The International Center for Research on the Management of Technology

What We Have Learned and Have Yet To Learn From Manufacturer-Supplier Relations in the Auto Industry

Akira Takeishi
Michael A. Cusumano

May 23, 1995 **WP # 126-95**

Sloan WP #3842

Sloan School of Management
Massachusetts Institute of Technology
38 Memorial Drive, E56-390
Cambridge, MA 02139

INTRODUCTION

Interorganizational relations is among the most important areas in the study of modern industrial society. In the division of labor, which defines the modern industrial society, where to set the boundary between what work takes place inside versus outside a company, and what kind of relations to build between organizations are key elements.

Concern with these key elements has increased in significance since the 1980s when a newly conceptualized mode of economic organization began to attract growing attention. This new mode is typified by cooperative, interdependent and long-term relations among independent organizations and contrasts with other modes: markets and hierarchies. It has been discussed in different domains of academic research with various names, including "hybrid mode" (Williamson, 1991) and "quasi integration" (Aoki, 1990) in economics, "quasi-firm" (Eccles, 1981) and "network form of organization" (Powell, 1990) in organizational theories, "dynamic networks" (Miles and Snow, 1984) and "strategic networks" (Jarillo, 1988) in strategic management, "flexible specialization" (Piore and Sabel, 1984) in industrial development, and "network-based industrial system" (Saxenian, 1994) in regional studies, to name a few. Despite the breadth of domains of research, these studies have in common that they addressed advantages or possibilities of the new mode.

Evidence supporting these arguments have been found in matured to high technology industries in the U.S., Europe, and Japan. They include, for instance, the success of the rich web of small firms of the northern Italian textile industry, the emergence of dense ties among firms and universities in the global biotechnology industry, the contribution of Japanese inter-firm relations to their competitive advantage in the world market, and the innovative leaderships of the Silicon Valley network system in the U.S. electronics industry. Many companies have recognized "opening their boundaries to form strategic alliances with suppliers, customers and venture partners" as an important organizational strategy (Kanter, 1989). Not surprisingly, how to manage relations between organizations, such as original equipment manufacturers (OEMs) and their components suppliers, has been an increasingly critical concern of managers, academic researchers, and government policy makers.

This paper examines these and other issues related to the management of suppliers in the automobile industry, an industry which presents an excellent laboratory to study how organizations interact, as with subjects such as labor relations, manufacturing practice, and product development. Section I gives a brief overview of recent supplier management issues in the industry, followed by a summary of recent empirical studies, done mainly on supplier-management relations in the

United States and Japan since the mid-1980s in section II. Section III reviews the same literature in terms of theoretical or conceptual perspectives that are both existing and missing in the research. In particular, this review critically discusses the existing studies with regard to the conceptions, level of analysis, and unit of analysis, partly referring to Granovetter's (1985) argument. The paper concludes with some summary comments on what we have yet to learn in our studies of supplier management, at least based on what we know and do not know about the automobile industry.

I. SUPPLIER MANAGEMENT IN THE AUTO INDUSTRY

A typical passenger car contains more than 30,000 parts. Although original equipment manufacturers such as General Motors and Toyota assemble final vehicles, as much as 70% of the components typically come from outside parts suppliers. These outside suppliers are often involved in design as well as manufacturing. This means that the competitiveness of an automobile producer is highly dependent on the efficiency of its suppliers and how effectively it manages the division of labor with these companies.

Various studies have shown that Japanese firms have had particularly efficient and effective supplier systems, and that these supplier networks have played a major role in the international competitiveness of the Japanese automobile industry (Abernathy, Clark and Kantrow, 1983; Cole and Yakushiji, 1984; Cusumano, 1985; Womack, Jones and Roos, 1990; Nishiguchi, 1994). Growing recognition of Japanese advantages and of the distinct features of Japanese supplier management have also persuaded automakers in the United States and elsewhere to move close to Japanese practices (Helper, 1991; Cusumano and Takeishi, 1991). Japanese supplier relations have even emerged as an important agenda item in U.S.-Japan trade talks: the American government has claimed that exclusionary transactions between Japanese automakers and their suppliers is unfair and contributes to the large U.S. trade deficit with Japan.[1]

The rapid and continuous expansion of domestic Japanese vehicle production for more than forty years, from about 13,000 units in 1950 to 13,500,000 in 1990, enabled Japanese automakers to establish a unique set of relationships with suppliers that has benefited both parties. The Japanese auto industry today is no longer in such favorable circumstances. Declining production volume and poor financial performance due to economic recession and appreciation in the value of the yen since 1990 have induced Japanese automakers to change how they manage suppliers. For example, Japanese automakers have disregarded past relationships in some cases and switched to lower cost suppliers. They have also encouraged some suppliers to diversify their sales base and sell to more than one automaker. Furthermore, the likelihood of cyclical fluctuations in the future,

rather than continuous expansion of production, will require Japanese automakers to introduce additional changes in their relationships with suppliers (Fujimoto and Takeishi, 1994a, 1994b). They will likely import more parts in response to the high value of the yen as well as constant pressure from the American government.

At the same time, Japanese automakers continue to seek more effective and efficient approaches to supplier management for their overseas manufacturing plants in the United States, Europe, and other regions. Japanese automakers have recognized that, to operate in different industrial, institutional, and cultural settings, they need to modify their supplier management practices (as well as their manufacturing and management practices). They cannot simply replicate the supplier networks and relationships they have had in Japan. At the same time, American and European automakers are also attempting to change their traditional approaches to supplier management and move somewhat closer to the Japanese model. Thus manufacturer-supplier relations around the world today are clearly in a fascinating transitional phase.

II. WHAT THE LITERATURE SAYS

This section reviews the results of major empirical studies of suppliers in the automobile industry. Because a primary concern of this paper is supplier management in global competition, we focus on research that contains an international comparative perspective. We have not directly studied European supplier relations in any detail, however. Therefore, we primarily discuss research and practices that compare firms in the United States and Japan since the mid 1980s.

As summarized in Table 1, most of the literature we examine falls into four main areas: (1) the *strategy* of manufacturer-supplier relations (i.e. studies dealing with choices of actions towards make or buy decisions and towards supplier management); (2) the *structure* of manufacturer-supplier relations (i.e. studies dealing with vertical integration, transaction patterns, numbers of suppliers, divisions of labor, or the supply chain); (3) the *process* of manufacturer-supplier relations (i.e. studies dealing with the behavior among firms, such as problem solving, communication, and coordination activities and methods); and (4) the *performance* of manufacturer-supplier relations (i.e. studies that track output measures such as prices, quality, flexibility, or development lead time).

Strategy

Several researchers describe both strategic considerations and structural and/or process characteristics of supplier-management relationships. These elements -- strategy, structure and process -- are not clearly separated in some literature. This is not surprising, since the organization

structure and process of firms often follow their strategy, while preexisting structures, environmental settings, and interorganizational relationships and processes are among the elements that can constrain firms' strategic behavior. In general, however, Japanese automakers appear to have a distinctive strategy for suppliers. Their approaches have differed from U.S. (and European) practices in the past, although American automakers' relations with suppliers have been evolving toward Japanese patterns.

Perhaps the most fundamental strategic issue determining the structure of manufacturer-supplier relationships is the make-or-buy decision. How much of a product will a manufacturer make in-house, and how much will it subcontract or purchase? This decision then leads to other decisions about how to control or deal with suppliers to guarantee high quality, low prices, high product variety, competitive technology, and reliable delivery times and volumes.

American automakers in the early part of the 20th century made a strategic decision to buy key suppliers and manufacture most of their components in-house, rather than subject themselves to the influence of outside companies (Monteverde and Teece, 1982). To secure low prices, they generally made outside suppliers bid on components, and had many suppliers per component so that no one company could exert undue leverage over the automaker. U.S. automakers thus grew rapidly by investing in their internal manufacturing operations. They also retained a relatively large number of outside suppliers, most of whom remained relatively detached from individual automakers.

In an attempt to conceptualize manufacturer-supplier relations, Helper (1989, 1991) applied Hirschman's (1970) framework and suggested a classification scheme based on how companies resolve problems. In an "exit" strategy, the customer that has a problem with the supplier finds a new supplier. In a "voice" strategy, the customer works with the supplier to resolve the problem (Helper, 1991: 15). Helper distinguished the voice versus exit strategies by two dimensions: information exchange (the nature and mutuality of the information flow between supplier and customer) and commitment (the supplier's degree of certainty that the customer will continue to buy its products for some length of time). When both information exchange and commitment are low, the relationship becomes "exit." When both are high, it becomes "voice." She argued that although in the early stage of the American auto industry manufacturers took the voice strategy, U.S. automakers had gradually shifted to the exit strategy. Yet since the early 1980s, they have begun to return to the voice strategy, stimulated by the voice-based Japanese supplier relations system.

The story in Japan was very different. To accommodate growth in production levels that began in the late 1930s and early 1940s, and then rose dramatically from the mid-1950s, Japanese automakers, led by Toyota and Nissan, decided to subcontract increasing amounts of parts production and even some final assembly. Along with this decision, they decided to cultivate

organizations for parts suppliers, establish parts and assembly subsidiaries, invest in their key parts suppliers, loan suppliers equipment and money, and transfer executives and engineers to these companies (Cusumano, 1985). These moves reflected a clear "strategy" for supplier relations and outsourcing. These moves also permanently altered the "structure" and "process" of manufacturer-supplier relationships in the Japanese automobile industry, particularly as other Japanese automakers followed the lead of Toyota and Nissan in raising their levels of outside contracting and forming supplier networks.

