

The Firm as a Collaborative Community

Reconstructing Trust in the Knowledge Economy

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Collaboration in Supply Chains With and Without Trust

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The growth of collaboration has occurred over the last few decades not only within firms but also across firms, through elaboration of complex supply-chain and alliance relationships. The automobile industry has long been used as an exemplar of important economic phenomena involving supply chains. For most of the first two-thirds of the twentieth century, mass production was dominant and the automotive industry was highly vertically integrated. During this period, economists dating back to Coase focused on determining why and when a given component would be procured outside the firm, in a market transaction, rather than supplied internally from a wholly owned subsidiary, through hierarchical coordination governed by transfer pricing. (See for example Coase 1937; Klein et al. 1978.)

Oliver Williamson's (1975, 1985) answer to the question primarily involved 'asset specificity'—when investments in firm-specific assets were required, economic logic pointed towards maintaining vertical integration, i.e. internal manufacturing, of those components. Under conditions of low asset specificity—commodity parts of one sort or another—transactions in spot markets or short-term contracts based on low-bid competition were superior for obtaining the best price for a given level of quality. The shorthand for this decision process was 'make vs. buy,' highlighting the differentiated advantages of hierarchy and market as methods of coordinating economic activity.

Roughly fifty years ago, another supply-chain phenomenon reappeared on the global automotive scene. Certain automakers procured parts externally, rather than through vertical integration, but not in spot markets or

through short-term contracting. Instead, they relied upon a small number of supplier firms with whom they had long-term business relationships (often including an equity stake)—‘relational’ contracts governed by understandings about sharing both pain and gain, and large amounts of asset-specific knowledge on both sides. This approach allowed the close coordination on design and manufacturing tasks usually associated with vertical integration, while maintaining the potential for price pressure and supplier competition associated with market transactions.¹

This development shifted attention from ‘make vs. buy’ to the different issue of ‘how to buy,’ which deals centrally with the terms of the relationship among the parties. Hirschman (1970) famously distinguished between economic relationships managed by the constant threat of ‘exit’ from those managed by ‘voice,’ an exchange of views within an ongoing relationship.² Helper and Sako (Helper 1991; Sako 1992; Helper and Sako 1995) apply these terms to the dominant modes of supply-chain management associated with the USA, whose ‘exit’ approach involves arm’s-length relationships, selection based on low bid, frequent switching among suppliers, and reliance on contracts for governance. In contrast, the ‘voice’ approach dominant in Japan involves long-term relationships, selection based on supplier capabilities, frequent collaboration within stable supplier partnerships, and reliance on normative understandings for governance.

In the language of Chapter 1, the buy–exit option relies on market, and the buy–voice option relies on community; the make option could rely either on hierarchy (as in a traditional vertically integrated organization), or on community (in a network-based firm).

The application of ‘exit’ and ‘voice’ to supplier relations captures the orientation of the parties towards their relationship (as opposed to just a single transaction) and frames the issues of information sharing that crucially affect the relationship beyond transaction-specific costs. ‘Exit’ is characterized by the creation and exploitation of information asymmetries by both parties, even when the relationship endures over long periods of time. ‘Voice’ requires shared norms of reciprocity that balance the willingness of the customer to undertake investments in the supplier’s capabilities against the supplier’s responsibilities to invest in new technology and capacity. As we discuss below, both exit and voice have been profit-maximizing strategies in the past, depending on such conditions as firm strategy and market structure.

Yet the ‘exit’ vs. ‘voice’ distinction is no longer as clear as it was just twenty years ago. On the ‘voice’ side, the closed *keiretsu* system of suppliers characteristic of Japanese industry has been considerably opened to market pressures, requiring more formalization and cost justification of the

relationships. On the other side, the hard-nosed 'exit' approach of US firms has faced pressure for increased collaboration to achieve the increased levels of quality demanded in the market. There has been a wide range of responses to these pressures, often mixed and contradictory. In the USA there are frequent attempts to achieve the necessary levels of collaboration *without* trust; but this approach is marked by internal contradictions which, we believe, make it unlikely that it can stabilize as a lasting model. Thus, we will argue, the industry is converging from all sides on a form of pragmatic collaboration, involving substantial levels of trust, though more open and formalized than the traditional Japanese system.

The transformation in supplier relations

Over the last half-century four trends—each characterized by a different rate of change—have had a profound effect on relations between automakers and suppliers.

First, global competition brought Japanese vehicles (beginning in the 1960s) and Japanese manufacturing facilities (beginning in the 1980s) to the USA. The need to compete with Japanese automakers on quality and the gradual diffusion of lean production created incentives for US automakers to increase product quality. Achieving this increased quality required a more closely coordinated relationship with suppliers vis-à-vis design, subassembly, and parts production.

Second, there was a trend away from vertical integration (deverticalization) in the USA, starting in the 1970s. Outsourcing of manufacturing was the initial focus, given a growing gap between wages and benefits at the automakers' in-house parts divisions (which were unionized) and at non-union independent suppliers. The subsequent decision that many design tasks should also be outsourced resulted in a much more rapid pace of deverticalization (as measured by the percentage of value-added outsourced by the automakers) and the creation of a new breed of megasupplier. Automakers also turned away from vertical integration for strategic reasons, perceiving increased competitive advantage from focusing on core competencies. By outsourcing both manufacturing and design, automakers could rely on specialized supplier expertise, rather than maintaining that expertise in-house, while also reducing labor costs.

The third factor is less a trend than a continuing reality amid other dramatic changes. Since establishing a dominant design in the 1930s, the product architecture of the automobile has been primarily integral,

requiring a great deal of ongoing communication among the designers of different parts. Starting in the mid-1990s, automakers and mega-suppliers alike began determined efforts to move towards a more modular approach. However, vehicle architecture has proved stubbornly resistant to these efforts and retains a high level of integrality, thus defying expectations of more independence for suppliers during the design process.

Fourth, global overcapacity in automotive assembly and the parts sector has increased price pressure on both automakers and suppliers. In the US context, this has given automakers greater leverage over most suppliers in price negotiations. Given a greater availability of parts from newly sophisticated suppliers in less-developed countries, automakers have more options for exit and hence a more credible threat in demanding that their existing suppliers meet, for example, a 'China price.' This reinforces the apparent value of US automakers' long-standing purchasing routines built around exit, and has contributed to organizational inertia with respect to moving towards a more collaborative mode of exchange.

The net result of these four trends is that the level of collaboration between automakers and suppliers has increased. Despite some developments during this same period that have appeared to push the auto industry in the direction of reduced collaboration, we find the underlying forces affecting supply chains have in fact made collaborative relations more important rather than less.

Yet we have been surprised to see that, contrary to customary expectations for collaboration, these supply-chain relationships do not always involve high levels of trust. That is, in response to these developments, some firms, especially in the USA, collaborate on certain core engineering, manufacturing, and product design tasks while at the governance level, where suppliers are selected and contracts are written, there is an adversarial relationship and lack of trust. We will explore to what extent this model of 'collaboration without trust'³—task-level collaboration without the underlying relational and value base that cements longer-term relationships—is a viable model.

This phenomenon poses two questions: (1) Can organizations with an exit-oriented tradition create effective forms of collaboration?; and (2) Does collaboration necessarily require trust? These questions bear on the central question of this volume. Other authors here, particularly Adler and Heckscher in Chapter 1, argue that effective collaboration requires trust and institutions of community to support it. To the extent that the bene-

fits of collaboration, such as flexible resource allocation and response to change, can be achieved *without* trust, that thesis is called into question.

Global competition, quality, and lean production

To an ever-increasing extent in the post-war era, the US industry operated in exit mode, with production of simple parts done by outside suppliers under short-term (one-year) contracts, often with multiple suppliers per part. The key consideration for US automakers was maintaining a credible threat of exit, to prevent 'hold-up' by suppliers taking advantage of asset-specific knowledge developed over time. Therefore, automakers created a large supply of potential suppliers, partly by outsourcing only simple manufacturing tasks (more complicated tasks like subassembly and design stayed in-house) and partly by standardized specifications and bidding procedures.

This short time horizon and extreme division of labor resulted in inefficiency and poor quality. For example, since suppliers usually did not design their own products, they could not optimize them for their own production processes.⁴ Since each supplier produced only a small component (e.g. one bracket rather than an entire headrest assembly), it was difficult to optimize across components. However, since each of the Big Three US automakers had similar practices, consumers did not have the ability to buy higher-quality cars. Despite their inefficiency, exit relationships therefore maximized automaker profits by making it easy to switch suppliers (Helper 1991; Helper and Levine 1992).

However, when the Japanese entered the US market, first with imports in the late 1960s and early 1970s and soon with local manufacturing plants in the early 1980s, consumers did gain access to more reliable cars. The Japanese quality advantage was based on thoroughgoing adoption of 'lean production' practices governed by voice supplier relationships.⁵ To compete with the Japanese, the Big Three had to improve quality by reuniting design and production and increasing the size of subassemblies. To do this, they needed more capable suppliers that combined a variety of skills, instead of the 'bend and send', 'shoot and ship' firms with few design or management skills, capable only of doing one narrow production process.

Deverticalization and the emergence of 'mega-suppliers'

In the 1970s, component design was largely done by the automakers in-house, although production was done by a mix of vertically integrated

divisions and financially independent firms. The reintegration of design and production could have occurred by taking more production back in-house. Instead, the opposite occurred—design gradually moved to suppliers, and the Big Three spun off their parts divisions.

Why did vertical integration decline? Three factors seem to be responsible:

1. A new breed of purchasing executive, exemplified by Ignacio (Inaki) Lopez at General Motors, promoted the idea that in-house parts production had become inefficient during years of Big Three quasi-monopoly of the US automotive market and that long-standing relationships with outside suppliers were 'cozy' and riddled with waste. To remedy this, purchasing moved towards a more aggressive use of market mechanisms—more outsourcing to reduce reliance on in-house divisions and intensified bidding procedures to force greater price competition among suppliers.
2. The wage gap between non-union independent suppliers and unionized in-house supply divisions grew during the 1970s, as suppliers grew more bold in their union-avoidance strategies and inflation eroded the purchasing power of non-union workers. The UAW was able to maintain its strength at the Big Three by threatening to shut down assembly plants, but did not have such leverage over independent parts suppliers, which were able to expand their non-union operations rapidly. By the mid-1980s, the wage gap between a worker in a Big Three component plant and an independent plant ranged from 2:1 to 3:1 (Herzenberg 1991).
3. Managers perceived an increase in returns to specialization. As automakers began to take advantage of innovations in electronics and plastics in the 1980s, they chose to rely on the expertise of outside suppliers from those industries rather than expanding their in-house knowledge. This increased reliance on outsiders was bolstered by new management theories (e.g. Prahalad and Hamel 1990) which argued that firms sticking to narrow core competencies performed better.⁶

The pace of deverticalization increased dramatically when first GM and then Ford spun off their captive parts divisions, creating Delphi (1999) and Visteon (2000), respectively. Delphi and Visteon immediately became the first 'mega-suppliers' (also known as Tier 0.5). More mega-suppliers were soon on the way, formed from horizontal merger and acquisition activity in order to compete for larger subassemblies, i.e. aggregations (or 'chunks')

of components. These were mostly existing automotive suppliers (Johnson Controls Inc., Lear, Magna, Denso, Eaton, Dana, TRW Automotive, Federal Mogul) now growing larger and taking over critical design and engineering tasks, handling more complex manufacturing and logistics tasks, and assuming a larger role in the management of second- and third-tier suppliers.⁷

More subcontracting does not necessarily mean more collaboration. The interface between design and production can be organized in three ways (Clark and Fujimoto 1991): supplier proprietary (supplier designs and manufactures the part and sells it through a catalog); OEM (original equipment manufacturer) detail controlled (all design specifications are predetermined by the OEM, the supplier has no design role and only manufactures the part), or 'black box' (the OEM provides performance requirements and basic parameters of size, weight, etc. and the supplier provides the rest of the design). From this perspective, 'black box' subcontracting involves the greatest collaboration of the sort that we term (below) 'pragmatic.'⁸

In data from the late 1980s, Clark and Fujimoto find marked differences between US and Japanese companies in how subcontracts are organized, with 62 per cent of all procurement cost handled in 'black box' mode in Japan vs. 16 per cent in the USA and 81 per cent of procurement cost handled in OEM detail controlled in the USA vs. 30 per cent in Japan; European firms were in between, with 54 per cent detail controlled parts and 39 per cent 'black box.'

