Industry and Innovation, Volume 11, Numbers 1/2, 45–79, March/June 2004

Carfax Publishing
Taylor & Francis Group

EMERGING STRATEGIES AND FORMS OF GOVERNANCE IN HIGH-WAGE COMPONENT MANUFACTURING REGIONS

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Much has been written on the process of vertical disintegration in manufacturing. Nearly everyone agrees (and considerable empirical data has been marshaled to show) that large original equipment manufacturers (OEMs) in industries ranging from automobiles to construction machinery and a wide range of industrial equipment are, as a trend, shutting down significant portions of their own in-house production and turning instead to outside suppliers for increasing amounts of the total value of their products. This process is driven, broadly, by a desire on the part of final assemblers to enhance their flexibility and lower their costs in production.

This much people agree on. Where people disagree is on the specific character of the new decentralized production arrangements and the consequences of these arrangements for component supplier firm strategies and sectoral governance mechanisms in higher labor cost regions: Are the new relations cooperative, collaborative, or are they still essentially about cost and price? Are they mutually beneficial for customer and supplier or are they simply about shifting inventory and other burdens of flexibility onto suppliers? Is vertical disintegration ultimately going to produce polarization in the industrial structure of component manufacturing with large, global, vastly diversified, and vertically integrated mega-suppliers on the one hand and manufacturers of standardized goods competing primarily on the basis of price and low labor cost advantage (located, ultimately, in low labor cost regions) on the other? Or does vertical disintegration create the potential for the emergence of a space for competitive and sophisticated small and medium-sized component producers in high labor cost regions, so long as the appropriate policy supports are in place and OEMs themselves act in a consistent manner?

The argument in this paper is that in order to understand the industrial structure, the range of active product market strategies as well as systems of governance emerging in components production in high-wage regions, it is important to avoid the urge to choose between the hard alternatives depicted above. This is because neither the actors in OEMs nor the actors in component producing firms make such drastic choices. Indeed, quite the contrary, both seem to distribute their strategies in ways that accommodate as broad an array of (even contradictory) sourcing strategies as possible. Within OEMs it is both the case that managers in charge of sourcing seek to maintain a diversity of in-house capacities and subcontracting relations AND

1366-2716 print/1469-8390 online/04/01/20045-35
DOI: 10.1080/1366271042000200448

that different strategic sourcing practices (for example, modularity and pragmatic collaboration) compete with one another for dominance (or at least a place) within the firm. In reaction to this de facto multiplicity of OEM sourcing strategies, the component producers are developing a broad range of firm strategies that take advantage of the (sometimes quite unpredictable) variety of OEM sourcing practices.

From the perspective of industrial structure, my claim will be that the multiple and contradictory processes of OEM vertical disintegration are producing four broad types of viable strategies in the component sector (in high-wage regions): (1) a multinational, broadly diversified and integrated cohort of large suppliers capable of and interested in developing and producing elaborate subassemblies and modules, but in large part competing as smaller subassembly producers with development capacity; (2) sophisticated mostly smaller and medium-sized producers able to develop and produce either specialized components or a modest array of integrated components as subassemblies and deliver them either directly to OEMs or to other suppliers; (3) quality small and medium-sized manufacturers with little or no significant development resources; (4) price driven low labor cost producers who do no design or development and are engaged in unstable arm's length relations with OEMs. The competitive advantage of such producers is typically low cost and short delivery time. These strategies are not mutually exclusive and it is possible to find component firms in all the high-wage regions that are actively pursing more than one or hybrid strategies among them. The point is that the current environment creates space for firms to pursue some version of each of these strategies.

From the perspective of firm and sectoral governance, the contradictory and non-unitary character of the sourcing practices of OEMs has given rise to the development of a wide array of mechanisms for spreading risk and managing the flow of technology and knowledge. Some involve extensive public and private collaboration, others are virtually entirely private and corporate, others are neither. In most cases, however, actors are attempting to construct systems of governance that permit the broadest possible range of strategic action for themselves in an unpredictable environment.

The paper is organized as follows. Section 1 discusses two different conceptions of the process of vertical disintegration prevalent in the literature. The point is to suggest that each conception captures actual strategies pursued by OEMs. Each perspective goes wrong, however, in thinking that it is describing unitary trends and seeking to interpret developments inconsistent with its view of the larger trajectory of change as either short-term lags or the result of correctable pathologies within OEM firms. I suggest that as an empirical matter it seems that actors in large OEMs are guided by multiple conceptions of the logic of their firm's strategy. OEMs are factionalized and different factions within the firm have different strategies for what decentralization should be and indeed, of what should be decentralized. Moreover, in many cases, people responsible for sourcing within OEMs are agnostic with respect to contending strategies and attempt simply to optimize production and appease their more strategically aligned superiors by cobbling together a blend of relationships inside and outside the firm that achieve desired targets of high quality and low cost. For the component producer, it is less important to try to guess which strategy will be the ultimate "winner" or which represents the actual underlying trend in the industry, than it is

to cope with the reality of the conflict of customer strategies in the way in which they seek to act strategically in the market.

Section 2 lays out how the four broad types of strategy seem to be emerging out of the current situation in the USA and Europe. Section 3 then turns to the question of governance and addresses a broad array of observable intra- and extra-firm mechanisms being created by companies and other associated actors to cope with the environment as they experience it. Throughout, the emphasis will be on the matter-of-fact pragmatic character of action among producers, on the importance of reflexive hedging strategies, and on very deeply embedded forms of learning in industrial practice.

1. MODULARIZATION VERSUS PRAGMATIC COLLABORATION

Over the last 15 years or so, there has been significant theoretical effort among students of industrial transformation to define the general features of the "new production paradigm" shaping relations and organizational development in manufacturing. By and large, people agree that an old model is in crisis and that it is being replaced by something else. "Fordism", the "standard firm", the "mass production model", etc. are typically held to have been historical forms of practice that dominated production during the great boom years after World War II. Since roughly the mid-1970s, this old system has been in crisis and the feeling is that at some point a new dominant form of practice will take the old system's place. There have been many candidate models suggested by the literature, many of which have since been either abandoned or modified beyond recognition or simply overtaken by events: Flexible Specialization, Diversified Quality Production, New Production Concepts, Systematic Rationalization, Lean Production, Wintelism, the Networked Firm, Flexible Accumulation, Post-Fordism, etc. In the contemporary discussion of vertical disintegration in the manufacturing sector, there are two prominent and competing models of the "new production paradigm" that have garnered a lot of attention: the Modularity/Contract Manufacturing model of Timothy Sturgeon, Richard Florida, Charles Fine, and others (Fine 1998; Sturgeon and Florida 2001; Sturgeon 2002; Sturgeon and Lester 2002)[1] and the model of "Pragmatic Collaboration" and Learning by Monitoring developed by Charles Sabel and his collaborators (Sabel 1994; Helper *et al*. 2000; Whitford and Zeitlin this issue).

The Sturgeon/Florida/Fine *et al*. view sees vertical disintegration as a process driven by rapid product change and characterized by the deconstruction of product design into discrete subsystems or functional modules (example in an automobile: front end, cockpit, drive train, common chassis platforms, etc.) with standardized interfaces among them. By shifting the production of such modules onto suppliers, OEMs increasingly concentrate their energies on design and seek to structure product design in such a way as to reduce manufacture to a process of following standard guidelines and optimizing inventory and logistical processes. In this way, paradoxically, flexibility is achieved through the increasing separation of conception from execution in the production chain. The paradigmatic case for this style of production is in the circuit

1 On the theoretical principles of modularity vs. integration in design, see the work of Ulrich (1995).

board dominated consumer electronics sector where OEMs retain control only over product design and engage large contract manufacturers who specialize in the production and assembly of a great variety of end products out of standardized components.[2]

The proponents of this perspective see the modularization model creeping slowly but inevitably into the automobile industry as globalizing firms seek to cope with global overcapacity, and shortening product cycles (Fine 1998; Sturgeon and Florida 2001).[3] On this view, the success of modularization in automobiles (and other transport industries) would have very distinctive consequences on the structure and strategies of the components industry supply base. Sturgeon and Florida (2001: 64) lay out their vision of the future structure of the component sector in the context of advancing modularization in the following way:

> The new face of globalization in the 1990s is best revealed by the rise of the global supplier. Companies such as Bosch, Denso, Johnson Controls, Lear Corporation, TRW, Magna, and Valeo have become the preferred suppliers for automakers around the world. Some automakers, particularly American firms, have combined a move to "modular" final assembly with increased outsourcing, giving increased responsibility to first-tier suppliers for module design and second tier sourcing. Many first-tier-suppliers have responded by embarking on a wave of vertical integration (through mergers, acquisitions, and joint-ventures) and geographic expansion to gain the ability to provide their customers with modules on a global basis. Thus we are seeing simultaneous trends toward vertical disintegration (by automakers) and vertical integration (among first-tier suppliers) that—in combination with globalization—is helping to create a new global-scale supply-base capable of supporting the activities of final assemblers on a worldwide basis.

Concentration and vertical integration occur at the first tier because OEMs want to gain efficiencies in assembly by having larger and larger modules delivered all at once from a minimum of sources. Suppliers, seeking to minimize transaction costs and limit potential hold-ups, assemble all the necessary pieces of a module under their own control. Moreover, because modules are being constructed for global assembly facilities, integrated first-tier component manufacturers can allocate production capacity of standard components among their own facilities around the globe to achieve optimal scale economies.

In this scenario, there is less and less space in the industry structure for independent small and medium-sized component producers. Competitive independents cannot match the scope of the emerging mega-suppliers so they either go out of business, leave the industry, or become takeover targets for their larger rivals. Those that continue to exist do so at lower levels of the supply chain and are increasingly confined to standardized or very low tech items around which competition on the basis of price will be fierce and for which producers in offshore locations with considerably lower labor costs will be at an advantage.

There is much data supporting this narrative about the trajectory of development in the automobile industry, especially as it applies to the actions of mega-suppliers

2 A case study in this vein is McKendrick *et al*. (2000). Bicycles are another good example of purely modular production: cf. Crown and Coleman (1996) and Ulrich *et al*. (1998).

3 For other overviews of modularity in the automobile industry, see McAlinden *et al*. (1999), Sako and Murray (1999), Sako and Warburton (1999), and Sako (2003).

(Shimokawa 2000; Sturgeon and Florida 2001). Modularity is a major theme in the industry today, and there are many competing conceptions of how a module could be defined within the automobile.[4] There are also a number of very well-known experiments with nearly complete modularity currently being undertaken by VW, Daimler Benz, and Ford (with more being planned) as well as other more pervasive smaller modular subassembly in many of the automobiles produced by virtually all automobile companies currently in the global industry.

