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### Governing Decentralized Production: Institutions, Public Policy, and the Prospects for Inter-firm Collaboration in US Manufacturing

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# GOVERNING DECENTRALIZED PRODUCTION: INSTITUTIONS, PUBLIC POLICY, AND THE PROSPECTS FOR INTER-FIRM COLLABORATION IN US MANUFACTURING

JOSH WHITFORD AND JONATHAN ZEITLIN

It is commonly agreed that the landscape of US (and international) manufacturing has changed significantly since the 1970s. The fragmentation of once-predictable mass markets rocked the Fordist order, with dramatic effects on corporate structure and divisions of labor within and between firms. Original equipment manufacturers (OEMs) now produce a greater variety of more customized products with shifting technology mixes. “Globalization” and the opening up of national markets allow OEMs to acquire inputs virtually anywhere, but also subject them to more direct competition at home, as well as to the increased uncertainties of exchange rate and raw material price fluctuations. In many key end-user industries—including automobiles and other transportation equipment; industrial, farm, and construction machinery; and electrical appliances—OEMs have seen years of relative stability in their core technologies (steel and mechanical engineering) shaken by the incorporation of innovations developed in other sectors, such as new materials and electronics. Many of these large firms have actively engaged with this new environment by retrenching to their “core competencies” in design, marketing, and assembly, and electing to “outsource” other activities to a series of smaller suppliers who now do much of the “real” manufacturing of components. These firms now often find themselves operating simultaneously in the supply chains of several relatively disparate end-user industries. The shift to a more decentralized organization of production in US manufacturing is easily seen in the changing distribution of workers across factories: between 1972 and 1992, plants with 500+ employees shed 3 million workers, while plants employing fewer than 500 added 2 million (Luria 2000).

Outsourcing is often viewed as an attempt by OEMs to shift costs to the weak, to avoid unions, and generally to decrease the wage bill. Wage-cost driven outsourcing is a particular problem in the US context (especially in the automobile industry), given the large union/non-union wage differentials, plant-level bargaining, the many southern “right-to-work” states with lower union density, and the dramatically reduced wage costs and compliant unions just across the Mexican border. However, while labor costs are *undoubtedly* important in many cases, they provide at best a partial explanation (Deavers 1997). In perhaps the most systematic quantitative study of

outsourcing decisions in manufacturing establishments, Harrison and Kelley (1993: 228), who can hardly be accused of turning a blind eye to the “dark side” of contemporary capitalism,<sup>1</sup> found that:

the search for numerical flexibility through subcontracting cannot be understood as manifesting only (or even primarily) a strategy for reducing the company’s dependence on high-cost labour. And we find no evidence that subcontracting is associated with union-avoidance *per se*.

In interpreting the increased propensity of OEMs to decentralize production, it is useful to distinguish amongst the various reasons for subcontracting. At the broadest level, the key *relative* shift is from “capacity” to “specialized” subcontracting. In the former type, the OEM retains substantial internal capacity, only sourcing externally to meet demand peaks; in the latter, the OEM becomes reliant—at least in the short and medium term—on the subcontractors’ specialized technology and/or labor skills.<sup>2</sup> There are myriad, complex, and often mixed motives for subcontracting a particular process or component—all made more salient by the changed competitive context. More fragmented and uncertain demand increases the risks of investment in both innovation and productive capacity, creating an incentive for OEMs to look for partners with whom to hedge that risk. Large firms use subcontracting to reduce their fixed costs, collectivizing work to ensure the efficient use of specialized labor and capital goods. Companies seeking to integrate new technologies into their products look outside for access to specialized skills that are difficult to “make” internally, and OEMs will sometimes consciously seek new knowledge by sourcing work to suppliers who serve other customers and other industries.

We do not claim that American manufacturers in the postwar era of mass production never engaged in specialized subcontracting, nor that OEM–supplier collaboration is a wholly new phenomenon even in the USA. Rather, we claim only that there has been a significant *relative* increase in the scale and scope of specialized subcontracting in US manufacturing in recent years.<sup>3</sup> Indeed, recent work in business history has amply demonstrated that this development represents in many respects a return to older patterns of collaboration between OEMs and suppliers. For example, discussing the American auto industry in the 1920s and 1930s, Schwartz (2000: 65) writes that “relationships in old Detroit were characterized by cooperative product development, long-term contracts, and the ‘voice’ system of resolving problems”. Similarly, referring to a slightly earlier period, Helper and Hochfelder (1997: 187) argue that “evidence indicates that many of the features of these so-called ‘Japanese-style’ customer–supplier relationships were present in the US auto industry before 1920”.

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1 Cf. Harrison (1994).

2 Watanabe (1972) distinguishes three types: capacity, specialized, and economic subcontracting, where the last refers to subcontracting based “on the parent company’s cost calculations about the cost-effectiveness of different forms of work organization” and includes efforts to realize economies of scale at the level of individual machines. For our purposes here, “economic” subcontracting can be treated as a subset of specialized subcontracting in those cases where the contracting firm cedes internal capacity and would face significant ramp-up costs were it to resume production.

3 See, for example, Helper (1991), Helper and Sako (1995), Helper and MacDuffie (1999), Dyer (2000), and Helper *et al.* (2000).

### A “NEW PRODUCTION PARADIGM”? SPECIALIZED SUBCONTRACTING, LEARNING BY MONITORING, AND PRAGMATIC COLLABORATIONS

Claims of a relative shift from capacity to specialized subcontracting have led to widespread hopes of a “new production paradigm”.<sup>4</sup> In this model, subcontracting relationships with outside suppliers mitigate the difficulties of volatile and fragmented markets that grant little cost leeway even as they demand increasingly diversified products with ever shorter life cycles. As OEMs slim down by focusing on core activities and outsourcing some operations, long-term supply chain management becomes central to corporate strategy. Large firms that once held substantial quantities of inventory and work-in-progress rely instead on suppliers consistently to deliver high-quality parts just-in-time (JIT). They devolve day-to-day production and require substantial supplier assistance on process and design improvements to turn new ideas into marketable products quickly, and must thus improve inter-firm cooperation and information transfer. OEMs give more business to fewer suppliers, and forge closer relationships with a core “strategic” group that they hope to align with their own goals. But these key suppliers are *not* envisioned as mere satellites orbiting a dominant but benevolent patron, dependent and beholden. Rather, in a practice somewhat in tension with the desire to extract priority treatment when needed, OEMs often push these same suppliers to become *more* independent, wanting them to work closely with other customers and other end-use industries. They share ideas, technology, and fixed costs with these “partner” suppliers in ways they recognize may benefit competitors, but hope the smaller firms will learn from *other* customers, acquiring competencies that can transform the supply base into a vital source of new ideas and technology.

In the academic literature, this vision of an end to Fordism and a reinvention of a more flexible production model came to the fore in the 1980s. It drew much of its initial theoretical vigor and empirical examples from the success of Japanese producers, especially in the automobile industry, and focused particularly on collaboration and cooperation, both in teams internal to the firm and across firms.<sup>5</sup> Given this starting point, it is unsurprising that a significant portion of the literature has focused first on whether US manufacturing is, will, or should become fully “Japanized”, while also asking whether or not the model needed to be adopted as a coherent whole and/or if it depended fundamentally on a high-trust Japanese cultural context.

Drawing particularly on developments in the automobile industry, it is now increasingly clear that since the mid-1980s, as Sabel (1996: 2) writes, “the organization of production in the US has become . . . substantially more collaborative or team-like: in a word, more ‘Japanese,’ and . . . [less] ‘American’ ”.<sup>6</sup> But, he adds, “there has been

<sup>4</sup> It may seem paradoxical to call this a “new production paradigm” immediately after having pointed out that current trends are in some ways a return to the pattern of OEM-supplier relationships that dominated the earlier part of the century. For our purposes, however, it does not matter whether the “new” paradigm is “truly” novel, in the sense of never having seen the light of day. If it is indeed happening, it does require some members of a generation that came of age in the era of mass production to re-invent, rework, and renew dormant practices.

<sup>5</sup> This literature was not confined to discussion of the diffusion of Japanese concepts. Key authors such as Piore and Sabel (1984), Sabel (1989), Hirst and Zeitlin (1991), Streeck (1991), Pyke and Sengenberger (1992), and Herrigel (1996) also emphasized the flexibility and good performance of industrial districts, especially in the Third Italy and Baden-Württemberg, to rethink the changing principles of production much more generally, developing such concepts as “flexible specialization” and “diversified quality production”.

<sup>6</sup> See also Helper and Sako (1995, 1998) for a comparative discussion of changing supplier relations in the USA and Japan.

surprisingly little change in the basic pattern of US corporate governance”, showing that the model is neither culturally specific nor so tightly coupled that firms are unable to adopt aspects of it piecemeal. Sabel (1996: 3) holds that “Japan has pioneered a distinct form of decentralized production organization that is universal, in the strict sense that its core features facilitate adoption in the most diverse settings, regardless of cultural preconditions.” Similar to our discussion above of an emergent “new production paradigm”, he finds the core diffusing element to be “Japanese customer-supplier relations” in which

a small number of top-tier contractors assume responsibility for co-developing crucial modules or subsystems with the final producer, coordinating the production of low-tier suppliers producing parts for subassemblies for their module, delivering the components just-in-time, and meeting targets for incremental improvement of production according to targets agreed with the customer.<sup>7</sup>

Helper *et al.* (2000: 444) provide one of the most ambitious attempts to date to synthesize the theoretical implications of firms’ increasing collaboration with suppliers in the context of reduced vertical integration. They contend that the ongoing reinvention of the customer-supplier relationship demonstrates the inadequacy of those “standard” models of the firm—“rendered as history by Alfred Chandler Jr and others”—that argue that firms exist “to reduce the hazards of collaboration that could not efficiently be overcome in market exchange”.<sup>8</sup> The standard theory is premised on the belief that the efficiencies of specialization create vulnerabilities that lead “owners of highly specialized, complementary resources” to fear opportunistic hold-up and thus cooperate only at great risk—leading to a “centralized, hierarchical and vertically integrated firm” in which “goals set by headquarters were achieved by hierarchically ranked, specialized subunits, all part of a single organization” (Helper *et al.* 2000: 461). In place of such unwieldy behemoths, they predict (and posit) the emergence of “non-standard” firms that are “federated, not centralized” in which “components or services crucial to the final product of one firm can be provided by independent companies and the firm’s internal specialized producers can provide outsiders with crucial inputs” (Helper *et al.* 2000: 465). Such non-standard firms have at their core work groups free to change their own internal organization and to choose inputs from either in or outside the company, coordinating directly with other internal units and with external customers and suppliers by means of “novel methods of iterated goal setting”. “Design follows a disciplined, decentralized process known as simultaneous engineering” and production depends on systems of error detection and correction that use “breakdowns in the new routines to trigger searches for weaknesses of the design or production process that escaped earlier detection”. These systems have at their core a principle of collaboration that Helper *et al.* (2000:

7 The now voluminous literature on “Japanization” emphasizes not only the widespread adoption of Japanese-inspired manufacturing practices outside their original setting, but also their selective modification and hybridization to fit different local economic and institutional contexts: see Boyer *et al.* (1998), Liker *et al.* (1999), Zeitlin (2000: esp. 43–46).