As these percentages suggest, the Japanese subcontracting system never achieved the same level of vertical integration in the auto industry as the USA and Europe. In that context, a low level of vertical integration was synonymous with a high level of 'black box,' collaborative subcontracting. The US case, in contrast, reveals that even as vertical integration dropped from its peak in the mid-1950s, the resulting subcontracting was not often collaborative; the detail-oriented approach has been quite consistent with the exit mode of exchange. Tables 10.1 and 10.2 reveal levels of vertical integration over time for the USA and Japan, respectively; the Japanese data are more recent (and more precise), the US data are chosen to reflect the impact of the Delphi and Visteon spin-offs.

The recent wave of deverticalization increases the reliance on 'black box' subcontracting as a replacement for the OEM detail-oriented approach. The decision by OEMs to pursue lower labor costs and to focus on core knowledge and capabilities initiated this move, and the resulting creation of mega-suppliers with enhanced design capabilities accelerated the trend.

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Table 10.1. Vertical integration—US Big Three

Company	1975(%)	1995(%)	2005 ^a
General Motors	75	66	^b
Ford	66	50	^c
Chrysler	50	33	^d

Note: Estimates, includes bought-in materials for in-house produced parts (Nishiguchi 1994; Rubenstein 2001).

^a Rubenstein (2001) estimates that GM, Ford, and Chrysler levels of vertical integration were similar—around 30%—after Delphi and Visteon spin-offs.

^b Delphi Corporation, when spun off from GM in 1999, was immediately the world's largest supplier, with worldwide sales of \$27 billion (\$21 billion in North America). 78% of its sales were to GM (54% in 2004).

^c Visteon Corporation, when spun off from Ford in 2000, had worldwide sales of \$12 billion, with 88% of its sales to Ford (70% in 2004).

^d Chrysler was purchased by Daimler-Benz in 1999; a few parts plants have been sold or closed.

Table 10.2. Vertical integration—Japan

Company	1984	1990	1996	2002
Toyota	12%/60%	11%/62%	10%/62%	10%/62%
Nissan ^a	10%/56%	10%/53%	8%/56%	4%/36%
Honda	5%/39%	5%/46%	5%/48%	4%/41%

Notes: Based on IRC data on component transactions for 200 key components, analyzed by Takeishi and Noro (2005), supplemented by Nobeoka and Manabe (forthcoming, see under references below) survey on nature of components. These time series data reflect 72 components that are the same for the entire period.

Figures on the left are purchases from in-house (vertically integrated) parts suppliers, for car and light truck manufacturing only.

Figures on the right are purchases from *keiretsu* suppliers, as defined by IRC based on financial affiliation, sales dependency, and historical relations.

^a Nissan figures in 1999 are 7% in-house and 55% *keiretsu* suppliers. Restructuring of Nissan's *keiretsu* began in 2000, reflecting the new strategy after the alliance with Renault.

Table 10.3 documents the growth of mega-suppliers beginning in the mid-1990s and Table 10.4 lists the top ten mega-suppliers as of 2003.

'Modularity' and the predicted decline of collaboration

One rationale for the creation of mega-suppliers was a prediction about the future of automotive product architecture. Influenced by the example of information technology, automakers and suppliers began anticipating the rise of 'modularity' as the new basis for designing automotive products. 'Modules' as a basis for product architecture are defined as elements that are 'interdependent within, and independent across,' whereas 'integral' product architecture is based on interdependence *both* within and across elements. Put differently, modules can be developed independently

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Table 10.3. The rapid increase in automotive 'mega-suppliers'

	1992	1995	1997	2000	2004
# of suppliers with:					
>\$10bn global sales	3	3	4	8	11
\$5–10bn global sales	2	11	10	10	12
\$2–5bn global sales	11	36	33	35	41

Source: *Automotive News*.

Table 10.4. Top ten global suppliers (sales in 2003)

1. Delphi (\$26.2 billion)
2. Robert Bosch (\$23.2 billion)
3. Denso Corp. (\$16.9 billion)
4. Visteon Corp. (\$16.5 billion)
5. Lear Corp. (\$15.7 billion)
6. Magna Internat'l (\$15.3 billion)
7. Johnson Controls (\$15.2 billion)
8. Aisin Seiki Co. (\$13.5 billion)
9. Faurecia (\$12.7 billion)
10. TRW Automotive (\$11.3 billion)

Source: *Automotive News*.

from one another and connected via standardized interfaces, established by the architecture's predetermined 'design rules,' while an integral architecture requires intensive coordination throughout the design process.⁹

Thus modularity, according to its proponents, is efficient in part because it requires little collaboration. Because a module provides one predefined function and its interface compatibility with other modules is assured through standardization, innovation within modules can proceed independently, without extensive coordination with innovations in other modules (Langlois 2002). Modularity may also reduce asset specificity. Any PC manufacturer can hypothetically use any hard drive from any supplier, as long as the predefined function is fulfilled and the standardized interface is present.

Beginning in the late 1990s (and influenced by the success of companies like Dell that take advantage of modular product architecture to 'build to order'), automakers began to think of how they could divide up the vehicle into discrete modules, some of which could be fully outsourced to mega-suppliers. At the same time, mega-suppliers brought proposals for module designs to their customers.

But the move towards modularity has been much less decisive than its advocates predicted a decade ago. Automotive product architecture,

unlike that of computers, has proved resistant to moving away from integrality. Though the term 'module' is often used today in the auto industry, it means something quite different than in the information technology world (Sako 2004). What is called a 'module' could be more accurately described as a chunk of physically proximate components that could be subassembled independently from the rest of the vehicle, tested for functionality after subassembly, and then installed on the final assembly line in a single step. This violates formal definition of 'modularity' in multiple ways: more than one function is mapped to the 'chunk,' there is no standard definition of the functions performed by a module (certainly not within the industry, but usually not even across models designed by the same automaker), and there is no standardized interface allowing interchangeable connectivity of modules.¹⁰

Why has it been so hard to modularize the car? First, in today's dominant design, space is at a premium, so components are designed to conform tightly to model-specific physical constraints. Related to this is the need to avoid problems that result from the interaction of the parts, problems that can result in noise, vibration, and harshness of ride. Similarly, laptop computers are more integral than desktop PCs because of the need to utilize scarce space efficiently.

Second, the 'look and feel' of a given vehicle is important to brand image and the emotional connection to the customer, and designers fear loss of distinctiveness from moving to the use of standardized modules, even within a single automaker.

Third, many important functions or subsystems are geographically distributed around the vehicle, such as safety, electrical, braking, steering. Achieving systemic integrity for these functions requires precise coordination across components to meet requirements for a vehicle of a particular size, weight, center of gravity, etc. Furthermore, when various companies began trying to divide up the vehicle into a set of standard modules, differences in design philosophy meant widely different numbers of defined modules and no agreement on modular boundaries.

Finally, the costs of automobile modules—although predicted to be lower due to economies of scale from standardization—have often proven to be higher than the collection of components, individually installed, that they were meant to replace. Engineering costs for modules can be higher. Some reasons are: OEMs preserve a 'shadow engineering' presence to monitor supplier engineers; OEMs are reluctant to allow a first-tier supplier to choose second- and third-tier suppliers due to the volume-based contracts the automakers have negotiated directly with

these suppliers, thus constraining product innovation and cost reduction; and supplier capabilities are in some cases not adequate to the design responsibilities given them, even as current purchasing routines prevent suppliers from including investment costs for those capabilities in their piece price.

Even aside from these industry-specific reasons, there is now a greater realism about the inherent limits of modularity, even for products whose architecture is easily decomposable into modules, because of the requirements of achieving advance agreement about module boundaries and a standardized interface.¹¹ Such agreement may be impossible to achieve (or to sustain over time) at any meaningful level of aggregation, given ongoing changes in underlying technologies and consumer demands for functionality, or simply a lack of willingness in a competitive context to sacrifice proprietary or brand-influential architectural features in order to achieve the gains from standardization.

Despite this litany of problems, the importation of the concept of 'module' has had value for automakers and suppliers by causing them to think about larger chunks of components as the relevant unit for design and sourcing decisions. It has also provided the rationale for changes that ultimately, we would argue, have more to do with deverticalization than with any change in product architecture—including the very formation, through mergers and acquisitions, of the mega-suppliers.¹²

Whatever can be said about the changes wrought by the arrival of 'modules' in the automotive industry, one thing that definitely did *not* occur was any reduction in task interdependence and coordination requirements between automakers, first-tier suppliers, and (by extension) lower-tier suppliers as well. In fact, due to the combination of the shift in design responsibility for components associated with deverticalization and the move towards designing and manufacturing bigger 'chunks' as discrete units, these requirements have, if anything, increased. The persistent integrality of automotive product architecture has made necessary continued intensive collaboration between assemblers and suppliers.¹³

Legacies of exit and global overcapacity

Although the shift towards collaboration was noteworthy during the 1990s, it was far from complete; legacies of exit remained in incentive systems and compartmentalized organization. Purchasing agents continued to be

rewarded for their ability to cut suppliers' piece prices, and not so much for their ability to ensure the on-time delivery of high-quality parts.

The temptation to return to exit was intensified by overcapacity, particularly among parts makers. Japanese automakers frequently brought their suppliers with them to the USA, often finding this easier than to train US firms in the techniques of lean production; in the 1980s over 300 Japanese auto suppliers came to the USA (Kenney and Florida 1993). Meanwhile, improvements in transportation and communication combined with low wages in less-developed countries made it attractive for multinational firms to build new plants in nations such as Mexico, China, and India (Sturgeon 2002).

This increase in new capacity was not matched by shutdowns of old capacity. Despite wage cuts, many workers, particularly those with high-school educations, found that staying in the industry was their best alternative. Much of the equipment used by plants that did go out of business was not scrapped, but rather was sold cheaply at auction to firms that continued to produce.

Eventually, supply and demand will come more into balance, but given the long life of both workers and equipment, it may take another decade. In the meantime, automakers will find themselves with a variety of suppliers to choose from, making exit on some occasions tempting even for practitioners of voice. As we discuss below, this excess supply does not obliterate the tendency toward collaboration that results from greater global competition in final product markets, but it does temper it.

The shift towards collaboration

To summarize: due to the four trends described above, we see an increasing degree of collaboration in automotive supply chains over the past ten to fifteen years. Given the higher costs (both perceived and real) of vertically integrated suppliers and the persistent integrality of vehicle product architecture, automakers found the pursuit of quality took a form that required more coordination and collaboration on design and production with financially independent first-tier suppliers.