Nonetheless, there are also a very large number of problems with the image of a completely modular automobile industry and hence obstacles to the emergence of the highly concentrated and vertically integrated component industry outlined by Sturgeon, Florida, and others. Moreover, problems with achieving modularity in the automobile industry apply with even greater intensity in lower volume manufacturing sectors such as off-road vehicle manufacture as well as a vast array of industrial machineries. As a result, it is possible to think that there continues to be a very robust space for independent small and medium-sized component production in these industries.

First, as many have argued, the automobile is very difficult to design in a fully modular way, with internally standardized components and standardized interfaces between modules. It is extremely difficult to design all "integral" elements out of such products.[5] As Sako and Murray (1999) note:

> a car is at once a group of physically contiguous sub-assemblies and a series of systems—climate control, safety, electronics and so on. System integration is essential to performance and yet systems may criss-cross physical subassemblies to a degree that renders their separate design almost impossible without sacrificing performance.[6]

This obstacle to design modularity is intensified in the context of pressure for rapid change and/or special customer demands on the product. Designers and engineers in the heat of delivery pressures and market struggle scrap the tedious process of creating standards and design customer- or product-specific solutions instead.[7]

Without modular design, however, it is difficult to achieve the complete break between design and manufacture that Sturgeon and others envision for the industry and which in large part is driving the argument for concentration and vertical integration among first-tier suppliers. The complexity of incorporating non-modular designs and subassemblies into a final product makes communication between design and manufacture inescapable. Indeed, the shorter the product cycle and the more rapid technological change, the more inescapable is such communication.[8]

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4 This point is based on interviews at VW, Daimler, BMW, Delphi, ZF, Hella, Continental Tires, Mahle, Arvin Meritor, Brose, Lear, Johnson Controls, and Eaton conducted in the USA and Germany in 2001, 2002, and 2003.

5 The distinction between modular and integral in product design is developed very clearly by Ulrich (1995: 425): "A modular architecture includes a one to one mapping from functional elements in the function structure to the physical components of the product, and specifies de-coupled interfaces between components. An integral architecture includes a complex (non one to one) mapping from functional elements to physical components and/or coupled interfaces between components."

6 See also questions about modularity in automobiles raised by Fujimoto (2000, 2001), Shimokawa (2000), Fujimoto and Takeishi (2001), and Sako (2003).

7 This has been an obstacle to standardization in machinery production, for example, over the entire history of industrialization. See, for example, Herrigel (1996). Thanks to Jonathan Zeitlin for helpful insights on this connection.

8 Novak and Eppinger (2001) make this point in an examination of the case of luxury automobiles.

But this means three things with respect to relations between OEMs and component producers in the context of vertical disintegration. First, in order to be able to engage knowledgeably with their suppliers about issues of manufacturing, OEMs are interested in preserving a broad array of in-house manufacturing know-how. To an increasing extent, such knowledge is being confined to areas of "core competence" where OEMs feel they have an efficiency or scale advantage over outsiders. But the desire to preserve in-house know-how in nearly all large OEMs extends beyond simple core competence calculations. Vast corporations with hundreds of plants often keep particular operations in-house in some areas while cutting them out in others. Or they incorporate them in some model projects while using outside firms in others.[9] Sturgeon *et al*. (among others) tend to view this as a kind of lag effect in the move toward vertical disintegration (caused by labor hostility or local management resistance) and modularization.[10] But in many cases, such as at a large German automobile producer I interviewed, the OEM wants to preserve a range of manufacturing resources "in-house" in order to be able to more effectively engage in collaboration with (and the evaluation of) outsiders. OEMs play an important role, in other words, as manufacturers even in the context of extensive vertical disintegration, in order to maintain their ability to participate in collaborative product design.

The second consequence is that the need to collaborate with suppliers in design and manufacture of complex integrated products makes OEMs less interested in the scope economies that diversified mega-suppliers can offer and also less interested in ceding control over the selection of second and third-tier component producers for all parts of the subassembly or module. In order to optimize their own internal learning processes, as well as minimize costs, OEMs tend to insist on selecting the array of component producers participating in their product teams. This is true of both Volkswagen and Daimler Benz, the world's two leading experimenters with the modularization of the automobile. A good indication of how seriously medium-sized component producers take this interest on the part of OEMs, is the recent decision by Keiper (formerly Keiper Recaro) to give up the production of complete seat modules and focus its operations instead exclusively on the production of the internal metal frames for seats. The firm, in other words, abandoned the ambition to produce modules itself and very self-consciously adopted a second-tier strategy of specialized component production.

The third consequence of the persistence of "integrated" design in manufacturing is that the range of actual designs of components and subassemblies across automobile models and companies is so vast that no vertically integrated first-tier supplier can possibly master all the design, technology, and manufacturing know-how needed to be competitive. As a result, the first-tier mega-suppliers find themselves compelled to focus their own production operations on core competences and subcontract other operations out to other producers. Vertical disintegration does not stop at the first tier.

9 This point emerges again and again in interviews with automobile companies and first-tier suppliers in Germany and the USA.

10 Indeed, a major finding of Sturgeon and Florida (2001: Section 9) is that employment in high-wage regions in the automobile industry (for example, the USA) actually increased over the course of the 1990s and in conjunction with progressive vertical disintegration in the industry. They attribute this to the infancy of modularization and urge policy makers to be concerned about American jobs as the modular model continues to diffuse.

This kind of OEM and first-tier supplier orientation does not guarantee that there will be a place for independent component producers in product teams or in the subassemblies actually supplied by the mega-suppliers. But it does remove the structural pressure to eliminate such a space that is part of the strong modularization view.

All of this is not intended to suggest that there is no interest in the automobile industry (or other manufacturing industries) in product modularization along the lines of consumer electronics. Nor is the suggestion that it is undesirable to do so. Considerable evidence suggests that there is tremendous interest and desire within the industry to pursue the full logic of modularization. Rather, the argument here is that there are significant obstacles to such a strategy, that powerful elements within OEMs recognize this, and as a result, engage in the strategic game of constructing decentralized product development and production teams according to alternative logics to that envisioned in the modular production paradigm. Vertical disintegration in the automobile industry is not governed by a single logic; rather there are a number of competing ones. I will develop the consequences of this contradictory situation for the structure of the components sector in the next section.

Before doing so, however, it is important to examine the other significant argument for the existence of a "new production paradigm" in manufacturing, the Sabel *et al*. Learning by Monitoring/Pragmatic Collaboration view. This view allows for greater optimism regarding the survival and competitiveness of independent small and medium-sized component producers in high-wage regions in the context of industrial vertical disintegration. And, it should be said, I have considerable sympathy for this alternative view. Nonetheless, I do think that the Pragmatic Collaboration view is of limited usefulness for understanding the dynamics shaping the emergence of component industry structures, strategies, and governance mechanisms due to its ultimately unitary conception of competitive logics in contemporary industry.

If the modular view focuses on the tendency to separate design and manufacture as production disintegrates, the Pragmatic Collaboration view focuses on the growing inescapability of their integration in the process of devolving production and development onto suppliers. Volatility of technology, shortening product cycles, and competition-induced cost pressures all place a premium on the need to simultaneously decentralize risk, reduce inventories, and widen the pool of specialized knowledge available to individual producers. These pressures lead OEMs to shift radically to outsourcing and in the process change the character of their relations with suppliers—shifting from old-style capacity subcontracting (where suppliers produce materials redundant to OEM in-house capacity) to specialized subcontracting (where suppliers produce materials for which there is no longer any capacity or know-how within the OEM).[11] This change in the character of suppliers being demanded is accompanied by two additional changes. First, OEMs reduce the size of their supply base, making them more reliant on a smaller number of more specialized producers. Second, the character of relations with this smaller number of suppliers becomes more intense, longer term, open, and collaborative. In order to ensure product quality and to

11 See Whitford and Zeitlin (this issue) for the distinction and an illuminating discussion of the two different kinds of subcontracting.

accelerate the process of design to manufacture, specialized suppliers are drawn into collaborative design and "simultaneous engineering" relations with the OEMs.

Thus, the new "production paradigm" in the Sabel *et al*. view is one in which production across all manufacturing sectors is dis-integrated and in which relations between customers and suppliers presuppose enduring market volatility (and hence the inevitability of change) and yet for that reason are constituted by collaborative processes of disciplined joint inquiry about how common projects can be improved to mutual benefit.[12] The school has an increasingly elaborate view of the (ideal) consequences of such production relations for the strategies of component firms and the structure and governance of the component sector. Helper and MacDuffie have done numerous close case studies of pragmatically collaborative relations in the automobile industry, and have documented the success of crucial mechanisms in facilitating effective and self-reproducible collaboration, such as benchmarking, simultaneous engineering, and error detection and correction (MacDuffie 1997; Helper and MacDuffie 1999). Whitford and Zeitlin (this issue) observe that component suppliers tend increasingly to adopt strategies of specialization or diversification, with specialization being possible both on particular manufacturing processes and on particular kinds of products, while among diversification strategies there are vertical and horizontal variants. And there have been excellent case studies of efforts on the part of OEMs and suppliers devoted in some sense to the Pragmatic Collaboration view of the contemporary transformation in industrial practice to construct governance structures that help enable suppliers to more effectively engage in pragmatic collaborative practices.[13]

Finally, though the group sees pragmatic collaboration occurring in virtually all sectors of manufacturing in the advanced industrial world, there is no illusion that this model is easily diffusing within manufacturing. Indeed, there have been numerous studies of the component supply base in the USA by Helper and several collaborators which indicate that the bulk of small and medium-sized producers do not currently have the engineering and skill resources, capital equipment, or productivity rates to effectively practice even roughly equal knowledge exchange with OEMs.[14] Such weaknesses make especially smaller component firms vulnerable to short-term abuse from OEMs, which in turn induces moves away, not toward, the build up of resources that could make effective and mutually beneficial collaboration possible.

