The Japanese Automotive Industry: Recent Developments and Future Competitive Outlook

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ABSTRACT

As the automotive industry becomes increasingly competitive and global in nature, it becomes more important to understand the dynamics of competition and the driving forces of key competitors. This working paper analyzes the Japanese automotive manufacturers and their primary subcontractors. It describes the Japanese role in the global industry, the structure of their domestic industry, changes over the past decade, the bursting of their bubble economy, and the implications of these dynamics for the North American auto industry. Some aspects of this study parallel Office for the Study of Automotive Transportation's recent analysis of the changing structure of the U.S. automotive parts industry to permit an international perspective.

*Chris Lin prepared this paper as a research assistant at The Office for the Study of Automotive Transportation, concurrently completing his MBA at the University of Michigan. He is presently employed at Ford Motor Company.

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Although their insights shaped the direction of my study, they are not responsible for the use I have made of their comments.

This study is dedicated to the memory of Glenn Tarr, my boss and mentor during my internship with Chevrolet. His dedication and genuine interest in numbers inspired me to further sharpen my quantitative and analytical skills in order to put to useful means.

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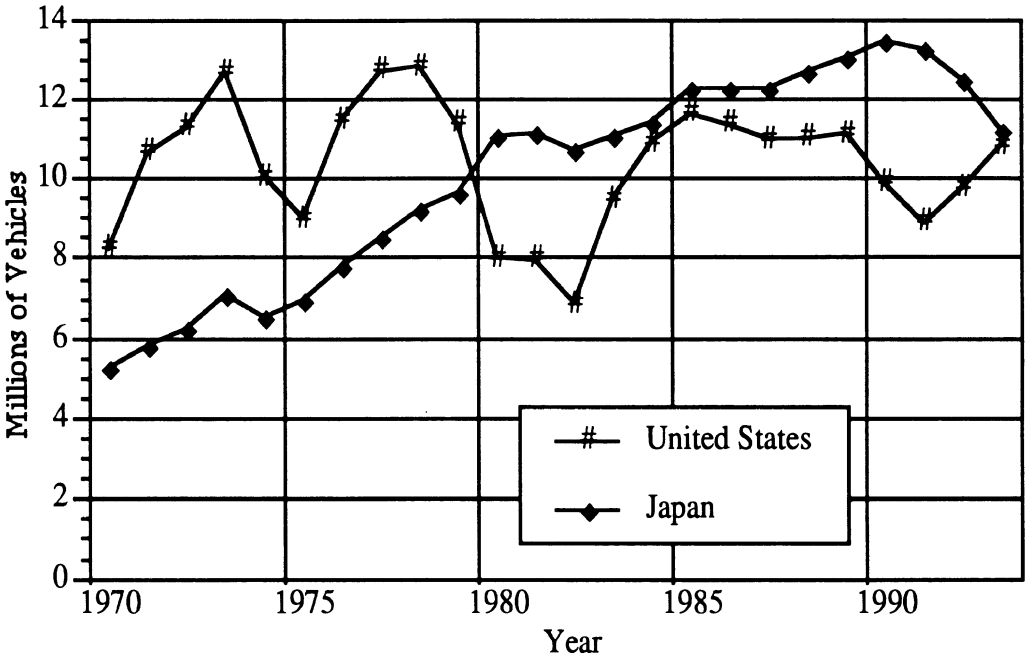
I. THE MACRO PERSPECTIVE

The Development of Japan's Role in Global Automotive Industry

Even though Detroit is still heralded as the auto capital of the world, Japan has produced more vehicles per year than the United States since 1980. Figure 1 compares U.S. and Japanese vehicle production. U.S. production fluctuated between 7 and 13 million over the past two decades, moving closely with domestic economic cycles, particularly after the oil shocks of 1974 and 1980. In contrast, Japanese production has been growing consistently over the past two decades from 5.3 million in 1970 to its 1990 peak of 13.5 million. The Japanese automotive industry developed in three stages: (1) infant domestic development, (2) export driven, and (3) regionalization.

Figure 1: Light Vehicle Production
United States and Japan; 1970-1993



Source: AAMA Motor Vehicle Facts and Figures 1993, Page 3
AAMA World Motor Vehicle Data 1993, Page 57

Figure 2: Motor Vehicle Registratior
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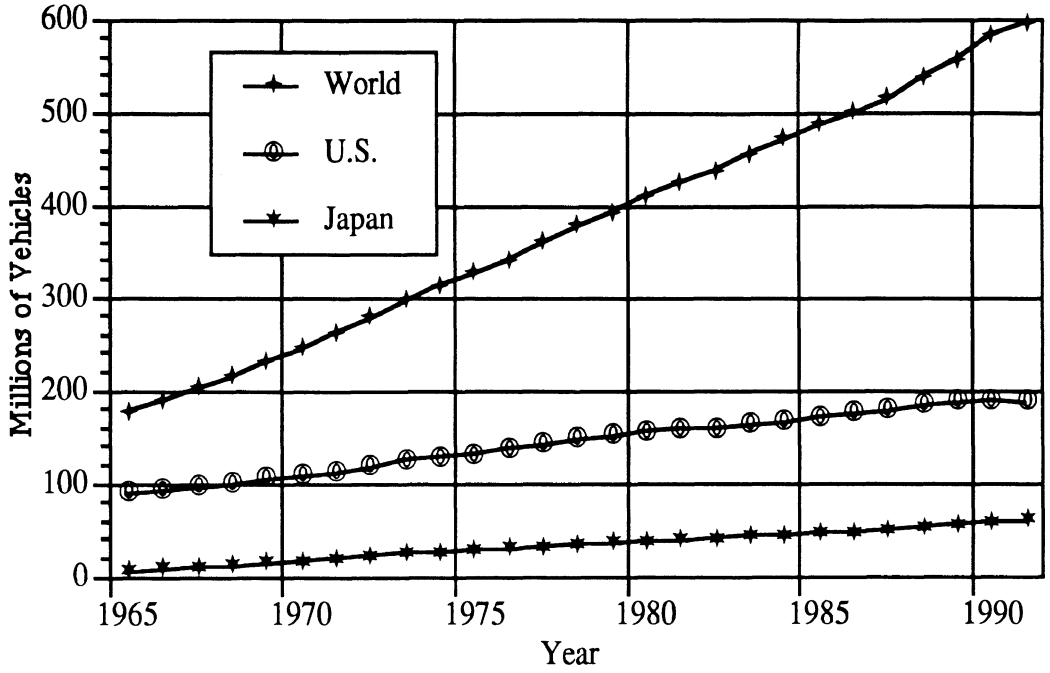
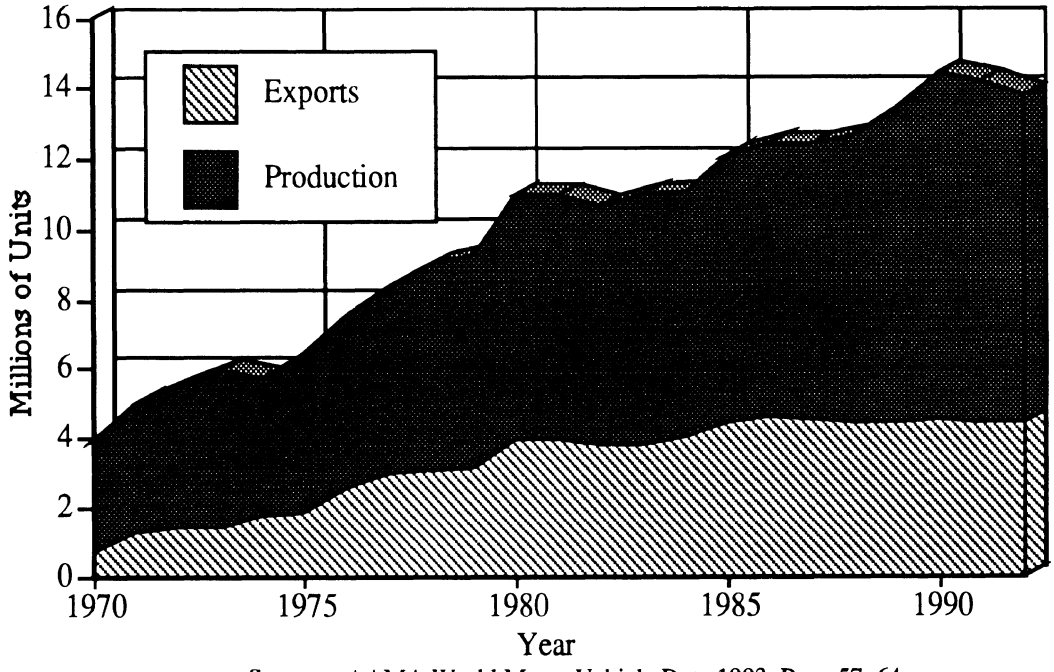


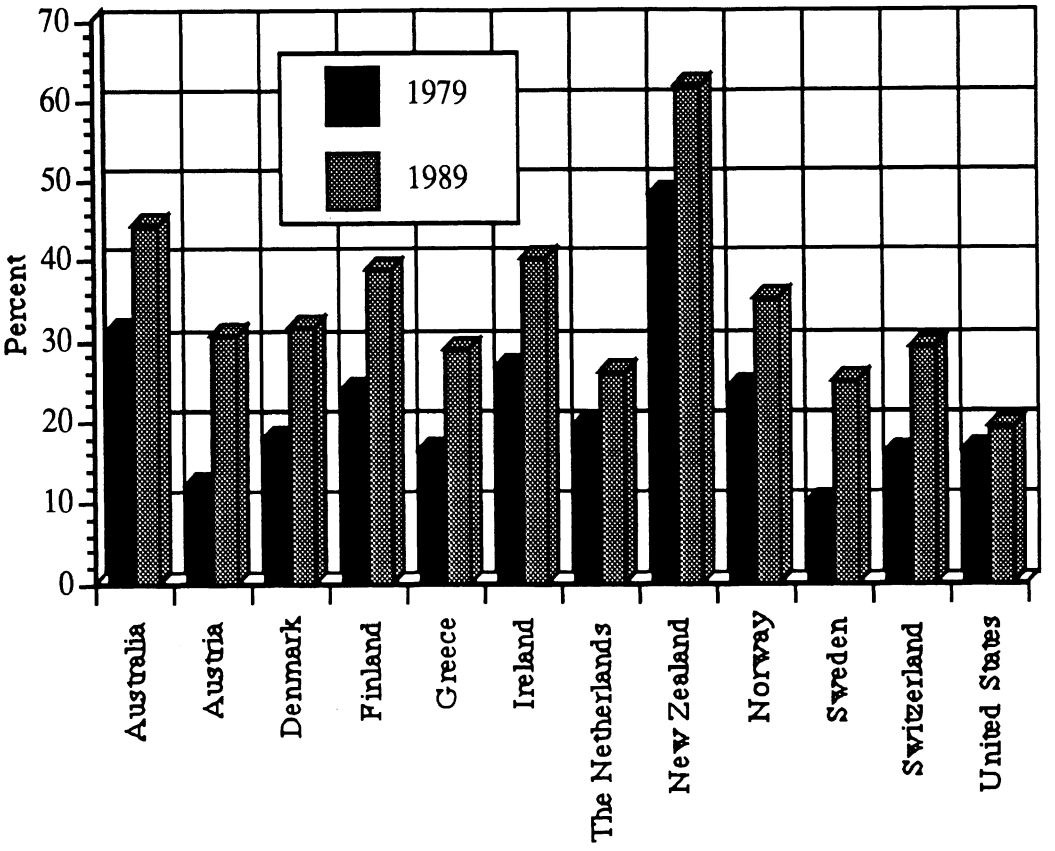
Source: AAMA Motor Vehicle Facts and Figures 1993, Page 3
AAMA World Motor Vehicle Data 1993, Page 57

Figure 3: Japanese Passenger Car Exports
and Domestic Production; 1970-1992



Source: AAMA World Motor Vehicle Data 1993, Page 57, 64

Figure 4: Japanese Passenger Car Import Penetration, Selected Countries; 1979 and 1989



Source: AAMA World Motor Vehicle Data 1993

Since 1985, the Japanese assemblers have developed regionalization strategies in order to offset trade tension and the appreciation of the yen. Transplants were established in the U.S. and Europe, and exports began to diminish. While the need for regionalization, or localized production, is apparent, there have been difficulties in successfully implementing this third phase of development. Negative growth in foreign market penetration between 1990 and 1992, combined with the sluggishness of the Japanese economy, has led to the first ever decline in production over a two-year period since World War II. The role of the automotive industry in the Japanese economy and internal structure of the industry must be analyzed to understand the severity and permanence of this phenomenon.

The Role of the Auto Industry in the Japanese Economy

The production of motor vehicles (shipments of Y31,344 billion) accounted for over 10 percent of total Japanese manufacturing and 30 percent of all machinery manufacturing in 1986.[1] The automotive industry is also an important source of employment for Japan: 5.5 million employees (over 10 percent of the 54.4 million total labor force) are either directly or indirectly employed in the industry. Over 200,000 workers are employed by assemblers and their subcontractors; the rest are employed in the supplier network and other supporting industries.[2]

THE JAPANESE AUTOMOTIVE INDUSTRY

Japanese Automotive Firm Structure

The Japanese automotive industry is characterized by a pyramid-hierarchical structure (see exhibit 1). In 1981, there were eleven assemblers and 9,500 suppliers.[3] Approximately 500 suppliers are considered primary suppliers due to their scale of operation, level of technological sophistication, and relationship with the assembler. A survey conducted by the Ministry of International Trade and Industry (MITI) in 1977 reveals the division of labor in the industry by modeling an unnamed automaker and its supplier relationships (see exhibit 2). It demonstrates that the critical tasks are performed by the primary suppliers and the assemblers, while the secondary suppliers do most of the work. Tertiary suppliers assist the secondary suppliers by performing the more cumbersome and labor-intensive jobs. In periods of high demand, tertiary suppliers outsource, or send work out, to small parts shops located in backyards and garages; these

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[1] Fourin Inc., *The Japan Auto-Parts Industries*. (Nagoya City, Japan: Fourin Inc, 1989).

[2] In 1982, 7 percent were in directly related fields such as OEMs & suppliers (696,000), sales & maintenance (997,000), fuel supply (248,000) transport and rental (1,594,000). The rest are in indirect fields such as materials supplies (716,000), fuel supplies, insurance, advertising, and other service providers (515,000). In contrast, the 3.72 million American automotive related jobs in 1982 represented 3.9 percent of total employment and 19.7 percent of employment in the manufacturing sector. Source: Robert E. Cole and Taizo Yukushiji, *The American and Japanese Auto Industries in Transition.* The Center for Japanese Studies — The University of Michigan and Technova Inc., Japan, 1984, pp. 20-21.

[3] Dodwell Marketing Consultants, *The Structure of the Japanese Motor Components Industry*, (Tokyo, Dodwell Marketing, 1982).

Exhibit 1: Structure of Japanese Automotive Industry

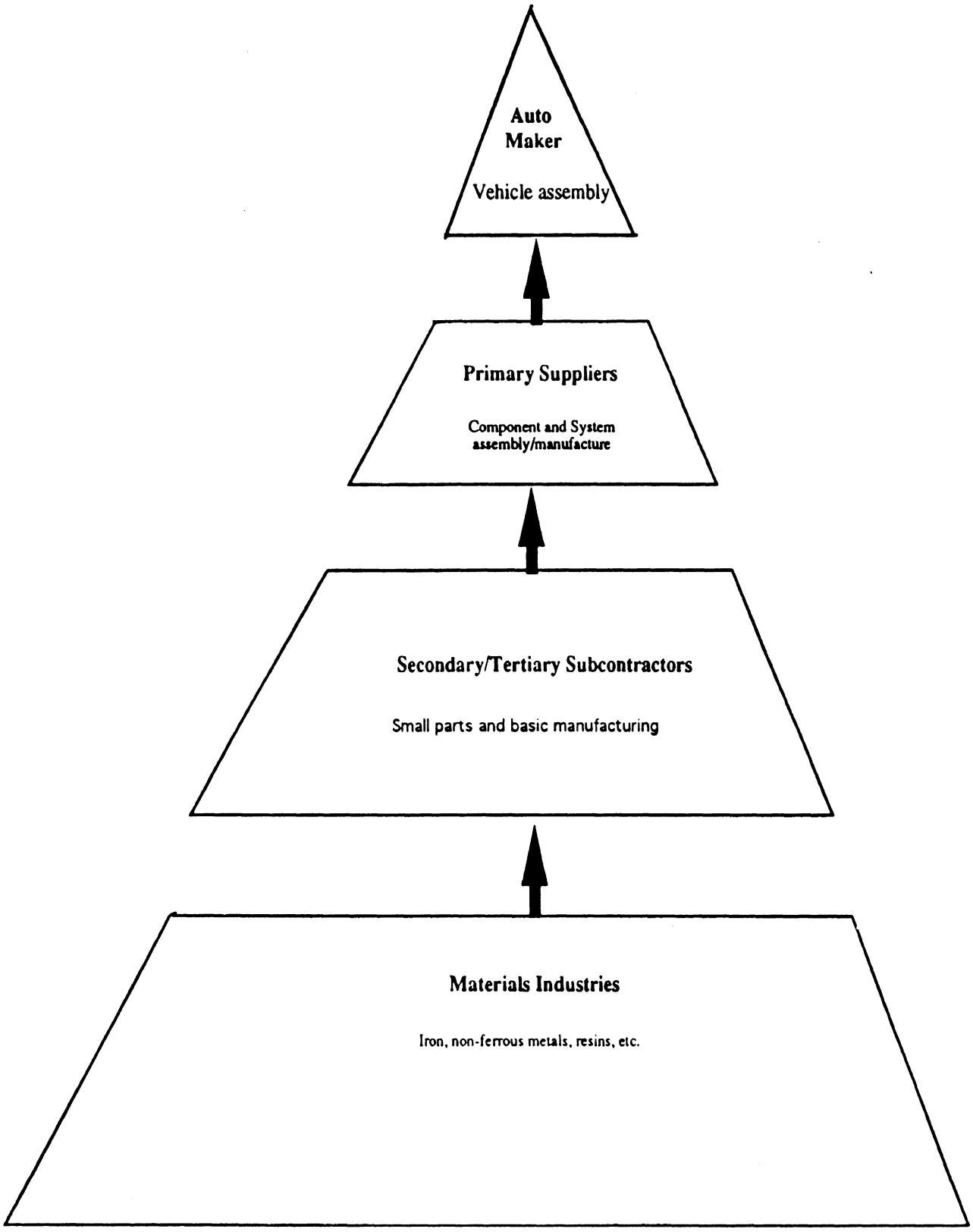
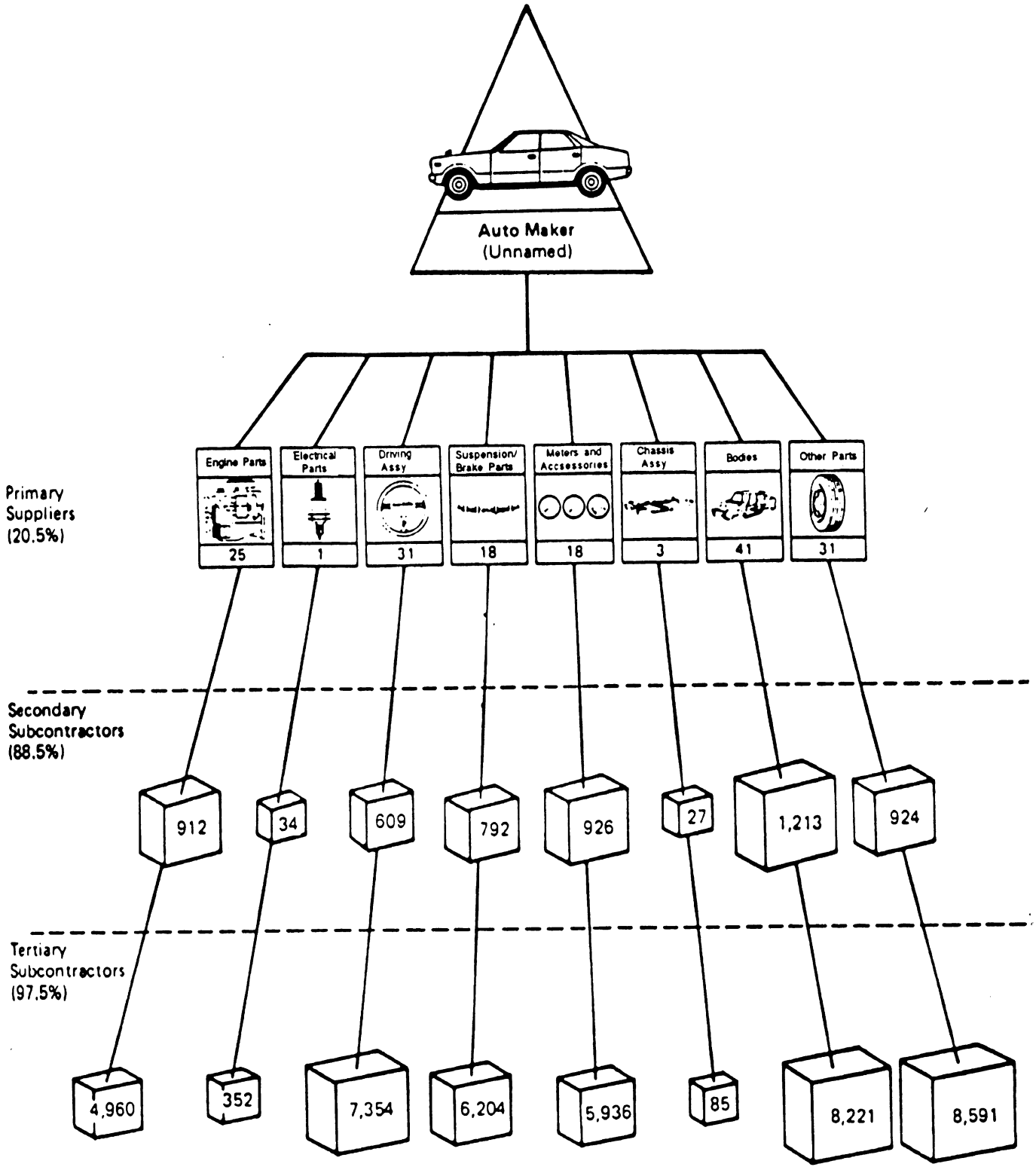


Exhibit 2: Division of Labor in the Japanese Automotive Industry



Source: Small and Medium Enterprise Agency, Ministry of International Trade and Industry (A survey conducted in 1977)

Notes: 1. The number of companies for "Primary Suppliers," "Secondary" and "Tertiary" subcontractors include possible overlappings.