8 In criticizing the “standard” theory of the firm, Helper *et al.* (2000: 444) take aim at transactions cost and property rights theorists, such as Oliver Williamson (1985) and Oliver Hart (1995), respectively, as well as Chandler (1962, 1977) himself.

466; see also Sabel 1994) refer to as “learning by monitoring” because it “ties mutual assessments of reliability to joint explorations of capability”.

Learning by monitoring forces companies to share information on performance of processes in ways that would have once been unthinkable, but “in volatile markets, companies realize it is simply too risky to assume that one’s current processes, no matter how much they improve on past practice, are competitive, let alone superior” (Helper *et al.* 2000: 467). The new principles of industrial organization, Helper *et al.* contend, are more efficient, and lead firms to understand what goals are feasible and how they can be achieved, while also yielding significant economies of scope. Perhaps more important, however, these pragmatic principles of firm organization counter opportunism by creating “an information symmetricizing machine in which actors must keep one another abreast of their intentions and capacities” and can align the interests of collaborators. As work groups learn the “search routines, problem-solving disciplines and the re-configuring of flexible equipment . . . product-specific resources are ‘de-specified’, coming increasingly to resemble general-purpose assets, and thus no longer the instruments or object of hold-ups”. The information exchange at the core of the model protects firms from “incompetent or unreliable” partners by “alert[ing] them to this danger before the consequences [are] ruinous” (Helper *et al.* 2000: 471–472).

Helper *et al.* (2000) make clear that they are writing about an emergent model, and do not claim to have fully described the current landscape of American production. Likewise, they are aware that the period of transition to the new production paradigm brings new risks to the OEMs, which give up control of production, delivery, and quality performance, depending instead on suppliers for the sorts of incremental “hands-on” improvements that require an intimate and tacit knowledge of day-to-day details. But they nonetheless claim that the “upshot of all these mechanisms acting together is that the construction of Japanese-type production systems does not presuppose the existence of long-term relations, because the system in the course of its operation produces them” (Helper *et al.* 2000: 474).

Drawing again on the US automobile industry, they argue that when competition became sufficiently intense to deny the OEMs large final market rents, the latter returned to a decentralized production model, one based on the pragmatic mechanisms of learning by monitoring. These mechanisms spread because they “advance knowledge [and thus] increase the payoff to cooperation, as well as reducing that of opportunism, so people get used to cooperating. This strengthens the rule of thumb that cooperation is good” (Helper *et al.* 2000: 476). The argument, acknowledged to be both positive and normative, is that the information sharing and benchmarking at the core of the new mechanisms will cause firms that experiment with them in less vulnerable areas to recognize their successes, and “once the cooperative exploration of ambiguity begins, the returns to the partners from further joint discoveries are so great that it pays to keep cooperating” (Helper *et al.* 2000: 445). The implications are clear: so long as markets are sufficiently competitive and firms learn the new principles, there is good reason to expect the emergence in the USA of a highly flexible and reactive model of production, one in which OEMs specialize in designing, assembling, and marketing innovative products, while a nimble but restricted group of suppliers delivers high-quality parts on demand, and regularly suggests incremental design modifications to lower the final cost of products.

### THE ELUSIVENESS OF THE “NEW PRODUCTION PARADIGM” IN THE US CONTEXT

We agree with Helper *et al.* that full-blown “Japanese-style collective institutions” are not required to “generate the conditions necessary to maintain and nourish collaboration”. But our own field research on OEM–supplier relations in Midwestern manufacturing leads us to question their claims that the “new production paradigm” is as “self-actualizing” as they seem to suggest, sufficiently able to “symmetricize” information and “despecialize” assets so as to moot the “classic” problems of opportunism. Unlike the “standard” theories they criticize, however, we do not believe vertical integration to be either a likely or a feasible response to these problems. We are convinced of the normative attractiveness of Helper *et al.*’s vision, but contend that its realization may also depend on a strong and facilitative public policy framework, attentive to the needs of and constraints on both OEMs and suppliers.

In the historic US context dominated by arm’s length relationships and capacity subcontracting, many small firms functioned only as low-overhead shops, working as batch producers of OEM-designed parts. Unsurprisingly, the many suppliers that are increasingly responsible for production are on average less productive than their OEM customers, generating less value-added per direct worker. They tend to employ a lower ratio of managers to production workers, and therefore have fewer professional staff to develop strategic plans for reorganizing work in efficient ways that reduce cycle times and cut costs while improving output. These enterprises spend less annually on capital upgrades and new equipment, instead adjusting labor costs to regulate production. They are less likely to be unionized, and invest less in their workforce. These features, together with low capital intensity, mean that less is spent annually on training, jobs tend to require fewer skills, and wages on the whole are lower. They also tend to sell their products to a relatively small group of customers: the large firms that incorporate the suppliers’ parts into their final products (Helper and Sako 1995, 1998; Luria 1996a, b).

The implications are many. Smaller US firms endure greater exposure to the market, often finding themselves asked by OEMs to reduce prices or to take on responsibility for additional services without commensurate remuneration. Such effective price cuts often come out of suppliers’ already lower margins, rather than being financed through parallel cost reductions or process improvements, and thus mean less capital available for strategic plans, R&D, technology development, capital investments, and worker training. Suppliers can get mired in a vicious cycle with limited hope of becoming more productive. With an increasing percentage of employment in small firms, more and more workers thus find themselves in lower-paying, less-skilled jobs, with far-reaching impact on American society as a whole (Helper and Sako 1995, 1998; Luria 1996a, b).

These averages matter and make clear the challenge, but they also do not spell “certain” doom. The small firm sector is not monolithic and firms can also change. Drawing on the database of the Performance Benchmarking Service and using value-added per full-time employee as a metric, Dan Luria (2002) has shown that there is high variance in the productivity and wages of sub-500 employee firms, and that the



distribution is very skewed at the high end—so much so that the top 10 percent of small firms in the database are twice as productive and pay twice as much as the median shop. Perhaps more importantly the key variable is not plant size per se but is rather a question of management, technology, and labor quality: small plants owned by large companies are no less productive, even on average, than are large plants.

US OEMs are also in a bind. They rely on the new model of vertical disintegration to cope with the complications of more volatile and fragmented markets. But this model entails dependence on outside suppliers for important parts of the production process, a dependence further complicated by three tensions. First, the processes outside the OEMs' core competencies are often simpler, less capital-intensive ones which add less value, employ a lower-skilled workforce, and return less profit to the firm; but to take advantage of increased flexibility, OEMs need suppliers to meet higher quality and delivery benchmarks, to keep up with technological change, and to improve their productivity. Second, OEMs dependent upon suppliers to do more than simply provide excess capacity cannot just switch suppliers when problems arise. As explained by an engineer at one OEM:

you can't take this design which was probably jointly developed and go take it to their competition and get a better [component]. We have to re-draw, re-test, re-everything... The cost of re-sourcing is huge. We recognized a long time ago that we have to stick with some of our [poor] suppliers because of the cost of re-sourcing it. We give them a lot of rope.

Finally, decentralized production demands levels of inter-firm coordination and information exchange between US OEMs and their suppliers that have been absent or weakly developed for generations.

Caught between the tension of preserving the advantages of a flexible, vertically disintegrated approach for their own firm and of maintaining cost and quality control over the parts that go into their products, OEMs are finding traditional supply management practices inadequate, and some are experimenting with new solutions. The next section begins our discussion of one such experiment, a partnership formed in 1998 between state agencies and six OEMs in the upper Midwestern state of Wisconsin to correct problems of cost and quality in a sustainable way for OEMs, but also to pass on to their suppliers some of the benefits in productivity and work conditions experienced in the large firms.

### CONTEXTUALIZING THE WISCONSIN MANUFACTURERS' DEVELOPMENT CONSORTIUM

The empirical material in this paper is based upon numerous interviews conducted between 1997 and 2003 with large and small manufacturers and other parties associated with the Wisconsin Manufacturers' Development Consortium (WMDC).<sup>9</sup>

<sup>9</sup> The many interviews with persons and at firms associated with this consortium have been conducted in four waves between 1998 and 2003 by the authors and other colleagues at the Center on Wisconsin Strategy (COWS). In the first wave, supplier development personnel at John Deere & Co. and five Deere suppliers were extensively interviewed by Jeff Rickert (see Rickert 1999). In the second wave (spring-summer 1999), 10 more suppliers and the rest of the OEMs were interviewed. For supplier interviews, each of these OEMs was asked to nominate at least two suppliers to take part in interviews, selecting those who worked for multiple OEMs in the consortium, and choosing one who had used the program in its first year and one who had not. This design aimed to allow firms to speak candidly about the practices of their customers without fearing that information could be traced

The WMDC is a public-private partnership of six OEMs<sup>10</sup> and the Wisconsin Manufacturing Extension Partnership (WMEP),<sup>11</sup> with the cooperation of the Wisconsin Technical College system. The operation, structure, goals, and performance of this collaborative effort to upgrade supplier capabilities will be discussed in detail later in the paper. To provide a context for that discussion we first draw upon our field research to present a composite portrait of the changing procurement strategies of these Wisconsin OEMs, describe the response of their suppliers to these changes, and then relate the barriers and difficulties both sides experience as they try to move toward the more flexible “new production paradigm”.

### *Supplier management and procurement strategies of Wisconsin OEMs*

As the trend towards mass customization gains pace, more and more markets are demanding products configured to the specific requirements of individual customers' orders. For Case, the number of base products and options in our mix has grown enormously. Our production managers are finding that they must be prepared to provide millions of different product configurations. (*Case Supplier Manual*, 1999)<sup>12</sup>

This quote from the *Case Supplier Manual* typifies the situation facing the purchasing departments of the OEMs in the Wisconsin consortium. Manufacturers are trying to produce a wider variety of products more quickly and at a lower cost. The motivations of the various firms are different, but all are pursuing a vertically disintegrated

*continued*

back to suppliers (since no one OEM knew exactly which of its suppliers were in the sample). In the third wave (fall 2000), researchers returned to 10 of the suppliers from the first two waves, to ask them about their use of the training, its effects, and how it fitted into manufacturing strategy. Significant portions of the empirical material from these interviews has been presented in two policy reports published by COWS (Rickert *et al.* 2000; Whitford *et al.* 2000). Finally, the authors are currently engaged in a multi-state research consortium, the Advanced Manufacturing Project (with Susan Helper, Gary Herrigel, Daniel Luria, and Joel Rogers, funded by the Alfred P. Sloan Foundation and the Wisconsin Manufacturing Extension Partnership), interviewing many more component manufacturers and OEMs in the upper Midwest, including several involved in some way with the WMDC. Material from this last round of interviews has been brought to bear particularly in the section discussing supplier strategies, but also in other sections where relevant.