Whitford and Zeitlin, summarizing much of Whitford's dissertation research, have also documented an extensive array of internal pathologies within OEMs themselves, and consequent pathological reactions on the part of suppliers, which undermine the construction of effective pragmatic collaboration. They find that OEMs, despite ostensibly declaring an interest in greater collaborative and open ties with suppliers, continue to engage in oligopsonistic pricing practices, inventory shifting, misleading forecasting, abuses of trust (such as the misuse of proprietary supplier info and not following through after suppliers have made commitments). OEMs, they continue, are

12 Helper *et al*. (2000) provide the most elaborate and extensive theoretical discussion of the model.

13 See the discussion of WMDC in Section 3 of this paper below and accompanying references.

14 Whitford and Zeitlin (this issue) present an excellent summary and discussion of this work (cf. also Helper and Sako 1995, 1998). Similar evidence has also been collected by Luria (1996a, b) though it is not accurate to lump him into the Pragmatic Collaboration camp.

also plagued by an array of organizational dysfunctions that disrupt the construction of stable collaborative relations (such as the random and arbitrary turnover of key staff, communication barriers, and mixed messages from different locations within the corporation and the plant). Each of these pathologies on the part of the OEM gives rise to suboptimal counter-strategies on the part of suppliers which collectively drive OEM–supplier relations away from pragmatic collaboration.[15]

All of this makes for a very robust research program, but in the end the work so far turned out by this school does not help us conceptualize the range of observable strategies and forms of governance that are emerging within the component manufacturing sector. All we are able to do is identify (quite numerous) examples of success and (equally as numerous) examples of "blockage" or "problematic OEM behavior" and supplier response that emerge on the whole out of random organizational incompetence rather than systematic strategy.[16] I want to suggest that this ordering of the data is unsatisfying and, moreover, that it is an artifact of the way in which the pragmatic collaboration school conceives of the current competitive situation. Ultimately, they reduce the range of coherent possibilities for the successful reproduction of a component firm in the contemporary world to three: either there is pragmatic collaboration (which can occur in many different institutional and governance contexts); or there is the old-style "standard" firm and its arm's length capacity subcontracting; or there is a mess of pathology between the two. The possibility that the range of cases in the middle ground between a unitary logic of vertical integration and a unitary logic of collaborative decentralization could themselves have a coherence and be subject to systematic strategies and structuring has not been part of the theoretical agenda of the pragmatic collaboration school.

Against the pragmatic collaboration view, I want to suggest that there are (at least) two ways that this "middle area" between cooperation and the arm's length relations of the standard firm is systematically structured. First, OEMs have a systematic interest, within the process of vertical disintegration, in cultivating a range of different sorts of relations with suppliers—not simply cooperative, pragmatically collaborative ones. This stems from the fact that purchasing and production managers conceive of the goals of knowledge acquisition, quality improvement, and cost reduction in the aggregate with respect to specific products. Hence they do not feel compelled to maximize all three concerns in every supply relation. Instead, they attempt to meet their aggregate goals through the cultivation of a variety of relations with suppliers. Second, due to the existence of different competing product development and production strategies within firms, it is reasonable to expect that OEMs will, also systematically, not present a single coherent face to their suppliers.

The idea that OEMs might have an interest in cultivating a variety of ties to suppliers stems from the way in which firms try to juggle their desires to extend their access

15 See the excellent sections in Whitford and Zeitlin (this issue) on "OEMs and internal barriers to supplier upgrading" and "What goes around comes around: the impact of OEM opportunism and incompetence on supplier practices".

16 Whitford and Zeitlin (this issue) claim that their pathologies are systematic and not random, but this claim rests uneasily both with their discussion of concrete successful examples of collaboration and their argument that there is a trajectory in this direction. It seems more accurate to characterize the pathologies they identify as random—they occur in some places and not in others. They are not uncaused, but neither are they the result of a general logic pervading OEMs.

to technological know-how, maintain quality standards in production, and continually reduce costs. In the pragmatic collaboration conception, these goals are solved together in the process of pragmatic collaboration itself, as collaborating firms pool and share know-how, learn to perfect their product, and lower the costs to produce it by constantly monitoring their procedures. But most OEMs do not seek to achieve all three goals in every relationship, every time. They attempt instead to meet aggregate goals for particular projects in particular timeframes, and they do so through a variety of means. And, there are constantly trade-offs.

For example, a product development team may choose to engage in collaboration with specialists on particularly significant technological areas where in-house know-how is weak and lure specialists into the relationship by offering generous terms. They will then seek to recoup cost saving in other areas, such as in scale economies gained in their own in-house core competence operations, or by shifting key component production to their own operations in lower wage areas. Or they can seek savings by not making additional design or technological changes in other component areas, and shopping the existing designs out to suppliers who can meet required cost targets at the required quality levels. They can also press other suppliers who make products for which little joint development is necessary in the current round, or who have had longer relations with the OEM, for steeper cost reductions (maybe in exchange for more lucrative work in a future round). In some cases they will have success, in others not. But the engineers and purchasing people will continue to mix and match relations and in-house and out-of-house capabilities until the aggregate target for the product and time period is satisfied. Cost targets are reached, quality levels are maintained, and know-how flows into the firm, even though relations with outsiders assume a variety of forms.

In this kind of process, it is in the interest of OEMs to cultivate a repertoire of supplier relations and capabilities, ranging from arm's length primarily build-to-print to deeply open and cooperative. This enhances the longer-term flexibility of the company in the product development process, and makes it possible for engineers and buyers to contemplate a variety of sourcing strategies to achieve their short-term goals. As the head of Forward and Global Sourcing at a large German automobile producer said: "We do not recognize any trends in the character of production or sourcing. We try to keep as many options open as possible." This kind of OEM flexibility can drive suppliers crazy—the same OEM can be cooperative and involve the supplier early in the development process on one component or subsystem, drive a hard cost-reduction line on another, and shop around some older prints that the firm developed with the company on a third, all the while never guaranteeing that terms won't change on each in a next round. But, as I will discuss in the next section, a range of suppliers are developing strategies that allow them to cope with this unpredictability.

This intentional cultivation of supplier relationship variety on the part of OEMs is then further exacerbated by internal conflicts within the OEM about the strategy of the firm in product development and production. As indicated above, there are strong elements within automobile companies, and increasingly in lower volume sectors such as construction and agricultural equipment, who are very interested in modularization. Such factions inevitably win "experiments" and "pilots" which involve a

different relationship between design and manufacture, and between customer and supplier, than other product models with non-modular designs. On the other side of the spectrum, internal OEM production facilities also make alliances with designers, engineers, and product development management to protect or enhance their position within products. In many cases, such facilities will attempt to diversify their own customers within the company to ensure optimal rates of operation. But such internal strategizing often leads to capacity bottlenecks on specific jobs that give rise to "old style" build-to-print capacity subcontracting. Factional struggle and cross-cutting strategies within OEMs simply as a matter of pragmatic fact create a broad array of different kinds of OEM–supplier relations.

The examples of intentional and de facto variety creation in the relationships that OEMs cultivate with their suppliers in the current environment of vertical disintegration, it should be clear, are not the result of random inconsistencies and incapacities in the execution of a single strategy (though such things always exist). Nor are they strategies that have emerged simply because an underdeveloped supply base had undermined a more preferable and unitary one. Nor, finally, are they merely the result of "lags" or obstruction by "backward" or more conservative elements within firms. Rather, they are systematic features of OEM strategic behavior in the contemporary context of vertical disintegration in production. It is a continuously self-reproducing situation of instability and the recomposition of relations within and between firms in high-wage regions of the global economy. There is no "transition" to a more stable, unitary set of relations. The noise is the thing.[17] In the following section, I will outline the range of types of supplier and strategies that are emerging in this context.

2. FOUR EMERGING TYPES OF SUPPLIER STRATEGY

The previous section has shown that it is impractical to allow oneself to be guided by a single unitary conception of a new production paradigm when attempting to understand the environment within which component producers currently perceive their possibilities and construct their strategies. OEMs are proving to be fickle, unpredictable, and inconsistent in the way in which they engage in relations with suppliers. In making this claim, I am not suggesting that OEM sourcing behavior is utterly unpredictable because it is governed by an infinite array of ultimately inscrutable firm-specific concerns. On the contrary, it seems clear that in the current environment of consistent vertical disintegration, OEMs have a stable and consistent array of concerns: they need increasing amounts of design/development capacity from suppliers, they require high levels of quality in production, and they are desperately concerned with cost reduction. It is just that they do not require an optimum of all three things from every relationship with suppliers.

Of the three, the most consistent OEM concern involves quality. Virtually every interlocutor in supplier firms in the USA and Germany that I have spoken to indicated that high quality levels are simply assumed by OEMs. But on the matter of cost reduction and development capacity, there is more variety. An OEM does not require

17 On the self-reproduction of instability in systems within the economy, driven by the lack of equilibrium between competing goals and strategies, see Luhmann (1988).

every supplier on every job to contribute independent development. There are still build-to-print jobs and standard products/processes that require no significant design or development on the part of the supplier. Similarly, cost reduction is a general pressure and source of concern for OEMs, but they do not need to apply (at least not in every instance) across the board non-negotiable targets on every part that they purchase in every product. Cost reduction is a waltz between the supplier and the OEM in which moves are made and reacted to over time.[18] It is also a jigsaw puzzle for engineers and purchasers in the OEM who need to piece together the aggregate savings out of a broad landscape of suppliers (both inside and outside the OEM) of heterogeneous capacity and with differing historical relations with the firm.

In this context, there are four distinct types of strategies emerging within the component supply sector in high-wage regions to cope with OEM purchasing demands: (1) the mega-supplier strategy of specializing on the production of elaborate subassemblies and modules; (2) the small and medium-sized specialist with development capacity; (3) the small and medium-sized specialist without development capacity; and (4) the low cost/rapid turnaround contract shop. Each strategy is an ideal type (see Figures 1–4). There are many firms that look exactly like the composites that will be described below. But there are also many hybrid strategies in which firms seek to pursue elements of more than one of the four ideal strategies.

(1) Mega-suppliers (Figure 1). Sturgeon and Florida suggest that the logic for the emergence of mega-suppliers is the need to assemble under one corporate roof the capacity to develop, produce, and deliver complete modules for OEMs in the automobile industry. And, to a certain extent, particularly during the boom period of the late 1990s, the desire to at least represent themselves as having the capacity to produce modules did drive merger and consolidation in the automobile components industry. But there are other advantages to the formation of large diversified groups in complex subassembly production that do not require a pervasive demand for large scale and standardized modules among OEMs. Such firms have the capacity (or at least have the potential to create the capacity) to gain leverage in the areas of both design/development and of cost reduction.

Leverage in design/development is easy to see, but not always easy to itemize. Even if all of the components and subassemblies that a given mega-supplier can produce are not integrated into all of the work that that supplier does with OEMs, the capacity to draw on the resources of engineers within one's own group (through a common R&D lab at the corporate level, and through informal internal electronic communication networks) who have experience with related components can be beneficial for collaboration with OEMs and with other suppliers. Firms can be "good collaborators" because they make knowledgeable design suggestions that contribute to the overall quality of the OEM's product, or which make contributions to cost reduction. Shared developmental resources can redound to the benefit of specialized parts.

Leverage in cost reduction is easier to see. Shared raw materials across a diversified stable of specialized component producers can allow a firm to gain scale economies

18 I develop this idea of the cost-reduction waltz more extensively in an internal AMP memo (Herrigel 2002). This is an issue that deserves its own paper.