2. The figures in parentheses for "Primary Suppliers," "Secondary," and "Tertiary" subcontractors show the respective percentages of small- and medium-sized businesses to the total in the respective sectors. Small and Medium Enterprise Agency defines a small- and medium-sized manufacturing firm as a company which employs fewer than 300 workers and/or whose paid-up capital is less than 100 million yen.

family-run operations provide the family with extra income, and provide even the lowest tier of suppliers a buffer for production. The lower tiers provide to the tiers directly above them as needed, and the higher tiers attempt to keep the tier directly below them content. This relationship is often described as paternalistic.

Most primary suppliers are subsidiaries or affiliates of the assembler; this lateral holding of stocks and intertwining of relationships is typical of the classical *kereitsu* system.[4] In 1990, 167 parts makers had equity relationships with vehicle makers; 53 of these parts makers had vehicle makers as their top shareholders. Table 1 provides further detail of the equity relationships. The sharing of interests creates a mutually dependent relationship: the supplier depends on the assembler for its sales and often finance capital, and the assembler depends on the supplier for technological advancements and uncompromised quality. This interdependence leads to customer and product specialization for most suppliers, yet few assemblers are dependent on any single supplier for a single part. Thus, the client (assembler) is considered the patron. In fiscal year 1981, the members of Auto Parts Industries Association (composed of 310 auto parts makers) delivered 84 percent of their output to their patron assemblers. Typically, a small group of suppliers will account for 70 percent to 100 percent of the supply of any one particular item.

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[4] *Keiretsu* is defined here as "groups of (Japanese) business firms tied by common industry or financial interest, and centrally coordinated by a bank, trading company, or major manufacturer." Taken from *Keiretsu, U.S.A.: A Tale of Japanese Power*, Mid-America Project, Inc., KY, July, 1991.

Table 1: Parts Makers Owned by Vehicle Companies (as of fiscal 1990)

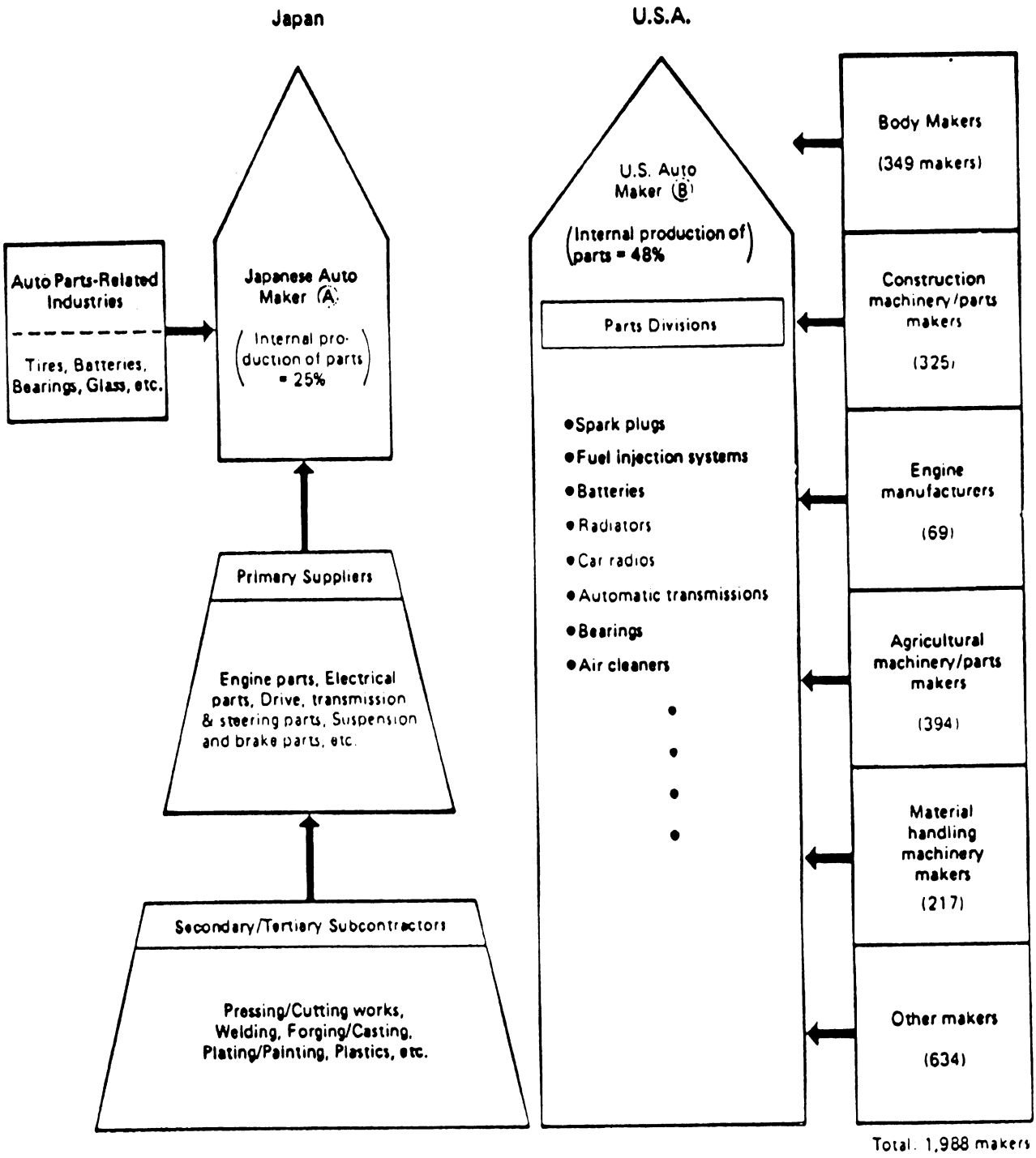
	Shares of equities							
	less than 5%	5-9%	10-19%	20-29%	30-39%	40-49%	50% or more	Total
Toyota	9	7 (1)	4 (1)	7 (7)	3 (3)	2 (2)	-	32 (14)
Nissan	7	4 (2)	2 (1)	12 (12)	6 (6)	3 (3)	2 (2)	36 (26)
Mazda	7	1	1 (1)	-	-	-	-	9 (1)
Honda	9	3 (1)	-	-	2 (2)	-	-	14 (3)
Mitsubishi	15	1	1	-	-	-	-	17
Suzuki	4	-	-	-	-	-	-	4
Daihatsu	3	-	-	-	-	-	-	3
Isuzu	6	6 (1)	-	5 (4)	1 (1)	-	-	18 (6)
Fuji	2	-	-	-	-	1 (1)	-	3 (1)
Hino	14	1	-	1 (1)	-	-	1 (1)	17 (2)
Nissan Diesel	13	1	-	-	-	-	-	14
Grand Total	89	24 (5)	8 (3)	25 (24)	12 (12)	6 (6)	3 (3)	167 (53)

Source: Tovo Keizai Incorporated

Note: The numbers enclosed in parantheses denote parts makers of which the vehicle manufacturers are the top shareholders.

In contrast to the American supplier structure, Japanese companies purchase a large portion of their components from a small set of primary suppliers (see exhibit 3). Thus, the number of suppliers that they interact with is smaller, and the relationship requires a greater level of reliability and long-term commitment. While some of the primary suppliers may be closely tied to the assembler (as are the auto parts divisions of the American firms) the Japanese assembler is not held accountable for the supplier's profitability or headcount. This provides the assembler a buffer when adjusting to production changes and the economic environment. The primary suppliers shift a portion of this adjustment cost to the secondary suppliers, who in turn transfer some to the tertiary levels.

Exhibit 3: Comparison by Division of Labor: Japan vs. The United States



Source: White Paper on Small and Medium Enterprises 1980, Ministry of International Trade and Industry

Honda, Mitsubishi, and Mazda have the simple, lateral, group structure illustrated in exhibits 1 and 2, above. Suzuki and Isuzu's structures are comparable, but they also share a relationship with General Motors. Toyota and Nissan's groups are more complex, as they also possess longitudinal relationships with another pair of assemblers.

Firm Characteristics/Measures

Although the Japanese assemblers have similar characteristics, it is important to understand the differences among the various groups. This study analyzes the eleven automotive assemblers and their key assembly subcontractors. In order to examine the dynamics of industry structure over time, data will be used to construct snapshots of the industry in 1981 and 1990.[5] The analysis will consider the groups' size in terms of employment, production, plant number and capacity, the plant ratios among different types of facilities, productivity, supplier relationships, overseas investment, and geographic location.

In terms of domestic production, Toyota is the largest vehicle producer, followed closely by Nissan. The remaining seven companies together make up the final third of Japanese domestic production. Table 2 summarizes the key characteristics of the Japanese automotive manufacturers, and highlights a number of changes in the Japanese automotive industry during the 1980s.[6] Four new plants were constructed: a tool and die plant, and an electronic plant by Toyota, a transmission plant by Fuji Heavy, and an engine plant by Isuzu. Employment decreased by 7.4 percent to approximately 203,000 employees. Production increased by 8.3 percent to approximately 992,000 vehicles per month. These trends indicate that the Japanese auto industry has been increasing its capacity through investment in new plants and equipment. Japanese auto industry wages have increased four-fold from 1975 to 1991, as shown in figure 5. Rising Japanese labor costs

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[5] Data were collected from Dodwell Marketing Consultants, Fourin Inc., and company annual reports.

[6] Appendix 1 provides detailed information on each plant including location, employment, monthly production, and products produced there.

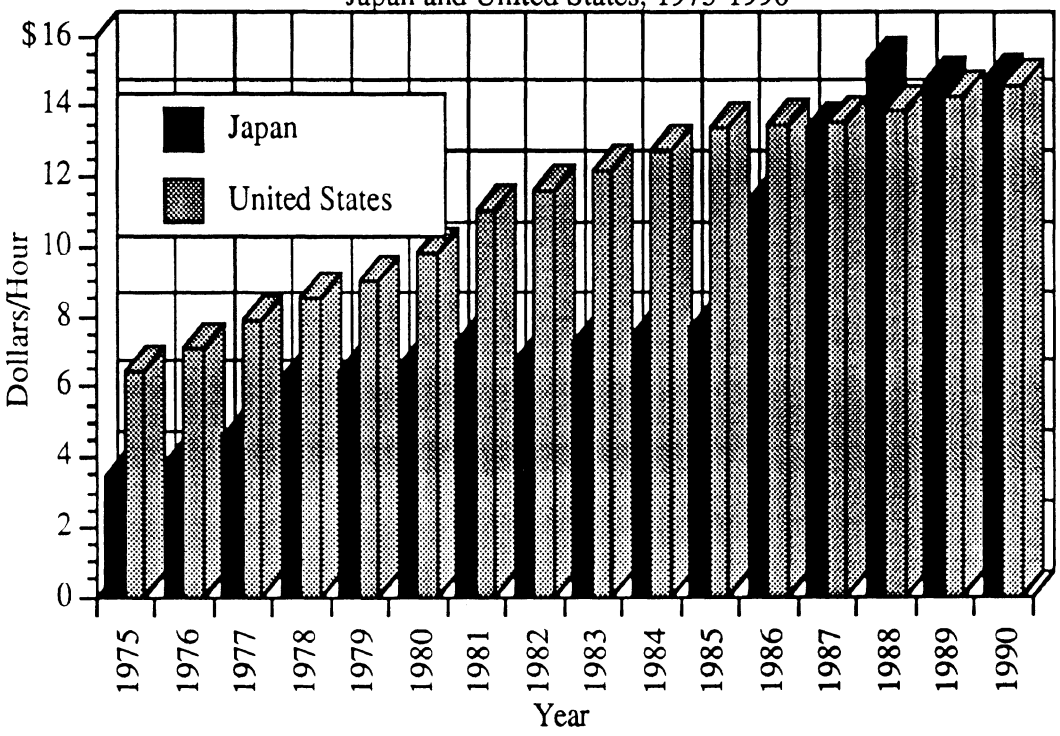
Table 2: Study of Firm Characteristics -- Facilities Located in Japan

	Number of Facilities			Employees			Production (units/month)			Monthly Units	Annual Units	Capacity Utiliza-tion	Productivity		
	1981	1990	Change	1981	1990	Change	1981	1990	Change	1990	1990	1990	1981	1990	Change
Toyota	10	12	2	21,100	23,900	2,800	179,000	194,845	15,845	205,100	2,461	95%	8.00	8.58	0.58
Toyota SC	11	11	0	22,000	23,757	1,757	154,000	134,412	-19,588	146,100	1,753	92%	7.00	6.15	-0.85
Daihatsu (-)	6	6	0	10,800	9,267	-1,533	50,000	71,447	21,447	51,000	612	140%	6.02	6.29	0.27
Hino (-)	3	3	0	7,940	7,682	-258	30,000	36,900	6,900	17,200	206	215%	3.85	2.34	-1.51
Nissan	9	9	0	56,400	34,963	-21,437	152,100	188,000	35,900	188,000	2,256	75%	5.00	5.66	0.66
Nissan SC	11	11	0	20,000	N/C	N/C	58,850	53,200	-5,650	53,200	638	85%	*	*	*
Fuji Heavy	6	7	1	8,220	9,831	1,611	47,670	48,875	1,205	58,041	696	*	*	*	*
Nissan Diesel	3	3	0	6,800	5,124	-1,676	5,600	4,544	-1,056	3,700	44	123%	0.98	*	*
Honda	5	5	0	18,500	23,147	4,647	83,000	110,496	27,496	109,000	1,308	101%	6.43	6.89	0.46
Mazda	4	4	0	27,500	26,585	-915	106,000	98,148	-7,852	98,148	1,178	*	3.85	3.69	-0.16
Mitsubishi	7	8	1	23,000	17,327	-5,673	90,150	104,447	14,297	107,000	1,284	98%	6.88	7.81	0.93
Suzuki	4	4	0	6,400	9,124	2,724	42,500	60,120	17,620	30,000	360	*	17.70	13.87	-3.83
Isuzu	4	5	1	15,900	12,410	-34,90	39,400	*	*	*	*	*	*	*	*
Total	83	88	5	244,560	203,117	-17,976	952,670	992,543	79,273	1,066,489	12,798	*	*	*	*
% Change			6.02%			-7.35%			8.32%						*

*Not Available

industry wages have increased four-fold from 1975 to 1991, as shown in figure 5. Rising Japanese labor costs promoted the use of additional investment in plants and equipment. The shift toward more capital intensive plants was a necessary response to a general shortage of manufacturing labor, as well as higher, and therefore more expensive, skill requirements needed in the production process. While the use of additional capital allows further gains in productivity, it also redefines the competitive strength of the production system.

Figure 5: Automotive Industry Wages, Japan and United States; 1975-1990



Source: Monthly Labor Statistics, Japanese Ministry of Labor

Capacity utilization for Japanese auto plants is estimated by dividing monthly production by the estimated monthly capacity provided in Dodwell. This calculation indicates that capacity utilization rates ranged from 75 percent to 215 percent. The number of plants calculated above 100 percent indicates an extra shift or overtime. The flexibility of labor-intensive plants, volume buffers provided by the patron-supplier relationships, and the portfolio of export markets all provide Japanese assemblers with the ability to maintain high capacity utilization rates.

Productivity was estimated by dividing the monthly production by the total employees in the company. Although this is not the traditional measure of productivity (direct labor hours per vehicle), the number provides some measure to differentiate efficiency among producers and gauges each organization's improvement over the decade. Mitsubishi experienced the greatest absolute gain in productivity. Toyota's productivity also increased substantially, but seemingly at the expense of its subcontractors. Nissan has improved its productivity, but needs to improve it further in order to compete with the most productive assemblers. Honda's productivity improved; Mazda's productivity declined. With higher labor costs in 1980s, it became imperative for Japanese automotive firms to increase labor productivity; most Japanese companies chose to accomplish this objective by investing in capital equipment.

Plants and the Subcontracting Relationship[7]

The total number of plants utilized by the eleven manufacturers and their subcontractors was 83 in 1981, and 88 in 1990. In both periods, about half of the plants were used for assembly, and nearly one-fifth of the plants were run by subcontractors. Toyota and Nissan were the largest users of subcontractors; eleven of sixteen plants assembling Toyota vehicles were subcontracted, and nine of the fourteen plants producing Nissan vehicles were subcontracted. The data obtained for this study focus on the subcontractors that assemble vehicles on a consignment basis for the eleven assemblers. The analysis primarily looks at the component plants owned by the assembler and the subcontracted assembly relationships, even though the *kereitsu* system also includes other primary suppliers sourcing components.

Exhibit 4 illustrates the subcontracting relationship of the Toyota Group. Daihatsu and Hino Motors are included with other subsidiaries and subcontractors in the group. Toyota is able to influence these smaller companies, with its 14.6 percent stake in Daihatsu and a 10.4 percent interest in Hino. The relationship also allows Toyota to bolster the subsidiary's financial strength,

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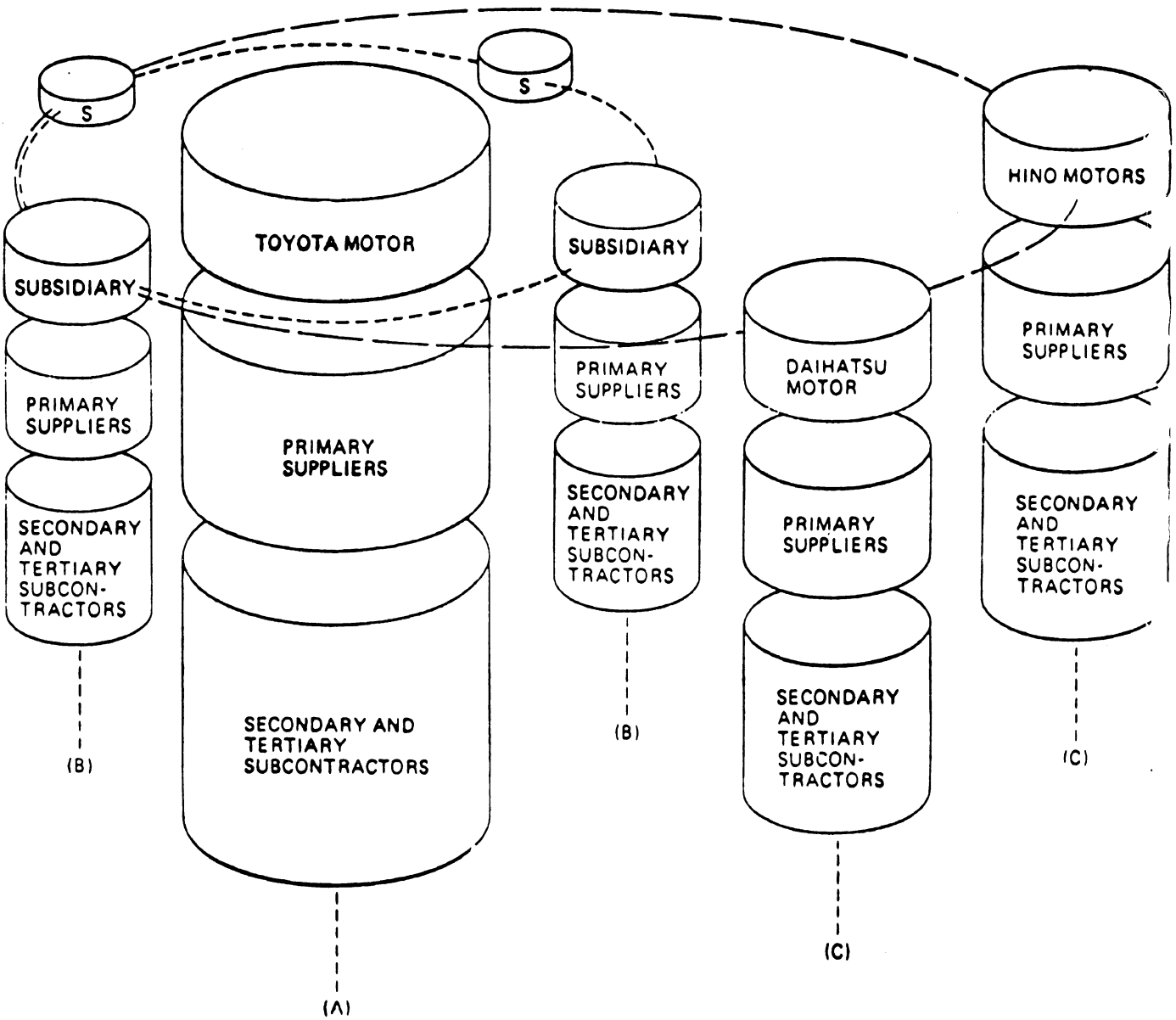
[7] Dodwell, Fourin Inc., and company annual reports and publications.