In another historical analysis, Nishiguchi (1994) found that Japanese subcontracting once incorporated dualistic elements, i.e. it used to take advantage of lower wages and other costs in the secondary economy consisting of smaller firms. More recently, however, firms (producers in particular) appear to maintain this structure for strategic reasons to gain the economic benefits. He argued that Japanese subcontracting is distinguished by the economic benefits derived from inter-firm problem-solving mechanisms that ensure high quality, low cost products. In this interpretation, mutual economic benefits and strategy, rather than cultural preferences, bargaining, "flexible specialization," or "dual economy" explanations, account for the structure of Japanese manufacturer-supplier relations.

Structure

Today, Japanese automakers continue to have lower in-house production ratios than most U.S. and European competitors, although accurate comparative data are hard to find.[2] One set of estimates from the 1980s, based on manufacturing costs, suggested that the in-house production ratios of Japanese automakers were between 25% and 30%, compared to 50% or so in the 1950s. These Japanese levels presented a stark contrast to GM, which ranged between 50% and 70%. Ford was between 40% and 50%. Chrysler, at about 30%, was comparable to the Japanese. The Japanese levels are deceptively low, however, because key Japanese suppliers are often affiliated with particular automakers through partial stock ownership (a pattern rarely observed in the United States). For example, at least Toyota and Nissan had "group" vertical integration rates that approximated 70% to 80% of their manufacturing costs (Cusumano, 1985).

Other researchers have analyzed vertical integration and make-or-buy decisions in the U.S. auto industry using transaction costs.[3] By statistically examining the backward integration at GM and Ford in 133 automotive components, Monteverde and Teece (1982) concluded that transaction considerations surrounding the cultivation of particular skills encourage vertical integration. Walker and Weber (1984) tested 60 make-or-buy decisions in a component division of a large U.S. automobile manufacturer. Their results showed that, although transaction costs (such as the volume uncertainty of a component) existed, comparative production costs were far more

important. In other words, if an outside supplier's costs were lower than internal production costs, the automaker generally purchased the component.

Instead of the transaction costs approach, Hart (1989) applied the property rights approach to the case of GM's taking over Fisher Body in the 1910s. He argued that not transaction costs but the need to control Fisher's physical assets led GM to take the action. On the other hand, Langlois and Robertson (1989) claimed that the search for a general theory of vertical integration is perhaps less interesting than seeking a schema that determines when various particular explanations, such as stages of industrial life cycle, conditions of demand, economies of scale and appropriability are applicable.

Although the degree of vertical integration is certainly an important issue, since the mid-1980s, GM and Ford have followed the Japanese and Chrysler in reducing their levels of in-house manufacturing. This has brought more attention to the "buy" decision. Some studies have observed that the number of suppliers per part has also decreased in the United States, and that suppliers have taken on a greater role in product development. Both trends suggest that the strategy and structure of manufacturer-supplier relations in the United States is becoming closer to that found in the Japanese automobile industry (Cusumano and Takeishi, 1991; Helper, 1991; Helper and Sako, 1994; Kamath and Liker, 1994).

In spite of lower rates of outsourcing, American automakers purchased from a higher number of suppliers than did the Japanese. For example, Asanuma (1988) found that Toyota had 172 suppliers at the firm level and 125 on average for each assembly plant. These numbers for GM were 5,500 and 800, respectively. A key reason for this difference seemed to be Japan's tiered or pyramid structure of contracting (Clark and Fujimoto, 1991; Nishiguchi, 1994). Japanese automakers buy sub-assembly units or system components from first-tier suppliers, who buy parts from subcontractors in the second tier, who buy from subcontractors in the third tier, and so on. Nishiguchi (1994: 122) called this a structure of "clustered control." Japanese automakers thus have direct transactions with only a small number of first-tier suppliers. American automakers, in contrast, purchase parts at relatively lower stages of assembly from a larger number of parts manufacturers.

The number of suppliers per type of part also differed between companies in the two countries. Asanuma (1988) found that American automakers retained, on the first tier, a larger number of marginal suppliers, and gave them purchase orders only intermittently. U.S. automakers also had a larger number of local suppliers who supplied only one or at most a few plants of a given customer.

Again, these and other differences between Japanese and U.S. automakers have been diminishing over time. Helper (1991), Cusumano and Takeishi (1991), and Kamath and Liker (1994) all reported decreases in the number of suppliers for American automakers during the late

1980s. These researchers also observed decreasing numbers of suppliers per part type in the United States as well as the emergence of a tiered structure of control. Cusumano and Takeishi (1991) as well as Nishiguchi (1993b) even found that the number of suppliers per part type during the late 1980s and early 1990s was smaller for American automakers than for the Japanese in some parts for particular products. Using a model based on the theory of incomplete contracts, Bakos and Brynjolfsson (1993) demonstrated that when non-contractible supplier investments such as investments in quality, responsiveness and innovation are important, the incentive considerations would lead buyers to limit the number of suppliers. This argument is consistent with the actual trend in the American auto industry.

With regard to the division of labor between suppliers and manufacturers in parts development, Asanuma (1989), Clark and Fujimoto (1991), and Nishiguchi (1993a) all found that Japanese suppliers played a larger role than U.S. suppliers. Clark and Fujimoto (1991) categorized the role of suppliers in product development into three modes: (1) suppliers that develop parts entirely as standard products (supplier proprietary parts); (2) suppliers that conduct detailed engineering based on functional specifications provided by automakers (black-box parts); and (3) suppliers that only produce parts completely designed by the automakers (detailed-controlled parts). Their survey data indicated that, in the mid- to late 1980s, black-box parts accounted for 60% of Japanese components. In the U.S., however, detailed-controlled parts accounted for 81%. More recently, American automakers have moved closer to the Japanese approach, relying more on black-box parts. This means that they are giving increased responsibility to suppliers and have asked them to be involved in product development more deeply and at earlier stages (Kamath and Liker, 1994).

While the foregoing studies discussed the structure of relations between an automaker and its supplier(s), Fujimoto and Takeishi (1994b) described the structure of transactions among multiple parties (customers and suppliers). Figure 1 illustrates the average transaction structure for different parts in terms of the sourcing dispersion per automaker and the customer dispersion per supplier in Japan. The sourcing dispersion (on the vertical axis) shows the number of suppliers on which an automaker depends, or how intense the competition is among the suppliers for that part. The customer dispersion (on the horizontal axis) indicates the average number of automakers on which a given supplier depends.

Japanese manufacturer-supplier relations are sometimes thought to be exclusive, with the assumption that only one supplier can enter the market for one automaker. These data, however, indicate that such "one-to-one" relationships are relatively rare. On average, each Japanese automaker procures each part from approximately three suppliers, and each supplier sells the same part to approximately three automakers. More importantly, the transaction patterns differ widely by the type of part. For example, there is a near "one-to-one" relationship for fuel tanks, with neither

side having a particular advantage. In the case of electronic switches, however, the automakers (customers) seem more powerful. On the other hand, suppliers are in the "power" position for glass parts. Manufacturers and suppliers have very loose relationships with regard to commodity products such as tires.

Whereas Figure 1 shows average transactions, Table 2 describes four different patterns of transactions among individual automakers and suppliers (Fujimoto, 1994). For example, in the case of bumpers (Type 4), major automakers utilize both in-house production and outsourcing from dedicated or independent suppliers (a mixture of make and buy, or tapered integration). This table does not cover all transaction patterns, but it suggests that the relations between automakers and suppliers might differ depending on transaction patterns. Variations in how manufacturers outsource different parts can lead to different levels of competitive pressure on suppliers, different degrees of dependency on suppliers, and opportunistic behavior by suppliers.

Another topic of recent research is the structure of the entire supply chain from first-tier suppliers to third-tier or lower suppliers. In Japan, for example, the relations between assemblers and first-tier suppliers constitute only a small part of the supplier chain. Whereas, according to Japanese census data, the number of first-tier suppliers is between 500 and 1,000, the number of second- and lower tier suppliers approaches 10,000.

To study this subject, Fujimoto, Sei and Takeishi (1994) jointly conducted a questionnaire survey during 1992, analyzing how automakers in a particular region of Japan divided labor in both production and engineering among all levels of suppliers. The questionnaire went to parts manufacturers in Kanagawa Prefecture, Japan's second largest prefecture for automobile production. The survey data suggests a pyramid-like structure of tiered suppliers as well as several specific observations summarized in Table 3.

First, there appear to be distinct differences among the layers of suppliers. The lower a supplier was in the pyramid, the more likely it was to have the following characteristics: a smaller size (measured by the number of employees); a higher ratio of minority production workers (female, part-time, family, or foreign); fewer engineering capabilities; and a smaller production lot size per part variation. A typical third-tier supplier, for example, was a small family-owned firm consisting of about 10 employees, some of whom were minority workers. It manufactured parts in small lot sizes using designs developed entirely by the original equipment manufacturers.

Second, although equity participation and the organization of *kyoryokukai* by Japanese manufacturers (see table footnote) are tools for enhancing close relations between buyers and suppliers, the survey indicates that equity participation existed only between assemblers and first-tier suppliers. Furthermore, the kyoryokukai only brought together assemblers, first-tier suppliers, and second-tier suppliers. Also, while most transactions between assemblers and first-tier suppliers had continued since the 1950s, those between the second and the third started mainly in

the 1970s or 1980s. This suggests that the lower a supplier was in the "pyramid," the weaker and shorter were its relationships with the buyer.