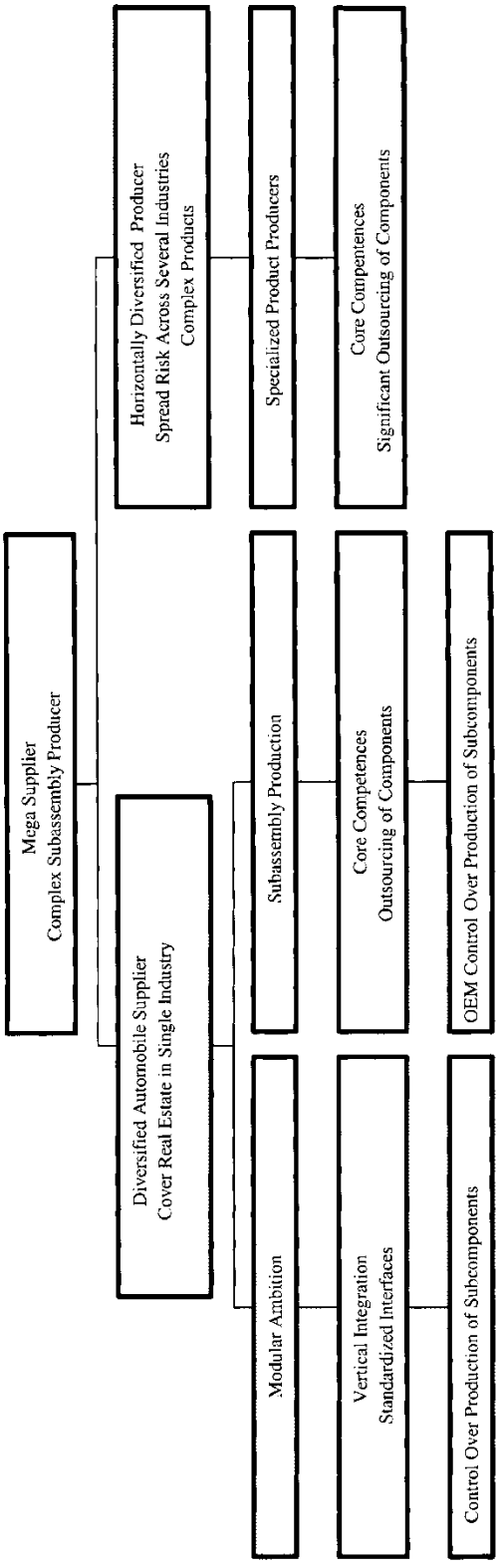

Mega Supplier
Complex Subassembly Producer
Diversified Automobile Supplier
Cover Real Estate in Single Industry
Horizontally Diversified Producer
Spread Risk Across Several Industries
Complex Products
Specialized Product Producers
Core Competences
Significant Outsourcing of Components
Subassembly Production
Core Competences
Outsourcing of Components
OEM Control Over Production of Subcomponents
Modular Ambition
Vertical Integration
Standardized Interfaces
Control Over Production of Subcomponents

FIGURE 1.

in its own purchases with steel, textile, plastic resin suppliers, etc. It is also possible to provide individual subsidiary units with consulting and technical assistance in reorganizing their production operations in ways that are leaner and more efficient.

Typically the term mega-supplier has been used to refer to the emergence of large vertically diversified first-tier suppliers in the automobile industry (Valeo, Magna, Bosch, ZF, Delphi, Visteon, Arvin Meritor, Johnson Controls, Lear, etc.). These suppliers diversify up and down (what often they hope will be) an integrated system of subassemblies within the automobile. But there are other large and broadly diversified component manufacturers that have pursued a strategy of horizontal diversification, collecting a vast array of complex components and subassemblies that are of value to OEMs in a heterogeneous array of manufacturing sectors. These companies, such as Emerson Electric and Danaher in the USA, Benteler and Thyssen Krupp in Germany, and GKN in Britain seek to achieve the same forms of leverage in know-how and raw materials, but by spreading their exposure as a corporation across an array of sectoral business cycles.

Such large diversified corporate component producers have significant competitive advantages in the context of manufacturing vertical disintegration. But there are also significant impediments to the successful implementation of the strategy—at least judging from the recent experience of automobile mega-suppliers. In particular, the drive among automobile mega-suppliers to "cover enough real estate" on the technological systems of a car to be considered a viable module producer seems to have led to a lot of overreaching. It costs a great deal of money to assemble a diverse and global array of producers and the synergies of leverage and "bundling" that the model aims for are not always possible to achieve. There has been a notable recent bankruptcy (Federal Mogul) and a lot of the other American majors that expanded dramatically in the last 5 years in anticipation of modules are teetering on the edge of chapter eleven—Dana and Tenneco for example. Others, such as the auto parts division of TRW, are such a nightmare for their parent conglomerates that the parent is trying to sell them. There are profitable and broadly diversified global auto-suppliers, though, such as Magna, Bosch, ZF, Brose, Lear, Johnson Controls, and Arvin Meritor. So although the expansion strategy has been fraught with poor judgment and strategic miscalculation, it is not clear that the idea of scope economies in subassembly production, independent of the potential for module production, is unviable.

(2) and (3) Small and medium-sized quality producers with and without development capacity (Figures 2 and 3). The logic of greater scale and scope is not the

FIGURE 2.

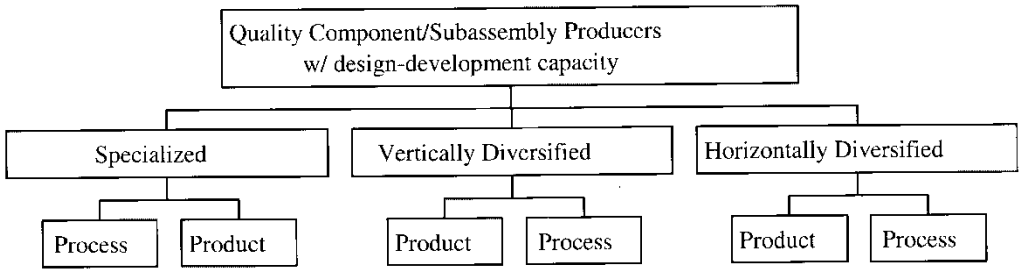
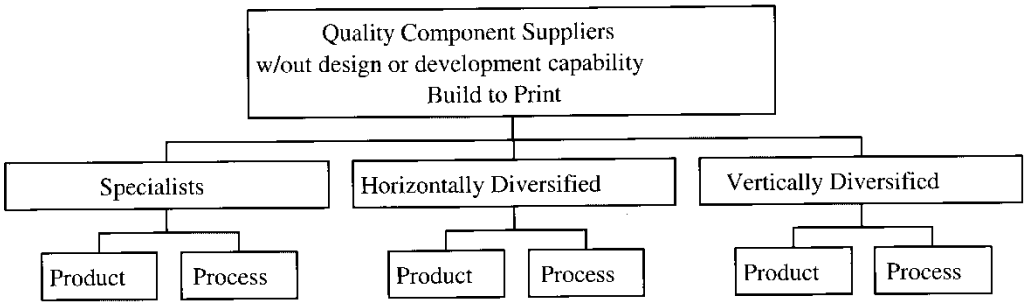


FIGURE 3.



only winning one in the contemporary environment. Small and medium-sized specialist firms can compete for work that larger players are not interested in—either because it involves no development or because the development that is required is too specialized or the market too small to justify the expansion of those capacities (as might be commonly the case in lower volume sectors such as construction machinery and agricultural equipment). Moreover, OEMs themselves can be reluctant to deal exclusively with large diversified suppliers, particularly if those suppliers are very large and have a great deal of leverage, because the OEM fears that they will themselves not have the power to gain favorable terms. In such cases—or in anticipation of the emergence of such cases—OEMs seek out smaller more specialized component producers who do have the desired know-how and skills, but who do not have the market power of the mega-supplier.

For all of the above reasons, there is demand for the products of smaller and medium-sized more specialized component and simple subassembly producers. The range of strategies being pursued by small and medium-sized firms in this context vary along three lines:

1. Do they seek to compete with significant development capacity or not?
2. Are they diversifying and if so, are they doing so vertically within an integrated product logic of a customer industry or are they doing so horizontally across customer industries?[19]
3. Are they specialists on manufacturing processes or are they producers of specific component products that involve an array of processes?

Essentially, this gives us the two middle types outlined in Figures 2 and 3: small and medium-sized firms capable of quality manufacturing with development and such firms without (or with limited) development capacity.

The expansion of in-house development capacity is expensive and is not a possible move for all firms. But its advantages are that it allows the smaller producer to get more lucrative work and establish earlier and more intimate collaborative ties with the OEM. This can be attractive to the OEM not only because they receive know-how from the supplier, but because they can collaborate with the supplier in cost reducing

19 As noted earlier, these dimensions of strategy have been very clearly outlined in Whitford and Zeitlin (this issue). I am indebted to the paper and to discussions with them for my own rendition here.

designs. Firms without development capacity, or with rudimentary capacity, are forced to compete on the basis of production quality and low cost alone, though they can very often engage in collaborative relations with the customer in an effort to discover mutually beneficial possibilities for cost reduction.

Among smaller and medium-sized suppliers, both with and without development capacity, in both the high volume auto sector and in the mid and low volume sectors, there seem to be two broad strategies that firms are adopting: diversification OR specialization.

The logic behind the pursuit of a diversification strategy varies slightly depending on whether or not it is vertical or horizontal, but in both cases the logic is similar to that which governs mega-supplier diversification. In the vertical strategy, as in the case of the automobile mega-suppliers, the strategy is driven by the fact that OEMs want their suppliers to do more and the diversifiers hope that the vertically related components or processes they select will be the ones that customers want. The horizontal diversification strategy, as we saw in the case of large firms such as Emerson Electric, seeks to spread business cycle risks across sectors (or lines of process specialization).

OEMs want more subassemblies and sometimes will want to one stop shop on a series of operations—cutting and stamping, plus welding, painting, etc. Some suppliers attempt to bring in additional functional capacities to be able to offer more to the customer. If, however, every customer does not want all the operations on every order or with every product, the diversified small firm will very often try to keep the various machines running in a job shop manner: as one owner of a diversified job shop in the Chicago area said "we will take any work we can find to keep things going". Hence they have the capacity to bundle and integrate on a product level, but can also pursue independent strategies on a process or functional level.