- 10 The six original OEMs are the Ariens Corporation (a maker of snow-throws and lawn and garden equipment), John Deere-Horicon Works (lawn and garden tractors), Harley-Davidson (motorcycles and motorcycle power-trains), Trane Corporation (industrial water chillers), Mercury Marine (boat motors), and Case-New Holland (agricultural equipment). Several of these OEMs are divisions of larger corporations producing for other markets from out-of-state plants (i.e. Deere construction and forestry and agricultural implements, Case construction, Harley assembly facilities, etc.), and nominate Wisconsin suppliers to these out-of-state plants. In 2001, these six OEMs purchased \$844,067,537 in materials from nominated suppliers. The consortium was previously called the “Wisconsin Supplier Training Consortium” and is better known by the original name. In early 2002, the consortium added Oshkosh Truck, a manufacturer of truck and truck bodies for the fire and emergency, defense, concrete-placement, and refuse-hauling markets. Mercury Marine withdrew from the consortium in the spring of 2003.
- 11 WMEP is a public-private partnership that receives some funding from the National Institute of Standards and Technology, through the Manufacturing Extension Partnership (MEP), but also draws funding from other sources, including the State of Wisconsin, and earns revenue selling consultancy services. Although some manufacturing extension programs go back to the 1950s and 1960s, the Clinton administration made them into an important part of US industrial policy and provided considerable new funding. As a result, many new MEPs sprung up across the USA in the 1990s (Turner 1999).
- 12 Case has since been acquired by New Holland to form Case-New Holland (CNH), which is now controlled by Fiat. Reporting on the merger, the *Financial Times* (18 May 1999) writes: “The groups are hardly strangers to restructuring. New Holland was formed in 1991 after Fiat merged its farm equipment operations with those of Ford, while Case is the result of several merger deals, notably its acquisition in 1985 of International Harvester of the US.”

manufacturing strategy. Case, for instance, moved from a “make-to-stock” strategy of building towards annual sales forecasts, and now aims to “make-to-order”, responding as closely as possible to current customer demand in the agricultural industry. Deere aims to concentrate its manufacturing operations as much as possible on their 4-month selling season. Harley-Davidson is trying to meet the rapidly rising demand for its products. Trane engages in concurrent engineering initiatives to “design new high-quality products at lower costs—and in less time than our competitors” (Trane, *Supply Line Signal*, 1999). Ariens, much smaller than the other consortium OEMs, has actually brought certain operations back in-house to service the firm’s own large customers more quickly. From these apparently diverse goals, a number of commonalities can be identified.

All of these firms are struggling to meet the ever changing demands of forces external to their operations. Whether in relation to the product market, their competitors, or government regulations, these OEMs have embarked on strategies aimed at rationalizing their supply operations to achieve increased flexibility and efficiency. They are also focusing on reducing their time to market. Harley-Davidson must fill a steady demand before customers find substitutes or become frustrated. Deere, Case, and Ariens operate in relatively mature and competitive markets with highly seasonal demand, and could thus garner considerable advantage by building closer to time-of-sale. All depend significantly on suppliers to perform key manufacturing operations, typically purchasing between one-half and three-fourths of the “cost-of-goods-sold”.<sup>13</sup>

These OEMs of the WMDC all operate in “mid-to-low-volume” batch production industries, meaning that the quantities of particular parts purchased from suppliers are much smaller than in the “high-volume” auto industry, but larger than the “one-off” design-to-order parts that might be purchased by specialized machinery producers and the like. Their identification as mid-volume producers is relevant for two reasons. First, it means that production overhead costs such as tooling and transport must be amortized over smaller volumes, which tends to protect domestic suppliers against more distant low-wage competition. Second, the ongoing supply chain “revolution” has been led by the automotive industry. The US automobile producers were first in line to borrow techniques selectively from Japanese manufacturers, but OEMs in other industries are now “borrowing” too, implementing, in full or modified form, target pricing, simultaneous engineering, supplier development teams, annual cost reductions, requests that suppliers divulge cost and process data, and so on.

Like the automobile manufacturers, the OEMs in the WMDC are reducing the number of suppliers in their supply base, and pursuing closer relationships with those that remain. Harley first trimmed its supply chain—from 1,200 in the late 1980s to 350 in 1999—to lower administrative costs and is now winnowing it again as they ask some suppliers to provide whole systems rather than simply discrete parts. Case, Trane, and Harley have tried to limit their supply chains to firms able to assist them in product and process innovation. In the mid-1990s, Deere-Horicon refocused the plant’s operations on just four core competencies, buying the rest outside even while

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13 As stated in a letter from the six original OEMs to the governor of Wisconsin, explaining the rationale for their funding.

trimming the supply base from 750 to 250. As a relatively small OEM, Ariens has a base of suppliers that is close geographically and can interact with the company on a number of levels—though they are also beginning to look to global markets to ensure cost-competitiveness for certain components.

As a result of these changes, OEMs are growing more concerned with suppliers' performance in terms of price, quality, delivery, and flexibility, with particular emphasis on cost reductions and lead times. Their concern for improving suppliers' performance is of course signaled by membership in the consortium, but most are more proactive than that. Deere, Trane, Harley, and Case all have created formal supplier development programs. These programs typically involve OEMs going beyond simply providing incentives for the practices they want their suppliers to follow, by sending their own dedicated engineers to work directly with suppliers to improve performance on the metrics the customer considers most important. In short, the OEMs invest resources to teach their suppliers the relatively tacit organizational routines and manufacturing techniques typical of the "new production paradigm" described above.<sup>14</sup> Engineers are sometimes sent on short "fire-fighting" projects at particularly problematic suppliers, but also do extended projects that can involve long stays at supplier firms. The "profits", or projected cost savings, from these projects are then divided according to formal agreements. The OEMs may also justify their share by arguing that suppliers should be able to make additional profits by applying their new learning to production for other customers.

But all is not rosy in the garden of US supply chain reorganization. There are also significant inconsistencies in the application of these guiding principles across and within OEMs, which frequently confound suppliers and undercut efforts to build the flexible and reactive decentralized production model that all ostensibly seek. Before discussing these barriers to supplier development, we present a synthetic portrait of US component manufacturers' strategic responses to the changing practices of their customers.

### *Supplier strategy in the new production paradigm*

In the many interviews conducted by the authors and their collaborators at supplier firms in the US Midwest, we found two underlying logics of supplier response to the new commercial environment created by their customers' reorganization: specialization and diversification, often crossed with each other in a variety of combinations. These represent a sort of "toolbox" of strategies that provide suppliers with ample opportunity to profit from the changing practices of their OEM customers, though none are without risks.

<sup>14</sup> Helper and MacDuffie (1999) deal with precisely this subject, at Honda of America. Rickert (1999) has written on supplier development at Deere in Wisconsin. For a good overview of supplier development by Japanese automakers, see also Sako (1998: 3). Describing the principle behind supplier development, she writes that "there is a difference between providing mere incentives for suppliers to improve performance through long-term customer commitments, and teaching the processes by which these improvements can be attained. The long-term, labour-intensive and hands-on mode of teaching by Japanese [vehicle manufacturers] reveals their firm belief that incentive structuring may be a necessary but not sufficient condition for facilitating suppliers to acquire a dynamic capability. The reason lies in the tacit nature of knowledge being taught to suppliers, not easily fully codifiable in manuals or textbooks."

*Specialization.* The most prominent strategy amongst suppliers served by the Wisconsin consortium was specialization on a particular set of processes or products, with the smaller firms mirroring the OEMs' focus on a limited set of core competencies. Rather than seeing just-in-time (JIT) production as a form of inventory-shifting, such suppliers seek to reduce cycle times in an effort to drive stocks, work-in-progress, and thus costs out of the *entire* supply chain. These companies become the real experts in production, using this position to reduce costs from or add value to the product by focusing on process or design improvements in ways not possible before, when they simply built to specifications provided by OEM engineering departments so unconcerned with inter-firm collaboration that they did not even tell suppliers the end use of components. As they specialize, they may even "fire" important customers whose needs no longer fit with the capabilities of the supplier.

The rationale behind this intensive focus on a single business was clarified by a wire harness manufacturer who had previously also done welding, but had eliminated that aspect of the business and shifted the composition of its end-user industries (and hence customers) by investing in capital equipment to focus exclusively on harnesses. This firm had recently acquired a contract from a major OEM known for keeping work inside because "[the OEM] realized their internal costing was [bad]. They don't use automated equipment, we use automated equipment" and can thus make the parts more cheaply. The OEMs do not necessarily have more advanced capital goods and better productivity; suppliers can specialize.

There is a risk, however, to a pure logic of specialization for supplier firms unless they are able to acquire new customers, especially given the current focus on cost-containment. With a static customer base, suppliers will eventually experience declining profits even if they maintain margins as efforts to reduce product cost simply translate into declining turnover. A pure specialization strategy is sustainable only if the suppliers' customers continuously grow or if they are still in supply chain trimming mode, so that the best specialists acquire competitors' market shares.

In response to this risk, some suppliers also utilize a logic of diversification, which takes two main forms. "Vertical diversification" seeks to capitalize on the OEMs' desire to reduce the size of the supplier base, while "horizontal diversification" derives from an effort to spread risk across a wider range of customers and industries.

*Vertical diversification.* Following a logic of vertical diversification, firms bring additional process and/or design capability under a single roof, with the goal of becoming a "one-stop-shop" for OEM customers. They believe that as OEMs lurch towards the purchase of full modules and subsystem, suppliers with sufficient capacity to provide multiple services will be advantaged, as customers will not want to manage relationships with multiple specialists. In cost-competitive markets with thin margins, these firms also hope that they will be able to capture a larger portion of the value chain by encompassing multiple processes, and believe that having many operations in-house complements the OEMs' need for ever shorter lead times.

Past efforts to avoid being constantly buffeted by the cyclical fluctuations of capacity subcontracting sometimes led small firms to venture into areas where they were less capable, including at times unprofitable proprietary products taken on to get "control of their destinies". These firms simply tried to get business—any business,

from any value chain, no matter how profitable—in the door to amortize overheads. Now, in specializing firms focused on a coherent set of core activities, revenue enhancement depends on capturing more of the *same* value chain, either by improving quality to move upmarket and adding design capabilities, or by adding complementary upstream and/or downstream operations, without encroaching too much on the core competencies of either their customers or suppliers.

Among suppliers interviewed, elements of this verticalization strategy were common, from a product specialist buying a small gearbox manufacturer so that they could provide a more complete system, to a process specialist who had gotten into proprietary products in the early 1990s to supplement irregular orders from OEMs but was now getting out of this business. Describing the Wisconsin consortium as indicative of a fundamental change, the interviewee claimed that although his customers are better, perhaps, at designing and marketing products, his firm is good at production. Upon this realization, his firm sold the proprietary product line, restructured to build exclusively for OEMs, and is now looking for ways to increase value-added by performing adjacent operations. They have a contract to make parts and then do final assembly work for some large items designed and marketed by an OEM, and will quote jobs in multiple ways (when customers give them sufficient information about a part's eventual use), with and without supplementary steps to see if they are competitive on these additional steps.