Third, the average number of final assemblers (definition in table footnote) was highest for first-tier suppliers and lowest for the third tier. The business of third-tier suppliers tended to be limited to automakers locating their assembly plants in Kanagawa prefecture (such as Nissan, Mitsubishi Motors, and Isuzu). In contrast, first-tier suppliers provided components not only to local assemblers but also to other assemblers located more distantly, including Toyota, Honda and Mazda. This means that lower tier suppliers were more dependent on the limited number of local assembly plants.

Process

A third area of literature deals with the process or behavioral characteristics of manufacturer-supplier relations, that is, how manufacturers and suppliers manage and coordinate their relationships. Here we also find numerous differences between Japan and the United States, though with some convergence toward Japanese practices.

Helper conducted a survey in 1989 that showed supplier-customer relations in the United States to be moving closer to a voice model, albeit with some exceptions (Helper, 1991: 17-20). This contrasts to her earlier 1984 survey, which showed more of an orientation in the United States towards exist relationships. The 1989 survey also detected a richer flow of information between the two parties (i.e., better quality data from suppliers and more frequent visits from customers for technical information), as well as an increased commitment on the part of customers (longer contracts and fewer suppliers per part). In addition, a more recent survey done with Sako showed that U.S. companies have continued moving toward the voice model, which is a problem-solving-oriented model and is more typical of Japanese manufacturer-supplier relationships (Helper and Sako, 1994).

Nishiguchi (1994) also studied problem-solving behavior. He found that the Japanese producer strategy of delegating a substantial portion of manufacturing functions to subcontractors has encouraged joint problem solving and generated various methods of problem solving, such as the target cost system, VA/VE problem solving techniques and resident engineers.

Other research supports Nishiguchi's findings. For example, Sei (1989), focusing on quality management practices among Japanese suppliers, found a similar problem-solving orientation. In specifications for parts drawings and in quality assurance contracts between Japanese automakers and suppliers, Sei found explicit expressions that assigned to suppliers the responsibility to solve whatever problems arise. He concluded that this practice has encouraged the continuous improvement of parts and materials quality in Japan.

A study that tries to explain the nature of relationships is Sako (1992). Based on detailed case studies of the British and Japanese electronics industry, she distinguished two ideal types of buyer-supplier relations: "obligational contractual relations" and "arms-length contractual relations." In contrast to the arms-length contractual relations, obligatory contractual relations have "a great transactional dependence on trading partners, a longer projected length of trading, a greater willingness to accept or offer orders before prices were negotiated and fixed, less contractualism, a greater degree of uncosted sharing of technological know-how and risk associated with business fluctuations"(Sako, 1992: 241). Sako also found that Japanese firms tend to use obligational contractual relations and the British firms arms-length contractual relations, and concluded that obligational contractual relations are based on ongoing trust ("goodwill trust") between buyers and suppliers.[4]

Bensaou (1992) studied how automakers coordinated relations with suppliers in the U.S. and Japanese automobile industries, focusing on the use of information technology. Relying on a survey distributed to managers at Japanese and American automakers, Bensaou analyzed uncertainty issues and coordination mechanisms. Uncertainty included environmental, partnership, and task concerns; coordination included structural, process, and technological mechanisms. His statistical analysis identified nine patterns of "fit" configurations between uncertainty and coordination: structural relationships; electronic integration; arms length relationships; mutual adjustment; quasi-integration; remote control; partnership control; electronic coordination; and electronic control, with each having a distinct set of uncertainty and coordination mechanism. For instance, in arms length relationships, under high environment and task uncertainty, firms did not make a high investment in coordination. This study revealed that these different configurations existed in both the United States and Japan. Bensaou found four configurations present in both countries, as well as two specific to the United States and three specific to Japan.

In product development, Kamath and Liker (1994) found that clear communication with suppliers and carefully considered targets were important tools to coordinate and manage the development efforts of suppliers. In addition, Dyer (1994) found that that face-to-face communication with suppliers in product development played an important role in Japan. Toyota, for instance, had "guest engineers" from suppliers work jointly at its own development sites and maintained intense face-to-face contact with nearly all its suppliers. On average, Toyota had five guest engineers per supplier and engaged in 7,235 man-days of face-to-face contact per year with suppliers, whereas GM had 0.2 guest engineers and 1,107 man-days of contact.

In addition to face-to-face communication and guest engineers, Dyer (1995) found that Japanese automakers share more information with suppliers, and have suppliers make more dedicated investment and build plants at a closer distance than the American counterparts, indicating higher "site, physical and human asset specificity"of Japanese supplier relations. This

notion is consistent with Asanuma's (1989) argument of "relation-specific skills," accumulated by suppliers who design, manufacture and improve costs and quality of parts for their customer.

Performance

Many external and internal factors affect the performance of a company, only some of which are under a company's control. Nonetheless, researchers have used various measures in their attempts to gauge the performance of manufacturer-supplier relations. These measures cover diverse aspects of product development, manufacturing, pricing, investment patterns, operating costs, and logistics.

In product development, for example, Clark and Fujimoto (1991) estimated that the more extensive involvement of suppliers and the strong supplier relationships of Japanese automakers accounted for one-third of their advantage in product development hours. Suppliers also appeared to account for four to five months of the Japanese advantage in product-development lead time.

In pricing and the manufacturing quality of purchased parts, Cusumano and Takeishi (1991) found that Japanese automakers, in contrast to U.S. automakers, enjoyed lower defect rates and more accurate target-price ratios (the degree to which suppliers met their proposed prices by the time they started production). The Japanese also benefited from greater price and defect reductions over time. The performance of suppliers to Japanese transplants in the United States fell in between the performances of suppliers to the Japanese and American automakers.

In manufacturing flexibility, Nishiguchi (1994) reported that Japanese automotive components producers surpassed all competitors in areas such as product mix and product variations, design changes, manpower flexibility, inventory levels, and delivery frequency. The next most flexible suppliers were to the Japanese transplants in the United States, and then suppliers to U.S. and European auto producers.

Helper (1991) showed that voice relationships generally lead to higher performance. She then argued that a rich flow of information between suppliers and manufacturers made possible the effective use of techniques such as value analysis and value engineering. As evidence, she produced survey results indicating that suppliers with voice (as opposed to exit) relationships with their customers used more computer numerically controlled (CNC) machine tools and computer-aided design (CAD) tools, produced in smaller batches, and more rapidly installed quality assurance systems.

Sako (1991) concluded from her case study that obligational contracting promoted competitiveness by economizing on organizational costs. These costs include searching for suppliers, as well as the costs of negotiations, inventories, monitoring, and the like.

Bensaou (1992) measured the coordination performance between manufacturers and suppliers by asking automakers' purchasing and engineering managers to rate suppliers on issues

such as satisfaction ratings with delivery times and buffer inventory levels. Among the nine configurations of coordination that he found, five emerged as relatively high performing. Within Japan, electronic control relationships showed the best performance, whereas, within the United States, electronic coordination exhibited the highest level of performance.

Dyer (1995) reported a positive relationship between interfirm asset specificity and performance. Comparative data for Toyota, Nissan, GM, Ford and Chrysler suggest a positive relationship between interfirm human asset cospecialization and both quality and new model cycle time, as well as between site specialization and lower inventory costs. He argued that a tightly integrated production network, characterized by proximity together with a high level of human cospecialization, outperforms a loosely integrated production network with a low level of human cospecialization.

III. PERSPECTIVES IN AND NOT IN THE LITERATURE

Analysts of interorganizational relations come from several disciplines and adopt many different theoretical or conceptual perspectives (for reviews of interorganizational relations in general, see Whetten, 1981; Hall, 1982; Galaskiewicz, 1985; and Yamakura, 1993). This variation is appropriate because, clearly, many factors determine the strategy, structure, process, and performance of supplier relations within one country as well in different countries. We also agree with the statement that "there is no one theory of interorganizational relations" (Galaskiewicz, 1985: 298). Nonetheless, many useful perspectives inherent in the literature we have cited help to explain what strategies, structures, and processes appear in manufacturer-supplier relations, as well as why there are differences in performance. The research also lacks several perspectives needed to explain manufacturer-supplier relations and performance more fully.

Conceptions: Undersocialized Versus Oversocialized Accounts

Although it is a generic framework, Granovetter's (1985) embeddedness approach provides some important insights into the research of interorganizational relations. Granovetter argues that some of the existing theories of economic action are either "undersocialized" or "oversocialized," and that these two theory tendencies have in common a conception of action and decision carried out by "atomized" actors. In undersocialized explanations of behavior, the tendency of atomization in theories results from an assumption of a narrow utilitarian pursuit of self-interest on the part of the actors. In oversocialized explanations, people are assumed to have internalized behavioral patterns, therefore, ongoing social relations are seen to have only a peripheral effect on their behavior. Granovetter claims instead that economic action is embedded in

structures of social relations and the embeddedness approach should thread its way between the oversocialized and undersocialized accounts.