Exhibit 4: The Toyota Group



product planning, parts rationalization, and overseas marketing capability. Hino and Daihatsu produce their own brands and also are subcontracted to produce Toyota-badged cars and trucks. Subcontractors accounted for approximately 46 percent of the 4 million Toyota-badged vehicles produced in Japan in 1981, and about 40 percent of the 4.1 million Toyotas produced in Japan in 1990. Toyota and its subcontractors were thus able to produce approximately 70 percent of the volume of GM vehicles produced in North America, with only half the number of plants.

Nissan's structure parallels Toyota's, except that Daihatsu is replaced by Fuji Heavy, and Hino is replaced by Nissan Diesel. Fuji Heavy and Nissan Diesel are Japanese assemblers that are also subcontractors for Nissan. Nissan owns 6.3 percent of Fuji Heavy and 45.6 percent of Nissan Diesel. Nissan and Fuji Heavy joined forces in 1968 to produce Nissan passenger cars, and have since shared management and some financial relations. Fuji Heavy also produces its own brand, Subaru. Nissan Diesel, a leading manufacturer of diesel trucks and engines, produces Nissan brand light-duty trucks for its parent company. Approximately 40 percent of the 3.1 million Nissan vehicles produced in Japan in 1981 were produced by Nissan's subcontractors and subsidiaries. This share dropped to approximately 35 percent of 3.5 million vehicles in 1990.

Honda and Mitsubishi are the two other assemblers that recently began to allow subcontractors to assemble vehicles under their respective brand names. Yachiyo Industry produces nearly 10 percent of all Honda-badged vehicles produced in Japan, and Toyo Koki produces multipurpose vehicles for Mitsubishi.

The subcontracting relationship is valuable to assemblers because it allows them to achieve significantly greater production without having to own all of the capacity. This gives them added flexibility to adjust to market conditions, and at the same time allows the assembler to maintain full employment and continue to operate at high capacity utilization rates. This relationship reduces risk and hedges investment. Furthermore, keeping the same loyal workers and continuing to operate the plant at high rates of capacity utilization allows management to continuously improve in-house productivity. Productivity advances result from innovations in process technology, cross-functional working teams, and close working relationships with primary suppliers. Japan's top four

assemblers, all of which use subcontractors for assembly, were able to increase their productivity substantially between 1981 and 1990.

Tension with Supplier and Subcontractor Relationships

While the subcontracting relationships and the *kereitsu* structure have been largely responsible for the competitiveness of the Japanese automotive industry, the subcontracting relationship can also be a burden, if the parent companies spread their resources too thinly over noncompany personnel and management systems. Moreover, the current economic climate and competitive environment have put special pressures on the unique structure of the Japanese auto industry. Current automotive markets require longer production runs and fewer models and the subcontractors responsible for producing established platforms or niche vehicles will have to alter their traditional roles. *Kereitsu* group membership is no longer a guarantee of success. The declining profitability of suppliers is another signal that the system is strained.

Even during the automotive boom in Japan in 1989-1990, financial statements indicated that the assemblers gained at the expense of their suppliers. The announcements of financial reports in fiscal 1989 reveal a significant gap in profits between the vehicle manufacturers and parts suppliers in Japan. While nine of the eleven manufacturers posted significant increases in domestic sales, approximately 30 percent of auto suppliers suffered a drop in profits despite an increase in sales turnover. Another 50 percent remained unchanged financially. Suppliers of equipment and electronic parts were able to achieve gains in sales and profitability during the auto sales boom.

The key drivers squeezing the profits of suppliers during the mid 1980s included the following: (1) labor shortages, which caused a surge in labor costs, (2) rising output, which drove suppliers to invest in automation and flexible equipment to make up for the labor constraint, (3) shorter product cycles, which made it imperative to achieve shorter runs and smaller lots and diminished the potential gains from scale economies, and (4) the necessity of following vehicle manufacturers overseas. The operating size of overseas plants is small due to the limited number of patron transplant customers, making it nearly impossible to produce most components at a lower

cost than in Japan. [8] The pressure on profits is forcing the industry to restructure, which has a number of implications on the geographical positioning of production.

III. GEOGRAPHICAL LOCATION ANALYSIS

The following regional analysis shows that the Japanese auto industry is concentrated in a few main industrial areas. It also describes the close geographical proximity between assemblers and their primary suppliers, and the geographical independence of the assemblers and their assembly subcontractors. Nine of the eleven automotive assemblers have their plants clustered in regions within a 150 kilometer radius of each other. Mitsubishi and Honda are exceptions and have operations spread across the country. The industry is concentrated in two main regions of Japan: (1) the Tokyo metropolitan area and (2) Aichi Prefecture. Some smaller firms are clustered in locations on the outskirts of these two main regions. Recent investments, though, have started or are planned for newly developing areas. The following section on the key areas clustered by automotive firms also describes the historic origins of company location and examines the merits of clustering.

Firm Cluster Areas

Tokyo Metropolitan Area

Tokyo has been an historic locus of Japanese power since 1590. The shogun Tokugawa Ieyasu made the minor castle town of Edo his capitol that year, which marked Japan's transition into a commercial state. During the subsequent 250-year Tokugawa era, Edo grew into the largest city in the world. The population of Edo reached one million by 1700. A class of merchants and artisans emerged to service the large number of *daimyo* and *samurai* warlords who were forced to spend a part of each year there under surveillance. In 1868, emperor Meiji abolished the shogunate and moved his court from Kyoto to Edo, renaming it Tokyo, "Eastern Capitol." The city began a

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[8] T. Kubo, "Under the Auto Booming, Japanese Parts Suppliers Bearing Woes in Profitability," *Asian Motor Vehicle Business Review*, (September 1990): pp. 2-5.

period of modernization to bring it in line with the West. The *daimyo* eventually left, and the merchants, now able to move more freely, settled in the hilly areas in the western part of the city.

The modern Tokyo metropolitan area, with a population of 13 million, is the most densely populated part of the country, and Japan's government, industry, and commerce are based in this capitol city. Heavy and light industries located in this coastal region include automotive, as well as electrical appliances, electronics, optical products, precision engineering, textiles, printing, and publishing. The 2,000-square-kilometer (800 square mile) metropolitan area houses 24 of the 88 plants analyzed in this study, and is the location for the headquarters of five of the eleven automotive assemblers.

Nissan is the largest of the assemblers in the Tokyo area, with headquarters in Tokyo and all but one of its plants within a 150 kilometer radius of the headquarters. The key subcontractors, including Fuji Heavy and Nissan Diesel, are also clustered in the Tokyo area. Fuji Heavy's three subcontractor organizations are in the same prefecture. These include 157 firms belonging to the Gunma Kyoryoku-Kai organization, 69 firms from Mitaka Kyoryoku-Kai, and 48 firms belonging to the Isesaki Kyoryoku-Kai group. The Nissan Diesel Yayoi-Kai is divided into four subgroups, which supply rubber, packing, machine parts, and castings, forgings, and pressed parts.

Even though Toyota is located in the Aichi prefecture, one of its main subcontractors, Hino, has three automotive plants located in the Tokyo area. The Hamura plant produces trucks for Toyota, the Nitta plant makes cast auto parts, and the headquarters plant in Hino produces medium and heavy-duty trucks and buses. Hamura is near the headquarters in Hino-city, which is 30 kilometers west of Tokyo and 90 kilometers south of Hino's farthest plant in Nitta.

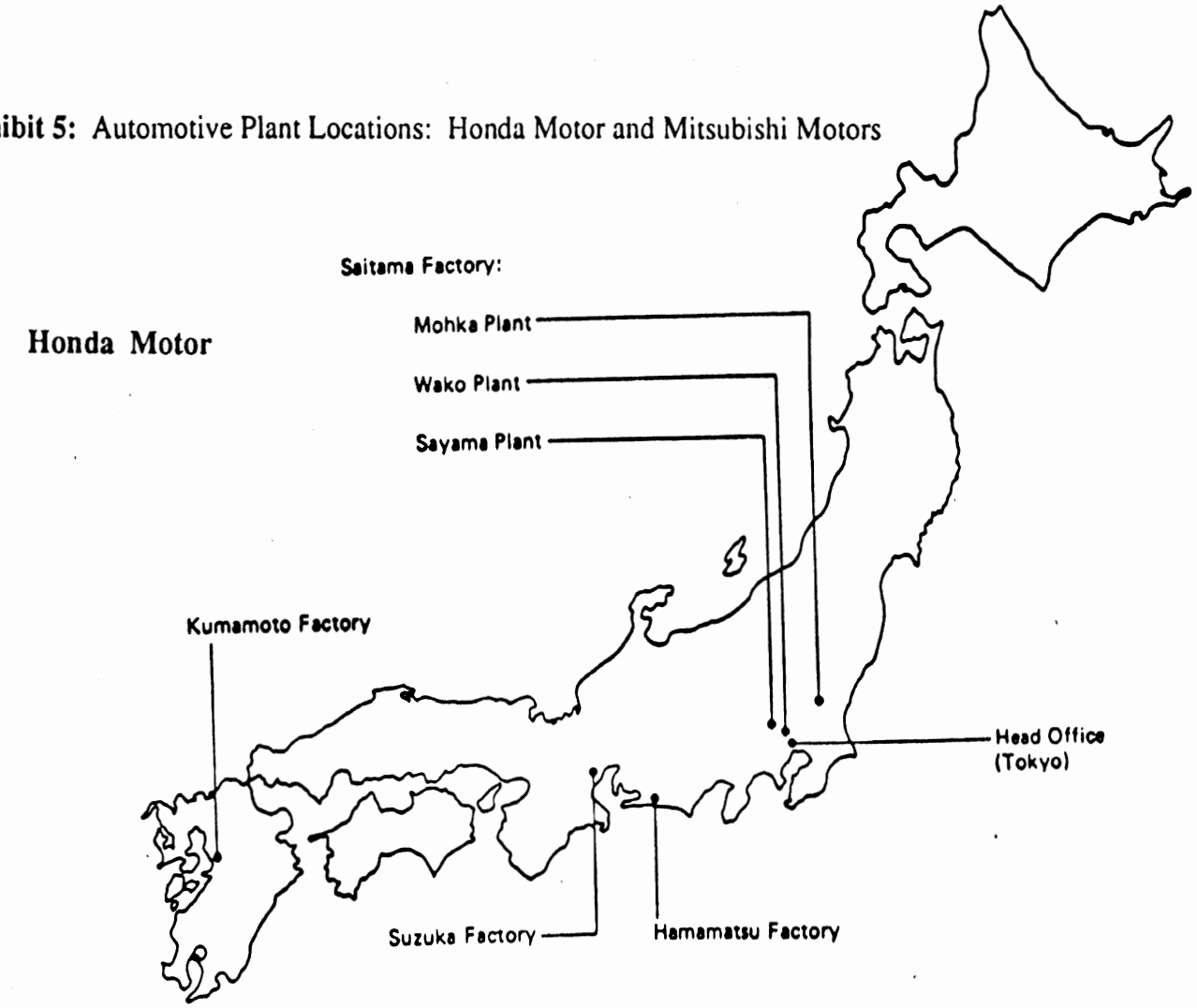
Isuzu has its headquarters in Tokyo, and initially its automotive plants were all in the Aichi prefecture. Tsurimi and Tochigi produce automotive parts, the Kawasaki plant produces medium and heavy trucks, and Fujisawa produces light trucks, buses, and cars. Tochigi is in the northern part of the prefecture, and the other three plants are south of Tokyo. The new (1992) engine plant was built in Hokkaido — very far from the traditional Aichi cluster — and currently has under 300 employees. The decision to build away from the Aichi cluster may have been based on the wage

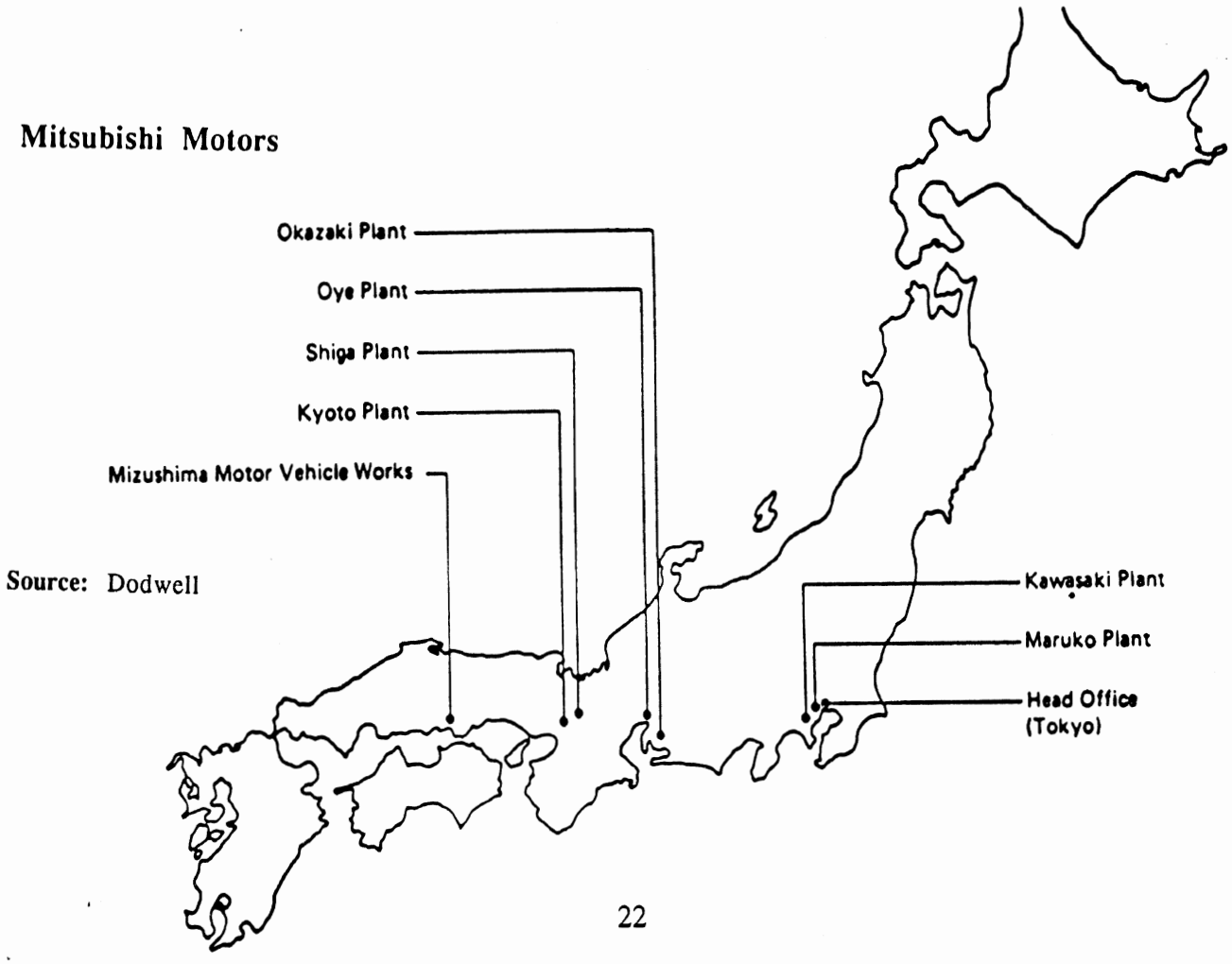
and land costs in the Tokyo area as well as on the saturation of industrial plants and infrastructure bottlenecks. Just-in-time (JIT) delivery of engines is a major characteristic of the Toyota production system; typically engines are delivered in small lots of six to twelve. The decision to produce engines at Hokkaido, so far away from the production cluster may indicate two scenarios: (1) Toyota is rethinking its implementation of the JIT production system or (2) the engines are being produced for off-shore assembly.

Tokyo Headquarters and Cluster with Scattered Operations

Honda has its headquarters in Tokyo, and three of its seven other plants are located nearby at the Saitama factory. The Sayama plant produces passenger cars, the Wako plant produces engines, and the Mohka plant produces auto parts. The Hamamatsu and Kuamoto plants produce motorcycles and are very distant from each other. The Suzuka factory, Honda's largest factory (both in terms of floor space and capacity) is located in the Kanto/Chubu district of Japan. Honda's other manufacturing clusters are far from their main manufacturing cluster and headquarters in Tokyo; the distance is evidence that some assemblers do produce in more than one central location.

Exhibit 5: Automotive Plant Locations: Honda Motor and Mitsubishi Motors





Source: Dodwell

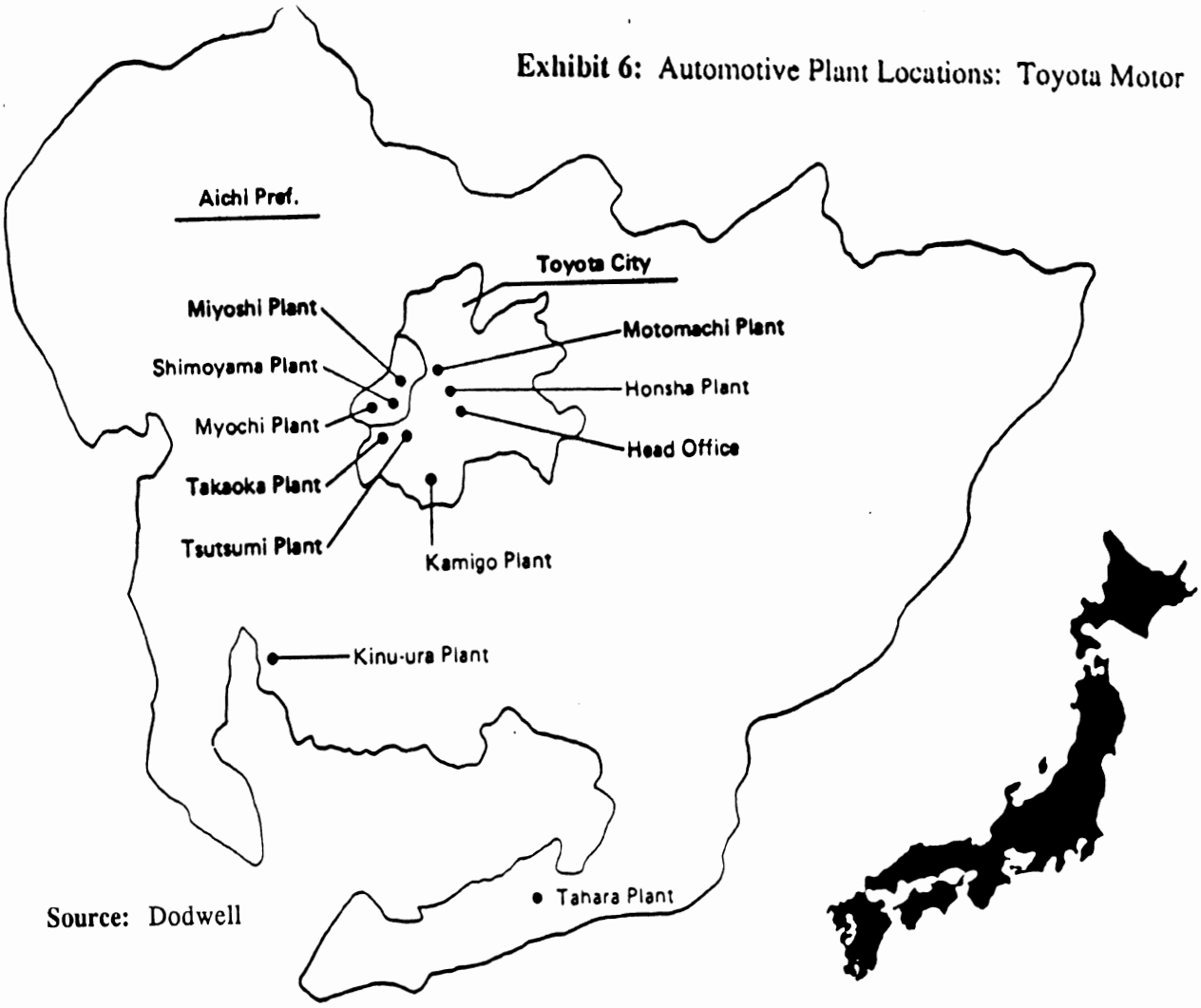
Mitsubishi is another exception to the company-cluster plant arrangement. With headquarters in Tokyo, the Mitsubishi operations also include plants in three other regions of the country. Mitsubishi's subcontractor organization, the *Kashiwa-Kai*, comprises 340 companies. The regional subgroups include (1) the Tokyo Motor Vehicle Works, which supply the Kawasaki and Maruko plants, (2) the Nagoya Motor Vehicle Works, which supply the Oye and Okaszaki plants, (3) the Kyoto Motor Vehicle Works, which supply the Kyoto and Shiga plants, and (4) the Mizushima Motor Vehicle Works. Mitsubishi's example further demonstrates that, while it is important for primary suppliers to be located near the assemblers, it is not essential for the assemblers to be located near each other. Exhibit 5 on the previous page illustrates the dispersed operations of Honda and Mitsubishi.[9]

Aichi Prefecture/Nagoya Area

Nagoya is Japan's fourth largest city and third largest port, located in the middle of the Tokyo-Hiroshima megalopolis. It is a prosperous commercial and industrial city with a population of two million. The Aichi prefecture is the second most concentrated automotive area due to the presence of Toyota (illustrated in exhibit 6).

