The Global Internet Economy

Edited by Bruce Kogut

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Suppliers and Intermediaries

Susan Helper and John Paul MacDuffie

The realm of e-business known as "business-to-business," memorably captured in the acronym B2B, has already passed through its first cycle of hype to disparagement, following closely on the heels of its near-relative, B2C ("business-to-consumer"). This is useful, for it means that the spirited but ultimately limited debate about whether new economy firms powered by new business models would overpower and displace old economy firms is largely closed. Instead, we can focus attention on a broader inquiry into the ways that the capabilities of the Internet can alter the modes of exchange among firms.

As the dust settles from the dot.com bust, B2B emerges as an enduring feature of the Internet economy in most of the countries featured in this volume. The Internet offers new tools that can be readily combined with the assets and capabilities of incumbent firms to transform the business processes of procurement and supply, or at least to make them much faster and more efficient. Whether these effects are evolutionary or revolutionary—and whether they lead to convergence or preserve divergence across industries and nations—is the central focus of investigation in this chapter. In this sense, our analysis of B2B provides an opportunity to understand how historical and institutional differences among countries affect the development of the Internet economy.

Initial predictions about B2B, as for the Internet overall, were deterministic in nature. Many argued that B2B would sweep away national differences in purchasing patterns; one representative quote states that "a supply chain revolution is underway.... The Internet will reduce search

and price discovery costs to a minimum.... The cost of changing suppliers will be zero" (Cohen and Agrawal 2000). In contrast, our view, encouraged by recent history, is that B2B will be evolutionary, not revolutionary. Business-to-Business reduces costs of transferring most types of information and, therefore, reduces the costs of most modes of exchange. Because switching to a new mode of exchange is expensive, most firms will develop B2B consistent with their existing mode. In this way, B2B will preserve divergence in modes of exchange.

We use the term "mode of exchange" to convey a set of standard procedures, common practices, communication patterns, and norms governing routine behavior in the value chain relationship between a supplier and its customer. We intend a meaning broader than a purely monetary definition of exchange, because we include the exchange of information and "know-how," the development of trust, and the influence of norms of reciprocity. A mode of exchange has a "legacy" that influences its future development; this legacy includes managerial mindsets—cognitive ways of characterizing means and ends, problems and solutions—as well as long-standing relationships embedded in incentive systems, procedures for transactions, regulation, and law.

Business-to-Business potentially affects the mode of exchange in two ways. First, it can alter how core tasks are accomplished. Second, it can change the infrastructure that underpins transactions. The legacy of a mode of exchange will generally tolerate changes of the first kind and be more resistant to changes of the latter kind. Thus we must also investigate what forces or factors, independent of B2B, may affect the infrastructural aspects of modes of exchange. Where the legacy of a particular mode is disrupted, it may create greater opportunities for B2B to have a more transformative impact.

In this chapter, we focus on incumbent firms in well-established industries whose historical patterns of exchange, generally grounded in national infrastructure and institutional norms, can provide the baseline for evaluating B2B's impact. The analytical exercise first takes the form of examining how different models of B2B affect core procurement tasks at firms that have a dominant mode of exchange. The second step is asking how various external factors will influence the infrastructural aspects of a given firm's mode of exchange and hence the potential impact of B2B. We will focus particularly on three factors: the consolidation and re-

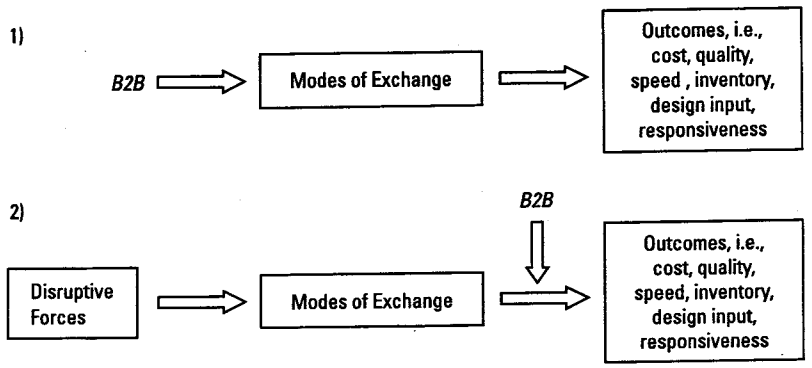

Figure 11.1
Two steps in analyzing B2B's impact on modes of exchange

structuring of incumbent firms; the deverticalization, global extension, and reconfiguration of supply chains; and changes in product markets and product architecture. Figure 11.1 displays the logic of this two-step analysis.

We will use the world automotive industry as our primary case for this analysis. Not only are the historical modes of exchange well documented in the industry, at both national and company levels of analysis, but the recent move by a majority of the world's largest automakers to establish an industry-wide B2B exchange (Covisint, which stands for Cooperation, Vision, and Integration) provides us with a specific B2B model to consider. By examining Covisint against the background of historically based modes of exchange in the auto industry, we can gain an excellent window into the potential impact of B2B on global industries and national economies. The dynamic task is to speculate (for B2B is in its infancy) on how national infrastructure, industry structure and competitive dynamics, and firm strategies for this particular industry will both shape and be shaped by the diffusion of B2B.[1]

We will address these questions: Will technical change in the form of the Internet transform relationships that automakers such as Toyota have for decades nurtured with their suppliers, replacing close ties with cutthroat auction markets? Will the strategies of multinational companies take precedence over national differences in infrastructure? Or will

distinctive patterns of supplier relations remain, with companies and nations developing e-business tools in ways that reinforce old paradigms? In short, will the Internet overwhelm historical choices, facilitating the convergence of national and firm approaches to procurement, or will it reinforce existing differences? Although we mostly anticipate the reinforcement of existing differences, as noted above, we are alert to particular external changes that, by fundamentally disrupting current modes of exchange, would facilitate a more transformative impact for B2B.

This chapter is structured in the following way. In the first section, we define "mode of exchange" more precisely and describe the potential impacts of B2B on the technological and institutional characteristics of different modes. In the second section, we differentiate the historic modes of exchange in the auto industry along a continuum from "exit" (in which automakers resolve problems with a supplier by finding a new supplier) to "voice" (in which automakers work with an existing supplier to resolve problems) and use them to characterize the U.S. and Japan cases at a national level. We also draw attention to the interaction between national infrastructure and company strategies. As companies expand their operations globally, the exit and voice models confront each other more directly and, to some extent, blend together.

In the third section, we bring the pieces of the argument together to make predictions about the impact of B2B in the automotive industry over the next 10–15 years. We start by identifying the specific contributions to performance improvement that B2B can offer the auto industry, given past legacies of exit and voice modes of exchange. Then we explore the history and structure of Covisint, and assess its prospects given our foregoing analysis of the industry. Finally, we describe how the three potentially disruptive factors described above will interact with the new capabilities provided by the Internet.

The fourth section extends the implications of our in-depth examination of the auto industry to other industries attempting to organize industry-wide B2B exchanges. We pay particular attention to the dynamics between exchanges set up on the industry consortia model and private exchanges set up between individual firms and their closest suppliers. We also probe the issue of where benefits are likely to accrue more or less evenly to all exchange participants versus where use of the exchange can generate a differentiated source of advantage.

The Impact of B2B on Modes of Exchange

We organize our notion of "mode of exchange" around four technological and institutional characteristics: (1) organization of the procurement process; (2) degree of standardization of transactions, interfaces, and products; (3) incentives for supplier investment; and (4) mechanisms and norms affecting the flow of knowledge in the supply chain.

Organization of the procurement process refers to the nitty-gritty details of how customers make their purchasing needs known, the form in which bids and proposals are received, the procedures for selecting among competing suppliers, the contracting arrangements governing a successful bid and the establishment of pricing, the formal (legal) rules affecting how disputes and problems are handled, the manner in which contracts are ended or extended, and so forth. These elements may take different forms at different firms and in different countries, depending on legal and regulatory statutes, the founding conditions under which the supply chain emerged, and the norms generated through years of repetitive procurement tasks.

In our view, the most significant short-term gain of B2B comes from exploiting the Internet's open architecture to automate the purchasing process across the different firms involved. An integrated e-procurement system allows manual, paper-based, labor-intensive processes such as purchase orders and invoices to be generated electronically. With data put into the system only once, data entry costs plummet, but even more significantly, data error problems, which can be tremendously difficult to find and eliminate, are minimized. Open-architecture information technology (IT), easily accessible by all parties in a supply chain, should also allow a reduction in inventory held as a buffer against uncertainties created by inaccurate or out-of-date information and, in turn, to reductions in scrap. For procurement of rarely needed goods and services, suppliers and customers can draw on shared expert systems that facilitate processes such as need identification, vendor selection, receiving, and accounts payable.

Standardization of transactions, interfaces, and products refers to the extent to which transactions can be completely defined; the extent to which interfaces can be completely specified to facilitate greater supplier independence in meeting customer requirements, hence reducing inter-

dependence, asset specificity, and transaction costs; and the extent to which products are commoditized to allow price competition that drives down costs.

Standardization of information is a prerequisite for B2B to work, because information must be encoded in ways that mean the same thing to multiple parties for the benefit of its open architecture to be realized. The use of XML (eXtensible Markup Language) in a B2B exchange provides data tags that can be read by the operating systems or applications of all exchange participants with minimal translation effort. This makes it possible to put all participants in a supply chain—large or small and located anywhere in the world—on the same information system with access to real-time data without expensive investment. All transactions involving that information can benefit from this standardization of format and process.

This standardization facilitates greater reliance on market mechanisms in procurement, most notably auctions of various forms. Auctions present huge opportunities for customers by reducing prices on well-specified parts that can potentially be made by several suppliers. Although the gain for customers may often come at the expense of supplier margins, the ready availability of auctions as a procurement mechanism can benefit suppliers, too; they may find it easier to bid into new markets where they have had no prior access, and they can also use auctions in their own procurement. Auctions can also facilitate greater efficiencies across the supply chain, for example, as a means to sell excess production capacity. Indeed, these savings create incentives for still greater standardization of products and interfaces as well.

Incentives for supplier investment can take two forms. If customers require specific assets, they may provide financial incentives to subsidize those investments by suppliers, yet if customer requirements can be met via non-specific assets (e.g., general-purpose machine tools), suppliers have the incentive to make investments that meet the needs of multiple customers, thus reducing total outlays.[2] In the former case, if customers purchase physical assets for suppliers, the incentives for suppliers to invest in complementary capabilities may be low, because customer control means that the physical assets could be removed.

B2B potentially affects supplier incentives to invest in two ways. The open architecture characteristic of the web allows suppliers to exchange

design and schedule information with their customers without making large, often customer-specific, investments in proprietary systems for EDI (electronic data interchange) and CAD (computer-aided design). Thus, the Internet offers the possibility of *de-specifying* assets while providing the same (or greater) functionality at a lower investment cost. Under this scenario, overall investment levels by suppliers might fall. Supplier investment could also fall for a less favorable reason: greater information transparency means that customers face lower costs of switching suppliers, making suppliers reluctant to invest for fear of being left with excess capacity.

Mechanisms and norms affecting the flow of knowledge in the supply chain refers to the non-contractual understandings of whether or not knowledge is shared freely between customers and suppliers (or across functions, i.e., design and manufacturing, within a firm) or protected fiercely as a potential source of advantage in a largely zero-sum relationship. This includes both information that is critical to negotiations conducted and decisions made during the procurement process (see above) and knowledge related to complex tasks where shared responsibility and task interdependence is high, such as product design. Mechanisms are characterized by the frequency of information-sharing and the variety of channels through which information flows, whereas norms apply to such areas as trust, gain- and risk-sharing, and how closely the parties adhere to contractual terms.