There was also ample evidence among suppliers interviewed that some use their role as specialists producing particular components to provide increased design and services. One small supplier that has steadily become increasingly engineering driven (from two engineers to six in just 5 years) comments that “the OEMs don't have the [design] horsepower anymore, they don't want to mess with it. They recognize that we are the experts at handling [our specialized operation]... They ask us to help with design and we do that”, adding that:

in my short time (12 years) with this company, I have watched it go from OEMs going “no, no, no, don't touch our drawings” to OEMs saying “hey what's the matter with my drawings” or “give me suggestions.” They have gotten to that point, now all they have to work on is making the changes.

For suppliers doing more intensive or specialized design, customers often do not come to them with blueprints ready, because, one commented, much of the information required to complete those prints resides with suppliers' engineers.<sup>15</sup>

Followed to its endpoint—though there is no reason suppliers cannot stop somewhere on this continuum—the logic of vertical diversification leads to a convergence of both product and process specialization strategies. The supplier becomes a full

15 The importance of design and service to the niche being carved out by some of these suppliers is, on one level, obvious. If a supplier can make a customer dependent for design work, or convince them to use proprietary materials or processes, the customer is temporarily “locked in”. Likewise, through engineering and service, suppliers are able to improve margins or add more value. Nevertheless, suppliers interviewed explicitly recognized that the ability to be a “partner”—including offering service and design—is often what it takes to get to the table in the current economy, and that the balance of power still sits with their larger customers. This point was well put by one supplier who explained that while it was useful to get customers to use their patented materials, they could not really turn this significantly to their advantage in price negotiations because “a supplier who is trying to put forward his 2 to 3% [increase] every year is in big trouble. You will get shopped around. If you are not holding prices, you are a bad supplier” and you will be replaced. It is just a matter of time before the customer finds a way out.

first-tier systems supplier, co-designing the product with the OEM, building those portions that fit its own core competencies, and sourcing the rest to other process specialists (upon whom they perhaps also depend for some design help).

There are, however, two fundamental risks to a strategy of vertical diversification. First, it is not easy to manage, and potential diseconomies of scope abound. Despite efforts to maintain coherence in the competencies acquired, diversifying suppliers may have difficulty managing multiple processes or products without adding costly overheads, leaving their market share vulnerable to leaner process specialists. Second, as suppliers are tooling up to become module-makers, and positioning themselves to acquire “first-mover” quasi-rents, some will inevitably run ahead of the market, face OEMs slow to devolve full responsibility (and hence, share of value-added) to the supply base, and find themselves burdened with capacities they cannot sell. Many large first-tier auto suppliers, which have integrated rapidly through mergers and acquisitions, such as Federal Mogul, Dana, Tenneco, and TRW, are painfully discovering the disadvantages of having become “wannabe module-makers” without obtaining enough module business to cover the costs involved.<sup>16</sup>

*Horizontal diversification.* A horizontal diversification strategy resembles in certain respects that of the “capacity subcontractor” in that the supplier takes existing process capabilities and seeks to diversify the customer base, ideally expanding across multiple sectors. This strategy may complement aspects of vertical diversification (especially in terms of adding new process capabilities), but differs in its underlying logic by focusing primarily on spreading risk across supply chains, rather than enhancing value-added within them.<sup>17</sup> Among interviewed firms, this strategy is well exemplified by a metal fabricator producing parts and subassemblies for OEMs in agriculture and construction markets that also does contract manufacturing for the computer industry, making the metal parts for servers and doing other subassemblies, or by a tube-bender that uses its capabilities to make both motorcycle frames and mufflers for off-road vehicles.

The advantages of risk diversification are obvious, and horizontalization is particularly desirable for suppliers operating in highly seasonal markets, which would otherwise be left with excess capacity in off-peak seasons. Horizontalizing firms may also benefit from industrial “cross-fertilization”, acquiring ideas from one sector and creatively applying them to others. But this strategy has its own problems. The loss of focus inherent in horizontal diversification can become problematic in the context of constant demands for creative cost-reduction suggestions. Furthermore, firms diversifying vertically into new processes also often build up fixed capital debt, creating a structural tendency towards horizontalization and an incentive to “buy business” by cutting margins to keep the machines busy, even though the firm may never become sufficiently expert in the new field to make the “investment” pay off.

<sup>16</sup> This point was made to us by Gary Herrigel of the University of Chicago in an internal memo for the Advanced Manufacturing Project (AMP).

<sup>17</sup> It also differs from a verticalization logic in that the supplier will utilize its varied capacities separately, rather than integrating them into a single product, thereby underscoring the point that we are dealing with a continuum of strategies.

*OEMs and internal barriers to supplier upgrading*

If we look only at the positive strategic possibilities opening up for capable suppliers by shifting OEM strategies, it might seem as though worries about suppliers' ability to handle their new responsibilities are misplaced. Such qualms are well-founded, however, not only because of a historic legacy of arm's length capacity subcontracting, but also because restructuring to improve quality and delivery while reducing costs does not come cheap. Suppliers are also understandably reluctant to take the long view without credible assurances that this will be rewarded by their customers. Many OEMs still hew to traditional procurement practices, seeking to leverage suppliers against one another and to drive down margins to unsustainable levels for short-term gains, just as there remain many suppliers quite willing to play the same game in reverse. Even the OEMs of the WMDC—despite espousing a real commitment to supplier partnership—often fail to live up to their end of the bargain. A substantial portion of suppliers' initial weakness and continued inability to develop advanced manufacturing capabilities can be traced back to the constraints imposed by OEMs' own behavior.

OEM practices that negatively affect supplier performance include deviations from apparently well-designed official procurement strategies and short-term exploitation of vulnerabilities opened up by the new relationships. Such practices arise in part from the same internal organizational obstacles that cause deviations from official policies, but also reflect ongoing internal debates within OEMs about the "optimal" level of collaboration with suppliers.<sup>18</sup>

*Cost reduction vs. price reduction.* It is now standard practice for OEMs, especially in the auto industry, to expect their suppliers to provide annual cost reductions, using "target costing" techniques selectively borrowed from Japan. Target costing has two main dimensions: reducing the initial cost of newly designed products; and ensuring that parts costs are further reduced while in ongoing production.

In new product development, as the practice is described by Nishiguchi (1994: 126), OEMs use a "market-price-minus" principle, rather than cost-plus. They work together with a selected set of suppliers who are expected to help to evaluate design possibilities, "keeping in view what the consumer needs and desires", but "the combined costs of the parts are reduced step by step, toward the target cost while keeping constant the required specifications".

For ongoing production, suppliers are expected to reduce their costs to meet target productivity improvements. As developed in the Japanese auto industry, Smitka (1991: 142) explains, the targets took into account the customer's own experience of productivity improvement, and were

chosen to be achievable, but were kept uniform across suppliers rather than being set higher for firms with a good track record or lower for firms with a poor one. Fixed targets (and hungry rivals) thus provided an incentive for firms to engage in internal process improvements.

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<sup>18</sup> For a fuller analysis of such internal debates within OEMs, which presents closer collaboration with suppliers as a strategic option but not necessarily the dominant one, see Gary Herrigel's paper in this issue.



The cost breakdowns used in the bidding process were also used to focus engineering efforts on areas “most amenable to improvement on the basis of interfirm experience. The reduction was thus intended to be fair across suppliers, and achievable in fact—even if it took the aid of the auto firm itself”.

In theory, these techniques should not cut into supplier margins (“price reductions”) and need not translate into wage reductions, or even into immediate changes in the organization of production, given the numerous and imaginative ways in which suppliers and OEMs can collaborate to reduce the effective cost of the product.<sup>19</sup> Their justification is quite straightforward: the responsibilities devolved to suppliers leave them more intimately familiar with the details of the components and their day-to-day production, and thus better positioned than the OEMs to come up with incremental innovations that can improve quality and/or reduce costs. OEMs may even require suppliers to meet a cost-reduction *suggestion* target. The suggestions must be potentially “implementable”, but the OEM may ultimately decide not to explore them. Importantly, this is envisioned as a *collaborative* practice, potentially involving concomitant changes at various places in the supply chain and thus requiring considerable information transfer and joint exploration of production cost drivers.

Unfortunately, despite attempts at partnering from some sections of OEM purchasing departments, oligopsonistic price bargaining is still prevalent in many customer-supplier relationships. Suppliers interviewed by the authors described numerous ways that OEMs use hardball negotiation tactics to achieve “brutal” price reductions. The US automobile industry is notorious for mandatory “hard” annual cost reductions (the “five percent letter”), at times without negotiation, and for a willingness to move production to low-wage countries; suppliers to non-automotive industries often complain of the bleeding over of techniques from the automotive industry, techniques they believe to be insufficiently attuned to the exigencies of wide product mixes and relatively low production volumes.<sup>20</sup>

Price pressures do not always come in such a hard-nosed form, but may follow instead from what is perceived by suppliers to be either bad-faith or incompetent collaboration in cost-reduction negotiations. Many interviewed suppliers emphasize that cost reductions achieved rarely match price reductions demanded. By claiming that they have discovered ways to eliminate costs in the production process, OEMs convince suppliers to deliver price cuts before the savings are secured. Suppliers are skeptical of such cost-reduction claims but nonetheless feel compelled to deliver price cuts in order to maintain business from their customer. If the projected cost

19 In the above-cited internal AMP memo, based on 30+ interviews with OEMs and suppliers in Illinois and Wisconsin, Gary Herrigel writes: “Reductions can also be achieved, e.g., through the cooperation of customer and supplier to gain leverage on raw materials purchases OR by redesigning the interface between supplied part and its environment OR by changing the details of delivery conditions OR by giving the supplier business in a new area in exchange for a price reduction in an older area. The possibilities here are very nearly limitless.” We emphasize that the diffusion of such systems of collaborative cost reduction reflects a recognition that these are industries in which the decentralization of production means that incremental innovations across subsystems will often require substantial inter-firm coordination.

20 Dan Luria, vice president of the Performance Benchmarking Service of the Michigan Manufacturing Technology Center, reports that among suppliers benchmarked by their service, those working for the auto industry are now reporting lower value-added than those not working for auto. This is a recent change, and may reflect the increasingly harsh cost pressures imposed on these suppliers (presentation at AMP meeting, November 2001).

reductions then do not pan out as the part goes into production, they are ultimately financed from the suppliers' margins.