At the largest level, and primarily at the level of products, this is what a lot of first-tier suppliers are doing—with mixed success. At the more modest level of the low volume metal shop selling parts to John Deere or Caterpillar, the diversification strategy winds up being process diversification and not product diversification.[20] Having a number of processes that it can run in-house, however, has a number of advantages. Knowledge of related processes can help a firm in the early development phases of a project. Even if a customer does not use the supplier for all processes, broad knowledge can help a firm make optimal, high quality, low cost designs. Diversification also makes it possible for the firm to diversify its customer base. Job Shop X in a Chicago suburb is a good example of this. They expanded over the last 15 years from a focus on complex welding to stamping and milling operations. Very little of the business that Job Shop X does involves the integration of all three operations. But having those three bases allows them to limit the amount of work that they do for any given SECTOR to 15 percent of total annual output. They haven't had a bad year for 15 years, are currently holding the line on prices, and are working full shifts.

The risks associated with diversification at the small shop level are not that different

20 Properly managed, the strategy could conceivably push the firm in the direction of the development of its own proprietary product, though I have not seen any serious examples of this.

from those facing the first tiers: it is expensive, they may not know the new operations as well as their original ones and the "bundling" work is not as extensive or as lucrative as the firm thought. A firm can lose its focus—which can be bad in the context of constant demands for creative cost-reduction suggestions—or simply not know the market for the new process or how to manage it properly.[21]

Moreover, with diversification into new areas, small companies build up fixed capital debt while simultaneously having to learn new markets and processes. This can lead to the pathology of "buying business". Firms need work to learn, but are not good enough to compete legitimately with other process specialists, so they buy the work they need by underbidding on jobs. Job Shop X, above, freely admitted to having done that when it was developing its machining center business. Underbidding and buying business is done no doubt by uncompetitive firms in all sectors of the components business. But there is a structural tendency toward this built into the diversification strategy.

The other strategy one finds among quality smaller and medium-sized component firms is specialization. The most successful cases are those in which firms specialize on a particular product. Specialization on a process is more risky—a lot depends on the process a firm specializes on.

The most successful component supplier firms I visited were specialized on a particular product with a strong niche. This principle of niche specialization is the credo of the Illinois Tool Works (ITW) auto supply group of companies—which as a case constitutes a hybrid between the mega-supplier and the small and medium-sized firm strategies, but mostly at the level of governance, not of strategy. I will use it here because it illustrates very nicely the continued possibilities inherent in the specialization strategy. Each of the units of ITW is independent—they make their decisions about product, technology, labor, whether or not to buy another company or to spin off a part of themselves (which they do all the time) entirely locally. ITW corporate is a holding company with a technology center attached to it. There are two layers of management between the head of the entire company and the General Manager of an operating unit in the auto area. ITW owns 600 companies (about 25 in the automobile components sector) and expands by 40 companies a year. Not all of the new companies are acquisitions; many are spin-offs that result from the break up into smaller specialized units of previous ITW entities. The company has a mantra principle: the so-called 80/20 analysis. Eighty percent of revenue and business will always come from 20 percent of operations. Firms should focus on the 20 percent and get rid of the other 80 percent of their operations. Doing this analysis constantly leads to splits in operating companies, the creation of new focused factories for specialized products.

The advantage of this kind of specialization—which is always on particular component products with a very competitive functionality in the products of the end user—is that it drives efficiency in production to very extreme levels. At the same time, in Smithian fashion, ITW believes that specialization focuses the mind and fosters

21 Family Firm Y in western Illinois purchased a metal bar cutting machine and set up an independent facility in Aurora to house it and couldn't make the machine or the facility run profitably. But companies like Family Firm Y seem to be in a panic about the ever insistent pressure to produce new cost reductions from Deere at least in part because they had so much differentiated business that they couldn't keep it all tightly under cost control.

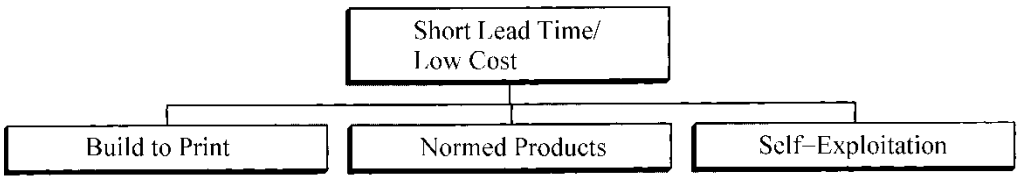
innovation. The very extreme risk that comes with the specialized focus is also an incentive for continuous improvement and technological innovation. Member firms are constantly embracing specialization and greater risk, but they also rely on a fair amount of information and tech exchange among the independent units (most of the general managers and engineers have worked together in the past at some historically common ancestral ITW company). Also, each ITW member company pays an annual fee for unlimited access to the corporate tech center. Most use it on a regular basis. So, like an industrial district, ITW companies are very flexible and specialized, and endure a lot of risk that comes from extreme specialization, but they also rely on an exoskeleton of open exchange and corporate tech support that makes it easier to deal with the risk. I want to come back to this example in the section on emergent governance structures.

The independent specialist companies that I visited were not as extreme in their specialization as the ITW member units. Most, such as Specialist 1 or Specialist 2 or Specialist 3, were specialized on specific kinds of component subassemblies—clutches or heavy-duty ball bearings (Specialist 3) or universal joints for agricultural equipment (Specialists 1 and 2). Each of these firms had an array of related products that they could offer or adapt or design specifically for their customer. But it was bounded within a clear area of specialization and involved a very specific kind of product, the market for which they were dominant players in. None of these companies were very interested in expanding what they did into other related technological areas. They were making their money making heavy-duty ball bearings and it was their agenda to keep themselves innovative and flexible enough within that area of specialty to stay close to the top of the market.

Of these companies, Specialist 3 and Specialist 2 were members of larger conglomerates (Emerson Electric and GKN, respectively) and could as a result draw on training and tech support from its corporate parent. Specialist 1 was an independent medium-sized firm, yet seemed to live with the risk of specialization through very close attention to the needs of the customer, investment in development capacity, and openness to info and experiences of other specialists in the region and in its business—it was a spirited participant in the Wisconsin Manufacturers' Development Consortium (WMDC), for example.

Specialists on particular processes were more mixed in terms of their health and success. One firm, Wisconsin Family Firm, which specialized on deep stamping was successful because its process was relatively complex, required very expensive machinery and dies, and involved smaller volumes. Thus few stamping houses would want to make the investment. The company was a strong player in the national market and was even able to hold the line on its prices with its customers. Half of its plant and equipment were destroyed in a fire 2 years ago and the company still made money that year. Interesting about that firm, though, was that they were in very close touch with a variety of other stamping houses, both their own competitors and houses with machinery a tad smaller than their own. After the fire, they were able to continue to fulfill orders by getting these other firms to take the business. There was a lot of information, customer, and technology sharing in their business. They got a lot of useful service out of their trade association, the Precision Metalforming Association (PMA), for example. This spread a bit of the risk that they incurred from

FIGURE 4.



specialization—or at least gave them an infrastructure of experience and capacity that the firm could draw on in a pinch.

This same kind of sharing of information and technology or process ideas also existed in another process specialist business—Chicago Family Screw—a screw machine shop. This was a family company that basically knew only screw machining. They were more vulnerable in the market and vis-à-vis their customers than Wisconsin's Family Firm or Specialist 1, because they had very limited development capacity and they were very small. But they were committed to specialization (or maybe they were stuck there). In any case, they made it work not only by paying very close attention to their customer's needs, but also by sharing info and sometimes customers with a group of other screw machine shops in Chicago—all family firms, all second generation.

All of the above is to suggest small and medium-sized component producers (and some hybrid conglomerates) are finding success in the context of the vertical disintegration of manufacturing by pursuing strategies of diversification or specialization (with or without development capacity and on either processes or products). Both diversification and specialization strategies have strengths. But it is noteworthy to see how successful and how reliant on outside help the specialists are. There also seems to be less structural vulnerability to low ball bidding practices in the specialization business—aside from the inevitable temptation to do so in down markets where you want to get business to keep your people and run your machines.

(4) Low cost/quick turnaround (Figure 4). It is very clear from the discussion of the strategies of small and medium-sized producers that there is a market for manufacturing capacity in which the most significant competitive advantage is low cost and rapid turnaround. The references to "buying business" and "we will produce anything to keep our machines going and our people employed" indicated not only that there are firms out there seeking to compete for low cost business, but that there is demand for it. Clearly, some of that demand is being provided by firms who are ultimately pursuing a different kind of strategy—for higher value-added work—but who for reasons of capacity balancing or to learn new processes solicit less profitable work at less (often less than) profitable terms. But it is also true that with the growth in size of the Mexican, Caribbean, and Eastern European population in the USA, it is possible for a firm to establish itself as a low cost producer in a market by holding its wage cost down to extremely low levels. Often the firm might itself be owned and operated by immigrants and be engaging in a simultaneous process of self-exploitation and technological learning.[22]

22 On immigrant businesses in the USA in general, see Portes (1998) and Waldinger (2001). On the Midwest and Chicago, see Huck *et al.* (1999), Arnsdorfer (2001), 29and Raijman (2001).

This is not a phenomenon confined to the US context. Several interviews in Germany revealed the growth of a low cost sub-supplier cohort in a variety of sectors. Indeed, in some cases, such producers were actually squeezing out the more established firms who had no development capacity in-house. Take the plastic injection molding firm, Spätzle, which is a supplier to Robert Bosch Power Tools. The firm makes a lot of the plastic housings for the tools. It also clothes electric conductors in duroplast which are then placed in electric motors. Things have been getting very difficult for the firm. It can't really compete in the very high volume business because this involves tremendous investment in expensive plant. Bosch produces most of its highest volume materials itself. Yet Spätzle is finding it difficult to get medium volume and/or specialized work that is profitable. On the one hand, much of that work involves quite a lot of development work and also crucial die and mold development capacity (neither of which the firm has traditionally had). On the other hand, a lot of the job shop work or simple medium volume, high flexibility work that does not involve development or specialized dies is increasingly done by small garage injection molding shops that self-exploit or that operate with a small number of immigrants and or part-time employees.

There is demand in the current environment of vertical disintegration for low cost, arm's length, quick turnaround parts production. To the extent that there are firms specialized on this demand, the firms tend to be generalists, that is, are capable of producing a wide array of product on a set of general purpose machinery. As we have seen throughout the discussion of the other three strategies, the low cost/quick turnaround strategy is often involved in hybrid strategies—a quality firm trying to balance capacity and keep skilled people employed; a firm seeking to gain experience with a new technology or enter a market in which it is not known to customers as a producer. Regardless of whether one finds the pure type or the hybrid, it is undeniable that there continues to be such work out there and that the level of demand is sustained and consistent enough to make the strategy a viable one.