This form of collaboration no longer fits cleanly into the 'exit' and 'voice' strategies that characterized the earlier phase. The typically American 'exit' pattern has been pushed in the direction of longer-term

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relationships; conversely, the typically Japanese ‘voice’ pattern has been confronted with greater competition from new entries into the once-closed group of suppliers, greater demands from the global expansion of existing customers, and unfamiliar demands from new customers—in short, a wider and more open range of relationships than the traditional *keiretsu*. Thus firms with an ‘exit’ legacy find themselves needing to develop collaborative capability in response to deverticalization; and firms with a ‘voice’ legacy must be more prepared to face competitive pressure.

Table 10.5 elaborates this hybrid collaborative mode of exchange in relation to ‘exit’ and ‘voice.’ The fundamental orientation of the parties is long term and relational, as with voice. However, customers are open to establishing relationships with new suppliers. Selecting a supplier does not involve bidding, as in exit, but nor is it based entirely on assessment of capabilities within a closed group of suppliers, as in voice. Rather suppliers are competitively evaluated and cessation of business is not uncommon, although less frequently and speedily than under ‘exit.’ This assessment continues even after the relationship is established. Carried over from voice is the manner in which performance problems are handled. Poor performance by Supplier A may not cause exit but a reduction in the share of the customer’s business, mirrored by an increased share for Supplier B.

Table 10.5. From ‘exit’ and ‘voice’ to hybrid collaborative mode of exchange

Exit	Voice	Hybrid Collaborative
Arm’s length and transactional	Long term and relational	Long term and relational
Open for new suppliers to bid	Set of potential suppliers mostly closed	Open to new suppliers, after a vetting period
Competitive selection by low bid—frequent and speedy exit	Selection based on capabilities—exit rare and slow	Competitive assessment—intermediate frequency and speed of exit
Design simplified by customer to enlarge pool of suppliers	Design controlled by customer, supplier involved via resident engineer	Larger design role for supplier, attention to supplier design capabilities
No equity stake	Often an equity stake	Equity stake depends on criticality of technology
Contracts for governance	Norms/dialogue for governance	Norms + process management routines for governance
Codified procedures	Tacit procedures	Process management routines make procedures explicit

While design under exit is simplified in order to generate a larger pool of potential suppliers, design under voice is typically organized so that supplier engineers can be 'resident' at the customer's design facility; yet the supplier role in developing new designs is limited. Under the hybrid mode, the supplier's design role is much larger, to the extent that customers express high concern about the level of a supplier's design capabilities—which was very unusual in the past.

While equity stakes are common under voice and not under exit, the hybrid mode finds variation. Automakers frequently take equity stakes in suppliers who are expert in technologies that are assuming an increased importance in vehicle design (e.g. electronics, composite materials), but otherwise this is not common. While the hybrid mode relies more heavily upon dialogue than formal contracts for governance, it also relies upon extensive use of formalized process management routines affecting problem solving in manufacturing and design rather than simply upon tacit understandings based on long-term relationships. Similarly, while exit codifies procedures and voice relies on tacit understandings, the hybrid mode relies on process management routines that make procedures explicit. These more general (less customer-specific) techniques make it easier for customers and suppliers to collaborate effectively even when the relationship is relatively new.

*Types of collaboration: with and without trust*¹⁴

It is our contention that convergence towards this hybrid mode of collaboration has characterized automotive supply chains over the past ten years and that this trend will continue. Within this general move towards increased collaboration, however, there remains substantial variation. Here we describe the range of responses and below we provide interpretations of the US patterns, where the most variation is found.

The greatest continuity with previous practice can be seen in Japan. Given the tradition of working closely with suppliers as collaborative partners, the hybrid mode takes the form of 'collaboration with trust,' a relatively small departure from the history of 'black box' subcontracting within a voice mode of exchange—although at some companies, the implications for the traditional *keiretsu* structure of the supply chain are quite significant. We explore the situation in Japan in greater detail as one of three case studies below.

The American Big Three's interpretation of collaboration has often been to impose increasing demands, on suppliers, resulting in suppliers having less

trust in OEMs than was the norm for the exit mode previously. For example, with suppliers taking a larger role in providing component designs as part of their bid, OEMs have been caught taking those incipient designs and sending them to another supplier to get a competitive bid. Breaking from a long tradition of paying for tooling as part of a supply contract, OEMs began telling suppliers they would now be responsible for those costs. Other extreme examples include OEMs demanding immediate 5 per cent price cuts, regardless of contractual terms already established; using online 'reverse auctions' in which some of the bids pushing prices to record low levels could not be verified as coming from credible suppliers; and, most recently, confronting suppliers with a 'China price' and demanding they meet it or lose the business, even in the midst of established contracts.

Such hard-nosed, transaction-based behaviors have at times provoked strong public reactions—to the point where any suggestion that collaborative activity might exist between these adversaries can seem absurd. One noteworthy speech was made by the CEO of a medium-sized supplier at the annual industry briefing meetings in Traverse City, Michigan, in August 2002.¹⁵ This excerpt captures the strong emotions stirred up by these developments:

There is little chance that beating the hell out of the supplier base and breaking contracts . . . is going to get to the root cause of your problem, Big Three. You know that the suppliers raked over the coals and used as a whipping boy to explain the Big Three's cost problem are the same suppliers investing, building partnerships, and earning a good return with the vehicle producers that have the growing market share. There is a discontinuity here. But it is also very clear that our futures are inextricably tied and neither can afford the other to fail. (Tim Leuliette, president/CEO of Metaldyne, 12 Aug. 2002)

Responding to this cry from the heart a few days later, GM's CEO Rick Wagoner had a ready answer: 'Stop whining!'¹⁶

Leuliette's speech points out a powerful underlying dynamic: When given the choice, suppliers will readily choose collaboration with trust over collaboration without trust. Gradually, but steadily, US suppliers have been learning to prefer working with the Japanese transplant manufacturers who operated in 'voice' mode when establishing supplier contracts—even as their Big Three customers came to adopt more and more of the design and manufacturing practices long in place at companies such as Toyota, Honda, and Nissan. Yet few suppliers can afford to turn their back on Big Three business, so many of them have adapted as best they can to operating under these new conditions.

Task-level convergence, governance-level divergence

The descriptions above suggest that our earlier statement about a convergent trend towards collaboration must be qualified. While supplier relations at the level of specific design and manufacturing tasks may be responding similarly to the forces analyzed above, these tasks are carried out within differing transactional contexts.

At the governance level, the policies that govern the transaction—the process of awarding work to a supplier (or, from the supplier's perspective, bidding for work), the negotiations over price, the responsibility for investments in tooling and other capabilities, who is responsible for warranty and product liability costs, and the way that disputes are handled—can all vary widely. Some firms are choosing a greater reliance on market mechanisms to keep price pressure on their suppliers, while others are choosing to pursue a small number of longer-term relationships within which various issues are resolved. Interestingly, at the firm level, past history of 'exit' or 'voice' doesn't necessarily determine which path is chosen.

At times these pressures can lead to contradictory behavior in different arenas. At one limit, we find instances where collaborative activity occurs at the task level, while at the governance level, OEMs subject suppliers to severe versions of 'exit' behavior.

Reflecting on these developments, some thoughtful observers suggest that there is no single emerging pattern but rather a portfolio of viable OEM-supplier relationships whose diversity is motivated by various things: risk hedging; the differential importance of one criterion (price vs. quality vs. design) for that particular part; internal lack of coordination at the OEM; suppliers' protective moves.¹⁷ Herrigel (2004) summarizes this perspective:

Are the new relations cooperative and collaborative, or are they still essentially about cost and price? . . . [It] is important to avoid the urge to choose between these hard alternatives. This is because neither the actors in OEMs nor the actors in component producing firms make such drastic choices. Indeed, both seem to distribute their strategies to accommodate as broad an array of (even contradictory) sourcing strategies as possible. Within OEMs, it is both the case that managers in charge of sourcing seek to maintain a diversity of in-house capacities and subcontracting relations and that different strategic sourcing practices compete with one another for dominance. In reaction to this de facto multiplicity of OEM sourcing strategies, component producers are developing a broad range of strategies that take advantage of the (sometimes quite unpredictable) variety of OEM sourcing practices. (pp. 45–6)

We have two objections to this view. First, inherent in our view of ‘voice’ (and of the hybrid mode) is the idea that the parties can actively circumvent any necessary trade-off between collaboration and efficiency. Collaborative ‘cost-down’ activities can achieve both. Second, we are skeptical that supplier relationships can be constructed or maintained by ‘mixing and matching’ contradictory strategies. Like cars, patterns of relationships are integral.

To explore the problems of ‘mix and match’ strategies, consider that economic relationships are based on mutual expectations resulting from past experience: if a pattern of low-trust expectations is established it cannot easily be shifted to high trust for a new transaction. Furthermore, any given pattern of relationships leads to differences all the way through the organizational system. For example, exit and voice require different criteria for choosing and compensating purchasing agents: exit strategies benefit from financially oriented purchasing agents who are compensated based on their ability to keep prices low; voice benefits from agents with engineering backgrounds and complex compensation schemes that balance multiple objectives.¹⁸

Indeed, the choice of strategy affects not just purchasing but the entire corporation. For example, maintaining a credible threat of exit is facilitated by an ability to make ‘apples-to-apples’ price comparisons. This in turn requires designs to be well documented (so suppliers know what they are bidding on), and suggests that purchasing will act as a gate-keeper, limiting suppliers’ access to the engineering department, where they might succeed in obtaining design changes that would limit purchasing’s ability to compare prices. In contrast, under voice much knowledge can remain tacit (not documented) since relationships change infrequently, and collaboration with engineering is considered a good thing.

Thus, while there can be some variation in how individual suppliers are treated, we question whether the pattern of task-level convergence and governance-level divergence can be explained by deliberate efforts by firms to sustain a portfolio of different purchasing strategies.

Emerging alternatives: pragmatic collaboration, with and without governance trust

Rather than a panoply of strategies, we see two emerging alternatives that account for the range of observations above: a convergent trend towards ‘pragmatic collaboration’ at the task level that can be found within divergent approaches at the governance level.¹⁹ The distinction we draw

between collaboration ‘with trust’ and ‘without trust’ reflects the consequence of superimposing the new reality of iterated co-design upon the legacies of ‘voice’ and ‘exit’ modes of exchange that continue to exert inertial influence on purchasing routines and governance arrangements. Fig. 10.1 displays the underlying logic generating this pattern.

In this view, the interdependent design and manufacturing practices linking automakers and their suppliers at the task level are *pragmatic* in that they confront the uncertain and changing nature of knowledge with a continuing willingness to question current routines and past choices and to explore alternatives. Collaboration emerges naturally during this exploration, partly because the process of dialogue and debate allows ‘learning by monitoring’ (see Chapter 2). Those individuals engaged in interdependent design and manufacturing tasks can assure themselves that even as they are advancing completion of the task, they are able to ascertain whether the other party is behaving in trustworthy, non-opportunistic fashion. Thus, the very process of pragmatic collaboration generates the levels of task-level trust necessary for the process of iterated co-design—and for persistence of task-level relationships.

The pragmatic evolution of collaboration opens the door, in our view, for participation in such collaborations by firms with an ‘exit’ history, since they too recognize the gains in the face of technological change and unpredictable market demand. The problem for such firms is the absence of trust at the governance level, and the difficulty of developing a form of pragmatic collaboration at that level capable of generating trust over time. We do not expect that this internal contradiction can be viable

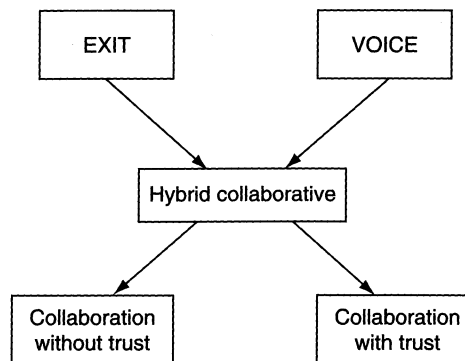


Fig. 10.1 Two patterns emerging from hybrid collaborative mode

over the long term, although we see a number of reasons why it will not disappear quickly. We return to these issues below.