Although auctions are a prominent feature of B2B, they clearly cannot be used for procurement of all products. Many complex products and services are rarely sourced entirely on the basis of price, nor are bids sought very often, as relationship-specific knowledge must be extensive for suppliers to fulfill customer requirements. In these cases, the value of B2B is as a source of timely and accurate information that aids coordination and collaboration. For example, the posting of production schedules on the web, updated in real time, would significantly reduce communication costs and delays from a change in the schedule. The asynchronous nature of web communication can facilitate interaction with a global supply base. Imagine a customer sending a real-time video of a quality problem whose cause was unknown to the set of suppliers whose parts might be involved. With all the parties able to access the same information, problem-solving speed and efficacy should be enhanced.[3]

Designs can also be posted on the web, eliminating the expense of proprietary design software. As with a quality problem, having common access to the same design information could facilitate discussions about design problems with all the relevant parties. However, technical barriers are not the largest obstacles to posting design data. Suppliers do not want their competitors to see their designs without some assurance that they would not lose business to a firm that could cheaply imitate it. Protection of proprietary information will certainly be required. But no technological security mechanism can fully substitute for the presence of trust between supplier and customer. Collaborative mechanisms will need reinforcement from other aspects of the customer-supplier relationship; B2B alone can't provide trust.

Summary

This analysis suggests that electronic procurement and collaborative planning through B2B will result in significant savings over current systems. Some are one-time savings, whereas others will affect every transaction. Because B2B facilitates both market mechanisms (e.g., auctions), and collaborative activities (e.g., joint product development), it can potentially reinforce whatever modes of exchange are already dominant in a particular industry, country, or firm—a point we develop further below.

Legacies of Past Modes of Exchange: Comparing the U.S. and Japanese Auto Industry

Two different modes of exchange emerged historically in the auto industry.[4] Following Hirschman (1970), these can be characterized as "exit" and "voice." In the exit model, automakers solve problems with suppliers (regarding price, quality, etc.) by replacing them with another supplier. In the voice model, an automaker works with the original supplier to resolve problems. The advantage of the voice model is a rich flow of information that can eliminate unnecessary or expensive process steps, whereas the advantage of exit for the automaker is that it is not locked in to any supplier. Since the 1930s, the U.S. auto industry has generally been characterized by exit relationships, whereas the Japanese industry has historically been characterized more by voice. Some convergence has been evident in recent years, towards voice in the United States and exit in Japan.[5]

Business-to-Business can readily reinforce and amplify either the exit or the voice approach because, by cutting communication costs of all kinds, it facilitates both auctions and collaboration. Firms typically move away from their historically dominant mode of exchange only in the face of evidence that they suffer a cost disadvantage large enough to offset the cost of switching to another mode. We turn now to examine the legacy of these dominant modes of exchange for U.S. and Japanese firms.

Exit Mode and U.S. Automakers

Given their history, U.S. automakers, can use B2B to exit more efficiently and more thoroughly than in the past. We can see the legacy of incentives and capabilities created by exit in each of our four characteristics.

Organization of the Procurement Process Maintaining a credible threat of exit is crucial for this mode. Thus, as GM vertically integrated complicated parts of its value chain (such as product design and the management of subassemblies) from the 1920s on, this partly served to minimize barriers to entry into supplier industries. A legacy of this strategy is that there are many suppliers capable of making simple parts, and GM retains in-house capability to design and integrate these parts. These conditions greatly facilitate auctions, because auctions work best if buyers can make "apples-to-apples" comparisons of bids submitted by a large number of potential suppliers.

Standardization of Transactions, Interfaces, and Products Historically, GM set the norm for the industry by devoting considerable effort to formalizing transactions with suppliers.[6] Designs were well documented, contracts had standard provisions, and purchasing agents had clear rules for supplier selection—they were to go with the low price, as long as finance and engineering thought that the firms were qualified to produce the parts (i.e., would not go bankrupt or be unable to deliver parts). Non-codifiable factors, such as responsiveness to engineering changes or quality problems, played a very small role. In the 1910s, these firms established the Society of Automotive Engineers (SAE) to promote standardization. Early projects focused on standardizing large parts such

as carburetors. But as Ford and GM grew, their engineers increasingly staffed the SAE's committees, and pursued a different agenda. Ford and GM had the volume to make carburetors and other important components in-house, and wanted to be able to compete on the basis of a superior design of these parts. So they narrowed the SAE's standardization efforts to parts such as nuts and bolts, and grades of steel (Thompson 1954).

Barriers to entry in the auto assembly business went up dramatically, as the firms that became the "Big Three" purchased independent suppliers of carburetors, bodies, and engines. In contrast, barriers to entry into the lower tiers of the supply chain dropped, but these were low-margin businesses that, under an exit system, lived from year to year with the anxiety of losing a contract. Only suppliers that diversified into other industries (such as Timken and TRW) remained independent and profitable. Thus standardization efforts first expanded and then contracted. These competitive dynamics had a significant impact on automobile design, moving it from "modular" to "integral." We expand on this point below.

Incentives for Supplier Investment Under exit, incentives were low, as suppliers knew they could easily be replaced. Incentives for investments that were specific to one automaker were particularly low. Fierce competition among suppliers led to the creation of two distinct types of firms. The first group was small suppliers who kept prices low due to minimal overhead and a willingness to accept small margins. The second group (mostly firms that had developed during the early voice period) tried to make profits by developing slightly improved products that could justify a higher profit margin. Often these firms obtained their new ideas from outside the auto industry; for example, TRW, Bendix, and Rockwell all participated significantly in aerospace.

The legacy of this low investment is positive for auctions in several ways. First, as mentioned above, low barriers to entry means more suppliers. Second, suppliers have been slow to adopt early versions of computer-aided manufacturing (CAM), computer-aided design (CAD), and electronic data interchange (EDI) that are to some extent made obsolete by e-business. A potential negative effect is that experience with these technologies is useful in adopting their Web-based successors.

However, it is not clear how much an automaker using an auction-based e-business strategy will be able to use these technologies anyway, as they require the supplier to trust the automaker with proprietary information.

Mechanisms for Knowledge Flow throughout the Industry Mechanisms for knowledge flow were not well developed during the exit period, and were hampered by a lack of trust. For example, when an OEM accepted a supplier's design, the design had to be copied onto the OEM's paper to protect the OEM's property rights. In the days of hand copying, this requirement frequently introduced errors—and certainly added costs.

Predicted levels of demand were often disputed. OEMs wanted suppliers to tool their plants so that they would have the capacity to meet even the most optimistic forecasts. Large suppliers such as TRW and Eaton employed their own economic forecasters so they would not be left with idle capacity.

Desire to maintain a credible threat of exit from any one supplier also hampered communication within the OEMs. Great efforts were made to prevent suppliers from going around purchasing agents to try to influence engineers to design a part in a favorable way (Corey 1977). This compartmentalization made it difficult to share information about different aspects of supplier performance. For example, there was no standard procedure for making sure that the assembly plant could make the purchasing department aware of a supplier's quality and delivery performance, or that engineering could systematically provide information to purchasing about responsiveness to engineering changes.

Voice Mode and Japanese Automakers

We predict that Japanese automakers will find that voice relationships with suppliers can be maintained more effectively than in the past, and they will be reluctant to interfere with these relationships by developing B2B capabilities that point toward exit. Thus, like Sako (chapter 9 in this volume) we see Japanese institutions shaping the way the Internet is adopted, and disagree with the polar views that these institutions will block Internet use altogether, or that the Internet will cause these institutions to look more like their Western counterparts.

Like the U.S. industry, the Japanese auto industry started with collaborative relations with suppliers. But whereas the U.S. industry evolved toward a combination of vertical integration and arm's-length relations with outside suppliers, voice has proven relatively stable in Japan.

Organization of the Procurement Process The procurement process was organized to facilitate collaboration between OEMs and suppliers. As discussed below, automakers (particularly Toyota, Nissan, and Honda) spent a great deal of time learning about (and improving) the details of suppliers' operations—a strategy that was feasible only with a small number of suppliers. Contracts were almost always for the life of the car model (typically four years), and were renewed if performance was satisfactory. If performance was not satisfactory, automakers sent teams of engineers to improve the operation, and would reduce the firm's market share (rather than cut them off completely) as a sign of displeasure (Nishiguchi 1994). Japanese automakers typically did not rely on market competition among suppliers to set prices; instead, prices were set using target costs, which were derived from a combination of marketing decisions about what consumers would pay, historical costs, and engineering determinations of what individual process steps would cost (Asanuma 1985).

Levels of Standardization of Transactions, Interfaces, and Products There has been little standardization of these elements, making it difficult to set up an auction market. As in the United States, products were not very standardized, though for different reasons. Particularly at Toyota, engineers saw their competence as integrating supplier-provided parts so as to produce excellent fit and finish, and relatively little noise, vibration, and harshness (NVH). However, component design is not as idiosyncratic as in the United States. First, Toyota in particular has focused on re-using parts across models to save design time and improve quality (Cusumano and Nobeoka 1997). These efforts at parts carryover mean that interfaces between different generations of the same model must have some commonality. Second, the low levels of vertical integration have made it possible for smaller automakers to survive by sharing suppliers of parts with a high minimum efficiency scale. (Japan has nine domestic automakers sharing a total production smaller than that of the U.S. Big Three). Particularly for smaller automakers such as Subaru and Isuzu, parts have more in common across automakers than they do in the United States or Europe (Takeishi, personal communication).

The criteria for awarding business to a supplier were not at all standardized. A supplier's bid was important, but automakers (particularly Honda) also considered such intangibles as the supplier's "attitude" (whether they were interested in learning Honda's methods of continuous improvement and in working hard to meet Honda's targets). Honda did not try to cost every aspect of a transaction, thus reducing the value of B2B's ability to categorize costs thoroughly. For example, if a problem arose during launch, Honda expected suppliers to pitch in to solve it, and worry about how much it cost later. Similarly, Honda would provide technical assistance (valued at $1 million by one supplier) without charge, and would sometimes award "good" (high-margin) jobs to a supplier in compensation for a job that had turned out to be unexpectedly low-margin (MacDuffie and Helper 1997). All of these discussions and trade-offs across transactions would be very difficult to encode in an automated "business rule."

Yet some Japanese automakers (especially Honda and Toyota) have invested a great deal in standardizing data on quality and delivery performance. These data facilitate identification of problems, evaluation of experiments to improve performance, and discussion of results. Thus, Japanese automakers have invested in standardization to improve collaboration with long-term partners who are willing to share a great deal of data about their operations, but they have not invested in the standards that would facilitate easy comparison of, and switching between, alternative suppliers (MacDuffie and Helper 1997).

Incentives for Supplier Investment In the early days of the Japanese auto industry, Japanese auto suppliers used cheap, general-purpose equipment and sold only a small portion of their output to the auto industry. Suppliers gradually developed knowledge and equipment specialized to the auto industry, receiving financial and technical assistance from their customers. Because suppliers knew they would not suddenly lose all of an automakers' business, they were willing to invest in both general and automaker-specific machinery. For example, adoption of computer-numerically controlled machine tools (CNC) was much higher

in Japan than in the United States. On the other hand, with few exceptions (Nippondenso, Yazaki), suppliers let automakers take the lead in developing new applications and new products; they did not actively sell new engineering approaches to automakers in the way that large U.S. suppliers did.