Ideal typical strategies, hedging, and hybridity

To conclude this section, it is important to note that all of the above strategies are ideal types. They represent possibilities for firms to pursue, but there is nothing about the practice of everyday life that prevents firms from combining strategies or creating new ones. As I indicated in the introduction to this paper, both OEMs and component producers are reluctant to understand their world as being marked by sharp trade-offs: for example, between collaborative OR arm's length contracting; or between high value-added products and less complex/lower cost ones; or, for the OEMs and the mega-suppliers, between outsourcing and vertical integration. Because customers seek to avoid defining their sourcing strategies around hard alternatives, suppliers try to avoid committing themselves to a single course as well. Firms are systematically hedging their bets: build up the internal capacity to produce integrated subassemblies or modules and yet continue to sell distinct single components; participate in development with a customer and build to print; produce high value-added products and less complex ones at low cost and with quick turnaround. Firms build the internal capacity to pursue one of the ideal strategies outlined above, but they also

systematically preserve (or cultivate) the capacity to act according to the logic of one (or several) of the others as well. This is hedging.

It is important to see that this hedging is not something that firms engage in because they do not yet know where the market (their customer's sourcing strategy) is ultimately going. Rather, they hedge because the environment in which they are acting makes such practices possible. OEMs are systematically sourcing in contradictory ways and the hedging by supplier firms is simply a recognition of the contradictory character of their market. They adopt a dominant profile or identity, say as sophisticated collaborator, but preserve their identity as arm's length builder of other people's developments because they cannot live with only one profile in the market. Moreover, because both customers and suppliers act in this contradictory way, the contradictory character of the industrial environment is reproduced: OEMs can find suppliers willing to produce in ways they desire and suppliers can find outlets for a variety of production strategies.[23] As a result, hedging as a capacity is more likely to be extended over time than to be curbed.

Finally, as the example of ITW above indicates, it is also possible in this environment for firms to construct strategies that do not simply combine elements of distinct types, but actually create distinctive hybrids that have an integrity that transcends type. ITW is a large corporation, with all of the advantages of development and purchasing leverage that that can entail. In this way it resembles the mega-suppliers. Yet in radical contrast to the mega-suppliers, ITW has no interest in establishing vertical connections (integration) among its specialized parts. Each operating unit acts in the market as a specialist. They have development capacity and are able to cooperate in both development and cost reduction. Yet unlike the small and medium-sized firms they resemble, ITW companies neither diversify, nor do they seek to engage in build-to-print or quick turnaround work. They apply 80/20 analysis to everything and systematically winnow away non-performing products and reproduce specialization by spinning off products that are profitable but which distract from the main specialization of the operating unit. The logic of the company fits well in the environment (and ITW is a very profitable enterprise for its shareholders), but as a holding company of specialists it exists as a hybrid in the landscape of component producer strategies.

3. EMERGING FORMS OF GOVERNANCE IN THE COMPONENTS SECTOR (FIGURE 5)

In order to see what the emerging forms of component industry governance are in the high-wage regions of North America and Europe, it is crucial to identify the range of salient governance issues within the sector. Different arrangements for governance can be constructed for the same governance problem. There are (at least) three general governance problems in the contemporary environment that component manufacturers and actors concerned with component manufacturing are attempting to address: (1) the problem of access to development capacity; (2) the development

23 Again, for one very fascinating theoretical discussion of this sort of logic of self-reproducing instability in the economy, see Luhmann (1988).

FIGURE 5: GOVERNANCE PROBLEMS.

The Problem of Access to Development Capacity	**Learning How to Achieve Quality & Service Targets while Constantly Reducing Costs.**	**The Problem of Benchmarking**
Intra-Corporate Centralized Model: ITW, Emerson, Danaher. Corporate Universities	Production Quality, Flexibility, Cost Reduction & Service Provision	Market Solutions: Consultancies & NonProfits Capital Goods Builders
Extra Corporate Decentralized Model: German Industrial District Model	Wisconsin/PA-employer led Illinois--Employer & Associational Cooperation w/State Government	Joint Ventures
	Wuppertal--Union restructuring	Collaboration
	Italy-Employer/Polytechnic consortia	Formal and Informal Networks

of the ability to achieve quality targets and provide additional services to the customer while simultaneously engaging in cost reduction; (3) the problem of benchmarking: i.e. the ability to keep oneself continually appraised of best practice among competitors, customers, and peers in the context of rapid product and technological change.

(1) The problem of access to development capacity. Clearly access to development capacity is a very key competitive advantage for many firms in the component sector. It facilitates access to collaborative relations with OEMs, which in turn provides access to greater know-how, and makes it possible to link design and cost reduction, etc. It is a coveted resource. It is also enormously expensive—engineers, capital equipment, continuous learning are all expensive and it is difficult to itemize clearly the specific contributions that each makes to the day-to-day situation on the balance sheet. Moreover, in the contemporary environment, the value of development capacity is enhanced when it is continually exposed to other capacities, as when a firm's developers meet with other designers and engineers from areas of specialty outside the firm or the production unit or other functional areas of the production process. For example, intimate knowledge of die making can be beneficial for development engineers interested in cost-effective designs, etc.

There are two significant organizational variants currently in play to govern the problem of access to development capacity: an intra-corporate "centralized" model and an extra-firm "decentralized" model. The centralized model has been mentioned a number of times above in the context of discussions of ITW, the auto mega-suppliers, and firms such as Emerson Electric. Those firms all operate relatively specialized local production units and subsidiaries with minimal development resources, but then make a central research organ available to the local units, typically for a generous yearly fee, rather than on a contract basis. The central "Technology Centers" act as exchange centers for the flow of know-how and technological

information within the entire concern. They are also charged with surveying the technological landscape of their industry for forms of knowledge that could be beneficial to the members of the concern. In this way, as discussed above, firms such as ITW are able to leverage their development capacity and provide significant benefit to extremely small operating units.

A decentralized version of this is the system of technical universities, research institutes, and *Fachhochschulen* (community colleges) that exist in contemporary Baden-Württemberg in southwest Germany. Baden-Württemberg is home to the largest 10 first-tier automobile suppliers in Germany (the two largest being the global firms ZF and Bosch). Such firms are able to replicate, to a certain extent, the internal resources of the "centralized" firms through their ties to the research labs of the local technical schools. The labs act as exchanges of information from different but synergistic areas of technology and they survey the landscape for emergent technologies. In addition to the public universities, in Baden-Württemberg there are also other public research entities focused on industrial technology, such as the Frauenhof Institute. Further, Baden-Württemberg is also home to one of the largest independent automobile design houses in the world, Porsche AG. This firm has much more development and design work than it is able to perform, prototype, and test in its own facilities, so it cultivates a broad array of relations with small and medium-sized component producers in the region to assist in its development activities. In this model, the region leverages development capacity for local component producing firms.

(2) Learning how to meet quality targets, and provide new customer services, while constantly reducing costs. The second emerging governance area in the contemporary environment of components production is the problem of how to develop cost-reduction capability while simultaneously improving the quality of your production and offering new forms of technical and logistical services to the customer. Traditionally, it was a rule of thumb in manufacturing that there was a trade-off between quality and cost: the higher and better the quality of manufacturing, the more costly it was. OEMs across the manufacturing sector today simply refuse to accept this trade-off. Suppliers who cannot meet quality specifications are not considered to be competitive bidders. But those who are unable to consistently meet quality levels within ever more severe cost frameworks will also be shut out of further bidding. High quality at low cost—indeed, at ever lower cost—is the framework that defines strategies and relations between OEMs and component producers today.

Such pressures by OEMs have given rise to what amounts to a revolution in manufacturing organization in contemporary industry. In particular, the principles of lean manufacturing, first established by the Japanese but now significantly improved upon and modified by producers in the USA and Europe, have become the widely accepted mechanisms for overcoming the old trade-off between quality and cost.[24] There is a whole basket of principles and organizational changes that are associated

24 The *locus classicus* description of lean production in the Japanese case, of course, is Womak *et al*. (1990). Good descriptions of the Japanese system of subcontracting are provided by Smitka (1991) and Nishiguchi (1994). Books that modify lean organizational principles for the American context, recommended by many of the component producers we interviewed, are Wantuck (1989) and Suri (1998).

with "lean" manufacture: cellular production, kaizen, cross-functional teams, low inventory, work pull, short lead times, elimination of work in process (wip), the development of broadly trained and cross-trained skilled workers, etc. Implementing such mechanisms in small and medium-sized firms is extremely costly and involves a great deal of new learning and training for both production workers and management staff. This is often very difficult to achieve with the resources a single small or medium-sized firm has on hand. As Whitford and Zeitlin (this issue) note:

> If it were *easy* to provide high-quality parts with low lead times and near perfect delivery, everyone would already be doing it, not merely *trying* to do it. Suppliers long engaged in low-technology, low-wage, low-skill batch production often do not have the managerial capabilities, the manufacturing engineers, the workforce, or the training capacity to upgrade their operations. To make the jump, many require extensive help and intervention from outside consultants, customers, and other training providers. But many suppliers even lack the knowledge, resources, and wherewithal to get such help.

Initially, OEMs themselves invested significant direct effort and cost in the form of "supplier development" to instruct their suppliers, one by one, in the new techniques. This, however, is a mechanism that has begun to disappear. In the place of supplier development, and on a much more extensive scale, is a very broad array of public and private and cooperative ventures aimed at upgrading the capabilities of the supply base in the areas of production quality, service provision, and cost reduction. The experiments can be categorized as consortial, associational, and corporate. In each case, public support may or may not play an important role.

The Wisconsin Manufacturers' Development Consortium (WMDC), described in detail by Whitford and Zeitlin (this issue), is an example of a public–private consortium of large OEM firms, public agencies such as the Wisconsin Manufacturing Extension Partnership (WMEP), and technical colleges devoted to the improvement of the capacity of local component manufacturers to compete at the levels of production quality and cost-reduction capability that the participating manufacturers require. Component supplier firms serving the members of the consortium have their participation subsidized by public money and they gain significant access to OEM know-how through participation in consortia-sponsored courses.[25] A similar program has been started in Pennsylvania, in the USA. There was also an interesting consortium in Piedmont, Italy, involving several important OEMs and first-tier suppliers, such as Fiat and Zanussi, as well as polytechnics in the region. The program was explicitly designed to improve the competitiveness of second-tier component suppliers in the region. With the difficulties of Fiat in recent years, however, the program has been discontinued.[26]

There are two different examples of associational leadership in the provision of services to firms seeking to square the circle of quality, service, and cost. The first is a program for supplier training directed by the Industrial Training Program (ITP) in

25 The final section of Whitford and Zeitlin (this issue) is devoted to a detailed discussion of this mechanism in Wisconsin. For more, see also Rickert *et al*. (2000), and the presentations by Mike Schmidt (Harley-Davidson), Paul Erickson (John Deere), and Mike Klonsinski (WMEP) at the conference on "Supply Chain Governance and Regional Development in the Global Economy", University of Wisconsin–Madison, 10 September 2002, available at: http://www.cows.org/supplychain/presentations.asp

26 On the Italian project, see Follis and Enrietti (1998); on the Italian case, see also Enrietti *et al*. (2002) and Negrelli (2002).