An example from an interviewed supplier illustrates this process. The customer informed this firm that the product would be redesigned to engineer out cost, and requested a 6.5 percent cost reduction in anticipation of the projected savings. The customer told the supplier that failure to meet target price would lead the part to be bid to competitors. The customer did not include the supplier in the redesign process, and did not provide blueprints before the price reduction request. The supplier was upset, and told the buyer on the engineering team that he was uncomfortable agreeing to produce a part he had never seen, since he was unsure that he could produce it in such a way as to achieve the projected savings. The buyer claimed that no other supplier had objected to this procedure, but accepted an alternative agreement whereby the supplier agreed to meet the target subject to review of the plans. The supplier met the requested price on the first product redesign, but when the final design arrived, it failed to deliver a part with the requisite cost savings. The supplier reported that the buyer told him that engineering was still "throwing prints over the wall to them", meaning that purchasing was being left in the dark as to the final product design. The different functions within the customer firm were not communicating in a way that would allow the supplier to provide information about how they could produce the part nor did it allow purchasing to mediate effectively between engineering needs and supplier capabilities.<sup>21</sup>

*Shifting risk and cost to suppliers.* One of the key features of the emergent manufacturing model is outsourcing, not only of production functions and parts but also of costs that had previously been assumed by the OEM. Of course, asking suppliers to provide new services is not problematic, but OEMs will also at times push costs onto suppliers in disingenuous ways, and then refuse in bargaining to recognize them. The reasons behind such disingenuous cost-shifting are complex, and do not necessarily require that the buyers themselves be acting in bad faith—they may simply be operating under constraints imposed on them by systemic irrationalities in their own organizations. In many cases, the costs could be eliminated or at least reduced through closer collaboration and better communication inside OEMs and between the OEMs and their suppliers; in the meantime, they land in full on supplier balance sheets.

Some supplier complaints regarding perceived cost-shifting really belong in the previous category, as examples of OEM efforts to wrangle effective price reductions. However, there are important examples, such as the interrelated issues of inventory-shifting and market forecasting, in which particular (short-term oriented) OEM practices turn a potentially positive-sum game into a zero or negative-sum affair that dumps risk and/or unremunerated costs on suppliers.

A central principle of the new production paradigm is that the OEMs—one-time holders of large stocks of inventory with ensuing high carrying costs, risk of obsolescence, and slow discovery of defects—now expect their suppliers to deliver

<sup>21</sup> Below, we will discuss the sorts of internal organizational obstacles that worsen these "darker" problems. This particular case is in part a result of one of the most famously endemic of OEM organizational obstacles: poor communication between the purchasing and engineering departments.

exactly the right amount of goods on very short notice. Their efforts to reduce their own inventories, they emphasize, should not simply result in pushing carrying costs down a level, but should push stocks and work-in-progress *out* of the system as “lean” and specialized suppliers reduce cycle times and lot sizes. To help the suppliers plan the use of their facilities, buy raw materials, and so on, the OEMs also provide them with order forecasts, which generally become “hard” orders at some fixed time prior to delivery, after which the OEM is required to purchase supplier production (though not necessarily on the date forecast).

This is in principle a positive-sum game, as it is in nobody’s interest to keep excess inventory in the system, nor is it in the interests of the OEM to have the suppliers caught with insufficient capacity when orders do materialize. But too often, the game goes awry.

First, the systems by which the OEMs transfer information between functional departments and then down to suppliers are relatively new, and have numerous kinks that cause suppliers to receive inaccurate information, forcing them to hold buffer inventory (since late delivery still reflects badly on the supplier). For instance, several suppliers blamed the new computer system at one of the OEMs for this problem. OEMs also may inflexibly presuppose shorter cycle times for some suppliers than are feasible in the short and medium term. Constraints inhibiting suppliers from reducing cycle times sufficiently can include the need for operations at second-tier suppliers, difficulties in obtaining specialized raw material, and the like.

Second, as many of the OEMs move towards “build-to-demand” strategies in which their production schedules are continuously revised—often at quite short notice as new market information comes in—their own predicted order volumes may become quite unreliable.<sup>22</sup> In and of itself, this is simply objective uncertainty, a systemic cost to be bargained over; the optimal solution is for the OEM to provide suppliers with the best information available. However, there is a short-term incentive for the OEM to shift risk onto suppliers by “erring on the high side” (“being optimistic”) in their forecasts, because customers are fearful that suppliers will have insufficient capacity to meet upswings, particularly for highly seasonal products where sales can be won and lost quickly by meeting the whims of the market more quickly than competitors. Suppliers see the prediction of orders in the future, do not realize that these are hoped-for “phantom” orders, and either build inventory or maintain sufficient unused capacity. After consecutive years of significant OEM underperformance relative to forecasts, one supplier angrily stated the problem succinctly—directly to his customer (at a supplier conference also attended by one of the authors): “your reservation of our capacity bankrupts us”. Another supplier to the same OEM complained that he had lost money in what should have been boom years because he had overhired in anticipation of an upswing that never came.

22 “Build-to-forecast” (BTF) and “build-to-demand” (BTD) strategies should be arrayed on a continuum. A pure BTF strategy would fix the number of units that would come off the line with some agreed upon advance notice, while a pure BTD strategy would produce only the units that had actually been sold. A modification of BTD that moves slightly towards a BTF would be to build to a relatively small buffer inventory that would then cushion market swings to some degree; the inventory would then be replenished regularly, which would allow for relatively accurate forecasts over short periods. A pure BTF with long advance forecasting makes planning production easy, but virtually guarantees an output that poorly predicts market demand, while a pure BTD risks an inability to react to market swings if production cycle times or capacity cannot be adjusted as quickly as demand fluctuates.

*Abusing trust.* In discussing the “non-standard firm”, Helper *et al.* (2000: 443) persuasively argue that collaboration is most effective when customers and suppliers are fully open with all process and costing data in order to “continuously improve their joint processes without the need for a clear division of property rights”—and imply this to be something of which the techniques of learning by monitoring will make them cognizant. But, in the experience of many suppliers, it is not accurate to say that they believe their customers will never raise a dispute over “property rights”, nor that they do not become vulnerable if they fully open their operations and books to customer scrutiny.

In general, suppliers interviewed believe that the ability to collaborate with customers over cost reduction is a competitive asset, and are eager to explore “mutually beneficial” cost reductions. The OEMs, for their part, know that they have leverage, but also realize that effective performance improvements are often best served by reining in their market power, using it only to ensure that suppliers stay “on their toes”.

Perhaps unsurprisingly, given the short-term incentives, OEMs frequently take unfair advantage of suppliers’ agreement to share private information. Examples often revolve around the sharing of supplier cost information or of supplier-provided cost-reduction ideas—necessary to meet targets set by the OEM—to the supplier’s competitors. One supplier reported, for example, that they had submitted a detailed proposal for cutting out a step in the production of a particular component at the request of the customer, who then passed on the suggestion to another firm which subsequently outbid them for that part. Another told of receiving a nine-page document of cost-reduction ideas prepared by a competitor on projects bid on by both suppliers. This did not engender trust, of course; the recipient had also prepared a similar document and given it to the customer, and now assumes that their competitors have all those ideas.

Short-term oriented misuse of information is most damaging to efforts to build a new production paradigm, but there are also other abuses of trust of a “standard” character that should not be ignored. For instance, one interviewee reported that a customer OEM had encouraged his firm to invest in additional production facilities to handle growing orders for a particular process, only to see new managers pull the most profitable jobs back in-house, leaving the supplier with only the “nuisance work”. The customer was again proposing to outsource work that would require expanded facilities, but the supplier bitterly observed that he would insist on a written agreement this time. Another was convinced by a buyer to buy raw steel wholesale rather than from distributors, and to pass on the cost savings—but when the market fell off, leaving the supplier with high inventory carrying costs, the lower price was already locked in—so the supplier ended up with a lower sale price *and* higher costs.<sup>23</sup>

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23 By the time the market fell off, the buyer who had cut the deal had moved on to another position in the OEM, so the supplier believed that future “good faith” for their action would not be forthcoming.

*Organizational obstacles to collaboration: staff turnover, communication barriers, and corporate-plant disjunction.* Aspects of the opportunistic practices reported by suppliers may be partially a result of deliberate corporate efforts to exploit the supply base, but internal organizational obstacles are probably more important. Problems of staff turnover, poor inter-departmental communication, and corporate-plant disjunction impede the development of collaborative relationships both because of issues of incentive compatibility—the local incentives of buyers and/or engineering are not always those of the organization—and because they frequently lead to miscommunications with negative repercussions.

Since process and performance improvement rely so heavily on open communication and information flow, it is not surprising that the suppliers interviewed found their inability to develop stable relationships with their customers frustrating. In addition to classic cross-functional conflicts like that between purchasing and engineering, suppliers consistently complain that the large size, cumbersome organization, and high staff turnover of OEMs hinder the emergence of closer partnerships and more effective communication with their customers.

Suppliers complain that in large OEMs, there are inevitably problems of communication, because of the high staff turnover as people move to different areas in the company. One asked “How do you learn who you are supposed to talk to?” The average length of tenure at his firm was in the high teens, which gave them the ability to foster continuing relationships, though only if the customer could provide similar stability. Another supplier characterized communicating with his large customers as a virtual nightmare because of the constant turnover of buyers in the OEM. This was compounded by the fact that they dealt with both corporate and plant-level buyers, up to four for each company. These change so often that it is hard to build relationships with them. The new buyers often have very little knowledge about their product and make extraordinary demands, expecting suppliers making engineered-to-order goods to behave like commodity producers.

Another major supplier complaint concerns inconsistent messages both from corporate and plant-level purchasing and between different plants of the same corporation. Here, the problems are myriad and cross-cutting. They include, for example, plant-level purchasing agents whose personal incentives are based upon cost reductions *now*, who are thus tempted to defect on commitments made at the corporate level. But suppliers will also complain that as relationship management gets “kicked upstairs”, the years of collaboration with plant-level people go by the wayside, and they are required to re-demonstrate their competency to people they view as “bean-counters” who do not recognize the importance of things such as a supplier’s willingness to come immediately to the OEM facility if their parts cause problems. Suppliers also complain that different plants of the same OEM will interpret a supposedly common strategy differently, and then object to being treated differently in turn by the supplier.

Across OEM departments, there are also disagreements that can lead to inconsistent application of company strategy. For example, although many OEMs claim to want to devolve greater engineering and subassembly design and manufacturing to suppliers—leading many suppliers to gear their operations to be able to do more—their movement in this direction has been sporadic. The vice president of manufacturing

at a relatively large supplier with module-making capabilities said that the engineering departments of his customers remained somewhat reluctant to trust the competence of supplier engineering (though he felt that in time that would change; he had previously worked for an automotive supplier, and said that even there the reality had lagged the rhetoric by about 5 years). His biggest complaint related to a similar problem: customers say that they want to cull the supplier base by purchasing subassemblies and modules from existing suppliers; but when his firm pressed for such larger jobs to quote, nothing was forthcoming, and they were not given the opportunity to “walk the line” at the OEM to learn of and to suggest ways to create subassemblies from the components they currently build. The supplier was left with expensive capabilities (large engineering staff and assembly) that matched customers’ purchasing strategies, but not what the buyers allowed him to quote.

*What goes around comes around: the impact of OEM opportunism and incompetence on supplier practices*

The OEMs’ inconsistent application of their own supplier management strategies push their suppliers to react in turn with systemically suboptimal local strategies. For each of the problematic OEM practices cited above—oligopsonistic price pressures, inventory-shifting, misleading forecasting, abuse of trust, organizational dysfunction, and a slower than expected devolution of responsibilities—we find examples of suppliers forced to react in ways they know to be problematic.