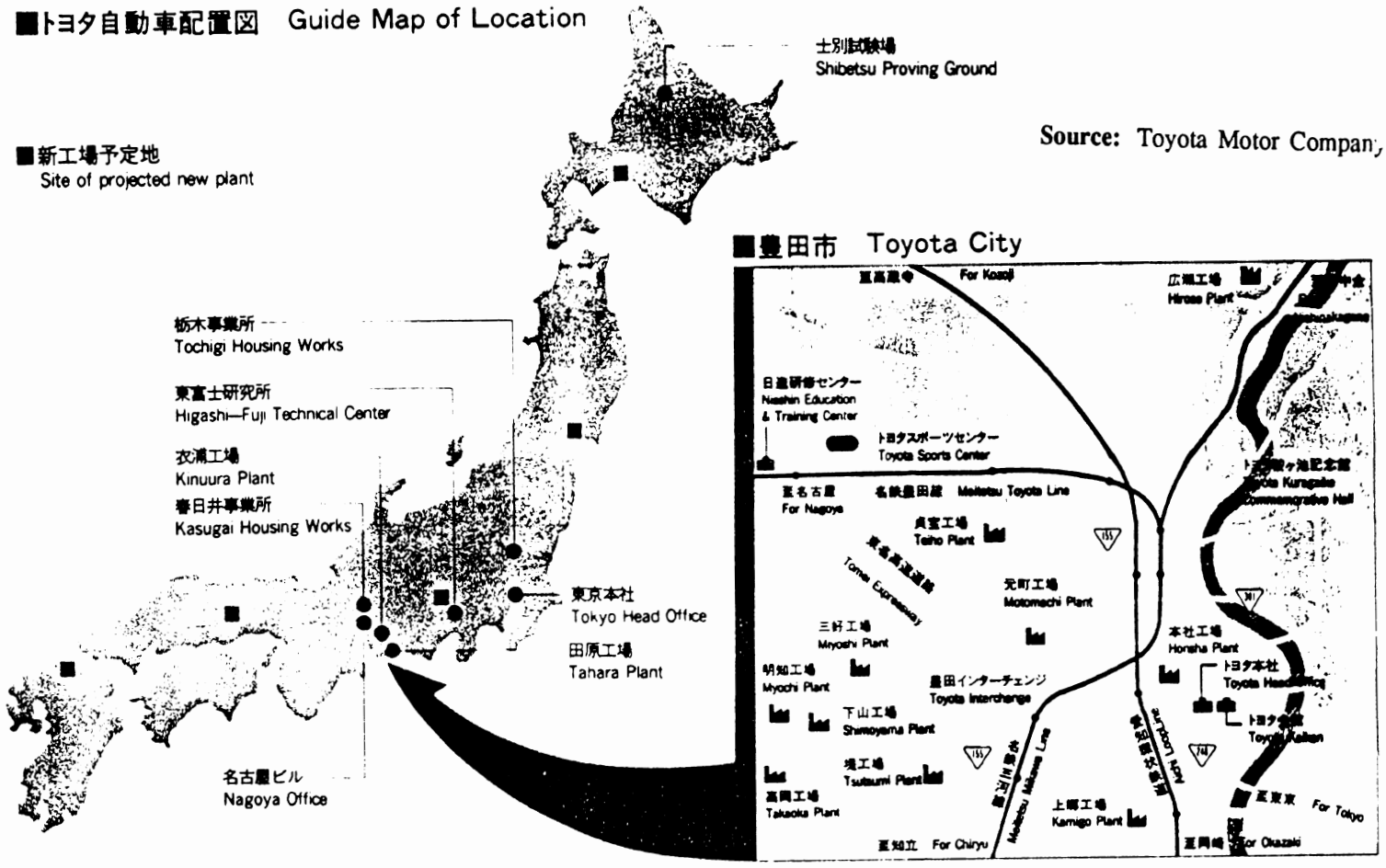
[9] See Appendix 2 for more maps of the location of Japanese domestic automotive facilities.

Exhibit 6: Automotive Plant Locations: Toyota Motor



Source: Dodwell

■トヨタ自動車配置図 Guide Map of Location



Source: Toyota Motor Company

Toyota Motor Co., Ltd. (TMC) was established on August 28, 1937, with capital of 12 million yen. Toyota began in the Nagoya region as a spinoff of Toyoda Automatic Loom Works (TALWs). Toyoda Automatic Loom Works entered the automotive industry with the launching of the Model G1 truck in 1935. In 1936, they completed construction of their first complete automobile assembly plant in Kariya — near the TALWs. With a vision for full-scale automobile production, the company purchased a large plot of land in Koromo-cho — a municipal region 30 kilometers east of Nagoya. This undeveloped property covered with trees would emerge as the hub of the Toyota Motor Group by the mid 1960s. In the late 1950s, the municipal government of Koromo, encouraged by the progress of Toyota's development, drew up plans to be an automobile industrial city with TMC at its center. Toyota recommended that its suppliers move to Koromo so that they could reinforce production needs for JIT and *jikoda* [10] with the affiliated industries.[11] In 1958, Koromo was renamed Toyota City.[12]

There are eleven Toyota plants in the prefecture, and nine of them are within the boundaries of the Toyota City limits. Toyota's auto parts manufacturing group, the *Kyoho Kai*, consists of 224 parts makers, which are regionally organized into three subgroups. The *Tokai Kyoho Kai* is the largest subgroup, consisting of 136 companies located in the Tokai district with Toyota's plants. The *Kanto Kyoho Kai* consists of 63 companies, located in the central part of Japan near Tokyo. The third subgroup, *Kansai Kyoho Kai,* consists of 25 companies clustered in the western part of Japan. A number of Toyota's main subcontractors are located outside of the Aichi prefecture. Daihatsu is in the Osaka prefecture, and Hino Motors is located near Tokyo. While Toyota's example reinforces the importance for primary suppliers to be located near the assemblers in order to utilize effectively the JIT production system, it also demonstrates that subcontractors do not have to be located near the patron company in order to assemble the patron's vehicles.

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[10] The two main pillars of the Toyota production system are the just-in-time system (having suppliers supply parts on a timely, needs basis) and *jikoda* (self-regulation and building quality into the process).

[11] Toyota Motor Company, *A History of the First 50 Years.* Toyota City: Toyota Motor Corporation, 1988, p. 66.

[12] Ibid. p. 146.

Osaka Prefecture (Kansai area)

Osaka is a huge industrial and commercial city responsible for a quarter of Japan's industrial output. The airports handle 40 percent of total exports. It is home to the country's pharmaceutical industry and also produces textiles, iron, and steel. The warlord Hideyoshi founded Osaka in the sixteenth century as a city for merchants. The great business and banking dynasties (Sumitomo, Itochu, Marubeni, Sanwa; and Daiwa) trace their roots to Osaka. Sanwa and Daiwa are two of Daihatsu's five primary banks. Daihatsu was established in 1907, publicly listed in 1949, and began producing cars in 1966. In 1968, it began to subcontract for Toyota.

All four of Daihatsu's automotive plants are located in the Osaka prefecture within an 80 kilometer radius of the headquarters and main plant in Ikeda. The Shiga and Tada plants produce engines, auto parts, and machine tools for captive use. The Kyoto and Ikeda plants produce assembled vehicles (including those subcontracted by Toyota). Nearly 80 percent of Daihatsu's production is used domestically. Daihatsu's subsidiary, Daihatsu Shatai, has one outside assembly facility in Maebashi City, Gunma prefecture, approximately 100 kilometers northwest of Tokyo. The Osaka prefecture is next to Toyota's Aichi prefecture, so Daihatsu could supply Toyota with parts, if necessary, to support Toyota's production system.

Hiroshima Prefecture

Mazda (Toyo Kogyo) is isolated in the lower central part of Japan. Three of Mazda's four plants are located in the Hiroshima prefecture, and the Hofu plant is in nearby Yamaguchi prefecture. The Miyoshi plant produces diesel engines and is approximately 70 kilometers away from Hiroshima on Highway 54. The Hofu plant produces compact cars and transmissions and is approximately 130 kilometers away from the Hiroshima headquarters via Highway 3. Thus, transportation from headquarters to the other plants takes approximately two hours via truck.

Tokai Region

Suzuki's three automobile manufacturing plants are located in the Tokai region. The Osuka plant makes castings and die castings, and the other two plants each assemble 50 percent of the Suzuki vehicle total. Kosai produces minicabs and commercial vehicles, and Iwata produces four-wheel drive vehicles and engines. These three plants are located within 65 kilometers of each other. The other facilities are dedicated to producing motorcycles and parts.

Merits and Implications of Clustering

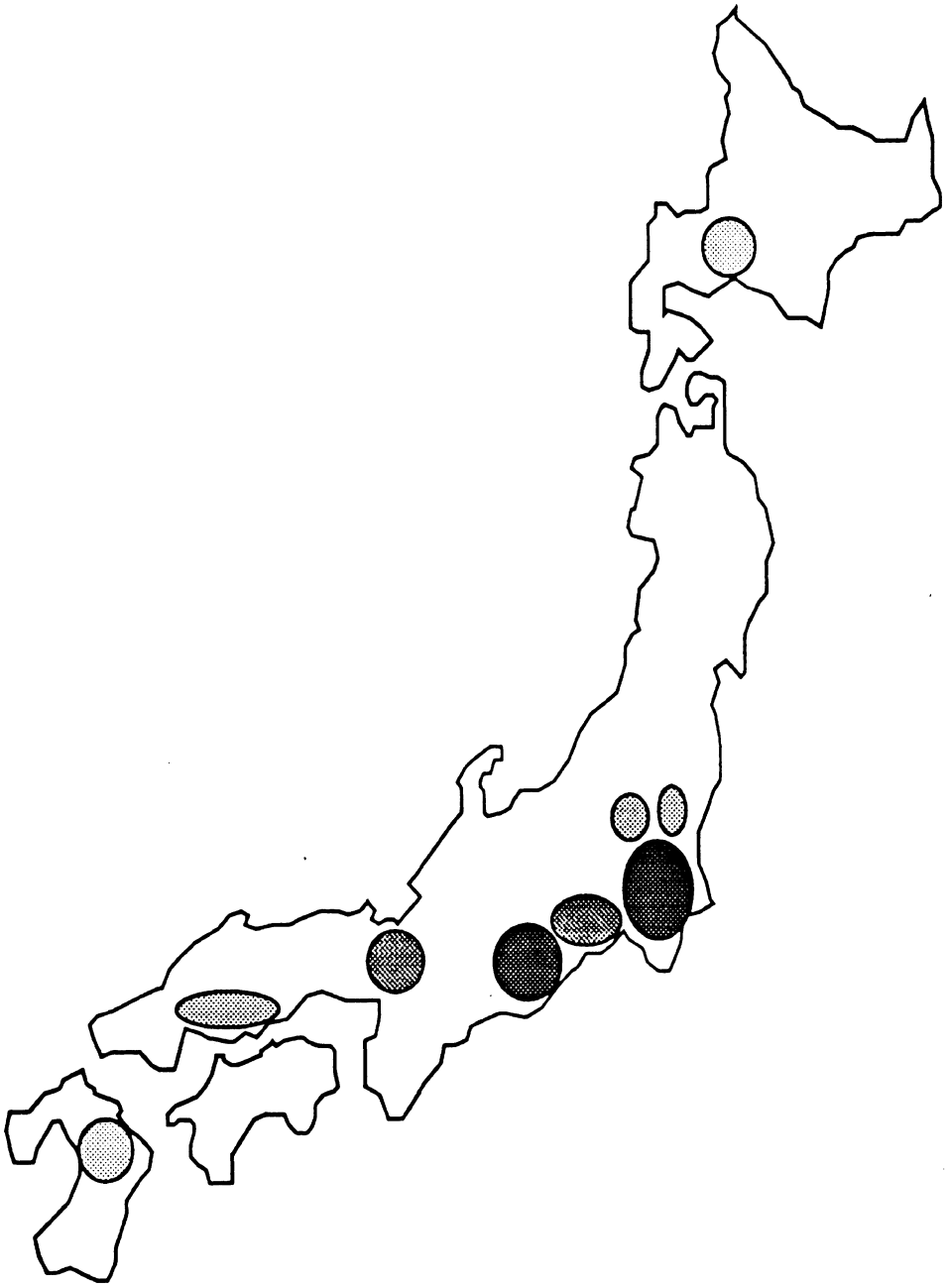
Clearly, the industry map of Japan (shown in exhibit 7) indicates that the auto industry is clustered in a few areas of the country. The map illustrates the size and concentration of the clusters. The darker circles indicate a higher concentration. Assemblers of the same company or group may tend to locate in the same cluster for the following reasons:

First, the origins of the auto maker, the historic roots of the cities, and the relationships of the automaker with their primary banks, or *kereitsu,* can influence the geographical outcomes. Often, the company's relationship with its primary bank largely determines the location of the head office.

Second, coordination with headquarters and other plants is facilitated by geographical proximity. Upstream, it enables primary suppliers to coordinate more efficiently. Downstream, the manufacturer will be able to coordinate its delivery and transportation to gain from volume discounts in shipping from the same dock.

Third, the concentration of the firms and the clustering effect of the suppliers with the assemblers are logical, given the patron-supplier system and the use of JIT production methods. The proximity of primary suppliers to the patron assemblers is necessary due to the demands of the JIT production system. Toyota's example demonstrates the strong influence that the assembler has on the supplier's welfare and longevity. Locating in the vicinity demonstrates commitment to the

Exhibit 7: Plant Clusters of Japanese Vehicle Manufacturers



Note: The darker shaded areas indicate heavier concentration of plants.

long-term relationships and allows the groups to implement the demands of the JIT system effectively. By positioning all of the assembly plants near a central location, the same supplier will be able to supply the same parts to a number of assembly plants with JIT schedules and also realize scale economies. If we assume that the minimum efficient scale (MES) for full component assembly is 500,000 units annually,[13] 28 of the 45 assembly plants would not be supplied on an efficient scale and JIT basis by their engine and stamping suppliers if the assembly plants were not clustered. By clustering, all are able to produce efficiently and just in time.

Fourth, during postwar reconstruction, there may have been incentives for certain regions of the country to develop faster than other regions. While political reasons may have influenced the development of the industry, such incentives and demographic characteristics may also influence the downsizing and relocation of the industry.

Despite the merits of clustering, two assemblers, Mitsubishi and Honda, are not clustered. Downsides to clustering include the excessive demands for labor, rising land costs, infrastructure bottlenecks (which slow the JIT system), the inability to expand production, and congestion (which upsets most urbanites). Recruiting qualified workers is nearly impossible in urban areas, but traditional poor farming areas such as Tohoku (in the northeast) and Kyushu have workers available. Moreover, strong infrastructures and lower taxes for new start-ups provide incentives to decentralize operations.

Movement to New Areas in Japan — Domestic Regionalization

The traditional areas of the automotive industry are saturated and no longer ideal, due to high land costs and shortages of qualified labor. Evidence of this can be seen in the addition of new plants away from the Tokyo and Nagoya areas and recent plant openings in the northern island of Hokkaido and the southern island of Kyushu. Hokkaido and Kyushu are new areas of growth for

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[13] This estimate is derived from the minimum efficient scale for engine and transmission plants and stamping facilities in the U. S.; further, it assumes that the Japanese plants are under comparable constraints as American and European assemblers.

the automotive industry. Exhibit 8 illustrates how the industry is relocating from concentrated central regions to the less-concentrated northern and southern areas.

Toyota started up a parts plant in autumn, 1992, to join the existing Isuzu plant on Hokkaido. For the first time since the late 1980s, parts are transported via railway; truck transport, the conventional method of parts delivery, was unable to meet excessive demands. Low land prices and high quality of life have made this island an attractive place for a number of foreign firms to establish their new start ups. With an area equivalent to that of Austria, a population equal to Denmark's, and a GNP falling between that of those two nations, Hokkaido is comparable to a single European nation, with plenty of room to grow. In the 1990s, Hokkaido is seeking to engage in direct exchanges with other countries rather than routing exchanges through Tokyo, as has been done in the past.[14]

Kyushu, the south western island of Japan, is emerging as the new subcenter of the Japanese auto industry. Toyota's new vehicle production facility in Kyushu started up in spring, 1993, joining the operating Nissan vehicle production, and Honda motorcycle engine and transmission facilities. Mazda and Daihatsu's planned plants on this southern island will bring the total of firms with facilities on this southern island to five by 1996. Suppliers have followed the assemblers as would be expected. In Kyushu alone, 128 firms built new facilities between 1990 and 1992; previously only 107 plants were located there.

Toyota's decision to expand beyond its traditional clustering in the Mikawa district in the Aichi prefecture is rather revolutionary. Although it allows the company to escape the land and labor costs of operations in the Aichi area, it adds significant costs to parts transport and signals that the merits of concentration in Mikawa may be weaker than they once were. The labor shortage is the primary driver of this change; the regionalization of production facilities seeks to ensure an adequate workforce. In 1990, President of Toyota, Dr. Shoichiro Toyoda, stated "Plant

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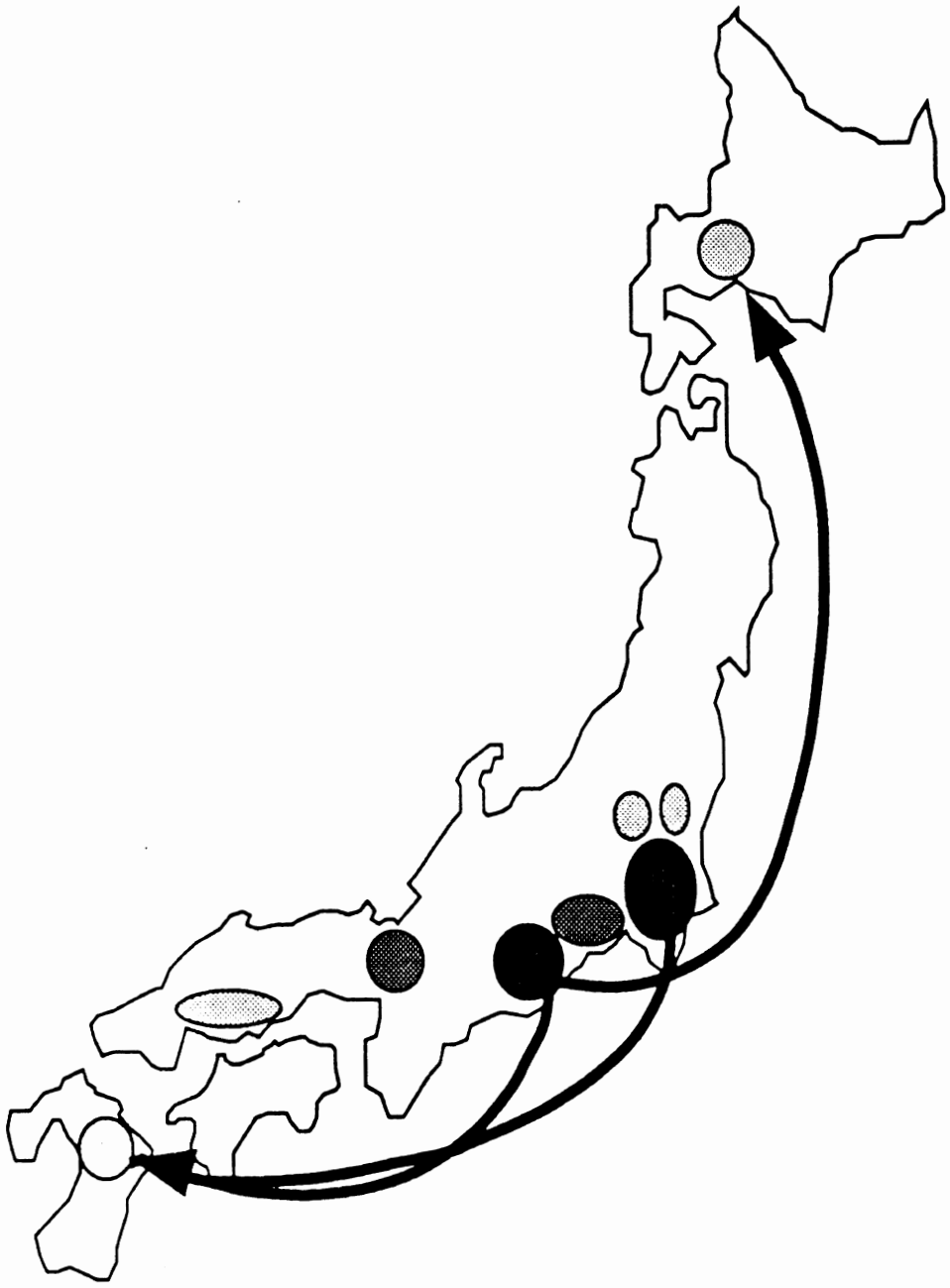
[14] Yokomichi Takahiro. "Hokkaido, the New Frontier for Foreign Companies in Japan," *Tokyo Business Today*, 61 (March 1993) pp. 28.