Mechanisms for Knowledge Flow throughout the Industry

Suppliers' trust in their customers grew over time, given the low frequency of switching and high technical assistance from customers. This made suppliers more willing to share detailed information about their costs and processes, without worrying that this information would be used to deprive them of what was considered a fair return on their investments.

Initially, suppliers served as buffers, simply providing capacity when the OEM could not meet demand. But in the 1950s, Nissan and Toyota, aided by local governments and unions, began to provide extensive technical assistance to suppliers, gradually spreading knowledge about the philosophies of just-in-time and continuous improvement throughout the supply chain. Many suppliers became involved in "black-box" product development, in which the OEM specified only performance requirements and exterior dimensions, while the supplier did the rest of the design work, yielding a product tuned to the supplier's production process, thus increasing productivity and quality. As long as these requirements were met, the OEM often did not keep a close watch on the exact specifications of what a supplier was making. And, with an experienced supplier, OEMs often did not bother clearly to spell out their requirements, because the supplier had an intuitive knowledge of how to interpret vague OEM drawings (Cole 1986; Nishiguchi 1994; Odaka, Keinosuke, and Fumihiko 1988; Sako 1996, 1999). This lack of clarity became a problem when designs were transferred to local suppliers as automakers globalized their production (Helper 1998; Couch 1999); it would be an even bigger problem in trying to put specifications on the Internet and conduct an auction. To run an auction, they would have to invest in documenting more fully (and more centrally) the details of design, and building suppliers' capabilities for responsiveness to formal engineering changes.

The automakers did conduct design competitions. In some cases, assemblers would take an aspect of a supplier's design that they liked, and provide it to a supplier whose overall design and price they liked better. However, the OEM would compensate the losing supplier in some way, by providing either some volume of the part under license from the winning supplier, or extra business on another part (MacDuffie and Helper 1997).

Japanese automakers are much less compartmentalized than U.S. firms, with a great deal of emphasis on cross-functional teams and job rotation. Supplier selection and evaluation is done with input from production planning and quality control as well as purchasing. At Honda, suppliers receive a monthly report listing numerical performance measures, plus comments from each group on ways to improve. As discussed above, decisions on how to respond to these numbers are not based on preset rules, but rather are discussed in frequent meetings.

U.S. and Japanese Cases Compared

Compared to Japan, the U.S. auto industry has had relatively adversarial and arm's-length relationships with outside suppliers for most of its history. This strategy has had several negative consequences for the U.S. industry: less willingness by most suppliers to invest in product design capabilities and capital equipment, less information flow between suppliers and customers, higher inventories, and lower quality. It has also had some neutral or positive consequences, such as a compartmentalized organization, integral designs, and a small group of suppliers whose competitive advantage increasingly depends on their ability to come up with new products. Conversely, the Japanese industry is characterized by a large number of suppliers skilled in black-box design and just-in-time production. On the negative side, few Japanese suppliers are experienced in selling their ideas to customers, and the automakers are not skilled in selecting new suppliers.

Now that the auto industry is global, U.S. and Japanese modes of exchange no longer exist in isolation from each other. Under pressure from Japanese competition, the U.S. industry has moved toward voice in the last 15 years. Collaborative problem-solving within and across firms, spurred by the efforts of Japanese transplants to develop local supply chain

capabilities, is increasingly common (MacDuffie 1997; MacDuffie and Helper 1997; Dyer 2000). Suppliers have taken on more of a role in design, and contracts now usually last four or five years, rather than one, as was typical before the 1990s. However, the parties continue to talk about their relationship in adversarial terms, and describe competition as fierce. These moves toward voice have been strongest at Chrysler (until the 2001 DaimlerChrysler financial crisis), and weakest at GM.

As they globalize, Japanese automakers have moved somewhat toward exit, scaling back the role of traditional suppliers in favor of U.S. or European firms discovered during their expansion overseas. In addition, Japanese suppliers have become somewhat more independent, for example breaking (outside Japan) an informal ban on supplying to both Nissan and Toyota (Ahmadjian and Lincoln 2001). However, ties between customers and suppliers remain in general much closer than in the United States.[7]

With the increasing consolidation of the world's automakers (as we discuss in more detail below), fewer cases of "pure" exit or voice approachs can be found. Although suppliers tend to remain more strongly identified with national boundaries, their exposure to the demands of multiple customers operating production facilities in multiple countries also increases their responsiveness to different modes of exchange. Furthermore, to the extent that different kinds of components require different procurement processes, both U.S. and Japanese automakers may gain more choices from B2B that would allow them to mix modes of exchange under a hybrid strategy.[8]

This greater latitude, combined with the blurring of dominant modes of exchange, may reduce but will not eliminate national differences. Indeed, which B2B capabilities are developed first and the priority given to their use will be affected by the institutional norms associated with historically dominant modes of exchange in different countries. In this way, B2B's reinforcing and amplifying effect could contribute to strategic differentiation based on national differences. In other words, an American, German, or Japanese firm—finding themselves able to pursue their preferred mode of exchange more easily and at lower cost—may well choose to adhere to those historical patterns rather than sampling from the broader choice set that B2B offers them.

It is important to note, however, that not all configurations of practices are feasible. One cannot expect suppliers to make large investments, or to provide proprietary information, without some security that they will receive a return for their efforts. To some extent, B2B helps with this. By lowering the costs of information flow, B2B makes more collaboration possible with fewer long-term safeguards, because Internet-based technologies for computer-aided design and for exchanging scheduling information are much less customer-specific than their predecessors. And, if B2B makes it easier to find new customers or suppliers, then the risks of dedicated capacity becomes less severe. However, if the barrier to exchanging information is trust, then even if the cost of transmission is zero, firms will not do so. Participating in B2B will not, in itself, generate trust; indeed, as we will see, it can threaten trust.

Predictions for Automotive B2B: Evolutionary or Transformative?

In this section, we will focus on three issues: (1) our evaluation of how automotive B2B can contribute to performance improvements along various dimensions; (2) our view of the strengths and weaknesses of Covisint's industry consortium structure; and (3) our assessment of possible disruptive developments in supplier relations that could affect our primary hypothesis about B2B as an evolutionary extension of already dominant modes of exchange.

Sources of Performance Improvement

A large subset of the improvements from B2B—particularly those related to automation of the procurement process and to standardization of transactions, interfaces, and products—accrue to firms regardless of their dominant mode of exchange. These savings are likely to be one-time, transitional gains rather than providing a source of continuous improvement. Even so, they will powerfully fuel the diffusion of B2B in the next five years. Gains due to increased supplier investment and improved information flow may be harder to obtain at first, but should provide opportunities for continuing improvement in cost, quality, and delivery performance—especially for firms operating in collaborative mode.

We discuss five potential sources of performance improvement from B2B: (1) automating procurement processes; (2) interoperability; (3) auctions; (4) collaborative planning; and (5) collaborative design. We also estimate total savings from all these sources. We draw here on interviews with managers at both automotive and IT firms and on data from early auto industry experiments in order to predict B2B's future trajectory.

Automating Procurement Processes In the traditional purchasing process, a purchasing manager issues a request for quotes, acknowledges receipt of quotes, chooses a supplier, gets approval from a supervisor, and notifies the winning supplier. Meanwhile, a marketing manager at a supplier is preparing a quote, getting approval from a supervisor, and, if the supplier wins the order, acknowledging receipt of a purchase order. Each of these steps generates paper that must be filed, and time is lost in sending the message (either by fax or phone), and finding a supervisor to sign off on decisions. Dan Jankowski, head of corporate communications for Covisint, explained the expense involved in just the request for quote stage. "The automaker FedExes a binder, which can be 3 inches thick, to each of a dozen suppliers. If they change a specification, then they have to redo the whole thing, each time introducing the possibility of errors in collation, and losing lots of time" (Jankowski 2001).

E-business offers the potential to dramatically reduce both the lead time and the cost involved in purchasing. Notifications can be sent instantly via e-mail, and the approval process can be automated with software that incorporates "business rules." These rules can be simple (Manager X is authorized to spend up to $10,000) or complicated (a set of criteria for actually choosing among the bids); the rules can incorporate any procedure that can be codified into software. The rules can also ban purchases from non-authorized suppliers, leading to further savings if the authorized suppliers are cheaper (which they may be if the firm has negotiated quantity discounts).

Estimates of the impact of reduced paperwork suggest that costs may fall from $75–150 to $10–30 per purchase order (Marti 2000). A similar estimate, from Kevin Prouty of AMR, predicts that an online exchange can bring purchase order costs down from their current level of $125–145 to $30–35 (Kisiel 2000b).

Interoperability In order to achieve these savings, the buyers' and suppliers' computers need to be able to communicate with each other. With electronic data interchange (EDI), the pre-Internet application of information technology to this problem, each party signs up with a vendor who provides software and a communications link; either all must use the same vendor or the vendors must use compatible software.

Starting in the 1960s, EDI systems were developed to help firms substitute information for inventory. These systems speeded up the transmission of information dramatically, and by eliminating the need for re-keying data, also cut errors by orders of magnitude. However, the technology was enormously expensive; in the mid 1990s, a small supplier might spend $45,000 per year in EDI-related expenses. These expenses included software for communications, special training for EDI operators, and payments to a value-added network (VAN) provider to transmit the documents and to translate them for computers of many different kinds. In addition, there were large up-front costs, including custom programming to connect the EDI system to the company's billing and inventory management systems (Marti 2000).

Because of the expense, only 30–40 percent of automotive suppliers use EDI, according to Peter Weiss, former co-CEO of Covisint (Konicki 2001a, 5). As a result, even by the late 1990s, large suppliers typically received scheduling information directly from automakers via EDI, and then transmitted the schedules to second- and third-tier suppliers via fax and phone, because these lower-tier firms in the supply chain did not have the capital to invest in EDI.

At TRW, we learned that this process of migrating the information all the way down the chain could take 5–10 days, a delay adding significantly to inventory (author interviews 2000 at TRW; Jansen, CommerceOne; Ford). On Monday morning, TRW would receive a weekly schedule from its automotive customers via EDI and would feed this information into its Materials Resource Planning (MRP) system, which would figure out what TRW needed from suppliers to meet the automakers' requirements for seat belts, and send the information (often by fax rather than computer) to these suppliers. These second-tier suppliers would wait for their other customers to send them production requirements before coming up with a schedule. Based on this

information, a supplier (say a seat belt buckle provider) would send its requirements to its suppliers in the third tier, and so on.

How could it take so long? First, the updating process at each firm can take a day. When TRW receives its customers' requirements, it must translate the entire document it receives from Ford in order to understand what has changed. Second, it is often not possible for a firm to skip a link in the chain. For example, suppose Ford plans to increase its production of the Focus by one unit compared to last week. This information by itself isn't useful to the seat belt buckle provider, because it doesn't know how many seat belt buckles TRW has in inventory, how many seat belt buckles TRW will need next week, whether the seat belt buckle might be the same for a Nissan seat belt, what Nissan's production levels are, and so on.

Two developments, both based on open standards, promise easier communication among many users. The Internet offers a significantly cheaper way of communicating with other firms compared to VANs. First, Internet access fees are 50–80 percent lower than those charged by VAN providers, and almost all firms now have access to the Internet. It is cheaper largely because the transmission lines are shared across many people; the Internet is more like a highway, and a VAN is more like a private road. Also, use of a web browser provides universal access to multiple servers, a huge improvement over each user having to customize each EDI link.