According to him, transaction cost theory, for instance, is an undersocialized explanation of behavior, while culturalism is an oversocialized explanation. Among the studies cited in this paper, Monteverde and Teece (1982) and Walker and Weber (1984) applied a transaction cost approach. Both showed that transaction costs could explain make-or-buy decisions, but only in part. Walker and Weber found that comparative production costs overshadowed transaction costs when manufacturers made decisions on in-house manufacturing versus outside sourcing. Monteverde and Teece (1982: 212) pointed out that the backward integration at GM and Ford took advantage of the ability of their internal organizations to reduce their exposure to opportunism from suppliers. However, various studies suggest that this type of opportunism is all but absent in the less integrated Japanese automobile industry, where manufacturers and suppliers closely cooperate in design as well as manufacturing. The transaction cost theory, which assumes that actions will be driven by opportunism, does not obtain in this case, as argued by Granovetter.

Dore (1987) emphasized a cultural perspective to explain the different approach taken in Japan, insisting that transaction costs for Japanese firms may well be lower than elsewhere because of "moralized trading relationships of mutual goodwill." Dore's explanation has some merit to the extent that all organizations reflect some characteristics of their local culture and society. It falls short, however, as a complete explanation. For example, if culture has determined the structure and process of supplier-management relations in Japan, then we cannot account for the recent change in the behavior of Japanese automakers as they search for new low-cost suppliers, regardless of past transactions. Furthermore, even within Japan, Toyota has had a much stronger supplier network than Nissan or the other Japanese automakers, yet they all operate within the same cultural and social environment (Cusumano, 1985). In addition, Japanese transplants have successfully built relationships with American suppliers who do not share the Japanese cultural tradition of "goodwill" trust and cooperation (Kenney and Florida, 1993).

Helper's voice-exit model attempts to bridge economic accounts and social or political accounts of manufacturer-supplier relationships. According to Hirschman (1970: 15), on which Helper based her model, exit belongs to the realm of economics, and voice to the realm of politics, and both are equally important determinants of interorganizational relationships. Bensaou (1992) also took the perspective that various elements affect relations, including transaction costs as well as organizational and political-economic considerations. This study is unique in that Bensaou explicitly took into account environmental and technological factors such as market uncertainty and task analyzability, which differ by part type, automaker, and country. He also identified some connection between coordination configurations and performance.[5]

It seems to us that any satisfying explanation of manufacturer-supplier relations will need to adopt multiple perspectives with the embeddedness approach. Furthermore, particular phenomena need specific explanations rather than general, all-encompassing theories. For example, manufacturer-supplier relationships seem to vary by the type of part. To understand why, or how manufacturers and suppliers might better manage their relationships for different types of components, we need to analyze in detail the specific factors behind these different patterns.

Level of Analysis: Interorganizational Networks and Boundary Spanning Roles

Granovetter (1985) suggested that we should view firms and relationships as part of a broader structure or "network" of relationships, rather than as individual or "atomistic" entities or merely dyadic relations. Although most authors only analyze interfirm relations or transactions between an original equipment manufacturer and its supplier(s), manufacturers and suppliers relate to each other within a network of relationships that stretches across the supplier chain. Rather than focusing on dyadic relations, researcher could extend the level of analysis to interorganizational networks both *horizontally* and *vertically.*[6]

Manufacturers, even in Japan, have more than one supplier for each component, and suppliers in turn have their own range of customers and suppliers. Thus, researchers should incorporate into their analyses the fact that relationships exist not only between one customer and one supplier, but also among multiple customers and suppliers (horizontal extension) across the whole supply chain (vertical extension). It is possible that the actions as well as the attitudes and behaviors of actors in the supplier chain can only be fully explained in terms of their positions within a network of relationships.

As Nohria (1992: 7) argued, even comparative analyses of organizations should take into account differences in network characteristics. For example, one may argue that some American suppliers defined as first-tier are counterparts of the Japanese second-tier suppliers, since they provide parts to component divisions of the U.S. automakers rather than to assembly divisions directly. If we compare those American first-tier suppliers and Japanese second-tier suppliers, we might find more similarities, as opposed to comparing the first-tier suppliers in both countries. An international study of entire supply chains would provide an even better comparison. This might help us understand what is truly unique and effective (or ineffective) in Japanese, or American and European, patterns of supply-chain management.

Within the network perspective, we can see the value of analyses that focus on particular elements, such as where a firm exists within a tier of relationships within the supply chain. For example, it is clear that Japanese automakers have built relations with their first-tier suppliers based on high levels of mutual dependency and a specialized division of labor. Many studies suggest that the result is higher levels of efficiency in manufacturing and product development, compared

to other automakers around the world. Recent data from Fujimoto, Sei, and Takeishi (1994), however, show that this is not the whole story if one looks at the entire supplier system in Japan.

Below the first tier we observe a different world, as illustrated in Figure 2. In the upper tiers, from assemblers down to second-tier suppliers, an integrated and stable division of labor seems to exist. Inside this "core" group of firms, the buyer-supplier relations are diversified (suppliers have multiple customers) yet long-term, and are facilitated by kyoryokukai organizations. For third-tier suppliers, which are outside the core group, there are few kyoryokukai, customers are limited to local assemblers, and the transaction history is shorter. Also, within the core group, there is a cleavage between first- and second-tier suppliers, where the equity ties from assemblers ended.

The supplier network and system of inter-firm relations depend upon all the tiers in the system. But the role of firms in the lower tiers is not so clear. Although the Fujimoto, Sei, and Takeishi survey data are only suggestive, it does seem that lower tier suppliers engage in smaller lot size manufacturing. This brings up the issue of how, in an industry where economies of scale are important to efficiency, lower tier suppliers could live with small lot sizes. We do know that scale does not explain performance entirely, and minimum-efficient scales appear to vary with different production practices (Cusumano, 1985). But there are other possible explanations for efficiency in the case of lower tier suppliers.

For example, most of these are small firms averaging about 10 employees, with very small indirect costs, such as general administration and sales expenses. This is not the case for upper tier suppliers. The fact that no third-tier suppliers in the Fujimoto, Sei, and Takeishi sample did engineering also indicates that their expenses are mostly manufacturing-related. Another reason for their efficiency could be their low wage expenses. This study did not collect data on wages, but other data indicates that small firms pay wages as low as 60% of those in larger firms (Cusumano, 1985). Third-tier suppliers also employed more female, part-time and foreign workers, who usually receive lower wages and total compensation. With those cost saving factors, as well as lower capital investment (seen, for example, in their greater use of relatively inexpensive general purpose machines), third-tier suppliers can probably provide small lot-size components more easily and cheaply than upper tier suppliers.

Japanese automakers have been widely acclaimed for their manufacturing flexibility. They manufacture vehicles with more variety and still have higher productivity than foreign competitors. They can serve many different international markets as well as different customer segments within any one market with relatively small penalties in manufacturing efficiency or quality. Previous empirical studies have argued that Japanese automakers have achieved this combination of efficiency and flexibility through their manufacturing practices as well as supplier networks (Cusumano, 1985; Womack, Jones and Roos, 1990). These studies, however, do not precisely

specify how lower tier suppliers that make small lot-size parts contribute to this performance advantage, or what economic and social consequences these lower tier suppliers might face. Nishiguchi (1994) addressed the issue of flexibility at suppliers more directly, although we still need to know how the degree or type of flexibility varies by firm characteristics, and to what extent flexibility corresponds to where a firm is located in the supplier chain.

It could also be argued that the clustered division of labor and control corresponds to differences in the division of labor and control mechanisms between bureaucratic and non-bureaucratic organizations. As shown in the Fujimoto, Sei, and Takeishi (1994) data, third-tier suppliers are primarily family-owned and very small, and presumably not very bureaucratic. This suggests that at least part of the Japanese advantage in the past has stemmed not solely from the competencies of the automakers at the top of the pyramid but also from their interactions with small, non-bureaucratic firms that, for a variety of reasons, combine flexibility and efficiency.

In addition to horizontal and vertical extensions, this area of research can also benefit from extending the level of analysis *internally*: looking at the level of departments or individuals within the organization (internal extension).[7] Most studies cited examined inter-firm relations at the organizational level based on the firm-level data or individual-level data such as questionnaires to managers.

What is missing in the existing literature is explicit and detail analyses of boundary spanning persons and departments.[8] In particular, when we examine the processes of manufacturer-supplier relations, we should pay more attention to the role, function, capability and power of the boundary spanning persons and departments both externally and internally. For instance, actual communication between automakers and suppliers is undertaken between boundary spanning personnel and departments, including purchasing, development, production control, quality assurance departments, as well as even top executives. Trust, if any, also emerges through the interactions between them. Accordingly, to understand communication, commitment, problem solving and trust, we should study which persons in which departments interact with their counterparts in what ways, and how they are positioned within the organization. This is, again, consistent with Granovetter's (1985: 504) suggestion for future research: we should "pay careful attention to the actual patterns of personal relations by which economic transactions are actually carried out."

Unit of Analysis: "Efficiency" and Beyond National Comparisons

From the practitioner point of view or from the strategic management perspective, a critical question is how to manage inter-firm relations in such a way as to outperform the competitors. While many studies cited at the beginning of this paper addressed the advantages of the intermediate mode or network form over market and hierarchy, they did not examine what is a

more effective and efficient way of managing interfirm relations within the mode or form. Some empirical researchers have made some progress in this area, although this research also has limitations.

Among the studies reviewed in the previous section, Bensaou (1992) found that particular coordination configurations are linked to better performance. His study, however, was developed solely on a questionnaire survey that asked managers in automobile companies to state their perceptions. The results were somewhat conceptual and abstract, rather than practical and operational.