Illinois's Department of Commerce and Community Affairs (Kulek 2002). This program provides public funds to a variety of Illinois industry associations with membership structures composed primarily of small and medium-sized component manufacturers. In the case of the Valley Industrial Association (VIA) (in the outer western suburbs of Chicago) (Whalen 2002) or of Norbic (a membership-based Industrial Development Association on the north side of Chicago serving primarily small and medium-sized producers), the ITP awards the associations funds and member firms make specific proposals to the association for training subsidies. Fifty percent of the expense of training is paid for by the program. VIA encourages members to make use of the funds (which they do in large numbers), but does not give advice or assistance as to the types of training that may be necessary. Norbic provides consulting services to its members to help them optimize the kind of training they utilize and then provides grants to firms for the training (Kulek 2002; Whalen 2002).[27]

Another associational variant of policy to enhance the cost-reduction capabilities of groupings of component producers has been developed in the Bergisches Land region in western Germany—the second largest center of automobile components production in the country and the largest concentration of small and medium-sized component producers in that sector. For traditional reasons, public policy is very underdeveloped in the Bergisches Land for suppliers (Herrigel 1996: ch. 5). Local banks are overwhelmed and cash poor; larger banks are pulling away from the industrial Mittelstand (SMEs); employers' associations are traditionally factionalized and as a result passive. Ironically it is the local IG Metall union, as the strongest extra firm institution in the region, that has stepped into the breach and begun pushing firms to upgrade and embrace newer forms of work and production organization that make it possible to balance high quality and low cost in manufacturing. The union's goal is to protect jobs in the region by enhancing the competitiveness of the firms that are located there. In effect they are constructing a system of "co-management" within local firms that has the positive effect of tying individual producers to the network of knowledge and resources of the world's largest industrial union.

IG Metall's involvement in restructuring takes place in one of two ways.[28] First, in a significant array of cases, agents from the trade union district office in Wuppertal act directly as consultants, offering firms advice on how to restructure their product palette, their labor and production arrangements, and their finances in order to be able to achieve the quality and cost targets demanded by large automobile industry OEMs. Second, and more often, the union acts as an intermediary between the firm and consultants who come in, audit the company, and provide advice and consulting on how to restructure the firm to be competitive.

Typically the union becomes involved (in either of the above ways) because it is asked to do so, first by the works council in a troubled firm (either in bankruptcy or in financial trouble) and then by the management itself. The union establishes a set of conditions with the firm on restructuring—i.e. they will help with connections

27 On Norbic's activities, see: http://www.norbic.org/. On Norbic's industrial training grants, see: http://www.norbic.org/industrial_training_program.htm

28 A description of IG Metall's activities in Wuppertal was presented (in English) by Fritz Janitz at the Wisconsin Conference on "Supply Chain Governance and Regional Development in the Global Economy", 10 September 2002, http://www.cows.org/supplychain/presentations.asp

and line up consultants as long as the firm agrees to certain parameters (in the interest of IG Metall members) in the restructuring process. With agreement, the union then goes ahead and lines up the consultant. There are a number of very skilled local consultants who have had success in local restructuring. They know the firms, know the regional culture, know the industry, etc. But the union also uses its position to pressure the works council (to the extent it is resistant) to adopt practices in the long-term interest of the competitiveness of the firm (cells, teams, continuous monitoring, benchmarking of best practices in the industry, etc.).

In these ways, IG Metall plays a pivotal role in the management of small and medium-sized firm adjustment in the region. The union is simultaneously a broker and a conveyor of specialized knowledge. IG Metall mediates consultants who help troubled firms restructure; it establishes guidelines for the general restructuring process with the firm before the consultants are deployed; it engages itself in the internal restructuring discussion and is typically given access to the firms' books. Moreover, due to the structure of the German Federal Works Constitution Act, the union is in a remarkably good position to be able to evaluate the performance of the various actors it engages and sets into action in the restructuring process. Union officials from the local district office sit on the supervisory boards of important mega-suppliers (core customers of local SME firms) and are hence privy to very intimate info on the mega-supplier and on its work organization and production organization practices—worldwide. IG Metall knows what the customers of local firms want and is in a position to helpfully convey that information to its clients and critically evaluate management suggestions and the performance of consultants.

The final variant of governance mechanisms capable of balancing manufacturing quality with continuous cost reduction is a corporate one. Here there are two different kinds of mechanisms: one directed by internal corporate consulting units on operating units that are active as component suppliers; the other directed by OEM firms toward their component suppliers.

The first mechanism can be found among large component and complex sub-assembly producers such as Emerson Electric, Danaher, GKN, and more specialized component producers such as ITW. These firms operate their own internal organizational consultancies, in part through logistics departments, but also through their corporate "Technology Centers". Firms such as Danaher are widely known for their uniformly "lean" production operations and they are able to achieve this across a broad array of operating units and subsidiaries through the use of corporate training programs for operating unit engineers, managers, and workers (often run through their corporate university) and technical consultants who benchmark subsidiaries within the conglomerate and disseminate info on successful organizational forms. Much like the trade union in Wuppertal, these corporate institutions broker solutions for independent operating units, bringing knowledge and expertise to a local production level which those local units would not have been able to marshal on their own.

The second mechanism is in many ways a variant on the now increasingly discontinued practice of supplier development, although here the aim is to provide training to groups of suppliers to enable them to reorganize rather than to directly reorganize individual suppliers. Moreover, in the most prominent case, this corporate policy is undertaken with local government subsidy. The same Illinois ITP program

mentioned in the discussion of associational initiatives above also makes supplier training money available directly to the three largest Illinois manufacturing OEMs—Caterpillar, John Deere, and the Ford Motor Company (which operates a massive assembly complex on the south side of Chicago). These firms are charged with using the money to train suppliers that they identify as needing production quality assistance and improved cost-reduction capability. In these cases, the large OEM designs the curriculum and offers training that it believes will enable suppliers to consistently achieve quality and cost-reduction targets that the firm establishes (DeDobbelaere 2002). In effect, the state of Illinois outsources regional industrial policy to the major actors and shapers of industrial practice in the state.

(3) The problem of benchmarking. A third general governance area in the contemporary environment is the problem of benchmarking. By this I do not simply mean the formalized practice of systematically surveying the competitive landscape for best practice. Rather, I mean the term to be understood very broadly as the capacity of a firm to be able to keep abreast of and compare its own capacities to new developments in product design and technology, service provision, and production technology that exist in the industries in which component producers are active. This is an extremely necessary capacity in the current environment, as production organization, product design, technology, materials, etc. are changing rapidly and the interrelationship between all elements in the industry are being continually redefined and realigned. To keep up, firms must have an awareness of new developments, not only in the area of their more or less narrow specialty, but in neighboring and potentially competing areas of production and technology. As in the other governance areas, there are a variety of different extant attempts to address this problem across the sector in North America and Europe: market, corporate, cooperative, associational, and informal networks.

Given the significance of the problem of keeping up for component producers, it should not be surprising that a market has emerged for the provision of this as a service. Component producers in the USA and Europe have access to a broad array of specialized consultants, academic professors, state-sponsored consultancies (Manufacturing Exchange Services), trade association seminars, etc. Energetic producers with a budget for such things can take advantage of these services—though, as services, they tend often to be overly general and unrelated to the specific demands of day-to-day business in a particular firm. Even so, if a firm is mired in the trenches of arm's length work with a very small budget, purchasing some information from the market can be useful. The MEPs, as they are subsidized by Federal NIST monies, can be both affordable and useful for small component producers.[29]

29 The MEPs in the USA, funded in part by Federal NIST money, have regionally dispersed organizations in nearly every state. The Chicago Manufacturing Center, one of five MEPs in the state of Illinois, provides a good overview of its mission on its website, http://www.cmcusa.org/:

> The **Chicago Manufacturing Center** works with manufacturers to improve productivity, expand markets and retain high-wage, high-skill jobs. Using its own staff of expert consultants as well as a network of alliance partners, CMC offers a full range of consulting services tailored to the needs of small and mid-sized manufacturers and related technology based businesses.Since its founding in 1994, CMC has completed 2,800 projects with more than 1,200 companies. CMC consultants earn excellent customer satisfaction ratings and a high volume of repeat business. Serving the six-county Chicago metropolitan area, CMC is a not-for-profit

A much more interesting and significant market area for technical and production information, however, has emerged on the capital investment side. Increasingly machine tool manufacturers, and other producers of production equipment, have recognized that in order to be able to sell new equipment, they also need to provide their customers with technical development services that point out possibilities in production and production organization that the customer could, but currently does not, take advantage of. German machine tool producers, in particular, provide technical know-how about process flow and product design to their customers, not only when they sell them a new machine, but also as a form of maintenance of the machine in a customer's machinery park. For the machine tool producer, there is a significant amount of uncompensated know-how transfer that occurs in these contractual relations, but the extension and growth of such services within such firms occurs nonetheless as a way to develop and maintain the competitiveness of the market for machine tools. Capital good producers need to keep their customers, especially the small and medium-sized ones, competitive in order for them to continue to supply them with capital goods!

Another contractual solution to the benchmarking problem understood in this broad sense is the formation of a joint venture with a firm in an area of technology, production specialty, or service provision that is crucial to a firm's present or future competitiveness. This relatively expensive option is available primarily to mega-supplier firms (and those with comparable resources) who are interested in acquiring significant know-how in an area, but are not so interested that they would like to acquire outright a specialist in that area. Firms enter joint ventures when they have been able to identify a specific area of serious potential interest for the future of the firm, but do not have adequate in-house expertise or capacity to systematically develop that area. Systematic collaboration, protected and made exclusive by contract, with an outside firm in possession of the desired expertise is often viewed as a relatively low risk way to "keep up" with market trends. If the project or technology winds up in fact being significant, firms seek to end the joint venture either by buying out the partner's interest—or by purchasing the partner (or vice versa). This kind of terrain surveying is very specific, however, and typically focuses on technology.