Case examples

We turn now to consider three individual case examples: (1) the continuing phenomenon of ‘collaboration with trust’ in Japan, as practiced by firms like Toyota and Honda and the recently different approach of Nissan; (2) the coping strategy of Stoneridge, a small second-tier supplier faced with heavy downward pressure on profit margins from its Big Three customers; and (3) the effort by mega-supplier Delphi (formerly part of GM and hence with a strong legacy of ‘exit’) to change its purchasing and supply-chain management practices in order to move towards the ‘collaboration with trust’ model.

Starting from the premise that the pace and extent of deverticalization and lean production are requiring more collaborative interdependence between automakers and suppliers, the first case considers how Japanese firms have updated their former ‘voice’ approach to what we are calling ‘collaboration with trust.’ The second and third cases consider the USA, where OEMs and suppliers alike have a legacy of ‘exit’ relations with low trust. Here we find contradictions, with an increase in trust-destroying behaviors by OEMs on the one hand—as in the second case of Stoneridge, a small US electronics supplier—while on the other hand some mega-suppliers attempt to move towards ‘collaboration with trust’—as in the third case of Delphi. The cases will set the stage for a final discussion of what kind of supplier relationships we are most likely to see in the future, both in the US context and beyond.

‘Collaboration with trust’ as work in progress—supply-chain management at Toyota, Honda, and Nissan

Toyota and Honda are rightly regarded as the leading practitioners of ‘collaboration with trust’ in their relationship with suppliers, although the earlier characterization of the ‘voice’ mode of exchange was often applied to all Japanese firms. We include Nissan in this assessment because of its much-heralded recovery from near-bankruptcy after an alliance with Renault and the importation of a Western CEO (Carlos Ghosn) who set out energetically to dismantle key aspects of the old supplier system. Taking a

current snapshot of these firms is a good way to consider 'collaboration with trust' as a work in progress.

We will argue that current manifestations of 'collaboration with trust' are not simply the previous 'voice' mode of exchange, whose Japanese form was highly intertwined with the industrial structure of interlinked firms known as *keiretsu*. Rather, they are a modern adaptation reflecting the forces and pressures affecting the entire industry, as described above, as well as the very substantial foreign direct investment by leading Japanese automakers in establishing a manufacturing footprint and building local supply chains all over the world. Globalization has required collaborative processes that are considerably more accessible to out-of-network suppliers and contain more explicit articulation of norms and values as well as specific guidance in how to approach task interdependencies.

Japan's prolonged recession in the 1990s—what some observers call the 'lost decade'—put tremendous strains on both first-tier and lower-tier suppliers in Japan. First-tier suppliers were often asked to join their OEM customers in expansion efforts overseas, opening new plants first in the USA and then in Europe. At the same time, these firms were investing heavily in South-East Asia in order to reduce their production costs, but this severely strained the lifetime employment commitments at their domestic plants and sparked social criticism of their role in the 'hollowing out' of the Japanese economy. Smaller second- and third-tier suppliers faced a starker challenge. Japanese OEMs typically pledged to invest heavily in supply base development when entering a new country and they (and their first-tier partners) could easily replace the small Japanese supplier by sourcing their parts from domestic suppliers near their new overseas manufacturing plants. While these small suppliers were not cut off completely, many struggled to stay in business. The general economic conditions are somewhat improved now, but the fundamental challenge to small Japanese suppliers to justify their continued place in the supply chain remains.

During this same period, the past pattern of strong vertical control of design activities and production coordination by the OEM has begun to change. This raises the same fundamental dilemma: OEMs want suppliers to take a larger role in design and in managing lower tiers of the supply chain, but they also want to maintain their knowledge and power; they recognize that they must 'know more than they make.'²⁰ Suppliers must therefore make more investment (in capacity and knowledge), which is potentially redundant and not paid for by OEMs.

Japanese OEMs have also put suppliers under growing pressure for cost reduction. Nissan took the lead, with Carlos Ghosn setting forth a drastic cost-cutting plan that aimed to shock the old *keiretsu* system into changing past patterns. Toyota, determined not to let Nissan gain any cost structure advantage, followed soon with its CCC 21 program (Construction of Cost Competitiveness for the Twenty-First Century) that aimed for 30 per cent reductions in parts prices—targets much higher than the usual incremental ‘cost-down’ targets.²¹

Akira Takeishi (2003) and his colleagues argue that Japanese OEM–supplier relations must move into a new fourth phase, after three previous phases that emphasized cost, quality, and engineering input for individual components respectively. The newest phase emphasizes horizontal coordination with suppliers of other components for improved design, greater system integrity, and more innovation at both component and system levels, as well as exploration of more modular design principles.

The Japanese word *kyogyo* is used to describe this phase; it means ‘collaborative division of labor.’ OEMs have shown a willingness to turn more design responsibilities over to suppliers who can manage these horizontal collaborations most successfully. Certain examples of *kyogyo* are well publicized in Japan, e.g. an instrument panel console for a new Lexus model that resulted from the self-initiated collaboration of Sumitomo Denko (an electronics firm) and Toyota Gosei (a plastics firm) and that achieved sizeable improvements in terms of lighter weight, lower parts count, and lower overall cost.

Initial expectations were that *kyogyo* might be the first step towards modularization, but this particular example suggests otherwise, for the Lexus console is completely idiosyncratic to a single Lexus model. It is possible that these suppliers will attempt a more standardized design that they can offer to multiple customers, in order to spread their fixed costs over more units. Within the Japanese context, where the integrality of product architecture is accepted as fundamental to how product development is organized, we think it more likely that these horizontal collaborations will continue to result in highly integral designs that still require high vertical design interdependence with OEMs. Thus ‘collaboration with trust’ within Japanese supply-chain structures is likely to take on more of this ‘first horizontal, then vertical’ coordination flavor in the future.

Within overseas operations, Toyota and Honda continue to strengthen their local supply chains in terms of systematic production capabilities to reduce cost, improve quality, increase logistical accuracy, and shorten lead

times, often through direct supplier development activities that began in the 1990s and continue to the present day. Slower to develop have been supplier-to-supplier working groups, called *Jishuken* in Japan; these are considered to be a better method of supplier development in terms of sustainability, since the direct supplier assistance by the OEM often produces too much dependency.²²

Overall, supplier development in the USA has been a slower and more difficult process than originally envisioned by the Japanese OEMs. At first, it was difficult for Toyota and Honda to find suppliers who would agree to participate in their collaborative approach. Dyer and Singh (1998) quote Toyota's VP for purchasing Koichiro Noguchi from Dyer's interview with him in 1992:

Many U.S. suppliers do not understand our way of doing business. They do not want us to visit their plants and they are unwilling to share the information we require. This makes it very difficult for us to work with them effectively; we also can't help them improve. (p. 673)

More recently, Hajime Ohba, head of Toyota's Supplier Support Center in Kentucky, locates the reason in the overwhelmingly financial orientation of many US suppliers; they emphasize short-term fixes that produce immediately visible savings, typically through inventory reduction, and don't persist with more fundamental changes in how they approach manufacturing.²³

As noted above, US suppliers are increasingly vocal about their preference for working with Toyota and Honda rather than the Big Three, with evidence that overall costs are lower and the amount of innovation contributed is higher. As these automakers localize more design activity to their R&D facilities in the USA and Europe, more design involvement by local suppliers will result.

Nissan's situation demonstrates some of the gains and losses that occur when a company with a 'voice' tradition resorts to 'exit' behavior. In early 1999, Nissan was in deep financial crisis, with both Moody's and Standard and Poor's announcing plans to reduce its credit rating to 'junk' status unless it received outside investment.²⁴ Renault provided that investment in March 1999, assuming a 36.8 per cent stake in Nissan and thus freeing up \$5.4 billion in capital and retaining 'investment grade' bond status.²⁵ Carlos Ghosn from Renault, already well known for his success in cost cutting and turning around troubled operations, became the new CEO.

One target of Ghosn's cost cutting was Nissan's *keiretsu* ties with suppliers. Nissan had followed a traditional *keiretsu* approach, cultivating

extensive financial and personnel interconnections with its suppliers. Retained earnings were typically invested in purchasing shares of these affiliated companies and supplier CEOs were routinely appointed from among the ranks of senior Nissan executives approaching retirement. By 1999, Nissan held equity stakes in *keiretsu* companies totaling over \$4 billion. Yet these cross-sharing holdings and personal relationships did not yield the cost advantages achieved by Nissan's competitors, such as Toyota. At the time of the alliance, Nissan's purchasing costs were estimated to be 20–25 per cent higher than Renault's costs.

Ghosn and the Nissan board reached an early decision to end its equity participation in *keiretsu* supplier companies and to accept competitive bids from outside suppliers, as part of the Nissan Revival Plan (NRP), which also included internal plant closings. This freed up billions in capital for investments in new products and debt servicing. *Keiretsu* suppliers were still encouraged to compete for Nissan's business, but with high expectations for ongoing cost reductions. With this introduction of 'exit' mechanisms, Nissan's purchasing costs declined by 20 per cent by March 2002, one year ahead of the NRP schedule. The number of suppliers shrank by 40 per cent overall. One reason was platform consolidation; prior to NRP, Nissan had seven plants producing vehicles based on twenty-four platforms, while after NRP, four plants produced vehicles based on fifteen platforms.

From most accounts, this change of policy was implemented remarkably quickly and smoothly. Although Ghosn was criticized heavily at first by the Japanese media and government officials, he won internal support for these policy changes by creating a set of cross-functional teams that reported directly to the Executive Committee and were given access to all company information. These teams, rather than external consultants, had primary responsibility for developing recommendations for how to achieve the goals of the turnaround. Supplier companies often made dramatic changes in response to Nissan's new policy; for example, one long-time supplier of brake systems chose to focus on just one group of components, divesting itself of all other businesses and hence moving from a first-tier to a second-tier position in Nissan's supply chain.²⁶

Ghosn's next plan—called Nissan 180 to reflect an increase of sales by 1 million vehicles, an 8 per cent operating margin; and zero debt—was even more ambitious. To be achieved by April 2005, Nissan 180 called for a further 15 per cent reduction in purchasing costs while also developing twenty-eight new models for release by 2007—including seven completely new products. Soon signs of strain began to emerge. In May 2003, Nissan opened a new plant in Canton, Mississippi (completed in a speedy 2½

years) with three brand-new vehicles, a new workforce, and new suppliers—defying the conventional wisdom that new plants should build existing products to reduce start-up risks. By April 2004, quality problems from this plant (as revealed in J. D. Power's initial quality survey of consumers) dragged Nissan down to eleventh place, from sixth place the previous year, with 147 defects per 100 vehicles—greatly exceeding the industry average of 119. While the plant itself had start-up problems, many observers attributed the problems to 'cheap parts' from suppliers that couldn't be installed precisely (Bremner et al. 2004).

Is this quality decline an inevitable consequence of Nissan's switch to exit mechanisms? Ghosn's actions in response to this crisis suggest that he is returning to a more collaborative approach. Dramatically, he flew to Mississippi in May 2004 with over 200 Nissan engineers to undertake extensive examination of quality problems at the Canton plant and at suppliers; changes in product and process design followed, as well as operational problem solving and extensive worker training.²⁷

Then in November 2004, Ghosn held a meeting with Nissan suppliers at which he reportedly changed his position on the value of *keiretsu* relationships, saying, 'Not everything about the keiretsu was wrong. It simply did not function properly at Nissan in the past. With Nissan's subsidiaries, the *keiretsu* system was too cozy, but at Toyota, the system seems to be functioning very well. From now on, we need stronger ties with our suppliers.'