Similarly, Helper (1991) reported that a "voice" approach to management leads to better performance. The voice-exit polarity, however, is a simplification of reality, especially since her classification scheme measures only information exchange and commitment through contract length and reduction of the number of suppliers. Since we have observed a convergence toward the voice model, we need further research that breaks down this model of behavior into a richer set of patterns and social contexts. Dyer (1995) identified various types of asset specificity which contribute to performance differences among automakers, yet numerous other factors could also contribute.

Another issue to be addressed is that most studies on suppliers take the perspective either of the automakers or their suppliers, but not both, probably because it is difficult to obtain matching data from both sides. However, even though performance may be satisfactory for one party, if it is not satisfactory for the other, the relation may lose effectiveness in the long-term.[9] In order to analyze effective relations over the long-term, we should investigate combined performance or evaluations of the customer and supplier. Dyer (1995) attempted to combine both automakers' and suppliers' performance in inventory costs and profitability. Similar approach should be encouraged in future research.

Most researchers also adopt the perspective of national industry-level comparisons, rather than conduct comparative analyses of individual automakers and their supplier networks (see Table 1). National comparisons have value to the extent that generalizations are valid for most firms in a particular country. But we have observed a convergence in supplier-management practices in Japan, the United States, and Europe. Hence, we now need to examine differences in practices and performance at a more sophisticated level. In this regard, we think the approach and perspectives discussed above could make some contributions. Granovetter (1985) indicated that a web of social relations is mainly what explains the level of efficiency of organizational forms.

Even in manufacturing practice and performance during the late 1980s, differences among firms within particular countries were as large or larger than differences between averages in each country. This is apparent in the data presented in Womack, Jones, and Roos (1990), even though these authors chose to focus on national comparisons. Clark and Fujimoto (1991) compared

product-development performance both by national averages and by different approaches to project management; they provide a more insightful set of data that can be an example for future research on suppliers. Another potentially instructive study is described in Nobeoka (1993) and Nobeoka and Cusumano (1994). This abandoned overt national comparisons of product-development performance and, instead, focused on difference strategies and performance characteristics associated with these different strategies.

IV. CONCLUSION

We clearly know a lot about manufacturer-supplier relations, although there are still many aspects of this subject that we do not know much about (Table 4). In general, we think future research needs to provide a more holistic, integrated analysis based on multiple perspectives. Future studies should extend the level of analysis horizontally, vertically, and internally, and include social and network considerations as well as point to strategic implications for efficient management . There are many studies with rich empirical findings to build on, in particular Helper (1991), Bensaou (1992), Nishiguchi (1994), Sako (1992), and Sei (1990). Each offers a different but complementary perspective.

For a more integrated analysis, researchers may need to combine the viewpoints of both automakers and suppliers. This dual-perspective analysis could lead to a better picture of how manufacturer-supplier relations as a whole affect productivity and quality in parts development and manufacturing, as well as new technology development.

We have also noted that different researchers observe some convergence in supplier management in the world auto industry toward what has been the Japanese model. In addition, we see new attempts to seek efficient and socially acceptable ways to manage supplier relations that suit different regions of the world as well as competition on a global rather than national basis. Managers, researchers, and policy makers thus need to understand several categories of issues more deeply.

First, it is always useful to know what constituted effective and efficient models of manufacturer-supplier relations in the past, because this understanding provides insights into the present and the future. A study of history is not enough, however, and this leads to a second category: we must continue to study how the situation of manufacturer-supplier relations varies and undergoes change in different countries around the world to the extent that national differences and generalizations remain valuable for strategic decision making or government policy. Third, we need to research more carefully what is required for efficient and socially acceptable manufacturer-supplier relationships in different countries as well as in competition that takes place on a global

basis. Most firms now operate in multiple countries, and have supplier networks that are global, yet much supplier research is still oriented toward particular nations and markets. Fourth, we need studies that suggest the likely directions or patterns that manufacturer-supplier relations will take in the future under different scenarios. It would be useful, for example, to reflect on what patterns of convergence will mean if particular countries or firms retain some elements of their past relationships.

In sum, we would like to see future research on manufacturer-supplier relations that takes on the following characteristics:

Analyses that combine multiple perspectives (rather than either oversocialized or undersocialized accounts, such as transaction costs or cultural explanations).

Analyses that consider transaction patterns among multiple parties (rather than focus on one-to-one relations between an assembler and a supplier).

Analyses that take into account the whole supply chain (rather than focus on assemblers and first-tier suppliers only).

Analyses that analyze interactions among boundary spanning personnel and departments (rather than focus on abstract firm level only).

Analyses that identify efficient as well as socially effective practices (rather than focus on highly conceptual or simplistic abstractions).

Analyses that are based in strategic, structural, or process differences (rather than focus on broad national comparisons).

Analyses that adopt both the manufacturer and supplier viewpoints (rather than focus on one perspective or the other).

REFERENCES

Abernathy William J., Kim B. Clark, and Alan M. Kantrow (1983). *Industrial Renaissance. Basic Books*, New York.

Adams, J. Stacy (1976). "The Structure and Dynamics of Behavior in Organizational Boundary Roles," in M.D. Dunnette (ed.), *Handbook of Industrial and Organizational Psychology.* Rand McNally, Chicago: 1175-1119.

Adams, J. Stacy (1980). "Interorganizational Processes and Organization Boundary Activities," in B. Staw and L. L. Cummings (eds.), *Research in Organizational Behavior*, Vol. 2, JAI Press, Greenwich, Conn.: 321-355.

Aldrich, Howard, and Diane Herker (1977). "Boundary Spanning Roles and Organizational Structure." *Academy of Management Review*, Vol. 2, No. 2, April: 217-230.

Aoki, Masahiko (1990). "Toward an Economic Model of the Japanese Firm." *Journal of Economic Literature*, Vol. 28, March: 1-27.

Asanuma, Banri (1988). "Japanese Manufacturer-Supplier Relationships in International Perspective: The Automobile Case." Working Paper #8, Faculty of Economics, Kyoto University.

Asanuma, Banri (1989). "Manufacturer-Supplier Relationships in Japan and the Concept of Relation Specific Skill." *Journal of the Japanese and the International Economics*, 3, March: 1-30.

Bensaou, Mustapha (1992). "Inter-Organizational Coordination: Structure, Process, Information Technology." Unpublished Ph.D. Dissertation, MIT Sloan School of Management, Cambridge, MA.

Bakos, J. Yannis, and Erik Brynjolfsson (1993). "From Venders to Partners: Information Technology and Incomplete Contracts in Buyer-Supplier Relationships." *Journal of Organizational Computing*, 3 (3): 301-328.

Clark, Kim B., and Takahiro Fujimoto (1991). *Product Development Performance.* Harvard Business School Press, Boston, MA.

Cole, Robert, and Yakushiji Taizo (1984). *The American and Japanese Auto Industry in Transition.* University of Michigan Press, Ann Arbor.

Cusumano, Michael A. (1985). *The Japanese Automobile Industry.* Harvard University Press, Cambridge, MA.

Cusumano, Michael A., and Akira Takeishi (1991). "Supplier Relations and Supplier Management: A Survey of Japanese, Japanese-Transplant, and U.S. Auto Plants." *Strategic Management Journal*, Vol. 12: 563-588.

Dore, Ronald (1987). *Taking Japan Seriously: A Confucian Perspective on Leading Economic Issues.* Stanford University Press, Stanford, California.

Dyer, Jeffrey H. (1994). "Dedicated Assets: Japan's Manufacturing Edge." *Harvard Business Review*, November-December: 174-178.

Dyer, Jeffrey H. (1995). "Specialized Supplier Networks as a Source of Relational Quasi Rents: Evidence from the Auto Industry."

Eccles, Robert (1981). "The Quasi-firm in the Construction Industry." *Journal of Economic Behavior and Organization*, 2: 335-357.

Evan, William M. (1993). *Organizational Theory: Research and Design.* MacMillan, New York.

Fujimoto, Takahiro (1994). "Buhin Torihiki Kankei to Sapuraiya Sisutemu: Jidosya Sangyo wo Chuushin ni" [Parts Transactions and Supplier System: Mainly from the Case of the Automobile Industry]. Discussion Paper Series, 94-J-19, University of Tokyo.

Fujimoto, Takahiro, Shoichiro Sei, and Akira Takeishi (1994). "Nihon Jidosya Sangyo no Sapuraiya Sisutemu no Zentaizo to sono Tamensei" [Supplier System in the Japanese Automobile Industry: Its Entire Structure and Multifaceted Features]. *Kikai Keizai Kenkyu*, No. 24, May, Kikai Shinko Kyokai Keizai Kenkyusho: 11-36.

Fujimoto, Takahiro, and Akira Takeishi (1994a). "Jidosya Sangyo [The Automobile Industry]," in Yoshikawa Hiroyuki and the Japan Commission on Industrial Performance (eds). *Meido in Japan* [Made in Japan]. Daiyamondo-sha, Tokyo: 103-131.