*Non-negotiable cost-reduction targets.* When the OEMs’ legitimate (and effective) efforts to push suppliers to ferret out cost reductions evolve instead into the inflexible application of a “hard” and non-negotiable target, two systemic irrationalities emerge: gaming and disinvestment.

It is not feasible to remove 5 percent a year from a product where raw materials represent the major component of costs. Because credit for past success is not fully given, and because they are expected to meet annual targets, suppliers may feel compelled to play the cost-reduction programs like a “game” in which they temporarily withhold ideas to make sure they correctly fall into fiscal years (that is, they are careful not to give 7 percent one year, lest they fail to meet 5 percent the next). This is exacerbated by buyer turnover so that, as one said, “we might have made some guy a hero, and next year, you have someone who [could not care less] about what you did for that guy”.

When suppliers meet cost-reduction targets out of their own margins, there is simply less money left over for new investment; and without such investment, they are unlikely to come up with the sorts of productivity improvements that can make annual cost reductions sustainable. For the OEMs, causing such disinvestment—“eating the seed corn”—makes sense only if they believe that the supplier can be replaced with minimal cost because of generalized overcapacity in the industry and minimal asset-specific investment.

*Inventory-shifting.* Many suppliers see the OEMs’ shift to JIT production as providing them with a competitive advantage vis-à-vis foreign competition. They are right, so

long as they are in fact able to remove inventory from the entire production system by reducing cycle times, and do not simply become a warehouse for OEM parts (what is often called “just-in-case” production). If they take the latter approach—which, as noted above, is sometimes made necessary because of OEM practices—nobody gains.

*Misleading forecasting.* The obvious response—common among suppliers interviewed—is to simply discount OEM forecasts (i.e. if they are 25 percent high on average, simply remove that amount). The systemic risk, however, is that suppliers may discount the OEMs’ forecasts at varying rates, which is extremely problematic. The entire supply chain depends on sales by the OEM; given JIT production, if a single key supplier is significantly late on deliveries because of insufficient capacity in an upswing, the OEM and its entire supply base loses business too—not just the errant-forecasting supplier.

*Abusing trust.* Suppliers who fear that their customers will use process information to ratchet down supplier margins are careful to “muddy the waters” as they pass such information to customers, and will at times even refuse OEM offers of help because they fear the impact on price negotiations. For example, one interviewee had refused to participate in a process mapping exercise because they feared the customer would share proprietary information with competitors bidding for the same business. Another explained that he had developed the ability to use a cheaper material on some of his product, but shared the idea only with a customer with which he had a sole-source relationship, and was careful not to mention it to another that maintains multiple sources for all product families. Were this supplier to share it, the idea would immediately be passed to his competitor and would provide him no advantage whatsoever.

*Organizational dysfunction and the slow devolution of responsibilities to suppliers.* Poor information sharing across OEM departments and between OEMs and suppliers makes it difficult for suppliers to understand how to get their ideas heard by their customers, and requires them to waste time and resources simply managing the relationship. A particularly important supplier to one of the WMDC OEMs likened the relationship with their key customer to that of the child of dysfunctional parents, required to pass information from the one to the other to keep the family together (meaning, in this case, forcing OEM purchasing, marketing, and engineering to agree on a design that could be built at a reasonable cost). Suppliers who are unable to get their ideas acted upon will cease to provide those ideas. The slowness of OEMs to reward suppliers who are adding the capability to deliver the services ostensibly asked for means that these shops may be undermined by lower-overhead suppliers, and may not be around when the OEMs finally bring reality closer to rhetoric.

### ASSESSING THE TRANSITION TO THE NEW PRODUCTION PARADIGM

Our study of mid-volume machinery manufacturers and their suppliers provides good evidence of a *partial* transition to a more collaborative inter-firm organization of production. But our findings also demonstrate that this process does not seem to be

as “self-actualizing” as Helper *et al.* suggest. These authors argue that so long as markets are sufficiently competitive, experimentation with functionally superior Japanese-style customer-supplier relations will lead firms to build on and expand their initial successes with the “cooperative exploration of ambiguity”, thereby resulting in the diffusion of a more collaborative new production paradigm (Helper *et al.* 2000: 445). Our interviews challenge this claim, showing that even firms seeking to cooperate in good faith too often find their efforts subverted by a complex interaction between pre-existing weaknesses in the supplier base and intra-organizational conflicts within the OEMs. These problems should not be viewed as random organizational dysfunctions obstructing the path to an otherwise attractive and attainable model, but rather as systemic relational blockages that cannot easily be overcome without assistance from actors and institutions external to the firms themselves. Hence it is not surprising that public authorities at various territorial levels are experimenting with institutional solutions intended to ease the transition to a more decentralized production regime.

In the next section, we discuss a range of institutional solutions to the dual problems of supplier upgrading and barriers to inter-firm collaboration. Existing efforts focus primarily on improving supplier performance *per se*, which is only a first step—a necessary but not sufficient condition—for successful collaboration. Thus, in our discussion of state efforts to improve the supply base, we will focus particularly on the Wisconsin Manufacturers’ Development Consortium, because its emphasis on incorporating multiple voices is suggestive of the sorts of public-private institution building that could enhance not just supplier performance, but also proactively encourage greater collaboration between OEMs and their suppliers.

### THE RANGE OF INSTITUTIONAL STRATEGIES: PUBLIC, PRIVATE, AND CONSORTIAL

The increased prevalence of small and medium-sized manufacturing firms, coupled with OEMs’ pressing need to maximize the effectiveness of a vertically disintegrated structure, provides a strong rationale for public policy to play a facilitative role in providing affordable managerial, technical, and training resources to assist in the upgrading of component manufacturers. The performance of this critical swing sector is essential not only to the protection of the manufacturing and employment base, but also to the improvement of the skills, wages, and career prospects of a significant portion of the workforce.<sup>24</sup>

There are examples of private “market” or firm-led solutions, which would include not only OEM supplier development programs, in which the customer provides assistance to its own suppliers, but also the many multi-plant supplier groups which employ their own continuous improvement specialists and other such resources to support their satellite plants. Even in these cases, however, there remains a potential role for public policy in the delivery and subsidization of supplier modernization

<sup>24</sup> Manufacturing is an essential part of the Wisconsin economy, providing about one-quarter of the state’s gross product (second only to Indiana). Wages in manufacturing also tend to be better than those in the service sector, though not as good in small manufacturing firms as they are in large firms.



services. OEMs can leverage public manufacturing “modernization” resources to make their internal supplier development programs more effective. Satellite plants of larger groups may benefit from outside expertise (or from OEM supplier development assistance), and many firms interviewed by the authors are effectively coupling the public infrastructure with resources internal to the firm.

Beyond the simple provision of an educational infrastructure, such as the technical or community college system, there are a variety of modes through which state government resources are used to upgrade the base of small and medium-sized suppliers. In Illinois, for example, the Industrial Training Program disburses approximately \$12 million directly for training to manufacturing firms. Some 15 percent of this money goes to a competitive grant program in which individual firms apply for money, while the remainder goes to “multi-company” programs that supply training to many different manufacturing firms at 50 percent subsidized rates. The multi-company training programs can be administered either “horizontally”—grants are given to associations that subsidize training for their members, often at local community colleges or from private training providers—or “vertically”—single OEMs use state money to administer training programs for their suppliers. The Wisconsin consortium that is the focus of this section crosses these two principles, using an association of OEMs to administer a supplier training program in conjunction with existing state manufacturing modernization resources.<sup>25</sup>

### *The Wisconsin Manufacturers’ Development Consortium*

The Original Equipment Manufacturers making up the Wisconsin Manufacturing Extension Partnership Supplier Training Consortium provide a collaborative mechanism to facilitate the building of a well integrated and results oriented supplier training framework in order to gain competitive advantage for small and medium sized Wisconsin manufacturers. The Consortium provides guidance to WMEP in curriculum selection and development, as well as overall program administration. (STC, *Mission Vision*, 8 May 1999)

*Program structure and history.* Originally known as the Wisconsin Supplier Training Consortium, the WMDC began as a joint effort between WMEP and John Deere. A Deere supplier development manager on the WMEP board of directors saw the growing importance of suppliers to the company’s own manufacturing activities, as well as the growing impact of OEM-supplier relations on Wisconsin’s economy, and joined with the executive director of WMEP to recruit representatives from the other five OEMs that now form the consortium. The consortium partners also drew support from the state technical college system, with which WMEP already had a close relationship. It was inaugurated in summer 1998, aided by a \$500,000 allocation from the state budget that subsidized the classes so that small and medium-sized enterprise (SME) participants could get high-quality training at a 50 percent discount.

In the first year, the consortium drew on Deere’s existing supplier training infrastructure for administrative services and a large portion of the training. In July 1999, WMEP took over full management of the consortium, raising some fears among

<sup>25</sup> Space constraints preclude a full comparison in this paper of all the advantages and disadvantages of the various policy alternatives. Our focus on the Wisconsin consortium does not imply that this is the only potentially attractive model.

suppliers about continuity and causing concern at Deere corporate headquarters as well, given the potential loss of control of a program viewed as having effectively improved the performance of many company suppliers. However, the shift in administrative governance went smoothly, and brought a number of positive opportunities for all involved. The other OEM partners acquired a greater ability to shape the training curriculum but were also obligated to give real input. The WMEP's greater role puts the agency in a position to act as an "honest broker" to ensure that the costs and benefits are shared out fairly among the participants, and discourages opportunism by firms who often compete for the same customers and suppliers.<sup>26</sup>

The consortium provides suppliers with a problem-centered training program, primarily focused on the concrete goal of improving performance in lead and cycle time reduction, delivery, product quality, and cost. It also aims to improve supplier viability more generally by enhancing supplier-OEM business relationships, increasing understanding of OEM performance expectations, and perhaps helping suppliers to gain additional customers. Training is limited to firms nominated by at least one of the governing OEMs. To be eligible, suppliers must be located in Wisconsin and employ fewer than 500 people (that is, be considered SMEs as defined by the National Institute of Standards and Technology). Furthermore, the OEMs are required to select firms they consider "strategic", and with which they have at least a 24-month relationship that they intend to continue.

The consortium claimed in its original mission statement that it would establish a "curriculum of emphasis" based on a consolidation of the OEMs' performance expectations, and would help suppliers to assess training needs. In practice, this has proved an uneven process. Needs assessment and guidance have been somewhat sporadic, though important in some cases and an essential part of WMEP's strategic vision for the program. The course offerings were originally selected by the OEMs to reflect their own supply chain management strategies, beginning with a list provided by the Wisconsin Technical College system and the Deere training department. A subset of these were then agreed upon by the consortium as a whole.<sup>27</sup> WMEP has

26 This "honest broker" role of public agencies has elsewhere been found to facilitate the success of collaborative partnerships among competitors in related areas of common interest such as joint research and development (Tripsas *et al.* 1995).