Second, the Internet's open standards mean that document translation is less complicated. For example, a standard Web browser such as Internet Explorer can translate documents written in HTML, meaning that (in contrast to EDI) little special training to operate the system is needed. (Marti 2000; Glushko 1999). The development of XML (Extensible Mark-up Language) allows computers to communicate with each other in a more advanced way than does HTML (Hyper-Text Markup Language). While HTML contains tags that describe typography—for example, ⟨i⟩ 5.95 ⟨/i⟩ would tell the receiving computer to italicize *5.95*. In contrast, in XML, tags refer to characteristics of the item. For example, ⟨price⟩ 5.95 ⟨price⟩ and ⟨product description⟩ radio ⟨product description⟩ says that "5.95" is a price and "radio" is a product description. With a program called a parser, it is easy to sort radios by price—very useful if one wants to compare bids. The fact that each element of

data has a tag greatly eases translation. By contrast, in a traditional database (e.g., an Excel spreadsheet), items are described only by their location (e.g., column B row 5) and are only subsequently tied to a variable name. Thus, the entire database must be brought into the host computer and translated before any of it can be understood—dramatically slowing the pace of communication.

Although the future vision of XML anticipates full interoperability, the current reality is more complex. There are issues of transition from EDI to XML. "We used to be XML purists," said Bob Glushko, CommerceOne's VP of document engineering (August 2000). "But now we see that firms are not going to abandon their investments in EDI." At CommerceOne and elsewhere, lots of code is being written to translate EDI messages into XML, and to allow communications from firms with EDI to firms that do not have EDI.

XML itself is far from encoding a standard set of business processes. To take just one example, at the present time, XML data tags are not standard. For one buyer or e-marketplace, ⟨price⟩ may refer to a retail price stored in some database, whereas another may use the same tag to refer to the wholesale price. Even if the message content encoded by XML is standardized, there is no guarantee that it will satisfy the processing expectations of a trading partner. For example, Business A may expect an acknowledgement when it sends a purchase order to Business B, but Business B's practice is to send an invoice and a shipping notice (Global Trading Web Association 2001). This lack of standardization means that suppliers to different exchanges and customers must have translators between their form of XML and the one used by each of their potential customers (or be prepared to retype information manually upon each request for a quote). The expense of these steps may limit the number of new bidders, a barrier to realizing the "zero switching cost" ideal.

The reality of needing to make XML operable in a world with substantial prior investment in EDI has given rise to different visions of how extensive interoperability must be for e-markets to work. We describe two distinct strategies below, associated with Oracle and CommerceOne, the primary software providers to Covisint.

Auctions The ability to exchange price data quickly greatly facilitates auctions. In theory, an OEM should be able to search for suppliers all

over the world and easily compare bids submitted in XML format. Early experiments revealed the tremendous potential for auctions to reduce prices. In one dramatic example (Colvin 2000), an automaker was buying plastic parts through FreeMarkets.com (GM's original B2B partner, before the announcement of Covisint). It had paid $745,000 for the last pre-auction batch of parts. After 33 minutes of bidding by 25 suppliers, the price came down to $518,000. That auction was one of five run that day for that automaker. Parts that would have cost $6.8 million under the old procurement system sold for $4.6 million after the auctions. Small wonder that many interpret B2B as primarily a means, through auctions, for OEMs to squeeze supplier margins even more successfully than in the past (Taylor 2000).

Yet the applicability of auctions is more limited than it first appears. The key issue is the desirability of standardization (necessary for automated comparisons across bidders) from the point of view of various actors. Automation works less well when a firm wishes to incorporate tacit knowledge or discussion into a decision. For example, one automaker tried using an auction to source printed circuit boards in 2000. But they had to withdraw the auction, because they decided that the low bidder would not meet their needs. According to the CEO of Solectron, who eventually won the business, "We asked them, 'Do you want to fly first class or coach?' Sure, it's cheaper in coach, but you know we treat you first-class. We always deliver on time, and never charge you for engineering changes. A printed circuit board is way too complicated for an auction—the specs are always changing," (Ko Nakamura, CEO of Solectron, Sloan Foundation Annual Meeting, April 2001).

This incident suggests three problems with auctions. First, a customer may have criteria other than price (such as delivery or responsiveness). One way to handle this is to limit bidding only to approved bidders. All auctions on Covisint have done this; few have had more than eight bidders. Another remedy is to weight the different criteria. In principle, this problem is not too difficult to solve if the trade-offs among the criteria can be quantified. For example, CommerceOne's Auction Services 4.0 allows for comparison of bids across multiple criteria. However, so far it has been used only for trade-offs on terms of payment, and even so has had to be shut down several times because the software cannot handle the complexity (authors' interviews at CommerceOne).

Second, bidders can feel manipulated, even when the pool of bidders is pre-qualified and when criteria (and trade-offs among them) are clearly identified and quantified. One reason is that when auctions take place in real time (eBay style), the only attribute that other bidders can see is the price being bid. So a bidder does not know if a low bid is being submitted by a high-quality competitor, or by a ringer incapable of meeting all the performance expectations of the customer. We heard numerous examples in which the supplier awarded a bid through auction was later eliminated on performance grounds (authors' interviews; Akira Takeishi, personal communication).

Third, the customer may find it costly to quantify trade-offs across criteria in advance. Indeed, the customer may find that discussion of potential trade-offs both internally and externally generates valuable data for choosing a supplier. Using auctions can both preclude this discussion and may alienate potential partners on other projects. Early evidence suggests that supplier participants in auctions perceive their relationship with customers with less trust and more dissatisfaction, and state a desire to differentiate their products and/or services so they cannot be procured through auction (Jap 2000). Given the risk for voice-mode firms of alienating their close supplier relationships, they will be less inclined to use auctions, except perhaps for non-vital procurement, such as office and cleaning supplies.

Collaborative Planning The Internet offers the promise of "visibility throughout the supply chain," through which participants could continuously update each other about their production plans. Much of this could be done in an automated way. Because translating and updating can be done so quickly, real time operations are possible. For example, Ford would send its schedule to TRW's computer, which would check that TRW's plants had the capacity to meet Ford's requirements. If so, the computer would create a production schedule, without need for human intervention. If not, the computer would generate an exception notice.

Information could flow the other way as well. Suppose the second-tier supplier decides to shut down for deer-hunting season. It could send a notice to TRW saying that it will not produce anything the first week of November, but could ship extra in each of the last two weeks of October.

TRW could approve this new schedule, and then confirm to Ford that the schedule will be met.

The above represents a technical challenge—large, but one that can be handled. Some pieces of the new vision are already in place. SupplySolution offers a web-based product that enables a supplier to see its customers' level of inventory for the supplier's component in real time, leading to 20–40 percent declines in inventory within a few months of adoption (⟨www.supplysolution.com⟩; interviews with users).

However, before capacity planning can become truly collaborative, several strategic issues must be resolved. First, "capacity" is not entirely technically determined. How much does a supplier say it has available to allocate to TRW versus to its other customers? If it says it has a lot of capacity, TRW may think the supplier is desperate for work and ask for a price cut. If it says it has only scant capacity, TRW may take that as a signal to find another source. A supplier might be tempted to allocate the same capacity to two customers, and simply hope that they won't ask for it at the same time. Furthermore, a supplier's capacity may depend on the price; the suppliers may be willing to schedule production on relatively inefficient machines or run a second shift and pay operators overtime if the price were high enough.

Thus B2B doesn't allow a second-tier supplier to skip links in the chain—it just offers information flow in seconds instead of days. To know how it should react to a change in production at Ford would require TRW to let the entire supply chain see Nissan's production schedule as well. This may be technically feasible before long, but a great deal of trust would be necessary across the industry for this to occur.

If a key legacy of exit is lack of investment by suppliers in information systems, the move to B2B might provide an opportunity to leapfrog over the EDI stage; suppliers' lack of prior investment in EDI would mean less has to be thrown away. But the business process reengineering done to facilitate the transition to EDI is crucial for the success of collaborative planning over the Web. This reengineering was done because linking EDI systems with internal order management and production scheduling processes required extensive custom programming. The rationalization and customization of these linkages may be necessary even for suppliers that skip the EDI stage.

In any case, much of the investment in EDI is not wasted. According to Bob Jansen (formerly of CommerceOne, now at VIA systems), "Collaborative planning has a tremendous number of challenges—it is only as good as the information being transmitted. If the information isn't right, then with the Internet, I'm just communicating bad information faster. EDI is treated as software, but it is really a tool for reengineering business processes.... Firms that haven't gone through this process can mess up the whole chain" (personal interview, August 2001). Jansen provided the following example:

> I had a customer once that was always making manual interventions to his MRP system, because, he said, "its numbers are wrong." It turns out that there were a lot of data entry errors in the Bill of Materials, for example saying it took 50 gallons of oil to make one part rather than to make one batch of parts. Also, this firm didn't report scrap until the end of the week. So all week long, you'd be thinking you had a lot more parts than you did, or that the MRP system was wrong, because you couldn't find the parts. So if we set up a system where every day this firm is sending information to Ford about its inventory levels, but it is only updating scrap once a week, we're just transmitting bad information faster. The delay is not in the software application, as in getting accurate information from the shop floor into the computer. This is the key to supplier participation in the [capacity] planning aspects of Covisint.

Supply chain management software also offers the opportunity to shift costs, as well as to reduce them. "If you set up a build-to-order system, you cut the reaction time of your suppliers. If you link them in when the customer orders, then the suppliers, on their nickel, can see when your inventory of their part reaches a critical level, so you don't need release analysts to go over stock levels" (Paul Hebeler, Automotive Director, Oracle Corporation 2001).

Whether the EDI or XML path is chosen, IT infrastructure and capability must be built into the automotive supply base for collaborative planning to advance. A survey of 434 Ohio auto suppliers in early 2001 found that only 82 percent used computers in their business, 34 percent had access to the Internet, and 20 percent had a Web site. (For those firms with over a hundred employees, the figures were 95 percent, 52 percent, and 42 percent.) It is interesting to note that these figures are below those for U.S. households, 45 percent of whom claimed to have Internet access in March 2001 (Furchgott 2001). Of those firms that had

Internet access, 71 percent used a modem—far from a high bandwidth connection (Sabety 2001).

In summary, we agree with observers who claim that the potential benefits of collaborative planning over the Internet are huge. But this aspect of B2B will require two things: first, long enough time horizons that even small suppliers can develop capabilities for accurate reporting of inventory and link their business systems to the Internet; and second, enough trust within the supply chain that parties will reveal their capacities accurately. Both are attributes of the voice mode of exchange, suggesting that the benefits of collaborative planning will disproportionately accrue to firms operating in voice mode.

Collaborative Design E-business also offers the opportunity for designers (either in the same firm or different firms) to work in parallel. As with EDI and inventory planning, a pre-Internet technology based on proprietary software already exists—computer-aided design (CAD). In the United States alone, GM, Ford, and Chrysler each chose a different CAD standard, requiring suppliers that wished to have a design relationship with all of the automakers to maintain three different CAD systems, at a cost of about $100,000 per year per seat in software and (more importantly) time for engineers to acquire and maintain familiarity with the software.

The savings from collaborative design tools are difficult to estimate, although most observers agree they will be substantial. The primary gain will come from avoiding the delays and errors associated with today's exchange of design information, which happens imperfectly because of the different proprietary CAD systems, and by eliminating many of the face-to-face meetings between supplier and customer engineers that are now the mainstay of product development.