Fujimoto, Takahiro, and Akira Takeishi (1994b). *Jidosha Sangyo 21 Seiki heno Shinario* [The Automobile Industry: A Scenario towards the 21 Century]. Seisansei Shyuppan, Tokyo.
Galaskiewicz, Joseph (1985). "Interorganizational Relations." *Annual Review of Sociology*. 11: 281- 304.
Gerlach, Michael L. (1992) *Alliance Capitalism: The Social Organization of Japanese Business*. University of California Press, Berkeley, CA.
Granovetter, Mark (1985). "Economic Action and Social Structure: The Problem of Embeddedness." *American Journal of Sociology*, 91: 481-510.
Hall, Richard H. (1982). *Organizations: Structure and Process* (Third edition). Prentice-Hall, Englewood Cliffs, N.J.
Hart, Oliver (1989). "An Economist's Perspective on the Theory of the Firm." *Columbia Journal Law Review*, 89: 1757-1774.
Helper, Susan (1989). "Strategy and Irreversibility in Supplier Relations: The Case of the U.S. Automobile Industry." Working Paper #89-22, School of Management, Boston University.
Helper, Susan (1991). "How Much Has Really Changed between U.S. Automakers and Their Suppliers?" *Sloan Management Review*, Summer 1991: 15-28.
Helper, Susan, and Sako Mari (1994). "Supplier Relations in the Auto Industry: A Limited Japanese-U.S. Convergence?" Paper submitted to Supplier Think Tank, MIT International Motor Vehicle Program, Cambridge, MA.
Hirschman, Albert O. (1970). *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*. Harvard University Press, Cambridge, MA.
Jarillo, J. Carlos (1988). "On Strategic Networks." *Strategic Management Journal*, Vol. 9: 31-41.
Kamath, Rajan R., and Jeffrey K. Liker (1994). "A Second Look at Japanese Product Development." *Harvard Business Review*. November-December: 154-170.
Kanter, Rosabeth Moss (1989). *When Giants Learn to Dance: Mastering the Challenges of Strategy, Management, and Careers in the 1990s*. Simon and Schuster, New York.
Kenney, Martin, and Richard Florida (1993). *Beyond Mass Production: The Japanese System and Its Transfer to the U.S*. Oxford University Press, Oxford, U.K.
Langlois, Richard N., and Paul L. Robertson. (1989). "Explaining Vertical Integration: Lessons from the American Automobile Industry." *The Journal of Economic History*. XLIX, No.2: 361-376.
Miles, Raymond E., and Charles C. Snow (1984). "Fit, Failure and the Hall of Fame." *California Management Review*, Vol. 26, 3: 10-28.
Monteverde, Kirk, and David J. Teece (1982). "Supplier Switching Costs and Vertical Integration in the Automobile Industry." *Bell Journal of Economics*, 13: 206-213.
Nishiguchi, Toshihiro (1993a). "Competing Systems of Auto Components Development." Paper submitted to Annual Sponsors' Briefing Meeting, MIT International Motor Vehicle Program, Cambridge, MA.
Nishiguchi, Toshihiro (1993b). "Governing Competitive Supplier Relations: New Auto-Industry Evidence." Paper submitted to Annual Sponsors' Briefing Meeting, MIT International Motor Vehicle Program, Cambridge, MA.
Nishiguchi, Toshihiro (1994). *Strategic Industrial Sourcing: The Japanese Advantage*. Oxford University Press, New York.
Nobeoka, Kentaro (1993). "Multi-Project Management: Strategy and Organization in Automobile Product Development." Unpublished Ph.D. Dissertation, MIT Sloan School of Management, Cambridge, MA.
Nobeoka, Kentaro, and Michael A. Cusumano (1994). "Multi-Project Strategy and Market-Share Growth: The Benefits of Rapid Design Transfer in New Product Development." MIT Sloan School of Management Working Paper #3866-94/BPS, May 1994, Cambridge, MA.
Nohria, Nitin (1992). "Is a Network Perspective a Useful Way of Studying Organizations?" in Nitin Nohria and Robert G. Eccles (eds.), *Networks and Organizations: Structure, Form, and Action*. Harvard Business School Press, Boston, pp. 1-22.

Piore, Michael J., and Charles F. Sabel (1984). *The Second Industrial Divide: Possibilities for Prosperity*. Basic Books, New York.
Powell, Walter W. (1990)."Neither Market nor Hierarchy: Network Forms of Organization," in B. Staw and L. L. Cummings (eds.), *Research in Organizational Behavior*, Vol. 12, JAI Press, Greenwich, Conn., pp. 295-336.
Rousseau, Dennis M. (1985)."Issues of Level in Organizational Research: Multi-level and Cross-level Perspectives," in B. Staw and L. L. Cummings (eds.), *Research in Organizational Behavior*, Vol. 7, JAI Press, Greenwich, Conn., pp. 1-37.
Sako, Mari (1992). *Prices, Quality and Trust: Inter-Firm Relations in Britain and Japan.* Cambridge University Press, Cambridge, U.K.
Saxenian, Annalee (1994). *Regional Advantage: Culture and Competition in Silicon Valley and Rout 128*. Harvard University Press, Cambridge, MA.
Sei, Shoichiro (1990). "Aimai na Hacchu, Mugen no Yokyu ni yoru Hinshitsu Gijutsu Suijun no Kojo" [Improving Quality and Technology through Vague Specification and Never-ending Requirements] in Chuo University (ed.), *Jidosha Sangyo no Kokusaika to Seisan Shisutemu* [Internationalization and Production Systems in the Automobile Industry]. Chuo University Press, Tokyo.
Thompson, James D. (1967). *Organizations in Action*. McGraw-Hill, New York, NY.
Van de Ven, Andrew H., and Diane L. Ferry (1980). *Measuring and Assessing Organizations*. John Wiley & Sons, New York.
Walker, Gordon, and David Weber (1984). "A Transaction Cost Approach to Make-or-Buy Decisions." *Administrative Science Quarterly*, 29: 373-391.
Whetten, David A. (1981). "Interorganizational Relations: A Review of the Field." *Journal of Higher Education*. 52 (1): 1-28.
Williamson, Oliver E. (1991). "Comparative Economic Organization: The Analysis of Discrete Structural Alternatives." *Administrative Science Quarterly*, 36: 269-296.
Womack, James P., Daniel T. Jones, and Daniel Roos (1990). *The Machine that Changed the World*. Rawson Associates, New York.
Yamakura, Kenshi (1993). *Soshiki kan Kankei* [Interorganizational Relations]. Yukikaku, Tokyo.

END NOTES

[1] Attention to and criticism of Japanese interfirm relations are not limited to those in the auto industry. Japan's interfirm relations and organizations have been analyzed in various areas. For instance, see Gerlach (1992) for a study of Japanese business networks.

[2] See Cusumano (1985: 186-193) for comparative estimates.

[3] There is no similar study of vertical integration of Japanese automakers, although Cusumano (1985) and Nishiguchi (1994) provide an historical explanation of the lower in-house production ratio in Japan.

[4] Although this is a study of the electronics industry, Sako extended this concept to the auto industry (Helper and Sako, 1994).

[5]As mentioned above, the success of Japanese supplier management seems to have been supported by favorable circumstances, and we need to examine to what extent the "traditional" Japanese model can be sustained in an adversarial and turbulent environment.

[6] According to Van de Ven and Ferry (1980), there are three levels of analysis of interorganizational relationships: (1) pairwise or dyadic interorganizational relationships; (2) interorganizational sets; and (3) interorganizational networks. Studying the relations between one customer and one supplier belongs to the first, whereas studying the relations among multiple parties belongs to either the second or third, depending on the level of analysis.

[7] In studying organizations, researchers must explicitly address the role of level (organization, department, work group, individual) in organizational phenomena and properly specify one's analytical model (Rousseau, 1985).

[8] For boundary spanning roles, activities, and personnel, see Thompson (1967), Adams (1976, 1980), Aldrich and Herker (1977), and Evan (1993).

[9] For instance, according to our recent interviews with American suppliers, although the number of suppliers has been reduced and the length of contracts has become longer, suppliers' profitability has been suppressed due to the requirement of price reduction from manufacturers. They are not necessarily comfortable with current relations with customers. Similarly while the Japanese auto industry no longer expect a favorable environment with constant growth of production, how to establish an efficient yet sustainable relations with suppliers has become a difficult challenge for automakers.