A broader and more pervasive form of terrain surveying is the process of benchmarking within collaborative relations between OEMs and their suppliers. It is particularly common among those quality producing firms with development capacity already involved in collaborative relations with their customers (Figures 1 and 2). As the pragmatic collaboration model has pointed out, the process of seeking continuous improvement and surveying the landscape for best practice is a routine part of contemporary collaborative relations. Indeed, such collaboration pools the "terrain surveying" resources of the participants in the collaboration. Smaller producers benefit from the in-house technical resources of OEMs as well as the experience of production practice that its larger interlocutors accumulate through their involvement with a broad array of component suppliers in more and less directly related technical

continued

company that receives public and private sector funding to support high quality service delivery at fees that small and mid-sized companies can afford. CMC's funding partners include the U. S. Department of Commerce, the City of Chicago, the Illinois Department of Commerce and Community Affairs, private corporations and foundations.

markets. Collaborating OEMs, in turn, benefit from their component supplier's experience and know-how about technology and production practice that the latter has gained from relations with other customers. Collaboration is the premiere mechanism for the solution of the benchmarking problem for both OEMs and component suppliers.

The issue of terrain surveying, however, is especially pressing for that layer of component producer that competes as a quality producer, but with little internal development capacity (Figure 3). Here the need to have access to trends in production and technology is crucial for the continued competitiveness of the firm, and yet because the firm has little of its own internal development resources, it does not engage as frequently (or even at all) in the kind of rich reciprocal knowledge transferring collaborations described in the previous paragraph. There is little knowledge that is transferred between customer and supplier in "build-to-print" work.

At the moment, such producers affected by this benchmarking deficit have access to the kinds of "market provided" knowledge noted above. But both independent consultants (even not for profit ones) and capital goods providers, while helpful, have their limits for small firms. The former are expensive and typically provide only general knowledge, while the latter provide specific knowledge, but tend on the whole to pay attention to the problems of customers based on the price and number of machines being provided. The smaller the customer, the more fleeting the attention of capital goods provider engineers.

Consequently, smaller and medium-sized firms attempting to survive in the component market solely on the basis of their production quality seek compensation through two alternative mechanisms, one informal and decentralized, and the other formal and centralized. The informal mechanism is horizontal exchange of experience with similarly situated producers. The example from above of the Wisconsin stamping firms and the Chicago screw machinery companies illustrates how informal networks of communication between firms can have a beneficial impact on individual firms' sense of their own standing within a community of experts. Firms exchange information about customer practices, relevant new technologies and forms of organization, useful consultants, competent banks, etc. Those that live in the same region can engage in these activities in informal settings—health clubs, golf courses, school events for children, leagues in which employee teams engage in sport competition, etc. Those that live more distant from one another can engage in exchange at trade shows or professional meetings (for example, trade association functions). Such exchanges, as the examples above indicated, can be very useful for firms—though it is very difficult to quantify the precise degree to which such exchanges are useful.

The more formal way in which less well-endowed firms can engage in terrain surveying and benchmarking is through their trade associations. Different trade associations have different strengths when it comes to benchmarking activities. German trade associations have a much more robust and longer tradition of providing such services across a broad array of relevant areas than do American trade associations (Kwon 2002: ch. 4). But services such as formal surveys of all members along specific competitive dimensions—or polls indicating extent of adoption of crucial work practices (e.g. cellular manufacturing), or association sponsored travel to foreign

competitor markets (including visits to competitor firms) can be important benchmarks for smaller, less well-endowed firms.[30]

None of the above, however, rivals the intensity of the benchmarking that is produced through the cooperative procedures involved in pragmatic collaboration. Consequently, its fair to say that firms attempting to maintain a position in the component market based on quality manufacture without any development capacity are in a structurally precarious position. They desperately need to "keep up" in order to be able to continue to win bids. Their primary competitors are better endowed companies primarily engaged in collaborative relations with OEMs seeking to hedge by acquiring build-to-print work. Because the latter hedging companies are continuously engaged in collaborative benchmarking and continuous improvement, they can more easily "keep up" and hence threaten to push the former firms out—either entirely out of business or down into the quick turnaround, low-wage business currently constituting the bottom of the barrel of component work.

4. Conclusion: No Single Trajectory, Multiple Strategies, a Wide Range of Governance Arrangements

This paper has provided a broad survey of the current terrain of components production in the high-wage regions of North America and Europe. Its central message is that it is unwise to believe in the unitary characterizations of the development of relations between OEMs and suppliers in contemporary manufacturing. The character of the current environment aligns strategies among all parties such that heterogeneity in relations between customers and suppliers is systematically reproduced.

Four broad types of strategy are currently possible and being pursued in today's market. They are represented by Figures 1–4. There is a considerable amount of hedging as well as hybridity observable among component producer strategies. In a similar way, the range of governance mechanisms currently being developed and deployed among producers in the sector is quite broad. The same problem is being addressed by multiple alternative institutional arrangements. Mechanisms can be either public or private, or both, and formal or informal. They are corporate, associational, consortial, and market-based.

It is not at all the case that all of the forms of governance surveyed here are equally adept at enhancing the competitiveness of component producers. Some, such as the Wisconsin supplier consortium and the internal corporate technology and consulting arrangements, have highly developed systems of monitoring which provide feedback and make self-correction, learning, and optimization possible in the arrangements. Others, such as the Illinois training programs, lack these crucial mechanisms for learning and optimization. As a result, training is driven by final assemblers or, in the case of the associational programs, by individual component producers. Little horizontal or vertical communication occurs in any systematic way in such arrangements,

30 One small (less than 60 employees) German producer of industrial flat springs, for example, participated in an international benchmarking survey on skill training organized by the European Spring Federation, the (US) Spring Manufacturers Institute, and the British EMTA-National Training Organisation for Engineering Manufacture. Though the response rate was relatively low (7 percent), the firm felt that the survey provided valuable information regarding its relative position in its market on the training issue.

making it difficult for both producer and policy makers to optimize the quality of services provided.

Monitoring seems to be a crucial mechanism for learning and for continuous improvement (Sabel 1994), yet it appears that many of those arrangements surveyed here with serious monitoring mechanisms in place were achieved at the cost of limiting participating units' extent of access to the outside. The technology and production consulting mechanisms inside conglomerate manufacturing corporations, for example, place pressure on members to use them (and not others), and as a result close member actors off from potential knowledge and sources of know-how on the outside. Similarly, the frequently voiced complaint against the WMDC in Wisconsin is that it is a membership cartel, providing services to only a particular select membership and not to others. To the extent that such complaints are not the sour grapes of those excluded, concerns focus on the arbitrary boundaries for knowledge and cooperation among component producers that the consortium constructs. Not only are suppliers to other OEMs excluded from exchanges within the consortium, but suppliers to the same OEMs located nearby but across the border in the states of Illinois, Iowa, and Minnesota are also excluded. It appears that the advantages of learning and monitoring are achieved in many cases—even the most successful ones—at the cost of limitations on the degree of openness of the organizations.

Finally, none of the governance arrangements surveyed seems to be in a position to battle perhaps the most severe problem confronting component producers in the current severely recessionary environment in North American and European manufacturing: the constant pressure on component producer margins driven by unremitting OEM demands for cost reduction. During the 1990s, many manufacturing OEMs expanded aggressively, but this led to excess capacity and high indebtedness when global manufacturing markets fell into recession in 2001. Feeling pressure on their balance sheets, OEMs have sought to squeeze savings out of their supply chain—either by shifting purchases to low cost regions such as China and Eastern Europe, or by insisting on severe cost reductions from their domestic suppliers, or both. This, in turn, has produced a crisis in manufacturing in both North America and Europe, as small and medium-sized producers find it increasingly difficult to keep people employed and even stay in business as the recession persists and cost-reduction pressures from OEMs continue unabated.

The governance problem here is that neither OEMs nor component suppliers have an effective mechanism for producing a counterweight to factions within OEMs (often allied with finance departments) pushing to recover space in their own margins by pressing the supply chain on theirs or component producers undercutting their colleagues in the market in a desperate attempt to retain business.

One can easily point to elements within OEMs who recognize the illogic of pressing suppliers—why punish those producers who one increasingly relies upon for the design and production quality of one's own product? Why decimate a pool of know-how and resources locally when the long-term interest of the firm is increasingly dependent upon access to as broad a pool of technical and manufacturing knowledge as possible? Nonetheless, it is difficult to establish the legitimacy of this view within the functional departments of the OEM as a whole. The behavior of some firms seems to be guided by this kind of thinking: interviewees at BMW, ZF, and ITW all insisted

on the need to cultivate the supply base. But revealingly, an interlocutor at ITW told me that his firm "tries not to treat our suppliers the way that OEMs treat us". As the other side of this remark suggests, there are many OEMs in the current environment who have not been able to restrain the internal forces within their organizations seeking to use the supply chain as a way to improve short-term margins in the recession.

Component producers also struggle with significant obstacles to effective self-organization and the construction of mechanisms of self-defense against aggressive OEM sourcing policies. The basic dilemma for component producers is the following: when work is scarce, producers reluctant to provide customers with what they want can easily be replaced with another who is desperate enough to produce at the terms demanded. Good people begin to do bad things in this kind of market, often even just to get work and keep production going. When such behavior becomes the norm, markets begin to break down as producer competition pushes prices beneath profitable levels.

To my knowledge, there is no mechanism in the component supplier market, either in the USA or in Germany (or Europe), to block this kind of pathological behavior. German component producers established an association, Arbeitsgemeinschaft Zuliefererindustrie (ArGeZ), in the early 1990s to counteract the efforts of Ignazio Lopez at Opel and later VW to impose non-negotiable price reductions on suppliers. This association succeeded in establishing a template for contracts with a baseline for terms and delivery conditions. A similar code of conduct was later adopted by the automobile producers association, the Verband der Automobileindustrie (VDA) (Kwon 2002). Nothing of the sort exists for component producers in the USA, but even these German measures have proven to be weak in the face of desperate OEMs struggling with their balance sheets in recession. And, of course, these normative guidelines have no effect on OEMs' decisions to source outside of Germany.

Some sort of brake on the ability of cost-reduction obsessed factions within OEMs to abuse their conjuncturally presented position of advantage during periods of economic distress is needed. Without it, all manner of firms in the component industry in high-wage regions could sustain significant damage if the current recession continues to drag on.

Plainly, there are interests within both the OEMs and among component suppliers that see the need for a mutually beneficial solution to this problem. If the current recession continues, perhaps it will become possible for those with common interests to reach across the divide to solve the problem—there are ominous implications associated with failure to do so. It could of course also be that the current recession will end and the need for output will replace the current obsession with cost reduction in finance departments. This will release the current tension on component producers, but it will not solve the underlying problem. Players on both sides will do well to remember their common interests and seek a governance solution for their relations that effectively induces self-restraint on both sides when periods of scarcity and financial distress tempt good people to do bad things.

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