Intertwined technical and organizational barriers prevent collaborative design from becoming common practice. First, having a collaborative design space on an Internet server is not the same as having a common product design program. Although the different designers working on a project will have a common area to store documents, and can change the documents located in the central file, these changes will not affect the files in the designers' own CAD system. These will still have to be entered

manually (Jankowski 2001; Oracle interview), reducing productivity and leading to the possibility of errors.

Second, suppliers are very worried about data security (Reuters 2001). "If there is concern, it's one of data ownership, what happens to that data," says John Van Alstyne, president of e-business technology for supplier Freudenberg-NOK. "We don't want people mining our data" (Milligan 2001).

Some of these problems can be addressed technically. Some collaborative software makes it possible to add and delete features of a design according to the identity of an individual user. For example, a designer at an automaker could see how several parts mesh together, whereas each of the suppliers might be able to see only their own part (Jankowski 2001). But other security issues have more to do with trust in the customer. Suppliers were very angry in 1993 when GM purchasing czar Jose Ignacio Lopez in several cases turned over supplier designs to their competitors, hoping to generate lower bids—well before e-business was underway. Collaborative design tools cannot, through technical means, prevent this from happening again.

Total Savings Current estimates of the savings from automotive B2B span a considerable range. Goldman-Sachs estimates total savings of over $2,000 per vehicle, with more than half of these savings occurring post-factory, in distributing cars to consumers. Procurement-related supply chain savings are estimated at $807 per vehicle, or more than 7 percent of the cost of purchased parts and 4.4 percent of the total cost of a $20,000 car (Lapidus 2000). We believe a more accurate figure might be around $500 per vehicle—still a large number. Almost one-quarter of the potential supply chain savings come from improved timeliness and accuracy of information that allows the reduction of inventory held in the supply chain—benefits experienced under both exit and voice modes.[9]

Although all parties potentially benefit from these savings, the advantage that information transparency gives to the large automakers and first-tier suppliers in managing the complexity of their operations and pressing for cost reductions from lower-tier suppliers (in either exit or voice mode) suggests that the majority of the benefits will accrue to them. Assuming the persistence of present-day competitive intensity, a sizable portion of the gains may well be passed on to consumers.

Covisint—History, Structure, and Prospects

As described above, B2B offers a huge potential for performance improvements of various kinds, the achievement of which is stymied less by technical issues than by conflicting strategies, both across exit and voice modes of exchange and between OEMs and their suppliers. Can Covisint, the automakers' online exchange, overcome its own technical and organizational challenges while also helping align these strategies? In the section below, we briefly sketch the history and structure of Covisint and assess its prospects from the perspective of modes of exchange.

History and Structure In November 1999, Ford and General Motors simultaneously announced separate plans to put virtually all of their global purchasing activity into huge web-mediated exchanges called AutoXchange and TradeXchange, respectively. Suppliers howled, because they feared that, as with CAD, they would have to maintain multiple expensive interfaces. As a result of this fear, and of the automakers' realization they could save money by pooling investment in infrastructure, Ford and GM abandoned their separate exchanges and began secret meetings to form an industry-wide consortium. In February 2000, Ford, GM, and DaimlerChrysler announced the unified exchange called Covisint and invited the rest of the world's automakers to join as well; Renault and Nissan joined in April, with Toyota and Peugeot following suit several months later. As of April 2001, this left only VW, BMW, and Honda as holdouts among the major OEMs.

The potential of this new exchange was heralded as enormous: it would handle $240 billion in purchasing for ninety thousand companies worldwide (some estimates range as high as $750 billion, depending on assumptions about how much lower-tier suppliers will use the exchange for their own purchasing), generate transaction fees of $3 billion per year (if suppliers were mandated to use the exchange, and were charged standard e-marketplace fees of 0.5 to 1.5 percent of transaction value), and cut $3,000 from the price of an average car. There was excited talk of a Covisint IPO, whose stock price would soar due to its revenue-generating potential. The exchange quickly secured $240 million in corporate funding, hired two hundred consultants and loaned employees, and signed an equity deal with CommerceOne that valued Covisint at $59 billion (Baer and Davis 2001).

Suppliers remained skeptical. In February 2000, soon after Covisint was announced, and at the height of the dot.com boom, a group of suppliers asked for an equity stake, but were rebuffed. A group of eight large suppliers subsequently announced they might form their own online exchange concept. Covisint began attempts to woo this group of suppliers back, offering them profit-sharing in June and inviting 18 suppliers onto a Customer Council in July that began meeting monthly to get input from the supplier perspective (Kisiel 2000b). Thus mollified, the eight suppliers disbanded their initiative, and one by one, agreed to join Covisint (Milligan 2001). About forty suppliers now belong to the exchange.

In a concession to suppliers, Covisint has backed away from its initial idea that sellers would cover most of the costs of using the exchange by paying the transaction fees. Talk of an IPO disappeared even before the Internet bubble burst, because its revenue model only served to confirm the worst fears of suppliers that these revenues would be drawn directly out of their margins. Instead, fees will be paid by buyers, not on transactions per se but whenever they use a supplier's online catalog, or originate an auction.

Covisint also faced antitrust scrutiny. In September 2000, the U.S. Federal Trade Commission and German Bundeskartellamt agreed that the venture had, at least for the time being, met their antitrust concerns—but they will continue to monitor the exchange to make sure there is no sharing of price information among the exchange's owners.[10]

In December 2000, Covisint began operating, and in January 2001, it announced its board of directors. The board has 12 members, including two each from the founding automakers and one from Renault. Five seats were left open—one for the CEO (who was not named until May 2001), with the remaining seats to go to suppliers. The additional seats were created so that founding automakers would not have a majority on the board (Jankowski 2001).

The early attention to Covisint emphasized its exit features heavily —particularly auctions, which offer the most visible source of savings. This is partly because the IT firms involved in Covisint, Oracle and CommerceOne, have both developed software for auctions in the past, but don't have much experience with supply chain management software. Increasingly, however, statements from Covisint executives have shifted gears to emphasize the tools that support collaborative knowledge

exchange among suppliers and their customers. This has been necessary to attract suppliers to participate in the mammoth task of establishing the IT infrastructure and XML overlay for Covisint. But it also points out the tension between the exit and voice views of what Covisint can—and should—be.

Assessing Covisint's Propects With many of the independent B2B exchanges founded in the late 1990s now closed for lack of revenues, certain strengths of Covisint's consortium structure are clear: given commitments from its equity partners, the exchange will have both guaranteed transactions and financial liquidity. Indeed, Covisint's progress to date is striking, given that only 10 percent of the thousand B2B exchanges launched in the past 18 months are processing any transactions whatsoever (International Data Corporation study, cited in *The Economist* 2001).

During the first six months of 2001, Covisint managed transactions worth more than $33 billion (13 percent of the $240 billion that Ford, GM, and DaimlerChrysler buy annually). Fully 2.5 million items were bought (primarily strategic materials) using the exchange's two hundred catalogs, in 420 auctions conducted by the exchange's one thousand registered users. The auctions were not just for standard parts; DaimlerChrysler used the exchange to buy $3 billion in "highly engineered parts" during four days in May. (Sources did not explain how the auctions worked.) Moreover, two hundred subscriptions had been sold for Covisint's collaborative design software, the Virtual Project Workspace (Jankowski 2001).

The main equity partners report that they are already seeing results from their investment. For example, DaimlerChrysler purchased over $100 million in components through Covisint between December 2000 and March 2001, saving on average 17 percent, even though, the company complained, they were limited to the small number of suppliers who have joined the exchange (Milligan 2001). In July, Ford announced that it had saved $70 million by using the exchange (in reduced paperwork and lower supplier prices), much more than the cost of its investment in Covisint (Konicki 2001a, 2001b; Grande 2001).

It is the automakers' clout and purchasing volume that keeps Covisint powerful, but that also keeps it divided. The consortium approach

must confront the tremendous differences in organizational culture and modes of exchange among the equity holders. Even among the founding partners—GM, Ford, and DaimlerChrysler—there are big differences in their approaches to procurement and supplier relations, given Chrysler's shift toward voice and GM and Ford's shift toward exit in the 1990s. Unless Covisint can support either mode of exchange equally well, it may come to be dominated by certain automakers and shunned by others; the latter may pursue alternate exchanges, most likely private networks of their own design and including only their suppliers.

Toyota offers one case in point. Although it was reported in May 2000 that Toyota would join (Kisiel 2000a), rumors later in the year asserted that this decision would be reversed. For now, Toyota is still officially a member but does not hold an equity stake (*Manufacturing Engineering* 2001). But our interviews with consultants to Covisint suggest that although Toyota has closely followed what was going on at Covisint, it is not likely to join in any substantial way. During the early months of Covisint, Toyota proceeded to set up its own exchanges, for both OEM and aftermarket parts. Although the OEM parts exchange will involve bidding, "this is not an open bidding system," said Gene Tabor, Toyota general manager for purchasing. "We are not changing the way Toyota selects suppliers. We will still decide upfront who will be a Toyota supplier, and we wouldn't go to them for a sourcing quote until we have had discussions with them, and they've understood our strategies and philosophies." Sources of savings mentioned in the article were fewer mistakes in paperwork and data re-entry, and did not include lower prices from suppliers due to auctions (Chappell 2000).

Certain automakers have stayed aloof from Covisint from the start. VW and BMW have announced they would each set up their own exchanges (Kisiel 2000e). BMW worries that "Covisint is too controlled by our friends in America. We don't want our secrets in the hands of competitors," said William Becker, senior vice president of purchasing. And Bertil Thoren, head of purchasing at Volvo (now owned by Ford) said, "There is a risk [with Covisint] that relationships with suppliers could be affected. We don't want to destroy these relationships. We don't think we will ever take online quotes for parts" (Catterall and Chew 2000).[11]

Indeed, even Covisint's founding partners are pursuing other options. In August 2000, the U.S. arm of DaimlerChrysler announced that it was

developing its own system called FastCar to use the Internet to link design, engineering, finance, procurement, and manufacturing, with other divisions and with suppliers. "Covisint will never host our geometry [product design specifications]. Covisint will never host our business. Covisint will be our communications portal for suppliers," said Karenann Terrell, described by *Automotive News* as "DaimlerChrysler's B2B guru." DaimlerChrysler wants to develop this software itself because it sees it as a competitive advantage, she added (Kisiel 2000d, 2001b). GM is also developing its own exchange (GM SupplyPower) for most functions; GM views Covisint only "as a trading site for auctions and e-procurement," says GM chief information officer Ralph Szygenda (quoted in Joachim and Moozakis 2001; see also Wecker 2001).

Suppliers remain skeptical, even though Covisint has toned down its rhetoric about the power of auctions, preferring to discuss its supply chain management and design services instead. At a Covisint briefing in May 2001 that one of us attended, during a break a representative of a major supplier first looked around nervously to make sure Covisint representatives were not within earshot, and then said, "You do a dance [with Covisint]. On the one hand, you don't want to alienate your largest customers. On the other, you don't want to get locked into something that might not work, or might not meet your needs." In a confidential survey of 434 Ohio auto suppliers conducted in early 2001, only 24 percent of first-tier auto suppliers said they planned to join; 0 percent of third-tiers did (calculated from Sabety 2001). Dana, a $13 billion supplier with eighty-two thousand employees and a notable holdout from Covisint, has been running its own exchange, in partnership with FreeMarkets and Ariba (Baer and Davis 2001).