Nissan, immediately thereafter, raised its stake in Calsonic Kansei Corp., a maker of dashboard modules, from 27.6 per cent to 41 per cent (more than a controlling share). In order to support the high number of new product launches, Ghosn announced a new 'project partnership system' in which collaborative teams of Nissan and supplier engineers would 'review parts from scratch and aim to achieve higher quality at low cost.' A new plant, built on the grounds of a former university, will take the 'supplier park' concept of co-location one step further by putting supplier operations under the same roof with Nissan assembly lines. Furthermore, Nissan recognizes that its suppliers have not been keeping up with the R&D investments made by Toyota's main suppliers. According to Calsonic Kansei's CEO, Nissan's increased financial stake recognized that 'we needed financial assistance to oversee the process from R&D to extending our worldwide production and supply chain.'²⁸

Thus Nissan appears to be moving back towards 'collaboration with trust' as rapidly as possible, following its restructuring-driven move away from the voice-without-exit world of the traditional Japanese *keiretsu*. Nissan's new approach emphasizes extensive supplier involvement in

design, close collaboration on a project basis, and investments in supplier capabilities. How much these collaborations can flourish against the backdrop of Nissan's extensive shift to exit mechanisms in recent years remains to be seen. Nissan may be tempted to resort to exit threats to gain continued price reductions.

Toyota's CCC21 program may also contain indications of where 'collaboration with trust' is headed—not least because its architect, purchasing vice president Katsuaki Watanabe, has become the next CEO of the company, as of 1 July 2005. Many of the savings achieved since the program's launch in 2000 have come from teams of Toyota engineers working with suppliers on design issues, in particular the reduction of part counts and product variants. Often a supplier is asked not only to implement improvements in their own operations but also to help identify where Toyota's design and manufacturing process for a part increases costs. In one much-publicized example, Toyota once had thirty-five different versions of the interior assist grip installed above each door. After a joint investigation by a CCC21 team and suppliers, now only three grip styles cover all of Toyota's ninety models (Dawson 2005). This required as much—if not more—change on Toyota's side as it did from the supplier.

This type of collaborative problem solving—involving careful study and mutual adjustment—is also how Toyota hopes to cope with the challenge of meeting the 'China price' for many components. CCC21 is identifying global benchmarks for 180 key components on price and quality, including those established by major US and European competitors with extensive manufacturing facilities in China like Robert Bosch and Delphi. The goal is to come as close as possible to the benchmark price without any sacrifice in quality.

Where benchmarking reveals that an outside supplier has the best price, Toyota may award them a portion of its growing business for that component—providing competitive pressure while also giving its own group of suppliers more time and opportunity to make further improvements. This mix of continuity of relationship with competitive pressure amid growth in demand is characteristic of Toyota's approach with suppliers. The prospect that the China price may be so low that it takes considerable time for suppliers to match it will test Toyota's commitment to this strategy, though we predict that they will not switch towards exit despite the potential for short-term cost gains. In any case, those gains may be less substantial if these new suppliers do not have the strong problem-solving capabilities upon which Toyota relies.²⁹

Survival strategies at Stoneridge: scrambling to keep ahead of commoditization

This case considers how Stoneridge, a small American second-tier supplier, has coped with the 'exit'-oriented supply chain restructuring by US auto companies in recent years as of 2004.

Stoneridge is a supplier of highly engineered, application-specific, electrical and electronic products to automotive OEMs, including control devices, sensors, power distribution, and system management components. It operates twenty-four manufacturing plants in the USA, Mexico, Brazil, Europe, and Asia, and has 6,000 employees and approximately \$682 million in annual sales.

Jerry Pisani, Stoneridge's President and chief executive officer, provided these reflections on the demands placed on his firm by the Big Three OEMs during an International Motor Vehicle Program (IMVP) conference session on 'Building Tomorrow's Supplier Capabilities Amid Today's Pressures.' He enumerated a long list of additional expectations placed on suppliers by their customers, which we have grouped into four categories:

1. Costs to absorb (program management; inventory management, longer payment terms);
2. Investments to make (supplier-owned tools; advanced IT; advanced R&D and prototypes);
3. Liabilities to assume (warranty indemnification; charge-back for quality defects by customer plants); and
4. Rights to waive (intellectual property rights; established contractual provisions).

In response, Pisani argued, Stoneridge is pursuing multiple survival strategies.

1. The management culture must promote lean production/six sigma thinking in order to achieve operational excellence, both in manufacturing but also through involvement in iterated co-design; this is necessary but not sufficient because of convergence in performance on this dimension across the industry.
2. The product life cycle must be carefully managed. Both product differentiation (through features or associated services) and planned product obsolescence are needed to keep a few steps ahead of the threat of commoditization. By seizing on technical inflection points as a time to introduce new advanced features, margins can be boosted

on newer products even as prices are being reduced on older products. Deep knowledge of the customer is required to support this survival strategy, as is the relentless pursuit of cost reduction described above.

3. Even a small supplier must be mindful of operating in a global industry. Sales to multiple countries and automakers help build the volume that is necessary to amortize product development investments. A diversified customer base provides some protection against firm-specific volatility in demand and currency fluctuations. Working with partner firms (particularly for joint venture overseas investments) reduces financial risk, even as it raises coordination costs/risk. Participation in emerging markets provides option value with respect for future demand growth.
4. Investments must be carefully monitored to ensure adequate returns and to avoid the trap of maximizing revenues at the expense of profits. Profitability should be tracked at a micro-level, tied to product lines through activity-based costing. Inventory turns should be benchmarked against competitors to ensure that industry standards are met or exceeded. The balance sheet should be kept relatively unleveraged to retain maximum flexibility with regard to future investments.
5. Stoneridge's own suppliers must be carefully managed through disciplines of cost management, with an effort to focus on a small group of 'best in class' suppliers with whom relationships are long-term. These suppliers should be global in their manufacturing footprint but also in their strategic orientation. Stoneridge should work to educate them and directly develop their capabilities.
6. Learning should be maximized through selective use of consultants (as trainers, not doers); centralized corporate-level training (more focused and cost-effective than outside training); and attentive migration of best practices across facilities and divisions.

It is striking that even for a supplier like Stoneridge operating in a situation where its customers focus myopically on price and trust is minimal, many of these survival strategies involve collaboration—externally with OEM engineers, with joint venture partners, with their own suppliers, and internally across divisions and within plants. Evidence from Helper and Stanley's recent survey of small and medium-sized second- and third-tier suppliers in the northern Midwest states suggests that even competitors are exchan-

ging information and technical assistance; 37 per cent responded affirmatively to a statement that 'my firm receives technical assistance from competitors,' in contrast with only 17 per cent who said they received such assistance from their customers.³⁰

At one level, the Stoneridge survival strategies seem to point towards developing the most collaborative relationship with customers that can be achieved. Understanding customer needs and differentiating products to offer unique sources of value are two approaches consistent with the 'collaboration with trust' mode.

Yet for the most part, these survival strategies are self-protective vis-à-vis customers. The only remedy for operating in the face of a low-trust relationship with key customers is to manage product life cycles strictly to keep ahead of commodity pricing pressures. Financial survival requires avoidance of commitments that build volume and revenue but have low return on investment (ROI). Suppliers must be prepared to make quick moves to phase out product lines where pressures are strong to cut prices below actual costs.

Although Pisani did not say so, it is easy to imagine that he would prefer working with customers who are not entirely focused on price; and that he would be more likely to offer the fruits of Stoneridge's investments in advanced R&D and product innovation to those customers. This suggests that one dynamic over time for suppliers who have some customer relationships characterized by trust and some that are not, will be to shift effort and contribution (in design insight, technological innovation, and willingness to forward-invest) to the former group. The question for the 'collaboration without trust' group of customers is whether they will perceive this risk—of suppliers withholding contribution and shifting commitments—in time to remedy it, or whether they will find new sources of suppliers and new means—presumably market based, since reverticalization seems highly unlikely—of acquiring the knowledge and innovation that they would be losing.

Toyota comes to Delphi—cost management in the land of exit

This case study examines the efforts of one US-based 'mega-supplier'—Delphi Corporation³¹—to introduce 'collaboration with trust' into the US context where the 'exit' mode still prevails. The focus of the case study is Delphi's efforts to shift how it manages its own suppliers, because it is here that the firm's intention to move towards a more collaborative approach is most evident.

Delphi has undertaken a serious effort to implement the Delphi Manufacturing System (DMS) that is closely modeled on the Toyota Production System (TPS) in order to overcome its problematic cost structure, change mindsets, and diversify its customer base. For the purchasing function, this means implementing two core TPS processes known as 'cost management' and 'cost profit planning'.

One of Delphi's primary methods for developing DMS is to hire senior people—*sensei*, or teachers in Japanese—from Toyota and Honda, two of the world's best lean producers. Kaz Nakada, a member of the famed OMCD (operational methods and cost management division) at Toyota—the internal 'consulting' group created by Taiichi Ohno and the guardians/stewards of TPS—is now a lean *sensei* at Delphi. Where he has a similar role. With his help, Delphi has hired other Toyota people who are skilled in cost management and cost profit planning. Delphi also hired Dave Nelson, who was VP of purchasing at Honda of America for ten years.³²

Delphi's approach to changing supplier relations draws heavily from Toyota and Honda's approach with their US suppliers. For the small group of suppliers identified as 'core,' Nelson starts Delphi's lean supplier development process with a face-to-face meeting that includes the top executives at the supplier's location.

We do the meetings one by one; it's a time to set expectations. I explain that Delphi wants them to be a strategic supplier and is willing to work closely with them. We expect them to be committed to being the best supplier in the industry. I tell them it won't be easy but they'll be glad they made the effort. I explain how cost management works and that if the process works right, the margin of both companies will improve. We ask them to work with us on achieving the best possible understanding of cost and explain that developing this cost standard will take the place of the multiple rounds of bidding they are accustomed to. Then we help them become more competitive through lean implementation.³³

The next step is to educate the supplier in how the cost management process works. Materials from a Delphi lean supplier development session provide insights into how these TPS disciplines foster a 'collaboration with trust' approach.³⁴ Suppliers are told at the start that the remedy for dealing with relentless pressure on margins is achieving ongoing cost reductions. This is achieved through a strategic sourcing policy at Delphi that relies on both a cost management methodology and on lean supplier development activities; the former identifies the opportunities for cost reduction while the latter develops supplier capabilities to take advantage of those opportunities. Cost management is presented as a 'new paradigm'—the 'modern agriculture' approach that relies on science, logic, and facts vs. the old

paradigm ('hunters and gatherers') that relies on 'playing poker' through 'multiple bidding rounds.'

Suppliers are told what cost management is *not*: not a one-time cost-down method, not a tool to use against suppliers by squeezing their profits or sharing their proprietary data with others. Rather it is an explicitly collaborative pursuit of the 'ideal' cost, defined as the 'lowest total unit cost in the world that is achievable with effort.' (Tables 10.6a and 10.6b.)