27 WMEP schedules the courses in numerous areas around the state and contracts with instructors to teach the courses, using personnel from the technical colleges, the Deere training department, and other independent instructors. Courses are often cancelled when enrollment is too low, but suppliers are not limited to the scheduled times and can arrange instead with the WMEP to hold a (nominated) course on-site. To increase program uptake, on-site courses are offered for a flat rate, permitting the supplier to bring as many people as desired (and allowing them to divide costs with other nominated firms by sharing classes). Perhaps unsurprisingly, on-site courses have proved the more popular option. In the 1999 fiscal year (July 1999-June 2000), 36 classes were held "as scheduled", while 106 took place on-site. Overall, 50 different companies sent 1,586 students (1,135 "unique" students) to 2,244 eight-hour training days, worth over \$250,000 at market rates, though suppliers are charged only about half the market rate. The remainder was subsidized by a grant from the state budget, which stipulated that no supplier receive more than \$20,000 in subsidies, while the sum total of suppliers nominated by a given OEM was not to exceed \$100,000. This latter constraint was somewhat loose, because many of the suppliers work for multiple consortium OEMs, allowing their nomination to be shifted around when the cap became a problem. At the close of the first grant, the state began administering the money directly to WMEP, which then in turn provides the training subsidy directly from its own budget, benefiting as well from NIST's 33 percent "match" for every dollar spent by the manufacturing extension programs. They have dropped the spending caps, but retain the requirement that subsidies go only to SME suppliers (WMEP, like all NIST manufacturing extensions, is required to serve the SME population).

since culled undersubscribed courses, while adding others upon OEM request. Whether or not this process has resulted in a course selection that can truly be considered an integrated “curriculum” rather than a menu of related classes from which suppliers can select à la carte remains an open question, though the latter seems still to be a more accurate description.

*The effects of the program and its interaction with OEM and supplier strategy.* Many of the supplier firms interviewed were responding to the OEM focus on defining a core competency, and are themselves seeking to “do one thing and do it well”, but as they restructure and refocus, they cannot lose sight of basic manufacturing performance. Commenting on the diversity of his end-user industries in some regards, a supplier noted that “in terms of quality, cost and timing, they are *exactly* the same... People are looking for 99.8% or so on time, 500 ppm or less defects and 5–7% cost reductions over the year.” The supplier training program provides these small firms with a toolbox, an economical source of ongoing training for both managerial staff and production workers as they structure their operations to meet the changing realities of the marketplace.

Because of the variegated nature of individual firm’s restructuring processes, it is difficult to separate out and quantify the effects of any supplier training program—in the abstract language of statistical methodology, there are too many sources of variation. But suppliers themselves do recognize how their companies have changed and can assess the impetus of those changes, providing us with considerable evidence in interviews of concrete and measurable improvements on key manufacturing metrics such as cycle time, productivity, and on-time delivery.<sup>28</sup> While direct effects at the level of the workforce are difficult to measure, the program has had some impact there as well. Some interviewees asserted that in selecting employees to be trained, they looked to those in whom they intended to make long-term investments and develop for promotion. Wages of the production workforce at many firms interviewed were also rising. Although this rise cannot be directly ascribed to the training program, public assistance to suppliers in upgrading their operations and skill base may

28 Space constraints preclude a full discussion of the concrete effects and usages of the training program. Detailed discussion of concrete results is available in reports produced by the authors and their collaborators at the Center on Wisconsin Strategy (Rickert *et al.* 2000; Whitford *et al.* 2000; Whitford 2002; Vidal *et al.* 2003). Some examples may help to provide a flavor for the sorts of changes that occur. A machine shop that was learning to create part families and implement cellular production reported that jobs that were once quoted at 6–8 weeks lead time now average just 3 weeks, and much less in some cases. In their second cell, for example, cycle time dropped from 47 days to 3, and scrap rates in cells have been more than halved. Even in the batch area, working often with very old but still efficient (and paid for) equipment, they have managed to reduce cycle time by improving set-ups. Overall reject rates are below 700 parts per million (p.p.m.), and work-in-progress has improved. Their safety has improved considerably, so much so that a workers’ compensation insurance rating of 1.8 just 6 years ago has been reduced to 0.8. Perhaps most importantly, both profits and margins have improved. Another supplier reports that after restructuring operations based on the WMEP training, inventory has been dramatically reduced—by 70 percent—while cycle time also improved, from about 7 weeks 3 years ago to 4 weeks today. The customer reject rate has spiked up and down, but is now generally between 0.25 and 0.5 percent, where 3 years ago it ranged as high as 1.5–2 percent. The improved quality, the president said, is due to a combination of factors, including training, but the focus on process has undoubtedly been a factor, remarking that “three years ago, if you had asked me what our rejects were caused by, I would have said ‘operator error’; but now, rejects are more caused by process problems”. The company has been reducing job classifications, and has doubled—to 50 percent—the percentage of the workforce that is cross-trained.

nonetheless have played a permissive role in helping small firms to mitigate the impact of exogenous wage pressures on their competitiveness through improvements in worker productivity.

One of suppliers' biggest difficulties in implementing change is quite simply that they lack sufficient resources to dedicate to process improvement; for many of these suppliers, training alone is not enough. Perhaps more important than the direct effects of specific classes is the interaction of supplier training with the factors that ensure that the flexible manufacturing concepts pushed by the supplier training consortium are in fact implemented on the shop floor. In the vision of the Wisconsin consortium, these "factors" are often actors external to the supplier, drawn from two sources: the WMEP itself, which employs a team of manufacturing specialists that sells consulting services to small and medium-sized enterprises, subsidized partially by the federal government through the National Institute of Standards and Technology (NIST); and OEM supplier development engineers, who regularly work on projects at supplier firms.

Among interviewed suppliers, many of the most successful cases of supplier restructuring facilitated by the Wisconsin consortium have resulted from the ability of OEM supplier development engineers or WMEP manufacturing specialists and supplier management to leverage the resources provided by the training program to help implement successful projects by providing supplier supervisors and lead operators with an understanding of the principles of flexible (or "lean" as it is now increasingly termed) manufacturing. The difficulty of actually *implementing* change at the supplier firm is well known to the OEMs. A lead manager in charge of supplier development at one of the OEMs comments that "the engineering part of supplier development is by far the easiest thing to handle. The change management side, on the other hand, is by far the most difficult" and is one that can be helped along by providing suppliers with an independent training source.

The issue was well summed up by the general manager at a supplier that had used extensive training as well as working with customer supplier development engineers. He said that if the WMEP courses were *not* teaching similar principles and practices to those espoused by his customer, it would have forced him to question whether the knowledge at the customer was really up to date. Having them both on the same page gave him confidence that his firm really was getting state-of-the-art manufacturing principles. It was also useful to go to courses with other suppliers who were similarly trying to revamp their operations with "lean" concepts, and were able both to share ideas and assure his company that they would work outside the classroom.

Suppliers also believe that the courses help them to understand the principles behind the projects implemented by their customers, so that they become more able to generalize these lessons to other areas of their factories. They hope that with the aid of the ongoing subsidized training they will be able to undertake new operations themselves with the possibility of offering cost reductions to the OEMs, while also keeping a larger share of the benefits than is possible in projects instigated and monitored by customers.

The WMEP consulting services—a major source of the organization's revenue—also benefit significantly from their link to the consortium. In part, as with OEM supplier development engineers, WMEP manufacturing specialists can encourage

their clients to take advantage of the subsidized training to help them carry out the contracted projects. The WMEP uses its ties to and knowledge of the purchasing strategies of the affiliated OEMs, as well as its role as the training provider, to encourage suppliers to contract with WMEP manufacturing specialists. Thirty-six percent of the suppliers who have used supplier training have also hired WMEP manufacturing specialists,<sup>29</sup> and one of the OEMs has arranged meetings between WMEP personnel and a subset of key suppliers to encourage these firms to work with them on continuous improvement projects.

At present, the WMEP and the supplier training program largely serve to complement existing OEM supplier development and supply management resources. But such a supplier training consortium could develop into a more complete externalized framework in which the OEMs increasingly depend on the consortium and the WMEP—effectively outsourcing the functions they have developed to deal with the consequences of outsourcing. This would necessitate much greater information sharing than currently exists between the WMEP and OEM purchasing departments, requiring, for example, the latter to share substantial internal data on supplier performance and to notify the former about problem areas at particular suppliers. It would also require improved progress in the formation of a “curriculum of emphasis” with its implied agreement among the consortium OEMs on the goals of purchasing strategy.

A fully externalized supplier training system is unlikely to develop, however, without significant changes in the US institutional infrastructure. For example, instruction in “customer-specific” procurement systems would be facilitated by harmonization of supplier certification procedures and coordination of processes across the OEMs. Such harmonization is surely possible—as shown by the success of the various ISO and QS 9000 quality assurance standards—but nonetheless poses some very real difficulties. Many OEMs are extremely proprietary about their particular corporate systems, and may be quite loath to cede control to external actors. Another major institutional barrier stems from the USA’s disjointed federal structure: WMEP’s territory, and thus the consortium training, stops at the state line, but all of the OEMs in the WMDC have numerous suppliers in other states (and several of them also have key production facilities in other states).<sup>30</sup>

### *Regional industrial policy and consortial models of supplier training*

The WMDC has enjoyed considerable practical success during the first 4 years of its operation, and has formed the template for a similar policy initiative in the state of Pennsylvania. To date, it has focused primarily on the first condition required for the emergence of a “new production paradigm”—improving the skills and capabilities of the existing supplier base. The WMDC in its current form by no means embodies all that a consortial model *could* do to help overcome the many “relational” barriers to

<sup>29</sup> As of 18 January 2002 (from an email from WMEP staff to one of the authors).

<sup>30</sup> Harley-Davidson has spearheaded the formulation of another training consortium (with different OEMs around its operations in York, Pennsylvania, and Deere’s corporate supplier training division is active in several states, but these efforts certainly do not yet meet the standard of cross-state coordination that a fully externalized system would require.

deeper OEM–supplier collaboration. Nonetheless, the Wisconsin experience presents a useful empirical benchmark against which to discuss the advantages, limitations, and open questions surrounding a consortial approach to industrial policy in a decentralized manufacturing economy.

A multi-firm, public–private partnership such as the Wisconsin consortium can assist its participants in developing collaborative solutions to common problems and strengthen the state’s supplier base by performing three interrelated functions:

*Facilitating information flow.* The partnership structure of the consortium allows the WMEP to aggregate the common needs of OEMs and transmit these to suppliers and training providers. If properly conducted, the curriculum development and review process of OEM representatives creates greater transparency for suppliers about current and potential customers’ quality and service needs, thereby assisting them to adjust their operations to meet the latter’s expectations. It also allows OEMs to speak with a single voice to training providers, enhancing their collective influence and ensuring a better fit between course offerings and firms’ training requirements. Supplier representatives should also be queried systematically about the adequacy and appropriateness of the training in meeting their own perceived requirements.