It may well be the code writers at Oracle and CommerceOne that have the most influence over how much Covisint affects the mode of exchange of these different companies (Lessig 1999b). (Indeed, the actions of these players have important implications for how Internet capabilities evolve and for regulatory requirements; see Yao, chapter 13, and the book's concluding chapter.) If the code writers emphasize exit-type capabilities first, it will make Covisint all that much more useful to firms already inclined toward exit, and less so for those inclined toward voice.

So far, the different strategies pursued by the two major software providers have been a major source of tension within Covisint. In 1999, GM

had chosen CommerceOne and Ford had chosen Oracle to power their independent sites. When the automakers decided to join forces, they simply ordered their software partners to work together. It was decided that there would be a UNIX platform, with basic infrastructure from Oracle, transactional capabilities provided by CommerceOne, and other firms providing software for supply chain management (Jankowski 2001).

These two IT firms have very different business models. CommerceOne envisions a process of "reintermediation" based on open standards and creation of common business libraries using XML. Firms would communicate with each other through an e-marketplace that provides translators converting various legacy databases into a standard form of XML, in addition to procurement services related to currency conversion, tax law advice, shipping, and financing (interview, CommerceOne April 2001). This infrastructure is intended to support an Internet business model in which "relationships are experimental and evolving, and have shorter lifetimes.... The goal is 'describe once, {sell, buy} anywhere,' which won't be met through point-to-point coupling approaches" (Glushko 2000).

CommerceOne franchised its MarketSite technology to a variety of e-marketplaces, some organized regionally (such as those organized by British Telecom and NTT), and some organized by industry (such as the Apparel Buying Network). Any type of procurement system could operate over a MarketSite network, including those offered by CommerceOne competitors Oracle or Ariba. CommerceOne is actively working with international standard-setting bodies to create a Global Trading Web, in which XML tags would be standardized enough so that if, for example, USX prepared a catalog for one e-marketplace (such as eSteel), it could be linked to another e-marketplace (such as Covisint) and USX's back office operations without re-keying. CommerceOne would make money by charging a fee (ranging from $.25 to $2) to suppliers for each transaction (Marti 2000; interview, CommerceOne, April 2001).

In contrast, Oracle's view is that most communication will take place directly between companies. The translation problem won't be so hard, because in their view, Oracle software will become the standard at most companies (just as Microsoft is the de facto standard for word-processing and spreadsheet applications). Larry Ellison, CEO of Oracle, has said publicly that he believes that CommerceOne will soon be out of business.

In response, CommerceOne believes that Oracle's strategy dooms users to inferior applications, because they won't be able to pick "best of breed" products that aren't Oracle-compatible (CommerceOne, Oracle interviews). So much for partnership!

So far, it seems that Oracle's business model is winning. Oracle and CommerceOne each own 2 percent of Covisint. (Ford and GM, in turn, each own 14 percent of CommerceOne [Kisiel 2001a]). However, Oracle will be paid a one-time fee for its software and will also get an (undisclosed) share of Covisint's gross revenue, whereas CommerceOne elected to get paid on a per-transaction basis. Because there have been relatively few transactions and few members, CommerceOne has not made as much money as expected.

CommerceOne is also suffering from other strategic decisions by Covisint. One of the key benefits of CommerceOne's global XML approach for users is the ability to connect across many e-marketplaces. But in an effort to keep transaction volume on its own exchange high, Covisint has opted not to make interconnection available (Jankowski 2001). Furthermore, the key software that CommerceOne is providing Covisint is for auction-based procurement, which is slated to become a less important piece of the site as collaborative tools are added. To strengthen its involvement in key Covisint functionality, CommerceOne is working at present on a supply chain management application for direct materials in partnership with SAP. (For more on the German firm SAP, and the high degree of complementarity between its products and traditional competencies in production scheduling, see Casper, chapter 7 in this volume.)

By inviting these "code writers" in, the automakers have placed a wild card in their future. Their choice may not affect just the structure of Covisint, but of other e-marketplaces as well, due to the huge size of Covisint. If the Oracle model wins, the B2B experience could end up being similar to consumers' experience with Microsoft: the software is relatively standardized and well integrated, but lock-in is high, and much of the profit from efficiency gains will go to the software firm, rather than to automotive suppliers, OEMs, or consumers. If CommerceOne's more open source vision wins, B2B exchanges and users may well need to spend more time sitting on standardization committees and integrating their own set of software applications, but will spend significantly less money.

Another issue is proprietary versus public exchanges. Both CommerceOne and Oracle are benefiting from the pursuit of private online solutions by firms unwilling to put all their eggs in the Covisint basket. Both firms sell applications that customers can use behind their own firewall, and help customers move applications back and forth between a proprietary exchange and a secure network host belonging to Covisint. In fall 2001, Covisint began to accept this option as well, signing contracts with Delphi to host the supplier's private exchange, and agreeing to become a portal for Ford's Supplier Network purchasing site, offering a single sign-on to the site and to Covisint, even though the site uses technologies that aren't on Covisint's list of preferred platforms. As *Internetweek* pointed out, these moves raise a question: "Are Covisint's two priorities—creating a self-sustaining business and setting technology standards for the auto industry—in direct conflict?" (Joachim and Moozakis 2001).

The promise of B2B was that firms would agree on HTML-like standards that would allow them to avoid the expense of a software Tower of Babel, in which a firm has to invest in many different programs to be able to communicate with all of its business partners. Yet recent developments show that this feature is not a given part of the Internet. Even Covisint's chief technical officer, Kevin Vasconi, is worried: "Left to our own devices, we'll do to XML what we did to EDI, and that would be a travesty," he said (Joachim and Moozakis 2001).

Thus, one possibility is that battles over standards and open sourcing will have as great an effect on the structure of B2B as they will in the public sphere. As Lessig (1999b) points out, the more open source code is, the more difficult it is for government to dictate how software must be written (e.g., whether it must include features to enable government monitoring of users), because many people could modify the code to defeat the government's purposes. In the case of B2B, the more open the code, the more profits are likely to accrue to traditional players in the industry (rather than software developers), and the less integrated the offerings are likely to be (meaning compatibility problems are more likely to arise, and that individual manufacturers may be able to reap competitive advantage from how well they use a common service like Covisint). (For more on the power of code writers, see the introduction to this volume.)

Another scenario is that the ultimate outcome is not path-dependent. In this view, held strongly by CommerceOne, firms initially start out with private exchanges and gradually move more functions over to the public e-marketplace as they realize that it is reliable and secure—and much cheaper (CommerceOne interviews, March 2001). Note that in this case, however, firms still incur the huge upfront cost of setting up a network.

Are there national differences reflected in the strategies of these code writers? Almost all of the major B2B firms are U.S.-owned. However, we do not think that this necessarily means that the software reflects American business culture more than others. Above, we have discussed two key strategic differences in code writing: whether the purpose of the software is collaboration or auctions, and whether its architecture is open or proprietary. As we have seen, US firms are active in all four areas: CommerceOne promotes open architecture and auctions, whereas Oracle's software is proprietary. And SupplySolution's open-architecture collaboration tool is part of both Covisint (a public exchange) and JCI's proprietary exchange.

With respect to architecture, European programmers in other types of software use both proprietary architectures (SAP) and open (Linux). The key determinant of strategy appears to be not nationality, but timing: first-movers appear to aim for proprietary standards, whereas open architecture is a feature that later entrants can use to woo customers. Some German companies are developing private exchanges utilizing both in-house software development and the capabilities of U.S. software firms; VW is working with MatrixOne and EDS, and Bosch with Ariba and CommerceOne (Joachim and Moozakis 2001). Such a strategy is slower than immediately buying and utilizing an existing open architecture product but may allow for customization while avoiding the mistakes of early adopters.

However, if U.S. exit-influenced preferences for auctions are likely to be embedded in software from U.S. software providers, this could influence the options available to global firms that would prefer to pursue voice mode. Those companies (e.g., Toyota) may simply develop their own private exchanges with software developed specifically to support voice mode. However, if many suppliers are signed up by Covisint and operating more in exit mode, they may not be so ready to work with firms in voice mode. Or Toyota may miss out on the opportunities of auctions

by not having ready access to the prevailing auction software, and not making complementary investments in the necessary business processes.

An alternate path could emerge from supplier attempts to achieve competitive advantage within a network of firms following the voice mode. Johnson Controls Inc. (JCI) has set up its own exchange, called NexCommerce, containing a mix of software packages, integrated by JCI, to support "Collaborative Commerce" or "C-commerce." Suppliers who are "Peer Partners™" of JCI will get access to a pre-engineered software and procedural toolset for product design, schedule fulfillment, and so on, optimized for use with JCI. "Early adopters of C-commerce in automotive will achieve first-mover advantages, much like their counterparts Cisco, Celestica, and others have already achieved in high-tech by using their supply and netbatsu partners to achieve profitable scalability and growth," writes John Waraniak, director, E-Business Speed, Johnson Controls Inc. (Waraniak 2001).

According to Tom Hachiya, a partner with Computer Sciences Corporation's Consulting Group:

> The challenge to JCI is, just as the industry is finally understanding the role of the systems integrator, they are moving to a network integration business model. JCI is setting up a virtual keiretsu, evolving their supply base from a sandlot baseball metaphor (where teams are assembled using available players on a happenstance basis) to a business model more closely resembling the organized "big leagues." JCI's goal is first to establish and then to optimize commercial, technical, and procedural connections with the best n-tier suppliers. The first mover advantage for JCI is that competitors like Magna, Delphi or Visteon will be handicapped by having to a) do business following JCI's processes, b) find alternate (lesser) suppliers or c) bear the cost of installing their own infrastructure.
>
> JCI has an incentive to make their mix of technical and procedural components somewhat unique, i.e., a blend of "off the shelf" technologies and proprietary intellectual capital, not entirely compatible with whatever Covisint eventually gets around to offering. Wherever Covisint is successful in establishing the de-facto standard, the benefit or value will inure to Covisint's OEM sponsors. JCI is betting on obtaining a return on their infrastructure development investments by superior access to their preferred suppliers' capabilities due to the reluctance and difficulties in replicating comparable (expensive) connections with Delphi, Covisint, etc. As JCI begins to compete more on the capabilities of their proprietary network than their internal competencies, it also commits them to more collaboration with *their* suppliers. There is a significant disincentive to working with supplier partners not on the network due to the friction of incompatible processes and technologies.

Ultimately, then, the race is between the commoditization acceleration effects of open standards versus the derivative value of collaborative supplier networks. The success of these proprietary networks in delivering customer value will largely be a function of their ability to outmaneuver Covisint and the open standard model. (Personal interview, December 2001)

In summary, auctions are still the most advanced application at Covisint, although collaborative planning and design tools are under development. Customers seem to be using auctions as a winnowing device, rather than binding themselves to select the low bidder, even from among the suppliers they themselves have declared qualified. Often what happens is that customers hold an auction among eight suppliers, and then negotiate among the top two or three firms. This suggests that even U.S. firms do not want to take advantage of the Internet's capabilities to pursue a pure exit model, and will be interested in Covisint's collaborative planning and design tools—or in developing their own such tools in a private exchange. One possible outcome is that B2B tools take on the disadvantages of the lack of standardization of their predecessors (EDI, CAD), and that the promise of cheap communication will not be realized. Whether firms use private exchanges or Covisint, software with open or closed architecture, we expect that automakers and suppliers will find ways to encode their historically dominant mode of exchange because of the high organizational costs of switching.