Table 1: Recent Studies of Manufacturer-Supplier Relations in the Auto Industry

Study	Area	Major variables	Level of analysis	Unit of analysis	Unit of comparison	Data source
Asanuma (1988, 89)	Structure	Number of suppliers, supplier's role in development and manufacturing (relation-specific skill)	Dyadic	Interfirm relations	Country (J,U)	Case studies
	Process	Price negotiation				
Bensaou (1992)	Structure	Market concentration	Dyadic	Transaction by parts	Transaction, country (J,U)	Questionnaire to automakers
	Process	Communication, conflict and resolution, trust, commitment				
	Performance	Company rating of suppliers				
Clark & Fujimoto(1991)	Structure	Supplier's role in development	Dyadic	Development project	Firm, country (E,J,U)	Questionnaire to automakers
	Performance	Development lead time				
Cusumano(1985)	Strategy	Outsourcing and forming supplier network	Dyadic	Interfirm relations	Firm (J)	Case studies (historical)
	Structure	Vertical integration, subsidiaries				
Cusumano & Takeishi (1991)	Structure	Number of suppliers, contract length	Dyadic	Transaction by parts by model	Country (J,J/U,U)	Questionnaire to automakers
	Process	Information exchange				
	Performance	Target price ratio, price change, defect rate, defect rate change				
Dyer (1994,95)	Process	Face-to-face communication, guest engineers, information sharing, distance between plants, non-redeloyable capital investment (asset specificity)	Individual, department	Interfirm relations	Firm, country (J,U)	Case studies Questionnaire to suppliers
	Performance	Defect rate, new model cycle time, inventory level, profitability				
Fujimoto (1994)	Structure	Transaction matrix between multiple customers and suppliers	Network	Transaction by parts	Firm, parts (J)	Industry data
Fujimoto, Sei & Takeishi (1994)	Structure	Firm size, number of customers, supplier's role in development, production lot size, stock ownership	Supply chain	Interfirm relations	Tier (J)	Questionnaire to suppliers
Fujimoto & Takeishi (1994b)	Structure	Number of suppliers, number of customers	Network	Transaction by parts	Parts (J)	Industry data
Helper (1989, 91)	Strategy	Voice vs. exit strategy	Dyadic	Transaction by parts	Firm, country (J,U)	Questionnaire to suppliers
	Structure	Number of suppliers, contract length				
	Process	Communication, commitment				
	Performance	JIT delivery/production, investment				
Kamath & Liker (1994)	Structure	Supplier's role in development	Department	Interfirm relations	Firm, country (J,U)	Case studies
	Process	Communication, target setting				
Monteverde & Teece (1982)	Structure	Vertical integration	Dyadic	Transaction by parts	Parts (U)	Industry data
Nishiguchi (1993a,b)	Structure	Number of suppliers, supplier's competition, supplier's role in development	Dyadic	Transaction by parts by model	Country (E,J,U)	Questionnaire to suppliers & automakers
Nishiguchi(1994)	Strategy	Strategy for collaborative manufacturing	Dyadic, supply chain	Interfirm relations	Country (E,J,J/U, J/UK,U)	Case studies (historical) Questionnaire to suppliers
	Structure	Tiered structure, number of suppliers, contract length, supplier's role in development				
	Process	Problem solving				
	Performance	Manufacturing flexibility				

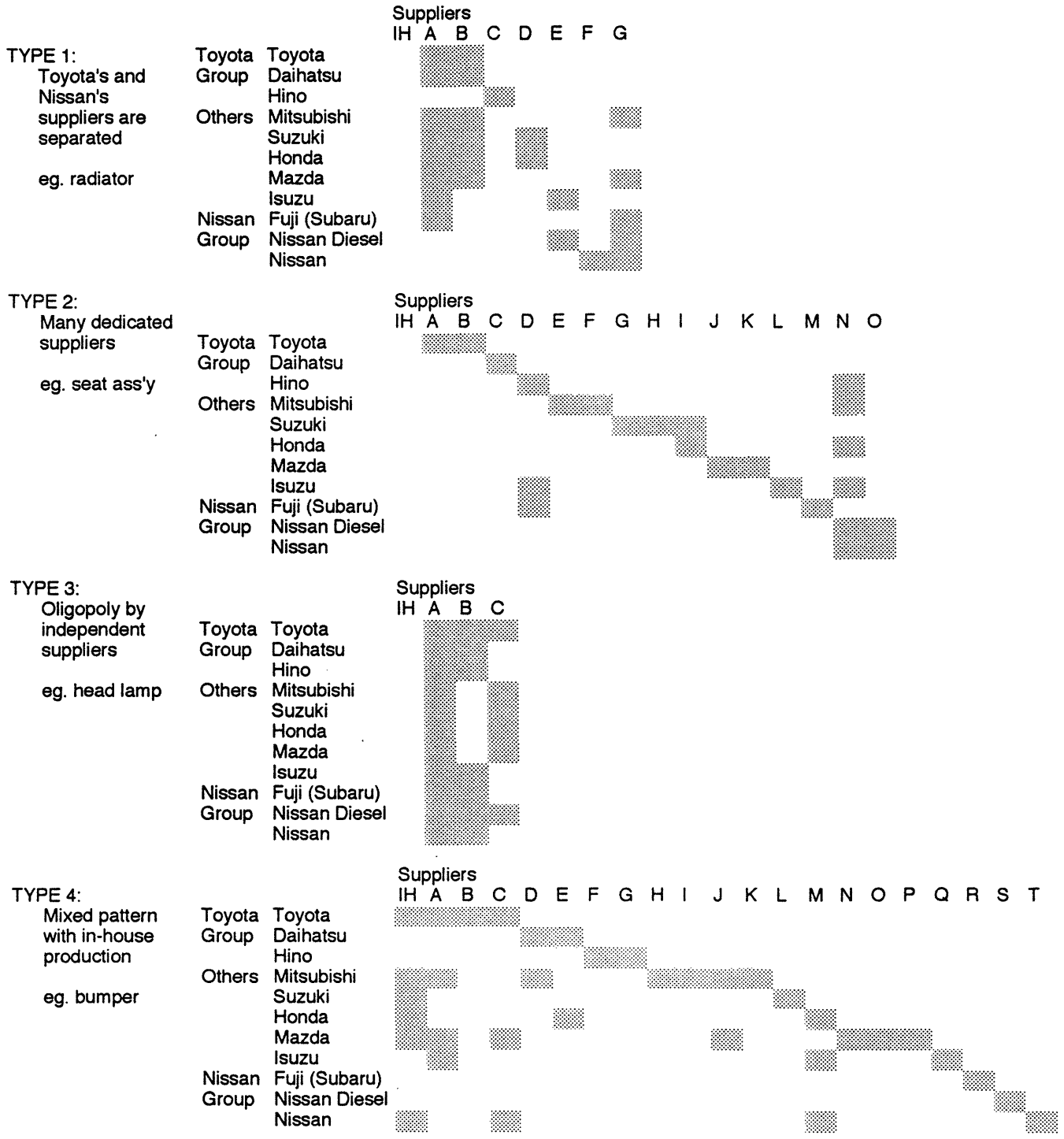
(Continued)

Table 1: ***(Continued)***

Study	Area	Major variables	Level of analysis	Unit of analysis	Unit of comparison	Data source
Sako (1992)	Structure Process	Dependence, contract length Trust, communication, risk sharing, technology transfer (arm's length vs. obligational contractual relations)	Dyadic, supply chain, department	Interfirm relations	Firm, country (J,UK, J/UK)	Case studies
Sei (1990)	Process Performance	Problem solving, contract and specifications Defect rate, tolerance	Dyadic	Interfirm relations	Country (J,J/U,U)	Case studies
Walker & Weber (1984)	Structure	Vertical integration	Dyadic	Transaction by parts	Parts (U)	Company data

Note: Level of analysis: network=interfirm network level analysis; supply chain=supply chain level analysis; dyadic=dyadic interfirm relations level analysis; individual/department=individual/department level analysis
E=Europe, J=Japan, U=U.S.A., UK=U.K., J/U=Japanese transplant in the U.S., J/UK=Japanese transplant in the U.K.
Only major areas, variables, level of analysis,unit of analysis and comparison, and data source are shown.

Table 2: Patterns of Supplier-Manufacturer Transaction Matrix in Japan (1990)



Note: ▨ = transaction exists as of 1990. IH = Inhouse production.
Daihatsu and Hino, whose stocks are partially owned by Toyota, belong to Toyota group.
Similarly, Fuji and Nissan Diesel belong to Nissan group
This list of the four types is not exhaustive.

Source: Fujimoto (1994) with some additional data from industrial source.

Table 3: Description of Suppliers by Tiers
(Summary of the Survey Results in Kanagawa, Japan)

Attributes		First tier	Second tier	Third tier
Employees	# of employees	Larger (1,200)	Middle (70)	Smaller (10)
	Average age of employees	Younger (39)	Middle (42)	Older (46)
	Production workers	Mainly fulltime male workers	Mainly fulltime male workers	Higher rate of family, female, part-time, foreign workers
Buyers	Buyers	Mainly assemblers and 1st tiers, but also 2nd and 3rd tiers	Mainly 1st and 2nd, but also assemblers and 3rd tiers	Mainly 2nd and 3rd, but also 1st tiers
	Final assemblers	Diversified	Diversified	Limited to local
	Average # of assemblers	More (5.3)	Middle (4.5)	Less (2.5)
Relations with the primary buyer	Starting year	Mainly 1950's (45%)	Mainly 60's (32%), then 70's (24%)	Mainly 70's (47%) and 80's (42%)
	Participating kyoryokukai	79% join	70% join	30% join 45% no kyoryolkukai
	Support from buyers	Equity share (41%), Directorship (33%), Equip. loan (25%) No support(38%)	Equip. loan (25%) Tech. support(19%) No support (54%)	Tech. support(11%) Equip. loan (11%) No support (79%)
Operations of the major part	Operations in charge	Subassembly, stamping machining, welding	Subassembly, stamping machining, welding	welding, machining
	Production lot size (thousand/month)	Larger (4500)	Middle(500)	Smaller (100)
	Variation of the part	More (595 types)	Middle (107 types)	Less (35 types)
	Lot size per variation	Larger (7600)	Middle(5000)	Smaller (4000)
	Engineering of the part	Own eng. (59%)	Own eng. (23%) Buyer's eng. (77%)	Buyer's eng. (100%)

Note: The sample size differs slightly across the cells, but in most cases 40 responses for the 1st tier suppliers; 60 for the 2nd; 20 for the 3rd; and 120 in total.
The numbers are either the sample means or % of the sample distribution within the group.
1st/2nd/3rd tier supplier: a supplier whose largest buyer is a vehicle assembler/1st tier supplier/2nd tier supplier
Buyers: The buyers who directly purchase the parts from the supplier.
Primary buyers: the buyer who accounts for the largest sales for the supplier.
Final assemblers: The final assembler which uses the parts the supplier manufactures.
Kyoryokukai: An association organized by the buyer to facilitate communication between the buyer and the participating suppliers.
The major part: the type of parts which accounts for the largest amount of sales for the supplier.
This is based on a questionnaire survey conducted in 1992 summer in the Kanagawa prefecture, which is the second largest prefecture for the automobile production in Japan.