Exhibit 8: Declustering of Japanese Vehicle Manufacturers



Note: The darker shaded areas indicate heavier concentration of plants.

decentralization has both advantages and disadvantages — the advantage of solving the labor shortage problem was judged to be more important than the disadvantages."[15] Plans to start up another new electrical parts production facility in the Tohoku province (northeast Japan) in 1994 reinforce the pattern of regionalization, decentralization, and in-house production.

By 1995, Toyota's Hirose plant will be expanded, and the Tohoku plant will be built, thus allowing Toyota to have 10 percent of its electronics production in-house. By initiating its own in-house electronics development and utilizing suppliers other than Nippondenso or Aisin Seiki, Toyota has (1) transformed its long-standing, two-supplier system for electronics, (2) introduced more competition and spread out its investment, and (3) developed its own expertise in electronics. Nippondenso's diversification of customers domestically and abroad combined with its use of second-tier suppliers outside the traditional Toyota Group may signal further breakup of the *kereitsu* supplier system.[16] As competition increases, it may become imperative for assemblers to cross *kereitsu* lines and align with the strongest suppliers possible—a strategy inconceivable in the past. Also, suppliers may be forced to sell to nonpatron customers in order to further develop their businesses.

While it appears that the development of these new regional areas has eased the problem of land constraints, the challenge of labor shortages is met for only the short term. As the birth rate slows, the population ages, and working hours decline, the labor shortage will continue to be a serious obstacle for the Japanese companies.

It appears that the current phase of overseas expansion to North America and Europe is over. The Japanese assemblers are planning to reconcentrate their efforts on domestic production and expansion into other Pacific Rim countries. There were five new assembly plants built during the 1981-1990 period analyzed earlier. Nine new facilities (scheduled for completion by 1995) will

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[15] H. Niiyama, "Toyota's New Plant Construction Project and Future of the Group Production," *Asian Motor Vehicle Business Review* 1 (August 1990): p. 3.

[16] Tetsuo Kubo and Hiroshi Nakano, "Toyota Moving Electronics Production In-House," *Asian Automotive Business Review* 3 (April 1992.): p. 6.

add another 1.75 million vehicles to the current production capacity (see table 3). Nissan and Toyota have already set up their new plants in Kyushu, and Mazda has expanded its Hofu factory.[17] However, a number of firms are reassessing their investment and expansion plans as production capacity outstrips the market demand. Daihatsu, for example, has delayed construction of the second stage of its Shiga factory until 1995 and has put on hold its construction of a Kyushu facility. The large capital investments and increasing labor costs have raised break-even points and the minimum efficient scale of plants. Managing plants to yield a high capacity utilization rate is even more challenging in the current environment. Much of the capacity that produced vehicles for export to North America and Europe in the 1980s has been replaced by transplant operations. Table 4 provides estimates of the Japanese production capacity in the three major regions.

Table 3: Japanese Automakers' New and Planning Domestic Facilities

Maker	Facility	Annual Production Capacity	Start-up
Toyota	Toyota Kyushu	200 thousand vehicles	1993
	Toyota Tahara	130 thousand vehicles	1991
	Kanto Auto Works Kanagasaki	100 thousand vehicles	1994
	Toyota Auto Body Mio	100 thousand vehicles	1995
Nissan	Kyushu	240 thousand vehicles	1992
Mazda	Hofu	160 thousand vehicles	1992
Mitsubishi Motors	Mizushima	180 thousand vehicles	By 1995
	Okazaki	180 thousand vehicles	By 1995
Daihatsu	Ryuoh the second facility	170 thousand vehicles	1989
	Ryuoh new facility	190 thousand vehicles	1992
Honda	The third line of Suzuka facility	220 thousand vehicles	1989

Source: *Asian Auto Business Review*, November 1992, Volume 3, Number 3, p. 14.

[17] Omichi Yasunori, "Adjustments in the Car Industry Required," *Journal of Japanese Trade and Industry* 4 (1993) p. 13.

Table 4: Japanese Automotive Industry's Productive Capacity in the United States, Europe, and Japan

(Vehicles) (est.)

	1990	1995
U.S.A.	1,175,000	2,770,000
EUROPE	350,000	1,330,000
JAPAN	13,700,000	14,300,000
TOTAL	15,800,000	18,400,000

Source: *Asian Auto Business Review*, March 1992, Volume 3, Number 3, p.4.
Note: 1. Figures include joint and cooperative, consignment and assembler production.

2. Production increase capacity in Japan includes 240,000 vehicles at Nissan's second Kyushu facility beginning in 1992. Toyota's Miyata, Kyushu, operation will produce 200,000 vehicles starting in 1993. Mazda will expand production at its Bofu facility in 1992 by 160,000 vehicles annually.

3. Including overseas facilities, the Japanese automotive industry's productive capacity in 1992 is about 17 million vehicles. Because of the increase of productive capacity in three main regions (U.S.A., Europe, Japan), the Japanese automotive industry's (worldwide) productive capacity in 1992 is expected to reach 20 million vehicles.

Movement Overseas — Global Regionalization

The overseas expansion of the Japanese auto industry has continued at an increasing rate over the past decade. Japanese vehicle assembly plants in North America and Europe have increased from three in 1985 to seventeen in 1991. Transplant production capacity has increased from 640,000 vehicles to three million over the same time period.[18] Transplants are new, generally efficient, well sited, and serve a political, as well as an economic purpose. They are being used to meet local demand in North America and Europe and to export vehicles and parts to Japan and other areas of the world.[19] Finally, the location of transplants in Europe, as well as the United States, serves as a hedge against foreign currency fluctuations.

Key suppliers have been pressured to follow their patron assemblers abroad. During the 1980s, Japanese supplier firms established 234 parts facilities in the United States. Figures 6 and 7 illustrate how the number of parts facilities established in the United States increased with the

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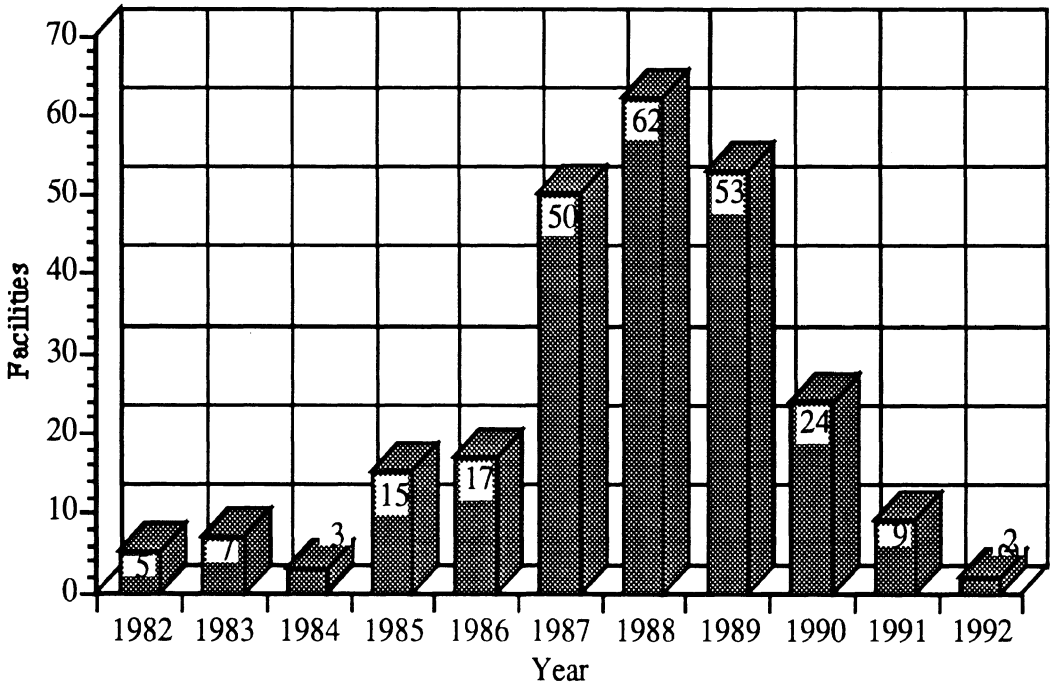
[18] Tetsuo Kubo, "Analysis of Automakers' Low Profitability Trend - Serial Worsening Profitability of Toyota, Nissan, and Mazda," *Asian Automotive Business Review* 3 (November 1992): pp. 11-15.

[19] Mack Chrysler, "Permanent Shift to Transplants?" *Tokyo Business Today* 60 (August 1992): pp. 12-13.

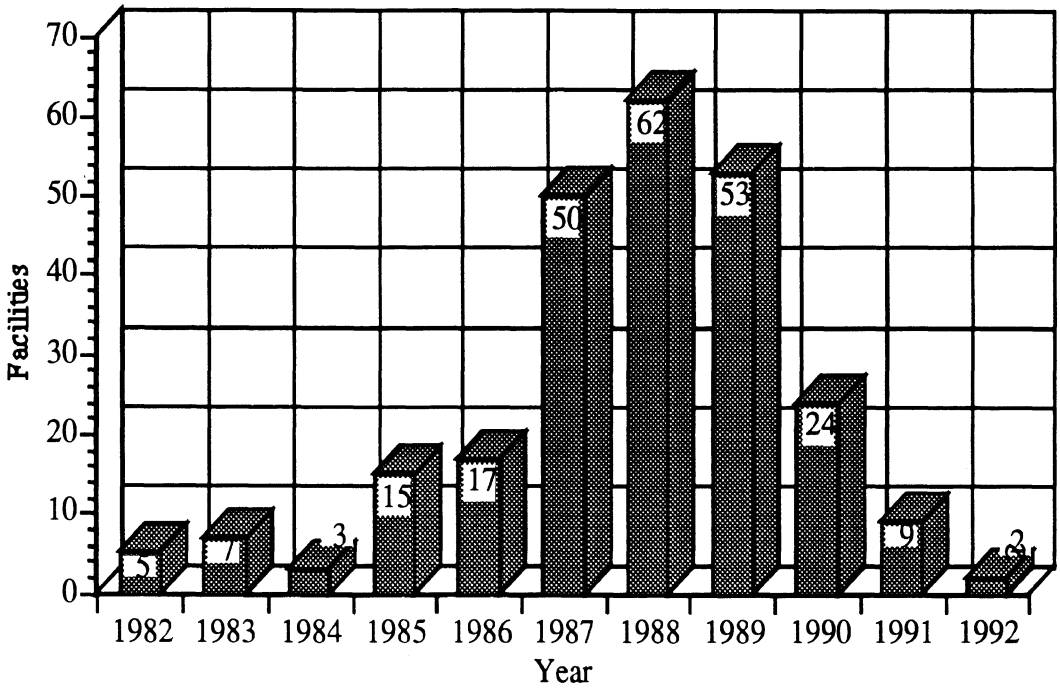
development of transplant assembly operations. The overseas investment presented new opportunities to the Japanese auto industry, but also presented new challenges and pressures. Clearly, it is beneficial for the assembler to have the same supplier, providing the quality, delivery, and service to which the assembler is accustomed. However, the supplier must bear a great burden in investing abroad; it is not able to obtain the same scale economies that it could in Japan, due to the smaller volumes produced in the United States. The decline in transplant establishments during the early 1990s may signal the end of the first wave of expansion, or it may indicate a retreat by the suppliers and assemblers that are finding profitability overseas difficult. In either case, further penetration by Japanese suppliers in the United States is not likely in the near future. Those that have set up shop in the States are now looking to diversify their customer base and product portfolio.

Figure 6: Japanese Invested, U.S. Located Part and Component Facilities Reported Startups 1982-1992



Source: Japanese Automotive Supplier Investment Directory, Fifth Edition, Office for the Study of Automotive Transportation, The Universtity of Michigan, page VI

Figure 6: Japanese Invested, U.S. Located Part and Component Facilities Reported Startups 1982-1992



Source: Japanese Automotive Supplier Investment Directory, Fifth Edition, Office for the Study of Automotive Transportation, The Universtity of Michigan, page VI

The competitive pressure of almost 300 new Japanese transplant parts facilities have encouraged traditional, U.S. suppliers to build modern facilities in order to compete, and have forced many other U.S. parts facilities to shut down completely. This intensified competition, combined with the Big Three shift in purchasing strategies, [20] has forced traditional American suppliers to adapt swiftly to the changing environment in order to survive.

In contrast to a "community" model of gradual expansion, exemplified by Ford and GM in Europe over the past 50 years, the Japanese model of rapidly building new capacity has a number of costs from a corporate and societal perspective. Financially, it was costlier to invest in new plants and equipment and train new workers. Although the assemblers were able to develop lean production systems, the large capital investment forced firms to spread their financial resources; this further pressured profitability for assemblers and suppliers. Social and political costs resulted

[20] Movement towards developing greater long-term relationships where suppliers are involved in the development process of new vehicles and produce subassemblies instead of basic parts.

from the displacement of thousands of workers and the business failure of numerous suppliers. Although transplants now employ over 100,000 in the United States, and it can be argued that the American consumer has received higher value as a result of such expansion, the European community is not likely to accept such social costs.[21] Even though the Japanese assemblers were successful at quickly establishing overseas capacity to avert trade friction and to hedge their foreign currency risk, they incurred difficulties and social costs, which also must be considered in further developing their global strategy.

Japanese automotive firms have also been solidifying their presence in the Southeast Asian automotive industry—the fasting growing market in the world. The Japanese suppliers located in Southeast Asia are able to supply their patrons and also take advantage of the low-cost labor. A number of plants make wire harnesses and other labor-intensive items exclusively for export to Japan. The Japanese development and commitment to the Southeast Asian automotive industry allows Japanese companies to find another source of low-cost labor. The Japanese investment allows the Southeast Asian countries to develop their industrial infrastructure; in return, the Japanese have a bargaining chip to open these growing auto markets to receive their exports. In 1990, 2 million vehicles were sold in the largest ASEAN nations—Thailand, Malaysia, Indonesia, and the Philippines; during the late 1980s and early 1990s, automotive sales experienced annual growth rates of 30 percent. The Japanese assemblers dominate these markets with an estimated 90 percent market share.[22] While these markets are in early stages of development, they can be expected to play an important role in the future of Japan's global automotive strategy.

Much of the Japanese expansion overseas has been fueled by the success of automotive manufacturers in recent years. However, much of their financial success has been attributed to the domestic bubble economy, which has since burst. Japanese firms have been forced to rethink their

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[21] Sean McAlinden, "Commentary: A U.S. Perspective on the Globalization of the Automotive Industry," International Automotive Industry Forum, Phoenix, Arizona, December 1990.

[22] Tim Barrett, Steve Hartle, Chris Lin, and Don Mills, "American Strategic Entry into ASEAN Nations," corporate strategy paper for Professor Majumdar, University of Michigan School of Business Administration, March 5, 1993.

strategic direction under adverse financial situations. The following section describes this economic phenomenon, its effects on industry growth, and implications for the auto industry during the post-bubble era.

IV. BURSTING OF THE JAPANESE BUBBLE ECONOMY

Description: Rise of the Bubble

The bubble era was a time of rapid and substantial rise in asset prices during the second half of the 1980s in Japan.[23] Three key developments prompted this growth:

(1) The sharp appreciation of the yen, prompted by the Plaza Accord of 1985, set Japanese interest rates at historically low levels. In 1985, one U.S. dollar was valued at 250 yen; in April 1993, one dollar was valued at 113 yen. The yen continues to appreciate toward the Y100/$1 mark. The yen more than doubled in value during 1985-1993, so that Japanese consumer spending power was greatly enhanced. In 1987, the official Japanese discount rate on bank borrowing was at 2.5 percent — half the rate in 1985. The low return in savings and the low cost of borrowing prompted further consumption and investment.

(2) As the monetary policy shifted towards accommodation, and firms were more reluctant to borrow from banks, there was a sharp increase in financial activity. As asset prices continued to rise, their rise reinforced the value of hidden assets on corporate balance sheets, which elevated stock prices beyond their real value. Corporations shifted their financing from debt to equity by issuing convertible and warrant bonds. Banks shifted their focus from relationship lending to speculating in real estate and the stock market.[24]

(3) Thirty years of sustained, domestic economic growth gave the Japanese assemblers a significant advantage over their international competitors. Bullishness of the Japanese economy

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[23] See, for example, Ryuichiro Tate, "Special Report: The Bubble Economy," *The Nikkei Weekly*, April 12, 1993, pp. 11-12.

[24] Maryann N. Keller, "Crisis in Japan - Recessions, Secular Trends Force Industry Restructuring", Furman Selz, Inc., April 5, 1993.

was sustained by international expansion and the soaring yen; lenders and borrowers paid less attention to risk and excessive investments were made in Japanese assets.

Amid some of the heaviest trading in market history, the Nikkei 225 Stock Average virtually doubled in two years, from 13,113 yen in 1985 to 26,000 yen in 1987. Japan's stock market became the largest in the world; in 1987, it accounted for 41.7 percent of the world's total market capitalization. Property assets also soared 240 percent over this five year period, from 1,004 trillion yen in 1985 to 2,389 trillion yen in 1990. By 1990, the value of Japanese land assets were quadruple the value of land assets in the United States. As these asset prices skyrocketed and the yen appreciated, consumer confidence and optimism peaked, with the excess spending of the late 1980s. Japan's per capita GNP had grown from $11,000 in 1985 to $24,000 in 1990, the highest level of per capita GNP among major industrial nations.

Although this growth phenomenon was unprecedented, it did not correspond to the conditions of the real economy; as the asset prices plummeted, the phenomenon was increasingly described as a "bubble." A bubble is defined as the portion of a movement in asset prices that cannot be explained by the basis of economic fundamentals.

The Bursting of the Bubble

In December 1989, Yashushi Mieno, the new head of the Bank of Japan, deflated the bubble by raising the official discount rate several times. The collapse of the stock market in early 1990 and the plummeting of land prices were clear signs that the bubble had burst.[25] By the spring of 1992, the Nikkei index had settled around 16,500 after a two-year descent from a high of 38,000. The collapse has made raising fresh funds through equity financing more difficult, and borrowing from banks more expensive. Even though the cost of capital has increased sharply, economists assert that this is a return to normal levels. The bursting of the bubble is forcing firms as well as consumers to change their investment and purchasing behavior. "Until the bubble burst, many

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[25] Kermit Lanser, "Things Japanese: A Shift of Focus," *Financial World*, (August 4, 1992): p. 92.

companies seemed to behave as though it were an implicit assumption that real estate values would continue to rise or at least not fall." [26] The sharp decline in value has diminished the value of their assets and weakened the purchasing power of their previously free-spending domestic consumers; the downturn has adversely affected consumer confidence. Excessive capital investment during the bubble era put even more downward pressure on profits and now threatens the Japanese commitment to high rates of capital-investment and R&D spending.

Other unhealthy signs in the real economy include a rise in bankruptcies, a decline in industrial productivity, and a fall of corporate profits. The sharp increase in the cost of capital, tight labor supply, and the aging population present further challenges for Japan's economy to overcome. Other challenges include the decrease in the number of new college graduates in Japan expected to begin in 1995, dependence on exports, and growing political pressure abroad.

Implications and Recent Developments in the Auto Industry

The automobile industry was a major beneficiary of the bubble economy. Low rate loans and equity financing available encouraged a wave of investments by the auto makers. Higher consumer wealth led to a boom in automotive sales. New car registrations from 1980 to 1985 increased by a solid eleven percent, then sales more than tripled during the next five years. The excess consumer spending of the bubble era spurred automotive sales beyond expectations and Japanese auto companies reaped huge gains.[27] These profits were reinvested in new facilities, capital improvements, and overseas expansion.

The industry now suffers from the bursting of the bubble, with declining sales, historically low profits, and a weakened presence overseas. The industry declined in 1991 for the first time in eleven years; sales were down 3.3 percent. Vehicle sales volumes declined again in 1992, the first time in history that Japanese automotive sales have declined significantly for two consecutive years.

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[26] Tate Ryuichiro, et al., "Special Report: the Bubble Economy." Nikkei Weekly (April 12,1993): p. 11.

[27] Appendix 3 summarizes the sharp gains in profitability for the automakers and suppliers.

Sales declined again in 1993 to make it a record third consecutive annual decline.[28] Declining vehicle sales are not the industry's only major difficulty. The Japanese auto industry now finds itself saddled with inappropriate product development and marketing strategies. The end of rapid growth in disposable incomes with the bursting of the the bubble economy also signaled the end of growth in markets for high-end and niche vehicles. In recent years, models were frequently upgraded to provide fresh styling, and record product proliferation took place to capture and retain sales. A new "value" emphasis has appeared in Japanese auto markets. The industry must restructure to adjust to new, modest expectations of Japanese car buyers.