Beginning with 'supplier cost' (from the original supplier quote or industry benchmarks), the first goal is 'agreed-upon cost.' This is achieved through discussion after the customer compares the supplier cost with its book of cost standards, developed through exhaustive study of all currently available versions of a component along with a similarly detailed assessment of current and future raw material and commodity prices. This cost standard takes the place of a multiple bid system; only very occasionally are multiple bids taken as a check on the cost standards. The cost standard provides a starting point for reaching the 'agreed-upon cost'; this is also where a short-term cost reduction target is applied. But the 'agreed-upon cost' does not define the parameters of the improvement efforts. That is set by the 'ideal cost'—the ultimate goal—which takes the minimal cost for each factor achieved anywhere in the world to construct a hypothetical target that is kept as a visible goal to avoid complacency as 'agreed-upon' cost targets are reached. (Table 10.3)

'Reality-based' price reductions are contrasted with the 'arbitrary price-downs' often inflicted upon suppliers by 'exit'-oriented OEMs. Arbitrary price-downs erode profits because they are mandated independent from progress on cost reduction. 'Reality-based' price reductions closely track cost reductions so that margins are preserved rather than eroded. Customers help suppliers achieve these cost reductions first by identifying the gap between 'supplier cost' and 'ideal cost' and then by drawing up 'creative improvement plans' to apply countermeasures to each identified gap.

This problem-solving approach of working collaboratively towards cost reduction is an archetypal example of interdependent process management. Delphi has a process for charting 'creative improvement plans (Fig. 10.2).' When completely filled out, such a chart is crammed with information and symbolic markers of a collaborative effort—names of champions on the customer and supplier sides, an explicit statement of the Delphi's 'savings sharing percentage' that is applied to each cost savings achieved (making it clear that the supplier retains a percentage as well); and very detailed breakdowns of cost savings for every factor of production and for every part number, reinforcing norms of information sharing and transparency.

Creative Improvement Plan Part Information		Creative Improvement Plan Champions	
Part Number		Delphi Buyer	Start Date
Part Description		Delphi Cost Leader	Start Date
Current Price		Delphi Commodity Team Leader	Start Date
Supplier		Supplier Champion1	Start Date
Supplier Mfg. Location		Supplier Champion2	Start Date

Creative Improvement Plan Cost Savings Goals											
LINE#	CREATIVE IMPROVEMENT IDEA (attach drawings, pictures, or any other relevant information if necessary)	CURRENT STATE PIECE COST	FUTURE STATE PIECE COST	DELPHI SAVINGS OPPORTUNITY	POTENTIAL DELPHI-PIECE COST SAVINGS OPPORTUNITY	Implementation	Target Implementation Date	LUMP SUM TOWARD IMPACT	TARGET IMPLEMENTATION DATE	PART P/O CHANGE EFFECTIVE DATE	CHAMPION
1					\$0.00						
2					\$0.00						
3					\$0.00						

Fig. 10.2 Delphi form for charting creative improvement plans

In many cases, these cost reduction processes carried out by Delphi together with its suppliers yield savings. Table 10.6 shows one example that produced a 25 per cent reduction in supplier unit cost. The means for achieving the savings included changes in production layout that improve flow and eliminate wasted motion, thus reducing direct labor costs; improvements in the accuracy of material and cycle time specifications; and improved packaging. This process emphasizes identifying cost elements accurately by eliminating faulty specifications and erroneous assumptions, even if the more accurate assessment of a given cost element is higher than the original estimate.

If cost management is the short-term, real-time discipline for achieving cost reduction, cost profit planning is the long-term approach to eliminating cost at the source. Cost profit planning views the sources of manufacturing cost differently, in comparison with traditional manufacturing cost accounting. In the traditional view, design accounts for 5 per cent of costs; materials for 50 per cent; labor for 15 per cent; with 30 per cent allocated to indirect and overhead costs. In contrast, cost profit planning views design decisions as affecting 70 per cent of cost, vs. only 5 per cent for labor, 5 per cent for overhead, and 20 per cent for materials.³⁵

Table 10.6a. Cost management example

Before		After	Cost (%)
	Machining		
- 1 operator running 1 CNC station		- 1 operator running 3 CNC stations	8.1
	Part stacking		
- 1 operator running 1 stacker - Manual stacking performed as needed		- 1 operator running 2 stackers - No manual stacking required	5.3
	Assembly		
- Straight line layout - No communication - 5 piece flow - 6.5 operators - 90 pieces/hour		- U-shaped module - Improved communication - 1 piece flow - 6 operators - 126 pieces/hour	8.9
25% reduction in overall cost with improvement to supplier margins			

Source: Delphi Corporation.

How can design affect so much of cost? Decisions made during design lock in certain requirements for labor and materials and logistics. Hence the primary way to tackle reducing those costs on a long-term basis is to go back to the point in the design process where alternative choices could be considered.

The cost profit planning process developed by Toyota proceeds in the following way. Each aspect of cost is tracked back to that point in the design process where it is locked in, and a lower cost target is assigned. Where does this cost target come from? Unlike cost management, which focuses on what is hypothetically attainable from best possible manufacturing practice, this cost target is calculated following the opposite of a cost-plus logic. The desired market price for the entire vehicle is set by the OEM based on analyses of consumer perceptions of value, the desired level of profit is subtracted, and what remains is the target cost for the vehicle. This is then decomposed, following the same logic, to come up with a target cost for each component, and then for each design element of the component. Value engineering activities during product development then attempt to achieve that cost target.

The implications for collaborative and iterative co-design are enormous. Through supplier involvement with value engineering activities, costs can be taken out before the manufacturing process even begins, making it much easier to envision reaching the hypothetical ideal cost, or at least closing the gap substantially. This supplier involvement represents a blend of design ideas and operational ideas; suppliers are primarily expected to

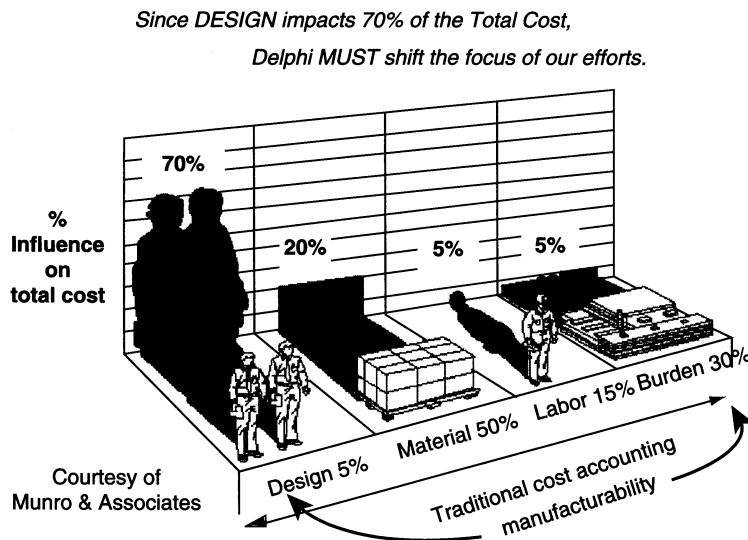


Fig. 10.3 Cost profit planning at Delphi

contribute their input on how to make the manufacturing process easier (what is sometimes called 'design-for-manufacturing'), but at the same time, they are learning far more about the design aspects than they would under the traditional 'black box' system.

Supplier impact on costs during design can be substantial. We saw a summary of one such example that first identified the expected cost from the cost standards set by external research; next showed the range of supplier quotes, including the quote from the recognized cost leader; and then indicated that the cost leader, during the design process, recommended a switch from a two-step to a one-step manufacturing process. This change reduced the part cost 45 per cent below the cost leader's cost with the old design. This dramatic cost reduction was achieved without any adverse impact on the supplier's profit margins.

Delphi summarizes, for its suppliers, what is different about this approach in the following way. Prices are set not by multiple rounds of bidding but by comparing the 'supplier cost' with the cost standard and having discussions to get to an 'agreed-upon cost.' Further improvements upon the 'agreed-upon' cost are achieved through the 'creative improvement plan' in the short term and by cost profit planning—to eliminate costs during the design stage—in the long term. After starting with a negotiated already low cost, Delphi works with the supplier on cost reductions and

Table 10.6b. Cost profit planning example

Product:	Oil Control Valve
Project:	OCV
Division:	E&C
Annual Volume:	2 million +
SOP:	November 2005
Component:	Frame
Design:	2-piece stamping with spot welding
Costbook:	0.80 euros
Supplier quotes:	0.28–0.75 euros
Cost leader estimate:	0.33 euros
VE activities:	Cost leader and suppliers recommend 1-piece
Status:	1-piece design in process
New cost leader estimate:	0.18 euros (45% avoidance over 2-piece)

Source: Delphi Corporation.

price reductions follow as a matter of course, consistent with norms of sharing cost savings.

Delphi then tells suppliers what changes in customer and supplier roles are required to make this collaborative mode a reality. The customer must: (1) become experts on commodity pricing and manufacturing processes in order to develop effective cost standards; (2) focus on cost discussions vs. multiple rounds of bidding and negotiating; (3) get the lowest upfront ('agreed-upon') cost through reliance on cost standards and benchmarking; (4) establish 'creative improvement plans' with suppliers and document their 'reality'—their actual progress—in implementing these plans; (5) work to help suppliers develop capabilities and pursue ideal cost, focusing on their manufacturing realities rather than price; and (6) share cost improvement savings with the supplier.

The supplier, in turn, must: (1) provide cost breakdown/cost standard information; (2) discuss operational issues with the customer; (3) identify where the customer's decisions (design, scheduling, commodity purchasing) are adding cost and tell the customer; (4) take ownership of the creative improvement plan and identify opportunities for cost reduction; (5) assign target costs to specific design and manufacturing steps and pursue those cost savings aggressively; and (6) share cost improvement savings with the customer.

It is worth noting the extent to which these Toyota-derived processes of cost management and cost profit planning capture the essential elements of collaborative community as defined in this volume. Disciplined processes and a focus on facts ('realities') provide reliable and valid performance outcomes marked by ongoing improvements that build common purpose between the customer and supplier and, over time, trust. An

ethic of contribution permeates the customer–supplier relationship, from the joint development of creative improvement plans to joint involvement in design to achieve target cost goals: the core value or standard for trust is not performance to preset targets, but the willingness and capability to engage in discussion about how to work towards solutions of problems. There is a strong expectation that all parties will frame problems as opportunities for mutual gain. Both sides take responsibility for gathering and sharing relevant information and vow to avoid gaming behavior that exploits information asymmetries.

What success has Delphi had implementing this system? The potential impact is certainly huge. As of the end of 2004, Delphi has 4,000 suppliers and purchases \$14 billion in parts annually. This number of vendors is greatly reduced from the roughly 9,000 suppliers in place when Dave Nelson arrived but is still judged to be too high, given the intention to have more long-term collaborative relationships. The intention is to focus purchases on 1,000–1,500 suppliers. Three years after his arrival at Delphi, Nelson has completed ninety-two expectation-setting meetings with senior executives at this core group.

This patient one-at-a-time approach seems to be bearing fruit. Under the direction of a former Toyota cost management *sensei*, cost standards are steadily being developed for all the Delphi commodities and manufacturing processes. Quality levels have improved from 10,000 defective parts per million in 1995 to 28 PPM in 2003. The director of Delphi's lean production activities told me that in 2003, Delphi saved \$500 million from lean-derived improvements in design, manufacturing, and purchasing.³⁶

This effort to remake Delphi's relationship with its own suppliers has certainly run into obstacles. Paul Brent, director of Delphi's supplier development program, said,

I spend a lot of my time making sure that our purchasing guys act in ways consistent with the relationship we're building with the supplier through cost management and lean supplier development. We acknowledge to the suppliers that we are in the midst of our own lean transformation. It helps that with the lean supplier development process, we are already starting to build good relationships and trust. We don't even deal with price. We assess the state of their operations at the beginning and get the benchmarking in place to capture improvements, and then we begin working on creative improvement plans.³⁷

When we asked Dave Nelson what he sees in the future, he said,

We're moving rapidly in this new direction. We're working more and more closely with Toyota and getting more business from them; they are lending us some

of their best lean supplier development engineers. I see a one-way evolution in the move towards cost management. Once we get past a certain point, it will be impossible to unravel. Suppliers won't want to do conventional bidding on parts. A customer that insists on bids will end up paying significantly more.