Disruptive Pressures to Modes of Exchange

So far, we have primarily considered how B2B directly affects modes of exchange; the first step in our analysis, as portrayed in figure 11.1. Now we turn to the second step in our analysis, considering how external factors affecting modes of exchange might alter our main prediction that B2B will reinforce historical dominant practices, relationships, and mindsets. These disruptive pressures could alter organizational switching costs and could also change the cost/benefit ratio for implementing various B2B capabilities. Here we continue our focus on the automotive industry case; in the next section, we consider these issues more broadly.

Global Restructuring and Strategic Alliances As firms from different countries and exchange traditions are linked through mergers and alliances of various kinds, the dynamics of restructuring and of global strategy-making will affect their future trajectory in unpredictable ways. In the auto industry, DaimlerChrysler and Renault-Nissan provide two contemporary examples. In both cases, financial crises led to mergers in which the dominant partner insisted on a shift from voice to exit.

Chrysler's very early history was more consistent with voice than either GM or Ford, yet it spent more than fifty years operating under the dominant exit approach of the U.S. industry. When near-bankruptcy in 1979 forced Chrysler to work collaboratively with its suppliers and unions simply to survive, historical patterns were broken. Chrysler sought to make its collaborative "extended enterprise" the basis for competitive advantage in the mid 1990s, under the leadership of Thomas Stallkamp (Dyer 2000). Yet in the management crisis of late 2000 that brought Daimler into direct control of Chrysler (following the exit of Stallkamp and many other Chrysler executives), the first-announced decisions were directed at cutting procurement costs by edict—all suppliers were instructed to reduce their prices to Chrysler by 10 percent if they wanted any future business. Consulting studies were produced that suggested suppliers had taken advantage of the collaborative regime to gain or maintain unreasonably high prices, and suddenly exit arguments and mechanisms had high legitimacy again. This is noteworthy because Daimler-Benz has hardly been a strong advocate of a strict exit approach in its German operations, nor would it be likely to propose similar measures to its German supply base in a similar situation.

Renault-Nissan is an even more intriguing case. Nissan's financial crisis, sustained over many years of decline and failed management initiatives, managed to discredit the entire Japanese approach to management, enabling Carlos Ghosn to enter from Renault and demand the breakup of Nissan's keiretsu purchasing arrangements. How will this sudden move toward exit be perceived in a country that still highly values voice (and whose two most successful automakers, Toyota and Honda, are very visible practitioners of this mode of exchange)? Will access to B2B capabilities make it easier or more difficult for Renault-Nissan to make this transition in Japan? If we are right that Covisint will initially lean toward procurement mechanisms such as auctions—and given Renault-Nissan's early and enthusiastic support for taking an equity stake —then we predict its participation will in fact speed movement toward exit.

Transfer of Responsibility from OEMs to Suppliers Our second factor pulls toward the voice mode of exchange. As OEMs transfer more responsibility for design, manufacturing, and logistics to first-tier suppliers, the exit mode with suppliers will be less viable.

This deverticalization is a relatively recent trend. Over the past 15 years, many suppliers have invested heavily in design capabilities in order to take over design tasks from OEMs. Suppliers have hoped to persuade automakers of the benefits of sourcing full modules (such as complete interiors) from one firm. The central argument has been one of "core competence"—design and production would be integrated on a large scale, by firms that specialized in all the relevant technologies. Wall Street looked favorably upon this strategy, and a great wave of consolidation occurred among auto suppliers in the 1990s. In some cases, small suppliers were bought by large suppliers aiming to provide "full service" design, production, and logistics services. In other cases, they remained independent, but increasingly supplied to a large, "first-tier" supplier rather than directly to the automaker.

This emergence of "mega-suppliers" at the first tier calls into question the hypothesis that Covisint's primary effect will be to squeeze supplier margins. These suppliers will design and coordinate the production of complete modules and subsystems (more on this below) that are too complex and idiosyncratic, given current product architecture, to be put out for auction. Furthermore, the number of suppliers capable of providing these bundles of products and services are too few in number to support much price competition. These suppliers are big enough that they could benefit greatly from using Covisint's capabilities to organize their own purchases from second- and third-tier suppliers. So although there is still considerable suspicion about Covisint among these new mega-suppliers, they may turn out to be more natural allies of the automakers than is now apparent.

National differences in modes of exchange will affect these power dynamics (Fine 1998), which will in turn affect the adoption and diffusion of B2B. If B2B involved only traditional industry players, it might simply recreate the current industry structure, particularly the dominance of the OEMs. However, the development of B2B capabilities will require that IT and logistics firms—with their very different product development rates, product architectures, and approaches to standardization—become

intertwined with the OEMs and their suppliers. As noted above, given that these outside firms will be helping to establish the protocols and write the code for the auto industry's B2B tools, their predilection for particular modes of exchange will be highly influential (Lessig 1999b).

Changes in Product Architecture The "dominant design" for automobiles has been quite stable for most of the past century, but now automakers and suppliers alike are investigating the potential gains and liabilities of moving toward a more modular product architecture. To the extent that this trend continues, the procurement requirements for modules are sufficiently different from that for simple components that it will disrupt current modes of exchange; this disruption will be accentuated if industry standards are identified for even a subset of those modules. The modular approach faces a number of obstacles, but the fact that modularity could facilitate the move toward a "build-to-order" system may increase the incentives to shift product architecture in this direction (Helper and MacDuffie 2001).

Discussions of modularity are often confounded by confusion about terminology. Following Ulrich (1995), we distinguish between a system, defined as the totality of components, interfaces, and software providing a key vehicle function, and a module, defined as a physically proximate "chunk" of components, typically from multiple systems, which can be assembled into the vehicle as one unit. The product architecture is the scheme by which functional elements are arranged into physical chunks and by which the chunks interact. It can range from modular to integral, and also from open to closed, in terms of whether standards are industry-wide or proprietary.

In contrast to the current personal computer industry, which is highly modular and open, the current dominant product architecture for automobiles is substantially integral rather than modular, and closed rather than open. That is, most components are not standardized across products or companies and have no common interface; hence, they are highly interdependent with other components and idiosyncratic to a particular model. The specifications for components are typically treated as proprietary and model-specific, shared only between an OEM and a supplier, rather than being widely known and accessible to a wide range of suppliers. Components from different companies or even different models

within the same company cannot be easily combined, so customization requires idiosyncratic modifications (Sako and Warburton 1999).

This product architecture is partly the result of the history of the industry, as described above. But some integrality seems inherent to the functioning of a modern car. For example, in designing a safety system, seat belts and airbags need to be in the interior, where the passengers are. But sensors need to be near the outside of the car, where the obstacles are. In contrast, it is relatively easy for computer makers to unite system functions and geography, for example, to put all functions related to typing in the single physical unit of the keyboard.

We believe that the extent to which the product architecture of an automobile moves toward modularity will be yet another influence on whether B2B will be primarily directed toward exit or voice modes of exchange. Modules can vary on two dimensions: (1) they can be produced either by vertically integrated or independent suppliers, and (2) they can be designed to fit only one OEM (or only one car model), or to be standardized across models and OEMs. If modular designs are outsourced to suppliers but remain nonstandard and OEM-specific, extensive interaction during design between OEMs and suppliers will be required. Similarly, if vehicle design remains integral, yet the production of OEM-designed components is outsourced extensively to suppliers, extensive interaction will be needed. In both cases, voice mode would be indicated, and would favor B2B capabilities that support collaborative product design.

In contrast, an exit strategy works well if: (1) there are many suppliers who can make a particular part (so the threat to leave is credible), and (2) there is little payoff to interaction between automaker and supplier, so frequent switching does not harm quality. If modular designs are kept vertically integrated (because control of modules is seen by OEMs as a "core competence"), the outsourced components would be relatively simple parts procured more readily via the exit model. An intermediate case might occur if module designs are standardized across the products of different automakers. On the one hand, this would reduce the need for communication between OEM and supplier as in the exit mode; on the other hand, these parts would be more complicated to make than individual components, with fewer suppliers capable of making them, reducing the automakers' ability to switch, as in voice mode.

Automakers may well vary in their choices about outsourcing and parts standardization. If a given module design is standardized, made interchangeable across products of two customers, then the supplier of that module to both customers would be hedged against sales declines at either one.[12] However, agreeing on a module standard across the industry limits any single automaker's freedom to design new capabilities into their vehicles. For example, a firm such as Toyota, which favors more integral designs and a voice approach to suppliers, would most likely move toward modules by doing the design work internally, maintaining model-specific idiosyncrasies to insure the integrity of the overall design, and working closely with its long-term suppliers on accomplishing production performance targets. On the other hand, GM—which favors a more modular product architecture, the outsourcing of modules, and an exit approach to suppliers—would prefer standardized modules available from multiple suppliers, so it could use its volume purchasing power and threat of exit to drive down module prices.

Summary

If one thing is clear from this complex summary of a complex industry, it is that the impact of B2B on modes of exchange is not by any means technically determined. For maximum effect, the nature of a firm's B2B investment should be complementary to its other investments, the investments of its competitors, and the nature of its competitive environment. In this sense, the effects of B2B will depend on the extent to which complementary changes occur in product design strategy (modular versus not, standardization versus not) and procurement strategy (voice versus exit), not to mention retail strategy (build-to-order, factory direct, dealer direct), which concerns B2C modes of exchange and is not our focus here.

These e-effects could be path-dependent: the order in which these changes occur could affect the ultimate outcome. For example, if the short-term effects of the Internet are to promote exit relations with suppliers, the scenario of moving toward complex modules sourced to powerful first-tier suppliers would become less likely than if voice-inspired information exchange with suppliers were to dominate. The reason is that the less tightly linked suppliers would probably not develop the skills to produce complex modules.

B2B's Next Phase: Implications for Modes of Exchange

B2B will have a staying power that will outlast the dot.bust that has afflicted B2C but, as the auto industry case makes clear, it will take forms very different from those first heralded by e-business proponents. Independent public exchanges, never a factor in autos, are failing at a rapid rate. The most visible failure, Ventro (previously Chemdex), a public B2B exchange for the life sciences and medical equipment industries, held its IPO in July 1999 and saw its share price rise from $15 to a high of $240. Its revenues in 1999 were $30.8 million. Yet at the end of March 2001, Ventro reported its second straight quarter of zero revenues; its marketplaces are shut down, three-quarters of its staff laid off, and its stock trading below $1.

With sellers and buyers under no obligation to transact through Ventro's public catalogs and procurement software, the exchange was unable to maintain the liquidity necessary to support its increasingly expensive infrastructure. Both suppliers and customers were able to reach better deals on commodity products through more specialized exchanges,[13] and able to build specific exchanges for longer-term relationships with more sophisticated supply chain management services. These problems are not unique to Ventro; observers now predict that fewer than 20 percent of the thousand B2B public exchanges founded in the last two years will survive in any form.

Ventro's experience highlights the advantages of the consortia approach at the industry level. These include a guaranteed source of transactions, financial liquidity, and a higher probability of achieving standards that facilitate interoperability. Other prominent B2B consortia include:

- Worldwide Retail Exchange, founded in March 2000 by more than fifty large multinational retailers, including Best Buy, Kmart, J.C. Penney, Safeway, and Target in the United States, Delhaize in Belgium, Auchan and Casino in France, Jusco in Japan, Royal Ahold in the Netherlands, and Kingfisher, Marks and Spencer, and Tesco in the United Kingdom. A competing exchange, Global Net Exchange, was founded at about the same time by Sears Roebuck (United States) and Carrefour (France); Kroger in the United States, Metro AG in Germany, and Sainsbury's in the United Kingdom have all joined subsequently. Wal-Mart is the exception, choosing to run its own B2B exchange with its vendors.