The decline in profitability was traumatic. Combined annual profits in 1992 for Japanese automakers dropped more than 50 percent to Y500 billion from around Y1.1 trillion in peak years. Three of Japan's automakers reported losses.[29] Toyota's 1992 fiscal settlement announced that profits were down 63 percent from the previous year. In 1993, Nissan announced its first ordinary loss since public offering. Honda and Mazda expected poor profits for their 1993 settlements.

The increased number of facilities has lead to lower capacity utility rates, and therefore, lower profits. Decreased profits have also resulted from higher production costs — mainly the cost of materials and parts. This trend has continued since the mid 1980s, but now sales are not increasing to keep up with the increased costs. Moreover, a declining capital-turnover ratio delays the investment recovery period, while depreciation costs are at record levels. Toyota's profit-to-sales ratio dropped to 3.96 percent in 1992, the first time in over a decade that the ratio has dipped below the 4 percent level (the ratio necessary for paying out expected dividend and wage hikes). Even though Toyota is the most efficient Japanese producer in terms of unit cost, it still suffers from severely high fixed costs traced to recent, massive investments in plant, equipment and product development. The cost of capital investment and R&D outlays, carried out with the bubble economy to forge a "strong company," have rapidly swelled as interest rates have risen.[30] During

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[28] *Tokyo Business Today*, February 3, 1993.

[29] Dr. Shimokawa Koichi, "The Auto Industry Enters an Era of Restructuring and Globalization," *Journal of Japanese Trade and Industry*; 4 (1993): pp. 8-11.

the bubble period, many of the firms invested in long-term projects, such as new factories, that only made sense at very low interest rates. These investments are not generating much cash flow to cover the borrowings that were used to finance them. Even though the capital was cheap up front, the average borrowing is proving to be quite costly.[31]

Between 1984 and 1991, Japanese automakers shifted their financing from debt to equity by issuing $25 billion in convertible and warrant bonds. In the bullish economy, it was expected that the stock prices would continue to rise, and obligations would be converted. After stock prices declined to reflect their real value, lenders asked to be paid back; companies were faced with the prospect of refinancing with straight debt and higher interest rates, or liquidating assets to pay their obligations.[32] This increased cost of capital is causing financial distress for operations abroad as well.

Japanese investment overseas fell by 28.3 percent in fiscal 1992, the third consecutive annual drop. Annual investment outlays now total about one-third of the $49.1 billion for the peak year of 1989.[33] Moreover, about 20 Japanese parts manufacturers have withdrawn from the European market due to the collapse of Japan's bubble economy and the economic recession in Europe. The Japan External Trade Organization said its survey of new Japanese firms moving into the European market also hit a low of 27, compared with 112 in 1990 and 56 in 1991.[34]

The bursting of the bubble has slowed the momentum of American exports to Japan. Total imported (into Japan) car sales for 1991 were 197,184 units, down 12.1 percent from the previous

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[30] Ryoichi Higurashi and Momoko Ito, "Japanese Automakers Rethink Efficiency vs. Profit," *Tokyo Business Today* 60 (March 1992): p. 39.

[31] Michael Smitka, *The Decline of the Japanese Auto Industry - Domestic and International Implications*, Working paper from the Washington and Lee University, July 1992, p. 32.

[32] Keller, *Crisis in Japan*, page number unavailable.

[33] *Agence France Presse*, May 9, 1993.

[34] *Japan Economic Newswire*, March 27, 1993.

year. Most of the loss was incurred by the German luxury car makers (GM sales grew at a slower rate (5.3 percent) and Ford sales declined slightly).

To summarize the effects on the Japanese automotive industry, the bubble economy enhanced domestic sales, product proliferation, profitability, equity financing, capital investment, and overseas expansion. As the assets grew larger than their real value in the bubble economy, the effects on the automotive industry were severe. The rise of the bubble enhanced the resources of the Japanese automotive industry. But since the economy is indeed a bubble that has burst, it leaves behind a number of real, short-term dilemmas, which the auto companies must solve in order to prosper again.

In his book—*Rejuvenation of the Japanese Economy: Beyond the Bubble Economy*—Yoshio Suzuki, chairman of the Nomura Research Institute and one of Japan's leading economists, proposes three major directions for Japan to take: (1) benefitting consumers through economic policies; (2) reforming the financial system; and (3) maintaining the free trade system and making other meaningful contributions to the global order.[35] Applications of these reforms for the automotive industry would take out the inefficiencies of the distribution systems, thereby making automobiles more affordable, and motivating the industry to promote free trade. Tactically, this would mean opening the Japanese market to foreign competition and developing a more balanced trade account with key trading partners, through local procurement strategies and local assembly.

V. NEW PARADIGM FOR THE JAPANESE AUTOMOTIVE INDUSTRY

Analysis of the changes in the Japanese automotive industry over the past decade indicate that the *kereitsu* relationships, once heralded as Japan's secret for competitiveness during its emergence as a world-class competitor in the automotive industry, will be loosening due to the pressures of the domestic economy and the globally competitive environment.

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[35] Michio Uchida, "Now Even the Public Wonders: Is Japan at a Crossroads?" *Tokyo Business Today* 60 (September 1992) pp. 14-16.

Key findings from the geographical analysis indicate that the traditional clusters of firm operations are beginning to decentralize in order to escape the labor shortages and infrastructure constraints. The regionalization strategies will evolve in the form of declustering of operations within Japan and diffusion of the value chain internationally. Globally, the Japanese are adjusting to the shift in comparative labor advantage by moving labor-intensive production of components to Southeast Asia (and to China in the future) for export to Japan. The Japanese firms are continuing to adapt to the political pressures from North American and European industries and governments with increased transplant production in the local markets. While this strategic shift temporarily diminished volume efficiency in Japan, such a move was inevitable due to the shortages of land and labor and the rising yen. Finally, the redistribution of operations worldwide allows the Japanese firms to be closer to the markets that they sell in, offers a number of cost advantages, and allows them to hedge currency risks over the long term.

The postregionalization phase of the Japanese auto industry signals a diminishing role of Japan's export of fully assembled vehicles to the traditional markets of North America and Europe. No longer will these full-assembly, firm clusters, responsible for such a large portion of Japan's exports, be concentrated in one firm's specific area. Rather, the firms will decentralize into newly developing industrial areas (i.e., the islands of Kyushu and Hokkaido) in order to escape the labor shortages of the traditional clusters. It appears that overcapacity will still exist in Japan in the middle of the 1990s, but traditional areas will gradually ramp down as the working hours and the number of qualified workers diminish. This decline should offset the increased production capacity created by the new emerging areas. Nissan's closing of its Zama assembly plant and relocation of workers into Kyushu is an example of the shift and dilution of focus. The closing of plants in traditional clusters will continue to alleviate the issue of overcapacity. Most likely, the older plants and the facilities too small to accommodate automation will be the first to shut down. Not only will the clusters gradually dilute, but the export share of total vehicles will decline as transplant production ramps up to meet overseas demand. Extra capacity will force Japanese assemblers to

seek out new export opportunities in other nontraditional areas. Southeast Asia, China, Latin America, and Eastern Europe are among the top contenders for new growth opportunities.

Even though exports of fully assembled vehicles to traditional markets have begun to decline, trade continues to be active. The content of exports will change because assembly facilities have been constructed in the major markets of North America and Europe, and labor-intensive parts manufacturers have been positioned in Southeast Asia. Labor-intensive parts (e.g., wire harnesses) will be produced in Southeast Asia for export to Japan. High value-added parts and critical components will be assembled in Japan for export to the large market economies. Japan will shift its export content from fully assembled vehicles to engines and transmissions — the high value-added parts and critical technologies that require the largest economies of scale. In effect, Japan will be able to globally source this technology for final assembly in its assembly plants located world-wide. Local content regulations, pressure from domestic parts makers, and market fundamentals will encourage local sourcing of other parts as the *kereitsu* relationships dissolve.

This gradual, yet fundamental, shift from export strategy to transnational regional strategy has a number of important implications. As capacity and production shift overseas, and the domestic market matures, the production of Japanese vehicles in Japan will decline unless it is offset with new export opportunities elsewhere. The loss of scale economies will force the industry to restructure in order to remain competitive. In order to offset inefficiencies created from this regionalization, automakers will have to lengthen their product cycles and reduce the variety of different components so that parts makers can regain economies of scale with longer production runs. Although local content requirements will make opportunities for local parts makers more accessible, global sourcing of critical components will replace the exporting of fully assembled vehicles.

VI. SUMMARY AND DISCUSSION

This paper discusses the evolution of the Japanese automotive industry structure, and suggests areas for restructuring. Improving relations between the assemblers and their suppliers is not the sole solution to the complex situation; suppliers have been faced with a number of obstacles and continue to receive intensified pressure from their patrons. The following conditions pressure the system to change: the productivity plateau, labor shortages, infrastructure bottlenecks, slowed growth in domestic demand, trade frictions, continued appreciation of the yen, and rapid technological changes. Moreover, the bursting of the bubble economy has exacerbated the severity of the situation.

In response to these changing conditions, the parts makers are undertaking a number of initiatives including (1) the rationalization of production: extending runs to achieve economies of scale; (2) customer diversification: extending relationships beyond the patron to customers outside the conventional group; (3) product diversification: conducting their own R&D and producing more of their own products; and (4) overseas investments: supplier transplants to follow the patron business overseas, and sourcing from operations in low-wage Southeast Asian countries and China.[36]

The loosening of *kereitsu* relationships and the trend towards the initiatives discussed may result in mergers among parts makers and moves toward relationships with leading suppliers outside the *kereitsu* group.[37] As this trend unfolds globally, American suppliers attempting to obtain orders from Japanese transplants will no longer face the same burden of overcoming the *kereitsu* lines, but will have to be world-class suppliers in order to survive the rationalization of the parts industry. Survivors will be able to develop high value-added products and maintain high levels of productivity. Large production capacity and superior management capability are also critical success factors.

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[36] Fourin Inc., *The Japan Auto Parts Industries*, (Nagoya City, Japan: Fourin Inc.,1989-90).

[37] Further upstream, vehicle makers will strive to use common parts with other manufactures; for instance, Mazda and Nissan have jointly developed automatic transmissions through JATCO.

As Japanese assemblers face the new realities of the postbubble, postcontinuous-growth era, they must further differentiate their competitive strategies and focus on their core strengths. In the continuous-growth era, all Japanese auto companies would attempt to compete head-to-head in most segments and in most areas of the value chain. This style of competition was effective in the past decades due to (1) the growing and protected domestic market, (2) the opportunities for entry and growth in large international markets, (3) the comparative advantages of low labor costs and a weak yen, (4) the gains in productivity from technical and process innovation, (5) the lean production system, which emphasized JIT delivery and *jikoda*, and (6) commitment of the supplier base, which further enhanced potential gains. With these advantages, the newly challenged Japanese automotive companies must now adapt to a new economic environment, restructuring, and developing a new source of competitive advantage.

In order to confront the domestic land and labor shortages, the auto manufacturers are declustering their operations by moving to Hokkaido and Kyushu islands. Production and employment have been gradually dissipating from the concentrated clusters out to these newly industrialized regions; this movement alleviates the infrastructure constraints on congested clusters. The Japanese also escaped their labor shortage by establishing operations overseas. Transplant operations in North America and Europe circumvent trade pressures, and new facilities in Southeast Asia provide the Japanese firms with a low-cost source of skilled labor. China, another source of low-cost labor, may play a larger role in the near future. Both areas also represent large potential export markets.

Producing in the three main continental regions of North America, Europe, and Asia allows the Japanese automotive companies to hedge against foreign currency fluctuation — in particular, the further appreciation of the yen. However, spreading out production capacity among various markets creates disadvantages in terms of diluting the concentrated high volume necessary for achieving economies of scale. The challenge is to balance the currency hedge and the capacity hedge so that the system is insulated from foreign currency fluctuation, and yet able to reach efficient production levels. The balance is easier to attain if the vehicles and operational income are

able to move freely from country to country, and if localization rates can be varied. High-volume production is also important, but may be difficult for the smaller companies to achieve in all three regions. Creating a portfolio of production sites and markets also provides companies with exposure to technical and market developments worldwide.[38]

With resources spread globally, it becomes important for the Japanese vehicle producers to effectively use their domestic workforce and maintain profitability. Firms must concentrate on expanding revenues and profitability, now that the continuous growth era is over. Even though Figures 1 and 3 above illustrate how production in Japan has declined in the past two years, and export's share of production has declined for the past seven years, further analysis should be conducted to show if the same trend holds true for growth measured in revenues. By producing critical technology and high value-added components (e.g., transmissions) in Japan, the highly skilled workforce is better utilized, and domestic revenues are maximized. Thus, even though assembly takes place overseas, much of the profit and control is maintained in Japan. This pattern parallels the regionalization of the automotive industry in the United States years ago when engines produced in the Detroit area were transported to assembly plants located in various regions of the country. Such a global sourcing strategy can also utilize the comparative low-cost labor advantage of the companies' operations in Southeast Asia. Assessment of each company's strengths in the value chain[39] in various markets provides firms with a concept of which areas to strengthen and which areas to exit.

While global procurement strategies and hedging overseas may enhance profitability, standard economic theory asserts that the key to enhancing profitability is to spread the fixed costs over a greater number of units. To the Japanese assemblers, this means extending product-development cycles, reducing product variety, standardizing parts, and maintaining high capacity-utilization rates.

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[38] McAlinden, *Commentary: A U. S.. Perspective on the Globalization of the Automotive Industry, International Automotive Industry Forum, Phoenix AZ, December 1990.*

[39] Automotive design, procurement, manufacturing, and marketing.

In order to implement some of the initiatives described above, firms must have broad geographical scope and high volumes of production in each area. Since most companies do not have such large operational scopes, arrangements with other companies become increasingly important. Developing cooperative arrangements with other major assemblers and parts makers (Japanese, American, and European) will be critical to developing the necessary capability for competing in the 21st century.

Appendix 1

Key Characteristics of Japanese Automobile Manufacturers

Toyota Motor Manufacuturing Corp.						
		1982		1990		
Toyota Facilities	Products	Employees	Production (Vehicles /Month)	Employees	Capacitv* (Units /Month)	Output
Honsha	Trucks, buses	2,500	20,000	2,000	18,000	-
Motomachi	Passenger cars	4,800	19,000	5,600	40,000	-
Kamigo	Engines, transmissions	3,700	-	3,200		-
Takaoka	Passenger cars	5,400	90,000	5,200	63,100	-
Miyoshi	Chassis parts	1,800	-	1,900		-
Tsutsumi	Passenger cars	5,500	36,000	6,000	45,000	-
Myochi	Castings (engine parts, chassis parts)	800	-	900	-	-
Shimoyama	Diesel and gasoline engines, emission control devices	1,300	-	1,700	-	-
Kinuura	Functional parts	1,200	-	2,000	-	-
Tahara	Passenger cars, trucks	2,900	14,000	5,100	39,000	-
Teiho	Machine tools, dies	-	-	2,800	-	-
Hirose	Electronic equipment	-	-	380	-	-
	In-house Production Sub-total	29,900	179,000	36,780	205,100	-
		Employees (Assembly)	Productivity (Unit/Emp./Mo)	Employees (Assembly)	Productivity (Unit/Emp./Mo)	
		21,100	**8.5**	**23,900**	**8.6**	

Toyota Motor Manufacturing Corp. Subcontractors						
		1982		1990		
Toyota Subcontractors Facilities	**Products**	**Employees**	**Production (Vehicles /Month)**	**Employees**	**Capacitv* (Units /Month)**	**Output**
Tovoda Automatic Loom Works						
Jagakusa	Vans, pickups	1,400	20,000	1,783	-	22,000
Toyota Auto Bodv						
Fujimatsu	Cars, car-derived vans	4,500	30,000	4,972	-	35,000
Kariya	Vans	1,400	10,000	1,674	-	10,000
Kanto Auto Works						
Higashi Fuji	Cars, car-derived vans	1,800	10,000	2,250	-	14,500
Yokosuka	Cars	3,400	10,000	3,578	-	20,000
Hino Motors						
Hamura	Trucks, cart	2,800	24,000	2,800	-	11,600
Daihatsu Motor						
Ikeda	Vans	5,100	32,000	5,100	-	16,000
Kyoto	Vans	1,600	18,000	1,600	-	17,000
Gifu Auto-Bodv						
Honsha	Trucks, vans	820	-	800	-	-
Central Motor						
Honsha	Vans, cars, ambulances	1,267	-	990	-	-
Araco						
Honsha	4WD utility vehicles	3,400	-	3,400	-	-
	Interior parts				-	-
Tot.EEs	Subcontract Prod. Total	27,487	154,000	28,947	146,100	
		Employees (Assembly)	Productivity (Unit/Emp./Mo)	Employees (Assembly)	Productivity (Unit/Emp./Mo)	
		22,000	**6.2**	**23,757**	**7**	
	Passenger cars	273,000	252,246			
	Trucks and buses	89,000	81,654			
	Total	362,000	333,900			
	Capacity utilization		92.24%			

Nissan Motor Company, Ltd.						
		1982		1990		
Nissan Facilites	Products	Employees	Production (Vehcles /Month)	Employees	Capacitv* Units/Mth	Output
Oppama	Cars	5,600	34,000	4,439	40,000	
Zama	Compact cars	6,100	32,000	4,646	35,000	
	Machines, tools					
Murayama	Cars	5,800	25,000	4,487		
	Axles, machines, tools		1,100		45,000	
Tochigi	Cars	8,100	32,000	7,087	1,600 *	
	Cylinder heads, intake manifolds,				38,000	
	axles, light alloy wheels					
Kyushu	Cars, pickups	4,000	28,000	4,349	30,000	
	Engines				30,000 ~	
	Axles				30,000 ~	
Yokohama	Engines, forgings, machines, tools, castings 135,000 *	6,400	-	5,384	135,000*	
(Incl. Kurihama)	Axles	400	-		220,000 *	
Yoshiwara	Transmissions, transaxles for FWD	4,600	-	4,571	170,000 *	
Kanbara)	models castings, forging, powder	600	-			
	metallurgy					
	Steering gears				200,000 *	
	In-house production total	41,600	152,100		188,000	141,518
		Employees (Assembly)	Productivity (Unit/Emp./Mo)	Employees (Assembly)	Productivity (Unit/Emp./Mo)	
		29,600	**5.1**	**25,008**	**5.7**	

Nissan Motor Company, Ltd. Subcontractors						
		1982		1990		
Nissan Subcontractor Facilities	**Products**	**Employees**	**Production (Vehcles /Month)**	**Employees**	**Capacitv* Units/Mth**	**Output**
Nissan Diesel	Pickups (as subcontractor)	7,100	5,600	NA	3,700	4,544
Nissan Shatai	Compact cars (as subcontractor)	6,900	40,000	NA	37,000	28,597
Aichi Machine Ind.	Vans, trucks (as subcontractor)	4,700	13,000	NA	12,000	11,448
Takada (Press) Kogyo	Compact cars (as subcontractor)	1,300	250	NA	500	500
	Subcontract total	20,000	58,850	NA	53,200	45,089
		Employees (Assembly)	Productivity (Unit/Emp./Mo)	Employees (Assembly)	Productivity (Unit/Emp./Mo)	
		20,000	**5.1**	**NA**	**NA**	
	CU					

Honda Motor Company, Ltd.						
		1982		1990		
Honda Facilities	Products	Employees	Production (Vehcles /Month)	Employees	Capacitv* Units/Mth	Output
Sayama	Passenger cars	4,500	37,000	6,250	45,146	
Wako	Engines for cars and motorcycles	1,700	-	2,017		
Mohka	Engine parts, CV joints	400	-	874		
Hamamatsu	Motorcycles, tillers, generators, automatic transmissions	3,500	-	4,244		
Suzuka	Passenger cars, mopeds, scooters	8,400	46,000	9,782	55,150	
Kumamoto	Motorcycles, lawn mowers	1,600	-	2,300		
Yachiyo Industry		-	-	(as subcontractor)	Need Data	
Total	Passenger cars			25,467	109,000	110,496
	CU				1	
	In-house Production Sub-total	20,100	83,000	25,467	109,100	
		Employees (Assembly)	Productivity (Unit/Emp./Mo)	Employees (Assembly)	Productivity (Unit/Emp./Mo)	
EE(ASSM)	Productivity (Unit/EE/mo)	**16,032**		**100,296**	**6**	

Mazda Motor Manufacturing						
		1982		1990		
Mazda Facilities	Products	Employees	Production (Vehcles /Month)	Employees	Capacitv* Units/Mth	Output
Hiroshima	Honsha - Commercial vehicles,	24,200	79,000	23,660	18,300	
(Honsha and	engines, transmissions, axles					75,482
Ujina plant	Ujina - Compact cars				51,700	
districts)	engines, transmissions,					
	machine tools					
Hofu	Compact cars	2,600	27,000	2,588	20,000	26,240
	Transmissions					
Miyoshi	Diesel engines	400	-	337		
	Passenger cars	27,500	106,000	26,585	66,000	70,283
	Trucks				24,000	27,865
	Total				90,000	98,148
	CU				9	
	In-house Production Sub-total	27,500	106,000	26,585	90,000	
		Employees (Assembly)	Productivity (Unit/Emp./Mo)	Employees (Assembly)	Productivity (Unit/Emp./Mo)	
	Productivity (Unit/EE/mo)	**27,500**	**1**	**26,248**	**3**	
						*not all dedicated to assembly