Evidence of various kinds is emerging to suggest that those following the 'collaboration with trust' approach are reaping real economic gains. Delphi provides its suppliers with data on the profits achieved by companies that follow cost profit planning vs. those that do not; the difference is roughly 2 to 1. A 2004 consulting study³⁸ finds evidence from surveys that suppliers working with Toyota and Honda achieve costs that are, on average, 8 per cent lower than those working with other North American OEMs, mostly attributable to the avoidance of time and cost during multiple bidding rounds and to the elimination of design-influenced cost based on supplier input during the product development process.

Finally, in recent interviews, the authors are hearing some suppliers saying, privately, that they are increasingly reserving their most advanced technological innovations for their Japanese customers. While they can't afford to refuse business from the Big Three, they can refuse to provide their best knowledge and effort to customers who relentlessly squeeze their margins and violate trust by taking advantage of having access to proprietary supplier information.

The Delphi case shows that it is possible for a first-tier supplier with historical roots in the traditional US approach of 'exit' to move towards 'collaboration with trust' in its relationships with both customers and second- and third-tier suppliers. Delphi's progress has depended on senior management commitment to putting 'lean processes' in place throughout the company; on the presence of knowledge resources (*sensei*); and on the growing willingness of suppliers to differentiate among their customers in their level of contribution to design innovation and cost improvement.

Even amid its current financial difficulties, we believe that enough people at Delphi have seen the benefits of collaboration with trust—both senior management and the middle ranks of design and manufacturing engineers and purchasing staff—to sustain the commitment to this approach.

Implications of collaboration with and without trust

This section discusses implications of the above analysis for our understanding of collaborative community. We address the dynamics of collaboration in this context by addressing four questions: (1) Is trust needed for

Collaboration in Supply Chains

Table 10.7. Collaboration with and without trust

	Collaboration without trust	Collaboration with trust
Legacy mode of exchange	Exit	Voice
Governance level (purchasing regime)	Adversarial/short term and arm's length	Long term and relational
Task level (design/engineering)	<ul style="list-style-type: none"> • Iterative co-design • Interdependent process management • Low discretionary effort (?) 	<ul style="list-style-type: none"> • Iterative co-design • Interdependent process management • High discretionary effort
Information exchange	Low at governance level; high at task level	High at governance and task level
Trust	Low governance; ? task	Emergent → High

collaboration? (2) Can the gains from collaboration with trust be appropriated by other firms that are practicing collaboration without trust? (3) What are the micro-level social and economic dynamics of collaboration without trust? (4) What constraints are faced over time by collaboration with trust?

Before doing so, we summarize similarities and differences between collaboration with and without trust in Table 10.7. The difference in legacy mode primarily affects the purchasing regime at governance level. At the task level, we see similar reliance on iterative co-design and interdependent process management regardless of the level of trust at the governance level. However, we speculate that the level of discretionary effort applied to making the economic relationship work effectively (including solving emergent problems) may differ even at a task level, as a consequence of a 'trickle-down' effect of the lack of trust at the governance level.

With respect to information exchange, we see similarly high amounts at the task level but a striking feature of low trust at the governance level is a constricted and formalized flow of information—something that should have long-term consequences for quality. Finally, with respect to trust at the task level, we believe that empirical investigation will be needed to determine the conditions under which this is possible. We now address a series of questions on the dynamics of collaboration with and without trust.

Is trust needed for collaboration?

The evidence of this chapter suggests that trust is not a *precondition* for collaboration. We argue that a shift of knowledge-intensive design work from OEMs to suppliers is under way, as part of a move to deverticalize the automotive industry. This work requires collaboration by necessity,

particularly given a (still) largely integral product architecture and the diffusion of innovations of iterated co-design and shop-floor problem solving associated with lean production (Toyota Production System). The evidence of this chapter is that firms are being pushed in the direction of collaboration whether or not they have prior traditions of trust-based supplier relations. Collaboration without trust can emerge where 'exit' approaches to purchasing routines and governance mechanisms persist.

However, we predict that collaboration will prove to be more successful if it takes forms that allow for the emergence of trust over time. Given a volatile set of external circumstances and ongoing advances in technology that must be absorbed, collaborative co-design—when well executed—will lead to superior outcomes and provide experiences of success that will help build trust. This trust is likely to be fragile at first, easy to destroy with a single exploitative act during the purchasing process, such as the customer sending the supplier's proprietary design information to competitors seeking a competitive bid. It may also exist primarily at a micro-level of personal relationships among engineers and managers who have worked together during co-design and may not diffuse readily to individuals who are not part of the co-design experience such as purchasing agents.

Can the gains from collaboration with trust be appropriated?

Since, increasingly, suppliers work with multiple customers, some of which help the supplier improve through supplier development activities, there is a risk that other customers might 'free ride.' Imagine that a supplier has improved its design and manufacturing capabilities through collaborative interaction with Customer A. Now suppose that Customer B, not willing to make such investments in supplier capabilities and operating under a low-trust purchasing regime, can gain the benefits of this supplier's superior capabilities simply by awarding it some business, under the assumption that the supplier capabilities will diffuse naturally within the firm. Or, Customer B could demand to receive the same annual cost reduction offered to Customer A, figuring that the only way the supplier could attain these reductions would be through the same process improvements.

Many observers do make an argument of this kind, claiming that the improvement of supplier capabilities in the USA, prompted by the Japanese transplants, has given their Big Three competitors a considerable upgrading in cost and quality—a 'rising tide lifts all boats' hypothesis. Yet Dyer's (1997) evidence suggests that this may be only partially true: he

found that the diffusion of best practices within the same supplier can be remarkably low. Two production lines side by side within the same supplier plant, one dedicated to a Big Three customer and the other to a Japanese transplant, had widely different performance. His explanation was partly based on organizational barriers to diffusion of knowledge and partly on differences in production philosophy that affected manufacturing outcomes. For example, Toyota worked with the supplier plant to implement one-piece flow of parts through the production process, emphasizing the use of small containers that could be moved by hand and short lead times. These techniques were not useful to the GM line in the same plant, because GM mandated the use of standard containers, containers that were so large that forklifts were required to move them.

Our view is that while some capabilities are generic and all customers will benefit from a supplier's improvement, others are relationship and context specific. Even without deliberate intent, a supplier drawing on deep knowledge of Customer A achieved through a long-term relationship governed by trust and frequent interactions will be able to provide more innovative designs and insightful process improvements than it will be able to provide to customer B with whom it has an arms-length relationship applying generic process management routines. The consequences over time will be a growing gap between what Customer A and Customer B are receiving, even from the very same supplier.

What are the micro-dynamics of collaboration without trust?

One way to describe the micro-level motivations and dynamics of collaboration without trust is by focusing on the typical culture and experiences of different professions. For example, consider a general hypothesis that the engineers want to collaborate, but the automaker purchasing agents are so intent on squeezing suppliers for every last nickel that they are eliminating the prospect of effective collaboration. In the absence of direct evidence, we would speculate that value and personality differences are important: that an 'ethic of contribution' among engineers inclines them more positively towards collaborative activity than purchasing agents. Unlike quality control/improvement, which is often a win-win situation between workers and managers in a manufacturing setting, parts sourcing may lack a task that would pull automaker purchasing agents and supplier salespeople into greater interdependence and help develop norms of reciprocity.

Another framing would use the language of incentives: 'Engineers and automaker purchasing agents are each responding rationally to the

incentives they face.' Engineers are evaluated on completion of interdependent tasks (such as whether designs are finished on time and pass crash tests) that require collaboration between counterpart engineers at automaker and supplier. Automaker purchasing agents are rewarded for reducing piece prices, causing them to evaluate the benefits of collaboration (vs. trust-undermining price-reducing actions) in each period for which they are rewarded. They thus ignore a potential lost stream of future benefits from collaboration.

Both framings contribute to an explanation of why the cost management/cost profit planning approach used by Toyota (and being adopted by Delphi) can be successful at the governance level, facilitating collaboration with trust. First, it provides a different set of goals and experiences for purchasing agents that over time changes their culture. The Toyota approach involves coming to an agreement upon an initial cost based on careful preparation of cost standards and then pursuing cost reduction to reach the target cost. This decision to focus on the 'reality' faced by the supplier's manufacturing plant, and hence to reduce prices only after reducing costs, provides the basis for norms of mutual gain and reciprocity and builds trust. Second, purchasing agents are judged based on their ability to contribute to these tasks, giving them an incentive to think about the value of collaboration over a longer period.³⁹

What constraints are faced over time by collaboration with trust?

Long-term collaborative relationships with little or no threat of exit can certainly face constraints in the form of complacency, rigidity, 'group-think' tendencies, etc. Meta-routines for examining skeptically all current practices may be important to avoid stagnation. Furthermore, sudden environmental changes or financial pressures may require rapid response that might not allow fulfillment of the commitments of collaboration—a tension between flexibility and the market as mentioned early in the volume. However, as long as all unexpected shocks—whether from external or internal sources—are approached according to collaborative norms of information sharing, reciprocity of effort, shared distribution of gains and losses, firms following these norms should possess a greater adaptability than firms which are able to make very quick short-term decisions. It is for this reason that MacDuffie (1995) describes the Toyota Production System in terms of 'flexible production' rather than 'lean production.' This perspective is supported by empirical evidence that flexible produc-

tion plants can achieve high levels of product variety without suffering a decrement in cost or quality performance.

Predictions about the future of 'collaboration without trust'

Above, we predict that collaboration without trust will not perform as well as collaboration with trust, and also predict that suppliers will prefer to deal with customers operating collaboratively with trust. This would suggest a steady evolution towards collaboration with trust as the dominant mode.

Yet we do not expect that collaboration without trust will disappear any time soon. From the perspective of transaction cost analysis with which we began this chapter, it may seem surprising that suppliers would make investments in assets tied to one customer (e.g. 'free' design work absent any contract) with so few safeguards. However, suppliers have assets they need to pay off, in plant and equipment, technology etc., and if they can cover part of these costs, they are still better off than they would be without any sales. Customers know this, and can bid commodity producers down to their marginal costs. To the extent they are willing to accept less than perfect substitutes for their first-choice product, they have bargaining power over non-commodity producers as well.

This transition could last for a long time. The overcapacity situation affecting the parts sector is not likely to change quickly; indeed, the forces promoting the addition of capacity in low-wage countries (their large direct-labor cost advantage) as well as those slowing the removal of existing capacity in high-wage countries (the long-lived nature of capital equipment) remain strong.

It is also possible that some future trends affecting supply chains in the automotive industry could decrease the necessity for collaboration. To the extent that tasks relatively predictable in their frequency, timing, and informational requirements can be automated (relying on sophisticated software that can be contextually responsive), the total requirement for collaboration may decrease, even as the proportion of non-automated tasks that are collaborative—and that would benefit from trust—would increase. Furthermore, if fundamental technological shifts—towards alternate fuels, new drive train designs such as fuel cells, new materials, new uses of information technology within the vehicle—break the dominant design sufficiently for a more modular product architecture to become possible, collaborative activity could shift towards module definition and interface standardization and away from high interdependence during design, with more market-based modes of module procurement.

