and

long-term commitments that facilitate joint problem-solving and information sharing. The former suffers from high transaction costs resulting from information asymmetry and opportunistic behaviour, whilst the latter faces high switching costs. Hirschman's contrast between exit and voice, as applied to automotive supplier relations illustrates the pros and cons of each (Helper and Sako 1995).

From the points of view of both OEMs and suppliers, different supplier parks represent a different balance between exit and voice. At one extreme, some OEMs have provided the land and buildings (admittedly in many cases with public sector incentives like tax remission and subsidies), and suppliers merely offer low-cost labour in relatively labour-intensive operations such as wire harness assembly. Suppliers can easily pack away their assembly equipment and re-locate elsewhere. In this case, the 'quasi-integration' that has resulted has not undermined the flexibility in switching trading partners. At the other extreme, the sole-sourcing of modules that a supplier has contributed to designing and developing, and the supplier's purchase and ownership of land, buildings, equipment and tooling which are specific to a supplier park, is based on a deeper relationship that goes beyond what can be gauged from the proximity and specific investments visible on production sites.

Supplier parks have indeed become the most visible sign of the umbilical cord between OEMs and suppliers. But they may be a production tip of the iceberg that involves R&D and product design activities that go beyond the supplier park. The extent of exit (flexibility) and voice (commitment) therefore cannot be assessed by looking merely at the existence of a supplier park at a time, but must involve an examination of what happens prior to the creation of a supplier park, and the assessment of the relationship between the OEM and supplier at the corporate (not plant) level.

3.3 Employment Dilemma

A main difference between modular consortia and supplier parks is that the management of labour is as though for a single firm in the former but not so in the latter. If the OEM's motive in creating supplier parks is to outsource so as to access low-cost labour (often in a non-union environment), then the unified human resource system for modular consortia negates this basis for outsourcing. Moreover, even with intermediate proximity of looser supplier parks, the synchronization of work pace

between OEMs and suppliers on the park, particularly if they are connected with a conveyor belt, may lead to worker demand for similar conditions at work. Social pressure for the harmonization of employment terms may come, with or without, unions' organizing drive. Even without unions, local labour markets may become crowded out, although for the moment, many supplier park locations are also areas with sufficient labour supply.

A relatively straightforward case is that of modular consortia with a unified employment governance. The purpose of such governance is clearly illustrated by a statement by MCC Smart CEO Andreas Renschler: 'it's crucial to connect everyone (i.e. systems partner suppliers) into the same social system, to create a sense of community and shared purpose. That's where management comes in. At Hambach, we have 12 companies involved in building cars. Smart owns only the property, yet everyone involved identifies themselves as Smart' (*Automotive News* March 10, 2003).

It is precisely this sort of social system that some OEMs wish to avoid if they want employees working for different suppliers not to come together in solidarity, with or against the OEM workforce. The wish to access low-cost labour is often a reason for maintaining a diversified employment governance. For example, even if Visteon, as an ex-Ford division, is bound by Ford labour agreement, by partnering with Anterist & Schneider, Visteon is able to use workers with lower wage rates at Saarlouis. Giving individual suppliers autonomy in their own human resource practices may lead to highly varied practices, with respect to the use of temporary workers, and outcomes in labour turnover and absenteeism, as Rothstein (2002) found in the case of GM's Silao plant in Mexico.

At the moment, clustering is seen to have the disadvantage of undermining differential wage rates, but the extent of coordination amongst supplier companies' human resource managers varies from park to park. Varied HR practices make it more difficult to develop standardized work practices across firms within the park.

3.4 Governance Ambiguity

The fourth, and last, dilemma to be discussed concerns the governance of supplier parks. Supplier parks represent a simultaneous implementation of vertical integration of production flows and vertical disintegration of ownership. The latter is

a product of OEMs wishing to save on capital costs as an attempt to enhance their return on capital employed. But this has led to the notion of coordinating the whole production process without direct ownership. Thus, management control on supplier parks is no longer through ownership of the means of production. In many cases, management by committee consisting of OEM and supplier personnel is seen as a major form of coordination and control. But OEMs continue to take a lead in such committees, giving direction and command to suppliers which are otherwise autonomous.

Conclusions

This paper surveyed the automotive supplier park phenomenon by setting it in a literature on the disintegration of large firms and the clustering of productive activities. Beyond a common definition of a clustering of suppliers adjacent to, or close to, the OEM's final assembly line, supplier parks – variously termed modular consortia, industrial parks, campuses and condominiums, differ in their characteristics. The key dimensions were identified as the physical layout, extent of synchronization of operations, who owns location-specific assets (esp. land and buildings), whether or not employment governance is unified or diversified, and whether suppliers are mere assemblers or are involved in design and development. A different combination of these dimensions give different incentives for OEMs and suppliers, giving a different balance between voice (commitment) and exit (flexibility).

In relation to the broad literature, supplier parks are definitely an outcome of the disintegration of large firms, as OEMs wish to outsource, not just to access low-cost labour but more importantly to offload the burden and risk of large capital investments to suppliers. Yet a combination of dispersed ownership but unified employment governance, for example, put to the test what is meant by a firm and how the boundary of the firm should be drawn. Supplier parks also inform the debate on whether or not multinational companies are a force for de-territorializing regions. It was argued that embeddedness in a locality can remain, which is as much about making commitments to a locality as about relying on immobile factors of production. Lastly, proximity between OEMs and suppliers on supplier parks has multiple functions. Automobiles are only a partially modular product; the entire car can never be totally modular. This means that for some autonomous chunks of the car, such as engines, proximity is not necessary, but for other parts, coordination and practice will remain of enduring

importance. Hence the continued importance of proximity. But as in electronics, the auto manufacturing processes have been subjected to a relentless attempts at standardization and codification, so that proximity plays a part in promoting such attempts and to fuel rivalry in making improvements over productivity and quality based on these standards. Thus, 'mysteries of the region' do play a part, but one should not overemphasize the notion as the sole reason for clustering.

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