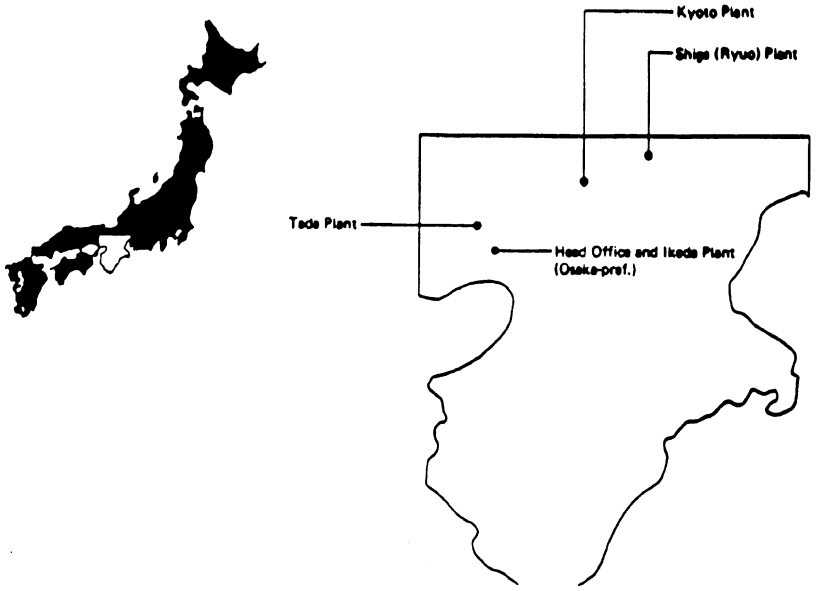
Mitsubishi Motors Corporation						
		1982		1990		
Mitsubishi Facilities	Products	Employees	Production (Vehcles /Month)	Employees	Capacitv* Units/Mth	Output
Oye / Ohe	Cars, vans, buses	2,700	5,000	1,973		
			9,000			
Okazaki	Cars	1,600	11,000	1,957		
Mizushima	Cars, vans, light-duty trucks	5,900	34,000	5,174		
			23,000			
Kyoto	Engines	3,800		3,017		
Shiga	Passenger car engines	200		308		
Kawasaki	Trucks, Engines	2,900	8,000	2,932		
Maruko	Transmissions for truck	1,400		616		
Toyo Koki	Multi-purpose vehicles			1,350		
	(subcontract)					
Total	Subcompacts	23,000	90,150	17,327	52,900	50,801
	Trucks & buses		50,000		34,300	29,992
	Midgets		40,150		19,800	23,654
	Total				107,000	104,447
	CU				1	
		Employees (Assembly)	Productivity (Unit/Emp./Mo)	Employees (Assembly)	Productivity (Unit/Emp./Mo)	
EE(Assem)		**13,100**	**6.9**	**13,694**	**7.8**	

Isuzu Motor, Ltd.						
		1982		1990		
Isuzu Facilities	**Products**	**Employees**	**Production (Vehcles /Month)**	**Employees**	**Capacitv* Units/Mth**	**Output**
Hon-Kojo	Cars, vans, pickups			6,269		
Yajima	cars, vans					
Ohta-Kita	Axles, Suspensions					
Ohizumi	Transmission, Auto Engines			1,200		
Mitaka	Auto Engines			1,100		
Isezaki	Bus Bodies			738		
Kiryu Ind.	Trucks, Vans (subcontracted)			530		
	Total					
	Mini cars				23,600	21,662
	Subcompacts,compacts, vans, pickups				34,300	27,034
	Buses				141	179
*	Productivity (Unit/EE/mo)		Productivity (Unit/EE/mo)			
	8					
EE(Assem)						

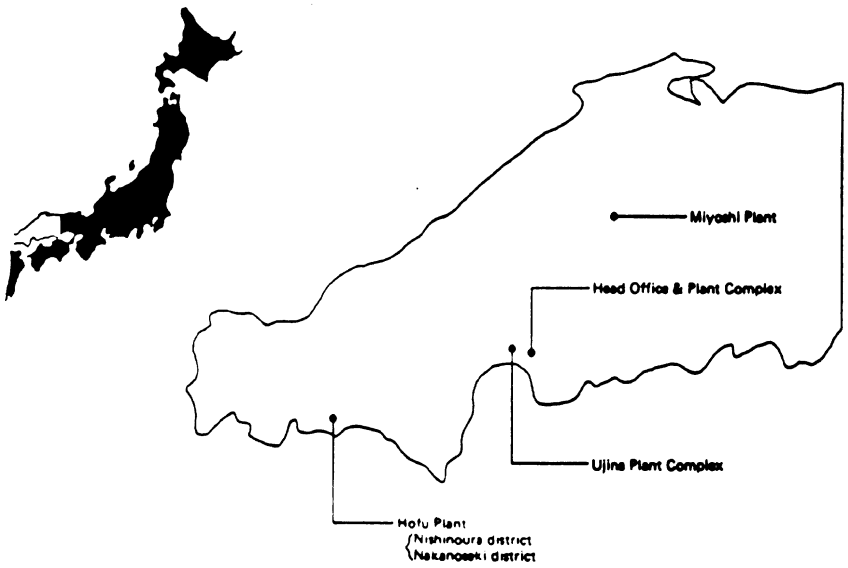
Appendix 2

Maps of Japanese Domestic Automotive Facilities' Locations

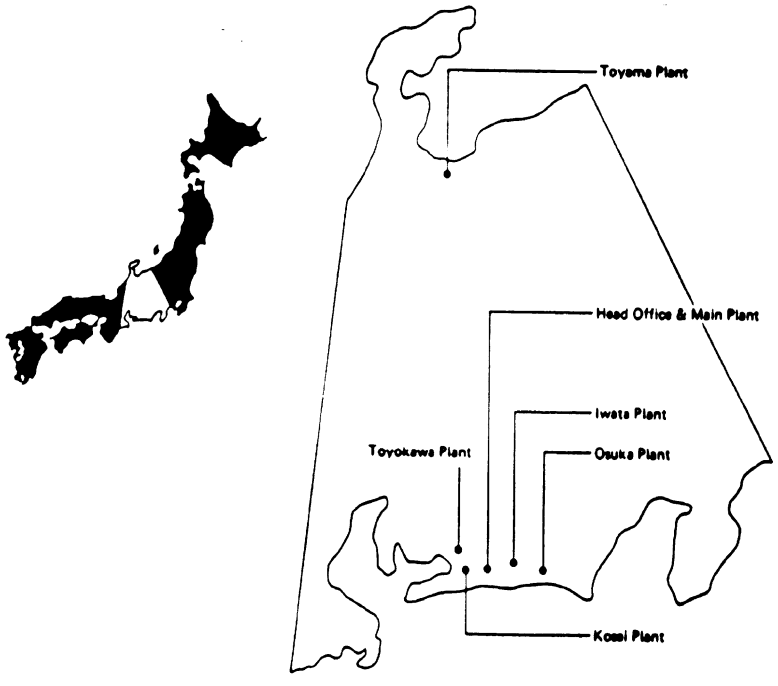
Daihatsu Motor



Toyo Kogyo

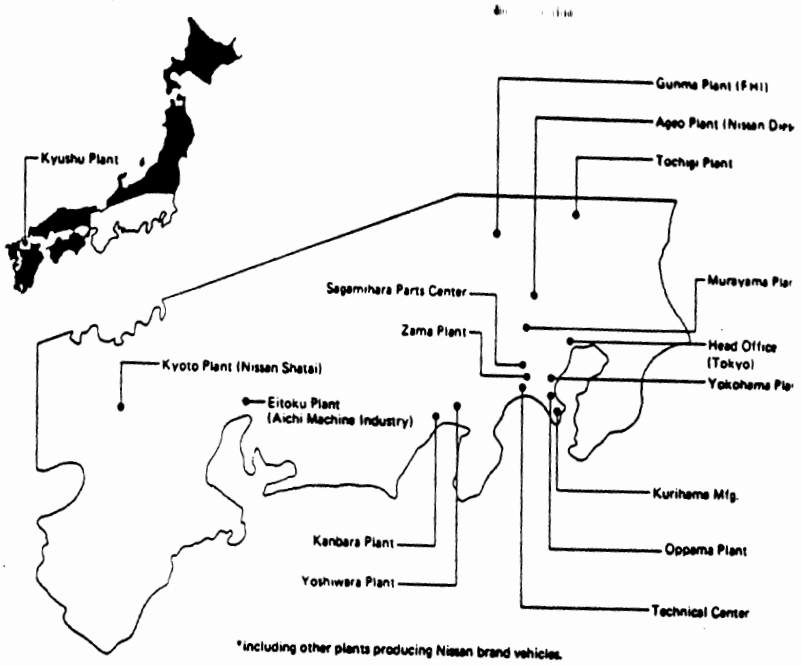


Suzuki Motor



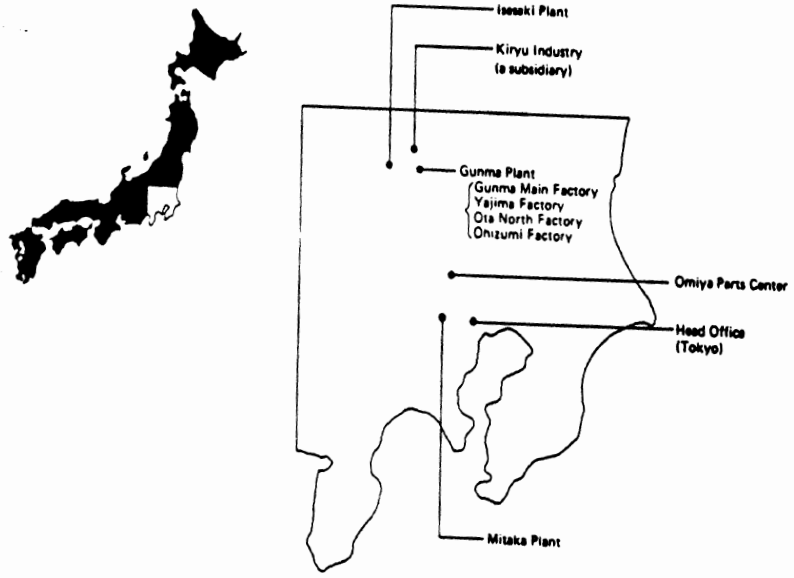
Source: Dodwell

Nissan Motor



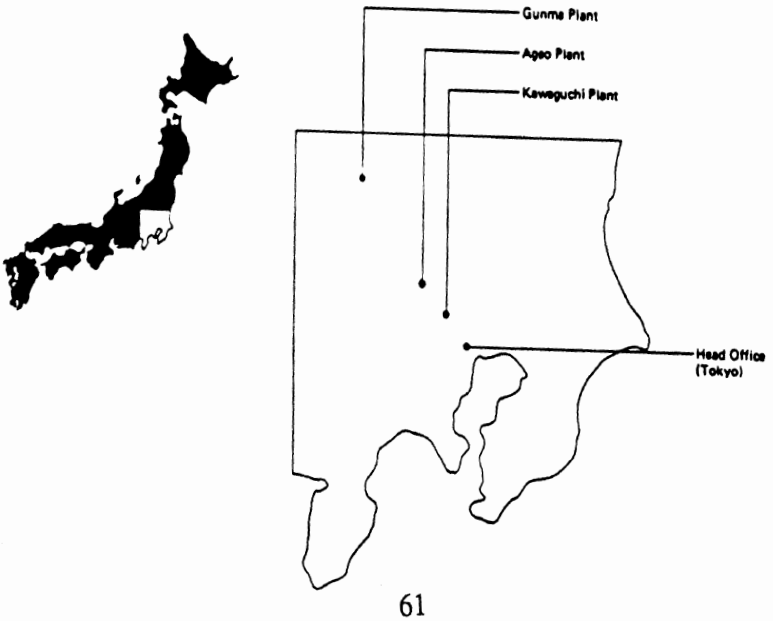
(PART II)

Fuji Heavy Industries



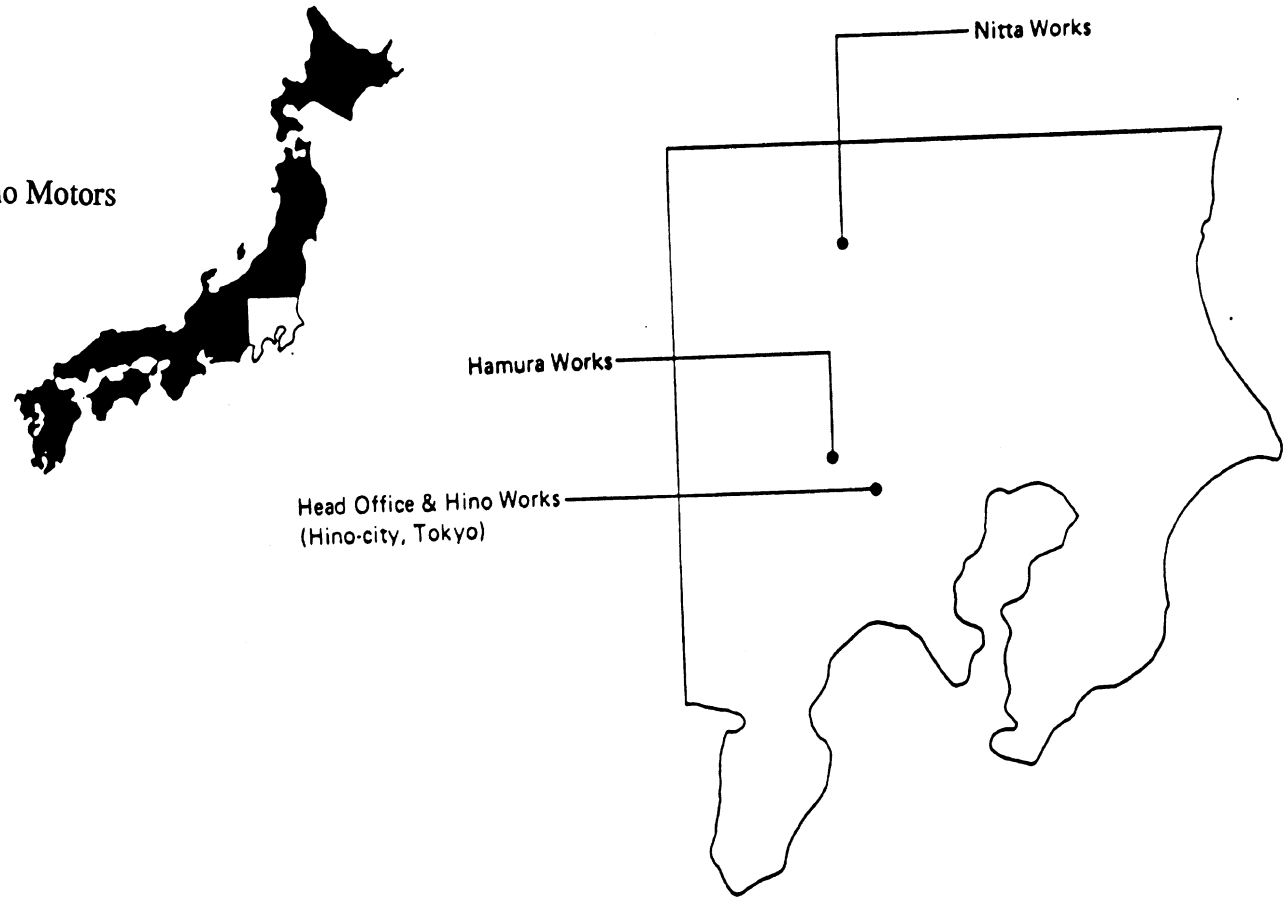
(PART II)

Nissan Diesel

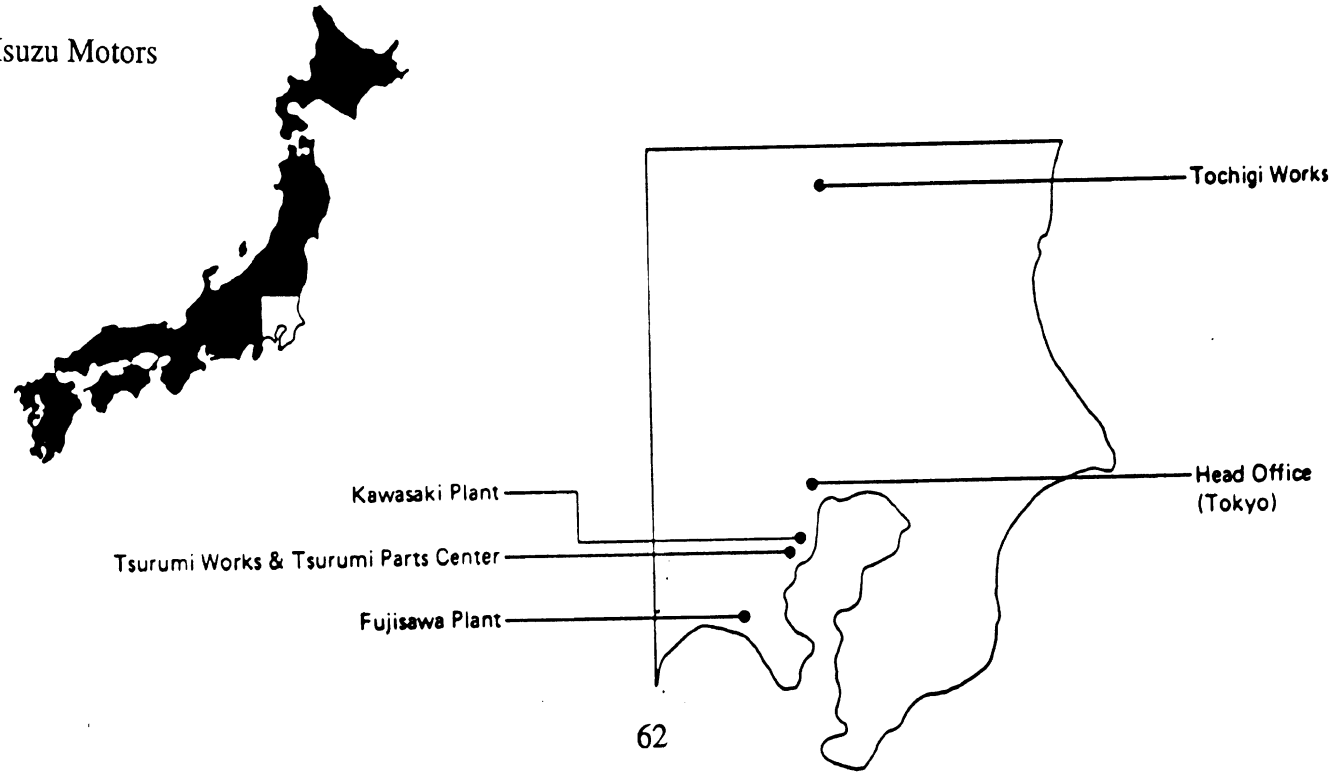


Source: Dodwell

Hino Motors



Isuzu Motors



Appendix 3

Profitability for Japanese Automakers and Suppliers in Overseas Expansion

Outline of Japan Automakers' North American and European Facilities Established in the 1980s

		Local Plant		Start-up	Annual Production Capacity	Investment Breakdown
Toyota	North America	New United Motor Manufacturing Inc		Dec.,1984	200 thousand Vehicles	$800 million
		Toyota Motor Manufacturing U.S.A. Inc.		May,1988	200 thousand Vehicles	$800 million
		Toyota Motor Manufacturing Canada Inc.		Nov.,1988	65 thousand Vehicles	C$400 million
	Europe	Toyota Motor Manufacturing (UK) Ltd.		Dec.,1992	200 thousand Vehicles	£700 million
Nissan	North America	Nissan Motor Manufacturing Corp.,U.S.A.		Jun.,1983	44 thousand Vehicles	$745 million
	Europe	Nissan Motor Manufacturing (UK) Ltd.		Jul.,1986	200 thousand Vehicles	£600 million
		Nissan Motor Iberica, S.A.		1980 *(C.P.)	100 thousand Vehicles	N.A.
Honda	North America	Honda of America Mfg., Inc.	Marysville	Nov.,1982	360 thousand Vehicles	$883 million
			East Liberty	Dec.,1989	150 thousand Vehicles	$380 million
		Honda Canada Inc.		Nov.,1986	100 thousand Vehicles	C$280 million
	Europe	Honda of the U.K. Mfg., Ltd.		Oct.,1992	100 thousand Vehicles	N.A.
Mazda	North America	Mazda Motor Manufacturing (USA) Corp.		Sep.,1987	240 thousand Vehicles	$550 million
Mitsubishi Motors	North America	Diamond-Star Motors Corporation		Sep.,1988	240 thousand Vehicles	$600 million
Fuji Heavy Industries & Isuzu	North America	Subaru-Isuzu Automotive Inc		Sep.,1989	160 thousand Vehicles	$500 million
Isuzu	Europe	IBC Vehicles Ltd.		Sep.,1989	60 to 70 thousand Vehicles	£34 million
Suzuki	North America	CAMI Automotive Inc.		Apr.,1989	200 thousand Vehicles	C$615 million
	Europe	Land Rober Santana S.A.		1984 *(C.P.)	35 thousand Vehicles	N.A.