Even in the presence of dramatic technological change, we predict that collaborative activity between automakers and suppliers will remain high and might even increase. It is tempting to speculate that customers would benefit from relationships with less commitment when 'radical' or 'disruptive' innovations (Abernathy 1978; Christensen 1997) make their current suppliers' capabilities obsolete.

This seems plausible, but does not in practice seem to have been the case in the auto industry. The industry has over the last twenty years adopted a number of such innovations (such as the change from mechanical to electrical control of carburetion, suspension, etc., and experimentation with alternative power trains). But it is not clear that automakers using more collaboration were slower than others, and in fact most of the new technologies are supplied in partnership with existing suppliers. Perhaps this continuity is due to features of the auto industry (such as the integrality of its products, high volumes, and high demand for reliability) that mean even a new supplier of a radically new product must take a lot of time to learn about unchanging features of the industry, giving existing suppliers a chance to learn about (or buy) the new technology.

What we can assert with confidence is that the automotive industry will continue to be a fruitful context for examining modes of inter-firm economic exchange, since its global scale, technological scope, and overwhelming product and process complexity generate such a challenging and diverse set of decisions about purchasing strategy. The important intangibles of 'look and feel' associated with automotive products and brands will resist any sweeping move towards modularization and preserve the knowledge intensity and idiosyncratic requirements for systemic integrity that place collaboration at the heart of this industry.

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Notes

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1. Collaboration between automakers and their suppliers was not invented by the Japanese. Until the 1920s, US suppliers played a key role in product design and innovation in the industry. Gradually, vertically integrated divisions came to take on this role, and suppliers (except for a few large independents) played the role of 'cheap capacity.' Vertical integration fell in the 1930s, then rose in the 1950s before falling again in the 1980s and 1990s. See Hochfelder and Helper (1996); Helper (1991); White (1971).
2. Hirschman offers a third category, 'loyalty,' which affects the relationship between exit and voice by discouraging those who are dissatisfied with an economic relationship from leaving it immediately. With less likelihood of 'exit,' there is an increased likelihood they will resort to 'voice,' thus providing valuable information to improve the relationship. This addresses the situation in which the presence of both exit and voice options yields a net bias towards exit; the possibility of exit may, in Hirschman's words, 'atrophy the development of voice.' The implication, in the supply-chain context, is that a supplier will benefit when its customer displays some loyalty and pursues voice mechanisms. Indeed, choosing to display such loyalty is central to the strategy associated with this mode of exchange, since especially at the beginning of relationships, there are often bumpy periods in which the benefits of switching (often tangible, such as a lower price) seem to outweigh the loss of the ongoing relationship (which entails costs that are often hard to measure, such as loss of trust).
3. We define both 'collaboration' and 'trust' below. Susan Helper coined this phrase in connection with a presentation at an International Motor Vehicle Program (IMVP) conference in Sept. 2002. See also Helper and Stanley (2004).
4. For example, a supplier with small stamping presses might want to design small parts and weld them together, while a supplier with larger presses would prefer to produce fewer, larger parts.
5. These practices include: simultaneous engineering during product development, involving iterated communication about a design space that is steadily narrowed to reflect emergent understandings of which choices will optimize the design

across multiple dimensions of performance; continuous improvement routines that pursue 'root-cause' solutions to cost and quality problems through rigorous, comprehensive experimentation with different manufacturing approaches; and just-in-time inventory practices that interlink supplier and automaker factories in a minimal-buffer regime that requires precise coordination and well-developed logistics capabilities. See Fujimoto (1999); Womack et al. (1990); MacDuffie (1997); Helper et al. (2000).

6. It is unclear how much of an independent effect the new theories had, or whether they were rationalizations of decisions taken due to labor cost differentials. Attention to these differentials was magnified due to automakers' accounting systems, which focused on direct labor costs and did not capture other kinds of costs as effectively.
7. Ironically, the mega-suppliers often became *more* vertically integrated, as they strived to provide one-stop shopping for their deverticalized customers.
8. The Clark and Fujimoto typology isn't comprehensive from the perspective of this chapter. Black box subcontracting could be purely market based; the OEM could essentially say to the supplier 'here are the parameters, meet them, if you don't we'll go somewhere else.' Indeed, this approach is what some observers imagine will be commonplace with a modular product architecture, as discussed below. In practice, the category of 'black box' in Clark and Fujimoto's data collection did involve considerable interactive deliberation between OEM and suppliers over the parameters of a component and how they were to be achieved. Perhaps a closer concept to our description of 'pragmatic collaboration' is relational subcontracting (the term used in transaction cost economics). Certainly the issue of how extensively the parties work together on determining parameters, identifying design problems, and jointly solving them is central to the issue of collaboration in supply chains.
9. See Ulrich (1995) for the classic definition of modules as involving a one-to-one mapping from component (design element) to function. For a useful reconceptualization of product architecture that challenges and extends the Ulrich definition, see Fixson (2005).
10. Fixson et al. (forthcoming) track the evolution of cockpit designs over three periods while also tracking the extent of outsourcing of design and manufacturing tasks from automakers to suppliers. They find that outsourcing is much more extensive than any change in product architecture; indeed, the changes described as 'stage 1 modularity' are primarily to allow one-step installation during assembly and do not reflect any of the more fundamental attributes of modularity.
11. See Langlois (2002); Chesborough (2002); Jacobides (2002); Brusoni et al. (2001); Sabel and Zeitlin (2004).
12. For an expanded treatment of this line of argument, see MacDuffie (2005).
13. A similarly incorrect prediction of an inevitable decline in collaboration due to increasing standardization was made by proponents of e-business in the late 1990s. See Helper and MacDuffie (2001).

14. By 'collaboration,' we mean undertaking tasks that require ongoing discussion; the outcome of these discussions is frequently a contingent action not anticipated or provided for in a contract. In contrast, in a non-collaborative arm's-length or 'exit' mode, a division of labor is agreed on in advance and little discussion occurs across the agreed-upon interface. By trust, we mean taking actions that leave oneself vulnerable to another party, with the expectation that one will not be taken advantage of. This definition corresponds to Sako's (1992) definition of 'goodwill' trust.
15. This speech was reported in the 12 Aug. 2002 issue of *Automotive News*; the entire text is available at www.autonews.com/article.cms?articleId=40392.
16. www.thefabricator.com/Articles/Fabricating_Exclusive.cfm?ID=25.
17. Herrigel (2004); Whitford and Zeitlin (2004).
18. In future research we will investigate the relationship between changing incentives and changing attitudes. Top management frequently expresses frustration that their subordinates do not react quickly to changes in strategy. For the case of purchasing, we would like to understand better the extent to which this slow reaction is due to some inherent resistance to change, a difficulty in changing habits, and/or reward structures not changing to reflect the changed strategy. This transition seems particularly difficult when a firm moves from the relatively clear and measurable incentives of exit (minimize piece prices and the costs of switching suppliers) to the more multifaceted, subjective requisites of voice (nurture suppliers, but don't accept substandard performance).
19. See Helper et al. (2000); Helper and MacDuffie (2001).
20. See Brusoni et al. (2001).
21. By most accounts, Toyota has largely succeeded in reaching this goal, saving nearly \$10 billion over its five-year span, a reduction of approximately one-third in procurement costs. The target of \$1.7 billion in cost savings for the fiscal year ending in March 2005 has not been met, however, falling short by 15% because of high steel prices. In response, Toyota is aiming to reduce the number of steel parts in an average vehicle from 610 to 500. See Chester Dawson, *Business Week*, 21 Feb. 2005.
22. See Sako (2002).
23. Ohba seminar, Institute for International Economic Studies Seminar Series #9706, Toyota Motor Corporation, 1997; cited in Sako (2003). See also Liker (2004).
24. This account of the Nissan turnaround is based primarily on Milliken and Fu (2005), supplemented by articles from *Business Week*, *Fortune*, *Forbes*.
25. This was not an acquisition but an alliance: Nissan retained its name and board of directors, the Nissan board continues to choose the CEO, and Nissan took the primary responsibility for implementing a revival plan.
26. Ghosn's account is captured in various interviews and in a *Harvard Business Review* article (Ghosn 2002), with an extended treatment of the Nissan turnaround in a book titled *Shift: Inside Nissan's Historic Revival* (Ghosn 2004).
27. See Welch (2004); Mackintosh (2004); Bremner et al. (2004); Sawyer (2004).

28. See Mikawa and Okudaira (2005).
29. In contrast, the exit-based legacies of documentation and codification (plus lower quality standards) may mean that a firm like GM can more quickly incorporate new suppliers with weak management skills.
30. See Helper and Stanley (2004).
31. Delphi is a world leader in mobile electronics and transportation components and systems technology. Multinational Delphi conducts its business operations through various subsidiaries and has headquarters in Troy, Mich., Paris, Tokyo, and São Paulo. Delphi's two business sectors—Dynamics, Propulsion, Thermal, and Interior Sector, and Electrical, Electronics, and Safety Sector—provide comprehensive product solutions to complex customer needs. Delphi has approximately 184,000 employees and operates 167 wholly owned manufacturing sites, 42 joint ventures, 53 customer centers and sales offices, and 33 technical centers in 40 countries. Delphi can be found on the internet at www.delphi.com as (data as of 13 May 2005).
32. The supplier development program that Nelson directed at Honda is analyzed in detail in MacDuffie and Helper (1998).
33. MacDuffie interview with Dave Nelson, Jan. 2005.
34. This account is drawn from presentation materials from a Delphi meeting with its suppliers in Nov. 2004.
35. Munro & Associates, industry average, cited in Delphi presentation to suppliers, Nov. 2004.
35. MacDuffie interviews at Delphi, Dec. 2003 and Jan. 2005.
36. MacDuffie interview with Paul Brent, Jan. 2005.
37. MacDuffie interview with Paul Brent, Jan. 2005.
38. 2004 Global Supply Management Survey, Planning Perspectives, cited in *Automotive News*, 10 Jan. 2005. When suppliers rank OEM-supplier working relationships, Toyota is first ranked, followed closely by Honda while Ford is ranked next-to-last and GM is ranked last. The gap between Toyota and GM has widened each year from 2002 to 2004.
39. Why do suppliers continue to participate in collaboration without trust? As we have discussed, in these relationships suppliers (a) pay for things that OEMs used to pay for (such as program management), without an increase in the piece price they receive, and (b) make specific investments in design without perfect safeguards (to use Williamsonian language). That is (to take a real example from our interviews), they invest sometimes millions of dollars to create a complete design for the interior of a minivan, a design that was not used because the automaker decided not to make that particular model, and that could not be adjusted to fit another model.

Suppliers' willingness to take on new variable costs (as in (a)), is a disguised price cut, which is possible due to increased bargaining power by OEMs due to supplier excess capacity. Suppliers accept these new terms because they have sunk investments; the new price is still greater than their marginal cost.

Suppliers might make investments in 'non-redeployable assets' (Williamson 1975) (case *(b)*) for a variety of reasons. These investments (e.g. in design engineer time) might allow them to earn a return on other assets (a factory). Or, there might be uncertainty about the buyer's ability to hold up the supplier. (In contrast, in transaction cost theory, if a firm invests in a specific asset without contractual safeguards, there is a 100% probability that it will not recoup the fixed cost of this investment. In our case, this isn't always true—the OEM might not have an alternative supplier that can step in immediately, the purchasing agent might have a longer discount rate than most, or other factors might make the net present value of cooperation greater than that of defection.)

This scenario also differs from that of Axelrod (1984) and of Helper et al. (2000) in that there is not necessarily an increasing payoff to collaboration as the number of periods of collaboration increases. As we have argued, engineers may see this payoff increase due to greater familiarity with each other's design practices, etc., but purchasing agents often have no way of valuing this familiarity.