*Sharing out the costs and benefits of widely needed services.* Many suppliers work for several competing OEMs. A consortial organization allows OEMs to contribute technical expertise and support to upgrade their suppliers’ capabilities without incurring the high fixed costs of in-house training operations, and with less risk that the benefits will be appropriated by competitors. Public subsidies reduce the cost of training to hard-pressed SMEs, while the watchful eye of the OEM provides an incentive for supplier participation. WMEP can thus devote less of its time and resources to marketing to potential clients and focus more on the provision of core services, while also ensuring that training activities reach a minimum efficient scale (NAPM-NIST White Paper 1999).

*Promoting mutual learning.* By facilitating the flow of information among OEMs, suppliers, and training providers, while sharing out the costs and benefits of widely needed services, the WMDC is in a strong position to promote mutual learning among the participants above and beyond the specific content of the training courses themselves. But this is perhaps the area where the consortium has thus far accomplished least. Curriculum development remains largely aggregative, with OEMs suggesting additional courses to meet their individual needs rather than seeking to align performance expectations or to harmonize supplier qualification and certification procedures. Besides the addition of two supplier representatives to the consortium’s governing body, no systematic framework has been created to allow suppliers to learn from one another nor to incorporate their responses to training courses and OEM procurement practices into the work of the consortium.<sup>31</sup>

Beyond these specific areas, perhaps the single largest *potential* contribution of

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31 These supplier representatives on the WMDC have recently organized a number of networking meetings with a view to creating a regular discussion forum, which could eventually evolve into an autonomous suppliers’ association.

the WMDC towards a better-functioning decentralized manufacturing system lies in its ability to create the all-important complementarity between OEM and supplier strategies. As it was summed up by one supplier:

The idea that two of my major customers would form a consortium with other people to help train their supply base . . . I saw that as “we’re in a whole different world now.” This is no longer “we do three quotes and send it to the lowest bidder and every year we go out and rebid it. . . and if things slow up at all, we cancel everybody’s orders and we make it in our own shop.” That was the paradigm in 1990 [but it is changed today].

### LIMITATIONS AND OPEN QUESTIONS

The WMDC is by no means a panacea for all that ails the Wisconsin supply base, and it is important to recognize its limitations. We present these as “open questions” because we believe that they should be treated as such, opportunities to rethink and revise the model, rather than inherent flaws in an otherwise promising—if partial—solution.

#### *Can consortial supplier development survive the current recession?*

At the time of writing, the USA is mired in a recession that has hit the manufacturing economy extremely hard, with two likely—and opposite—effects on firm strategy as regards their interests in consortial supplier development. One possible consequence is that OEMs seeing a profit squeeze will utilize short-term positional bargaining to salvage profits now, which increases price pressures on suppliers. Likewise, in response to tough times, supplier firms may simply “hunker down” to weather the storm, investing less in people they are not sure they will be able to keep.<sup>32</sup> This threatens the consortium, which will quickly die without a commitment from both the OEM partners and their suppliers to working together to improve operations for gains down the line. But there is also an opposite pressure. A recession can lead the OEMs to look more closely at their own organizations to identify areas where they can reduce their own fixed costs, which can make reliance on external public resources more attractive, even if this requires sharing strategic control of those resources with other firms and with state agencies.

Interestingly, however, the greatest threat to the consortium’s survival comes not from a lack of business coordination but from the state fiscal crisis. Wisconsin has an enormous deficit, needing to cut \$3.2 billion from a 2-year budget. As a result, even the relatively small state outlay to WMEP—\$1.5 million—was drastically cut to just \$100,000 for fiscal 2004, though not without considerable resistance and lobbying

<sup>32</sup> This can be seen in suppliers’ changing use of the training program. The portion of subsidized training classifiable as “ongoing skill development” has dropped considerably over the past year, as firms are less willing to invest in people they are not sure they will be able to keep. But the use of “project-based” training, such as instruction in the principles of lean manufacturing, has remained relatively steady, indicating that some firms may be taking advantage of the slow period to undertake more substantial restructuring projects.

from both the governing OEMs and many participating suppliers.<sup>33</sup> Nevertheless, both WMEP and the consortium are still in operation, and the longer-term funding picture remains the subject of considerable public debate.<sup>34</sup>

*Can consortia really help to align performance expectations and supplier development practices across the OEMs?*

Access to effective training and supplier development resources is an important problem, and is well handled by the consortial model discussed here. But supplier firms' larger problem remains that their customers, even those who talk the talk of open and collaborative supplier relations, often do not always walk the walk, partly because of internal organizational barriers. In theory, the subsidies could be used as a "stick" to monitor OEM behavior, but the sums involved are extremely small relative to the sales turnover of these firms; hence the OEMs would likely simply walk away from any such enforcement. But there are ways in which a multi-firm public-private partnership can be used to help firms to resolve these characteristic dilemmas of large bureaucratic organizations in ways that they themselves perceive as beneficial and cost-effective.

For example, the consortium could encourage participating OEMs to draw up a common code of good supplier relations practice, based on member firms' own official procurement policies. The compilation of such a code could stimulate the identification and diffusion of good practice among participating OEMs, while also guiding suppliers towards common performance expectations. Implementation of this code of practice within the consortium, together with the tangible impact of training provided on supplier performance, could be assessed by independent third-party monitoring, as in the case of ISO 9000 quality assurance programs. Participating OEMs found to be in breach of the consortium's code of good supplier relations practice could be asked to submit plans for correcting the problems identified by the external monitors within a reasonable time period. In cases of persistent uncorrected breaches of the code, consortium members and the WMEP could then consider a range of possible sanctions, culminating in exclusion from the consortium. The third-party monitoring process could itself be harnessed to mutual learning through benchmarking of supplier training practices and related research on OEM-supplier relations, thereby providing a systematic mechanism for generating improvements to the consortium's curricular offerings and code of good practice. Third-party reporting on the OEMs' performance in to implementing the collaborative supplier relations

33 WMEP is still eligible to receive up to \$3 million in federal government funds through NIST in fiscal 2004 as a 33 percent match, not only for state grants but also for other revenues such as fees paid by suppliers for services. State and federal support together accounted for 25 percent of WMEP's budget in fiscal 2002. Most of these public funds were used to cover WMEP's general operating expenses rather than to subsidize the supplier training program directly. Information based on emails from a member of the WMEP board, February and September 2003; Rick Barrett, "Technical aid for state's industries is endorsed", *Milwaukee Journal Sentinel* (online edition), 5 September 2003.

34 The new Democratic governor, Jim Doyle, has proposed to spend \$10 million on efforts to help manufacturing firms boost productivity, training, and technology as part of his "Grow Wisconsin" initiative. See John Schmid and Denis Chaptman, "Doyle unveils \$40 million plan to restore state's economy", *Milwaukee Journal Sentinel* (online edition), 11 September 2003. Some of this proposed state funding is aimed at supporting supplier development, and would likely be channeled through WMEP.



policies to which they are formally committed could potentially mitigate many of the organizational dysfunctions discussed above, strengthening the position of reformers in these companies. In assessing such a “code of conduct” (or any such proposal to leverage the consortium to improve OEM practices), it is essential to recognize that it is unlikely to work unless the OEMs can be convinced that it is beneficial to seek such external reinforcement as a means to enforce adherence to their own official procurement policies across plants.<sup>35</sup>

*Is the consortial model expandable?*

Beyond the “deepening” of the existing consortium, there are also questions of “widening” and equity. Does the existence of the WMDC create a “privileged club” of suppliers? Long-term political support for publicly subsidized training limited to a small subset of the state’s supplier firms is likely to be tenuous. Furthermore, to premise the delivery of manufacturing extension services on consortial models requires more than six OEMs and their suppliers. Wholesale expansion, beyond a few new members, of the existing consortium is problematic given the importance of the focus and commitment of the governing partners to its effective functioning. A more logical solution would be to stimulate the formation of additional consortia of locally rooted OEMs with a sufficient commonality of purpose and a substantial shared in-state supply base—as Pennsylvania appears to be doing. The existence of multiple consortia would also permit the different groups to benchmark their performance against each other to promote continuous improvement.<sup>36</sup>

## CONCLUSIONS

The worldwide reorganization of manufacturing has led to claims that flexible production—in various forms—is destined to replace “old” Fordist models. Attention in academic debates has therefore shifted away from the internal structures of firms to the external economies created by cross-firm interactions (Sturgeon 2002). Much of the literature on the changing face of US manufacturing, and particularly that focused on the importation and hybridization of Japanese practices, acknowledges (implicitly if not explicitly) that successful governance of decentralized production is vital to its future. This has large implications not only for OEMs’ competitiveness, but also for the capabilities and prospects of their small and medium-sized suppliers, with important knock-on effects given the increasing percentage of the manufacturing workforce employed in smaller firms. The big question thus becomes whether or not US manufacturers will be able in practice to build the collaborative positive-sum relationships with suppliers that could underpin a normatively attractive “new production paradigm”.

Helper *et al.* (2000) have offered a particularly stimulating and ambitious theoretical foundation for the emergence of inter-firm collaboration, based upon a model of the

35 For a related approach to the improvement of domestic and international labor standards through third-party monitoring and certification of corporate codes of conduct, see Fung *et al.* (2001).

36 For related proposals to deepen the impact and widen the reach of the consortial approach to supplier upgrading as part of a broader reorientation of Wisconsin’s economic development policies, see Ericksen *et al.* (2002).

“federated” firm versed in the pragmatic mechanisms of learning by monitoring, able to create long-term relationships by symmetricizing information, despecializing assets, and pushing suppliers to cooperate in the joint exploration of new possibilities. Our field research investigating changing OEM–supplier relationships in mid-volume industries in the American upper Midwest confirms that manufacturing firms are indeed actively seeking to build more collaborative relationships that require significant information-sharing and are more engaged in joint design than in the past. But our interviews also show that Helper *et al.* are too sanguine about the “self-actualizing” dynamics of learning by monitoring and pragmatic collaboration: even OEMs ostensibly committed to such collaboration—like those governing the WMDC—all too frequently find themselves tripped up by internal organizational obstacles, opportunism, and suppliers’ inadequate familiarity with flexible manufacturing practices.

Our account of the ongoing but incomplete transition to a more collaborative new production paradigm underscores the need for a reorientation of regional economic development policy in the USA. The small and medium-sized suppliers increasingly responsible for much direct production often lack the skills and capabilities to meet the rapidly changing demands of their large-firm customers without external support. At the same time, however, pervasive organizational dysfunctions within the OEMs themselves create systemic barriers to the fuller development of cooperative relations with suppliers. These relational blockages in turn suggest the need for creative public policies and institution building to encourage OEMs and suppliers to follow through on the collaborative strategies that they officially espouse. The Wisconsin Manufacturers’ Development Consortium offers a promising if unfinished and evolving model of the sorts of public–private partnerships that could serve as the institutional framework for such a collaborative restructuring of US manufacturing.

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