Note: (C.P.) = Capital Participation.

Source: Asian Automotive Business Review, November, 1992, Vol. 3, Number 11, p. 13.

Five Japanese Automakers' Trend of Worsening Profitability

(million Yen, %)

	Fiscal Term	Sales	Operating Profit	Production Cost			Capital Turnover Ratio
					Material Cost	Depreciation	
Toyota	1985. 6	6,064,420	505,891	4,618,502	3,941,359	162,697	1.71
	1986. 6	6,304,858	329,387	4,972,156	4,241,104	194,907	1.74
	1987. 6	6,024,909	248,364	4,864,535	4,100,782	220,259	1.49
	1988. 6	6,691,299	369,087	5,306,466	4,486,847	221,419	1.47
	1989. 6	7,190,590	400,522	5,764,303	4,892,881	226,735	1.35
	1990. 6	7,998,050	538,677	6,650,643	5,680,609	261,993	1.31
	1991. 6	8,564,010	338,787	7,407,084	6,305,765	291,369	1.41
Nissan	1985. 3	3,618,076	70,845	2,796,388	2,373,700	111,036	1.45
	1986. 3	3,754,172	58,999	2,936,814	2,508,169	114,310	1.51
	1987. 3	3,429,317	(8,449)	2,766,753	2,371,537	96,837	1.28
	1988. 3	3,418,671	47,610	2,641,498	2,272,724	82,232	1.18
	1989. 3	3,580,110	92,010	2,730,389	2,363,581	72,960	1.15
	1990. 3	4,005,550	138,664	3,290,774	2,842,038	77,175	1.20
	1991. 3	4,175,013	119,660	3,559,834	3,063,234	93,175	1.20
	1992. 3	4,270,523	33,775	3,719,689	3,148,478	120,110	1.15
Honda	1985. 2	1,929,519	70,702	1,342,483	1,023,885	50,292	2.00
	1986. 2	2,245,743	71,513	1,629,537	1,252,811	55,111	2.02
	1987. 2	2,334,597	82,780	1,743,067	1,340,783	58,534	2.03
	1987. 9	1,400,310	48,459	1,028,407	781,662	38,379	1.18
	1988. 3	1,249,737	21,145	939,763	722,775	31,633	1.01
	1989. 3	2,636,769	74,151	1,918,105	1,459,475	61,707	2.03
	1990. 3	2,748,863	100,407	2,085,370	1,578,689	74,095	2.01
	1991. 3	2,800,199	65,464	2,194,741	1,670,531	74,548	1.91
	1992. 3	2,911,044	54,106	2,231,041	1,703,532	70,766	1.97
Mazda	1985.10	1,569,553	69,129	1,311,888	1,008,223	51,981	1.99
	1986.10	1,626,187	16,082	1,428,802	1,097,325	58,166	2.01
	1987.10	1,602,293	5,107	1,431,132	1,088,459	62,199	1.84
	1988.10	1,844,319	26,176	1,632,968	1,246,055	63,315	2.01
	1989. 3	784,917	15,218	693,280	529,245	26,393	0.78
	1990. 3	2,045,567	40,151	1,767,347	1,458,241	59,222	1.97
	1991. 3	2,225,714	44,536	1,927,089	1,708,138	56,532	1.83
	1992. 3	2,304,110	21,015	2,026,696	1,791,022	64,610	1.80
Mitsubishi Motors	1985. 3	1,408,307	31,053	N.A.	N.A.	N.A.	1.61
	1986. 3	1,578,823	29,212	N.A.	N.A.	N.A.	1.49
	1987. 3	1,558,670	31,956	N.A.	N.A.	N.A.	1.40
	1988. 3	1,752,697	40,635	1,382,953	1,069,126	46,344	1.52
	1989. 3	1,898,828	44,072	1,474,876	1,164,523	42,843	1.64
	1990. 3	2,025,715	48,774	1,590,446	1,281,443	40,310	1.50
	1991. 3	2,313,636	65,822	1,850,613	1,487,950	50,362	1.49
	1992. 3	2,554,055	56,186	2,096,630	1,686,080	66,493	1.53

(Data : Security Reports)

Source: Asian Automotive Business Review, November, 1992, Vol. 3, Number 11, p. 12.

Main Japanese Suppliers' Financial Results ended March 1990

(Units : ¥ million, %)

Company Name	Sales(A) ('90 / '89 change)		(B) Operating Profit ('90 / '89 change)		Ordinary Profit ('90 / '89 change)		Net Income ('90 / '89 change)		(B)/(A) ('90 / '89 change)	
Aisan Industry Co., Ltd.	72,007	(5.1)	2,173	(△4.5)	2,152	(△10.4)	1,233	(△6.3)	3.1	(4.0)
Aisin Seiki Co., Ltd.	158,500	(12.9)	17,025	(5.9)	20,011	(10.8)	10,175	(11.0)	4.4	(4.4)
Akebono Brake Industry Co., Ltd	92,178	(11.6)	3,121	(29.1)	2,288	(22.1)	1,038	(27.1)	2.5	(2.3)
Alpine Electronics, Inc	70,816	(12.2)	3,215	(188.3)	2,302	(51.9)	1,186	(91.8)	3.3	(2.4)
Alps Filter Mfg. Co., Ltd	313,956	(2.3)	11,988	(80.9)	11,981	(61.3)	6,073	(0.1)	3.8	(2.4)
Bando Chemical Industries Ltd	57,171	(1.7)	3,773	(△1.9)	1,168	(16.8)	1,623	(11.1)	7.8	(6.8)
Chuo Hatsujo Kogyo K.K.	59,203	(5.7)	2,110	(△15.7)	2,918	(2.1)	1,730	(17.8)	4.9	(5.1)
Clarion Co., Ltd	73,113	(12.1)	1,571	(558.2)	1,552	(125.9)	1,375	(89.1)	2.1	(1.1)
Daikin Mfg. Co., Ltd	71,260	(10.2)	3,581	(△0.9)	3,671	(6.7)	1,890	(7.1)	5.2	(3.4)
Enshu Ltd	32,591	(1.7)	1,313	(△11.2)	1,062	(△13.7)	750	(△37.6)	3.3	(1.0)
Fuji Kiko Co., Ltd.	51,318	(19.8)	3,150	(51.0)	3,393	(62.8)	1,777	(56.3)	6.2	(1.6)
Fuji Machinery Co., Ltd.	12,852	(△9.1)	△178	(33.8)	△151	(11.2)	12	(△70.6)	△1.2	(△1.9)
Fuji Tekko Co., Ltd.	11,361	(22.1)	1,218	(62.1)	1,158	(75.0)	502	(39.0)	2.6	(1.8)
Furukawa Battery Co., Ltd	27,750	(1.1)	1,171	(△8.8)	353	(△21.7)	92	(△31.1)	1.3	(1.7)
Futaba Industries Ltd.	105,020	(8.1)	1,568	(△13.5)	5,896	(△7.1)	2,693	(△5.5)	5.6	(6.6)
Hashimkoto Forming Ind. Co., Ltd.	66,757	(13.9)	1,367	(225.4)	1,051	(3.6)	431	(11.2)	1.6	(1.7)
Hino Auto Body Ltd.	61,917	(1.8)	1,321	(20.3)	899	(12.5)	312	(0.9)	1.1	(1.3)
Horiba Mfg. Co., Ltd.	19,792	(10.6)	1,805	(3.6)	2,127	(11.3)	1,032	(0.5)	12.3	(11.9)
Howa Kogyo K.K.	61,235	(2.2)	1,516	(1.2)	3,565	(6.1)	1,585	(22.3)	5.8	(5.6)
Ichikon Industries Ltd.	106,870	(10.7)	1,109	(△8.6)	2,376	(△6.6)	1,080	(△13.3)	2.2	(2.6)
Izumi Kogyo K.K.	21,537	(1.1)	1,706	(△9.6)	1,331	(△10.6)	778	(61.9)	5.4	(6.4)
Jeco Co., Ltd.	22,593	(18.6)	250	(27.1)	520	(20.7)	221	(9.8)	2.3	(2.3)
Jidosha Denki Kogyo Co., Ltd.	50,130	(17.5)	1,148	(52.8)	1,388	(15.5)	640	(10.3)	2.8	(2.2)

Source: Asian Motor Vehicle Business Review, September, 1990, Vol. 1, Number 9, p. 68.

Main Japanese Suppliers' Financial Results ended March 1990 (cont.)

Company Name	Sales(A) ('90 / '89 change)		(B) Operating Profit ('90 / '89 change)		Ordinary Profit ('90 / '89 change)		Net Income ('90 / '89 change)		(B)/(A) ('90 / '89 change)	
Kanto Auto Works Ltd.	390,125	(16.5)	6,062	(3.2)	6,973	(9.2)	3,647	(12.0)	1.8	(1.9)
Kasai Kogyo Co., Ltd.	60,957	(14.5)	1,129	(211.9)	963	(27.3)	457	(44.2)	1.6	(1.4)
Kayaba Industry Co., Ltd.	166,261	(13.8)	7,360	(19.0)	6,226	(11.5)	2,919	(28.7)	3.8	(3.8)
Keihin Seiki Mfg. Co., Ltd.	44,691	(-)	1,110	(-)	1,057	(-)	534	(-)	2.4	(3.7)
Kenwood Corp.	51,768	(-)	1,031	(-)	1,553	(-)	618	(-)	3.0	(2.8)
Kiryu Industry Co., Ltd.	22,190	(13.9)	1,223	(201.5)	974	(173.1)	316	(101.5)	4.4	(1.7)
Koyo Seiko Co., Ltd.	231,030	(12.7)	9,305	(33.1)	12,258	(43.9)	5,859	(45.2)	5.3	(1.2)
Matsushita Comm'n Ind. Co., Ltd	363,122	(1.5)	13,880	(0.3)	23,167	(6.5)	10,276	(△ 10.6)	6.4	(6.3)
Meiwa Industry Co. Ltd.	21,057	(11.8)	1,001	(233.4)	1,097	(71.7)	499	(79.8)	5.2	(3.4)
Mikuni Corp.	49,875	(△ 1.5)	△ 737	(-)	△ 116	(-)	△ 345	(-)	-	(0.5)
Mitsubishi Steel Mfg. Co., Ltd.	79,198	(5.0)	2,681	(△ 40.6)	1,181	(△ 54.5)	337	(△ 88.5)	1.5	(3.4)
Mitsuba Electric Corp.	74,763	(13.8)	1,670	(8.5)	2,068	(△ 18.2)	1,127	(△ 9.8)	2.8	(3.8)
Mitsuboshi Belting Ltd.	72,335	(7.9)	2,571	(△ 10.6)	3,132	(8.7)	1,290	(2.3)	4.3	(4.3)
NGK Insurators, Ltd.	195,235	(5.5)	13,373	(4.3)	17,020	(2.1)	8,861	(9.8)	8.7	(9.2)
NGK Spark Plug Co., Ltd.	97,799	(5.1)	8,518	(△ 6.5)	10,051	(2.0)	5,308	(9.0)	10.3	(10.6)
Nichias Corp.	93,945	(12.1)	3,502	(19.2)	3,345	(17.1)	1,247	(18.9)	3.6	(3.4)
Nifco Inc.	38,775	(-)	4,720	(-)	5,962	(-)	2,789	(-)	15.4	(11.3)
Nippon Air Brake Co., Ltd.	59,517	(1.5)	3,232	(6.4)	3,019	(1.9)	1,634	(52.4)	5.1	(5.1)
Nippon Gasket Co., Ltd.	5,948	(9.0)	366	(△ 7.6)	574	(5.2)	253	(△ 6.6)	9.7	(10.0)
Nippon Seiki Co., Ltd.	61,936	(17.3)	2,474	(6.2)	2,642	(24.9)	1,278	(21.7)	4.3	(4.0)
Nippon Seiko K.K.	344,219	(-)	19,639	(-)	21,947	(-)	11,547	(-)	6.4	(5.7)
NTN Corp.	141,615	(-)	9,628	(-)	9,552	(-)	4,903	(-)	6.8	(6.5)
Pioneer Electronic Corp.	357,629	(-)	36,991	(-)	34,863	(-)	19,811	(-)	9.7	(8.1)
Press Kogyo Co., Ltd.	163,601	(△ 3.9)	1,771	(△ 26.4)	1,838	(14.1)	862	(3.8)	1.1	(0.9)
Riken Corp.	71,125	(7.4)	2,896	(13.5)	3,490	(△ 14.4)	1,059	(3.3)	4.9	(6.2)
Ryobi Ltd.	121,263	(3.8)	5,009	(18.9)	6,971	(48.4)	2,404	(△ 47.2)	5.7	(4.0)
S-Line Gifu K.K.	18,517	(-)	713	(-)	683	(-)	376	(-)	3.6	(4.4)

Main Japanese Suppliers' Financial Results ended March 1990 (cont.)

Company Name	Sales(A) ('90 / '89 change)		(B) Operating Profit ('90 / '89 change)		Ordinary Profit ('90 / '89 change)		Net Income ('90 / '89 change)		(B)/(A) ('90 / '89 change)	
Sanden Corp.	104,462	(7.4)	2,985	(△ 27.6)	4,381	(△ 13.5)	2,518	(△ 3.9)	4.2	(5.2)
Sanoh Industrial Co., Ltd.	36,664	(8.4)	2,092	(5.1)	2,411	(9.3)	1,246	(12.2)	6.8	(6.5)
Sawafuji Electric Co., Ltd.	19,353	(-)	787	(-)	651	(-)	343	(-)	3.4	(3.9)
Shin-Kobe Electric Machinery Co., Ltd.	53,025	(△ 1.0)	968	(△ 54.1)	1,008	(△ 36.2)	287	(△ 31.5)	1.9	(2.9)
Shinmei Kogyo K.K.	108,989	(11.4)	4,899	(10.3)	7,180	(41.3)	3,250	(31.8)	6.6	(5.2)
Shiroki Corp.	81,165	(17.9)	2,279	(0.4)	2,572	(7.8)	1,252	(10.2)	3.2	(3.5)
Showa Seisakusho K.K.	56,454	(-)	1,744	(-)	1,456	(-)	708	(-)	2.6	(2.9)
Stanley Electric Co., Ltd.	165,394	(14.2)	2,452	(△ 50.8)	4,323	(△ 34.8)	2,304	(△ 23.2)	2.6	(4.6)
Sumitomo Electric Indsutries Ltd.	700,375	(15.8)	33,933	(33.9)	30,825	(23.2)	16,155	(19.3)	4.1	(4.1)
Sumitomo Electric Igetalloy Co., Ltd.	159,101	(22.0)	3,799	(22.7)	3,192	(8.9)	1,490	(8.3)	1.9	(2.1)
Tachi-S Co., Ltd.	83,311	(26.8)	2,312	(95.7)	2,697	(66.1)	1,292	(12.7)	3.2	(2.5)
Taiheiyo Asty K.K.	38,907	(10.7)	939	(88.1)	1,166	(48.7)	661	(13.7)	3.0	(2.2)
Taikisha Ltd.	107,786	(14.3)	3,924	(13.3)	4,306	(8.1)	2,101	(27.7)	4.0	(4.2)
Teikoku Piston Ring Co., Ltd.	26,826	(11.3)	1,226	(25.8)	724	(11.9)	302	(9.8)	2.7	(2.7)
Tochigi Fuji Sangyo K.K.	31,033	(24.2)	3,561	(33.3)	3,422	(21.6)	1,690	(25.9)	10.1	(10.0)
Tokai Rika Co., Ltd.	161,850	(22.0)	3,193	(△ 21.3)	4,083	(△ 14.0)	1,775	(△ 16.2)	2.5	(3.5)
Tokyo Kinzoku Co., Ltd.	10,588	(10.0)	976	(9.2)	818	(0.2)	417	(15.2)	7.7	(8.5)
Tokyo Radiator Mfg. Co., Ltd.	19,715	(-)	△ 66	(-)	184	(-)	127	(-)	0.9	(0.5)
Tokyo Sokuhan Co., Ltd.	17,573	(14.6)	652	(57.1)	527	(48.1)	160	(24.6)	3.0	(2.3)
Topura Co., Ltd.	20,491	(4.2)	707	(△ 10.3)	673	(△ 14.8)	333	(6.8)	3.3	(4.0)
Topy Industries Ltd.	165,695	(9.3)	9,191	(△ 22.4)	7,670	(△ 4.1)	3,173	(15.0)	4.6	(5.3)
Toyo Rubber Chemical Ind. Co., Ltd.	206,673	(6.3)	6,466	(22.8)	4,616	(34.7)	1,965	(28.9)	2.2	(1.8)
Toyoda Automatic Loom Works Ltd.	191,514	(12.4)	24,150	(20.7)	27,205	(23.3)	15,665	(21.0)	5.5	(5.0)
Toyota Auto Body Co., Ltd.	343,209	(8.5)	5,608	(△ 4.6)	5,738	(△ 4.7)	2,974	(8.0)	1.7	(1.9)
Toyota Machine Works Ltd.	156,551	(17.5)	8,864	(97.9)	9,490	(78.9)	4,120	(65.3)	6.1	(4.0)
Trinity Industrial Corp.	30,917	(3.3)	706	(△ 21.3)	879	(△ 20.6)	404	(△ 10.1)	2.8	(3.7)
Yamakawa Industrial Co., Ltd.	77,751	(19.0)	2,605	(122.2)	2,158	(155.5)	1,013	(120.5)	2.8	(1.3)
Yuasa Battery Co., Ltd.	78,859	(4.4)	2,817	(△ 12.6)	3,095	(0.6)	1,418	(18.6)	3.9	(4.1)

Note : △ indicates losses

Appendix 4

United States and Japan Industry Ratios

Table 1: Breakdown of facilities by plant type and company							
	Assembly	**Powertrain**	**EE***	**Parts**	**MT&D**	***other**	**Total**
Toyota	5	2	1	4	1	0	12
Daihatsu	2	2	0	2	1	0	5
Hino	2	0	0	0	1	0	3
Nissan	5	5	0	2	3	0	9
Fuji Heavy	3	3	0	0	0	1	7
Nissan Diesel	2	1	0	0	0	0	3
Honda	3	2	0	0	0	1	6
Mazda	3	3	0	0	1	0	4
Mitsubishi	4	4	0	0	0	0	7
Suzuki	2	1	0	0	1	1	4
Isuzu	2	1	0	2	0	0	5
1990 Total	33	24	1	10	8	3	65
1990 ratio		72.73%	3.03%	30.30%	24.24%	9.09%	1.97

Table 2: Ratioss (Plant type/Assembly) by Company in 1990							
	Assembly	**Powertrain**	**EE***	**Parts**	**MT&D**	***other**	**Total**
Toyota	1.00	0.40	0.20	0.80	0.20	0.00	2.40
Daihatsu	1.00	1.00	0.00	1.00	0.50	0.00	2.50
Hino	1.00	0.00	0.00	0.00	0.50	0.00	1.50
Nissan	1.00	1.00	0.00	0.40	0.60	0.00	1.80
Fuji Heavy	1.00	1.00	0.00	0.00	0.00	0.33	2.33
Nissan Diesel	1.00	0.50	0.00	0.00	0.00	0.00	1.50
Honda	1.00	0.67	0.00	0.00	0.00	0.33	2.00
Mazda	1.00	1.00	0.00	0.00	0.33	0.00	1.33
Mitsubishi	1.00	1.00	0.00	0.00	0.00	0.00	1.75
Suzuki	1.00	0.50	0.00	0.00	0.50	0.50	2.00
Isuzu	1.00	0.50	0.00	1.00	0.00	0.00	2.50
1990 industry ratios		72.73%	3.03%	30.30%	24.24%	9.09%	

* EE = Electrical/Electronic

Table 3: Japanese Industry Ratios Over Time (1981 & 1990)								
	Assembly	**Powertrain**	**Engine**	**EE***	**Parts**	**MT&D**	***other**	**Total**
1981 Total	33	22	-	0	10	8	3	60
1981 ratio	-	0.67	-	0.00	0.30	0.24	0.09	1.818
1990 Total	33	24	-	1	10	8	3	65
1990 ratio	-	0.73	-	0.03	0.30	0.24	0.09	1.97
Net Change:	0	2	0	1	0	0	0	5

US Industry Ratios Over Time (1979 & 1991)

	Assembly	**Powertrain**	**Engine**	**EE***	**Parts**	**MT&D**	***other**	**Total**
1979 Total	71	25	14	0	122	-	0	257
1979 ratio	-	0.35	0.56	0.00	1.72	-	0.00	3.62
1991 Total	54	27	18	0	110	-	0	215
1991 ratio	-	0.50	0.67	0.00	2.04	-	0.00	3.981
Net Change:	-17	2	4	0	-12	-	0	-42

US-Japanese Comparison During 1990s

	Assembly	**Powertrain**	**Engine**	**EE***	**Parts**	**MT&D**	***other**	**Total**
1991 Totals	21	3	18	-1	100	-	-3	150

* EE = Electrical/Electronic

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