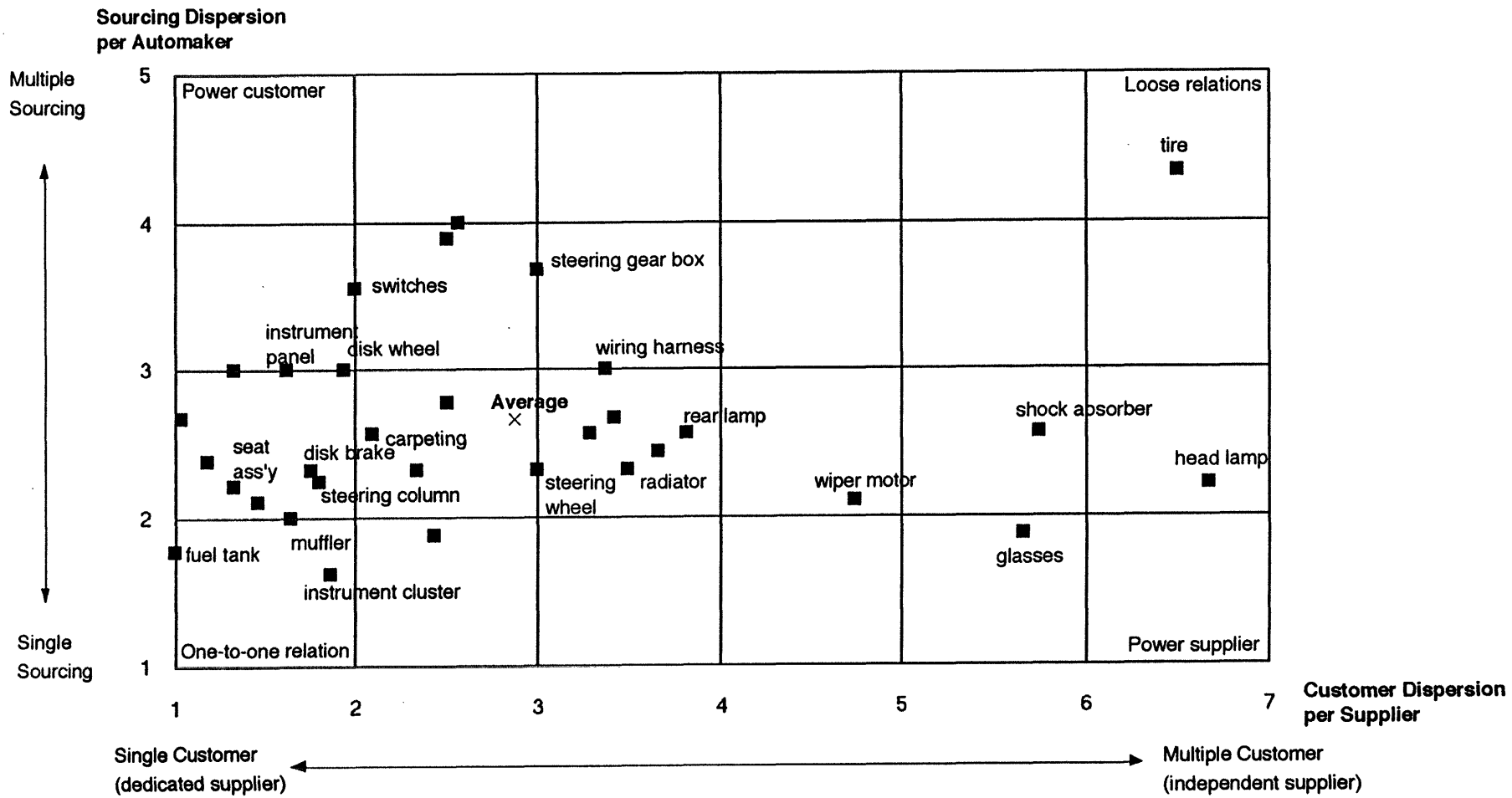
Source: Fujimoto, Sei and Takeishi (1994)

Table 4: Existing Studies and Future Research Perspectives

	Existing Studies	Future Research (suggested perspectives)
Conceptions	Undersocialized approach or oversocialized approach	Embeddedness approach economic action embedded in structure of social relations
Level of Analysis	Interorganizational dyadic relations or transactions	Interorganizational networks multiple customers and suppliers whole supply chain Actual patterns of personal relations boundary spanning personnel and departments
Unit of Analysis	Between the modes Market, hierarchy, network/intermediate	Within the network/intermediate mode
	Single-performance for either automakers or suppliers	Combined-performance for both automakers and suppliers
	National industry-level performance	Firm difference strategic implications

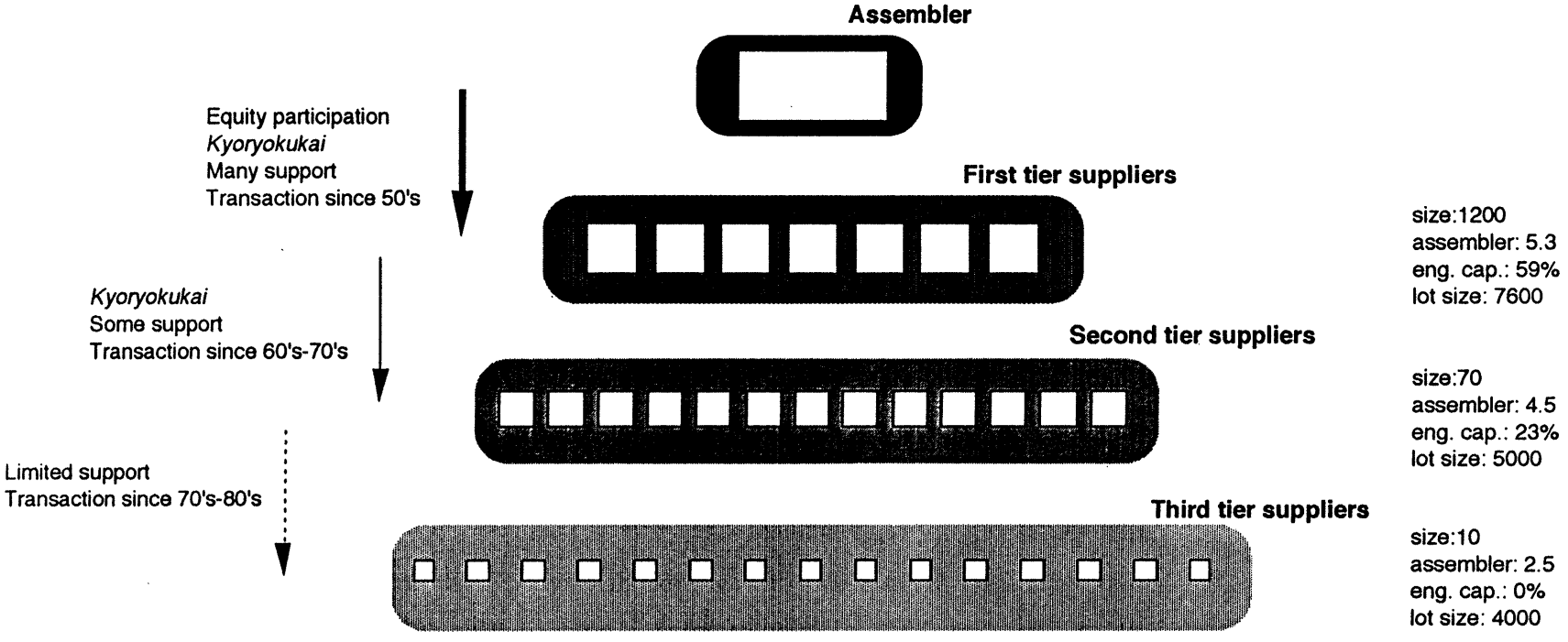
Note: Some of the existing studies have already taken some of the suggested perspectives.

Figure 1: Average Structure of Manufacturer-Supplier Transaction for Major Parts in Japan (1990)



Note: Sourcing dispersion = average # of suppliers / automaker
Customer dispersion = average # of customer (automakers) / supplier
Nine Japanese automakers are included. Two heavy duty truck manufacturers are excluded.
Source: Fujimoto and Takeishi (1994b)

Figure 2: Illustration of the Japanese Supplier System
(Summary of the Survey Results in Kanagawa, Japan)



Note: Size = # of employees.
Assembler = average number of the final assemblers which use the parts the supplier manufacturers.
Engineering capability = percentage of suppliers which did engineering of the major part.
Lot size = average production lot size per variation of the major part.
See the previous table for more detailed data and the definitions of attributes.
Although each supplier sells its parts to more than one automaker and/or upper supplier, here only one automaker is shown for simplicity.
Also, the number of suppliers does not reflect actual data.
Source: Adapted from Fujimoto, Sei and Takeishi (1994).