- Transora, a consumer products marketplace created in June 2000 by over fifty companies, including Kraft, Proctor and Gamble, and General Mills in the United States; and Cadbury Schweppes, Nestlé, and Unilever in Europe.
- Metalspectrum, a raw materials marketplace, is backed by over twenty of the leading firms in the metals industry, including aluminum giants Alcoa, Kaiser, and Reynolds. Its suppliers offer over 180 different metal products, from copper to aluminum and stainless to carbon steel.
- Pantellos, a consortium of 21 energy and utility companies, including Entergy Corp. and PG&E Corp.

These consortia share with Covisint the massive task of building the necessary infrastructure, deciding on the degree of interoperability they want, winning cooperation from both buyers and sellers, and deciding on the appropriate revenue model. So far, auctions are the most developed features of these exchanges and, as we would predict, the exchanges handling the most commodity-like products, such as Metalspectrum, have advanced the fastest. Although firms such as Target have increased their purchasing through Worldwide Retail Exchange, half of the volume so far has been for general and administrative items, such as plastic clothes hangers and office supplies. This category represents about 25 percent of Target's total procurement, or $8.2 billion. Much of the "cost of sale" purchases—those items for resale that make up the other 75 percent—are still not easily amenable to procurement on the exchange, because of the overwhelming variety Target sells (Totty 2001).

New revenue models are emerging from these consortia exchanges. One service offered by Transora is the Collaborative Planning, Forecasting, and Replenishment (CPFR) system designed by Syncra. Users of this service pay no fees whatsoever for transactions. What they pay for is the service of having accurate information generated instantaneously for buyer and seller alike, and their associated supply chains, through a web-based interface. This model is collaborative by design. Trading partners must reach an up-front agreement about confidentiality and dispute resolution, develop key metrics to track progress, and establish any financial

incentives and penalties. Plans for promotions, inventory policy changes, store opening/closings, and product changes must be shared, as well as demand forecasts and replénishment plans. Then when real time data on transactions are fed to all trading partners, they understand enough of the context to make sense of the data to adjust inventories, highlight over/understock conditions, and initiate replenishment (Johnson 2001).

Collaborative Planning, Forecasting, and Replenishment makes explicit a central truth about the consortia exchanges—that they will provide efficiencies through automation and standardization of the procurement process, while greater value-added activities, allowing more differentiated competitive advantage among their members, will arise from collaborative planning and design.

The consortia exchanges very much want to be the nexus of these latter activities. They are working hard to develop collaborative software tools and to persuade their trading partners that they will handle confidentiality and intellectual property issues appropriately. Yet some believe that collaborative planning and design will be better obtained through private exchanges between a focal firm and its supply chain and design partners. In a phrase from a recent Boston Consulting Group report on B2B, the goal will be "to exploit public exchanges to create private sources of advantage" (Elkington, Rasch, and Mosquet 2001). A firm could invite a supplier first encountered through an open auction on the industry exchange to join their private network for projects involving more complex procurement criteria and coordination requirements, more proprietary knowledge content, and a longer-term relationship.

There will be no shortage of software vendors rushing to support private network activities of this kind. L. M. Ericsson, which recently outsourced the building of mobile phone handsets to an electronics contract manufacturing firm, still runs five factories making cellular-network base stations. It recently installed supply chain software from Chicago-based PipeChain Inc. to aid collaborative planning. As Michael Totty (2001) reports:

> With the software, an Ericsson vendor can tell just by looking at a Web browser how rapidly Ericsson factories are using suppliers of a certain material, how many hours of inventory the factory has on hand, and how much the factory projects to use over the next several days and weeks based on actual orders and forecasts. The supplier can then adjust its production and shipping schedules accordingly, permitting it to make and deliver the component only as it's needed. What's more, the plants that supply the vendor can also use the software to adjust their production and shipping schedule.

This approach essentially adds new functionality and easier, lower-cost accessibility to the EDI model; database structure and variable definition are likely to be proprietary, at least initially. Ericsson (and PipeChain) might eventually benefit from the standard-setting activities of RosettaNet, the effort by a consortia of electronics companies to achieve XML-based global interoperability. This would increase the range of vendors available to Ericsson and the market for PipeChain's products. But until that time, Ericsson can achieve supply chain efficiencies on its own.

The future of industry consortia exchanges will involve complex governance issues. The basis for industry-wide collaboration is somewhat fragile, and developing industry-wide interoperability will require huge investments of time and money. They may well be undercut by the restlessness of individual firms to make progress through private exchanges developed with independent software firms. However, such specialized software firms may find they lack the capabilities to provide integrative tools for the full range of supply chain activities. The efforts of a firm such as Oracle to establish its approach as the database standard for B2B might help the industry consortia move more quickly, or simply make it easier for firms to opt out of the consortium exchange while still gaining access to a de facto standard.

What we don't know is whether the knowledge of industry context, procurement norms, and design processes that seems essential to apply B2B to collaborative planning and design is more likely to be established within an industry consortium or within private networks of trading partners. If multiple private networks thrive, it is possible that suppliers to multiple customers will face the same duplicate investment requirements that slowed the diffusion of EDI—even if the Internet makes the investment threshold easier to attain. As firms explore various exchange options, incentives for investment in getting the industry-wide exchanges up and running will be affected.

Ultimately, firms will probably hedge their bets, and not belong to only one exchange. There will be competition among types of exchange, along many different dimensions, that will greatly affect firms belonging to multiple exchanges. In short, B2B's next phase will have inter-firm

dynamics, involving both competition and cooperation, that will be far more complex and intriguing than the horse race between incumbents and startups that was the initial preoccupation of participants in this arena.

Conclusion

We have advanced in this chapter a central hypothesis about B2B—that it will have an evolutionary effect by accentuating and reinforcing existing modes of exchange. We see the largest impact of B2B as a significant reduction in the information costs of performing certain core procurement, planning, and coordination tasks between customers and suppliers. These gains will accrue, by and large, to all industry participants willing (and able) to make the initial investment to migrate these tasks to the Internet. This investment is already less for the Internet than for past electronic networks, such as traditional EDI, because of inexpensive hardware and open software protocols. However, considered across entire industries, these investment costs are still substantial, and much of the potential savings could be lost if firms choose proprietary rather than independent public exchanges. The degree of progress toward standardization of B2B protocols (including data labels in XML) will also have a tremendous impact on conversion costs and the ultimate level and distribution of benefits from B2B.

Regardless of whether the cost improvements for core tasks occur quickly versus slowly, or are large versus very large, these are primarily one-time gains associated with conversion to these new technological capabilities. The more substantial and lasting economic impacts of B2B will result from changes in the underlying transactional infrastructure of procurement. Here the legacy of past modes of exchange, both at individual companies and at the level of the nation-state, is powerful. Switching costs from a firm's dominant mode of exchange (or a nation's) to some other mode are extremely high. Given that B2B lowers information costs for any mode of exchange, the financial incentives to make the infrastructural shift are low.

This is true, in our view, as long as the environmental conditions supporting a given mode of exchange are stable. Once disruptive pressures affect a dominant mode of exchange, a firm may suddenly find the

tools and capabilities associated with B2B provide options for change that were previously unpalatable. At the country level, even more so, disruptive forces that challenge or invalidate the dominance of historical patterns of exchange will be needed before B2B is likely to have a transformative rather than an evolutionary impact.

It is a fluid time, when firms are experimenting with many kinds of B2B exchange and trying to figure out which mix will best support their procurement needs and strategic goals. Amid this experimentation, and in the absence of a strongly shared vision of what kind of exchange will best meet the interests of key stakeholders, investment incentives are very likely to be inadequate to allow pursuit of the most ambitious levels of standardization. Thus although private networks may be appealing because they overcome the governance problems of consortia, they may well lead to the problems of non-standard software that the open architecture of the Internet was supposed to prevent.

In summary, B2B demonstrates the powerful complementarities that exist between traditional capabilities and so-called "new economy" capabilities. These complementarities favor a strong continued role for incumbent firms and preservation of the historical legacies of different modes of exchange. Although the savings from B2B may increase the tenacity of these legacies in the short term, B2B does offer firms a wider range of feasible choices for procurement, collaborative planning, and co-design activities. The key to an effective supply chain is being able to respond flexibly to changes in conditions that are difficult to specify in advance, rather than the ability to automate routine tasks or run online auctions. B2B can be an important source of that flexibility.

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Notes

1. For analysis of the development of different historical trajectories in the auto industry, see Freyssenet et al. 2000.

2. Note that if a supplier cannot quickly replace a lost customer order, assets that could in principle be general purpose (such as a machine tool, or a broadly trained engineering staff), become in effect "dedicated capacity" (Williamson 1985; Helper 1995). A supplier will be less likely to invest in such capacity without contractual safeguards.

3. Note, however, that the video would not substitute completely for being at the actual site, because problem-solvers would not be able to pick up clues based on the senses of touch or smell, on chance conversations with people not participating in the video conference, or on intuition from the general factory environment.

4. This section draws on Helper, MacDuffie, and Sabel 2000; Hochfelder and Helper 1996; and Helper 1991.

5. Europe is an intermediate case, but has typically been closer to the US mode of exchange. For more on this point see Helper 1991; Sako 1992; Ahmadjian and Lincoln 2001.

6. For insight on the advantages and disadvantages of standardization for different economic agents, see Farrell and Saloner 1992; and Shapiro and Varian 1999.

7. For example, when a fire stopped production at Aisin Seiki, a firm that provided a brake component for 90 percent of Toyota cars, suppliers spent millions of dollars in inventing ways to make the component using general-purpose equipment (sometimes spending vastly more than the $2 price of the part), without negotiating any form of compensation in advance.

8. For example, Toyota may find it easier to experiment with auctions, because Covisint makes it easy to set up such transactions and find suppliers willing to participate. Conversely, the availability of cheap, general-purpose design tools may cause GM to experiment more with black-box design (of a type that does not involve information that suppliers consider to be their intellectual property).

9. For more detail, see the long version of Helper and MacDuffie 2001, posted at ⟨http://weatherhead.cwru.edu/helper⟩; and Fine and Raff 2001.

10. But this doesn't mean the Big Three do not face legal hurdles. In January, the aftermarket e-marketplace operated by Ford, GM, and DCX was sued by Choice Parts LLC for allegedly withholding access to industry parts data (Karpinski 2001).

11. Brian Kelley, former head of e-business for Ford, said it was a "myth" that "B2B is only about procurement and buying goods cheaper. It will start with procurement as the path of least resistance, but quickly move on to supply chain management and and product development, and, ultimately to complete integration of this ecosystem called the auto industry" (Kisiel 2000c). This view represents the convergent perspective of e-business champions rather well but neglects, in our view, the legacies of modes of exchange and pressures for competitive differentiation.

12. If a module supplier was owned by an automaker, other automakers might be reluctant to buy large amounts of parts from it, for fear of dependence and revealing proprietary information, so common interfaces would have less impact in the modules-with-vertical-integration scenario.

13. One reason why specialized exchanges can be more efficient is that their managers have the industry knowledge to screen information, in contrast to more general exchanges that send their members many RFQ's or supplier catalogs that are of no interest, because the only screening device they use is SIC code.